N00164 AR.000899
NSWC CRANE
5090.3a

Resource Conservation and Recovery Act Facility Investigation Report

for

SWMU 01 - Mustard Gas Burial Ground

Naval Surface Warfare Center Crane Division

Crane, Indiana

Volume 2 of 2 - Appendices

NAVFAC
Naval Facilities Engineering Command

Southern Division
Naval Facilities Engineering Command
Contract Number N62467-94-D-0888
Contract Task Order 0158

October 2004

APPENDIX A

BORING LOGS
AND
MONITORING WELL CONSTRUCTION SHEETS

Tetra Tech NUS, Inc.

BORING LOG

PROJECT NAME: NSWC CRANE
PROJECT NUMBER: CTO 158 #3959
DRILLING COMPANY: EFS
DRILLING RIG: HURRICANE IDPT

BORING No.: 01 SB01
DATE: 8-26-01
GEOLOGIST: WILDKWYCH
DRILLER: RIFFE

Sample No. and Type or RQD	Depth (Ft.) or Run No.	Blows / 6" or RQD (%)	Sample Recovery / Sample Length	Lithology Change (Depth/Ft.) or Screened Interval	MATERIAL DESCRIPTION: Soil Density/ Consistency or Rock Hardness	Color	Material Classification	USCS *	Remarks	PID/FID Reading (ppm): Sample	Sampler BZ	Borehole**	Driller BZ**
						BRN	SILTY CLAY	CL	ROOTS				
S-1	2		2/2				GRAVEL		DAMP	0	0	0	0
									GRAVEL				
S-2	4		1/2						DAMP	0	0	0	0
						ORG	CLAY		DAMP				
S-3	6		2/2	5.5		GRY	SANDY SILT (W/WEATHERED BEDROCK)	SM	DRY	0	0	0	0
				TD 6'			REFUSAL @ 6'						

* When rock coring, enter rock brokeness

** Include monitor reading in 6 foot intervals @ borehole Increase reading frequency if elevated reponse read

Drilling Area Background (ppm): 0

Remarks: 2" x 4' MACRO CORE

Converted to Well: Yes ____ No X Well I.D. #: ____

Tetra Tech NUS, Inc.

BORING LOG

PROJECT NAME: NSWC CRANE
PROJECT NUMBER: CTO 158 #3959
DRILLING COMPANY: EFS
DRILLING RIG: HURRICANE / DPT

BORING No.: 015B02
DATE: 8-26-01
GEOLOGIST: WUDKWYCH
DRILLER: RIFFE

Sample No. and Type or RQD	Depth (Ft.) or Run No.	Blows / 6" or RQD (%)	Sample Recovery / Sample Length	Lithology Change (Depth/Ft.) or Screened Interval	Soil Density/ Consistency or Rock Hardness	Color	Material Classification	USCS*	Remarks	PID/FID Reading (ppm) Sample	Sampler BZ	Borehole**	Driller BZ**
						BRN ORG	CLAY S-SILT	CL	ROOTS				
S-1	2		2/2			GRY	MOTTLED		DRY	0	0	0	0
				2.5		BRN	SILT S-CLAY	ML					
S-2	4		2/2	4		ORG			DRY	0	0	0	0
							CLAY T-F SAND	CL					
S-3	6		2/2				MOTTLED		DRY	0	0	0	0
				6.5			SILT PIECES OF SANDSTONE	ML					
S-4	8		2/2						DRY CRUMBLY	0	0	0	0
						ORG							
S-5	10		1.5/2	9.5		GRY	SILTSTONE		DRY CRUMBLY	0	0	0	0
				TD 9.5			REFUSAL @ 9.5'						

* When rock coring, enter rock brokeness

** Include monitor reading in 6 foot intervals @ borehole Increase reading frequency if elevated reponse read.

Drilling Area Background (ppm): 0

Remarks: 2"x4' MACROCORE

Converted to Well: Yes ____ No X Well I.D. #: ____

Tetra Tech NUS, Inc.

BORING LOG

PROJECT NAME: NSWC CRANE
PROJECT NUMBER: CTO 158 #3959
DRILLING COMPANY: EFS
DRILLING RIG: HURRICANE

BORING No.: 015B03
DATE: 8-26-01
GEOLOGIST: W. OKW YCH
DRILLER: RIFFE

Sample No. and Type or RQD	Depth (Ft.) or Run No.	Blows / 6" or RQD (%)	Sample Recovery / Sample Length	Lithology Change (Depth/Ft.) or Screened Interval	MATERIAL DESCRIPTION: Soil Density/ Consistency or Rock Hardness	Color	Material Classification	USCS *	Remarks	PID/FID Reading (ppm): Sample	Sampler BZ	Borehole**	Driller BZ**
						BRN	SILTY CLAY	CL					
S-1	2		2/2			ORG BRN	↓ MOTTLED	CL	DRY	0	0	0	0
						↓	↓	↓					
S-2	4		2/2			BRN ORG	SILT S-CLAY	ML	DAMP	0	0	0	0
				4.5		BRN ORG	CLAY S-SILT	CL					
S-3	6		2/2			1	1	1	DRY	0	0	0	0
S-4	7		1/2			BRN	SILT	ML	DRY				
				TD 7'			REFUSAL @ 7'						

* When rock coring, enter rock brokeness

** Include monitor reading in 6 foot intervals @ borehole Increase reading frequency if elevated reponse read

Remarks: 2" x 4' MACRO CORE

Drilling Area Background (ppm): 0

Converted to Well: Yes ____ No X Well I.D. #: ____

Tetra Tech NUS, Inc.

BORING LOG

PROJECT NAME: NSWC CRANE
PROJECT NUMBER: CTO 158 #3959
DRILLING COMPANY: EFS
DRILLING RIG: HURRCANE

BORING No.: 015B04
DATE: 8-26-01
GEOLOGIST: WUDKWYCH
DRILLER: KEVIN RIFFE

Sample No. and Type or RQD	Depth (Ft.) or Run No.	Blows / 6" or RQD (%)	Sample Recovery / Sample Length	Lithology Change (Depth/Ft.) or Screened Interval	MATERIAL DESCRIPTION: Soil Density/ Consistency or Rock Hardness	Color	Material Classification	USCS*	Remarks	PID/FID Reading (ppm): Sample	Sampler BZ	Borehole**	Driller BZ**
						BRN			ROOTS				
S1	2		2/2			ORG	CLAY S-SILT	CL	DAMP	0	0	0	0
				3		↓	↓	L					
S-2	4		2/2				SILT T-SAND	ML	DRY	0	0	0	0
				5		↓	↓ PIECES OF SANDSTONE	↓					
S-3	6		2/2			GRY ORG	CLAY MOTTLED	CL	DRY	0	0	0	0
				6.7		↓	↓ W/SILT	↓					
S-4	8 10		2/2				SILT T-FSAND	ML	DRY CRUMBLY	0	0	0	0
						↓	↓ (WEATHERED)	↓					
S5	10		2/2		DENSE	GRY BRN	SILT		DRY CRUMBLY	0	0	0	0
				TD 10'									

* When rock coring, enter rock brokeness

** Include monitor reading in 6 foot intervals @ borehole Increase reading frequency if elevated reponse read

Drilling Area Background (ppm): 0

Remarks: 2"x4' MACROCORE

Converted to Well: Yes ____ No X Well I.D. #: ____

Tetra Tech NUS, Inc.

BORING LOG

PROJECT NAME: NSWC CRANE
PROJECT NUMBER: CTO 158 #3959
DRILLING COMPANY: EFS
DRILLING RIG: HURRICANE / DPT

BORING No.: 01SB05
DATE: 8-26-01
GEOLOGIST: WVDKWYCH
DRILLER: RIFFE

Sample No. and Type or RQD	Depth (Ft.) or Run No.	Blows / 6" or RQD (%)	Sample Recovery / Sample Length	Lithology Change (Depth/Ft.) or Screened Interval	Soil Density/ Consistency or Rock Hardness	Color	Material Classification	USCS *	Remarks	PID/FID Reading (ppm) Sample	Sampler BZ	Borehole**	Driller BZ**
						BRN	SILT S-CLAY	ML	ROOTS				
S-1	2		2/2			↓	↓	↓	DRY	0	0	0	0
						BRN ORG	SILT + FG SAND	SM					
S-2	4		1.5/2						DRY	0	0	0	0
S-3	6		2/2						DRY	0	0	0	
S-4	8		2/2						DRY	0	0	0	0
S-5			0.5/2	TD 8.5'			REFUSAL (BEDROCK) @ 8.5'						

* When rock coring, enter rock brokeness

** Include monitor reading in 6 foot intervals @ borehole Increase reading frequency if elevated reponse read

Remarks: 2"x4' MACRO CORE

Drilling Area Background (ppm): 0

Converted to Well: Yes ____ No X Well I.D. #: ____

Tetra Tech NUS, Inc.

BORING LOG

PROJECT NAME: NSWC CRANE
PROJECT NUMBER: CTO 158 #3959
DRILLING COMPANY: EFS
DRILLING RIG: HURRICANE/DPT

BORING No.: 01SB06
DATE: 8-27-01
GEOLOGIST: WUDKWYCH
DRILLER: RIFFE

Sample No. and Type or RQD	Depth (Ft.) or Run No.	Blows / 6" or RQD (%)	Sample Recovery / Sample Length	Lithology Change (Depth/Ft.) or Screened Interval	Soil Density/ Consistency or Rock Hardness	Color	Material Classification	USCS *	Remarks	PID/FID Reading (ppm) Sample	Sampler BZ	Borehole**	Driller BZ**
						DRK		ML					
S-1	2		2/2			GRN	SILT		DRY	0	0	0	0
						↓	↓						
S-2	4		1.3/2	4		BRN	↓	↓	DRY	0	0	0	0
						ORG	CLAY S-SILT MOTTLED	CL					
S-3	6		2/2			GRY			DRY	0	0	0	0
						ORG	SILTY CLAY						
S-4	8		2/2	8		GRY	MOTTLED	↓	DRY CRUMBLY	0	0	0	0
							SILT (WEATHERED BEDROCK)	ML					
S-5	10		2/2			↓		↓	DRY CRUMBLY	0	0	0	0
S-6			0.5/2				SILTSTONE						
				TD 10.5									
							REFUSAL @ 10.5'						

* When rock coring, enter rock brokeness.

** Include monitor reading in 6 foot intervals @ borehole Increase reading frequency if elevated reponse read

Drilling Area Background (ppm): 0

Remarks: 2"x4' MACRO CORE

Converted to Well: Yes ____ No X Well I.D. #: ____

Tetra Tech NUS, Inc.

BORING LOG

PROJECT NAME: NSWC CRANE
PROJECT NUMBER: CTO158 #3959
DRILLING COMPANY: EFS
DRILLING RIG: HURRICANE

BORING No.: 015B07
DATE: 8-27-01
GEOLOGIST: WUDKWICH
DRILLER: RIFFE

Sample No. and Type or RQD	Depth (Ft.) or Run No.	Blows / 6" or RQD (%)	Sample Recovery / Sample Length	Lithology Change (Depth/Ft.) or Screened Interval	MATERIAL DESCRIPTION: Soil Density/ Consistency or Rock Hardness	Color	Material Classification	USCS *	Remarks	PID/FID Reading (ppm): Sample	Sampler BZ	Borehole**	Driller BZ**
						BRN/ORG	CLAYEY SILT	ML					
S-1	2		2/2				↓		DRY	0	0	0	0
							SILT						
S-2	4		2/2				↓		DRY	0	0	0	0
							PIECES OF SANDSTONE (WEATHERED BEDROCK?)		DRY	0	0	0	—
S-3	6		1/2	TD 5'									
							REFUSAL @ 5'						

* When rock coring, enter rock brokeness.

** Include monitor reading in 6 foot intervals @ borehole. Increase reading frequency if elevated reponse read.

Remarks: 2" x 4' MACRO CORE

Drilling Area Background (ppm): 0

Converted to Well: Yes ____ No X Well I.D. #: ____

Tetra Tech NUS, Inc.

BORING LOG

PROJECT NAME: NSWC CRANE
PROJECT NUMBER: CTO 158 #3959
DRILLING COMPANY: EFS
DRILLING RIG: HURRICANE / DPT

BORING No.: 015B08
DATE: 8-21-01
GEOLOGIST: WVDKWYCH
DRILLER: STRATI

Sample No. and Type or RQD	Depth (Ft.) or Run No.	Blows / 6" or RQD (%)	Sample Recovery / Sample Length	Lithology Change (Depth/Ft.) or Screened Interval	Soil Density/ Consistency or Rock Hardness	Color	Material Classification	USCS*	Remarks	PID/FID Reading (ppm) Sample	Sampler BZ	Borehole**	Driller BZ**
						LIGHT BRN	SILT	ML	ROOTS				
S1	2		1.5/2						DRY	0	0	0	0
							CALICHE NODULES						
S-2	4		2/2	4			T-CLAY		DRY	0	0	0	0
						ORG	SILT + FGR SAND	SM					
S-3	6		2/2			GRY	SANDSTONE FRAGS		DRY POWDERY	0	0	0	0
							WEATHERED SANDSTONE						
S-4	8		2/2			DK RED			DRY	0	0	0	0
						GRY				13			
	10			10		ORG				0	0	0	0
					V. SOFT		SILT STONE		DRY				
OVER PACK S-5	12		3/4				WEATHERED		CRUMBLY	0	0	0	0
				TD 12'			REFUSAL @ 12'	IRON STAINING IN SHOE					

* When rock coring, enter rock brokeness

** Include monitor reading in 6 foot intervals @ borehole Increase reading frequency if elevated reponse read

Remarks: (2" x 4') MACRO CORE

Drilling Area Background (ppm): 0

Converted to Well: Yes ____ No X Well I.D. #: ____

Tetra Tech NUS, Inc.

BORING LOG

PROJECT NAME: NSWC CRANE
PROJECT NUMBER: CTO 158 #3959
DRILLING COMPANY: EFS
DRILLING RIG: HURRICANE / DPT

BORING No.: 015309
DATE: 8-26-01
GEOLOGIST: WUOKWYCH
DRILLER: RIFFE

Sample No. and Type or RQD	Depth (Ft.) or Run No	Blows / 6" or RQD (%)	Sample Recovery / Sample Length	Lithology Change (Depth/Ft.) or Screened Interval	MATERIAL DESCRIPTION: Soil Density/ Consistency or Rock Hardness	Color	Material Classification	USCS *	Remarks	PID/FID Reading (ppm): Sample	Sampler BZ	Borehole**	Driller BZ**
						BRN ORG	SILT/CLAY	CL	ROOTS				
S-1	2		1.5/2						DAMP	0	0	0	0
S-2	4		2/2						DAMP	0	0	0	0
S-3	6		2/2						DRY	0	0	0	0
S-4			0.5/2				BEDROCK						
				TD 6.5'			REFUSAL @ 6.5'						

* When rock coring, enter rock brokeness.

** Include monitor reading in 6 foot intervals @ borehole Increase reading frequency if elevated reponse read

Drilling Area Background (ppm): 0

Remarks: 2"x4' MACROCORE

Converted to Well: Yes ____ No ✓ Well I.D. #: ____

Tetra Tech NUS, Inc.

BORING LOG

PROJECT NAME: NSWC CRANE
PROJECT NUMBER: CTO 158 #3959
DRILLING COMPANY: EFS
DRILLING RIG: HURRICANE IDPT

BORING No.: 01SB10
DATE: 8-27-01
GEOLOGIST: WUDKWYCH
DRILLER: RIFFE

Sample No. and Type or RQD	Depth (Ft.) or Run No.	Blows / 6" or RQD (%)	Sample Recovery / Sample Length	Lithology Change (Depth/Ft.) or Screened Interval	MATERIAL DESCRIPTION: Soil Density/ Consistency or Rock Hardness	Color	Material Classification	USCS*	Remarks	PID/FID Reading (ppm): Sample	Sampler BZ	Borehole**	Driller BZ**
						BRN	SILT gravel	ML	ROOTS				
S-1	2		2/2			BRN DRK	S-CLAY		DRY	0	0	0	0
							SILT						
S-2	4		2/2	4			GRADING TO		DRY	0.1	0	0	0
							SILTY CLAY	CL					
S-3	6		2/2				S-SAND			0.1	0	0	0
S-4	7		1/2			ORG GRY	SILT/CLAY + SAND PIECES OF SANDSTONE		DRY				
				TD 7'			REFUSAL @ 7'						

* When rock coring, enter rock brokeness

** Include monitor reading in 6 foot intervals @ borehole. Increase reading frequency if elevated reponse read

Drilling Area Background (ppm): 0

Remarks: 2"x4' MACROCORE

Converted to Well: Yes ____ No X Well I.D. #: ____

Tetra Tech NUS, Inc.

BORING LOG

PROJECT NAME: NSWC CRANE
PROJECT NUMBER: CTO 158 #3959
DRILLING COMPANY: EFS
DRILLING RIG: HURRICANE 10PT

BORING No.: 01SB11
DATE: 8-22-01
GEOLOGIST: WUDKWYCH
DRILLER: STRATI

Sample No. and Type or RQD	Depth (Ft.) or Run No	Blows / 6" or RQD (%)	Sample Recovery / Sample Length	Lithology Change (Depth/Ft.) or Screened Interval	Soil Density/ Consistency or Rock Hardness	Color	Material Classification	USCS*	Remarks	PID/FID Reading (ppm) Sample	Sampler BZ	Borehole**	Driller BZ**
						BRN	SILT	ML	ROOTS				
S-1	2		1.5/2			↓			DRY	3.4	0	0	0
						BRN GRY	S-CLAY		MOTTLED				
S-2	4		2/2			ORG	CALICHE		DRY	0	0	0	0
				4.5		ORG	SILT W/SAND	ML					
S-3	6		2/2			↓			DRY	0	0	0	0
						ORG							
S-4	8		2/2			GRY	(WEATHERED BEDROCK)		DRY	0	0	0	0
S-5	10		2/2			↓			DRY	0	0	0	0
				TD 10'									

* When rock coring, enter rock brokeness.

** Include monitor reading in 6 foot intervals @ borehole Increase reading frequency if elevated reponse read

Drilling Area Background (ppm): 0

Remarks: 2"x4' MACRO CORE

Converted to Well: Yes ____ No X Well I.D. #: ____

Tetra Tech NUS, Inc.

BORING LOG

PROJECT NAME: NSWC CRANE
PROJECT NUMBER: CTO 158 #3959
DRILLING COMPANY: EFS
DRILLING RIG: HURRICANE DPT

BORING No.: 01SB12
DATE: 8-25-01
GEOLOGIST: R. SIMPSON
DRILLER: EFS, KEVIN RIFFE

Sample No. and Type or RQD	Depth (Ft.) or Run No.	Blows / 6" or RQD (%)	Sample Recovery / Sample Length	Lithology Change (Depth/Ft.) or Screened Interval	Soil Density/ Consistency or Rock Hardness	Color	Material Classification	USCS*	Remarks	PID/FID Reading (ppm) Sample	Sampler BZ	Borehole**	Driller BZ**
							WEED AREA						
					SOFT	BRN	SILT TR FINE SAND	SM	MOIST, TR ROOTS	SEE			
			2/2		↓	↓		↓		SCREENING			
					↓	ORG BRN	CLAY SOME SILT TR F. SAND	CL	MOIST		LOG		
			2/2		MED. DENSE	↓		↓	TR RUST				
					↓	↓		↓	NODULES				
			2/2		↓	↓	MED. SAND SOME CLAY	SC	WEATHERED SANDSTONE				
					STIFF	↓	TR SANDSTONE FRAGS.	↓	MOTTLED GRAY, BRN				
			2/2		↓	TAN GRAY	F. TO MED SAND SOME CLAY TR ROCK FRAG.	↓	(SOME CLAY)				
					↓			SM					
			2/2		VERY STIFF	GRAY	WEATHERED SANDSTONE	↓	MOIST				
				TD 10'									

* When rock coring, enter rock brokeness.

** Include monitor reading in 6 foot intervals @ borehole Increase reading frequency if elevated reponse read

Drilling Area Background (ppm): 0

Remarks:

Converted to Well: Yes ____ No X Well I.D. #: ____

Tetra Tech NUS, Inc.

BORING LOG

PROJECT NAME: NSWC CRANE
PROJECT NUMBER: CTO 158 #3959
DRILLING COMPANY: EFS
DRILLING RIG: GEOPROBE

BORING No.: 01SB13
DATE: 8-24-01
GEOLOGIST: WUOKWYCH
DRILLER: STRATI

140-220

Sample No. and Type or RQD	Depth (Ft.) or Run No.	Blows / 6" or RQD (%)	Sample Recovery / Sample Length	Lithology Change (Depth/Ft.) or Screened Interval	Soil Density/ Consistency or Rock Hardness	Color	Material Classification	USCS*	Remarks	PID/FID Reading (ppm) Sample	Sampler BZ	Borehole**	Driller BZ**
						BRN	SILT S-CLAY	ML	ROOTS				
S-1	2		2/2			↓	↓	↓	DAMP	0	0	0	0
						ORG GRY	SILTY CLAY	CL					
S-2	4		2/2			↓	↓ MOTTLED	↓	DRY	0.3	0	0	0
				4.2		↓	Clayey SILT	ML					
S-3	6		2/2	5.5		↓	ORG SAND+SILT	SM	DAMP	0	0	0	0
						↓	clayey SILT T-SAND	ML					
S-4	8		2/2			↓	↓ PIECES OF SANDSTONE	↓	DRY	0	0	0	0
						ORG GRY	SILT T-CLAY						
S-5	10		2/2			↓	↓	↓	DRY	0	0	0	0
				TD 10'									

* When rock coring, enter rock brokeness.

** Include monitor reading in 6 foot intervals @ borehole Increase reading frequency if elevated reponse read

Drilling Area Background (ppm): 0

Remarks:

Converted to Well: Yes ____ No x Well I.D. #: ____

Tetra Tech NUS, Inc.

BORING LOG

PROJECT NAME: NSWC CRANE
PROJECT NUMBER: CTO 158 #3959
DRILLING COMPANY: EFS
DRILLING RIG: GEOPROBE

BORING No.: 01SB14
DATE: 8-24-01
GEOLOGIST: WUDKWYCH
DRILLER: STRATI

Sample No. and Type or RQD	Depth (Ft.) or Run No.	Blows / 6" or RQD (%)	Sample Recovery / Sample Length	Lithology Change (Depth/Ft.) or Screened Interval	MATERIAL DESCRIPTION: Soil Density/ Consistency or Rock Hardness	Color	Material Classification	USCS *	Remarks	PID/FID Reading (ppm): Sample	Sampler BZ	Borehole**	Driller BZ**
						DRK BRN	SILT	ML	ROOTS	0.1			
S1	2		2/2			BRN	SILT + CLAY	CL	DAMP	0	0	0	0
						BRN ORG							
S-2	4		2/2			↓	MOTTLED		DAMP	0.8	0	0	0
						ORG							
S-3	6		2/2			GRY	W/SAND		DRY	0.1	0	0	0
				6.4		ORG	Fine Sand + SILT	SM					
S-4	8		1.2/2	7.4		BRN ORG	Clayey SILT + SAND	ML	DRY	0	0	0	0
				TD 9.5									
							CANNOT DRIVE						
							SAMPLER TO 10'						
							PROBLEMS WITH						
							DPT RIG						

* When rock coring, enter rock brokeness

** Include monitor reading in 6 foot intervals @ borehole. Increase reading frequency if elevated reponse read

Drilling Area Background (ppm): 0

Remarks: 2"x4' MACROCORE

Converted to Well: Yes ____ No X Well I.D. #: ____

Tetra Tech NUS, Inc.

BORING LOG

PROJECT NAME: NSWC CRANE
PROJECT NUMBER: CTO 158 #3959
DRILLING COMPANY: EFS
DRILLING RIG: HURRICANE DPT

BORING No.: 01SB15
DATE: 8-22-01
GEOLOGIST: WUDKNYCH
DRILLER: STRATI

Sample No. and Type or RQD	Depth (Ft.) or Run No.	Blows / 6" or RQD (%)	Sample Recovery / Sample Length	Lithology Change (Depth/Ft.) or Screened Interval	Soil Density/ Consistency or Rock Hardness	Color	Material Classification	USCS*	Remarks	PID/FID Reading (ppm) Sample	Sampler BZ	Borehole**	Driller BZ**
						BRN	ROOTS	ML					
S-1	2		1.5/2	2.2			SILT		DRY	0.2	0	0	0
							SILTY CLAY	CL					
S-2	4		2/2	4					DAMP	0.1	0	0	0
							SILT S-CLAY	ML					
S-3	6		1.5/2	6					DAMP	0.1	0	0	0
						GRY ORG	SILTY CLAY mottled	CL					
S-4	8		2/2						DRY ORGANICS	0.1	0	0	0
				9									
S-5	10		2/2				SILT	ML	DRY	0	0	0	0
S-6	12												
				TD 12'			REFUSAL @ 12'						
							10 TO 12' SAMPLE STUCK IN BORING, REMOVED DPT TOOLS WITH BACKHOE INTERNAL WAS NOT LOSTEN CUTTING SHOE BROKE-OFF AND REMAINS IN HOLE 12'± DEEP						

* When rock coring, enter rock brokeness.

** Include monitor reading in 6 foot intervals @ borehole. Increase reading frequency if elevated reponse read.

Remarks: 2"x4' MACRO CORE

Drilling Area Background (ppm): 0

Converted to Well: Yes ____ No X Well I.D. #: ____

Tetra Tech NUS, Inc.

BORING LOG

PROJECT NAME: NSWC CRANE
PROJECT NUMBER: CTO158 #3959
DRILLING COMPANY: EFS
DRILLING RIG: HURRICANE 100T

BORING No.: 015B16
DATE: 8-21-01
GEOLOGIST: WUKMYCH
DRILLER: STRAT 1

Sample No. and Type or RQD	Depth (Ft.) or Run No	Blows / 6" or RQD (%)	Sample Recovery / Sample Length	Lithology Change (Depth/Ft.) or Screened Interval	Soil Density/ Consistency or Rock Hardness	Color	Material Classification	USCS *	Remarks	PID/FID Reading (ppm) Sample	Sampler BZ	Borehole**	Driller BZ**
				---		DRK	GRAVEL/ROOTS	ML					
S-1	2		2/2			BRN	CLAYEY SILT		DRY	0	0	0	0
						ORG	SILT T-CLAY						
S-2	4		2/2			GRY	MOTTLED		DRY	0	0	0	0
						BRN	CALICHE						
S-3	6		2/2	- 6		ORG			DRY	0	0	0	0
						ORG	Fine SAND + SILT	SM	CRUMBLY				
S-4	8		2/2			GRY	T-CLAY THROUGHOUT		DRY	0	0	0	0
						GRY	FINE SAND		WEATHERED				
S-5	10		2/2			ORG	(WEATHERED BEDROCK)		DRY BEDROCK	0	0	0	0
				TD 10'			TD 10'						

* When rock coring, enter rock brokeness.

** Include monitor reading in 6 foot intervals @ borehole Increase reading frequency if elevated reponse read

Drilling Area Background (ppm): 0

Remarks: 2" x 4' MACRO CORE

Converted to Well: Yes ____ No X Well I.D. #: ____

Tetra Tech NUS, Inc.

BORING LOG

PROJECT NAME: NSWC CRANE
PROJECT NUMBER: CTO 158 #3959
DRILLING COMPANY: EFS
DRILLING RIG: GEOPROBE

BORING No.: 015B17
DATE: 8-24-01
GEOLOGIST: WUDKWYCH
DRILLER: STRATI

Sample No. and Type or RQD	Depth (Ft.) or Run No.	Blows / 6" or RQD (%)	Sample Recovery / Sample Length	Lithology Change (Depth/Ft.) or Screened Interval	Soil Density/ Consistency or Rock Hardness	Color	Material Classification	USCS *	Remarks	PID/FID Reading (ppm) Sample	Sampler BZ	Borehole**	Driller BZ**
						DRK		ML	ROOTS				
S1	2		2/2	2		BRN	SILT T-CLAY	↓	DAMP	0	0	0	0
						BRN		CL					
S2	4		2/2	4		GRY	SILT+CLAY MOTTLED		DAMPNESS	0	0	0	0
						BRN	SILT T-CLAY	ML					
S-3	6		2/2	6			↓	↓	DAMP	0	0	0	0
						GRY ORG	CLAY S-SILT	CL					
S4	8		2/2				T-SAND MOTTLED @ BASE		DRY	0	0	0	0
S-5	10		2/2	9.7	1/. HARD		SILT MOTTLED	ML	DRY CRUMBLY	0	0	0	0
				TD 10'			CANNOT PUSH SAMPLE PAST 10'						

* When rock coring, enter rock brokeness.

** Include monitor reading in 6 foot intervals @ borehole Increase reading frequency if elevated reponse read

Remarks: 2"x4' MACRO CORE

Drilling Area Background (ppm): 0

Converted to Well: Yes ____ No T Well I.D. #: ____

Tetra Tech NUS, Inc.

BORING LOG

PROJECT NAME: NSWC CRANE
PROJECT NUMBER: CTO 158 #3959
DRILLING COMPANY: EFS
DRILLING RIG: GEOPROBE

BORING No.: 01SB18
DATE: 8-24-01
GEOLOGIST: WUDKWYCH
DRILLER: STRATI

Sample No. and Type or RQD	Depth (Ft.) or Run No	Blows / 6" or RQD (%)	Sample Recovery / Sample Length	Lithology Change (Depth/Ft.) or Screened Interval	MATERIAL DESCRIPTION: Soil Density/ Consistency or Rock Hardness	Color	Material Classification	USCS*	Remarks	PID/FID Reading (ppm): Sample	Sampler BZ	Borehole**	Driller BZ**
						BRN	SILT	ML	ROOTS				
S-1	2		2/2	1.5		ORG GRY	SILTY CLAY	CL	DAMP	0	0	0	0
						↓	MOTTLED T-SAND	↓					
S-2	4		1.5/2	4					DAMP	0	0	0	0
							SILT - T-CLAY	ML	CRUMBLY				
	6		2/2	6		↓	MOTTLED ↓	↓	DRY	0	0	0	0
S-3			1/1			BRN	SILT S-F. SAND		DRY	0	0	0	0
S-4	8		1/1			↓	↓	↓	CRUMBLY	0	0	0	0
				TD 8'			REFUSAL @ 8'						

* When rock coring, enter rock brokeness.

** Include monitor reading in 6 foot intervals @ borehole. Increase reading frequency if elevated reponse read.

Remarks: 2"x4' MACROCORE

Drilling Area Background (ppm): 0

Converted to Well: Yes ____ No x Well I.D. #: ____

Tetra Tech NUS, Inc.

BORING LOG

PROJECT NAME: NSWC CRANE
PROJECT NUMBER: CTO 158 #3959
DRILLING COMPANY: EFS
DRILLING RIG: GEOPROBE

BORING No.: 01SB19
DATE: 8-24-01
GEOLOGIST: WUDKWYCH
DRILLER: STRATI

Sample No. and Type or RQD	Depth (Ft.) or Run No	Blows / 6" or RQD (%)	Sample Recovery / Sample Length	Lithology Change (Depth/Ft.) or Screened Interval	MATERIAL DESCRIPTION: Soil Density/ Consistency or Rock Hardness	Color	Material Classification	USCS*	Remarks	PID/FID Reading (ppm): Sample	Sampler BZ	Borehole**	Driller BZ**
						ORG	SILTY CLAY	CL	ROOTS				
S-1	2		2/2	2		GREY	MOTTLED		DRY	0	0	0	0
						BRN ORG	SILT T-CLAY	ML					
S-2	4		2/2	4		↓	↓	↓	DRY	0	0	0	0
						ORG	clay	CL					
S-3	6		2/2	5.8			SANDSTONE FRAGS	↓	DRY	0	0	0	0
							SILT+SAND						
							SAND+SILT+CLAY	SM					
S-4	8		2/2			↓	↓ (WEATHERED BEDROCK)	↓	DRY	0	0	0	0
				8'			TD 8'						
							REFUSAL						

* When rock coring, enter rock brokeness.

** Include monitor reading in 6 foot intervals @ borehole Increase reading frequency if elevated reponse read

Drilling Area Background (ppm): 0

Remarks: 2'x4' MACRO CORE

Converted to Well: Yes ____ No X Well I.D. #: ____

Tetra Tech NUS, Inc.

BORING LOG

PROJECT NAME: NSWC CRANE
PROJECT NUMBER: CTO 158 #3959
DRILLING COMPANY: EFS
DRILLING RIG: HURRICANE / OPT

BORING No.: 015B20
DATE: 8-21-01
GEOLOGIST: WWOKWYCH
DRILLER: STRATI

Sample No. and Type or RQD	Depth (Ft.) or Run No.	Blows / 6" or RQD (%)	Sample Recovery / Sample Length	Lithology Change (Depth/Ft.) or Screened Interval	MATERIAL DESCRIPTION: Soil Density/ Consistency or Rock Hardness	Color	Material Classification	USCS *	Remarks	PID/RD Reading (ppm): Sample	Sampler BZ	Borehole**	Driller BZ**
						OFK BRN	SILT	ML	ROOTS				
S-1	2		2/2			BRN	↓		damp	0.4	0	0	0
						BRN	Clayey SILT						
S-2	4		2/2			ORG	SOME MOTTLING		dry	0	0	0	0
						↓	SILT W/F Sand						
S-3	6		2/2			↓	↓		dry	0.5	0	0	0
						ORG	SILT + Fgr SAND	SM	crumbly				
S-4	8		2/2			↓	WEATHERED SANDSTONE		dry	0.8	0	0	0
				TD 8'			REFUSAL @ 8'						

* When rock coring, enter rock brokeness.

** Include monitor reading in 6 foot intervals @ borehole Increase reading frequency if elevated reponse read.

Remarks: 2"x4' MACRO CORE

Drilling Area Background (ppm): 0

Converted to Well: Yes ____ No X Well I.D. #: ____

Tetra Tech NUS, Inc.

BORING LOG

PROJECT NAME: NSWC CRANE
PROJECT NUMBER: CTO 158 #3959
DRILLING COMPANY: EFS
DRILLING RIG: HURRICANE/DPT

BORING No.: 01SB21
DATE: 8-21-01
GEOLOGIST: WUDKUYCH
DRILLER: STRAT 1

Sample No. and Type or RQD	Depth (Ft.) or Run No	Blows / 6" or RQD (%)	Sample Recovery / Sample Length	Lithology Change (Depth/Ft) or Screened Interval	MATERIAL DESCRIPTION: Soil Density/ Consistency or Rock Hardness	Color	Material Classification	USCS *	Remarks	PID/FID Reading (ppm): Sample	Sampler BZ	Borehole**	Driller BZ**
				- - -		BRN	clay S-SILT	CL	ORGANICS T-GRAVEL				
S-1	2		2/2			ORG GRY	MOTTLED	↓	damp	0	0	0	0
						GRY	SILTY clay GRADES	↓					
	4					↓	TO SILT	ML					
						ORG	↓	↓	MICACEOUS				
S-2	6		3/4	6		↓	T-SAND	↓	dry	0	0	0	0
						BRN ORG	F.GR SAND + SILT	SM					
	8					↓	↓	↓					
									CEMENTED				
S-3	10		3/4		V. DENSE	GRY	↓ T-CLAY	↓	DRY	0	0	0	0
				TO 10'									

* When rock coring, enter rock brokeness

** Include monitor reading in 6 foot intervals @ borehole. Increase reading frequency if elevated reponse read.

Drilling Area Background (ppm): 0

Remarks: MACRO-CORE (2")

Converted to Well: Yes ____ No X Well I.D. #: ____

Tetra Tech NUS, Inc.

BORING LOG

PROJECT NAME: NSWC CRANE
PROJECT NUMBER: 3959
DRILLING COMPANY: BOWSER-MORNER
DRILLING RIG: VERSA-DRILL V1000X

BORING No.: 01T01
DATE: 9-7-01 / 9-8-01
GEOLOGIST: WUDKWYCH
DRILLER: J. VANKIAK

Sample No. and Type or RQD	Depth (Ft.) or Run No.	Blows / 6" or RQD (%)	Sample Recovery / Sample Length	Lithology Change (Depth/Ft.) or Screened Interval	MATERIAL DESCRIPTION: Soil Density/ Consistency or Rock Hardness	Color	Material Classification	USCS *	Remarks	PID/FID Reading (ppm): Sample	Sampler BZ	Borehole**	Driller BZ**
						ORG	GRAVEL SILT	ML					
						TAN	SILT	ML	DRY			0	0
	10												
						BROWN	SILT	ML					
	20								DRY				
						BROWN	SILT	ML				0	0
						BRN ORG	SILT & CLAY	ML					
	30					BRN GRY							
				32									
						ORG	SAND STONE					0	0
	40					ORG	SANDSTONE						
	50					DRK GRY	SHALE + SILTSTONE						

* When rock coring, enter rock brokeness.

** Include monitor reading in 6 foot intervals @ borehole. Increase reading frequency if elevated reponse read

Remarks: 6" AIR HAMMER 6" CASING SET TO 34'

Drilling Area Background (ppm): 0

Converted to Well: Yes ____ No X Well I.D. #: ____

Tetra Tech NUS, Inc.

BORING LOG

PROJECT NAME: NSWC CRANE
PROJECT NUMBER: 3959
DRILLING COMPANY: BOWSER-MORNER
DRILLING RIG: VERSADRILL V1000X

BORING No.: OIT01
DATE: 9-7-01 / 9-8-01
GEOLOGIST: WUDKWYCH
DRILLER: J. VANKIAK

Sample No. and Type or RQD	Depth (Ft.) or Run No.	Blows / 6" or RQD (%)	Sample Recovery / Sample Length	Lithology Change (Depth/Ft.) or Screened Interval	MATERIAL DESCRIPTION: Soil Density/ Consistency or Rock Hardness	Color	Material Classification	USCS *	Remarks	PID/FID Reading (ppm): Sample	Sampler BZ	Borehole**	Driller BZ**
	60					DRK GRY	SHALE + SILTSTONE						
	70					DRK GRY	SHALE						
	80					DRK GRY	SHALE						
	90					DRK GRY	SHALE						
	100					GRY	SANDSTONE						

* When rock coring, enter rock brokeness.

** Include monitor reading in 6 foot intervals @ borehole. Increase reading frequency if elevated reponse read.

Remarks: 6" AIR HAMMER

Drilling Area Background (ppm): 0

Converted to Well: Yes ____ No X Well I.D. #: ____

Tetra Tech NUS, Inc.

BORING LOG

PROJECT NAME: NSWC CRANE
PROJECT NUMBER: 3959
DRILLING COMPANY: BOWSER-MORNER
DRILLING RIG: VERSA-DRILL V1000X

BORING No.: 01T01
DATE: 9-7-01 / 9-8-01
GEOLOGIST: WUDKWYCH
DRILLER: J. VANKIAK

Sample No. and Type or RQD	Depth (Ft.) or Run No.	Blows / 6" or RQD (%)	Sample Recovery / Sample Length	Lithology Change (Depth/Ft.) or Screened Interval	MATERIAL DESCRIPTION: Soil Density/ Consistency or Rock Hardness	Color	Material Classification	USCS *	Remarks	PID/FID Reading (ppm): Sample	Sampler BZ	Borehole**	Driller BZ**
	110					GRY	SANDSTONE						
	120					GRY	SANDSTONE						
				TD 120'									

* When rock coring, enter rock brokeness.

** Include monitor reading in 6 foot intervals @ borehole. Increase reading frequency if elevated reponse read

Remarks: 6" AIR HAMMER

Drilling Area Background (ppm): 0

Converted to Well: Yes ____ No X Well I.D. #: ____

Tetra Tech NUS, Inc.

BORING LOG

PROJECT NAME: NSWC CRANE
PROJECT NUMBER: 3959
DRILLING COMPANY: BOWSER-MORNER
DRILLING RIG: VERSA-DRILL V-1000X

BORING No.: 01T02
DATE: 9-5-01
GEOLOGIST: WUDKWYCH
DRILLER: J. VANKIAK

Sample No. and Type or RQD	Depth (Ft.) or Run No.	Blows / 6" or RQD (%)	Sample Recovery / Sample Length	Lithology Change (Depth/Ft.) or Screened Interval	Soil Density/ Consistency or Rock Hardness	Color	Material Classification	USCS*	Remarks	PID/FID Reading (ppm) Sample	Sampler BZ	Borehole**	Driller BZ**
							GRAVEL		ROOTS				
						BRN	SILT	ML					
							S-CLAY						
	5												
						LGT							
						BRN	SILT S-FINE SAND	ML/SM					
						TAN							
	10								DRY				
	14			14									
	15										0	0	0
						BRN	SILT + CLAY	ML					
							(WEATHERED ROCK?)						
	20												
						DRK	SILT + CLAY	ML					
						GRY							
	25								DRY				

* When rock coring, enter rock brokeness.

** Include monitor reading in 6 foot intervals @ borehole. Increase reading frequency if elevated reponse read

Drilling Area Background (ppm): 0

Remarks: 6" AIR HAMMER SET 6" CASING TO 32'
2" CORE BARREL SCREEN 60-70'

Converted to Well: Yes X No _____ Well I.D. #: 01T02

Tetra Tech NUS, Inc.

BORING LOG

PROJECT NAME: NSWC CRANE
PROJECT NUMBER: 3959
DRILLING COMPANY: BOWSER-MORNER
DRILLING RIG: VERSA-DRILL V-1000X

BORING No.: 01T02
DATE: 9-5-01 / 9-6-01
GEOLOGIST: WUDKWYCH
DRILLER: J. VANKIAK

Sample No. and Type or RQD	Depth (Ft.) or Run No.	Blows / 6" or RQD (%)	Sample Recovery / Sample Length	Lithology Change (Depth/Ft.) or Screened Interval	MATERIAL DESCRIPTION: Soil Density/ Consistency or Rock Hardness	Color	Material Classification	USCS *	Remarks	PID/FID Reading (ppm): Sample	Sampler BZ	Borehole**	Driller BZ**
						LGT							
						GRY	SILT	ML					
						ORG							
						ORG	SILT + SAND	SM					
	30			30									
					SOFT	ORG	SANDSTONE		DRY				
	32					ORG					0	0	0
						GRY			33.7 FRACTURE				
						↓							
	35												
						yell	Shale + SANDSTONE		WET				
R-1						gry							
			59%				BEDDING PLANE FRACTURES		IRON STAINING 37-39'				
						↓							
	40												
			8.4/	40.2		DRK	SHALE		IRON STAINING BROKEN				
	42		9.5	41.5		GRY	SHALE + SILTSTONE COAL SEAMS THROUGHOUT		V. BROKEN				
				43.	V. SOFT								
	45						SHALE		DRY				
R-2							SILTSTONE						
			50%										
	50												

* When rock coring, enter rock brokeness.

** Include monitor reading in 6 foot intervals @ borehole Increase reading frequency if elevated reponse read

Drilling Area Background (ppm): 0

Remarks: 6" AIR HAMMER SET 6" SS CASING TO 32'
2" CORE BARREL SCREEN 60'-70'

Converted to Well: Yes X No ____ Well I.D. #: 01T02

Tetra Tech NUS, Inc.

BORING LOG

PROJECT NAME: NSWC CRANE
PROJECT NUMBER: 3959
DRILLING COMPANY: BOWSER-MORNER
DRILLING RIG: VERSA-DRILL V-1000X

BORING No.: 01T02
DATE:
GEOLOGIST: WUDKWYCH
DRILLER: J. VANKIAK

Sample No and Type or RQD	Depth (Ft.) or Run No	Blows / 6" or RQD (%)	Sample Recovery / Sample Length	Lithology Change (Depth/Ft) or Screened Interval	Soil Density/ Consistency or Rock Hardness	Color	Material Classification	USCS *	Remarks	PID/FID Reading (ppm) Sample	Sampler BZ	Borehole**	Driller BZ**
						GRY	SHALE						
	52		6.0/9.5	52									
						BLK	COAL		WET				
				52.5	HARD	GRY	SHALEY LIMESTONE		12"				
	55			54.5					WATER				
							V. FINE GR. SANDSTONE		52-62 INTERVAL				
R-3							ABANDANCE OF QUARTZ						
			82%										
	60												
			9.8/9.5										
	62			62									
					DRK	GRY	SHALE SEAMS		WET				
				62.5		GRY	V. FINE GR SANDSTONE						
	65												
R-4							SHALE SEAM						
			53%	68									
						ORG	SANDSTONE, SHALE +						
	70					GRY	COAL INTERBEDDED		IRON STAINING				
			7.5										
	72		9.5	72									
					SOFT	GRY	SILTSTONE		V. BROKEN				
							IRON STAINING						
R-5	75												

* When rock coring, enter rock brokeness.

** Include monitor reading in 6 foot intervals @ borehole Increase reading frequency if elevated reponse read

Drilling Area Background (ppm): 0

Remarks: 6" AIRHAMMER
2" CORE BARREL

Converted to Well: Yes X No _____ Well I.D. #: 01T02

Tetra Tech NUS, Inc.

BORING LOG

PROJECT NAME: NSWC CRANE
PROJECT NUMBER: 3959
DRILLING COMPANY: BOWSER-MORNER
DRILLING RIG: VERSA-DRILL V1000X

BORING No.: 01T02
DATE: 9-6-01
GEOLOGIST: WUDKWYCH
DRILLER: J. VANKIAK

Sample No. and Type or RQD	Depth (Ft.) or Run No.	Blows / 6" or RQD (%)	Sample Recovery / Sample Length	Lithology Change (Depth/Ft.) or Screened Interval	Soil Density/ Consistency or Rock Hardness	Color	Material Classification	USCS*	Remarks	PID/FID Reading (ppm) Sample	Sampler BZ	Borehole**	Driller BZ**
R-5						GRY	SILTSTONE						
							GRADING TO						
			66%				SILTSTONE +						
							SHALE						
	80			80			GRADING TO						
			7.6		M HARD	DRK GRY	SHALE						
	82		9.5			BLK			SOFT ZONES				
	85												
R-6				87	M. HARD		SHALE						
			75%			DRK	SANDY SHALE						
				89		GRY	QUARTZ VEINS		V. BROKEN				
	90						SHALE						
	92		9.4/9.5		M. HARD								
						DRK GRY BLK							
	95												
R-7													
				97.1									
						GRY	V. FINE GR SANDSTONE						
	100								CLAY ZONE				

* When rock coring, enter rock brokeness.
** Include monitor reading in 6 foot intervals @ borehole. Increase reading frequency if elevated reponse read.

Drilling Area Background (ppm): 0

Remarks: 6" AIR HAMMER
2" CORE BARREL

Converted to Well: Yes X No _____ Well I.D. #: 01T02

Tetra Tech NUS, Inc.

BORING LOG

PROJECT NAME: NSWC CRANE
PROJECT NUMBER: 3959
DRILLING COMPANY: BOWSER-MORNER
DRILLING RIG: VERSA-DRILL V-1000X

BORING No.: 01T02
DATE: 9-6-01
GEOLOGIST: WUDKWYCH
DRILLER: J. VANKIAK

Sample No and Type or RQD	Depth (Ft.) or Run No.	Blows / 6" or RQD (%)	Sample Recovery / Sample Length	Lithology Change (Depth/Ft.) or Screened Interval	MATERIAL DESCRIPTION: Soil Density/ Consistency or Rock Hardness	Color	Material Classification	USCS *	Remarks	PID/FID Reading (ppm): Sample	Sampler BZ	Borehole**	Driller BZ**
			9.7		M. HARD	GRY	V. FINE GR SANDSTONE						
	102		9.5										
	105		85%										
R-8													
									T-CLAY LENSES THROUGHOUT				
			9.5/										
	110		9.5		M. HARD								
						GRY							
R-9													
	115		3/5						V. BROKEN				
				TD 115'									

* When rock coring, enter rock brokeness.

** Include monitor reading in 6 foot intervals @ borehole. Increase reading frequency if elevated reponse read

Drilling Area Background (ppm): 0

Remarks: 6" AIR HAMMER
2" CORE BARREL

Converted to Well: Yes X No _____ Well I.D. #: 01T02

ATTACHMENT 1
BEDROCK MONITORING WELL SHEET

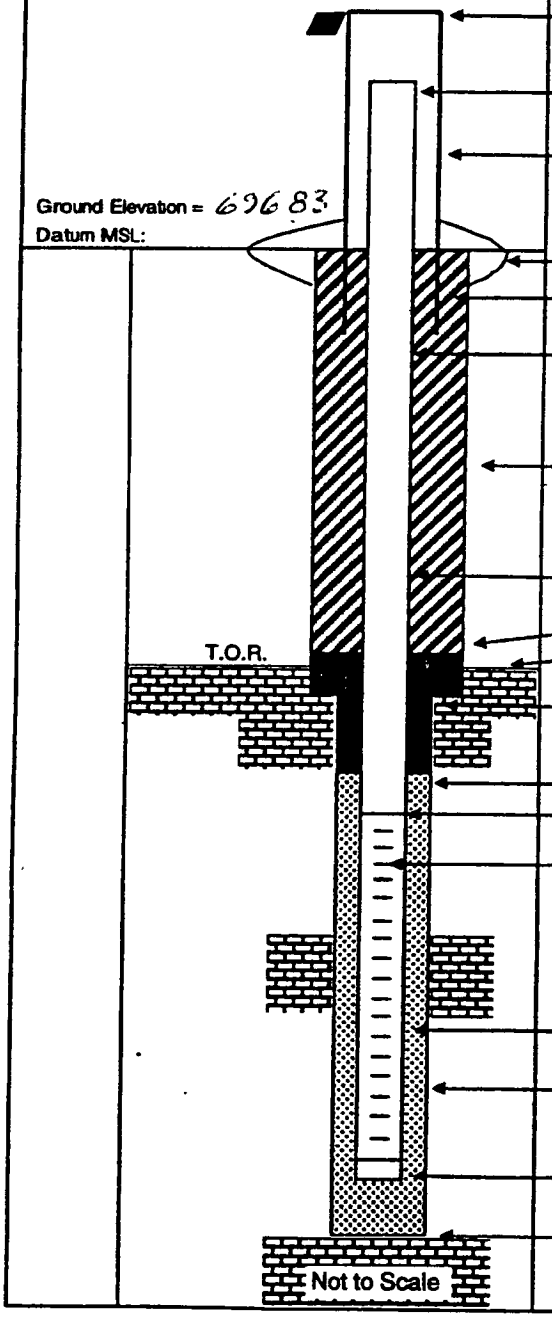
Tetra Tech NUS, Inc.

BEDROCK MONITORING WELL SHEET

WELL No.: 01T02

PERMIT No:

PROJECT:	NSWC CRANE	DRILLING Co.:	DUNCAN BROS.	BORING No.:	01T02
PROJECT No.:	3959	DRILLER:	VANKIAK	DATE COMPLETED:	9-8-01
SITE:	MC13G	DRILLING METHOD:	AIR ROTARY	NORTHING:	460178.98790
GEOLOGIST:	WUDKWYCH	DEV. METHOD:	SURGE & PURGE	EASTING:	578581.99350



Elevation of Top of Casing: _____

Stick Up of Casing Above Ground Surface: 2.96'

Elevation of Top of Riser: 698.89

I.D. of Surface Casing: 4"

Type of Surface Casing: STEEL

Type of Surface Seal: CONCRETE PAD

I.D. of Permanent Casing: 6"

I.D. of Riser: 2"

Type of Riser: PVC

Borehole Diameter: 6"

Type of Backfill: GROUT

Elevation / Depth Top of Seal: 646.83 50

Elevation / Depth Top of Bedrock: 666.83 30

Type of Seal: BENTONITE PELLETS

~~Elevation / Depth of Top of Fine Sand:~~ — / —

Elevation / Depth of Top of Filter Pack: 642.83 54

Elevation / Depth of Top of Screen: 636.83 60

Type of Screen: SCH. 40 PVC

Slot Size x Length: 0.020" x 10'

I.D. of Screen: 2"

Type of Filter Pack: #5 SAND (20-40 SILICA SIZE)

Diameter of Hole in Bedrock: Core / Ream: 6"

Elevation / Depth of Bottom of Screen: 626.83 70

Elevation / Total Depth of Borehole: 581.83 115'

BORING LOG
FIELD DATA

Project N W S C Groundwater Study Site Crane, Indiana Date 20 August 1981
Location Mustard Gas Burial Grounds Job No. 441-G150.11GR21/22
Drill Rig Failing Inspector J. Dunbar Operator C. Drake Surface El 683.14 ft Boring No. WES-1-1-81

SAMPLE NUMBER	DATE TAKEN	STRATUM FROM	STRATUM TO	DRIVE FROM	DRIVE TO	SAMPLE FROM	SAMPLE TO	TYPE OF SAMPLER	Hyd. Press	Cont.	CLASSIFICATION AND REMARKS
1	20 Aug	0.0		0.0	0.5	0.0	1.85	3"ShelbyTube	0	S.T.	Clay(CL): light brown to grey in
1A				0.5	1.0	1.85	2.15		160	Jar	color, soft to slightly stiff, low
				1.0	1.5				280		plasticity.
				1.5	2.0				360		Sample length: 2.15'
				2.0	2.5				420		
				0.0	5.0			7"Folding Auger			Cleanout
2	20 Aug		5.0	5.0	5.5	5.0	6.37	*3"Fixed Piston Sampler	0	S.T.	Sand (SP): light brown to grey in
2A		5.0		5.5	6.0	6.37	6.67		20	Jar	color, v. fine-grained, uniform,
				6.0	6.5	6.37	6.67		300		with thin zones of moderately hard
			7.05	6.5	7.05				750		cemented sand.
											Sample length: 1.67'
	20 Aug	7.05		7.05	14.5			5-5/8" Rock	Bit		Cleanout
											Sandstone: brown to darkbrown in

Sheet 1 of 2 Sheets

WES FORM JAN 74 819 EDITION OF NOV 1971 MAY BE USED

*3" Fixed Piston Sampler = 3" F.P.S.

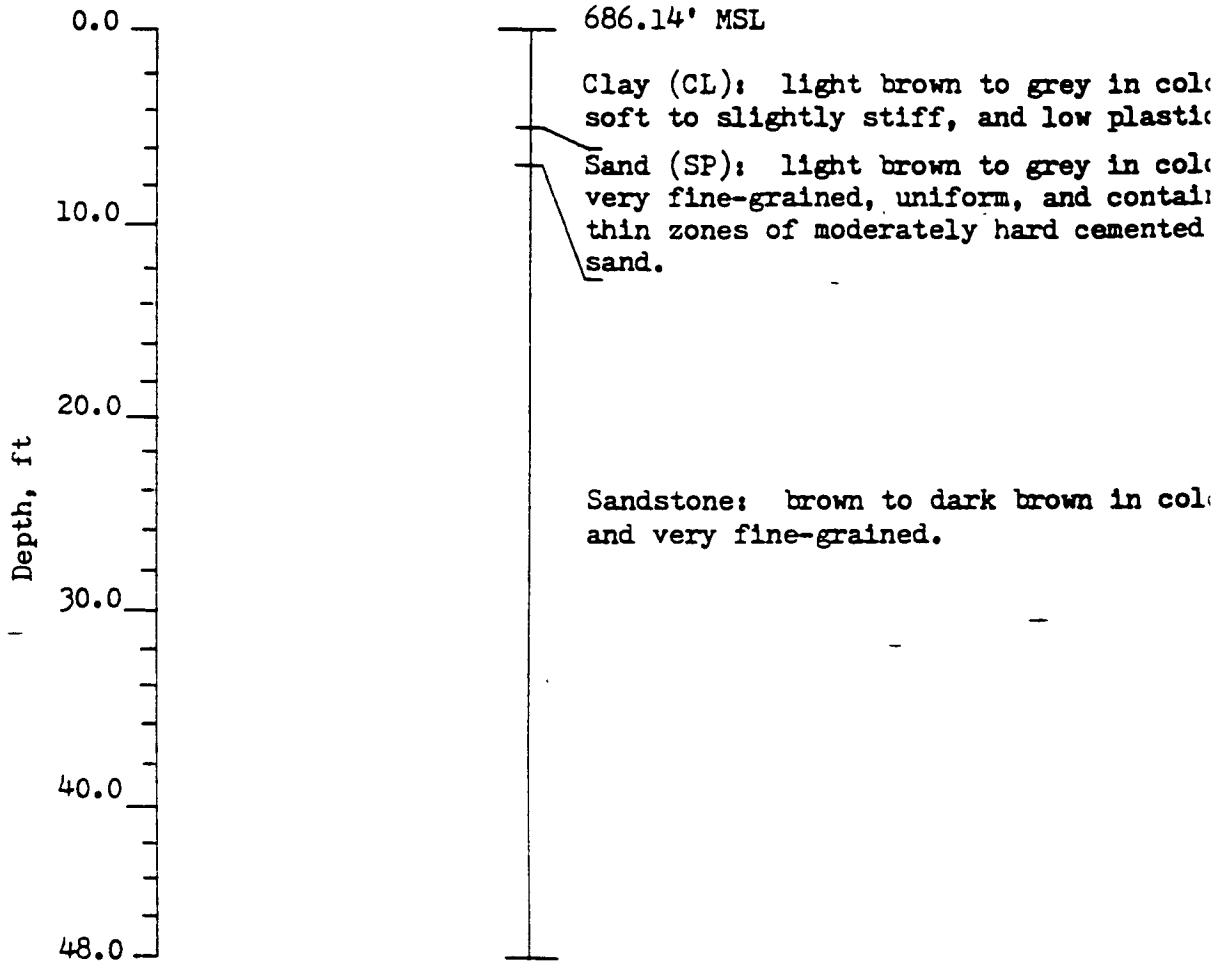
BORING LOG
FIELD DATA

Project _____ Site _____ Date _____
Location _____ Job No. _____
Drill Rig _____ Inspector _____ Operator _____ Surface El _____ Boring No. WES 1-1-81

SAMPLE NUMBER	DATE TAKEN	STRATUM		DRIVE		SAMPLE		TYPE OF SAMPLER			CLASSIFICATION AND REMARKS
		FROM	TO	FROM	TO	FROM	TO				
											color and fine-grained.
3A	21 Aug			14.5	14.75	14.5	14.75	3"F.P.S.	750	Jar	Sandstone; same as above.
	21 Aug		48.0	14.5	48.0			5-5/8" Rock	Bit		Sandstone
											Water encountered at 38 ft.
											Blew hole of cuttings and fall-in
											with air. Installed well.

WES 819 EDITION OF NOV 1971 MAY BE USED

Sheet 2 of 2 Sheet

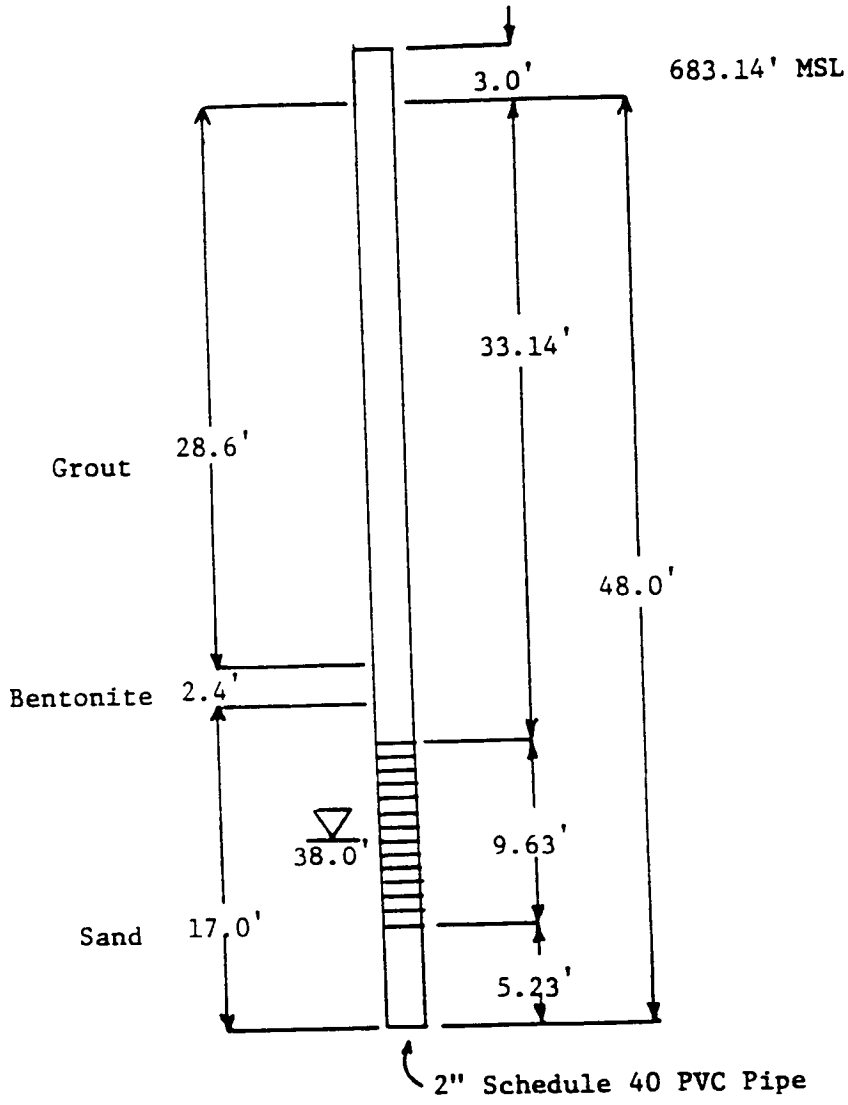


NWSC, Crane, Indiana

Mustard Gas Burial Grounds

Lithology

Boring Number: WES-1-1-81



Water depth at time of drilling

Well screen

NWSC, Crane, Indiana

Mustard Gas Burial Grounds

Well Completion

Boring Number: WES-1-1-81

BORING LOG
FIELD DATA

Project NWSC Groundwater Study Site Crane, Indiana Date 20 August 1981
Location Mustard Gas Burial Grounds Job No. 441-G150.11GR21/22
Drill Rig Failing Inspector J. Dunbar Operator C. Drake Surface El 664.04 ft Boring No WES-1-2-81

SAMPLE NUMBER	DATE TAKEN	STRATUM FROM	STRATUM TO	DRIVE FROM	DRIVE TO	SAMPLE FROM	SAMPLE TO	TYPE OF SAMPLER	Hyd. Press.	Cont.	CLASSIFICATION AND REMARKS
1A	22 Aug	0.0		0.0	0.5	0.0	0.65	3"ShelbyTube	180	Jar	Sandy silt(SM): lt. brown in color,
			1.2	0.5	0.65				700		dry, very fine-grained, with frag-
											ments of weathered sandstone.
				0.0	2.2	----------	----------	5-5/8 " Rock Bit		----	Cleanout for core barrel.
											Continued on Eng Form 1836, page 2.

WES FORM JAN 74 819 EDITION OF NOV 1971 MAY BE USED

Sheet 1 of 4 Sheets

Hole No. WES-1-2-81

DRILLING LOG	DIVISION U.S. Navy	INSTALLATION N.W.S.C., Crane, Indiana	SHEET 2 OF 4 SHEETS

1. PROJECT	.N.W.S.C. Groundwater Study
2. LOCATION (Coordinates or Station)	Mustard Gas Burial Grounds
3. DRILLING AGENCY	C.C.W.E.S.
4. HOLE NO. (As shown on drawing title and file number)	WES-1-2-81
5. NAME OF DRILLER	C. Drake
6. DIRECTION OF HOLE	☒ VERTICAL ☐ INCLINED ____ DEG. FROM VERT.
7. THICKNESS OF OVERBURDEN	1.2
8. DEPTH DRILLED INTO ROCK	21.6
9. TOTAL DEPTH OF HOLE	22.8
10. SIZE AND TYPE OF BIT	4"x5-1/2"
11. DATUM FOR ELEVATION SHOWN (TBM or MSL)	M.S.L.
12. MANUFACTURER'S DESIGNATION OF DRILL	Failing 1500
13. TOTAL NO. OF OVER-BURDEN SAMPLES TAKEN	DISTURBED: zero; UNDISTURBED: one
14. TOTAL NUMBER CORE BOXES	zero
15. ELEVATION GROUND WATER	
16. DATE HOLE	STARTED: 22 August 1981; COMPLETED: 22 August 81
17. ELEVATION TOP OF HOLE	664.04
18. TOTAL CORE RECOVERY FOR BORING	63%
19. SIGNATURE OF INSPECTOR	Joseph B. Timber

ELEVATION a	DEPTH b	LEGEND c	CLASSIFICATION OF MATERIALS (Description) d	% CORE RECOVERY e	BOX OR SAMPLE NO. f	REMARKS (Drilling time, water loss, depth of weathering, etc., if significant) g
664.04	0.0		Overburden - See page one for soil information.			
663.04	1.0					
662.04	2.0		No recovery			
661.04	3.0		Sandstone: light brown, very fine-grained with 85% uniform quartz sand and 15% misc. materials. Sandstone is dry, weathered, very friable to moderately friable, and bedding is distinct with zones of oxidation.			Run 1 Began 1:30 Rec 1.9' End 1:50 Loss 3.1' Time 20min. Gain__ Drl time 20min. Hyd press 200 psi Water press _ RPM 100± Drl Action Smooth Cuttings Brown
660.04	4.0		—Fractured			
559.04	5.0					Used carbide bit.
558.04	6.0		No recovery			
557.04	7.0		Run 1	38%	-	
556.04	8.0		No recovery			Run 2 Began 2:15 Rec 1.5' End 2:45 Loss 3.5' Time 30min Gain_ Drl time 30min Hyd press 150-200psi Water press_ RPM 100± Drl Action Smooth Cuttings Brown marks
555.04	9.0		Sandstone: same - Core loss appears to occur in areas of unconsolidated sands or very weathered sandstone.			
			—Fractured			
554.04	10.0		No recovery			

ENG FORM 1836 MAR 71 PREVIOUS EDITIONS ARE OBSOLETE (TRANSLUCENT) PROJECT HOLE NO

Hole No. ES-1-2-R1

DRILLING LOG	DIVISION	INSTALLATION	SHEET 3 OF 4 SHEETS

1. PROJECT	10. SIZE AND TYPE OF BIT
2. LOCATION (Coordinates or Station)	11. DATUM FOR ELEVATION SHOWN (TBM or MSL)
3. DRILLING AGENCY	12. MANUFACTURER'S DESIGNATION OF DRILL
4. HOLE NO. (As shown on drawing title and file number)	13. TOTAL NO. OF OVER-BURDEN SAMPLES TAKEN — DISTURBED — UNDISTURBED
5. NAME OF DRILLER	14. TOTAL NUMBER CORE BOXES
6. DIRECTION OF HOLE ☐ VERTICAL ☐ INCLINED ____ DEG. FROM VERT.	15. ELEVATION GROUND WATER
7. THICKNESS OF OVERBURDEN	16. DATE HOLE — STARTED — COMPLETED
8. DEPTH DRILLED INTO ROCK	17. ELEVATION TOP OF HOLE
9. TOTAL DEPTH OF HOLE	18. TOTAL CORE RECOVERY FOR BORING %
	19. SIGNATURE OF INSPECTOR

ELEVATION a	DEPTH b	LEGEND c	CLASSIFICATION OF MATERIALS (Description) d	% CORE RECOVERY e	BOX OR SAMPLE NO. f	REMARKS (Drilling time, water loss, depth of weathering, etc., if significant) g
554.04	10.0					
553.04	11.0		No recovery			
552.04	12.0		Run 2	30%	-	
			No recovery			
			Water at 12.8 ft.			
551.04	13.0					Run 3 Begin 3:00 Rec 4.33' End 3:30 Loss 0.4' Time 30min Gain - Drl time 30min Hyd press 100psi Water press - RPM 75± Drl Action Smooth Water ret Brown
550.04	14.0		Sandstone: same			
549.04	15.0					Remarks Switched from carbide to to diamond bit.
			Water at 15.7 ft.			
548.04	16.0		Highly oxidized			
			Run 3	91%	-	
			Contact from brown to grey colored sandstone.			
547.04	17.0		Shale seam - 3/4"			Run 4 Begin 4:00 Loss 3.37' End 4:30 Gain - Time 30min Drl time 30min Hyd press 100psi Water press - RPM 75± Drl Action Smooth Water ret Grey
546.04	18.0		Sandstone and interbedded shale: sandstone is grey, uniform, fine-grained quartz sands with numerous dark grey shale lamina interbedded.			
545.04	19.0		Shale ranges in thickness from 1/16" to 1/2" and controls rock breaks. Shale is fairly soft and sandstone is moderately friable.			Bit blocked off.
			Shale seam - 1/2"			
544.04	20.0		Run 4	100%	-	

ENG FORM 1836 MAR 71 PREVIOUS EDITIONS ARE OBSOLETE. (TRANSLUCENT)

PROJECT | HOLE NO

Hole No. WES-1-2-81

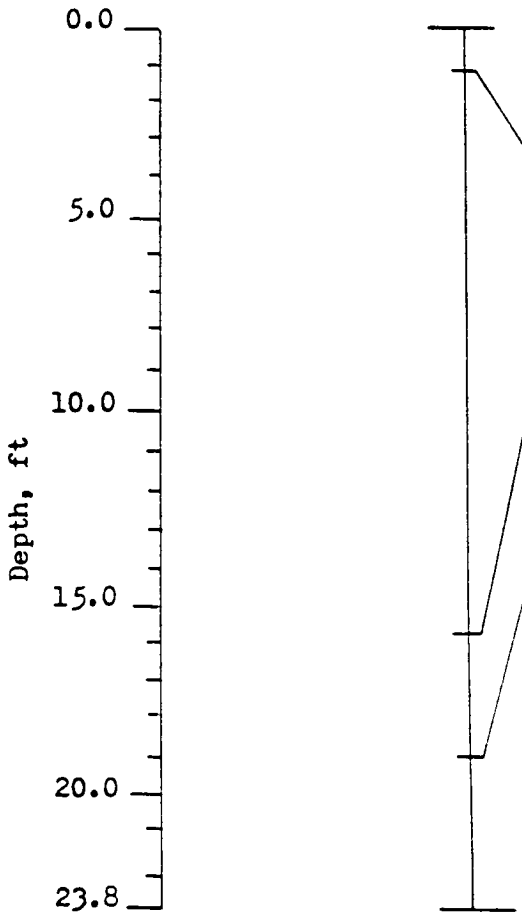
DRILLING LOG	DIVISION	INSTALLATION	SHEET 4 OF 4 SHEETS

1. PROJECT	10. SIZE AND TYPE OF BIT
2. LOCATION (Coordinates or Station)	11. DATUM FOR ELEVATION SHOWN (TBM or MSL)
3. DRILLING AGENCY	12. MANUFACTURER'S DESIGNATION OF DRILL
4. HOLE NO. (As shown on drawing title and file number)	13. TOTAL NO. OF OVER-BURDEN SAMPLES TAKEN — DISTURBED — UNDISTURBED
5. NAME OF DRILLER	14. TOTAL NUMBER CORE BOXES
6. DIRECTION OF HOLE ☐ VERTICAL ☐ INCLINED _____ DEG. FROM VERT.	15. ELEVATION GROUND WATER
	16. DATE HOLE — STARTED — COMPLETED
7. THICKNESS OF OVERBURDEN	17. ELEVATION TOP OF HOLE
8. DEPTH DRILLED INTO ROCK	18. TOTAL CORE RECOVERY FOR BORING %
9. TOTAL DEPTH OF HOLE	19. SIGNATURE OF INSPECTOR

ELEVATION a	DEPTH b	LEGEND c	CLASSIFICATION OF MATERIALS (Description) d	% CORE RECOVERY e	BOX OR SAMPLE NO. f	REMARKS (Drilling time, water loss, depth of weathering, etc., if significant) g
544.04	20.0		19.9' contact between sandstone and shale 0.2' black shale(pure) 0.05' black shale(pure)			
543.04	21.0		Sandy shale: recovered core indicates 60% soft, black sandy shale interbedded with a fine-grained, grey sandstone. Individual lamina range in thickness from 1/16" to 2".			Run 5 Began 4:30 End 4:50 Time 20min Drl time 20min Hyd press 100psi. Water press - RPM 75 Drl Action smooth Water ret - Remarks Run 5 Rec 1.0' Loss 1.95' Gain
542.04	22.0		No recovery - Left in hole			
541.04	23.0		Run 5	34%	-	
			Went back in with 5-5/8" rock bit to remove fall-in and core left in hole. Slight "oily" oder was smelled when pulling core barrel on last run. Had test run for mustard gas and negative results on test.			

ENG FORM 1836 MAR 71 PREVIOUS EDITIONS ARE OBSOLETE (TRANSLUCENT)

PROJECT | HOLE NO.



664.04' MSL

Silty sand (SM): light brown in color, dry, weathered, very fine-grained sand, and contains fragments of weathered sar stone.

Sandstone: light brown in color, very friable to moderately friable, weathere uniform, and very fine to fine-grained quartz sand.

Sandstone and interbedded shale: sand-stone is grey in color, uniform, and ve fine-grained quartz sand. Shale is da grey in color, soft, and ranges in thic ness from 1/16 to 1/2 in.

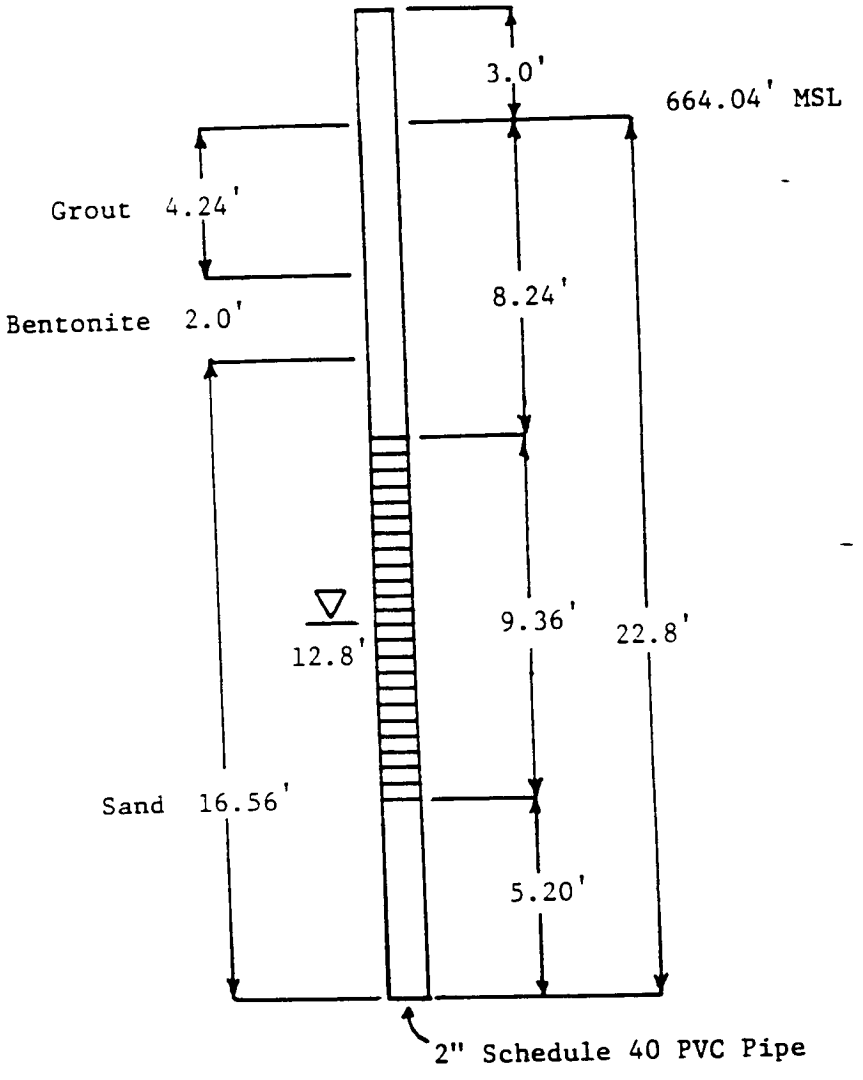
Sandy shale: black in color, soft, anc interbedded with fine-grained, grey stone lenses which range in thickness 1/16 to 2 in.

NWSC, Crane, Indiana

Mustard Gas Burial Grounds

Lithology

Boring Number: WES-1-2-81



▽ -Water depth at time of drilling

▤ Well screen

NWSC, Crane, Indiana
Mustard Gas Burial Grounds
Well Completion
Boring Number: WES-1-2-81

BORING LOG
FIELD DATA

Project NWSC Groundwater Study Site Crane, Indiana Date 25 August 1981
Location Mustard Gas Burial Grounds Job No. 441-G150.11GR21/22
Drill Rig Failing Inspector J. Dunbar Operator C. Drake Surface El 667.43 ft Boring No. WES-1-3-81

SAMPLE NUMBER	DATE TAKEN	STRATUM FROM	STRATUM TO	DRIVE FROM	DRIVE TO	SAMPLE FROM	SAMPLE TO	TYPE OF SAMPLER	Hyd. Press.	Cont.	CLASSIFICATION AND REMARKS
1	25 Aug	0.0		0.0	0.5	0.0	2.3	3"ShelbyTube	0	S.T.	Silt(ML): brown in color, soft
1A				0.5	1.0	2.3	2.5		20	Jar	organic matter, low plasticity.
				1.0	1.5				95		
				1.5	2.0				180		
			4.0	2.0	2.5				220		Sample length: 2.5 ft
				0.0	5.0	----------	----------	7" Folding Auger		---	Cleanout: assumed change at 4.0 ft
2	25 Aug	4.0		5.0	5.5	5.0	6.02	3" FixedPis-	0	S.T.	Clayey sand(SC) with fragments of
2A				5.5	6.0	6.02	6.27	ton Sampler	40	Jar	weathered sandstone: reddish brown
			6.45	6.0	6.45				280		in color, dry, and uniform fine-
											grained sand.
											Sample length: 1.27 ft
	25 Aug			5.0	6.5	----------	----------	7" Folding Auger		----	Cleanout

Sheet 1 of 2 Sheets

WES FORM JAN 74 819 EDITION OF NOV 1971 MAY BE USED

Monitoring Well 01 03

BORING LOG

Page 2 of 2

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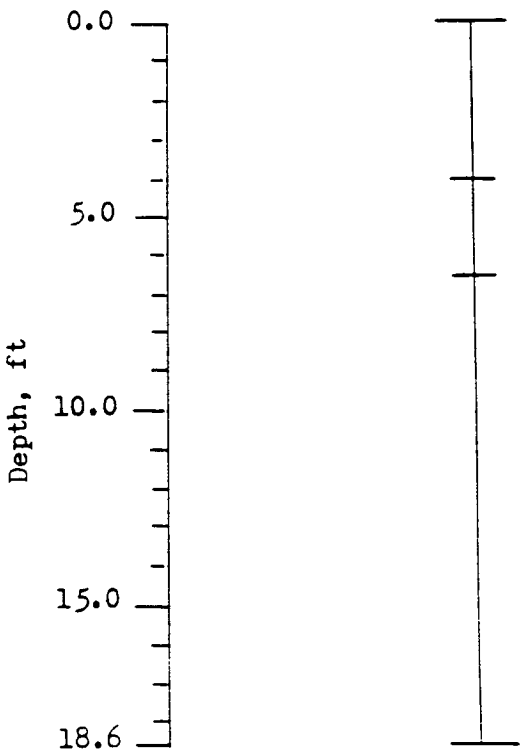


667.43' MSL

Silt(ML): brown in color, soft, organic matter, and low plasticity.

Clayey sand(SC): reddish brown in color, dry, uniform, and fine-grained sand and sandstone fragments.

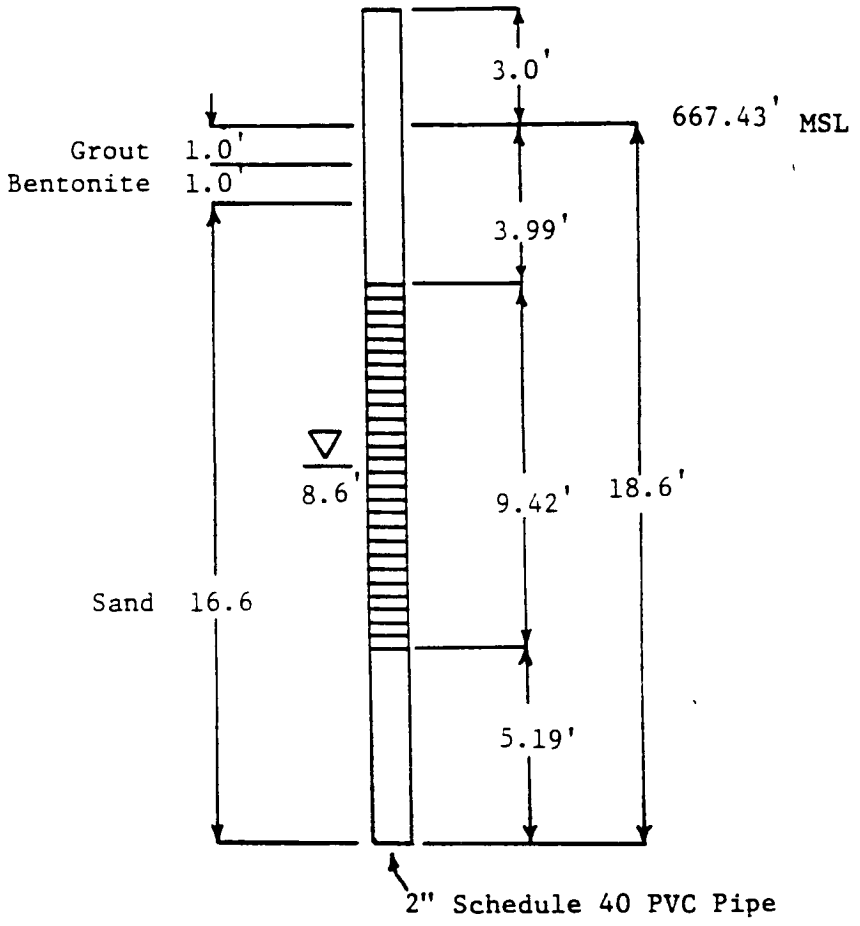
Sandstone: light brown to reddish brown and light grey in color, very friable to slightly friable, weathered, and very fin to fine-grained.

NWSC, Crane, Indiana

Mustard Gas Burial Grounds

Lithology

Boring Number: WES-1-3-81



Water depth at time of drilling

Well screen

NWSC, Crane, Indiana

Mustard Gas Burial Ground

Well Completion

Boring Number: WES-[illegible]8

Monitoring Well 01 04

Boring Log

Page 1 of 2

NOT AVAILABLE

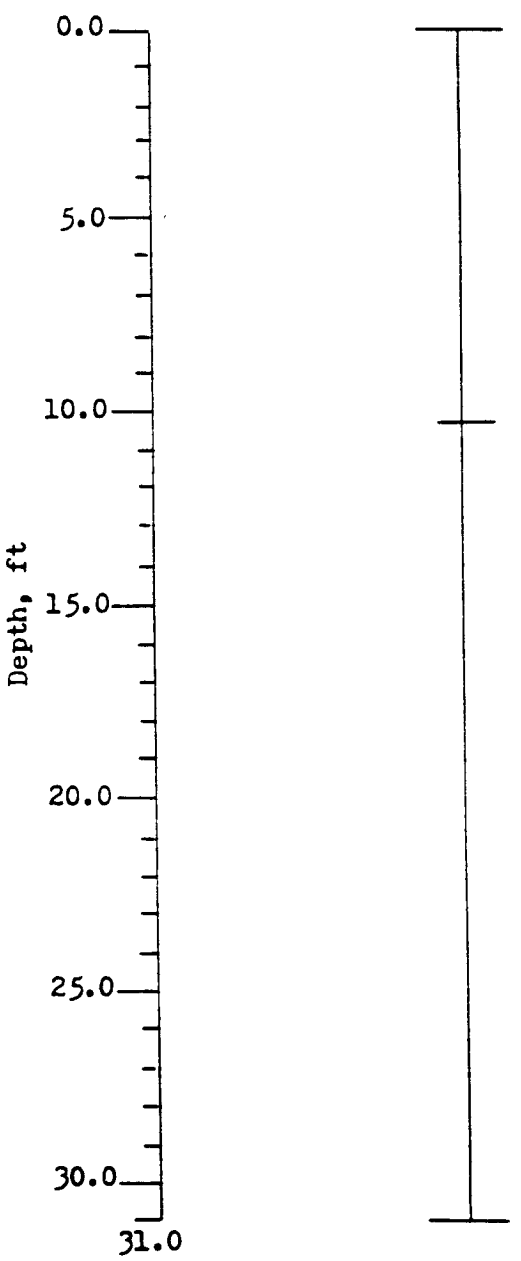
BORING LOG
FIELD DATA

Project _____ Site _____ Date _____
Location _____ Job No. _____
Drill Rig _____ Inspector _____ Operator _____ Surface El _____ Boring No. WES-1-4-81

SAMPLE NUMBER	DATE TAKEN	STRATUM FROM	STRATUM TO	DRIVE FROM	DRIVE TO	SAMPLE FROM	SAMPLE TO	TYPE OF SAMPLER	Hyd. Press.	Cont.	CLASSIFICATION AND REMARKS
3A	22 Sep		10.3	10.0	10.3	10.0	10.3	3" Fixed Piston Sampler	800	Jar	Sandy silt (SM) and weathered sandstone: grey to brown in color, dry, with sandstone reddish brown in color, fine-grained, and friable.
	22 Sep	10.3	31.0	10.0	31.0	----------	----------	5-5/8" Rock Bit	----------	----------	Water at 21 ft. Drilled to 31.0 ft. Water on 23 Sep 81 at 21 ft. Blew hole and installed well.
											Sandstone: reddish brown in color, fine-grained and weathered.

WES FORM JAN 74 819 EDITION OF NOV 1971 MAY BE USED

Sheet 2 of 2 Sheets



669.95' MSL

Sandy silt(ML): brown to grey in color, moderate cohesion, dry, stiff, and contains 20 to 30% fine-grained sand.

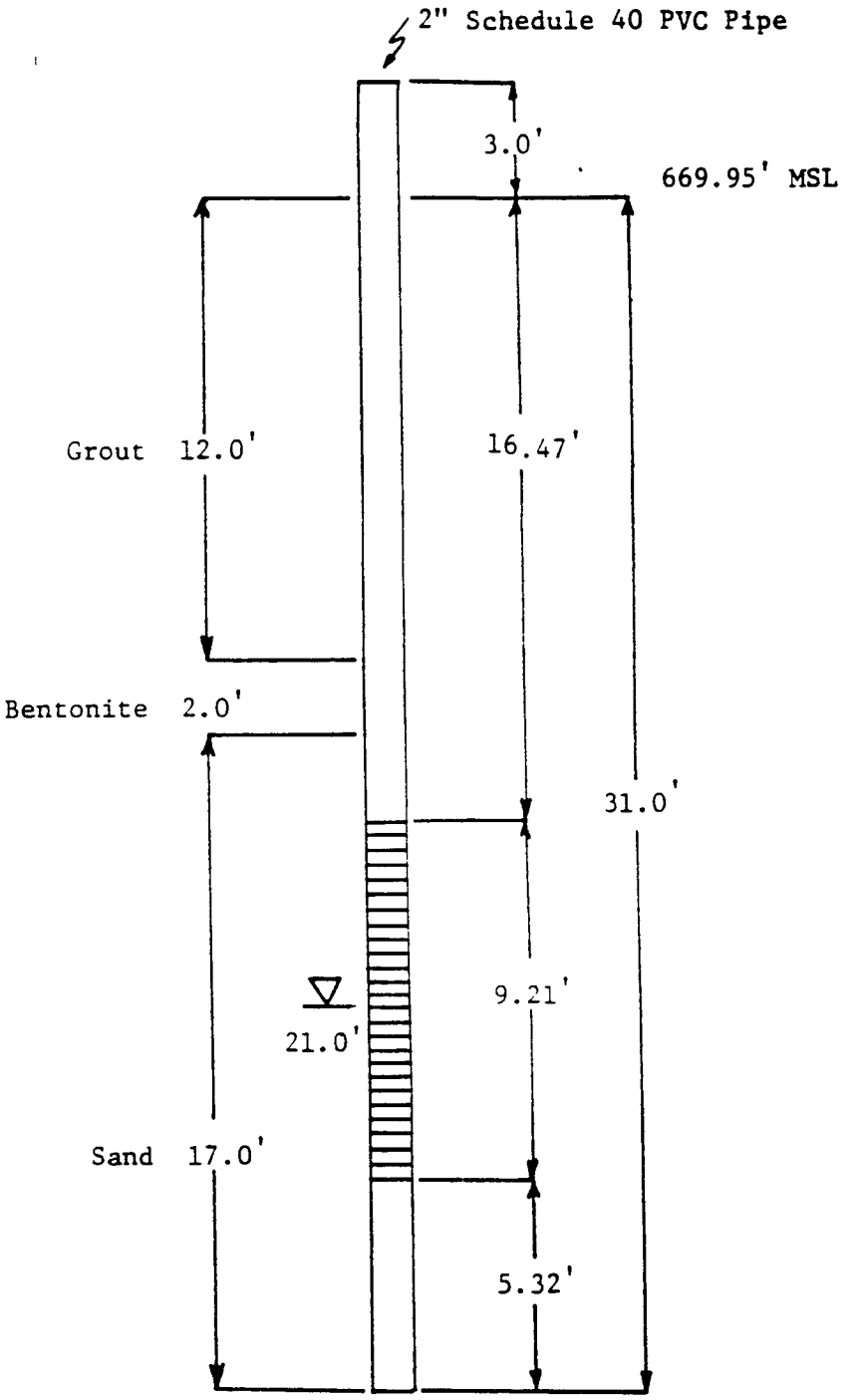
Sandstone: reddish brown in color, fine-grained, and weathered.

NWSC, Crane, Indiana

Mustard Gas Burial Grounds

Lithology

Boring Number: WES-1-4-81



Water depth at time of drilling

Well screen

NWSC , Crane, Indiana
Mustard Gas Burial Grounds
Well Completion
Boring Number: WES-1-4-

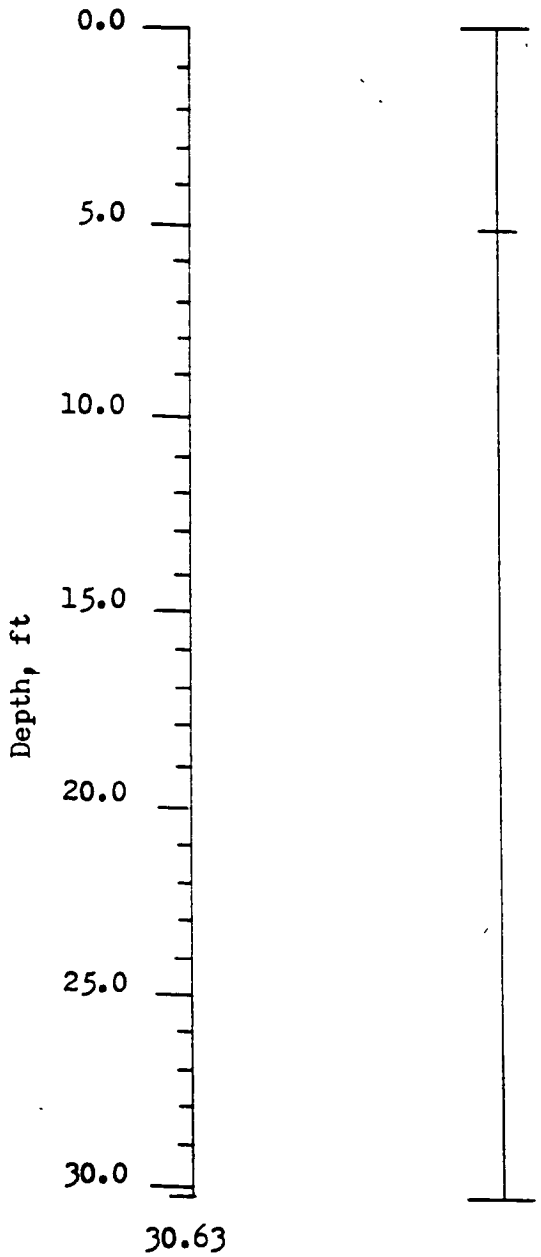
BORING LOG
FIELD DATA

Project NWSC Groundwater Study Site Crane, Indiana Date 23 Sep 81
Location Mustard Gas Burial Grounds Job No. 441-G150.11GR21/22
Drill Rig Failing Inspector J. Dunbar Operator D. Taylor Surface El 665.69 ft Boring No. WES-1-5-81

SAMPLE NUMBER	DATE TAKEN	STRATUM FROM	STRATUM TO	DRIVE FROM	DRIVE TO	SAMPLE FROM	SAMPLE TO	TYPE OF SAMPLER	Hyd. Press.	Cont	CLASSIFICATION AND REMARKS
1	23 Sep	0.0		0.0	0.5	0.0	2.28	3" Shelby Tube	60	S.T.	Clay (CL): brown in color, dry,
1A				0.5	1.0	2.28	2.48		80	Jar	little cohesion, uniform. Approx-
				1.0	1.5				100		imately 5% sand and gravel.
				1.5	2.0				120		
				2.0	2.5				120		Sample length: 2.48 ft
				0.0	5.0	------	------	7" Solid Auger	------	------	Cleanout
2A	23 Sep		5.2	5.0	5.5	5.0	5.5	3" Fixed Piston Sampler	800	Jar	Sandstone: brown in color, layered,
											v. fine-grained, dry, weathered,
											friable.
	23 Sep	5.2	30.63	5.5	18.0	------	------	5-5/8" Rock Bit	------	------	At 18.0 ft, monitored hole for
				18.0	30.63	------	------	5-5/8" Rock Bit	------	------	water, negative results. Water at
											20.5 ft. Sandstone: brown in
											color with interbedded grey shale.
											Installed well on 24 Sep 81.

Sheet 1 of 1 Sheets

WES FORM JAN 74 819 EDITION OF NOV 1971 MAY BE USED



665.69' MSL

Clay (CL): brown in color, dry, little cohesion, uniform, and contains 5% sand and gravel.

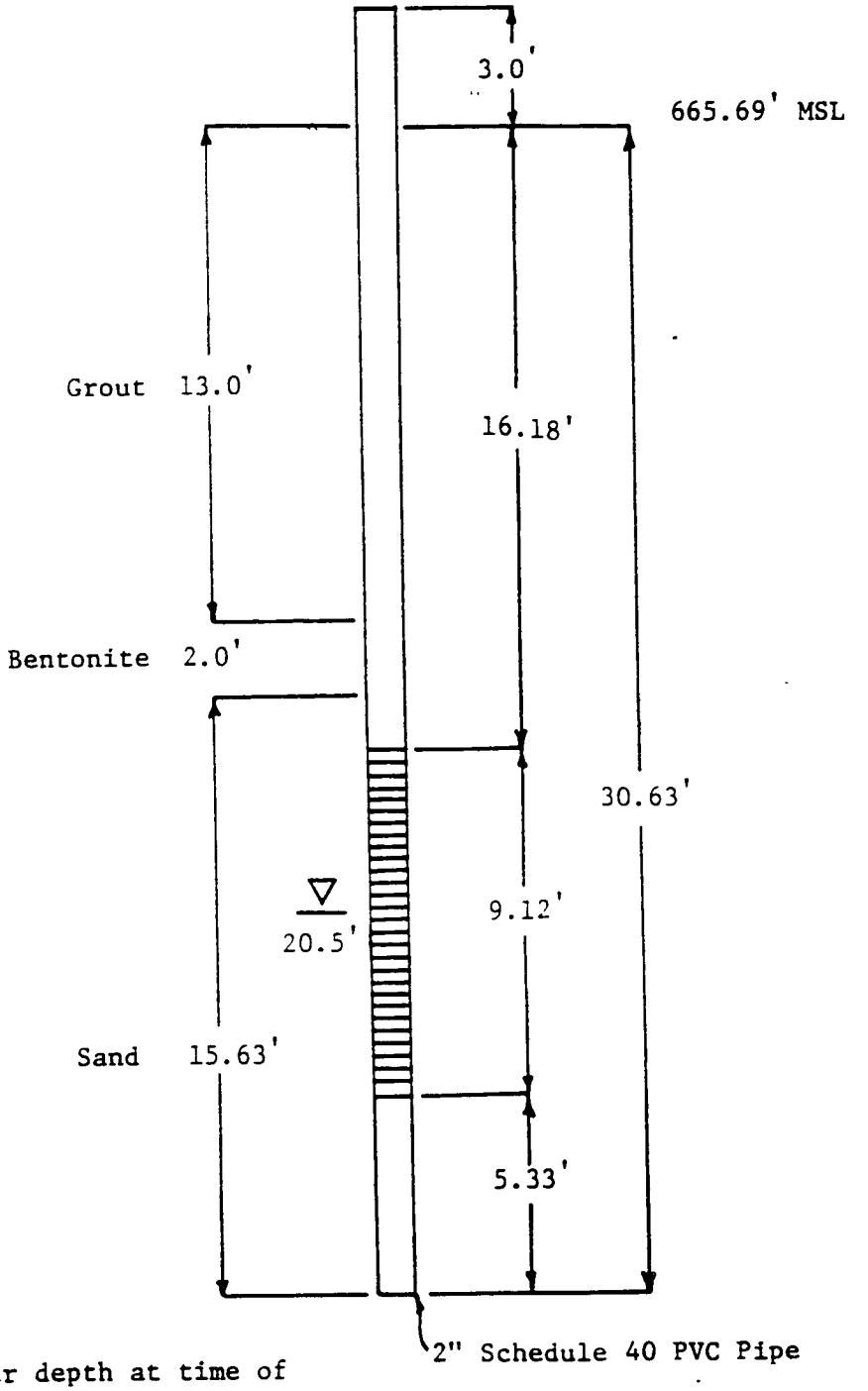
Brown sandstone and interbedded grey shale

NWSC, Crane, Indiana

Mustard Gas Burial Grounds

Lithology

Boring Number: WES-1-5-81



▽ Water depth at time of drilling

Well screen

NWSC, Crane, Indiana

Mustard Gas Burial Grounds

Well Completion

Boring Number: WES-1-5-81

BORING LOG
FIELD DATA

Project NWSC Groundwater Study Site Crane, IN Date 10 November 82
Location Mustard Gas Burial Grounds Job No. 441-G150.13GR21/22
Drill Rig Failing Inspector J. Dunbar Operator D. Taylor Surface El 596.02 Boring No. WES-1-6-82

SAMPLE NUMBER	DATE TAKEN	STRATUM FROM	STRATUM TO	DRIVE FROM	DRIVE TO	SAMPLE FROM	SAMPLE TO	TYPE OF SAMPLER			CLASSIFICATION AND REMARKS
	10 Nov			0.0	1.5			6-3/4"Rock Bit			6" Casing-Stickup 0.5'
		0.0	11.7	0.0	26.0			5-5/8"Rock Bit			Siltstone: reddish brown, grey, soft, weathered, dry
		11.7	23.5								Shale: grey, soft-medium, dry
		23.5	26.0								Shale: dark grey, black, dry
	10 Nov			0.0	50.0			5-5/8"Rock Bit			Air compressor filter went out and pumped large quantity of oil into hole. Traded air compressors and moved drilling rig 10 ft west to drill another boring. Grouted up contaminated hole.
		26.0	27.2								Coal: black, soft
		27.2	35.2								Shale: grey, soft
		35.2	36.0								Coal: black, soft
	11 Nov	36.0	54.5	50.0	90.0			5-5/8"Rock Bit			Sandstone: brown, red, fine-grained, 75% quartz sand, hard

WES FORM JAN 74 819 EDITION OF NOV 1971 MAY BE USED

Sheet 1 of 2 Sheets

WORKING DRAFT

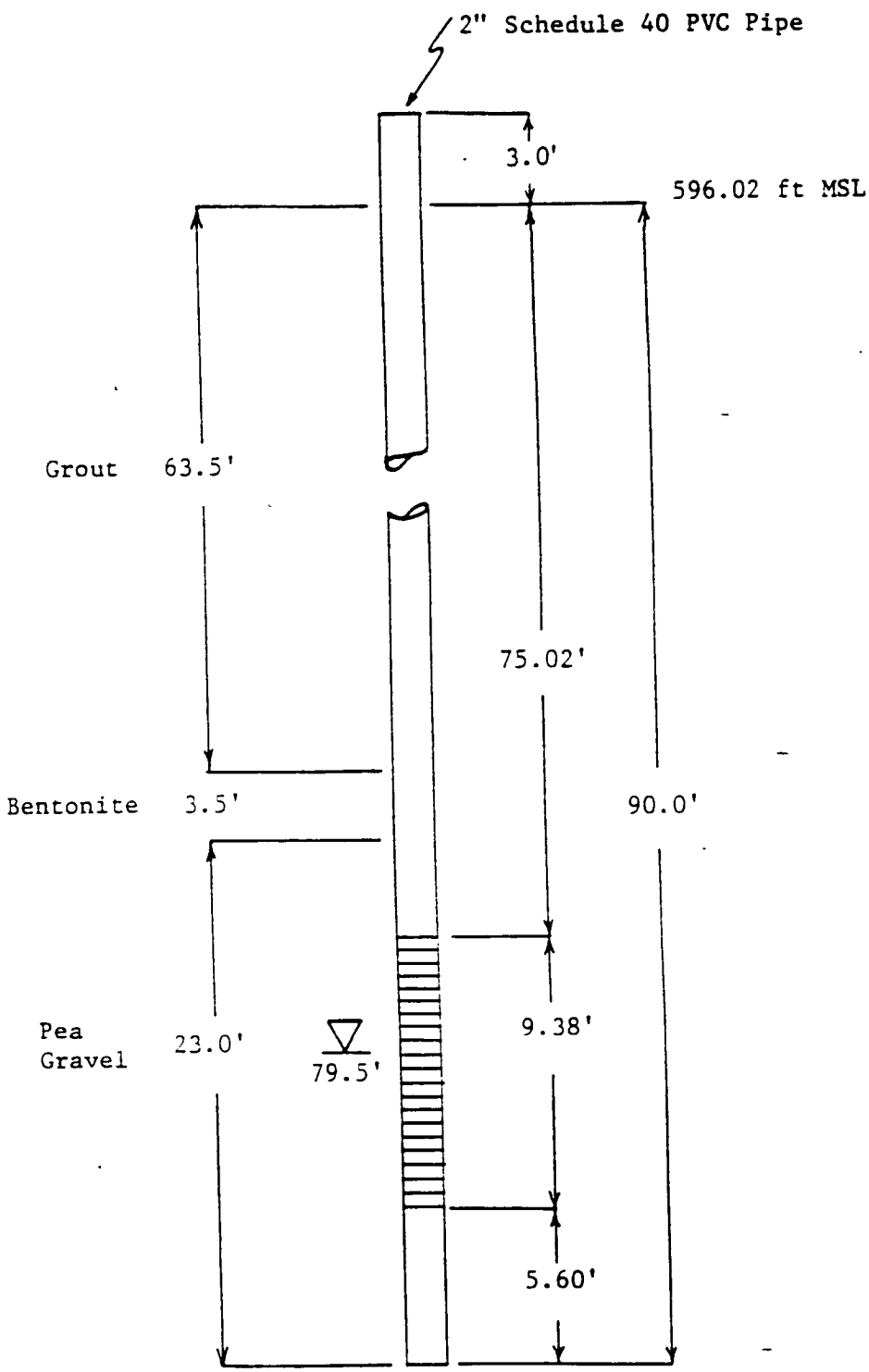
BORING LOG
FIELD DATA

Project _____ Site _____ Date _____
Location _____ Job No. _____
Drill Rig _____ Inspector _____ Operator _____ Surface El _____ Boring No. WES-1-6-82

SAMPLE NUMBER	DATE TAKEN	STRATUM		DRIVE		SAMPLE		TYPE OF SAMPLER			CLASSIFICATION AND REMARKS
		FROM	TO	FROM	TO	FROM	TO				
											Damp spot at 42 and 49 ft
											No water overnight
		54.5	82.5								Limestone: grey, white, hard
		82.5	88.5								Shale: grey, soft
		88.5	89.5								Limestone: grey, hard
		89.5	90.0								Shale: grey, soft
											Water at 79.5 ft - Blew water
											from hole several times and will
											monitor depth in morning before
											installing screen.
	12 Nov										Water level at 69.87 ft -
											installed well screen

WES FORM JAN 74 819 EDITION OF NOV 1971 MAY BE USED

Sheet 2 of 2 Sheets



Water depth at time of drilling

Well Screen

NWSC, Crane, Indiana
Mustard Gas Burial Grounds
Well Completion
Boring Number: WES-1-6-82

WORKING DRAFT

BORING LOG
FIELD DATA

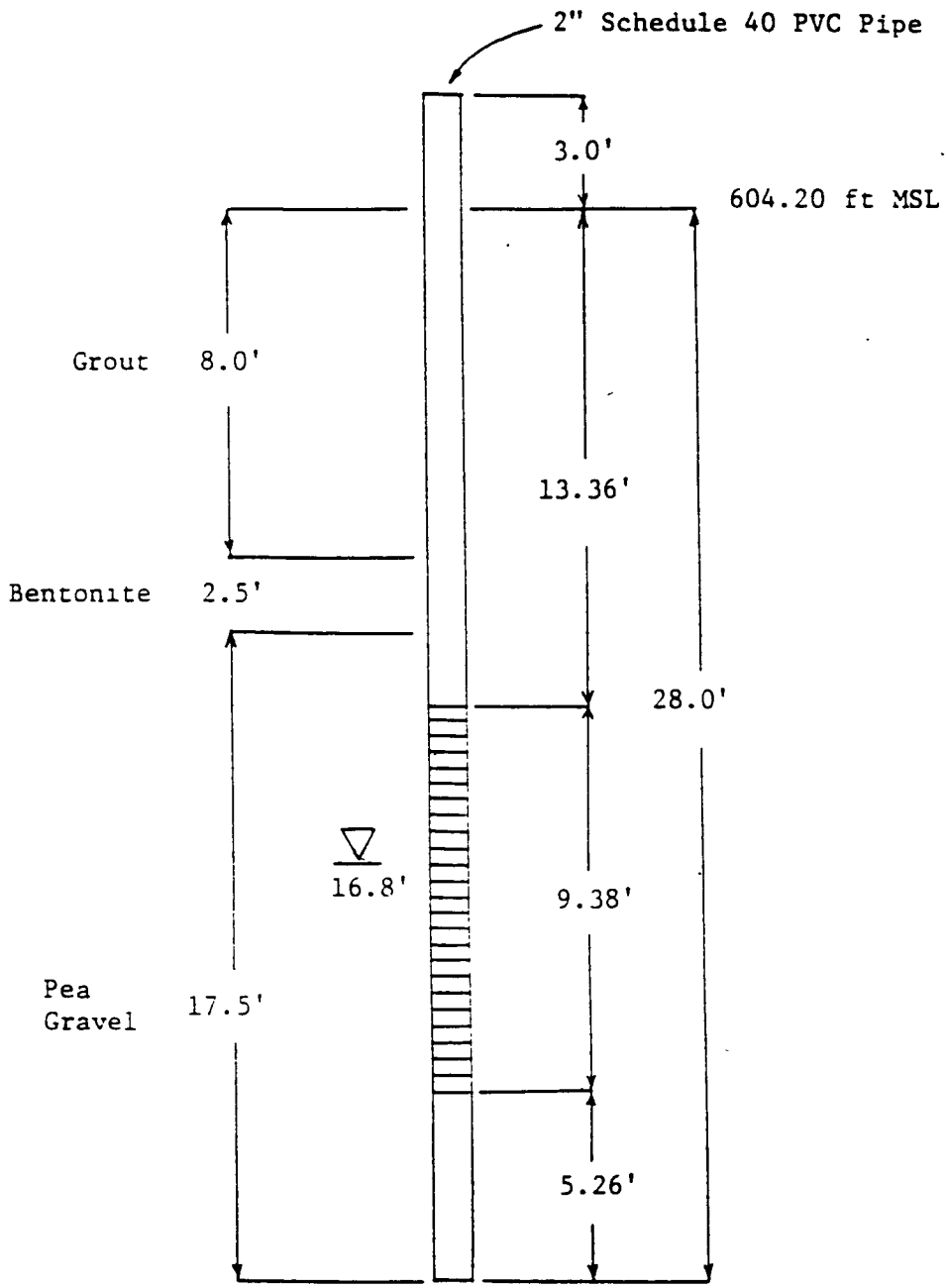
Project: NWSC Groundwater Study Site: Crane, IN Date: 14 November 82
Location: Mustard Gas Burial Grounds Job No. 441-G150.13GR21/22
Drill Rig: Failing Inspector: J. Dunbar Operator: D. Taylor Surface El: 604.20 Boring No. WES-1-7-82

SAMPLE NUMBER	DATE TAKEN	STRATUM FROM	STRATUM TO	DRIVE FROM	DRIVE TO	SAMPLE FROM	SAMPLE TO	TYPE OF SAMPLER			CLASSIFICATION AND REMARKS
	14 Nov			0.0	0.8			6-3/4"Rock Bit			6" Casing to 0.8-Stickup at 1.2 ft
		0.0	3.5	0.8	20.0			5-5/8"Rock Bit			Siltstone: brown, white, soft
				20.0	28.5			5-5/8"Rock Bit			weathered, dry
		3.5	28.5								Shale: grey, dark grey, soft
											Water between 15-20 ft -
											Water level at 16.8 ft after 60
											minutes. Installed well

WES FORM JAN 74 819 EDITION OF NOV 1971 MAY BE USED

Sheet 1 of 1 Sheets

WORKING DRAFT



Water level at time of drilling

Well Screen

NWSC, Crane, Indiana
Mustard Gas Burial Ground
Well Completion
Boring Number WES-1-7-82

Project NWSC Groundwater Study Site Crane, IN Date 15 November 82

Location Mustard Gas Burial Grounds Job No. 441-G150.13GR21/22

Drill Rig Failing Inspector J. Dunbar Operator D. Taylor Surface El 601.99 Boring No. WES-1-8-82

SAMPLE NUMBER	DATE TAKEN 1982	STRATUM FROM	STRATUM TO	DRIVE FROM	DRIVE TO	SAMPLE FROM	SAMPLE TO	TYPE OF SAMPLER			CLASSIFICATION AND REMARKS
	15 Nov			0.0	0.8			6-3/4"Rock Bit			6"Casing to 0.8 ft-Stickup 1.2 ft
				0.0	4.0			5-5/8"Rock Bit			Cleanout for core barrel
				4.0	6.5			Pitcher Sampler			Run 1-Cleanout to 6.5 with rock bit
				6.5	11.3			4x5½"Core Barrel			Run 2
				11.3	16.4			" "	"		Run 3
				16.4	21.1			" "	"		Run 4-Water starts at 18.0 ft
				21.1	25.5			" "	"		Run 5
				25.5	28.0			" "	"		Run 6
				28.0	31.1			" "	"		Run 7
		0.0	3.8								Siltstone
		3.8	12.0								Clay Shale
		12.0	28.8								Shale
		28.8	31.1								Limestone
											See boring log starting on
											page 2 for details

WES FORM JAN 74 819 EDITION OF NOV 1971 MAY BE USED

Hole No. WES-1-8-82

DRILLING LOG	DIVISION US Navy	INSTALLATION NWSC, Crane, IN	SHEET 2 OF 5 SHEETS

1. PROJECT: NWSC Groundwater Study
2. LOCATION (Coordinates or Station): Mustard Gas Burial Grounds
3. DRILLING AGENCY: CEWES
4. HOLE NO. (As shown on drawing title and file number): WES-1-8-82
5. NAME OF DRILLER: D. Taylor
6. DIRECTION OF HOLE: [X] VERTICAL [ ] INCLINED _____ DEG. FROM VERT.
7. THICKNESS OF OVERBURDEN: 0.0
8. DEPTH DRILLED INTO ROCK: 31.1 ft
9. TOTAL DEPTH OF HOLE: 31.1 ft
10. SIZE AND TYPE OF BIT:
11. DATUM FOR ELEVATION SHOWN (TBM or MSL): MSL
12. MANUFACTURER'S DESIGNATION OF DRILL: Failing 1500
13. TOTAL NO. OF OVER-BURDEN SAMPLES TAKEN: DISTURBED Zero; UNDISTURBED Zero
14. TOTAL NUMBER CORE BOXES: Zero
15. ELEVATION GROUND WATER:
16. DATE HOLE: STARTED 15 Nov 82; COMPLETED 15 Nov 82
17. ELEVATION TOP OF HOLE: 601.99
18. TOTAL CORE RECOVERY FOR BORING: 91.5%
19. SIGNATURE OF INSPECTOR:

ELEVATION a	DEPTH b	LEGEND c	CLASSIFICATION OF MATERIALS (Description) d	% CORE RECOVERY e	BOX OR SAMPLE NO. f	REMARKS (Drilling time, water loss, depth of weathering, etc., if significant) g
601.99	0.0					
			Siltstone: brown, white, weathered, soft-brittle, dry			
600.99	1.0					
599.99	2.0			0%		
598.99	3.0					
597.99	4.0					
596.99	5.0		Clay shale: brownish grey, grey, weathered, soft, oxidized in regions, recovered 1 ft with Pitcher Sampler	40%		
595.99	6.0		Run 1			
594.99	7.0		No recovery			2 11:45 3.7' 11.52 1.1' 7 Min 7 Min 200-300PSI
593.99	8.0		Clay shale: brownish grey, grey, dark grey, soft, dry oxidized in regions, weathered, thinly bedded to thickly bedded, attitude of bedding is horizontal, sandy	77.1%		70 ± Smooth Grey Carbaloid Drill Bit
592.99	9.0					
591.99	10.0					

WORKING DRAFT

ENG FORM 1836 MAR 71 PREVIOUS EDITIONS ARE OBSOLETE. PROJECT HOLE NO.

Hole No. WES-1-8-

DRILLING LOG	DIVISION US Navy	INSTALLATION NWSC, Crane, IN	SHEET 5 OF 5 SHEE

1. PROJECT: NWSC Groundwater Study
2. LOCATION (Coordinates or Station): Mustard Gas Burial Grounds
3. DRILLING AGENCY: CEWES
4. HOLE NO. (As shown on drawing title and file number): WES-1-8-82
5. NAME OF DRILLER: D. Taylor
6. DIRECTION OF HOLE: ☐ VERTICAL ☐ INCLINED _____ DEG. FROM VERT.
7. THICKNESS OF OVERBURDEN
8. DEPTH DRILLED INTO ROCK
9. TOTAL DEPTH OF HOLE
10. SIZE AND TYPE OF BIT
11. DATUM FOR ELEVATION SHOWN (TBM or MSL): MSL
12. MANUFACTURER'S DESIGNATION OF DRILL: Failing 1500
13. TOTAL NO. OF OVER-BURDEN SAMPLES TAKEN: DISTURBED / UNDISTURBED
14. TOTAL NUMBER CORE BOXES
15. ELEVATION GROUND WATER
16. DATE HOLE: STARTED / COMPLETED
17. ELEVATION TOP OF HOLE
18. TOTAL CORE RECOVERY FOR BORING
19. SIGNATURE OF INSPECTOR

ELEVATION a	DEPTH b	LEGEND c	CLASSIFICATION OF MATERIALS (Description) d	% CORE RECOVERY e	BOX OR SAMPLE NO. f	REMARKS (Drilling time, water loss, depth weathering, etc., if significant) g
591.99	10.0		Clay shale: same			
590.99	11.0		Run 2 RQD=64.7%			
589.99	12.0		No recovery			WL - Run 3 Began 12:45 Rec 3 End 1:05 Los 1 Time 20 Min Drl time 20 Min Hyd press 200-300 P Water press - RPM 70 ± Drl Action Smoo Grey, dar
588.99	13.0		closed - limonitic	72.5%		
587.99	14.0		Shale: grey, dark grey, soft, thinly bedded, horizontal, dry, sandy, oxidized, contains 2-5% thinly bedded (1/8") limestone			
586.99	15.0					
585.99	16.0		Run 3 RQD=64.9%			
584.99	17.0					WL - Run Began 1:25 Rec End 1:40 Los Time 15 Min Ga. Drl time15 Min Hyd press 200-30 Water press - RPM 70- Drl Action Smoot Grey
583.99	18.0		Shale: dark grey, black, soft, uniform, highly fractured, thinly bedded, horizontal. Water starts at 18 ft-	100%		Water s at 18 ft - I quantity pr
582.99	19.0		20.15 ft - 1/2" grey sandstone, fine-grained, hard			
581.99	20.0					

ENG FORM 1836 PREVIOUS EDITIONS ARE OBSOLETE PROJECT

Hole No. WES-1-8-82

DRILLING LOG	DIVISION US Navy	INSTALLATION NWSC, Crane, IN	SHEET 4 OF 5 SHEETS

1. PROJECT NWSC Groundwater Study	10. SIZE AND TYPE OF BIT
2. LOCATION (Coordinates or Station) Mustard Gas Burial Grounds	11. DATUM FOR ELEVATION SHOWN (TBM or MSL) MSL
3. DRILLING AGENCY CEWES	12. MANUFACTURER'S DESIGNATION OF DRILL Failing 1500
4. HOLE NO. (As shown on drawing title and file number) WES -1-8-82	13. TOTAL NO. OF OVER-BURDEN SAMPLES TAKEN: DISTURBED / UNDISTURBED
5. NAME OF DRILLER D. Taylor	14. TOTAL NUMBER CORE BOXES
6. DIRECTION OF HOLE ☒ VERTICAL ☐ INCLINED ____ DEG. FROM VERT.	15. ELEVATION GROUND WATER
7. THICKNESS OF OVERBURDEN	16. DATE HOLE: STARTED / COMPLETED
8. DEPTH DRILLED INTO ROCK	17. ELEVATION TOP OF HOLE
9. TOTAL DEPTH OF HOLE	18. TOTAL CORE RECOVERY FOR BORING %
	19. SIGNATURE OF INSPECTOR

ELEVATION a	DEPTH b	LEGEND c	CLASSIFICATION OF MATERIALS (Description) d	% CORE RECOVERY e	BOX OR SAMPLE NO. f	REMARKS (Drilling time, water loss, depth of weathering, etc., if significant) g
581.99	20.0					
			Shale: same			
580.99	21.0		Run 4 ROD=46.8%			WL - Run 5 Began 2:00 Rec 4.4 End 2:15 Loss - Time 15 Min Gain - Drl time 15 Min Hyd press 200-300 PSI Water press - RPM 70+ Drl Action ~~Water~~ ret Water-grey Remarks -
579.99	22.0					
578.99	23.0		Shale. same	100%		
577.99	24.0		fractured			
576.99	25.0					
			Run 5 ROD=54.5%			
575.99	26.0		fractured			WL - Run 6 Began 2:35 Rec 2.6' End 3:00 Loss - Time 25 Min Gain - Drl time 25 Min Hyd press 200 PSI Water press - RPM 70+ Drl Action ~~Water~~ ret Water-dark grey Remarks
574.99	27.0		Shale: same	100%		
573.99	28.0		Run 6 ROD=0.0%			WL - Run 7 Began 3:50 Rec 3.0' End 4:15 Loss - Time 25 Min Gain - Drl time 25 Min Hyd press 200-300 PSI Water press - RPM 70+ Drl Action ~~Water~~ ret Wet Brown Remarks Diamond Bit
			Shale: same			
572.99	29.0		Limestone: brown, grey, fossilized, cherty(2-3%), fine grained	100%		
571.99	30.0		fractured			

WORKING DRAFT

ENG FORM 1836 MAR 71 PREVIOUS EDITIONS ARE OBSOLETE PROJECT HOLE NO.

Hole No. WES-1-8-

DRILLING LOG	DIVISION US Navy	INSTALLATION NWSC, Crane, IN	SHEET 3 OF 5

1. PROJECT NWSC Groundwater Study	10. SIZE AND TYPE OF BIT
2. LOCATION (Coordinates or Station) Mustard Gas Burial Grounds	11. DATUM FOR ELEVATION SHOWN (TBM or MSL) MSL
3. DRILLING AGENCY CEWES	12. MANUFACTURER'S DESIGNATION OF DRILL Failing 1500
4. HOLE NO. (As shown on drawing title and file number) WES-1-8-82	13. TOTAL NO. OF OVER-BURDEN SAMPLES TAKEN: DISTURBED: UNDISTURBED:
5. NAME OF DRILLER D Taylor	14. TOTAL NUMBER CORE BOXES
6. DIRECTION OF HOLE ☒ VERTICAL ☐ INCLINED ____ DEG. FROM VERT.	15. ELEVATION GROUND WATER
	16. DATE HOLE: STARTED: COMPLETED:
7. THICKNESS OF OVERBURDEN	17. ELEVATION TOP OF HOLE
8. DEPTH DRILLED INTO ROCK	18. TOTAL CORE RECOVERY FOR BORING
9. TOTAL DEPTH OF HOLE	19. SIGNATURE OF INSPECTOR

ELEVATION a	DEPTH b	LEGEND c	CLASSIFICATION OF MATERIALS (Description) d	% CORE RECOVERY e	BOX OR SAMPLE NO. f	REMARKS (Drilling time, water loss, depth of weathering, etc., if significant) g
571.99	30.0					
			Limestone	100%		
570.99	31.0		Run 7 ROD=96.7%			

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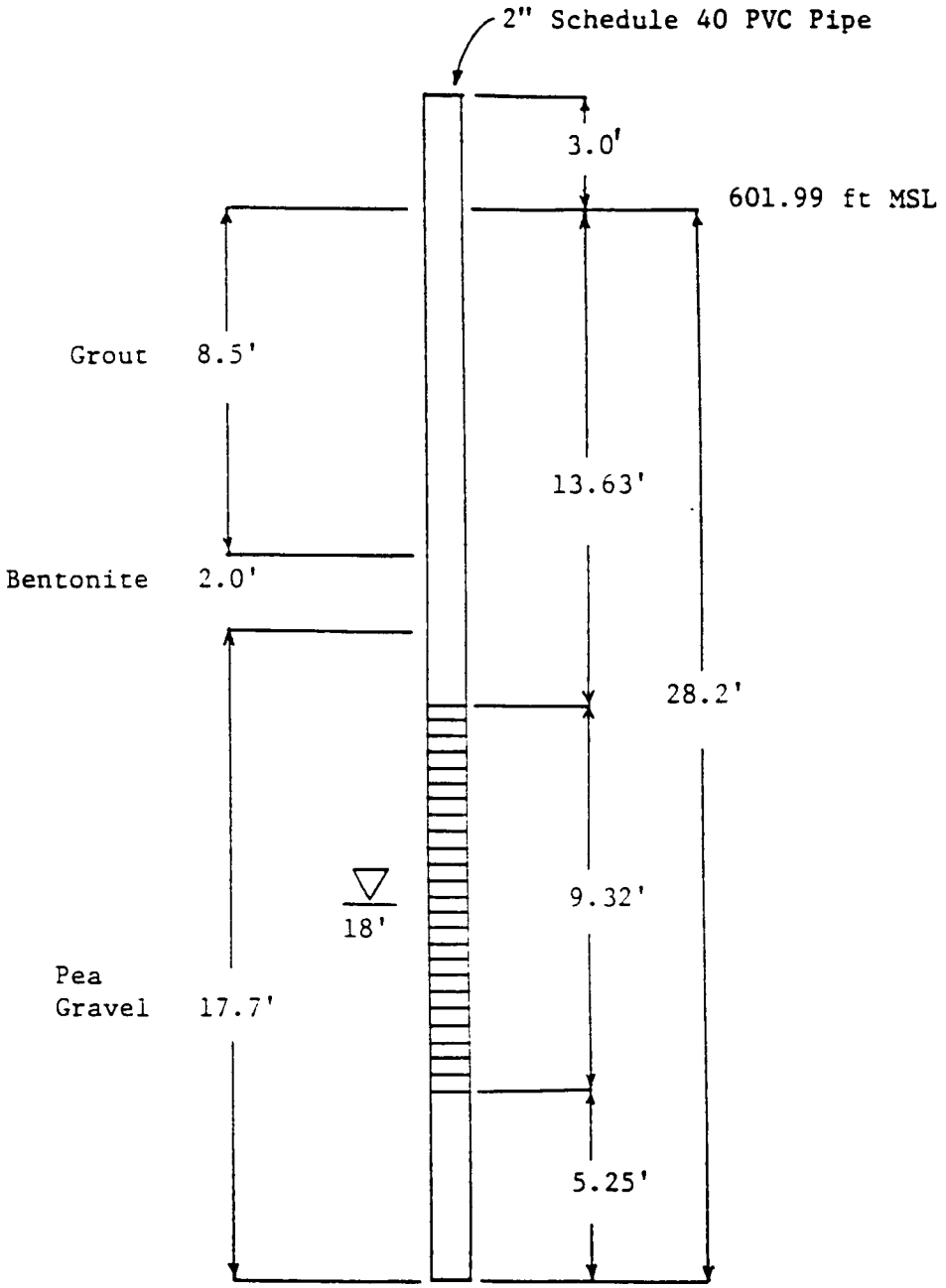
PROJECT | HOLE NO.



Water depth at time of drilling

Well Screen

NWSC, Crane, Indiana
Mustard Gas Burial Grounds
Well Completion
Boring Number: WES-1-8-82

WORKING DRAFT

BORING LOG
FIELD DATA

Project NWSC Groundwater Study Site Crane, IN Date 16 November 82

Location Mustard Gas Burial Grounds Job No. 441-G150.13GR21/22

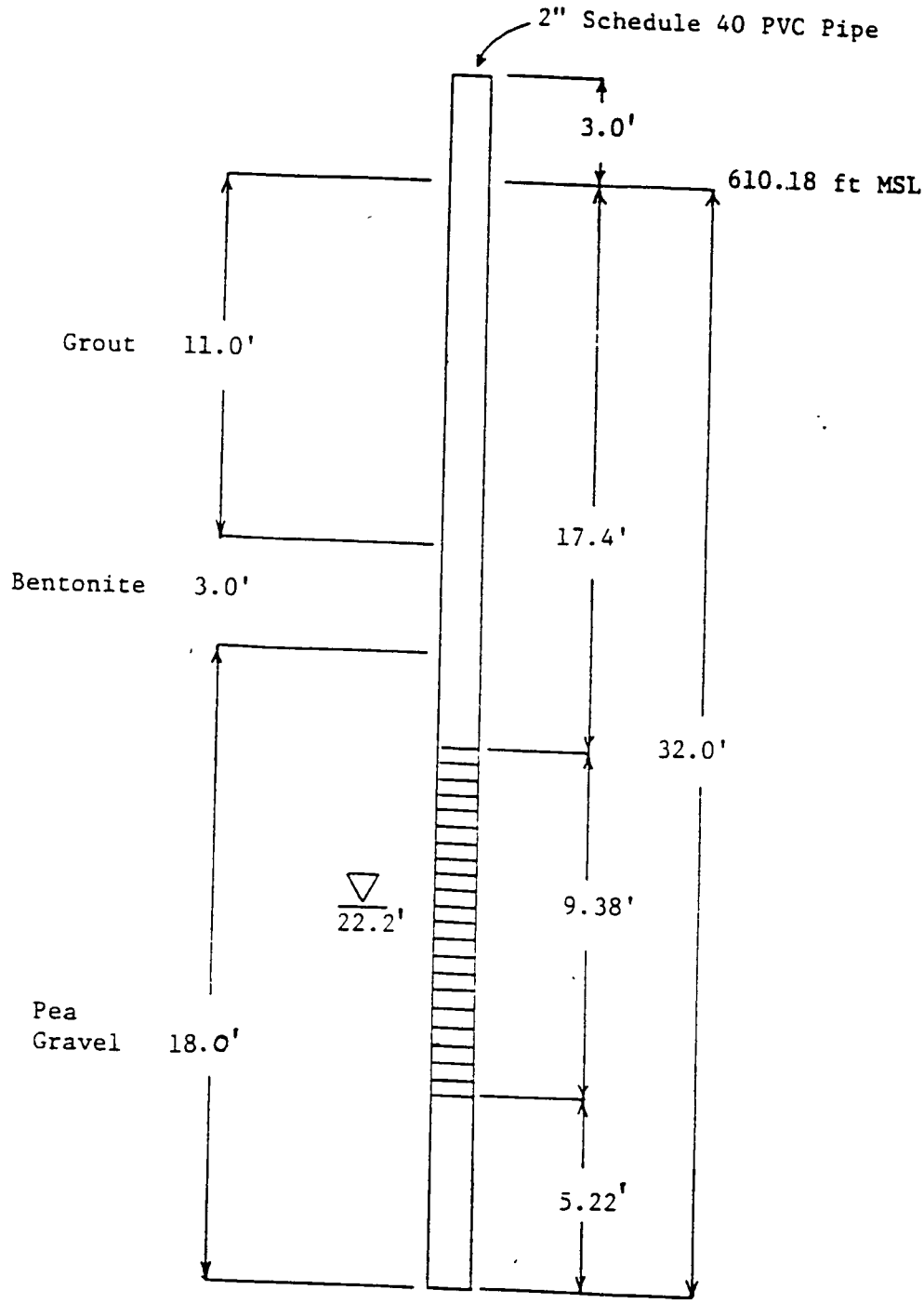
Drill Rig — Inspector J. Dunbar Operator D. Taylor Surface El 610.18 Boring No. WES-1-9-82

SAMPLE NUMBER	DATE TAKEN 1982	STRATUM FROM	STRATUM TO	DRIVE FROM	DRIVE TO	SAMPLE FROM	SAMPLE TO	TYPE OF SAMPLER			CLASSIFICATION AND REMARKS
	16Nov			0.0	1.0			6-3/4"Rock Bit			6" Casing to 1 ft-Stickup 1 ft
		0.0	1.5	0.0	29.5			5-5/8"Rock Bit			Clay(CL): brown, soft, sandy
		1.5	2.3								Sandstone: brown, fine-grained, weathered
											Clay shale: brownish grey, soft
		2.3	5.3								Clay shale: grey, soft
		5.3	9.0								Clay shale: brownish grey, soft
		9.0	11.3								Shale: grey, soft-slightly damp
		11.3	14.2								Shale: grey, soft
		14.2	17.0								Shale: light grey-grey, soft, wet
		17.0	24.0								Shale: dark grey, hard
		24.0	32.0								Water overnight at 22.2 ft -
	17Nov			29.5	32.0			5-5/8"Rock Bit			drilled to 32 ft and installed well

Sheet 1 of 1 Sheets

WES FORM JAN 74 819 EDITION OF NOV 1971 MAY BE USED

WORKING DRAFT



Water depth at time of drilling

Well Screen

NWSC, Crane, Indiana
Mustard Gas Burial Groun
Well Completion
Boring Number: WES-1-9-

BORING LOG
FIELD DATA

Project NWSC Groundwater Study Site Crane, IN Date 30 November 82
Location Mustard Gas Burial Grounds Job No. 441-G150.13GR21/22
Drill Rig Failing Inspector J. Dunbar Operator D. Taylor Surface El 636.77 Boring No. WES-1-10-83

SAMPLE NUMBER	DATE TAKEN 1982	STRATUM FROM	STRATUM TO	DRIVE FROM	DRIVE TO	SAMPLE FROM	SAMPLE TO	TYPE OF SAMPLER			CLASSIFICATION AND REMARKS
	30Nov			0.0	1.0			6 3/4"Rock Bit			6" Casing to 1 ft-Stickup 1 ft
		0.0	2.0	0.0	120.0			5 5/8"Rock Bit			Clay(CL): brown, soft, damp,
											sandy
		2.0	6.5								Clay shale: brown, grey, soft
		6.5	8.0								Clay shale and sandstone interbedded:
											brown, soft
		8.0	20.0								Sandstone with interbedded shale:
											sandstone is brown, grey, fine-
											grained and shale is dark grey, soft
		20.0	21.0								Coal: black, soft
											dry
		21.0	35.0								Sandstone: white, light grey, soft
											uniform
		35.0	65.3								Shale: dark grey, soft, damp at
											around 40 ft - very little water
											after 75 min.

WES FORM JAN 74 819 EDITION OF NOV 1971 MAY BE USED

BORING LOG
FIELD DATA

Project _____ Site _____ Date _____
Location _____ Job No. _____
Drill Rig _____ Inspector _____ Operator _____ Surface El _____ Boring No. WES-1-10-83

SAMPLE NUMBER	DATE TAKEN 1983	STRATUM FROM	STRATUM TO	DRIVE FROM	DRIVE TO	SAMPLE FROM	SAMPLE TO	TYPE OF SAMPLER			CLASSIFICATION AND REMARKS
		65.3	65.8								Coal/shale: black, soft
		65.8	73.2								Shale: light grey, dark grey, soft
		73.2	73.5								Shale/coal: black, soft
		73.5	83.0								Sandstone: grey, dark grey, very
											fine-grained, soft
		83.0	83.2								Limestone: grey, hard
		83.2	103.0								Sandstone: light brown, brown, grey
											very fine-grained, soft
		103.0	120.0								Limestone: grey, hard
	22Jan										Boring is to deep for any
											practical use. Filled boring with
											cement mix and grout. Moved
											approximately 10 ft from this
											location and drilled to 40 ft.
											Borings WES-1-12 and 13-83 on same

WES FORM JAN 74 819 EDITION OF NOV 1971 MAY BE USED

Sheet 2 of 3 Sheets

WORKING DRAFT

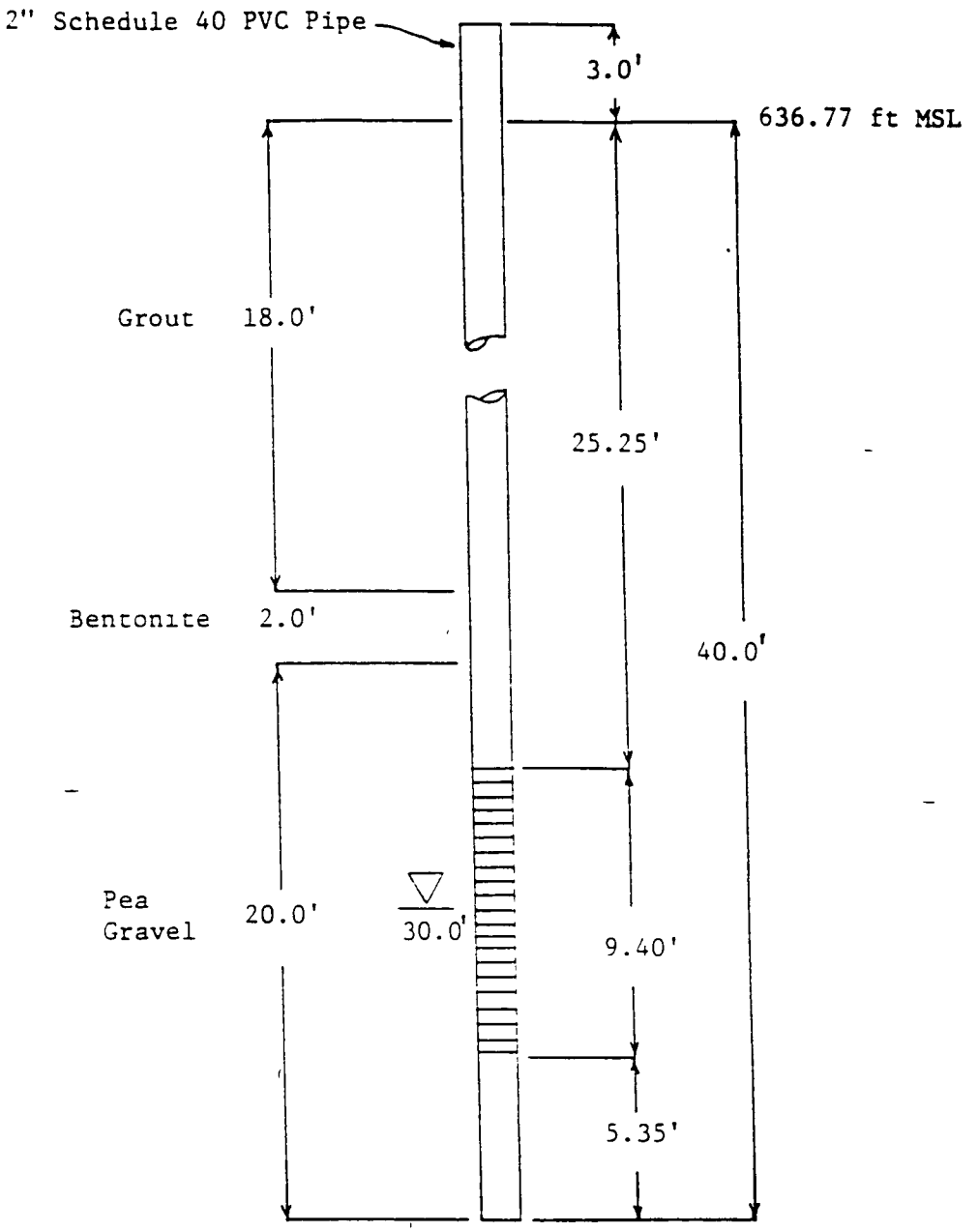
BORING LOG
FIELD DATA

Project _____ Site _____ Date _____
Location _____ Job No. _____
Drill Rig _____ Inspector _____ Operator _____ Surface El _____ Boring No. WES-1-10-83

SAMPLE NUMBER	DATE TAKEN	STRATUM		DRIVE		SAMPLE		TYPE OF SAMPLER			CLASSIFICATION AND REMARKS
		FROM	TO	FROM	TO	FROM	TO				
											shelf, encountered water between
											20 to 30 ft. Fractures are not
											present or not as intense at this
											location as in WES-1-12 and
											1-13-83. Believe there is a damp
											spot at 30.0 ft. Will construct
											a longer gravel filter around
											well screen.

Sheet 3 of 3 Sheets

WES FORM JAN 74 819 EDITION OF NOV 1971 MAY BE USED



Water depth at time of drilling

Well Screen

NWSC, Crane, Indiana
Mustard Gas Burial Grounds
Well Completion
Boring Number: WES-1-10-83

WORKING DRAFT

BORING LOG
FIELD DATA

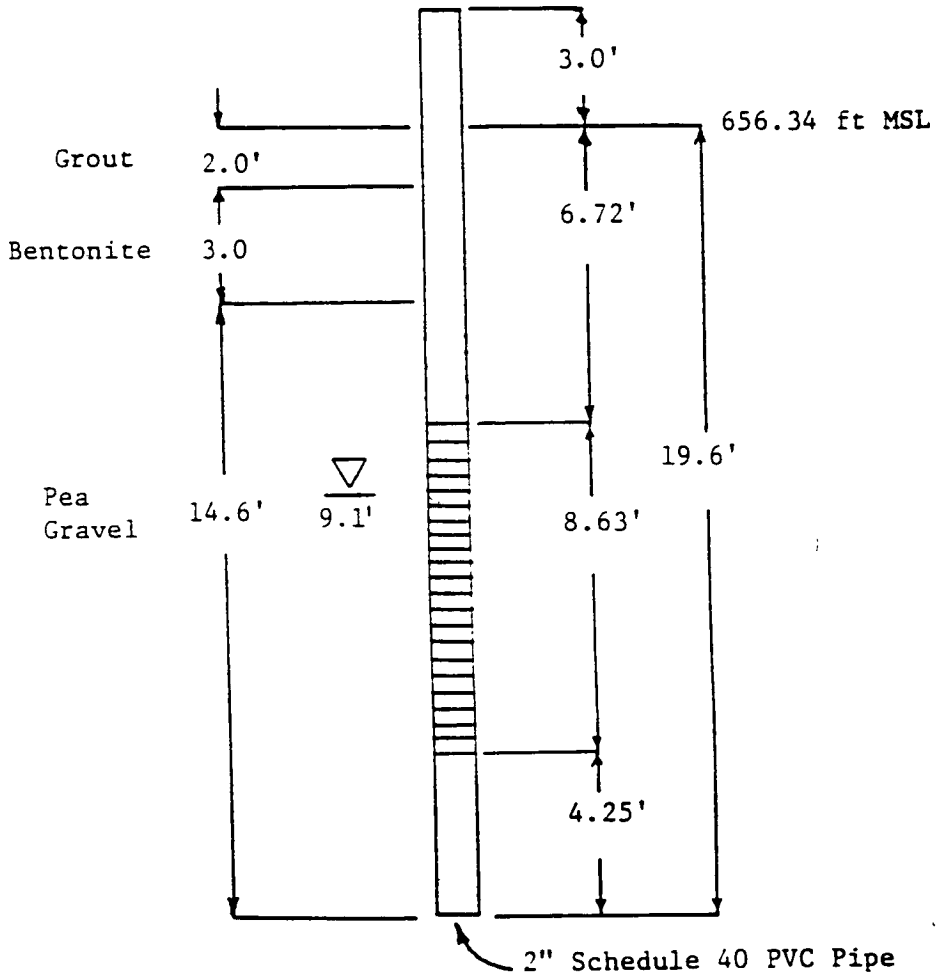
Project NWSC Groundwater Study Site Crane, IN Date 8 January 83
Location Mustard Gas Burial Grounds Job No. 441-G150.13GR21/22
Drill Rig Failing Inspector J. Dunbar Operator D. Taylor Surface El 656.34 Boring No. WES-1-11-83

SAMPLE NUMBER	DATE TAKEN 1983	STRATUM FROM	STRATUM TO	DRIVE FROM	DRIVE TO	SAMPLE FROM	SAMPLE TO	TYPE OF SAMPLER			CLASSIFICATION AND REMARKS
	8 Jan			0.0	1.7			6" Casing			Stickup 0.3 ft
	8 Jan	0.0	4.6	0.0	19.6			5-5/8"Rock Bit			Clay(CL): brown, soft, moist, organic matter(roots)
		4.6	11.1								Sandstone: brown, very fine-grained, friable, water at 9.1 ft
		11.1	14.4								Sandstone: grey, very fine-grained, clayey
		14.4	18.8								Shale: dark grey, soft, interbedded with sandstone
		18.8	19.6								Limestone(?): very hard, no return
											Installed well

WES FORM JAN 74 819 EDITION OF NOV 1971 MAY BE USED

Sheet 1 of 1 Sheets

WORKING DRAFT



Water depth at time of drilling

Well Screen

NWSC, Crane, Indiana
Mustard Gas Burial Gro
Well Completion
Boring Number: WES-1-

BORING LOG
FIELD DATA

Project NWSC Groundwater Study
Location Mustard Gas Burial Grounds
Site Crane, IN
Date 19 January 83
Drill Rig Failing
Inspector J. Dunbar
Operator D. Taylor
Surface El 634.05
Job No. 441-G150.13GR21/22
Boring No. WES-1-12-83

SAMPLE NUMBER	DATE TAKEN 1983	STRATUM FROM	STRATUM TO	DRIVE FROM	DRIVE TO	SAMPLE FROM	SAMPLE TO	TYPE OF SAMPLER			CLASSIFICATION AND REMARKS
	19 Jan			0.0	1.0			6-3/4"Rock Bit			6" Casing - 1.0 ft stickup
		0.0	1.5	0.0	38.0			5-5/8"Rock Bit			Clay(CL): brown, soft, damp
		1.5	3.0								silty sand(SM): reddish brown, soft, damp, fine-grained
		3.0	7.5								Clay shale: brown, soft
		7.5	10.0								Shale: dark grey, soft
		10.0	13.5								Shale: dark grey, medium
		13.5	17.5								Shale: dark grey, medium, sandstone lenses-very fine-grained
		17.5	18.8								Shale: grey, soft
		18.8	19.5								Sandstone: grey, hard, fine-grained
		19.5	22.0								Coal: black, soft
		22.0	23.5								Shale: dark grey, soft
		23.5	28.0								Shale and sandstone: dark grey, soft, fine-grained sandstone, water at 27 ft
		28.0	38.0								Shale: light grey, soft, uniform

WES FORM JAN 74 819 EDITION OF NOV 1971 MAY BE USED

BORING LOG
FIELD DATA

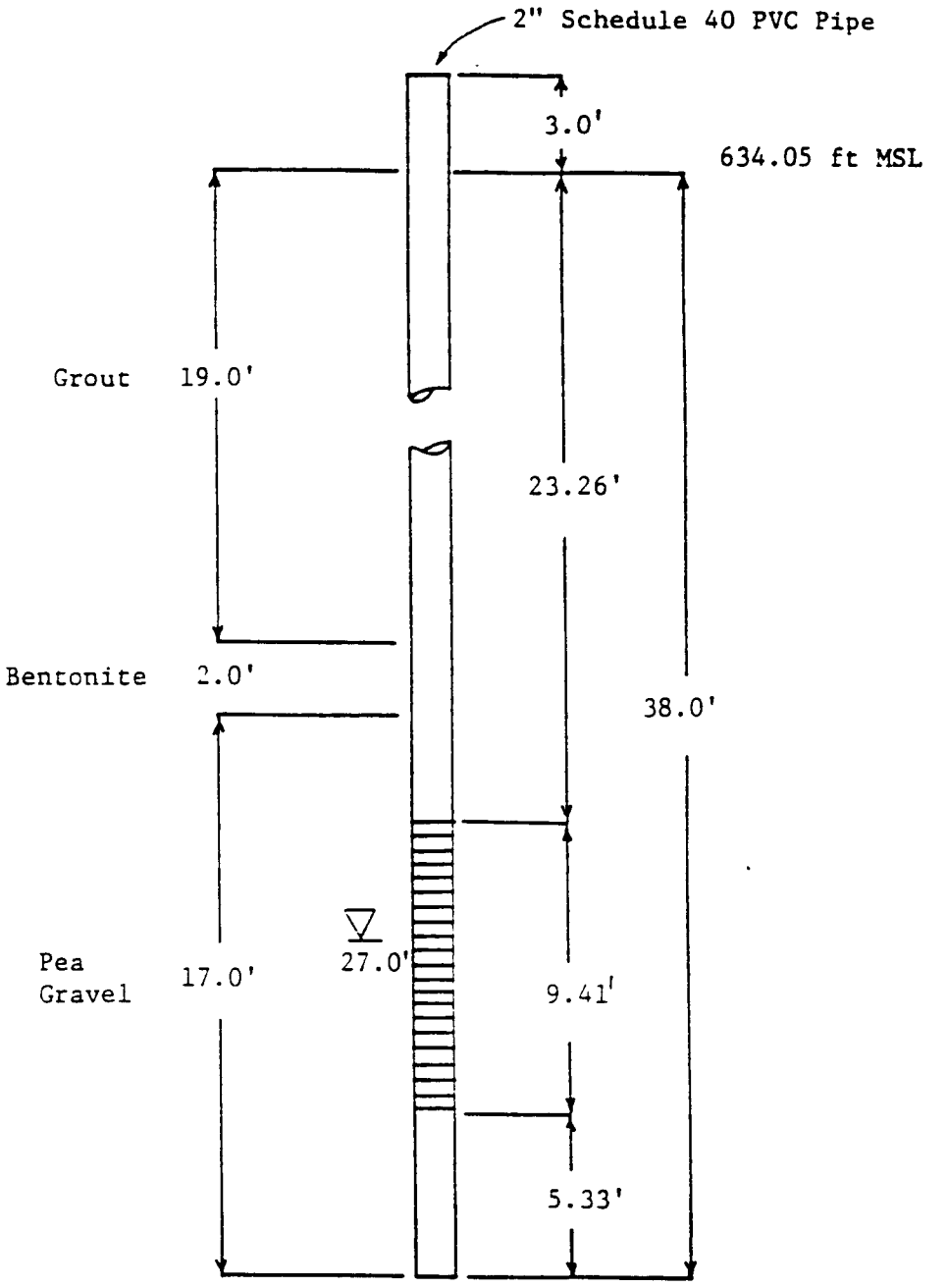
Project _____ Site _____ Date _____
Location _____ Job No. _____
Drill Rig _____ Inspector _____ Operator _____ Surface El _____ Boring No. WES-1-12-83

SAMPLE NUMBER	DATE TAKEN	STRATUM		DRIVE		SAMPLE		TYPE OF SAMPLER			CLASSIFICATION AND REMARKS
		FROM	TO	FROM	TO	FROM	TO				
											Installed well

WORKING DRAFT

WES FORM JAN 74 819 EDITION OF NOV 1971 MAY BE USED

Sheet 2 of 2 Sheets



Water depth at time of drilling

Well Screen

NWSC, Crane, Indiana
Mustard Gas Burial Grounds
Well Completion
Boring Number: WES-1-12-83

WORKING DRAFT

BORING LOG
FIELD DATA

Project NWSC Groundwater Study
Location Mustard Gas Burial Grounds
Site Crane, IN
Date 19 January 83
Drill Rig Failing
Inspector J. Dunbar
Operator D. Taylor
Surface El 634.98
Job No. 441-G150.13GR21/22
Boring No WES-1-13-83

SAMPLE NUMBER	DATE TAKEN 1983	STRATUM FROM	STRATUM TO	DRIVE FROM	DRIVE TO	SAMPLE FROM	SAMPLE TO	TYPE OF SAMPLER			CLASSIFICATION AND REMARKS
	19 Jan			0.0	1.0			6-3/4"Rock Bit			6"Casing - Stickup 1.0 ft
	21 Jan			0.0	4.0			5-5/8"Rock Bit			Cleanout for 4"x5½" Core Barrel
				4.0	7.2			4"x5½"Core Barrel			Run 1
				7.2	11.5			" " "			Run 2
				11.5	12.6			" " "			Run 3
				12.6	15.9			" " "			Run 4
				15.9	20.3			" " "			Run 5
				20.3	25.6			" " "			Run 6
				25.6	30.35			" " "			Run 7
				30.35	34.7			" " "			Run 8
	22 Jan			0.0	35.0			5-5/8"Rock Bit			Cleanout
		0.0	10.5								
		10.5	18.6								Clay Shale
		18.6	21.4								Shale(60%) and Sandstone(40%)
		21.4	22.9								Shale
		22.9	30.35								Coal (Bituminous)
											Sandstone

WES FORM JAN 74 819 EDITION OF NOV 1971 MAY BE USED

Sheet 1 of 6 Sheets

BORING LOG
FIELD DATA

Project _____ Site _____ Date _____
Location _____ Job No. _____
Drill Rig _____ Inspector _____ Operator _____ Surface El _____ Boring No. WES-1-13-83

SAMPLE NUMBER	DATE TAKEN	STRATUM		DRIVE		SAMPLE		TYPE OF SAMPLER			CLASSIFICATION AND REMARKS
		FROM	TO	FROM	TO	FROM	TO				
		30.35	35.0								Sandstone(80-90%) and Shale (10-20%)
											See boring log starting on page 3 for details. Installed monitoring well on 22 January 83. Flow is estimated to be approximately 10-20 GPM

WES FORM JAN 74 819 EDITION OF NOV 1971 MAY BE USED

Sheet 2 of 6 Sheets

WORKING DRAFT

Hole No. WES

DRILLING LOG	DIVISION US Navy	INSTALLATION Crane, IN
1. PROJECT NWSC Groundwater Study		10. SIZE AND TYPE OF BIT 4"x5½" Diamond
2. LOCATION (Coordinates or Station) Mustard Gas Burial Grounds		11. DATUM FOR ELEVATION SHOWN (TBM or MSL) MSL
3. DRILLING AGENCY CEWES		12. MANUFACTURER'S DESIGNATION OF DRILL Failing
4. HOLE NO. (As shown on drawing title and file number) WES-1-13-83		13. TOTAL NO. OF OVER-BURDEN SAMPLES TAKEN: DISTURBED Zero; UN Zero
5. NAME OF DRILLER D. Taylor		14. TOTAL NUMBER CORE BOXES Zero
6. DIRECTION OF HOLE [X] VERTICAL [ ] INCLINED ____ DEG. FROM VERT.		15. ELEVATION GROUND WATER
7. THICKNESS OF OVERBURDEN 0.0		16. DATE HOLE STARTED 20 Jan 83; COMPL 22
8. DEPTH DRILLED INTO ROCK 35.0		17. ELEVATION TOP OF HOLE 634.98
9. TOTAL DEPTH OF HOLE 35.0		18. TOTAL CORE RECOVERY FOR BORING 92.6
		19. SIGNATURE OF INSPECTOR [signature]

ELEVATION a	DEPTH b	LEGEND c	CLASSIFICATION OF MATERIALS (Description) d	% CORE RECOVERY e	BOX OR SAMPLE NO. f	REMARKS (Drilling time, water loss, weathering, etc., if ...) g
634.98	0.0					
633.98	1.0		Clay Shale: brown, dark grey, weathered, brittle, oxidized, limonitic, soft			
632.98	2.0					5-5/8" Rock Bit ft to make room 4"x5½" Core Bar
631.98	3.0					
630.98	4.0		MB = Machine break			21 January 83
629.98	5.0		MB; MB; MB — closed fracture			VL - Began 9:50 End 10:10 Time 20 Min Drl time 20 Min Hyd press 200 P Water press - RPM 70± Drl Action Smooth ~~Water~~ ret brown
628.98	6.0		fractured-weathered; Clay shale: brown, dark grey, weathered, brittle, oxidized, limonitic, soft.			Remarks Carbaloi bit
627.98	7.0		fractured - v. brittle, broke on removal from barrel; Run 1 RQD=15.6%	100%		
626.98	8.0		fractured - partial recovery; fractured - larger rock pieces (1" to 4" fragments)			Began 10:20 End 10:35 Time 15 Min Drl time 15 Min Hyd press 200 PSI Water press - RPM 70 ± Drl Action Smooth ~~Water~~ ret brown, orange Remarks Car bit
625.98	9.0		Clay shale: same; closed	88.4%		
624.98	10.0					

ENG FORM 1836 MAR 71 PREVIOUS EDITIONS ARE OBSOLETE. PROJECT HOLE

Hole No. WES-1-13-83

DRILLING LOG	DIVISION US Navy	INSTALLATION Crane, IN	SHEET 4 OF 6 SHEETS

1. PROJECT NWSC Groundwater Study	10. SIZE AND TYPE OF BIT
2. LOCATION (Coordinates or Station) Mustard Gas Burial Grounds	11. DATUM FOR ELEVATION SHOWN (TBM or MSL) MSL
3. DRILLING AGENCY CEWES	12. MANUFACTURER'S DESIGNATION OF DRILL Failing
4. HOLE NO. (As shown on drawing title and file number) WES-1-13-83	13. TOTAL NO. OF OVER-BURDEN SAMPLES TAKEN — DISTURBED: — UNDISTURBED: —
5. NAME OF DRILLER D. Taylor	14. TOTAL NUMBER CORE BOXES
6. DIRECTION OF HOLE ☒ VERTICAL ☐ INCLINED _____ DEG. FROM VERT.	15. ELEVATION GROUND WATER
	16. DATE HOLE — STARTED: — COMPLETED: —
7. THICKNESS OF OVERBURDEN	17. ELEVATION TOP OF HOLE
8. DEPTH DRILLED INTO ROCK	18. TOTAL CORE RECOVERY FOR BORING %
9. TOTAL DEPTH OF HOLE	19. SIGNATURE OF INSPECTOR

ELEVATION a	DEPTH b	LEGEND c	CLASSIFICATION OF MATERIALS (Description) d	% CORE RECOVERY e	BOX OR SAMPLE NO. f	REMARKS (Drilling time, water loss, depth of weathering, etc., if significant) g
624.98	10.0		∠: 45° Clay shale: same			
			Shale(60%) and Sandstone(40%): ultra fine horizontal lamina and lenses of interbedded dark grey shale and light grey, very fine-grained sandstone, soft to medium			
623.98	11.0		Run 2 RQD=48.8%			NL- - 3 Began 10:46 Rec 1.1' End 11:03 Los - Time 17 Min Gain - Drl time 17 Min Hyd press 200 PSI Water press - RPM 70± Drl Action Smooth ~~Water~~ ret lt to dark grey Remarks Carbaloid drill bit
622.98	12.0		MB Shale(60%) and Sandstone(40%) MB same as above	100%		
			Run 3 RQD=45.5%			
621.98	13.0		oxidized from 13.25 to 13.35 ft Spin			
620.98	14.0		Shale(60%) and Sandstone(40%) same as above	72.7%		NL - - 4 Began 11:13 Rec 2.4' End 11:20 Los 0.9' Time 7 Min Gain - Drl time 7 Min Hyd press 200 PSI Water press - RPM 70± Drl Action Smooth ~~Water~~ ret light-dark grey Remarks Diamond drill bit
619.98	15.0		Run 4 RQD=72.7%			
618.98	16.0		Shale(50%) and Sandstone(50%) same as above			
617.98	17.0					NL - Run 5 Began 11:40 Rec 4.4' End 12:00 Loss - Time 20 Min Gain - Drl time 20 Min Hyd press 200 PSI Water press - RPM 70± Drl Action Smooth ~~Water~~ ret light-dark grey Remarks same
616.98	18.0		MB	100%		
615.98	19.0		fractured Shale: dark grey, soft, uniform, possibly damp			
614.98	20.0					

WORKING DRAFT

Hole No. WES-1-1

DRILLING LOG	DIVISION US Navy	INSTALLATION Crane, IN	SHEET 5 OF 6 SH

1. PROJECT NWSC Groundwater Study	10. SIZE AND TYPE OF BIT
2. LOCATION (Coordinates or Station) Mustard Gas Burial Grounds	11. DATUM FOR ELEVATION SHOWN (TBM or MSL) MSL
3. DRILLING AGENCY CEWES	12. MANUFACTURER'S DESIGNATION OF DRILL Failing
4. HOLE NO. (As shown on drawing title and file number) WES-1-13-83	13. TOTAL NO. OF OVER-BURDEN SAMPLES TAKEN — DISTURBED: — UNDISTUR:
5. NAME OF DRILLER D. Taylor	14. TOTAL NUMBER CORE BOXES
6. DIRECTION OF HOLE ☒ VERTICAL ☐ INCLINED ____ DEG. FROM VERT.	15. ELEVATION GROUND WATER
	16. DATE HOLE — STARTED: — COMPLETED:
7. THICKNESS OF OVERBURDEN	17. ELEVATION TOP OF HOLE
8. DEPTH DRILLED INTO ROCK	18. TOTAL CORE RECOVERY FOR BORING
9. TOTAL DEPTH OF HOLE	19. SIGNATURE OF INSPECTOR

ELEVATION a	DEPTH b	LEGEND c	CLASSIFICATION OF MATERIALS (Description) d	% CORE RECOVERY e	BOX OR SAMPLE NO. f	REMARKS (Drilling time, water loss, depth weathering, etc., if significant) g
614.98	20.0		Run 5 ROD=79.5%			
613.98	21.0		Shale: same - no recovery			WL - Run 6 Began 12:35 Rec 4 End 1:10 Loss 1 Time 35 Min Gain Drl time 35 Min Hyd press 200 PSI Water press - R.M 70± Drl Action Smooth ~~Water~~ ret dark grey black, white Remarks wet at coal seam
612.98	22.0		Coal (Bituminous): black, blocky, brittle, fractured, weathered-sulfides with gossan			
611.98	23.0		∠45°			
610.98	24.0		Sandstone: light grey, white, fine-grained, quartz sandstone, thinly bedded to massive with cross bedding visible, fractures are weathered, oxidized, with partial solution filling.	79.2%		WL - Run 7 Began 2:05 Rec 3 End 2:25 Loss Time 20 Min Gain Drl time 20 Min Hyd press 200 PSI Water press - R.M 70± Drl Action Smooth ~~Water~~ ret lt. grey white Remarks Blocked off More water
609.98	25.0		MB MB MB Run 6 ROD=40%			
608.98	26.0		orange brown from 26.7 ft to 27.1 ft			
607.98	27.0					
606.98	28.0		Sandstone: same as above	100%		
605.98	29.0		orange brown from 29.3 ft to 29.6 ft closed			
604.98	30.0					

Hole No. WES-1-13-83

DRILLING LOG	DIVISION US Navy	INSTALLATION Crane, IN	SHEET 6 OF 6 SHEETS

1. PROJECT NWSC Groundwater Study	10. SIZE AND TYPE OF BIT
2. LOCATION (Coordinates or Station) Mustard Gas Burial Grounds	11. DATUM FOR ELEVATION SHOWN (TBM or MSL) MSL
3. DRILLING AGENCY CEWES	12. MANUFACTURER'S DESIGNATION OF DRILL Failing
4. HOLE NO. (As shown on drawing title and file number) WES-1-13-83	13. TOTAL NO. OF OVER-BURDEN SAMPLES TAKEN: DISTURBED / UNDISTURBED
5. NAME OF DRILLER D. Taylor	14. TOTAL NUMBER CORE BOXES
6. DIRECTION OF HOLE ☑ VERTICAL ☐ INCLINED ____ DEG. FROM VERT.	15. ELEVATION GROUND WATER
	16. DATE HOLE: STARTED / COMPLETED
7. THICKNESS OF OVERBURDEN	17. ELEVATION TOP OF HOLE
8. DEPTH DRILLED INTO ROCK	18. TOTAL CORE RECOVERY FOR BORING %
9. TOTAL DEPTH OF HOLE	19. SIGNATURE OF INSPECTOR

ELEVATION a	DEPTH b	LEGEND c	CLASSIFICATION OF MATERIALS (Description) d	% CORE RECOVERY e	BOX OR SAMPLE NO. f	REMARKS (Drilling time, water loss, depth of weathering, etc., if significant) g
604.98	30.0		Run 7 RQD=100%			
			Sandstone: same			
603.98	31.0		fracture-weathered and oxidized			WL - Run 8 Began 3:00 Rec 4.35 End 3:35 Los - Time 35 Min Ga - Drl time 35 Min Hyd press 200 PSI Water press - R.M 70 ± Drl Action Smooth Water lt-dark grey
			Shale content in this interval at 5-10%			
602.98	32.0					
			Sandstone (see above) with 10-20% thinly bedded, soft, dark grey shale seams, coal lamina are also present			
601.98	33.0					Remarks Stuck core barrel and removed on 22 January 83 Estimate quantity of flow to be 10 to 20 GPM
600.98	34.0			100%		
			Run 8 RQD=54%			
599.98	35.0		Reamed hole with 5-5/8" Rock Bit and set well			

WORKING DRAFT

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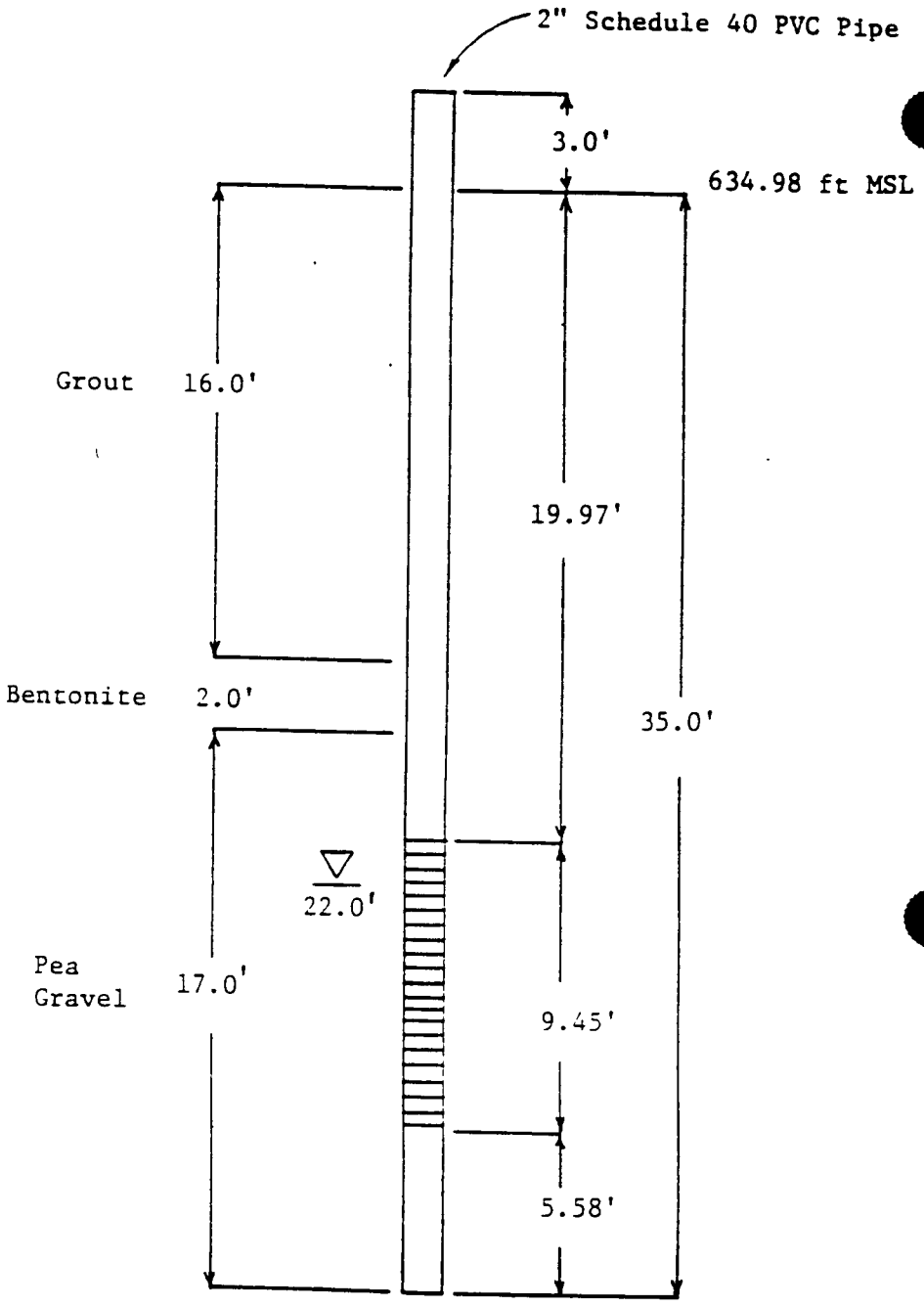


Water depth at time of drilling

Well Screen

NWSC, Crane, Indiana
Mustard Gas Burial Gro
Well Completion
Boring Number: WES-1-

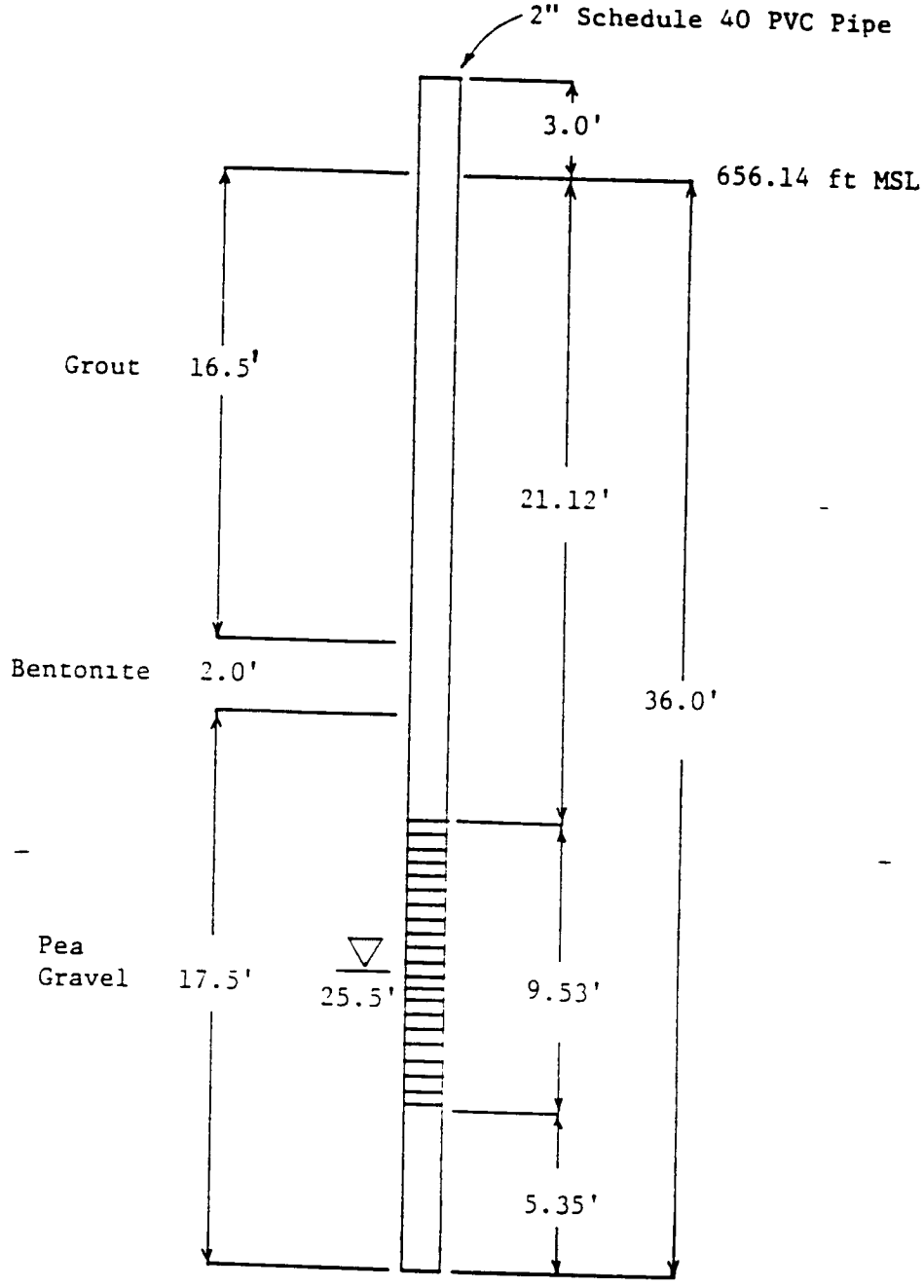
BORING LOG
FIELD DATA

Project NWSC Groundwater Study Site Crane, IN Date 25 January 83
Location Mustard Gas Burial Grounds Job No. 441-G150.13GR21/22
Drill Rig Failing Inspector J. Dunbar Operator D. Taylor Surface El 656.14 Boring No. WES-1-14-83

SAMPLE NUMBER	DATE TAKEN 1983	STRATUM FROM	STRATUM TO	DRIVE FROM	DRIVE TO	SAMPLE FROM	SAMPLE TO	TYPE OF SAMPLER			CLASSIFICATION AND REMARKS
	26 Jan			0.0	1.0			6-3/4"Rock Bit			6" Casing - 1.0 ft stickup
		0.0	3.0					5-5/8"Rock Bit			Clay(CL): brown, soft, damp, sandy
		3.0	6.0								Gravelly clay(GC): same as above,
											gravel is fine to coarse at 30%
		6.0	7.5								Clay(CL): brown, soft, damp
		7.5	14.5								Sandstone: brown, fine-grained,
											soft, weathered
		14.5	15.5								Shale: brown, dark brown, soft
		15.5	20.0								Sandstone: brown, light grey, fine-
											grained, soft
		20.0	24.0								Shale(60%) and sandstone(40%): light
											grey, dark grey, medium fine-grained
											sandstone
		24.0	36.0								Shale: dark grey, uniform, water
											at 25.5 ft
											Installed well

WES FORM JAN 74 819 EDITION OF NOV 1971 MAY BE USED

Sheet 1 of 1 Sheets



Water depth at time of drilling

Well Screen

NWSC, Crane, Indiana
Mustard Gas Burial Grounds
Well Completion
Boring Number: WES-1-14-83

WORKING DRAFT

BORING LOG
FIELD DATA

Project NWSC Groundwater Study Site Crane, IN Date 10 February 83
Location Mustard Gas Burial Grounds Job No. 441-G150.13GR21/22
Drill Rig Failing Inspector J. Dunbar Operator D. Taylor Surface El 663.01 Boring No. WES-1-15-83

SAMPLE NUMBER	DATE TAKEN 1983	STRATUM FROM	STRATUM TO	DRIVE FROM	DRIVE TO	SAMPLE FROM	SAMPLE TO	TYPE OF SAMPLER			CLASSIFICATION AND REMARKS
	10 Feb			0.0	1.0			6-3/4"Rock Bit			6" Casing - 1 ft stickup
		0.0	5.0	1.0	37.8			5-5/8"Rock Bit			Clay(CL): brown, soft, damp, sandy
		5.0	10.0								Limestone: grey, hard, fine-grained
		10.0	11.5								Clay: brown, soft
		11.5	13.2								Sandstone: reddish brown, fine-
											grained, soft
		13.2	15.8								Clay: brown, soft
		15.8	21.7								Sandstone: light brown, grey, fine-
											grained, soft
		21.7	32.0								Sandstone: grey, fine-grained, soft
											water between 25-26 ft
		32.0	33.0								Shale: grey, soft
		33.0	37.8								Sandstone: light grey, fine-grained,
											soft
											Installed well

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Sheet 1 of 1 Sheets

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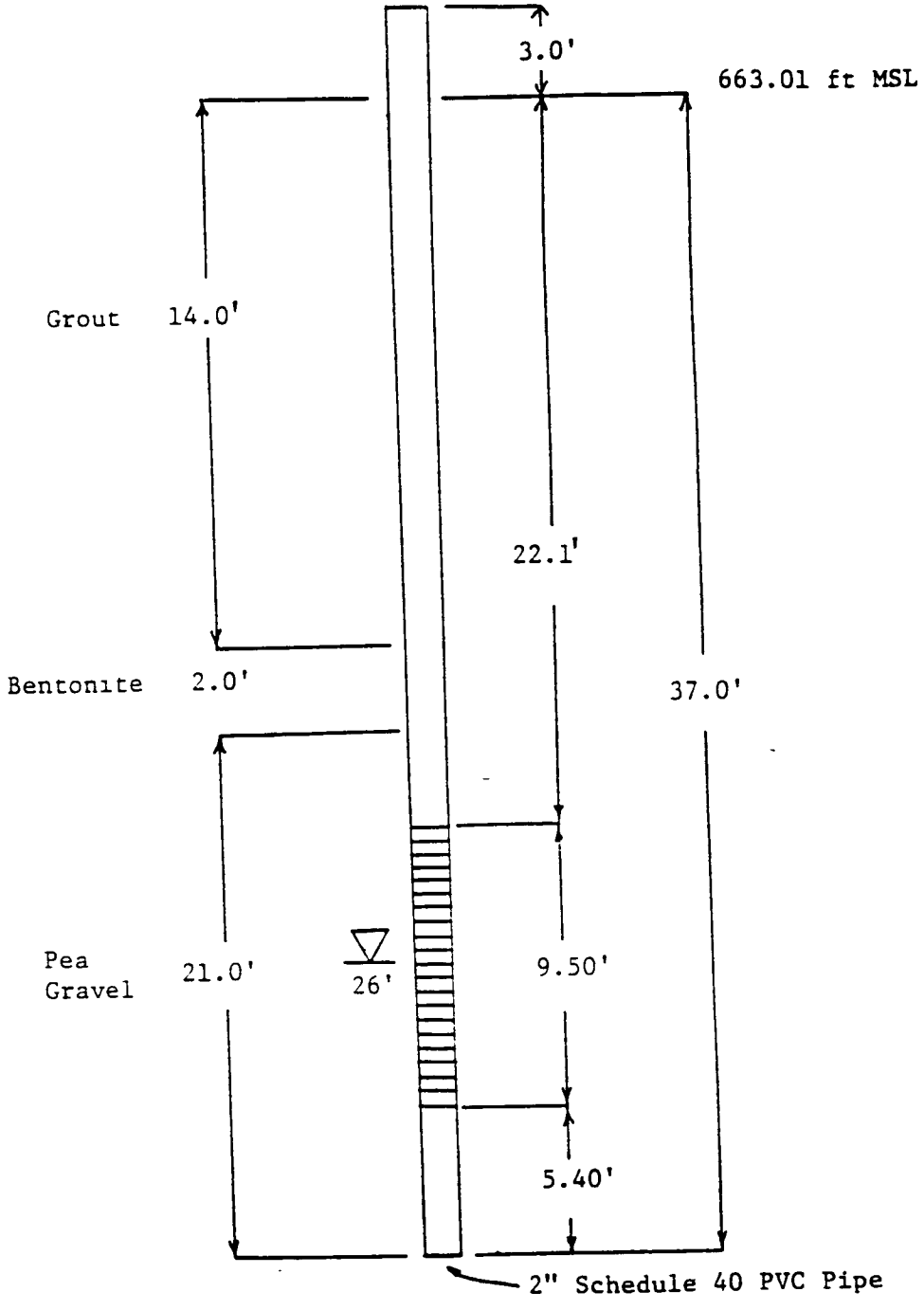


Water depth at time of drilling

Well Screen

NWSC, Crane, Indiana
Mustard Gas Burial Grou
Well Completion
Boring Number: WES-1-1

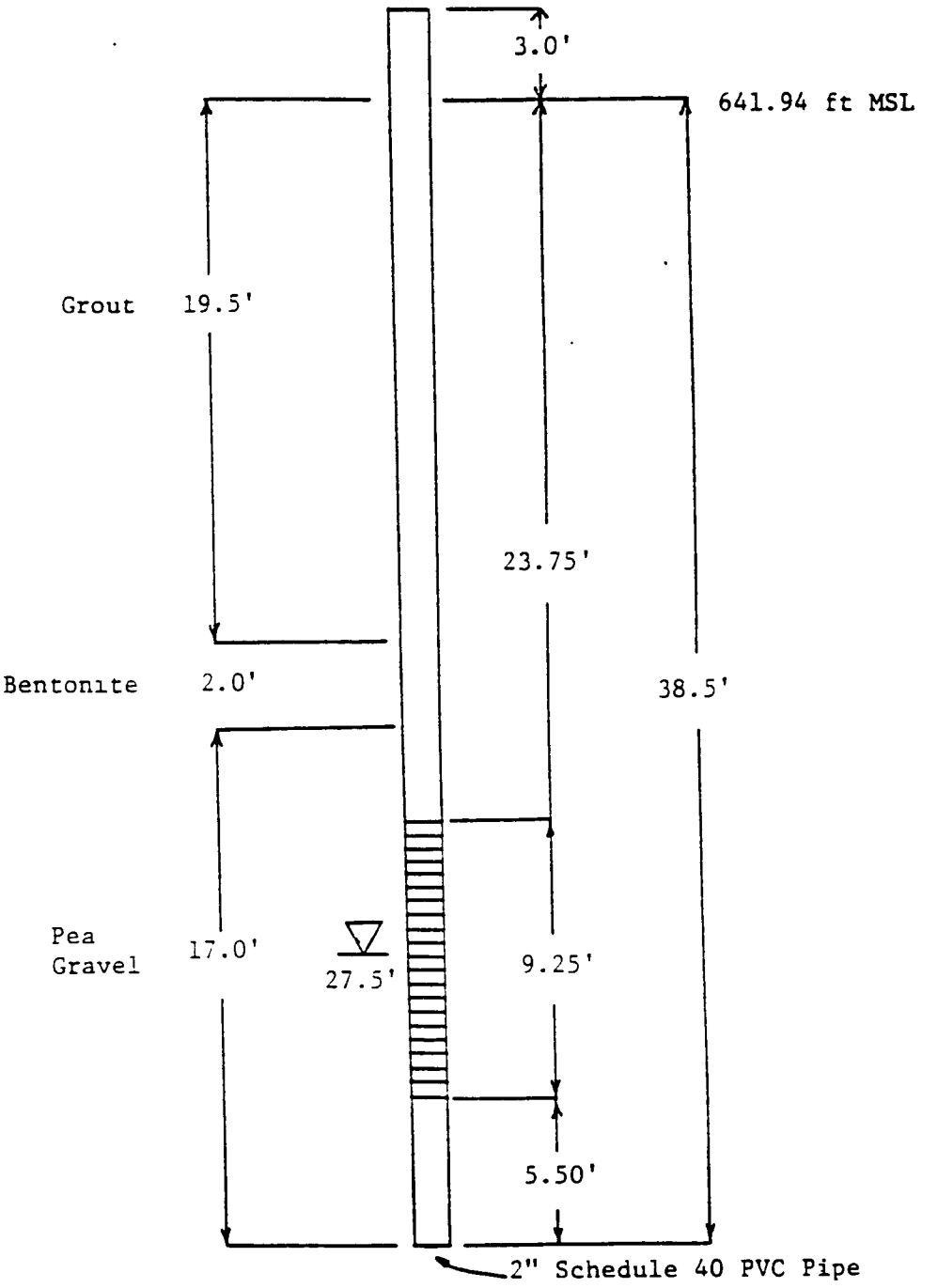
BORING LOG
FIELD DATA

Project NWSC Groundwater Study Site Crane, IN Date 11 February 83
Location Mustard Gas Burial Grounds Job No. 441-G150.13GR21/22
Drill Rig Failing Inspector J. Dunbar Operator D. Taylor Surface El 641.94 Boring No. WES-1-16-83

SAMPLE NUMBER	DATE TAKEN 1983	STRATUM FROM	STRATUM TO	DRIVE FROM	DRIVE TO	SAMPLE FROM	SAMPLE TO	TYPE OF SAMPLER			CLASSIFICATION AND REMARKS
	11 Feb			0.0	1.0			6-3/4"Rock Bit			6" Casing - 1 ft stickup
		0.0	9.5	1.0	38.5			5-5/8"Rock Bit			Sandstone: reddish brown, fine-
											grained, soft, weathered
		9.5	10.6								Clay: brown, soft
		10.6	16.5								Sandstone: brownish grey, soft,
											fine-grained
		16.5	26.0								Sandstone: grey, fine-grained, soft
		26.0	29.4								Sandstone: reddish brown, grey,
											soft, fine-grained, water at 27.5 ft
		29.4	35.2								Shale: blueish grey, soft, uniform
		35.2	36.0								Coal: black, soft
		36.0	38.5								Sandstone: grey, soft, fine-grained
											Installed well

WES FORM JAN 74 819 EDITION OF NOV 1971 MAY BE USED

Sheet 1 of 1 Sheets



Water depth at time of drilling

Well Screen

NWSC, Crane, Indiana
Mustard Gas Burial Grounds
Well Completion
Boring Number: WES-1-16-83

WORKING DRAFT

BORING LOG
FIELD DATA

Project NWSC Groundwater Study Site Crane, IN Date 12 February 83
Location Mustard Gas Burial Grounds Job No. 441-G150.13GR21/22
Drill Rig Failing Inspector J. Dunbar Operator D. Taylor Surface El 662.54 Boring No. WES-1-17-83

SAMPLE NUMBER	DATE TAKEN 1983	STRATUM FROM	STRATUM TO	DRIVE FROM	DRIVE TO	SAMPLE FROM	SAMPLE TO	TYPE OF SAMPLER			CLASSIFICATION AND REMARKS
	12 Feb			0.0	1.5			6-3/4"Rock Bit			6" Casing - 0.5 ft stickup
		0.0	2.8	1.5	39.0			5-5/8"Rock Bit			Clay(CL): brown, soft, damp, sandy
		2.8	10.0								Clay(CL) and sandstone gravel:
											brown, reddish brown, soft,damp, fin
											to coarse gravel, weathered
		10.0	18.0								Sandstone: tan, light brown, soft,
											fine-grained, uniform
		18.0	34.0								Sandstone: light brown, reddish
											brown, weathered, soft, water
											at 28 ft
		34.0	39.0								Shale: grey, soft, possibly oily
											Blew well several times. Appearance
											of oil film which did not come from
											compressor or rig. Installed well
											and gravel and rinsed with water to

WES FORM JAN 74 819 EDITION OF NOV 1971 MAY BE USED

Sheet 1 of 2 Sheets

WORKING DRAFT

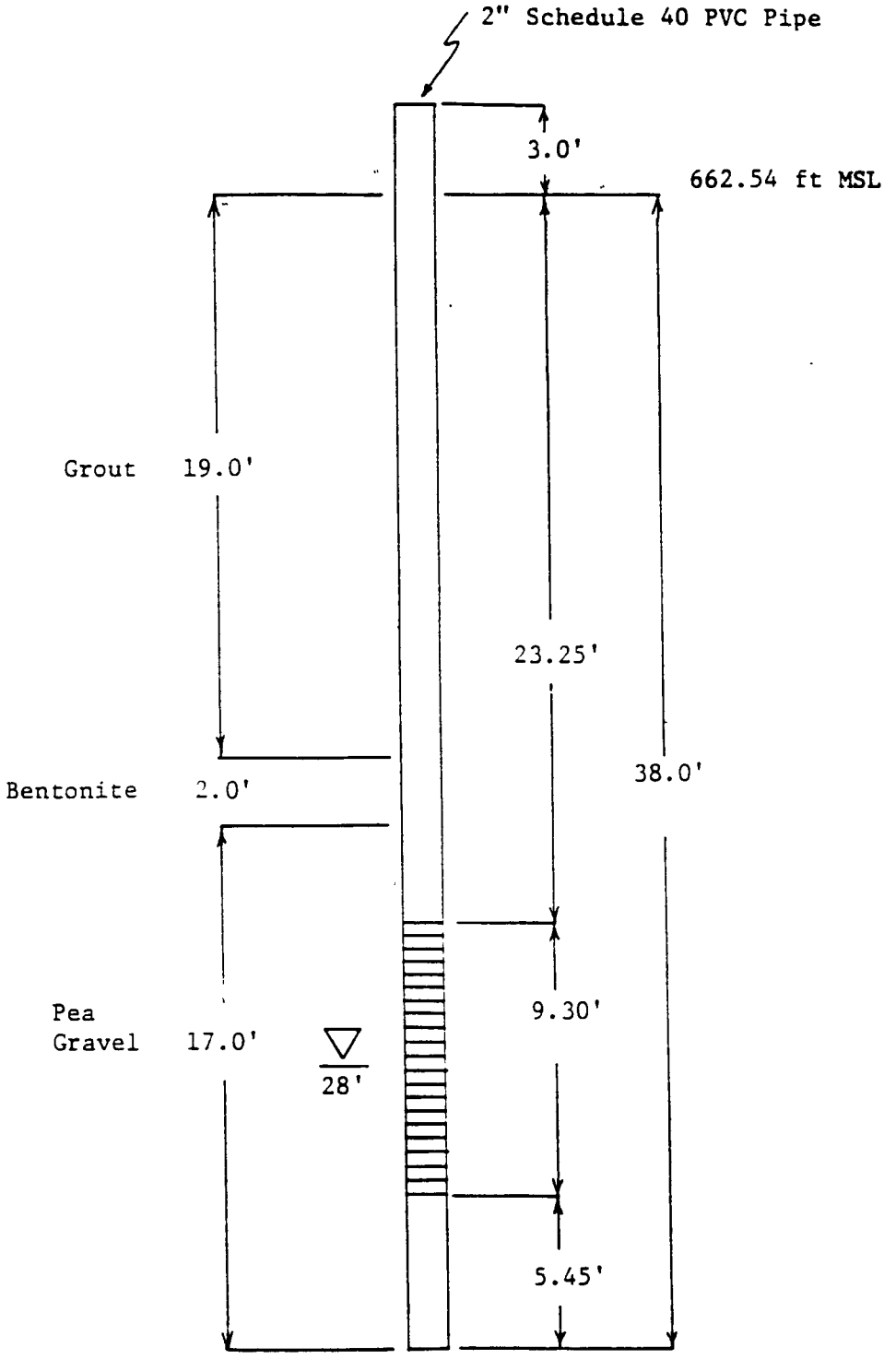
BORING LOG
FIELD DATA

Project _____ Site _____ Date _____
Location _____ Job No. _____
Drill Rig _____ Inspector _____ Operator _____ Surface El _____ Boring No. WES-1-17-83

SAMPLE NUMBER	DATE TAKEN	STRATUM		DRIVE		SAMPLE		TYPE OF SAMPLER			CLASSIFICATION AND REMARKS
		FROM	TO	FROM	TO	FROM	TO				
											clear up. Poured bentonite pellets
											and grouted up.

WES FORM JAN 74 819 EDITION OF NOV 1971 MAY BE USED

Sheet 2 of 2 Sheets



Water depth at time of drilling

Well Screen

NWSC, Crane, Indiana
Mustard Gas Burial Grounds
Well Completion
Boring Number: WES-1-17-8

BORING LOG
FIELD DATA

Project NWSC Ground-Water Study Site Crane, IN Date 17 June 1983
Location Mustard Gas Burial Grounds Job No. 441-G150.13GR21/22
Drill Rig Failing Inspector J. Dunbar Operator C. Drake Surface El 658.40 Boring No. WES-1-18-83

SAMPLE NUMBER	DATE TAKEN 1983	STRATUM FROM	STRATUM TO	DRIVE FROM	DRIVE TO	SAMPLE FROM	SAMPLE TO	TYPE OF SAMPLER			CLASSIFICATION AND REMARKS
	17 Jun	0.0	3.0	0.0	30.5			5-5/8" Rock	Bit		Clay (CL): brown, sandy, damp, slight to moderate cohesion, organic matter.
		3.0	11.0								Sandstone: light brown, soft weathered, very fine-grained, quartz sand.
		11.0	12.5								Sandstone: dark brown, weathered, soft, very fine-grained, quartz sand.
		12.5	13.5								Sandstone: light brown, weathered, soft, very fine-grained, quartz sand.
		13.5	13.7								Shale: light grey, soft.

Sheet 1 of 3 Sheets

FORM 210 USE OF THIS FORM MAY BE USED

WORKING DRAFT

WORKING DRAFT

BORING LOG
FIELD DATA

Project _____ Site _____ Date _____
Location _____ Job No. _____
Drill Rig _____ Inspector _____ Operator _____ Surface El _____ Boring No. WES-1-18-83

SAMPLE NUMBER	DATE TAKEN	STRATUM FROM	STRATUM TO	DRIVE FROM	DRIVE TO	SAMPLE FROM	SAMPLE TO	TYPE OF SAMPLER			CLASSIFICATION AND REMARKS
		13.7	14.0								Sandstone: light brown, soft, very fine-grained, quartz sand.
		14.0	16.5								Shale: light grey, soft.
		16.5	18.0								Sandstone: dark brown, very fine-grained, soft, wet at 18 ft.
		18.0	19.5								Sandstone and shale: brown, light grey, soft, thinly bedded.
		19.5	19.7								Sandstone: brown, weathered, very fine-grained.
		19.7	21.5								Sandy shale: dark grey, soft, sandy - very fine-grained.

WES FORM JAN 74 819 EDITION OF NOV 1971 MAY BE USED

Sheet 2 of 3 Sheets

BORING LOG
FIELD DATA

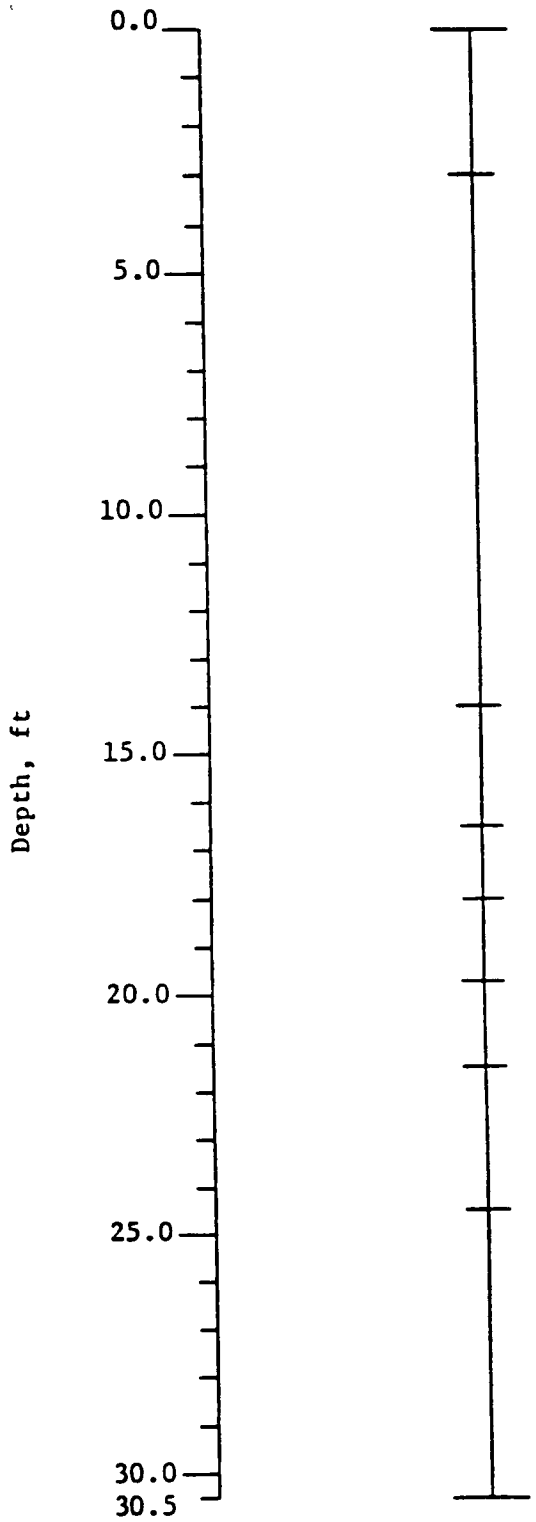
Project _____ Site _____ Date _____
Location _____ Job No. _____
Drill Rig _____ Inspector _____ Operator _____ Surface El _____ Boring No. WES-1-18-83

SAMPLE NUMBER	DATE TAKEN	STRATUM FROM	STRATUM TO	DRIVE FROM	DRIVE TO	SAMPLE FROM	SAMPLE TO	TYPE OF SAMPLER			CLASSIFICATION AND REMARKS
		21.5	24.0								Sandstone and shale: sandstone grades from dark brown to brown, shale ranges from light grey to dark grey, soft, thinly bedded.
		24.5	30.5								Sandstone: brown, tan, dark brown, soft, very fine-grained, quartz sand.
	18 Jun										Open hole overnight - water level at 14.04 ft. Installed monitoring well.

FORM JAN 74 819 EDITION OF NOV 1971 MAY BE USED

Sheet 3 of 3 sheets

INDIVIDUAL DRAFT



658.40 ft MSL

Clay (CL): brown, sandy, damp, slight to moderate cohesion, organic matter.

Sandstone: light brown, dark brown, very fine-grained, quartz, weathered, soft. From 13.5 to 13.7 ft, grey shale.

Shale: light grey, soft.

Sandstone: dark brown, weathered, soft, very fine-grained, quartz sand.

Sandstone and shale: brown, light grey, soft, thinly bedded.

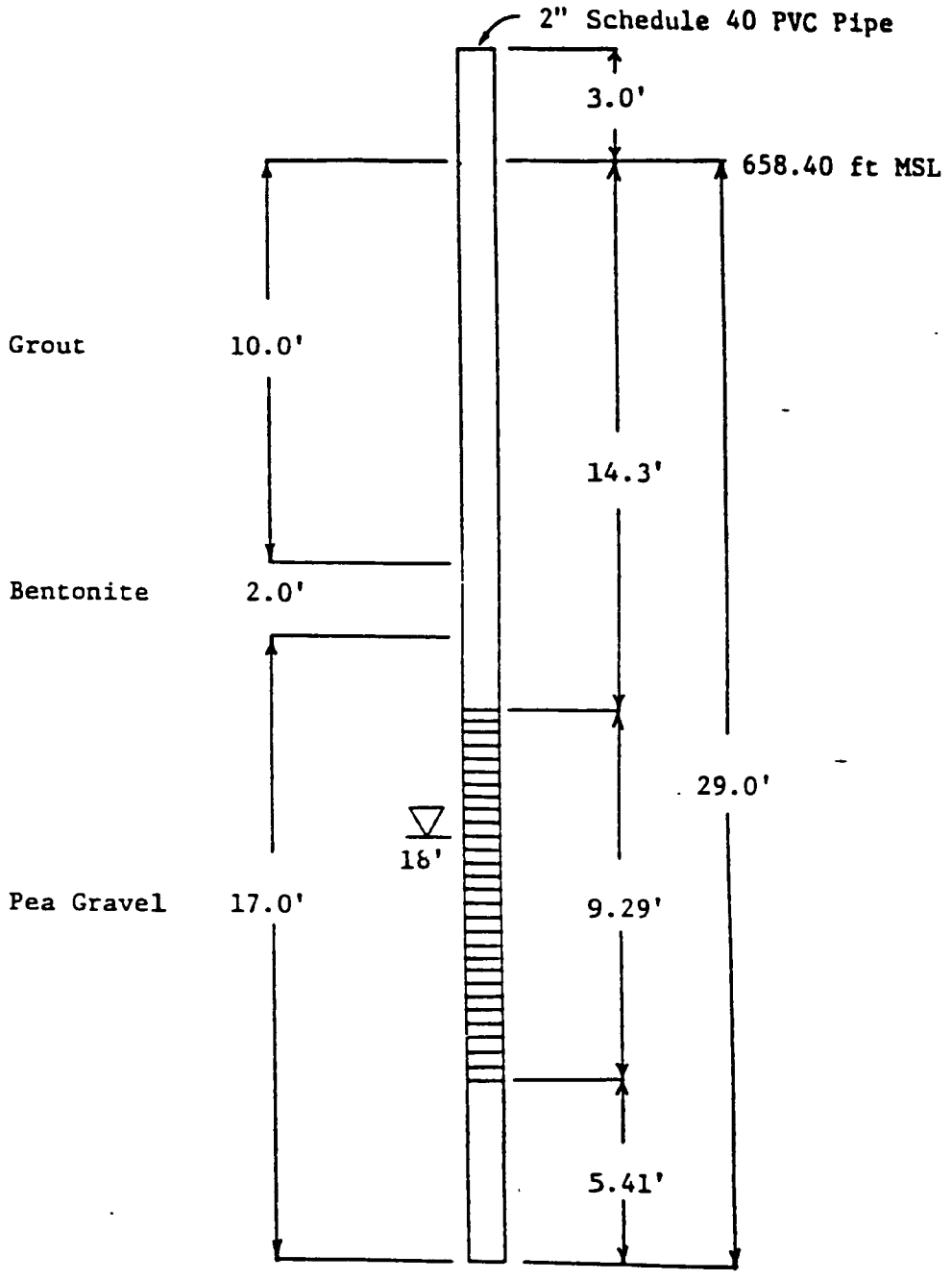
Sandy shale: dark grey, soft very fine-grained, white quartz sand.

Sandstone and shale: various shades of brown and grey, thinly bedded.

Sandstone: brown, tan, dark brown, sof very fine-grained, quartz sand.

NWSC, Crane, Indiana
Mustard Gas Burial Grunds
Lithology
Boring Number: WES-1-18-83

WORKING DRAFT



Water depth at time of drilling

Well Screen

NWSC, Crane, Indiana
Mustard Gas Burial Gr
Well Completion
Boring Number: WES-1-

WORKING DRAFT

WORKING DRAFT

BORING LOG
FIELD DATA

Project NWSC Ground-Water Study Site Crane, IN Date 17 June 1983

Location Mustard Gas Burial Grounds Job No. 441-G150.13GR21/22

Drill Rig Failing Inspector J. Dunbar Operator C. Drake Surface El 656.79 Boring No. WES-1-19-83

SAMPLE NUMBER	DATE TAKEN 1983	STRATUM FROM	STRATUM TO	DRIVE FROM	DRIVE TO	SAMPLE FROM	SAMPLE TO	TYPE OF SAMPLER			CLASSIFICATION AND REMARKS
	17 Jun	0.0	6.5	0.0	30.2			5-5/8" Rock	Bit		Clay (CL): brown, soft, sandy, organic matter, slight to moderate cohesion.
		6.5	11.5								Sandstone: brown, very fine-grained, soft.
		11.5	12.5								Shale: grey, very soft.
		12.5	15.0								Sandstone: light brown, very fine-grained, soft.
		15.0	16.0								Sandstone: light grey - same.
		16.0	16.5								Sandstone: brown - same.
		16.5	17.0								Clay/Shale: grey, very soft, damp.

Sheet 1 of 2 Sheets

WES FORM JAN 74 819 EDITION OF NOV 1971 MAY BE USED

BORING LOG
FIELD DATA

Project _____ Site _____ Date _____

Location _____ Job No. _____

Drill Rig _____ Inspector _____ Operator _____ Surface El _____ Boring No. WES-1-19-83

SAMPLE NUMBER	DATE TAKEN 1983	STRATUM FROM	STRATUM TO	DRIVE FROM	DRIVE TO	SAMPLE FROM	SAMPLE TO	TYPE OF SAMPLER			CLASSIFICATION AND REMARKS
		17.0	30.2								Sandstone: brown, grey, dark brown, very fine-grained, quartz sand, soft, thinly bedded with trace of shale.
	18 Jun										Open hole overnight - water level at 19.2 ft. Installed monitoring well.

Sheet 2 of _____ Sheets

WORKING DRAFT

Monitoring Well 01 19

Well Construction Sheet

NOT AVAILABLE

BORING LOG
FIELD DATA

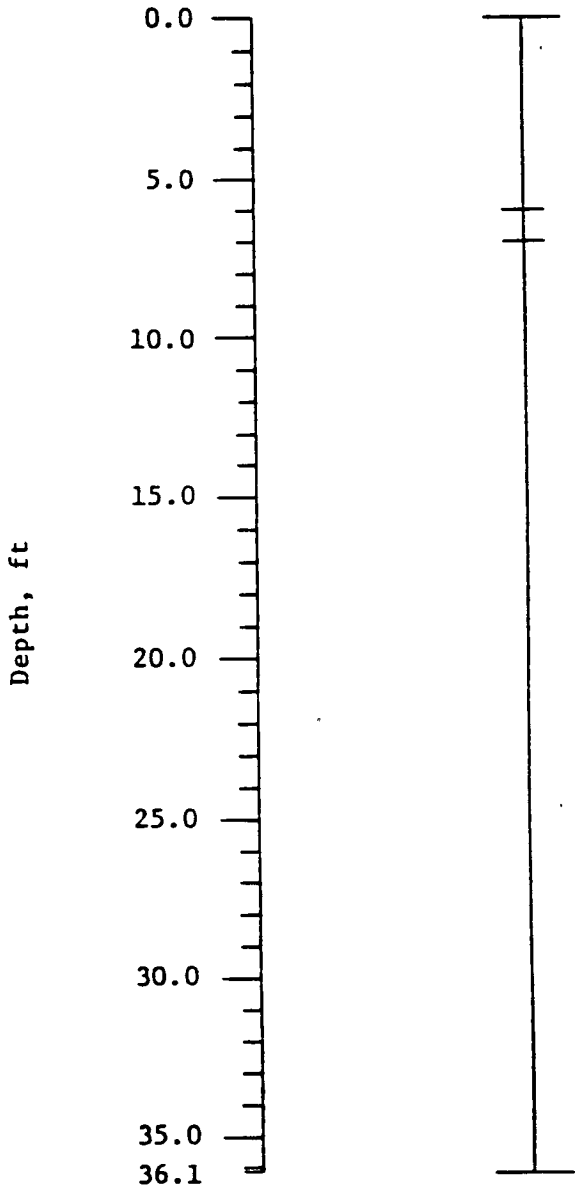
Project NWSC Ground-Water Study Site Crane, IN Date 20 June 1983
Location Mustard Gas Burial Grounds Job No. 441-G150.13GR21/22
Drill Rig Failing Inspector J. Dunbar Operator C. Drake Surface El 631.35 Boring No. WES-1-20-83

SAMPLE NUMBER	DATE TAKEN 1983	STRATUM FROM	STRATUM TO	DRIVE FROM	DRIVE TO	SAMPLE FROM	SAMPLE TO	TYPE OF SAMPLER			CLASSIFICATION AND REMARKS
	20 Jun	0.0	6.0	0.0	36.1			5-5/8" Rock	Bit		Clay (CL): brown soft, gravelly, damp.
		6.0	7.0								Sandstone: brown, very fine-grained, soft, weathered.
		7.0	36.1								Shale: grey, light grey, dark grey, soft, uniform, water at 20 ft.
	21 Jun										Hole open overnight - water level at 24.55. Installed monitoring well.

Sheet 1 of 1 Sheets

WES FORM JAN 74 819 EDITION OF NOV 1971 MAY BE USED

WORKING DRAFT



631.35 ft MSL

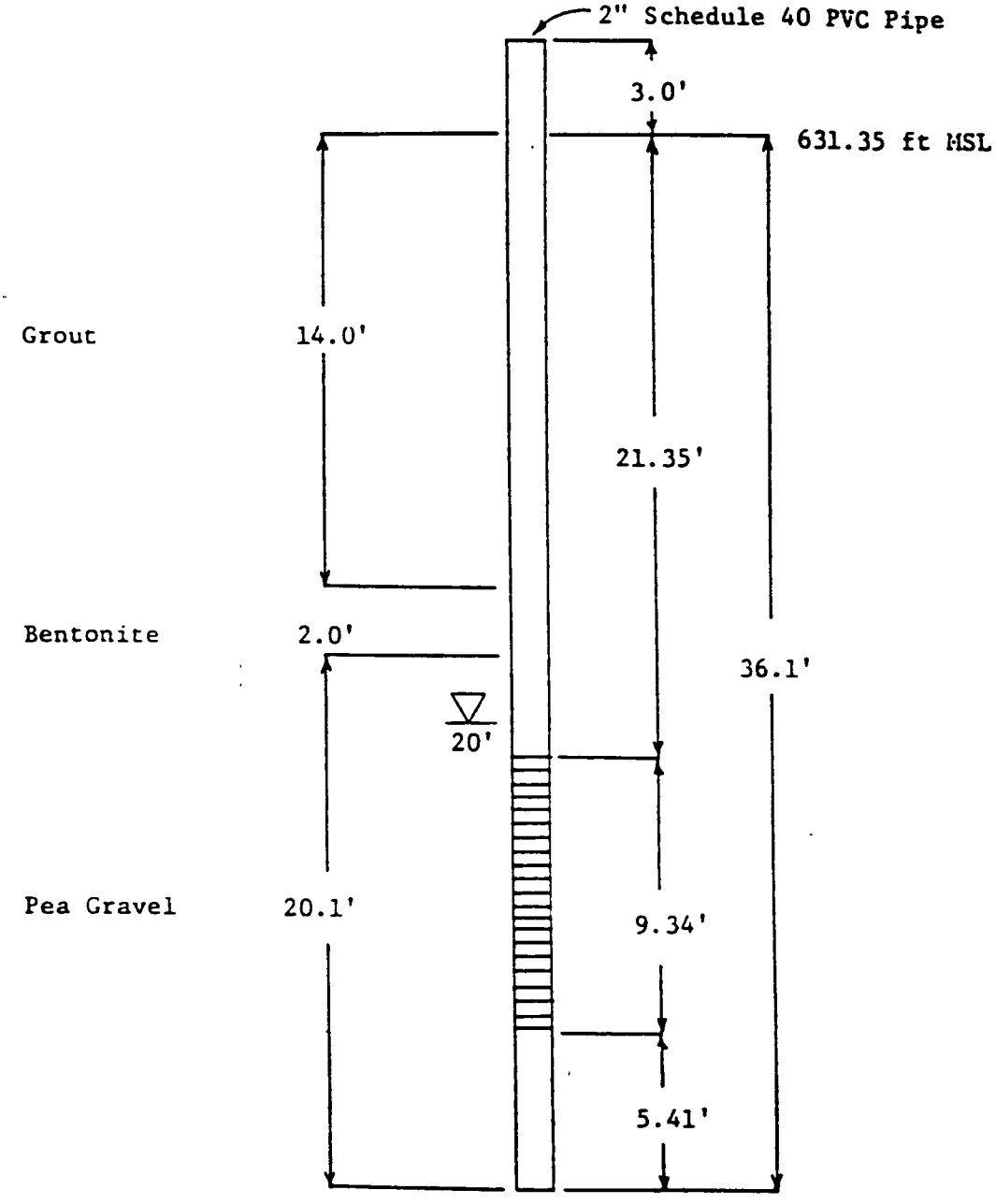
Clay (CL): brown, soft, gravelly, damp.

Sandstone: brown, very fine-grained, soft, weathered.

Shale: light grey to dark grey, soft, uniform.

NWSC, Crane, Indiana
Mustard Gas Burial Grounds
Lithology
Boring Number: WES-1-20-83

WORKING DRAFT



Water depth at time of drilling

Well Screen

NWSC, Crane, Indiana
Mustard Gas Burial Grounds
Well Completion
Boring Number: WES-1-20-8

WORKING DRAFT

BORING LOG
FIELD DATA

Project NWSC Ground-Water Study Site Crane, IN Date 20 June 1983
Location Mustard Gas Burial Grounds Job No. 441-G150.13GR21/22
Drill Rig Failing Inspector J. Dunbar Operator C. Drake Surface El 603.82 Boring No. WES-1-21-83

SAMPLE NUMBER	DATE TAKEN 1983	STRATUM FROM	STRATUM TO	DRIVE FROM	DRIVE TO	SAMPLE FROM	SAMPLE TO	TYPE OF SAMPLER			CLASSIFICATION AND REMARKS
	20 Jun	0.0	6.5	0.0	40.5			5-5/8" Rock	Bit		Clay (CL): brown, soft, gravelly, damp.
		6.5	9.5								Clay (CL): grey, soft, uniform.
		9.5	16.5								Clay (CL): brown, soft, uniform.
		16.5	24.5								Shale: grey, soft, uniform.
		24.5	40.5								Shale: light grey, grey, dark grey, soft, water at 28 ft.
	21 Jun										Installed monitoring well.

Sheet 1 of 1 Sheets

WES FORM 910 EDITION OF NOV 1971 MAY BE USED

WORKING DRAFT

Monitoring Well 01 21

Well Construction Sheet

NOT AVAILABLE

WORKING DRAFT

BORING LOG
FIELD DATA

Project NWSC Ground-Water Study Site Crane, IN Date 8 July 1983
Location Mustard Gas Burial Grounds Job No. 441-G150.13GR21/22
Drill Rig Failing Inspector J. Dunbar Operator C. Drake Surface El 653.55 Boring No. WES-1-22-83

SAMPLE NUMBER	DATE TAKEN 1983	STRATUM FROM	STRATUM TO	DRIVE FROM	DRIVE TO	SAMPLE FROM	SAMPLE TO	TYPE OF SAMPLER			CLASSIFICATION AND REMARKS
	8 Jul	0.0	13.0	0.0	35.0			6" Rock Bit			Clay (CL): brown and grey, sandy, soft to stiff.
		13.0	21.5								Sandstone: brown, weathered, very fine-grained, soft, damp at 17.5 (no water).
		21.5	22.0								Siltstone: brown, soft, weathered, damp at 22 ft.
		22.0	32.0								Sandstone: brown, light grey, soft, weathered, very fine-grained, water at 25 ft.
		32.0	35.0								Shaley Sandstone: brown, grey, dark grey, soft, weathered, very fine-grained.

WES FORM JAN 74 819 EDITION OF NOV 1971 MAY BE USED

Sheet 1 of 2 Sheets

BORING LOG
FIELD DATA

Project _____ Site _____ Date _____

Location _____ Job No. _____

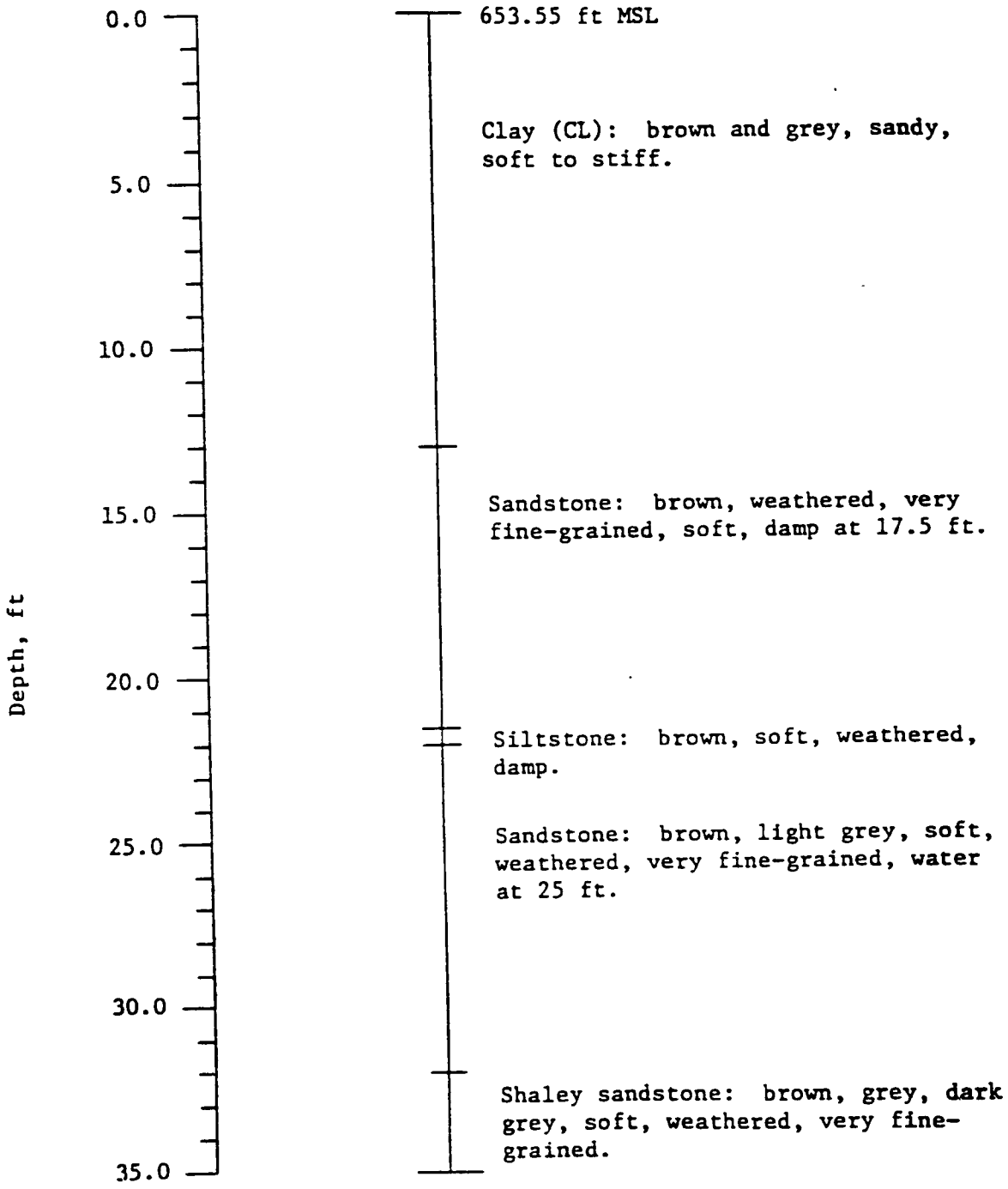
Drill Rig _____ Inspector _____ Operator _____ Surface El _____ Boring No. WES-1-22-83

SAMPLE NUMBER	DATE TAKEN 1983	STRATUM FROM	STRATUM TO	DRIVE FROM	DRIVE TO	SAMPLE FROM	SAMPLE TO	TYPE OF SAMPLER			CLASSIFICATION AND REMARKS
	9 Jul										Installed monitoring well.

Sheet 2 of 2 sheets

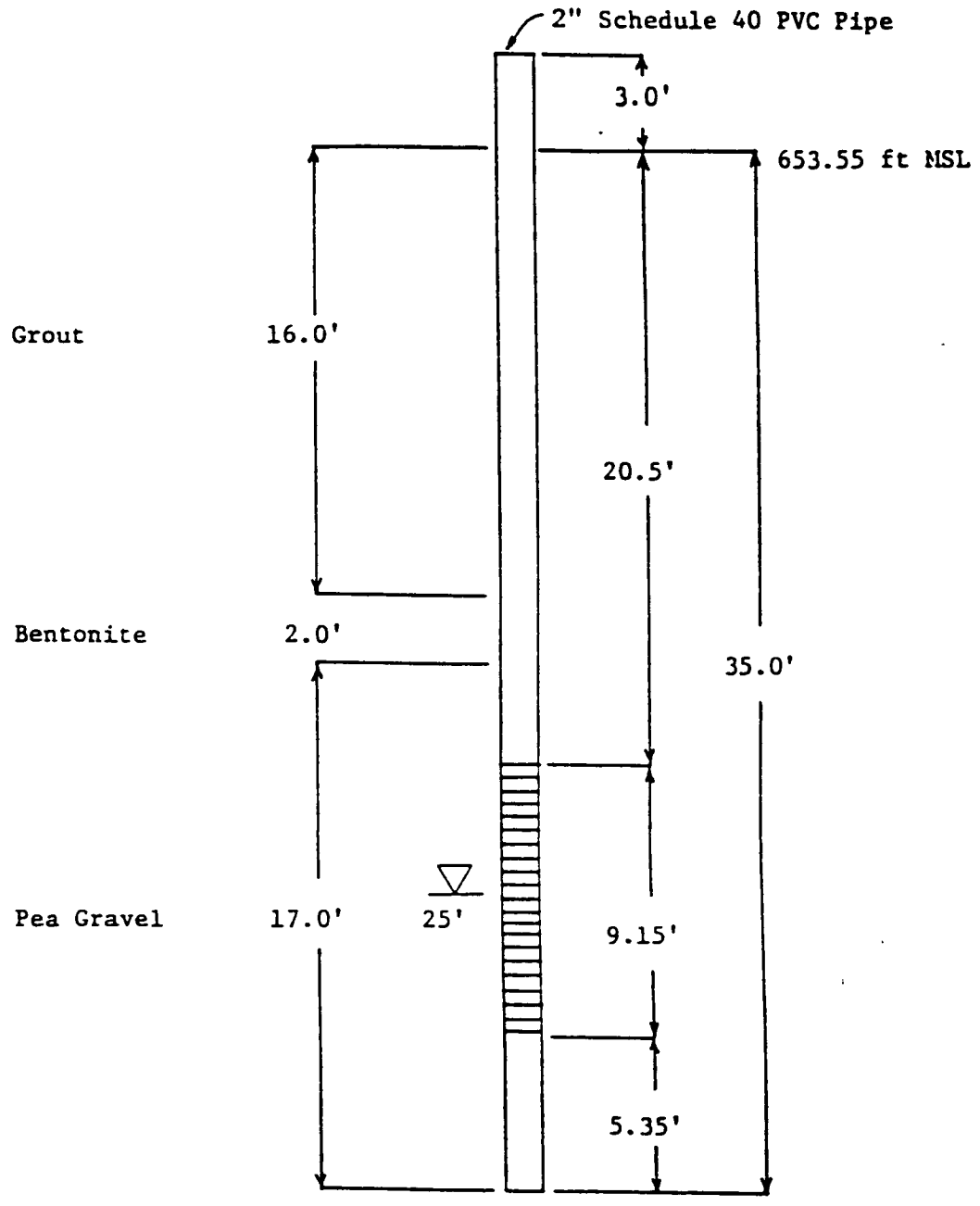
FORM 910 EDITION OF NOV 1971 MAY BE USED

WORKING DRAFT



NWSC, Crane, Indiana
Mustard Gas Burial Grounds
Lithology
Boring Number: WES-1-22-83

WORKING DRAFT



Water depth at time of drilling

Well Screen

NWSC, Crane, Indiana
Mustard Gas Burial Grounds
Well Completion
Boring Number: WES-1-22-8

WORKING DRAFT

WORKING DRAFT

BORING LOG
FIELD DATA

Project NWSC Ground-Water Study Site Crane, IN Date 9 July 1983
Location Mustard Gas Burial Grounds Job No. 441-G150.13GR21/22
Drill Rig Failing Inspector J. Dunbar Operator C. Drake Surface El 625.81 Boring No. WES-1-23-83

SAMPLE NUMBER	DATE TAKEN 1983	STRATUM FROM	STRATUM TO	DRIVE FROM	DRIVE TO	SAMPLE FROM	SAMPLE TO	TYPE OF SAMPLER			CLASSIFICATION AND REMARKS
	9 Jul	0.0	3.0	0.0	40.4			6" Rock Bit			Clay (CL): brown, soft to stiff, sandy.
		3.0	6.5								Sandstone: brown very fine-grained, soft.
		6.5	9.0								Sandstone and clay: very fine-grained, brown sandstone and soft, brown clay, damp.
		9.0	17.5								Siltstone: grey, very soft.
		17.5	19.0								Sandstone: brown, very fine-grained, soft, weathered.
		19.0	38.5								Shale: grey, dark grey, soft, damp spot at 30 ft with slight water.

Sheet 1 of 2 Sheets

WES FORM JAN 74 819 EDITION OF NOV 1971 MAY BE USED

BORING LOG
FIELD DATA

Project _____ Site _____ Date _____
Location _____ Job No. _____
Drill Rig _____ Inspector _____ Operator _____ Surface El _____ Boring No. WES-1-23-83

SAMPLE NUMBER	DATE TAKEN 1983	STRATUM FROM	STRATUM TO	DRIVE FROM	DRIVE TO	SAMPLE FROM	SAMPLE TO	TYPE OF SAMPLER			CLASSIFICATION AND REMARKS
		38.5	39.5								Coal: black, soft.
		39.5	45.0								Siltstone: light grey, soft.
											Water level overnight: 34 ft.
	11 Jul			40.4	45.0			6" Rock Bit			Drilled 10 ft below water depth. Rinsed mud from hole several times. Installed monitoring well.

Sheet 2 of 2 sheets

WORKING DRAFT

Monitoring Well 01 23

Well Construction Sheet

NOT AVAILABLE

WORKING DRAFT

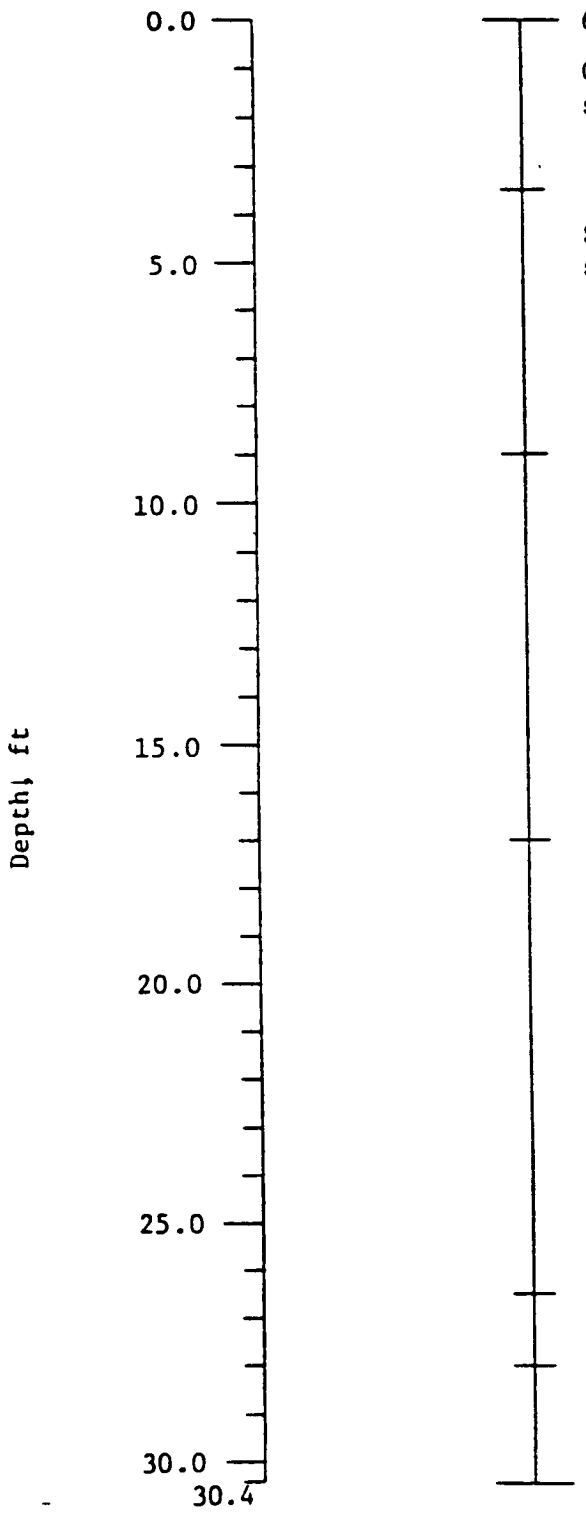
BORING LOG
FIELD DATA

Project NWSC Ground-Water Study Site Crane, IN Date 9 July 1983
Location Mustard Gas Burial Grounds Job No. 441-G150.13GR21/22
Drill Rig Failing Inspector J. Dunbar Operator C. Drake Surface El 600.57 Boring No. WES-1-24-83

SAMPLE NUMBER	DATE TAKEN 1983	STRATUM FROM	STRATUM TO	DRIVE FROM	DRIVE TO	SAMPLE FROM	SAMPLE TO	TYPE OF SAMPLER			CLASSIFICATION AND REMARKS
	9 Jul	0.0	3.5	0.0	30.4			6" Rock Bit			Clay (CL): brown, soft to stiff, sandy.
		3.5	9.0								Sandstone: brown, very fine-grained, soft.
		9.0	17.0								Clay and sandstone: brown, soft, sandy clay with interbedded very fine-grained, soft sandstone.
		17.0	26.5								Shale: grey, dark grey, soft, water at 20 ft.
		26.5	28.0								Siltstone: light grey, soft.
		28.0	30.4								Shale: dark grey, soft.

Sheet 1 of 1 Sheets

WES FORM JAN 74 819 EDITION OF NOV 1971 MAY BE USED



600.57 ft MSL

Clay (CL): brown, soft to stiff, sandy.

Sandstone: brown, very fine-grained, soft.

Clay and sandstone: brown, soft, sandy clay with interbedded, very fine-grained, soft sandstone.

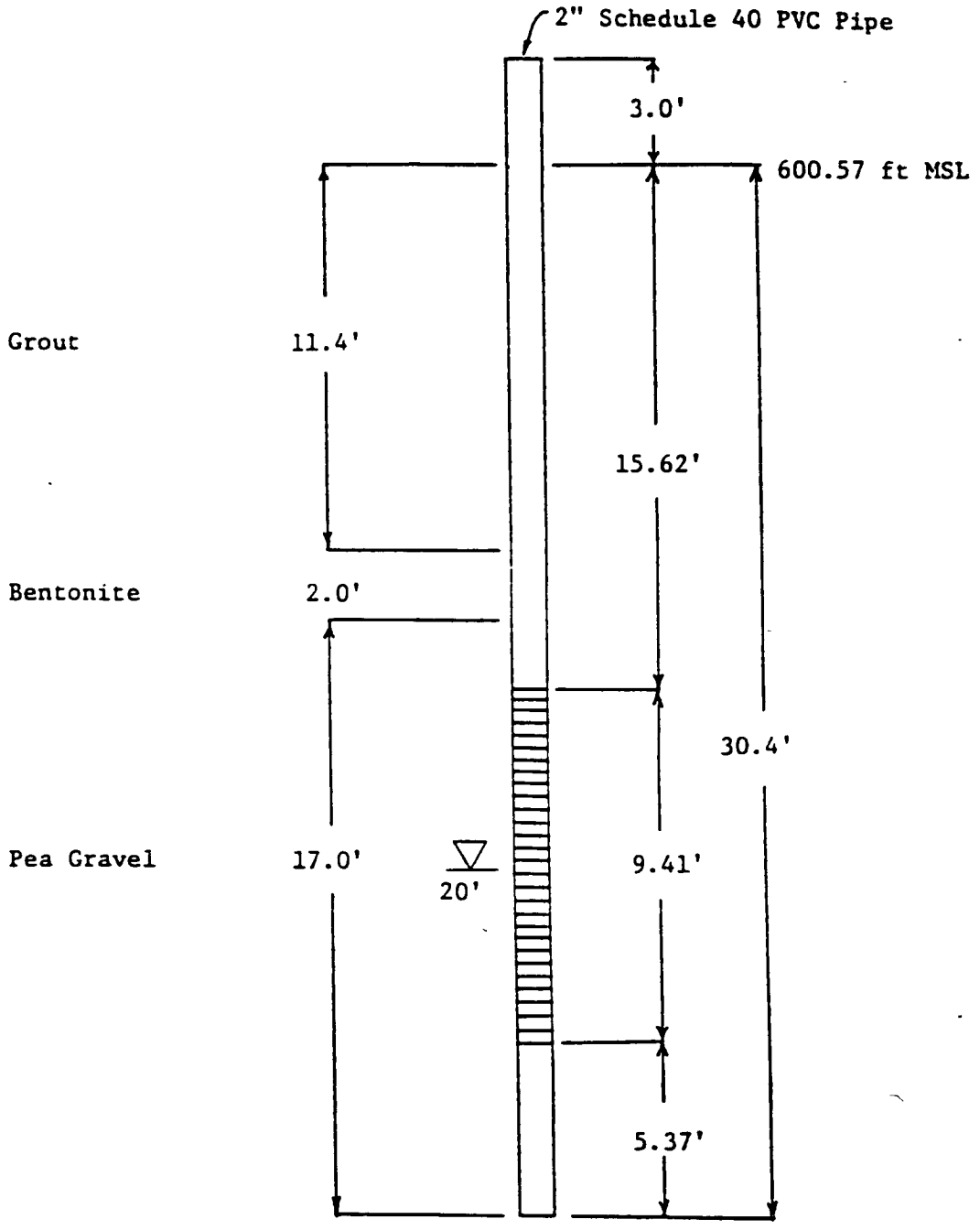
Shale: grey, dark grey, soft, water at 20 ft.

Siltstone: light grey, soft.

Shale: dark grey, soft.

NWSC, Crane, Indiana
Mustard Gas Burial Grounds
Lithology
Boring Number: WES-1-24-83

WORKING DRAFT



Water depth at time of drilling

Well Screen

NWSC, Crane, Indiana
Mustard Gas Burial Grounds
Well Completion
Boring Number: WES-1-24-63

WORKING DRAFT

BORING LOG
FIELD DATA

Project NWSC Ground-Water Study Site Crane, IN Date 6 August 1983
Location Mustard Gas Burial Grounds Job No. 441-G150.13GR21/22
Drill Rig Failing Inspector J. Dunbar Operator C. Drake Surface El 654.16 Boring No. WES-1-25-83

SAMPLE NUMBER	DATE TAKEN 1983	STRATUM FROM	STRATUM TO	DRIVE FROM	DRIVE TO	SAMPLE FROM	SAMPLE TO	TYPE OF SAMPLER			CLASSIFICATION AND REMARKS
	6 Aug	0.0	1.0	0.0	32.0			6" Rock Bit			Clay (CL): brown, soft, sandy, dry.
		1.0	7.0								Sandstone and clay: brown, grey, very weathered, thinly bedded, very fine-grained.
		7.0	16.5								Shale: brown, grey (15.5-16.5) soft, weathered, thinly bedded.
		16.5	19.0								Sandstone: brown, light grey, thinly bedded, soft, very fine-grained.
		19.0	21.8								Shale: brown and grey, soft.
		21.8	32.0								Sandstone and shale: brown, grey,

Sheet 1 of 2 Sheets

WES FORM 819 EDITION OF NOV 1971 MAY BE USED

WINDWARD DRAFT

BORING LOG
FIELD DATA

Project _____ Site _____ Date _____
Location _____ Job No. _____
Drill Rig _____ Inspector _____ Operator _____ Surface El _____ Boring No. WES-1-25-83

SAMPLE NUMBER	DATE TAKEN 1983	STRATUM FROM	STRATUM TO	DRIVE FROM	DRIVE TO	SAMPLE FROM	SAMPLE TO	TYPE OF SAMPLER			CLASSIFICATION AND REMARKS
											dark grey, thinly bedded, very fine-
											grained, soft, water at 22 ft.
											Installed monitoring well.
	6 Aug										

Sheet 2 of 2 Sheets

WES FORM JAN 74 819 EDITION OF NOV 1971 MAY BE USED

WORKING DRAFT

Monitoring Well 01 25

Well Construction Sheet

NOT AVAILABLE

BORING LOG
FIELD DATA

Project NWSC Ground-Water Study Site Crane, IN Date 6 August 1983
Location Mustard Gas Burial Grounds Job No. 441-G150.13GR21/22
Drill Rig Failing Inspector J. Dunbar Operator C. Drake Surface El 670.21 Boring No. WES-1-26-83

SAMPLE NUMBER	DATE TAKEN 1983	STRATUM FROM	STRATUM TO	DRIVE FROM	DRIVE TO	SAMPLE FROM	SAMPLE TO	TYPE OF SAMPLER			CLASSIFICATION AND REMARKS
	6 Aug	0.0	4.0	0.0	55.0			6" Rock Bit			Sandy clay (CL): brown, soft, dry.
		4.0	15.3								Sandstone: tan, brown, very fine-grained, weathered, thinly bedded with siltstone and clay shale.
		15.3	17.3								Clay shale: brown, soft.
		17.3	21.6								Sandstone and clay shale: brown, grey, thinly bedded, soft, very fine-grained.
		21.6	30.1								Shale: brown, grey, soft, thinly bedded.
		30.1	41.2								Sandstone and shale: light to dark grey, thinly bedded, very

Sheet 1 of 2 sheets

FORM 210 ... OF NOV 1971 MAY BE USED

WORKING DRAFT

WORKING DRAFT

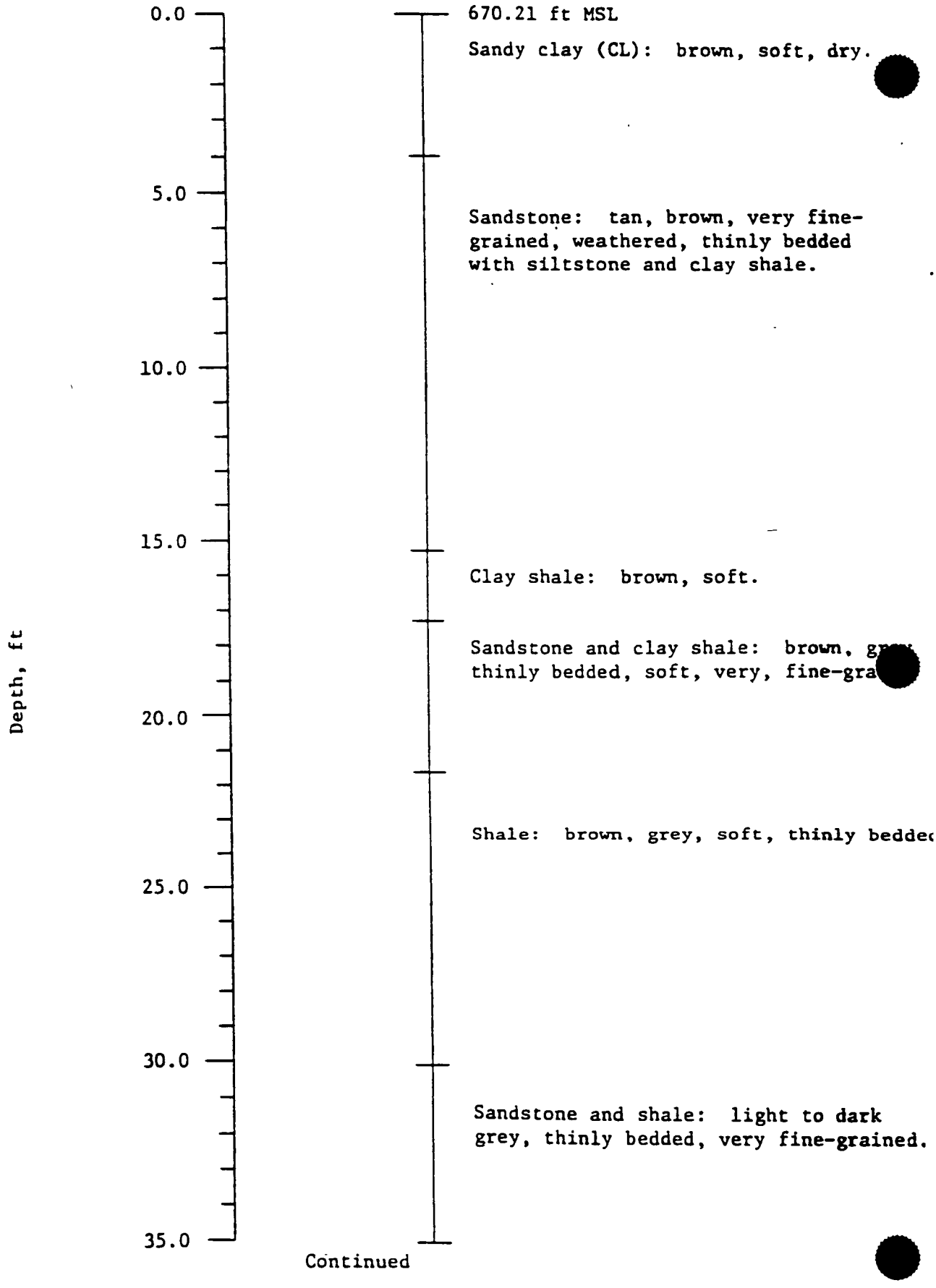
BORING LOG
FIELD DATA

Project _____ Site _____ Date _____
Location _____ Job No. _____
Drill Rig _____ Inspector _____ Operator _____ Surface El _____ Boring No. WES-1-26-83

SAMPLE NUMBER	DATE TAKEN 1983	STRATUM FROM	STRATUM TO	DRIVE FROM	DRIVE TO	SAMPLE FROM	SAMPLE TO	TYPE OF SAMPLER			CLASSIFICATION AND REMARKS
											fine-grained.
		41.2	45.0								Sandstone: brown, reddish brown, soft, very fine-grained. Water at 45 ft.
		45.0	49.5								Sandstone and shale: brown, light to dark grey, thinly bedded, very fine-grained, soft.
		49.5	52.0								Shale: grey, dark grey, soft.
		52.0	55.0								Sandstone: dark brown, soft, very fine-grained.
	6 Aug										Installed well.

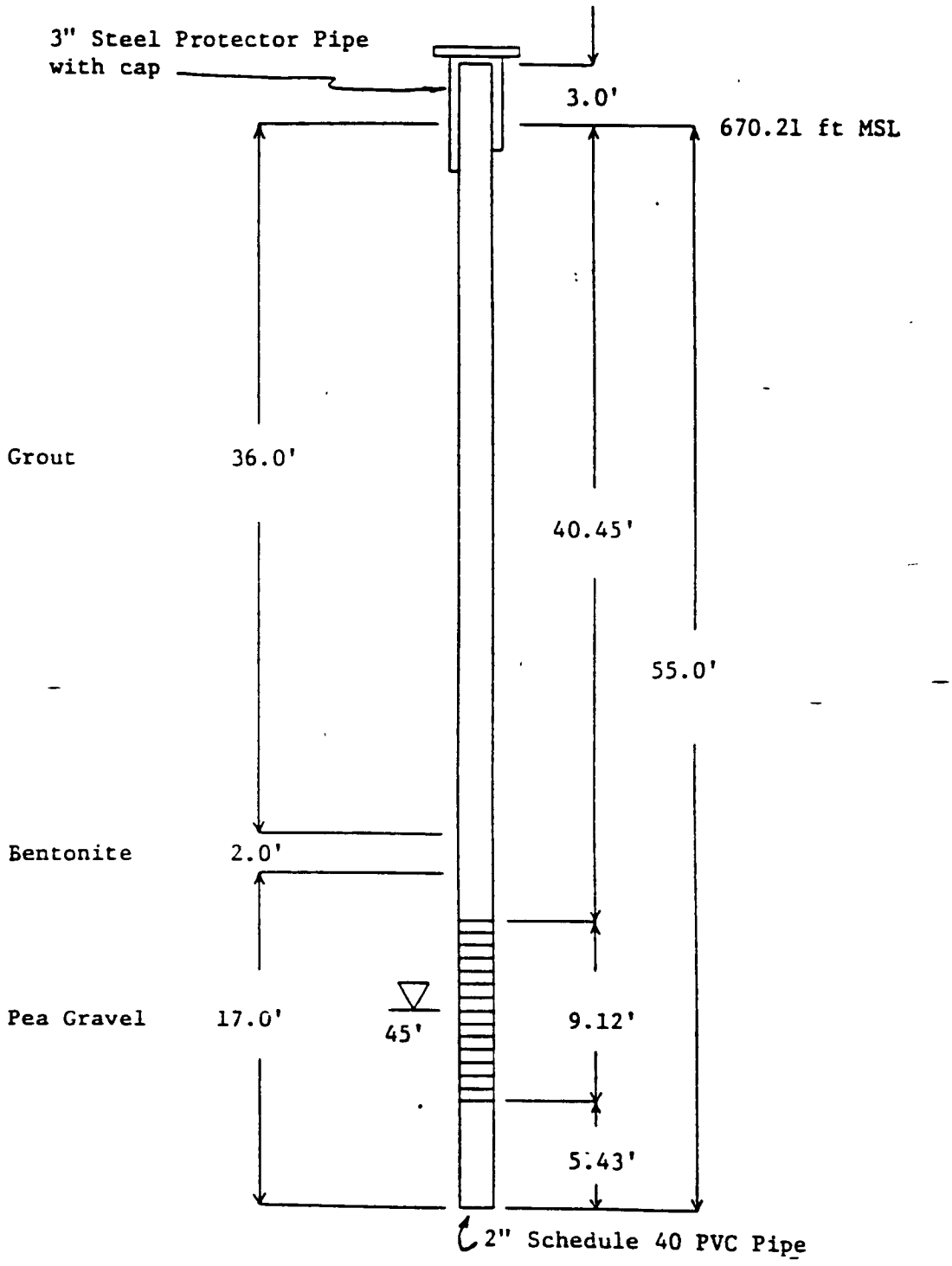
Sheet 2 of 2 Sheets

WES FORM JAN 74 819 EDITION OF NOV 1971 MAY BE USED



NWSC, Crane, Indiana
Mustard Gas Burial Grounds
Lithology
Boring Number: WES-1-26-83

WORKING DRAFT



Water depth at time of drilling

Well Screen

NWSC, Crane, Indiana
Mustard Gas Burial Grounds
Well Completion
Boring Number: WLS-1-26-83

WORKING DRAFT

BORING LOG
FIELD DATA

Project NWSC Ground-Water Study Site Crane, IN Date 6 August 1983
Location Mustard Gas Burial Grounds Job No. 441-G150.13GR21/22
Drill Rig Failing Inspector J. Dunbar Operator C. Drake Surface El 659.75 Boring No. WES-1-27-83

SAMPLE NUMBER	DATE TAKEN 1983	STRATUM FROM	STRATUM TO	DRIVE FROM	DRIVE TO	SAMPLE FROM	SAMPLE TO	TYPE OF SAMPLER			CLASSIFICATION AND REMARKS
	6 Aug	0.0	2.3	0.0	25.0			6" Rock Bit			Clay (CL): brown, dark brown, dry, soft, sandy.
		2.3	29.3								Sandstone: brown, tan, very fine-grained, thinly bedded with siltstone and shale, weathered, soft, hard at 23 ft.
	6 Aug			--	30.0			6" Rock Bit			Crooked hole - used guide to straighten and sheared drill rod with bit - moved over 6 in. and drilled alongside existing hole to intersect drill tools.
	9 Aug										Recovered rod and bit except for approximately 2 ft section of rod. Unable to recover small piece.

Sheet 1 of 2 sheets

WES FORM 819 EDITION OF NOV 1971 MAY BE USED

WORKING DRAFT

WORKING DRAFT

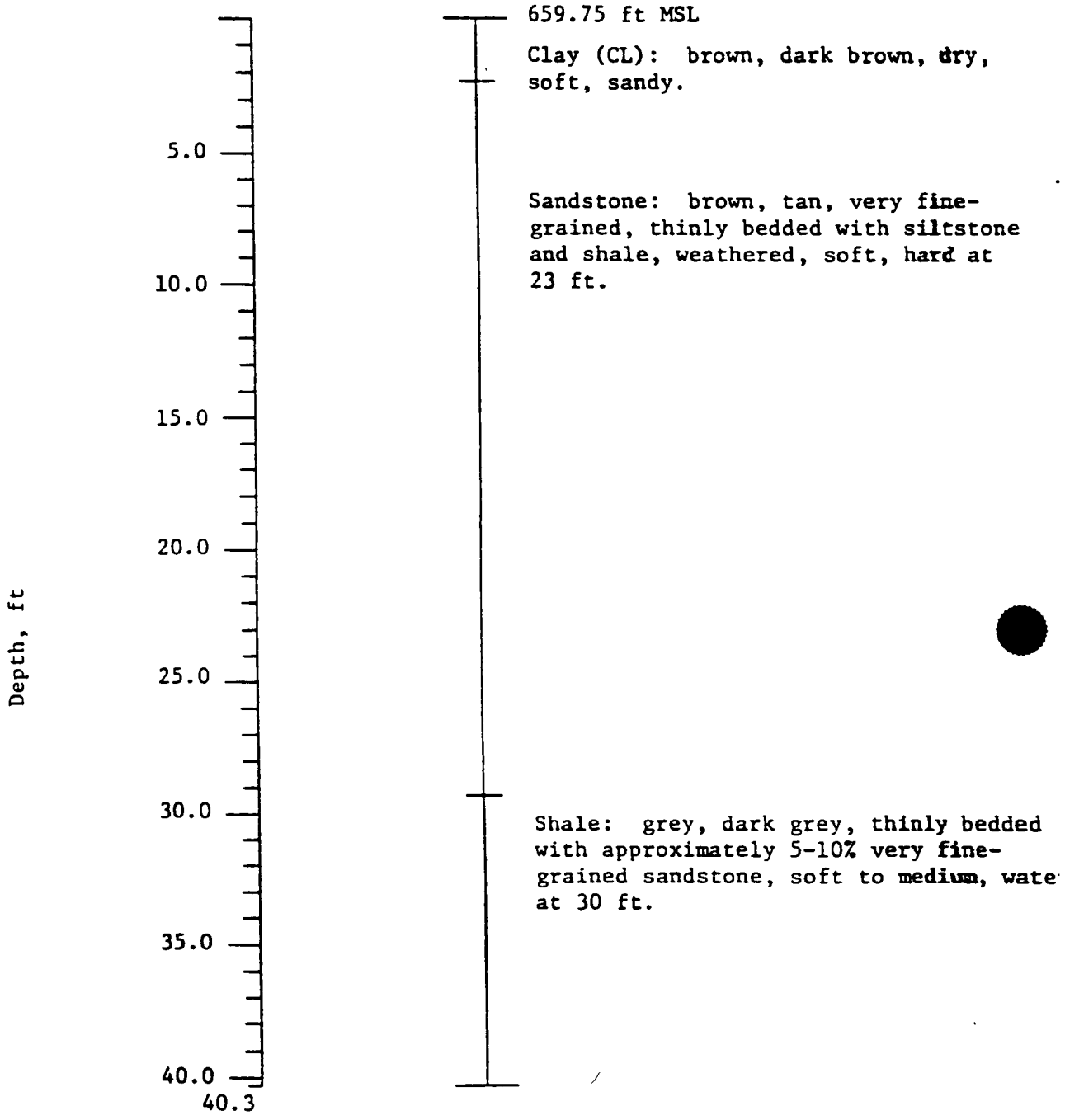
BORING LOG
FIELD DATA

Project _____ Site _____ Date _____
Location _____ Job No. _____
Drill Rig _____ Inspector _____ Operator _____ Surface El _____ Boring No. WES-1-27-83

SAMPLE NUMBER	DATE TAKEN 1983	STRATUM FROM	STRATUM TO	DRIVE FROM	DRIVE TO	SAMPLE FROM	SAMPLE TO	TYPE OF SAMPLER			CLASSIFICATION AND REMARKS
	10 Aug			0.0	40.0			6" Rock Bit			Moved 10 ft east and drilled another boring. Grouted boring with rod.
		29.3	40.3								Shale: grey, dark grey, thinly bedded with approx 5-10% very fine-grained sandstone, soft to medium, water at 30 ft.
	10 Aug										Installed monitoring well.

Sheet 2 of 2 Sheets

WES FORM JAN 74 819 EDITION OF NOV 1971 MAY BE USED



NWSC, Crane, Indiana
Mustard Gas Burial Grounds
Lithology
Boring Number: WES-1-27

WORKING DRAFT

Monitoring Well 01 27

Well Construction Sheet

NOT AVAILABLE

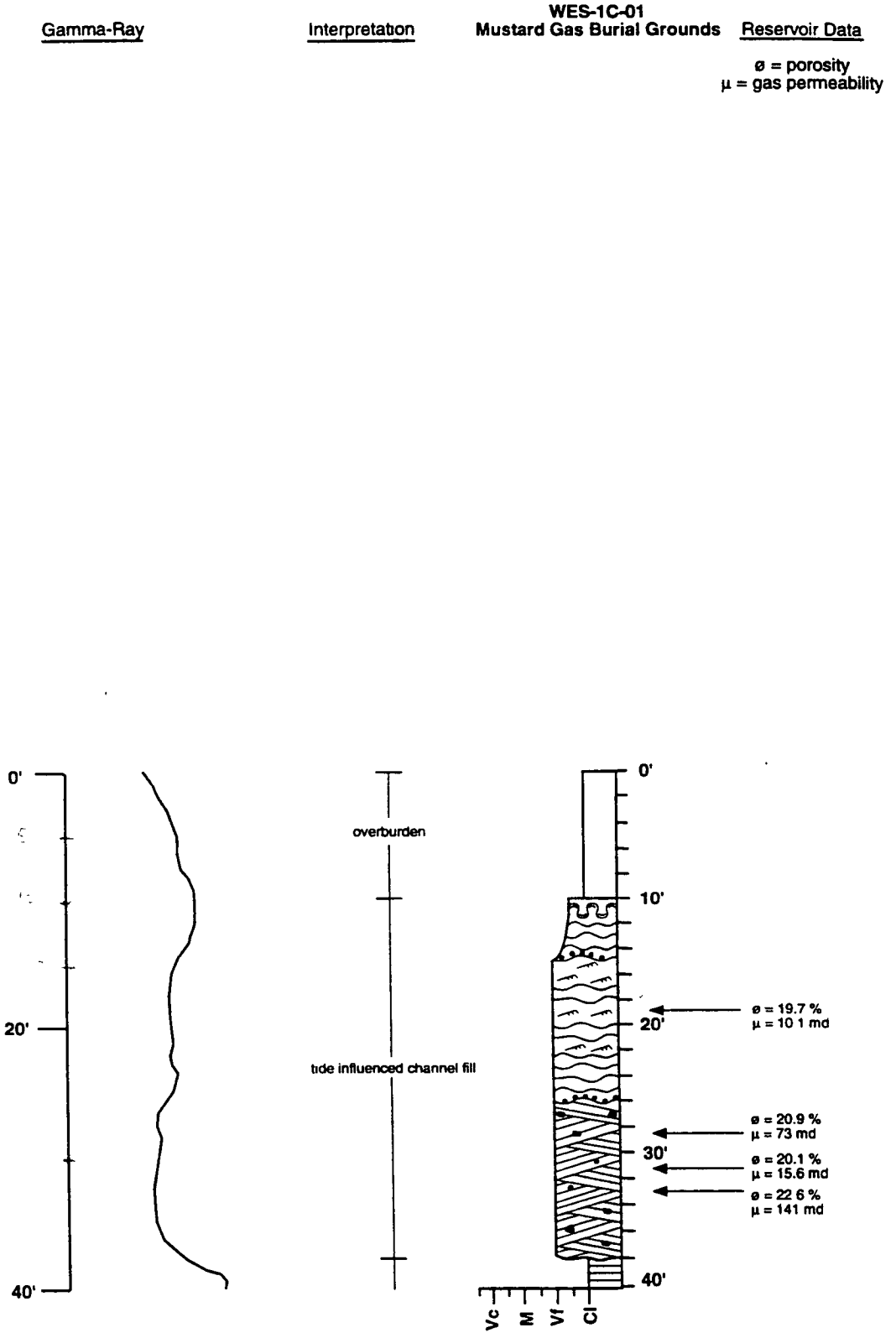


Figure 18b. Vertical columnar profile of corehole WES-1C-01

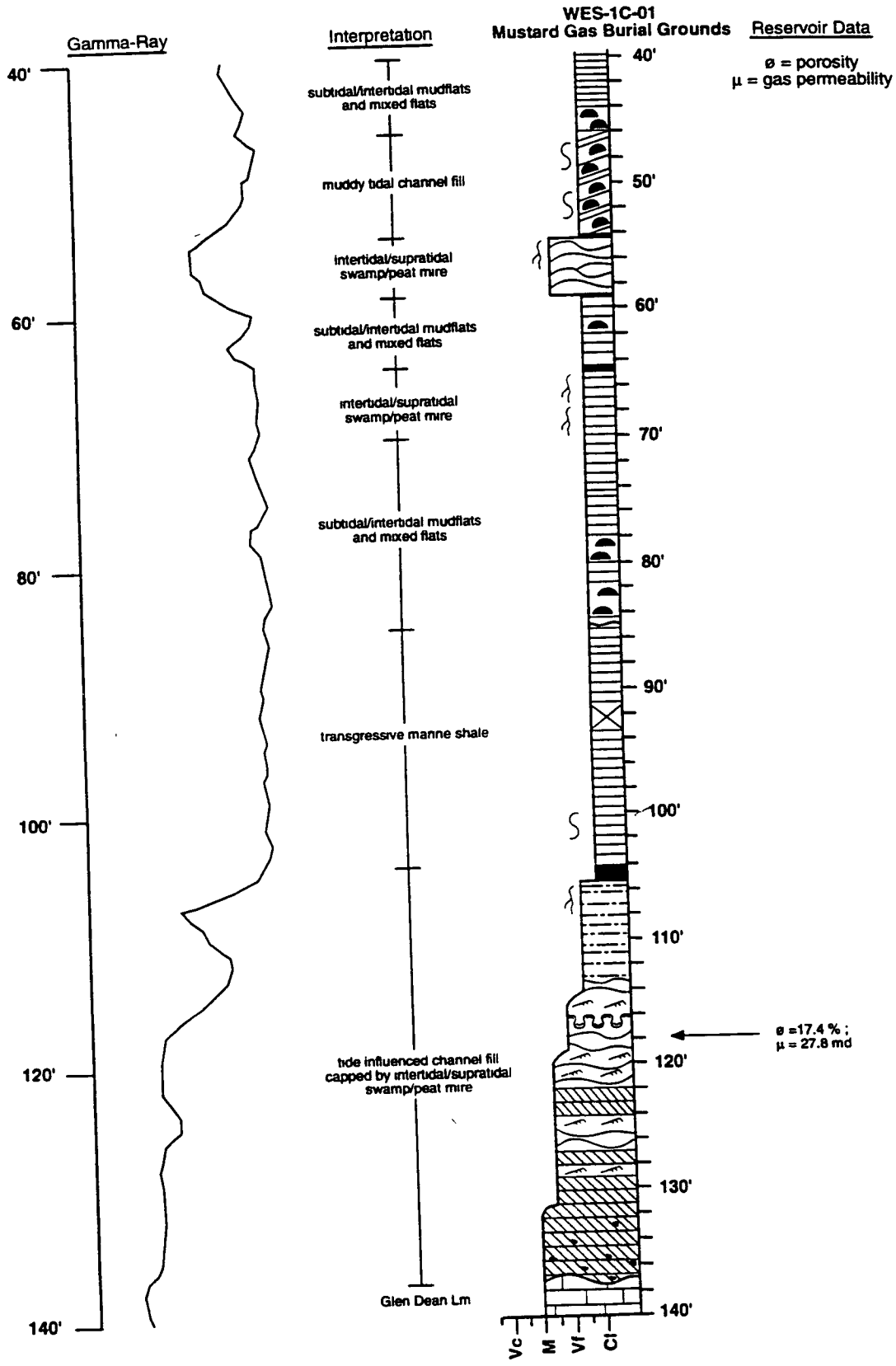


Figure 18a. Vertical columnar profile of corehole WES-1C-01

Tetra Tech NUS, Inc.

BORING LOG

PROJECT NAME: Crane-MGBG
PROJECT NUMBER: N3959
DRILLING COMPANY: Bowser-Morner, Inc.
DRILLING RIG: VERSA DRILL V1000X

BORING No.: 01T03
DATE: 5-30-02
GEOLOGIST: Conti
DRILLER: JAMES "SQUEAK" VANKIRK

Sample No and Type or RQD	Depth (Ft) or Run No	Blows / 6" or RQD (%)	Sample Recovery / Sample Length	Lithology Change (Depth/Ft) or Screened Interval	MATERIAL DESCRIPTION: Soil Density/ Consistency or Rock Hardness	Color	Material Classification	USCS *	Remarks	PID/FID Reading (ppm): Sample	Sampler BZ	Borehole**	Driller BZ**
S-1 @	0		.3/2			TAN	LIMESTONE FRAG AND		MOIST - POOR REC	0			0
1005	2						CLAYEY SILT			0			
S-2 @			1/2		STIFF	YELLOW BRN	CLAYEY SILT	ML	MOIST	0			
1010	4								SL. CALCAREOUS RESIDUAL SOIL	0			
S-3 @			1.5/2		STIFF	ORANGE BRN	CLAYEY SILT - TR	ML		0			
1019	6				TO	TO GRAY	SANDSTONE FRAGS		MOIST V. SL. CALCAR.	0			0
S-4 1024	7		.4/1	REF @ 7'	V STIFF	BRN	REF @ 7.0'		TOP OF ROCK				
				IIEIIE	M	GRAY	SANDSTONE.		@ 7' SANDSTONE				
					SOFT	BRN							
	10								WILL SET SURF CAS - 6" TO				
									15'				
									HOLE NOT MAKING MUCH				
									WATER TO 15.'				
									CORING BIT IS				
	15								5" Φ (OD) 2 3/8" ID - CORE				
					M SOFT	GRAY	SANDSTONE	VBR	1150 SL - WEATHERED	0			0
						BRN	(LAMINATED)		SEVERAL HORIZ JNTS TO	0			
						TO	NO PCS > 1' LONG		21' WATER STAINED	3			
						GRAY				4			
27/10	1	27%	9/10							0			
					TO			BR	21.8 - 22.3 HORIZ JNT	0			
								VBR	22.9 → 23.7 1 PC.	0			
								BR	22.7 → 22.9 HORIZ JNT	-			
					M				23.8 → 24.2 4 - HORIZ JNTS	-			
	25				HARD	GRAY	SANDSTONE.		1205	0			0

* When rock coring, enter rock brokeness

** Include monitor reading in 6 foot intervals @ borehole Increase reading frequency if elevated reponse read

Drilling Area Background (ppm): 0

Remarks: PUSHED 2" SPOON IN OVERBURDEN TO 7'
USING AIR ROTARY - REAMED TO 15' W/ 8 3/4" BIT
CORED THRU OPEN HOLE STARTING @ 15'.

Converted to Well: Yes ✓ No _____ Well I.D. #. 01T03

Tetra Tech NUS, Inc.

BORING LOG

PROJECT NAME: Crane-MGBG
PROJECT NUMBER: N3959
DRILLING COMPANY: Bowser-Morner, Inc.
DRILLING RIG: VERSADRILL V1000X

BORING No.: 01T03
DATE: 5/30/02
GEOLOGIST: Conti
DRILLER: JAMES "SQUEAK" VANKIRK

Sample No and Type or RQD	Depth (Ft) or Run No	Blows / 6" or RQD (%)	Sample Recovery / Sample Length	Lithology Change (Depth/Ft.) or Screened Interval	MATERIAL DESCRIPTION: Soil Density/ Consistency or Rock Hardness	Color	Material Classification	USCS *	Remarks	PID/FID Reading (ppm): Sample	Sampler BZ	Borehole**	Driller BZ**
	25				M SOFT	GRAY	SANDSTONE	VBR	1208 HRS	0			
									VBR W/ HORIZ JNTS				
									THRU OUT	0			
									POOR REC	0			
1.9/9.5	2	20%	9.5/9.5					TO					
								BR	HI ∠ JOINT	0			
									NEAR BOTM				
					M HARD				32.8-33.3				
	34.5			34.5 ±					1230 HRS	0			
									1240 HRS ±				
					M SOFT	GRAY	SHALE	VBR		0			
								BR					
				39.0					38 or 39 SHALE TO INTERBEDDED	0			
4.2/9.5	3	44%	8./9.5		M HARD	GRAY	INTERBEDDED		39' HORIZ JNT				
							SANDSTONE AND		41 → 43	0			
							SHALE		SEVERAL HORIZ JNTS				
									41.7 42.0	0			
	44			44 ±					42.3 42.5 1300				
					M HARD		SANDSTONE	BL		0			
										0			
5.7/9.5	4	55%	7/9.5										
									49' HORIZ JNT	0			

* When rock coring, enter rock brokeness

** Include monitor reading in 6 foot intervals @ borehole Increase reading frequency if elevated reponse read

Drilling Area Background (ppm): 0

Remarks: REAM HOLE W/ 8 3/4" BIT TO 72'. SET 6" STEEL PERM CASING TO 72' BGS.

Converted to Well: Yes ✓ No _____ Well I.D #: 01T03

Tetra Tech NUS, Inc.

BORING LOG

PROJECT NAME: Crane-MGBG
PROJECT NUMBER: N3959
DRILLING COMPANY: Bowser-Morner, Inc
DRILLING RIG: VERSA DRILL V1000X

BORING No.: 01T03
DATE: 5/30/02
GEOLOGIST: Conti
DRILLER: JAMES "SQUEAK" VANKIRK

Sample No and Type or RQD	Depth (Ft) or Run No	Blows / 6" or RQD (%)	Sample Recovery / Sample Length	Lithology Change (Depth/Ft.) or Screened Interval	MATERIAL DESCRIPTION: Soil Density/ Consistency or Rock Hardness	Color	Material Classification	USCS *	Remarks	PID/FID Reading (ppm): Sample	Sampler BZ	Borehole**	Driller BZ**
					M HARD	GRAY	SANDSTONE —	BR	50.3 HORIZ JNT				O
							BECOMES MORE		51 "	O			
							LAMINATED W/ SILTSTONE INTER		51.5 " 51.9 "				
	53.5			53.5			BEDS						
							SHALY SILTSTONE	VBR	(1325)	O			
								TO					
								BR		O			
				56.5	SOFT	BLK	COAL SEAM	VBR	COAL IS				
3.8/9.5	5	40%	7.6/9.5	57.5			TO	BR	VBR — TR OF VERT JNT	O			
					M HARD	GRAY	SANDSTONE						
										O			O
					M HARD	LT GRAY	SANDSTONE	BL					
				62.0						O			
	63				M SOFT	LT GRAY	SANDY SHALE	BR					
						TO	TO		(1340)				
						DK GRAY	SILTY SHALE	VBR		O			
									65.5 HARD 'CHERT' LIKE PC.				O
5.4/9.5	6	57%	8'/9.5					BL	67.1 " 68.6 " HORIZ JNTS	O			
										O			
				70.5	M HARD	GRAY	SANDSTONE W/	BR	70.5 HORIZ JNT 71.4 " "				
				71.5			SHALE SEAMS	TO		O			
5/30	72.5				M SOFT		SILTY SHALE	VBR	(1356)				O
	73.0												
6/2									(1035)				

* When rock coring, enter rock brokeness

** Include monitor reading in 6 foot intervals @ borehole Increase reading frequency if elevated reponse read

Drilling Area Background (ppm): 0

Remarks: SET CASING TO 72' ON 5/30/02

Converted to Well. Yes ✓ No _____ Well I.D. #: 01T03

Tetra Tech NUS, Inc.

BORING LOG

PROJECT NAME: Crane-MGBG
PROJECT NUMBER: N3959
DRILLING COMPANY: Bowser-Morner, Inc.
DRILLING RIG: VERSA-DRILL V1000X

BORING No.: 01T03
DATE: 5/30/02
GEOLOGIST: Conti
DRILLER: JAMES "SQUEAK" VANKIRK

Sample No and Type or RQD	Depth (Ft.) or Run No	Blows / 6" or RQD (%)	Sample Recovery / Sample Length	Lithology Change (Depth/Ft) or Screened Interval	MATERIAL DESCRIPTION: Soil Density/ Consistency or Rock Hardness	Color	Material Classification	USCS *	Remarks	PID/FID Reading (ppm): Sample	Sampler BZ	Borehole**	Driller BZ**
					M SOFT	GRAY	SHALE		TOP 3' VBR NO REC.	0			
					M HARD			VBR	76 → 77.5				
								BR	THINLY BEDDED W/ HORIZ BP.	0			
3.7/10	7	37%	7.2/10					BL					
										0			
								BR					
								VBR	82.3 → 82.5 VBR - HARD	0			
	83								SILTSTONE (1045)				
									TOP 4'	0			
									NO REC VBR				
										0			
								VBR	W/ HORIZ BP				
1.9/9.5	8	20%	6/9.5						JOINTS	0			
				89									
				90	M SOFT M HARD	LT GRAY	6" CLAYSTONE 6" SANDSTONE			0			
				91	M HARD	GRAY	SHALE	BR					
				91.8			SANDSTONE SEAM	BR		0			
	92.5			92.5	SOFT	BLK	COAL/SHALY TO SANDSTONE IN SHOE	VBR	W VERT JNT (1103)				
						GRAY				0			
					M HARD		SANDSTONE	VBR	(1140)				
						TO LT GRAY			PEBBLY & VBR W/ NUMEROUS HORIZ JOINTS. MOD-WEATHERED	0			
1.5/9.5	9	16%	8/9.5	97.0									
					M SOFT	GRAY	SHALE	VBR		0			
										0			

* When rock coring, enter rock brokeness

** Include monitor reading in 6 foot intervals @ borehole Increase reading frequency if elevated reponse read

Drilling Area Background (ppm): 0

Remarks:

Converted to Well. Yes ✓ No _____ Well I.D. #. 01T03

Tetra Tech NUS, Inc.

BORING LOG

PROJECT NAME: Crane-MGBG
PROJECT NUMBER: N3959
DRILLING COMPANY: Bowser-Morner, Inc.
DRILLING RIG: VERSA-DRILL V1000X

BORING No.: 01T03
DATE: 6/2/01
GEOLOGIST: Conti
DRILLER: JAMES "SQUEAK" VANKIRK

Sample No and Type or RQD	Depth (Ft) or Run No	Blows / 6" or RQD (%)	Sample Recovery / Sample Length	Lithology Change (Depth/Ft.) or Screened Interval	MATERIAL DESCRIPTION: Soil Density/ Consistency or Rock Hardness	Color	Material Classification	USCS *	Remarks	PID/FID Reading (ppm): Sample	Sampler BZ	Borehole**	Driller BZ**
					M SOFT	GRAY	SHALE			0			
				101.5									
	102				M HARD	GRAY	SANDSTONE	BR	LAST 6" SANDSTONE (1200)				
						TO TAN		BL		0			
								BR					
										0			
									105 HORIZ JNT				
									MOST OTHER BREAKS DUE TO DRILLING	0			
9.5/9.5	10	100%	9.5/9.5		M HARD	TAN	SANDSTONE						
										0			
									110 HORIZ JNT (1216)				
	111.5							BR	111.0 / 111.3 } HORIZ JNTS	0			
								TO	TR CLAY FILLED AND Fe STAINED				
								BR	LAST 1' OF CORE 111 → 116	0			
3.5									SEVERAL HORIZ BP JNTS				
9.5	11	37%	9/9.5					BR	Fe STAINED	0			
							SOME CROSS BEDDING		117.8 } HORIZ 118.3 } BP JNT				
									119.2 CLAY FILLED	0			
									120 - VERT JNT Fe STAINS THRUOUT				
									RUN 120.1 PEBBLY	0			
	121								CLAY FILLED (1235)				
					M HARD	TAN	SANDSTONE	BR	JNT @ BOTM 1/2" THICK	0			
									122 - 122.3 VERT JNT				
									122.9 HORIZ JNT	0			
									124 HORIZ JNT PEBBLY				

* When rock coring, enter rock brokeness

** Include monitor reading in 6 foot intervals @ borehole Increase reading frequency if elevated reponse read

Drilling Area Background (ppm): 0

Remarks:

Converted to Well: Yes ✓ No _____ Well I.D. #: 01 T03

Tetra Tech NUS, Inc.

BORING LOG

PROJECT NAME: Crane-MGBG
PROJECT NUMBER: N3959
DRILLING COMPANY: Bowser-Morner, Inc
DRILLING RIG: VERSA DRILL V1000X

BORING No.: 01T03
DATE: 6/2/02
GEOLOGIST: Conti
DRILLER: JAMES "SQUEAK" VANKIRK

Sample No and Type or RQD	Depth (Ft) or Run No	Blows / 6" or RQD (%)	Sample Recovery / Sample Length	Lithology Change (Depth/Ft.) or Screened Interval	MATERIAL DESCRIPTION: Soil Density/ Consistency or Rock Hardness	Color	Material Classification	USCS *	Remarks	PID/FID Reading (ppm): Sample	Sampler BZ	Borehole**	Driller BZ**
					M HARD	TAN	SANDSTONE		125 HORIZ JNT 125.7 " "	0			
4.1/9.5	12	43%	3.0/9.5				W Fe ST. JNTS	VBR	126.4 → 126.6				
									VBR w/ HORIZ JNT	0			
									127.4 127.7 "				
									128.6 129.0 "	0			
	130.5								130.0 " (1253)				
									SEVERAL HORIZ JNTS	0			
									MORE Fe STAINS @ 136 TO 138	0			
2.5/9.5	13	26%	9/9.5										
									137.3 VBR JNT	0			
									CALC @ 138±	0			
				138.5	HARD	GRAY	LIMESTONE	BR					
	140.0								139.3 HORIZ JNT (1314)	0			
								M	Fe STAINED				
										0			
								BR	144.7 45° JNT	0			
7.2/9.5	14	76%	9.4/9.5	44					Fe ST.				
									147-147.4	0			
									Fe ST HI ∡ JNT 147.8-148.2				
									VERT JNT. Fe ST	0			
									(1330)				
	149.5												

* When rock coring, enter rock brokeness

** Include monitor reading in 6 foot intervals @ borehole Increase reading frequency if elevated reponse read.

Drilling Area Background (ppm): 0

Remarks:

Converted to Well. Yes ✓ No _____ Well I.D. #: 01T03

Tetra Tech NUS, Inc.

BORING LOG

PROJECT NAME: Crane-MGBG
PROJECT NUMBER: N3959
DRILLING COMPANY: Bowser-Morner, Inc.
DRILLING RIG: VERSA DRILL V1000X

BORING No.: 01T03
DATE: 6-2-02
GEOLOGIST: Conti
DRILLER: JAMES "SQUEAK" VANKIRK

Sample No and Type or RQD	Depth (Ft) or Run No	Blows / 6" or RQD (%)	Sample Recovery / Sample Length	Lithology Change (Depth/Ft) or Screened Interval	MATERIAL DESCRIPTION: Soil Density/ Consistency or Rock Hardness	Color	Material Classification	USCS *	Remarks	PID/FID Reading (ppm): Sample	Sampler BZ	Borehole**	Driller BZ**
					HARD	GRAY	LIMESTONE	BL	150.8 HORIZ JNT	0			
									151.8 HORIZ JNT	0			
4.9/5.5	15	89%	5.4/5.5					BR					
									153 HORIZ JNT	0			
				154									
	155			155									
				BOTM									
							WELL 144-154						
							SAND 142-155						
							BENTONITE 136-142						

* When rock coring, enter rock brokeness

** Include monitor reading in 6 foot intervals @ borehole Increase reading frequency if elevated reponse read

Drilling Area Background (ppm): 0

Remarks:

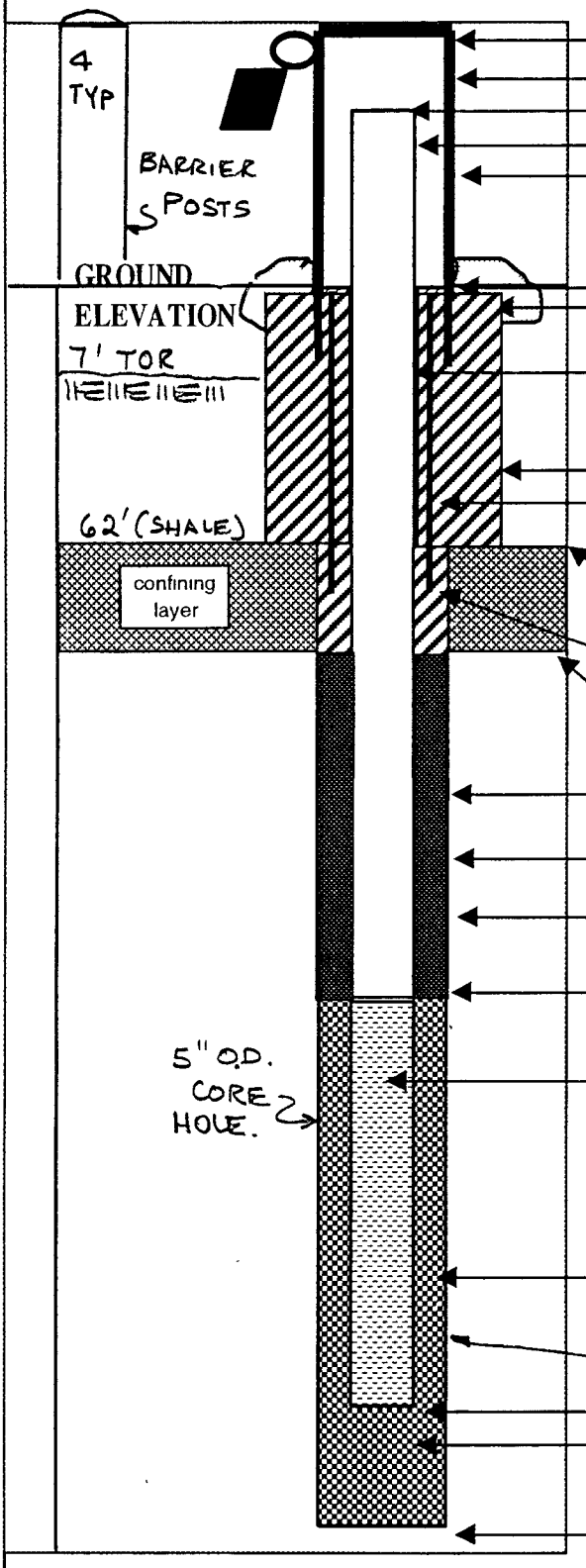
Converted to Well: Yes ✓ No _____ Well I.D. #: 01T03

BORING NO · 01T03

Tetra Tech NUS, Inc. **CONFINING LAYER MONITORING WELL SHEET**

PERMIT No

PROJECT:	Crane	DRILLING Co.:	BM, Inc.	BORING No.:	01T03
PROJECT No.:	N3959	DRILLER:	VANKIRK	DATE COMPLETED:	6-3-02
SITE:	MGBG	DRILLING METHOD:	AIR ROT	NORTHING:	1281095.46
GEOLOGIST:	CONTI	DEV. METHOD:	PUMP/SURGE	EASTING:	3030612.84



ELEVATION OF TOP OF SURFACE CASING	NA
STICK-UP TOP OF SURFACE CASING	NA
ELEVATION OF TOP OF RISER PIPE	667.12
RISER STICK-UP ABOVE GROUND SURFACE	2.33
I D OF SURFACE CASING	4"
TYPE OF SURFACE CASING	STEEL
GROUND ELEVATION	664.79
TYPE OF SURFACE SEAL	3'x3'x6" CONC PAD
RISER PIPE I D	2"
TYPE OF RISER PIPE	PVC
BOREHOLE DIAMETER	8 3/4
PERM CASING I D	6"
TYPE OF CASING & BACKFILL	STEEL CEMENT BENTONITE GROUT
ELEVATION / DEPTH TOP CONFINING LAYER	602.79/ 62
ELEVATION / DEPTH BOTTOM OF CASING	592.79/ 72
ELEVATION / DEPTH BOT CONFINING LAYER	575.79/ 89
ELEVATION / DEPTH OF SEAL	528.79/ 136
TYPE OF SEAL	CEMENT/ BENTONITE GROUT
ELEVATION / DEPTH TOP OF FILTER PACK	522.79 / 142
ELEVATION / DEPTH TOP OF SCREEN	520.79/ 144
TYPE OF SCREEN	PVC
SLOT SIZE X LENGTH	10 SL x 10'
I D OF SCREEN	2"
TYPE OF FILTER PACK	20-30 SIEVE SIZE SAND (SILICA)
BOREHOLE DIAMETER BELOW CASING	5"
ELEVATION / DEPTH BOTTOM OF SCREEN	510.79/ 154
ELEVATION / DEPTH BOTTOM OF FILTER PACK	509.79/ 155
TYPE OF BACKFILL BELOW WELL	SAND
ELEVATION / DEPTH OF BOREHOLE	509.79/ 155

Tetra Tech NUS, Inc.

BORING LOG

PROJECT NAME: Crane-MGBG
PROJECT NUMBER: N3959
DRILLING COMPANY: Bowser-Morner, Inc.
DRILLING RIG: VERSA DRILL V1000X

BORING No.: 01 TO 4
DATE: 5/31/02
GEOLOGIST: Conti
DRILLER: JAMES "SQUEAK" VANKIRK

Sample No and Type or RQD	Depth (Ft) or Run No	Blows / 6" or RQD (%)	Sample Recovery / Sample Length	Lithology Change (Depth/Ft.) or Screened Interval	Soil Density/ Consistency or Rock Hardness	Color	Material Classification	USCS *	Remarks	PID/FID Reading (ppm) Sample	Sampler BZ	Borehole**	Driller BZ**
S-1 e	0		1/2		M STIFF	ORANGE BRN	SILTY CLAY - TR	CL	MOIST -	0			
1305	2						TO ROOTS - CLAYEY SILT	ML	RESID. SOIL	0			
S-2 e			2/2			YELLOW BRN	CLAYEY SILT		MOIST	0			
1310	4						TO			0			
S-3 e			1/2		STIFF	GRAY BRN	CLAYEY SAND	SC	MOIST	0			
1315	6			6.2		YELLOW BRN	TR ROOTS TO WEATHERED		PUSHED 6 TO	0			
							SANDSTONE @ 6.2'		6.2 HIT REF.				
							REAM FROM 0 -						
							15 w/ 8 3/4" BIT						
	10						START CORE AT						
							15'						
	15												
					M HARD	TAN BRN	SANDSTONE.	VBR	(1415)	0			
								BR	SEVERAL (BEDDING PL.)				
								BR	17.4 18 HORIZ JNTS	0			
								BL	18.9 "				
5.4/10	1	54%	8.5/10					BR	20.5 "	0			
									20.8 21.6 "				
									22.2 22.5 "	0			
								BR	23.3 "				
									24.2 "	0			
	25				M HARD		SANDSTONE		SOME SOL. CAV. 1' FROM BOTTM				

* When rock coring, enter rock brokeness

** Include monitor reading in 6 foot intervals @ borehole Increase reading frequency if elevated reponse read

Drilling Area Background (ppm): 0

Remarks: PUSHED 2" SPOONS TO 6.2'
8 3/4" BIT TO 15'. START 5" OD CORE @ 15' (2 3/8" Φ CORE)

Converted to Well: Yes ✓ No _____ Well I.D. #: 01 TO4

Tetra Tech NUS, Inc.

BORING LOG

PROJECT NAME: Crane-MGBG
PROJECT NUMBER: N3959
DRILLING COMPANY: Bowser-Morner, Inc.
DRILLING RIG: VERSADRILL V1000X

BORING No.: 01T04
DATE: 5/31/02
GEOLOGIST: Conti
DRILLER: JAMES "SQUEAK" VANKIRK

Sample No and Type or RQD	Depth (Ft) or Run No	Blows / 6" or RQD (%)	Sample Recovery / Sample Length	Lithology Change (Depth/Ft.) or Screened Interval	MATERIAL DESCRIPTION: Soil Density/ Consistency or Rock Hardness	Color	Material Classification	USCS *	Remarks	PID/FID Reading (ppm): Sample	Sampler BZ	Borehole**	Driller BZ**
	25				M HARD	BRN	SANDSTONE	BR	(1425)	0			
								BR	SEVERAL HORIZ BP				
									JNTS	0			
									28.2 → 28.8 45° & JNT				
								BL	STAINED ≈30' SOME SOL CAV	0			
5.8/9.5	2	61%	8.8/9.5					BR	31 → 32 7- HORIZ JNTS				
						GRAY	SANDSTONE.		GRAY @ 32'±	0			
									(1435)	0			
	34.5												
							≈ 35.8 LAMINATED W/ V.THIN COAL	BL	POOR REC	0			
						TO BRN GRAY							
										0			
				39				BR					
4.3/9.5	3	45%	4.6/9.5		SOFT/	GRAY	SHALE		POSSIBLE SOFT SHALE @ 39'±	0			
					M SOFT								0
	44												
							NO REC - NOT SURE						0
							WHAT HAPPENED DRILLER NOTED V. SOFT MATERIAL POSSIBLE SHALE W/ CLAYS. - 1 PC IN CORE CATCHER WAS SHALY						
													0

* When rock coring, enter rock brokeness

** Include monitor reading in 6 foot intervals @ borehole Increase reading frequency if elevated reponse read

Drilling Area Background (ppm): 0

Remarks:

Converted to Well: Yes ✓ No _____ Well I.D. #: 01 T04

Tetra Tech NUS, Inc.

BORING LOG

PROJECT NAME: Crane-MGBG
PROJECT NUMBER: N3959
DRILLING COMPANY: Bowser-Morner, Inc.
DRILLING RIG: VERSA DRILL V1000X

BORING No.: 01T04
DATE: 5-31-02 / 6-1-02
GEOLOGIST: Conti
DRILLER: JAMES "SQUEAK" VANKIRK

Sample No and Type or RQD	Depth (Ft) or Run No	Blows / 6" or RQD (%)	Sample Recovery / Sample Length	Lithology Change (Depth/Ft.) or Screened Interval	MATERIAL DESCRIPTION: Soil Density/ Consistency or Rock Hardness	Color	Material Classification	USCS *	Remarks	PID/FID Reading (ppm): Sample	Sampler BZ	Borehole**	Driller BZ**
0/9.5	4	0%	1/9.5										
5-31													
	53.5			53.5									
6-1					M HARD	GRAY	INTERBEDDED SHALE	VBR	THINLY BEDDED	0			
							AND SANDSTONE		NUMEROUS ± (0745)				
									HORIZ BEDDING PLANE	0			
									JOINTS.				
										0			
1.6/9.5	5	17%	8.3/9.5										
										0			
										0			
	63				M HARD		SANDSTONE	BL	LAST 1.6' IS ONE PC. (0800)				
								VBR	THINLY TO	0			
				65.0 ±					THICKLY BEDDED				
					M HARD TO	GRAY	SHALE	BR		0			
					M								
4.2/9.5	6	44%	6.6/9.5		SOFT					0			
				69.8			PYRITE W/ COAL		SINCE NOT FULL REC - COAL	0			
				70.8	SOFT	BLK	COAL VERT JNT IN COAL	VBR	COULD BE 3' HIGHER				
					M HARD	GRAY	SANDSTONE	BL	LAMINATED W/ COAL	0			
	72.5								(0815)				
										0			
	75.0			75									

* When rock coring, enter rock brokeness

** Include monitor reading in 6 foot intervals @ borehole Increase reading frequency if elevated reponse read

Drilling Area Background (ppm): 0

Remarks

Converted to Well: Yes ✓ No _____ Well I D. #: 01T04

Tetra Tech NUS, Inc.

BORING LOG

PROJECT NAME. Crane-MGBG
PROJECT NUMBER. N3959
DRILLING COMPANY. Bowser-Morner, Inc.
DRILLING RIG. VERSA-DRILL V1000X

BORING No.: 01T04
DATE: 6-1-02
GEOLOGIST: Conti
DRILLER: JAMES "SQUEAK" VAN KIRK

	Sample No and Type or RQD	Depth (Ft) or Run No	Blows / 6" or RQD (%)	Sample Recovery / Sample Length	Lithology Change (Depth/Ft) or Screened Interval	Soil Density/ Consistency or Rock Hardness	Color	Material Classification	USCS *	Remarks	PID/FID Reading (ppm) Sample	Sampler BZ	Borehole**	Driller BZ**
					75'									
		75				M HARD	GRAY	SHALE w/ HORIZ BP JNTS	VBR	75→77 VBR	0			
					6" CAS				BR	W/ HARD-SS & QTZ FILLED VERT				
	5'/9.5	7	53%	7.2/9.5					BL	JOINT ≈ 76.8 THEN	0			
										BECOMES BLOCKY @ 77.5				
		80								TO 82'.	0			
						5" OD CORE								
6-1		82				HOLE				6-1-02 (0835)	0			
6/3		83		CLEAN OUT		M SOFT	LT GRAY			6-3-02 (1345)				
						M HARD				TOP 2' MISSING	0			
									BR					
										86.1 HORIZ BP JNT	0			
						M HARD	GRAY	SHALE		87.1 " "				
										87.7 " "	0			
	7.3/10	8	73%	8.0/10										
									BL	89 BECOMES BLOCKY	0			
										TO				
											0			
		93							BL	@ 93' (1410)				
											0			
										TOP 3.5 MISSING				
	1.4/9.5	9	15%	6.5/9.5						96-100 VBR	0			
										W/ SEVERAL BP JOINTS				
										HORIZ.	0			
					99.0									
					99.5	M HARD	LT GRAY	SHALY SILTSTONE						
						SOFT	BLK	COAL	VBR		0			

* When rock coring, enter rock brokeness

** Include monitor reading in 6 foot intervals @ borehole Increase reading frequency if elevated reponse read

Drilling Area Background (ppm): 0

Remarks SET 6" CAS TO 80' ON 6-1-02
CLEANED OUT TO 83 W/ROLLER BIT ON 6/3/02
RESUME CORING @ 83 FT.

Converted to Well Yes ✓ No _____ Well I.D #: 01T04

Tetra Tech NUS, Inc.

BORING LOG

PROJECT NAME: Crane-MGBG
PROJECT NUMBER: N3959
DRILLING COMPANY: Bowser-Morner, Inc.
DRILLING RIG: VERSA DRILL V1000X

BORING No.: 01T04
DATE: 6-3-02
GEOLOGIST: Conti
DRILLER: JAMES "SQUEAK" VANKIRK

Sample No and Type or RQD	Depth (Ft) or Run No	Blows / 6" or RQD (%)	Sample Recovery / Sample Length	Lithology Change (Depth/Ft) or Screened Interval	Soil Density/ Consistency or Rock Hardness	Color	Material Classification	USCS *	Remarks	PID/FID Reading (ppm) Sample	Sampler BZ	Borehole**	Driller BZ**
				100.0									
					M HARD	LT GRAY	MUDSTONE/CLAYSTONE	BR		0			
							TO						
	102.5						SILTSTONE		(1420)	0			
									GRADATIONAL				
							SILTY SANDSTONE	BR	CONTACT	0			
				106					106→107 Fe STAINED				
					M HARD	TAN	SANDSTONE		SEVERAL	0			
6.0/9.5	10	63%	9.0/9.5						HORIZ BP JOINTS				
									108.2→108.5 VERT JNT	0			
								VBR	(TIGHT)				
								VBR	109.5→110.5 VBR				
	112							BR	111-112 FE STAINED (1450)	0			
						TO							
				114	M HARD	GRAY	INTERBEDDED SS AND SH	VBR	114→117	0			
									VBR W SEVERAL BP				
5.4/9.5	11	59%	9.5/9.5					BR	HORIZ JOINTS	0			
										0			
				119		TO	GRADES INTO		118.7 HORIZ BP JOINT				
					M HARD	TAN	SANDSTONE ≈ 119.0		(1500)	0			
									120.5 " " 121.0 " "				
	121.5								121 REDDISH COLOR IN SS	0			
										0			

* When rock coring, enter rock brokeness

** Include monitor reading in 6 foot intervals @ borehole Increase reading frequency if elevated reponse read

Drilling Area Background (ppm): 0

Remarks:

Converted to Well: Yes ✓ No _____ Well I.D. #: 01T04

Tetra Tech NUS, Inc.

BORING LOG

PROJECT NAME: Crane-MGBG
PROJECT NUMBER: N3959
DRILLING COMPANY: Bowser-Morner, Inc.
DRILLING RIG: VERSA DRILL V1000X

BORING No.: OITO4
DATE: 6-3-02
GEOLOGIST: Conti
DRILLER: JAMES "SQUEAK" VANKIRK

Sample No and Type or RQD	Depth (Ft) or Run No	Blows / 6" or RQD (%)	Sample Recovery / Sample Length	Lithology Change (Depth/Ft) or Screened Interval	Soil Density/ Consistency or Rock Hardness	Color	Material Classification	USCS*	Remarks	PID/FID Reading (ppm) Sample	Sampler BZ	Borehole**	Driller BZ**
	125				M HARD	TAN	SANDSTONE	BR	NUMEROUS HORIZ BP	0			
								TO	JNTS				
0/9.5	12	0	8.5/9.5					VBR	126→128.4 VF GRAINED SS	0			
								TO	OR SILTSTONE SEAM				
						TO		BR	129→131 MORE Fe STAINED	0			
	131					BRN	SANDSTONE - M TO C GRAINED	VBR	‡ (1520)				
								TO		0			
								BR	W/ Fe STAINED JNTS				
										0			
6.0/9.5	13	63%	9/9.5						135.8→136.3'				
									VBR CONTACT ZONE.	0			
				136.3	HARD	GRAY	LIMESTONE	BR	UNCONFORMITY ?				
									137.1	0			
									138 HORIZ BP 138.4				
									138.6 JNTS 138.9	0			
	140.5			141					140.1 (1545)				
									140.1→140.5 VERT CALCITE FILLED				
									JOINT (TIGHT) 141-141.3 Hi	0			
7/9.5	14	74%	9/9.5						‡ JNT Fe STAIN 141.8→142.45°‡				
									JNT 142.8→143.1	0			
									Hi ‡ JNT (Fe) 144.7 HORIZ JNT				
									(FOSSILLIFEROUS)	0			
										0			
	150								(1615)				

* When rock coring, enter rock brokeness

** Include monitor reading in 6 foot intervals @ borehole Increase reading frequency if elevated reponse read

Drilling Area Background (ppm): 0

Remarks:

Converted to Well. Yes ✓ No _____ Well I.D. # OITO4

Tetra Tech NUS, Inc.

BORING LOG

PROJECT NAME: Crane-MGBG
PROJECT NUMBER: N3959
DRILLING COMPANY: Bowser-Morner, Inc.
DRILLING RIG: VERSA DRILL V1000X

BORING No.: 01T04
DATE: 6-3-02
GEOLOGIST: Conti
DRILLER: JAMES "SQUEAK" VANKIRK

Sample No and Type or RQD	Depth (Ft) or Run No	Blows / 6" or RQD (%)	Sample Recovery / Sample Length	Lithology Change (Depth/Ft) or Screened Interval	MATERIAL DESCRIPTION: Soil Density/ Consistency or Rock Hardness	Color	Material Classification	USCS *	Remarks	PID/FID Reading (ppm): Sample	Sampler BZ	Borehole**	Driller BZ**
	150			151	HARD	GRAY	LIMESTONE	BR	FOSSILIFERROUS 150.5	0			
3/3	15	100%	3/3						151 - HORIZ JNTS - SOME	0			
	153								Fe STAINS	0			
				BOTM @ 153'					(1640)				
							SET WELL ON 6/4						
							SCREEN 141 - 151						
							SAND 138 - 152						
							BENT 134 - 138						

* When rock coring, enter rock brokeness

** Include monitor reading in 6 foot intervals @ borehole Increase reading frequency if elevated reponse read

Drilling Area Background (ppm): 0

Remarks:

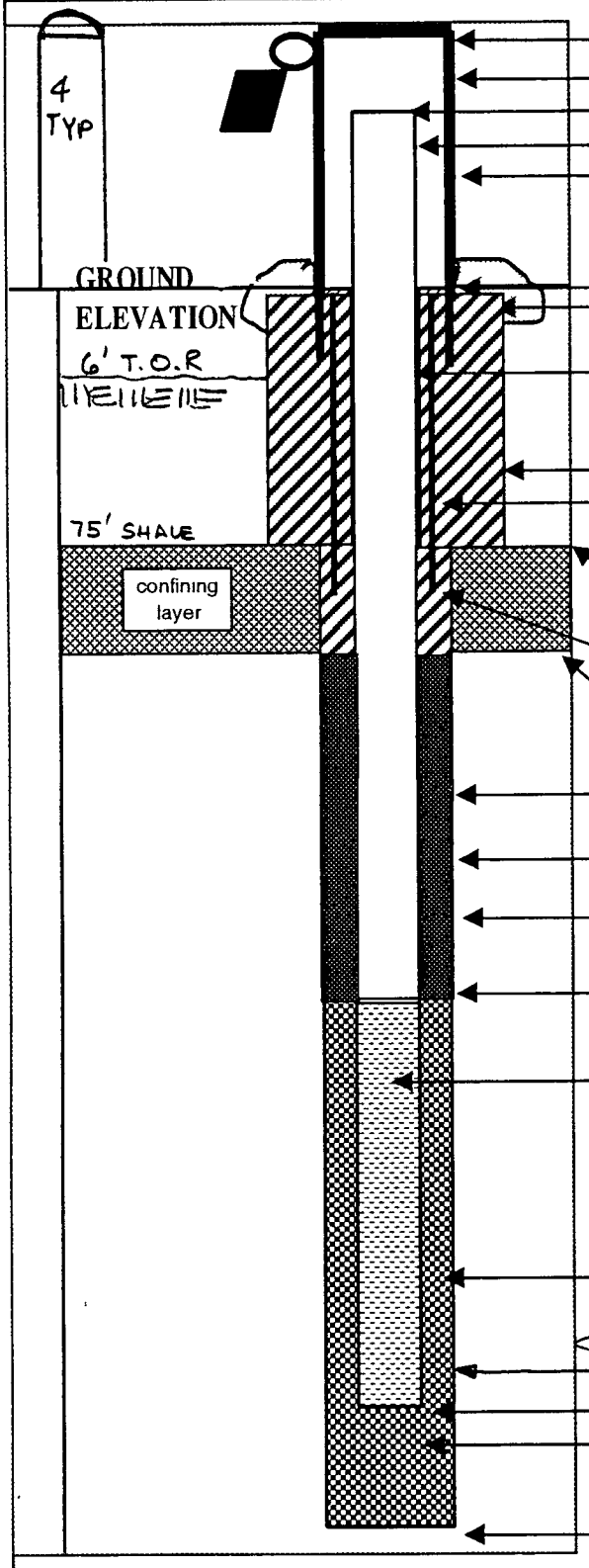
Converted to Well: Yes ✓ No _____ Well I.D #: 01T04

BORING NO 01T04

Tetra Tech NUS, Inc. **CONFINING LAYER MONITORING WELL SHEET**

PERMIT No

PROJECT:	Crane	DRILLING Co.:	BM, Inc.	BORING No.:	01T04
PROJECT No.:	N3959	DRILLER:	VANKIRK	DATE COMPLETED:	6-4-02
SITE:	MGBG	DRILLING METHOD:	AIR ROT	NORTHING:	1281175.89
GEOLOGIST:	CONTI	DEV. METHOD:	PUMP/SURGE	EASTING:	3030296.78



ELEVATION OF TOP OF SURFACE CASING	NA
STICK-UP TOP OF SURFACE CASING	NA
ELEVATION OF TOP OF RISER PIPE	665.81
RISER STICK-UP ABOVE GROUND SURFACE:	2.79
I D OF SURFACE CASING	4"
TYPE OF SURFACE CASING	STEEL
GROUND ELEVATION	663.02
TYPE OF SURFACE SEAL	3'x 3'x 6" CONCRETE PAD
RISER PIPE I D	2"
TYPE OF RISER PIPE.	PVC
BOREHOLE DIAMETER	8 3/4"
PERM CASING I.D	6"
TYPE OF CASING & BACKFILL	STEEL CEMENT BENTONITE GROUT
ELEVATION / DEPTH TOP CONFINING LAYER	588.02/ 75'
ELEVATION / DEPTH BOTTOM OF CASING	583.02/ 80'
ELEVATION / DEPTH BOT CONFINING LAYER	564.02/99.0
ELEVATION / DEPTH OF SEAL	529.02/ 134
TYPE OF SEAL	CEMENT/ BENTONITE GROUT
ELEVATION / DEPTH TOP OF FILTER PACK	525.02/138
ELEVATION / DEPTH TOP OF SCREEN	522.02/141
TYPE OF SCREEN	PVC
SLOT SIZE X LENGTH	10 SL x 10'
I D OF SCREEN	2"
TYPE OF FILTER PACK	#20-30 SIEVE SIZE SILICA SAND
BOREHOLE DIAMETER BELOW CASING	5"
ELEVATION / DEPTH BOTTOM OF SCREEN	512.02/151
ELEVATION / DEPTH BOTTOM OF FILTER PACK	511.02/152
TYPE OF BACKFILL BELOW WELL	SAND
ELEVATION / DEPTH OF BOREHOLE.	510.02/153

Tetra Tech NUS, Inc.

BORING LOG

PROJECT NAME: Crane-MGBG
PROJECT NUMBER: N3959
DRILLING COMPANY: Bowser-Morner, Inc
DRILLING RIG: VERSA DRIL V 1000X

BORING No.: 01T05
DATE: 6-4-02
GEOLOGIST: Conti
DRILLER: JAMES "SQUEAK" VANKIRK

Sample No and Type or RQD	Depth (Ft) or Run No	Blows / 6" or RQD (%)	Sample Recovery / Sample Length	Lithology Change (Depth/Ft) or Screened Interval	MATERIAL DESCRIPTION: Soil Density/ Consistency or Rock Hardness	Color	Material Classification	USCS *	Remarks	PID/FID Reading (ppm): Sample	Sampler BZ	Borehole**	Driller BZ**
S-1 e	0		1/2		M. STIFF	YELLOW BRN	SILTY CLAY - TR	CL	MOIST	0			
1320	2					MOTTLED	SAND - ROOTS						
S-2 e	.		1.5/2		STIFF	GRAY YELLOW		CL	MOIST	0			
1325	4					BRN	TR WEATHERED ROCK @ 4						
S-3 e	5		.8/1	5'	STIFF	BRN	RES. SOIL/ WEATHERED SANDSTONE		MOIST	0			
1330				REF @ 5'±									
							DRILL 0 → 15 W/						
							6" ROTARY BIT TO						
							FACILITATE LONG						
	10						DRILL RODS						
	15					GRAY			(1345)				
					M HARD	BRN	SANDSTONE	VBR	THIN BEDDED	0			
							LAMINATED		W/ NUMEROUS				
									HORIZ BP JNTS. Fe	0			
						TO	19 → 20		STAINED SEVERAL JNTS				
						TAN BRN	SOLUTION CAVITIES		CLAY FILLED	0			
37/10	1	37/10	9.1/10	21'			?		WET ≈ 20'± 21.2 - 21.7				
									VERTICAL JNT VBR	0			
								BL					
										0			
	25					GRAY			LAST 1' BECOMES GRAY 1405				

* When rock coring, enter rock brokeness

** Include monitor reading in 6 foot intervals @ borehole Increase reading frequency if elevated reponse read

Drilling Area Background (ppm): 0

Remarks: PUSH 2" SPLIT - SPOONS W/ RIG TO 5' REF.
CORE W/ 5" OD - 2 7/8" ID BIT 15 → 32'

Converted to Well: Yes ✓ No _____ Well I.D. #: 01T05

Tetra Tech NUS, Inc.

BORING LOG

PROJECT NAME: Crane-MGBG
PROJECT NUMBER: N3959
DRILLING COMPANY: Bowser-Morner, Inc.
DRILLING RIG: VERSA DRILL V1000X

BORING No.: 01T05
DATE: 6-4-02
GEOLOGIST: Conti
DRILLER: JAMES "SQEAK" VANKIRK

Sample No and Type or RQD	Depth (Ft) or Run No	Blows / 6" or RQD (%)	Sample Recovery / Sample Length	Lithology Change (Depth/Ft) or Screened Interval	MATERIAL DESCRIPTION: Soil Density/ Consistency or Rock Hardness	Color	Material Classification	USCS*	Remarks	PID/FID Reading (ppm): Sample	Sampler BZ	Borehole**	Driller BZ**
	25												
					M HARD	GRAY	SANDSTONE	BL		0			
				27.8					27.8 COLOR CHANGE	0			
2.8/7	②	40%	6.1/7		M HARD	GRAY BRN	SANDSTONE	VBR	w/ VERTICAL				
									JOINT 28.3 → 29 w/	0			
									CAVITIES - WEATHERED & Fe STAINED				
				31									
	32					GRAY	LAST 2" BECOMES SHALY	VBR	(1420)	0			
				BOTM @ 32'					TR OF COAL FILLED LAMINATIONS				
							SET WELL 21 – 31						
							SAND 18 – 32						
							BENTONITE 14-18						

* When rock coring, enter rock brokeness

** Include monitor reading in 6 foot intervals @ borehole Increase reading frequency if elevated reponse read

Drilling Area Background (ppm): 0

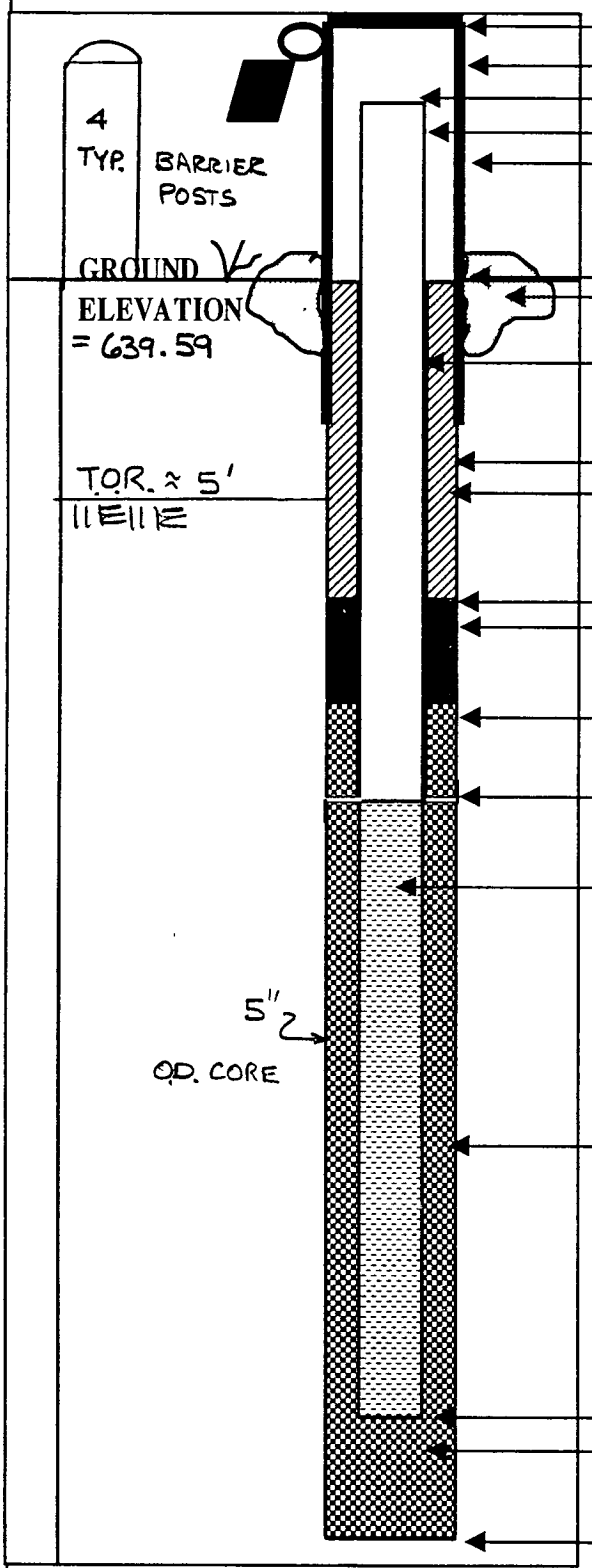
Remarks:

Converted to Well: Yes ✓ No _____ Well I.D. #: 01T05

BORING NO. 01T05

Tetra Tech NUS, Inc. **MONITORING WELL SHEET**

PROJECT:	NSWC CRANE	DRILLING Co.:	BM, Inc.	BORING No.:	01T05
PROJECT No.:	N3959	DRILLER:	VANKIRK	DATE COMPLETED:	6-5-02
SITE:	MGBG	DRILLING METHOD:	AIR ROT	NORTHING:	1281550.55
GEOLOGIST:	Conti	DEV. METHOD:	PUMP/SURGE	EASTING:	3029971.27



ELEVATION OF TOP OF SURFACE CASING	NA
STICK-UP TOP OF SURFACE CASING	NA
ELEVATION OF TOP OF RISER PIPE	641.85
RISER STICK-UP ABOVE GROUND SURFACE:	2.26
I.D OF SURFACE CASING	4" SQUARE
TYPE OF SURFACE CASING	STEEL
GROUND ELEVATION	639.59
TYPE OF SURFACE SEAL	CONC PAD 3'x3'6"
RISER PIPE I D	2"
TYPE OF RISER PIPE	PVC
BOREHOLE DIAMETER	6" TO 15'
TYPE OF SEAL	CEMENT/BENT
ELEVATION / DEPTH OF SEAL	625.59/ 14'
TYPE OF SEAL	BENTONITE CHIPS
ELEVATION / DEPTH TOP OF FILTER PACK	621.59/ 18
ELEVATION / DEPTH TOP OF SCREEN	618.59/ 21
TYPE OF SCREEN	PVC
SLOT SIZE X LENGTH	10 x 10'
I.D OF SCREEN	2"
TYPE OF FILTER PACK	#1 SAND (SILICA) 20-30 SIEVE
ELEVATION / DEPTH BOTTOM OF SCREEN	608.59/ 31
ELEVATION / DEPTH BOTTOM OF FILTER PACK	607.59/ 32
TYPE OF BACKFILL BELOW WELL	SAND
ELEVATION / DEPTH OF BOREHOLE	607.59/ 32

APPENDIX B

SAMPLE LOG SHEETS
AND OTHER
FIELD FORMS

APPENDIX B-1

MONITORING WELL INSPECTION SHEETS

MONITORING WELL INSPECTION SHEET

NSWC Crane MGBG

JOB # 3959

Well ID: 01 - 01

Time: 1636 **Date:** 7-14-01 **Inspector's Name:** SIMPSON / ROJAHN

Inspection Item	Types of Problems	Status		Observation
		S	U	
Well Tag	Is it in-place, legible	✓		PAINTED ON PVC
Well security	Condition protective case, cap, lock	✓		
Well pad	Concrete or ~~gravel~~ & condition	✓		SMALL CONCRETE
Well seal	Condition of...	✓		
Area Immediately around well pad	Record any evidence of/or standing water in area of well	✓		
Dedicated sampling equipment	Condition of...	—	—	NA
PVC Riser	Condition of riser & survey reference point	✓		NO OUTER CASE PVC ONLY

Comments: WL = 29.02

BTM = 50.9

Signature(s) [illegible]

Note: S= Satisfactory, U= Unsatisfactory
Check one, if unsatisfactory explain

NSWC Crane
Field Form
Revision: 2
November, 2000

MONITORING WELL INSPECTION SHEET

NSWC Crane MGBG

JOB # 3959

Well ID: 01-02

Time: 1618 **Date:** 7.14.01 **Inspector's Name:** SIMPSON/ROJAHN

Inspection Item	Types of Problems	Status		Observation
		S	U	
Well Tag	Is it in-place, legible	✓		PAINTED ON PVC
Well security	Condition protective case, cap, lock	✓		
Well pad	Concrete or gravel & condition	✓		SMALL CONCRETE
Well seal	Condition of…	✓		
Area Immediately around well pad	Record any evidence of/or standing water in area of well	✓		
Dedicated sampling equipment	Condition of…	—		NA
PVC Riser	Condition of riser & survey reference point	✓		NO OUTER CASE, PVC ONLY

Comments:

WL = 14.79

BTM = 25.7

Signature(s) [illegible]

Note: S= Satisfactory, U= Unsatisfactory
Check one, if unsatisfactory explain

NSWC Crane
Field Form
Revision: 2
November, 2000

MONITORING WELL INSPECTION SHEET

NSWC Crane MG-BG

JOB # 3959

Well ID: 01 - 03

Time: 1643 **Date:** 7.14.01 **Inspector's Name:** SIMPSON / ROJAHN

Inspection Item	Types of Problems	Status S	Status U	Observation
Well Tag	Is it in-place, legible	✓		PAINTED ON PVC
Well security	Condition protective case, cap, lock	✓		
Well pad	Concrete or ~~gravel~~ & condition	✓		SMALL CONCRETE
Well seal	Condition of…	✓		
Area Immediately around well pad	Record any evidence of/or standing water in area of well	✓		
Dedicated sampling equipment	Condition of…	—		NA
PVC Riser	Condition of riser & survey reference point	✓		NO OUTER CASE PVC ONLY

Comments:

WL = 10.90

BTM = 21.0

Signature(s) [illegible]

Note: S= Satisfactory, U= Unsatisfactory
Check one, if unsatisfactory explain

NSWC Crane
Field Form
Revision: 2
November, 2000

MONITORING WELL INSPECTION SHEET

NSWC Crane MGBG

JOB # 3959

Well ID: 01-04

Time: 1629 **Date:** 7.14.01 **Inspector's Name:** SIMPSON/ROJAHN

Inspection Item	Types of Problems	Status S	Status U	Observation
Well Tag	Is it in-place, legible	✓		PAINTED ON PVC
Well security	Condition protective case, cap, lock	✓		
Well pad	Concrete or ~~gravel~~ & condition	✓		SMALL CONCRETE
Well seal	Condition of…	✓		
Area Immediately around well pad	Record any evidence of/or standing water in area of well	✓		
Dedicated sampling equipment	Condition of…	—		NA
PVC Riser	Condition of riser & survey reference point	✓		NO OUTER CASE PVC ONLY

Comments: WL = 18.49

BTM = 33.7

Signature(s) [illegible]

Note: S= Satisfactory, U= Unsatisfactory
Check one, if unsatisfactory explain

NSWC Crane
Field Form
Revision: 2
November, 2000

MONITORING WELL INSPECTION SHEET

NSWC Crane MGBG

JOB # 3959

Well ID: 01-05

Time: 1624 **Date:** 7.14.01 **Inspector's Name:** SIMPSON/ROJAHN

Inspection Item	Types of Problems	Status		Observation
		S	U	
Well Tag	Is it in-place, legible	✓		PAINTED ON PVC
Well security	Condition protective case, cap, lock	✓		
Well pad	Concrete or ~~gravel~~ & condition	✓		SMALL CONCRETE
Well seal	Condition of...	✓		
Area Immediately around well pad	Record any evidence of/or standing water in area of well	✓		
Dedicated sampling equipment	Condition of...	—	—	NA
PVC Riser	Condition of riser & survey reference point	✓		NO OUTER CASE PVC ONLY

Comments: WL = 16.85
BTM = 33.4

Signature(s) [illegible]

Note. S= Satisfactory, U= Unsatisfactory
Check one, if unsatisfactory explain

NSWC Crane
Field Form
Revision: 2
November, 2000

MONITORING WELL INSPECTION SHEET

NSWC Crane MgBG

JOB # 3959

Well ID: 01-06

Time: 1458 **Date:** 7-14-01 **Inspector's Name:** SIMPSON/ROJAHN

Inspection Item	Types of Problems	Status		Observation
		S	U	
Well Tag	Is it in-place, legible	✓		
Well security	Condition protective case, cap, lock		✓	
Well pad	Concrete or gravel & condition	✓		
Well seal	Condition of…	✓		
Area Immediately around well pad	Record any evidence of/or standing water in area of well	✓		
Dedicated sampling equipment	Condition of…	—		NA
PVC Riser	Condition of riser & survey reference point		✓	BROKEN PVC @ GROUND

Comments: WL = FROM GROUND 68.11

BTM = " " 91.0

Signature(s) [illegible]

Note. S= Satisfactory, U= Unsatisfactory
Check one, if unsatisfactory explain

NSWC Crane
Field Form
Revision. 2
November, 2000

MONITORING WELL INSPECTION SHEET

NSWC Crane MGBG

JOB # 3959

Well ID: 01-07

Time: 1443 **Date:** 7.14.01 **Inspector's Name:** SIMPSON/ROJAHN

Inspection Item	Types of Problems	Status		Observation
		S	U	
Well Tag	Is it in-place, legible	✓		
Well security	Condition protective case, cap, lock		✓	
Well pad	Concrete or gravel & condition		✓	PAD & RISER BROKEN OFF @ GROUND
Well seal	Condition of...		✓	
Area Immediately around well pad	Record any evidence of/or standing water in area of well		✓	YES, WET AREA AROUND WELL
Dedicated sampling equipment	Condition of...	—	—	NA
PVC Riser	Condition of riser & survey reference point		✓	BROKEN @ GROUND

Comments: WL = ~~20~~ 14.50 FROM GROUND

BTM = 20.35 "

Signature(s) [illegible]

Note: S= Satisfactory, U= Unsatisfactory
Check one, if unsatisfactory explain

PHOTO TAKEN

NSWC Crane
Field Form
Revision: 2
November, 2000

MONITORING WELL INSPECTION SHEET

NSWC Crane MGBG

JOB # 3959

Well ID: 01-08

Time: 1444 **Date:** 7.14.01 **Inspector's Name:** SIMPSON/ROJAHN

Inspection Item	Types of Problems	Status S	Status U	Observation
Well Tag	Is it in-place, legible	✓		PAINTED ON PVC
Well security	Condition protective case, cap, lock	✓		
Well pad	Concrete or ~~gravel~~ & condition	✓		SMALL CONCRETE
Well seal	Condition of…	✓		
Area Immediately around well pad	Record any evidence of/or standing water in area of well	✓		
Dedicated sampling equipment	Condition of…	—		NA
PVC Riser	Condition of riser & survey reference point	✓		NO OUTER CASE, PVC ONLY

Comments: WL = 15.12

BTM = 31.2

Signature(s) [illegible]

Note: S= Satisfactory, U= Unsatisfactory
Check one, if unsatisfactory explain

NSWC Crane
Field Form
Revision: 2
November, 2000

MONITORING WELL INSPECTION SHEET

NSWC Crane MGBG

JOB # 3959

Well ID: 01-09

Time: 1451 **Date:** 7-19-01 **Inspector's Name:** SIMPSON/ROJAHN

Inspection Item	Types of Problems	Status S	Status U	Observation
Well Tag	Is it in-place, legible	✓		PAINTED ON PVC
Well security	Condition protective case, cap, lock	✓		
Well pad	Concrete or ~~gravel~~ & condition	✓		SMALL CONCRETE
Well seal	Condition of...	✓		
Area Immediately around well pad	Record any evidence of/or standing water in area of well	✓		
Dedicated sampling equipment	Condition of...	—		NA
PVC Riser	Condition of riser & survey reference point	✓		NO OUTER CASE PVC ONLY

Comments: WC = ~~17.06~~ KS 17.35

BTM = 34.5

Signature(s) [illegible]

Note: S= Satisfactory, U= Unsatisfactory
Check one, if unsatisfactory explain

NSWC Crane
Field Form
Revision: 2
November, 2000

MONITORING WELL INSPECTION SHEET

NSWC Crane MGBG

JOB # 3959

Well ID: 01 - 10

Time: 1551 **Date:** 7.14.01 **Inspector's Name:** SIMPSON / ROJAHN

Inspection Item	Types of Problems	Status S	Status U	Observation
Well Tag	Is it in-place, legible	✓		PAINTED ON PVC
Well security	Condition protective case, cap, lock	✓		
Well pad	Concrete or ~~gravel~~ & condition	✓		SMALL CONCRETE
Well seal	Condition of…	✓		
Area Immediately around well pad	Record any evidence of/or standing water in area of well	✓		
Dedicated sampling equipment	Condition of…	—		NA
PVC Riser	Condition of riser & survey reference point	✓		NO OUTER CASE, PVC ONLY

Comments: WL = 24.52

BTM = 42.8

Signature(s) [illegible]

Note: S= Satisfactory, U= Unsatisfactory
Check one, if unsatisfactory explain

NSWC Crane
Field Form
Revision: 2
November, 2000

MONITORING WELL INSPECTION SHEET

NSWC Crane MG-BG

JOB # 3959

Well ID: 01-11

Time: 1613 **Date:** 7-14-01 **Inspector's Name:** SIMPSON/ROJAHN

Inspection Item	Types of Problems	Status		Observation
		S	U	
Well Tag	Is it in-place, legible	✓		PAINTED ON PVC
Well security	Condition protective case, cap, lock	✓		
Well pad	Concrete ~~or gravel~~ & condition	✓		SMALL CONCRETE
Well seal	Condition of...	✓		
Area Immediately around well pad	Record any evidence of/or standing water in area of well	✓		
Dedicated sampling equipment	Condition of...	—		NA
PVC Riser	Condition of riser & survey reference point	✓		NO OUTER CASE, PVC ONLY

Comments: WL = 10.38
BTM = 21.7

Signature(s) [illegible]

Note: S= Satisfactory, U= Unsatisfactory
Check one, if unsatisfactory explain

NSWC Crane
Field Form
Revision: 2
November, 2000

MONITORING WELL INSPECTION SHEET

NSWC Crane MGBG

JOB # 3959

Well ID: 01-12

Time: 1603 **Date:** 7.14.01 **Inspector's Name:** SIMPSON/ROJAHN

Inspection Item	Types of Problems	Status S	Status U	Observation
Well Tag	Is it in-place, legible	✓		PAINTED ON PVC
Well security	Condition protective case, cap, lock	✓		
Well pad	Concrete or ~~gravel &~~ condition	✓		SMALL CONCRETE
Well seal	Condition of…	✓		
Area Immediately around well pad	Record any evidence of/or standing water in area of well	✓		
Dedicated sampling equipment	Condition of…	—	—	NA
PVC Riser	Condition of riser & survey reference point	✓		NO OUTER CASE PVC ONLY

Comments: WL = 25.91

BTM = 41.2

Signature(s) [illegible]

Note. S= Satisfactory, U= Unsatisfactory
Check one, if unsatisfactory explain

NSWC Crane
Field Form
Revision: 2
November, 2000

MONITORING WELL INSPECTION SHEET

NSWC Crane MGBG

JOB # 3959

Well ID: 01-13

Time: 1559 **Date:** 7.14.01 **Inspector's Name:** SIMPSON/ROJAHN

Inspection Item	Types of Problems	Status		Observation
		S	U	
Well Tag	Is it in-place, legible	✓		PAINTED ON PVC
Well security	Condition protective case, cap, lock	✓		
Well pad	Concrete or gravel & condition	✓		SMALL CONCRETE
Well seal	Condition of...	✓		
Area Immediately around well pad	Record any evidence of/or standing water in area of well	✓		
Dedicated sampling equipment	Condition of...	—		NA
PVC Riser	Condition of riser & survey reference point	✓		NO OUTER CASE, PVC ONLY

Comments: WL= 23.75

BTM= 38.8

Signature(s) [illegible]

Note: S= Satisfactory, U= Unsatisfactory
Check one, if unsatisfactory explain

NSWC Crane
Field Form
Revision: 2
November, 2000

MONITORING WELL INSPECTION SHEET

NSWC Crane MGBG

JOB # 3959

Well ID: 01-14

Time: 1350 **Date:** 7.14.01 **Inspector's Name:** SIMPSON/ROJAHN

Inspection Item	Types of Problems	Status		Observation
		S	U	
Well Tag	Is it in-place, legible	✓		PAINTED ON PVC RISER
Well security	Condition protective case, cap, lock	✓		
Well pad	Concrete or ~~gravel~~ & condition	✓		SMALL CONCRETE
Well seal	Condition of…	✓		
Area Immediately around well pad	Record any evidence of/or standing water in area of well	✓		
Dedicated sampling equipment	Condition of…	—		NA
PVC Riser	Condition of riser & survey reference point	✓		NO OUTER CASE PVC ONLY PVC AT A SLIGHT ANGLE

Comments: WL = 15.93

BTM = 38.7

Signature(s) [illegible]

Note: S= Satisfactory, U= Unsatisfactory
Check one, if unsatisfactory explain

NSWC Crane
Field Form
Revision: 2
November, 2000

MONITORING WELL INSPECTION SHEET

NSWC Crane MGBG

JOB # 3959

Well ID: 01-15

Time: 1353 **Date:** 7.14.01 **Inspector's Name:** SIMPSON/ROJAHN

Inspection Item	Types of Problems	Status		Observation
		S	U	
Well Tag	Is it in-place, legible	✓		PAINTED ON RISER
Well security	Condition protective case, cap, lock		✓	
Well pad	Concrete or gravel & condition	✓		SMALL
Well seal	Condition of...	✓		
Area Immediately around well pad	Record any evidence of/or standing water in area of well	✓		
Dedicated sampling equipment	Condition of...	—	—	NA
PVC Riser	Condition of riser & survey reference point		✓	BROKEN NEEDS REPAIRED (PVC)

Comments: WL = 25.75 → BROKEN, RISER MEASURMENT FROM GROUND ±

BTM = 39.1

Signature(s) [illegible]

Note. S= Satisfactory, U= Unsatisfactory
Check one, if unsatisfactory explain

NSWC Crane
Field Form
Revision: 2
November, 2000

MONITORING WELL INSPECTION SHEET

NSWC Crane MGBG

JOB # 3959

Well ID: 01-16

Time: 1532 **Date:** 7.14.01 **Inspector's Name:** SIMPSON/ROJAHN

Inspection Item	Types of Problems	Status S	Status U	Observation
Well Tag	Is it in-place, legible	✓		PAINTED ON RISER
Well security	Condition protective case, cap, lock	✓		
Well pad	Concrete or ~~gravel &~~ condition	✓		SMALL CONCRETE
Well seal	Condition of...	✓		
Area Immediately around well pad	Record any evidence of/or standing water in area of well	✓		
Dedicated sampling equipment	Condition of...	—		NA
PVC Riser	Condition of riser & survey reference point	✓		NO OUTER CASE PVC ONLY

Comments: WL = 36.02
BTM = 42.13

Signature(s) [illegible]

Note: S= Satisfactory, U= Unsatisfactory
Check one, if unsatisfactory explain

NSWC Crane
Field Form
Revision. 2
November, 2000

MONITORING WELL INSPECTION SHEET

NSWC Crane MGBG

JOB # 3959

Well ID: 01-17

Time: 1340 **Date:** 7.14.01 **Inspector's Name:** SIMPSON/ROJAHN

Inspection Item	Types of Problems	Status		Observation
		S	U	
Well Tag	Is it in-place, legible	✓		ID PAINTED ON PVC
Well security	Condition protective case, cap, lock	✓		
Well pad	Concrete ~~or gravel~~ & condition	✓		SMALL CONCRETE PAD, SOME MOVEMENT
Well seal	Condition of...	✓		
Area Immediately around well pad	Record any evidence of/or standing water in area of well	✓		
Dedicated sampling equipment	Condition of...	—	—	NA
PVC Riser	Condition of riser & survey reference point	✓		NO OUTER CASE, PVC ONLY

Comments: WL = 21.42
BTM = 40.7

Signature(s) [illegible]

Note: S= Satisfactory, U= Unsatisfactory
Check one, if unsatisfactory explain

NSWC Crane
Field Form
Revision: 2
November, 2000

MONITORING WELL INSPECTION SHEET

NSWC Crane MGBG
JOB # 3959

Well ID: 01-18

Time: 1653 **Date:** 7.14.01 **Inspector's Name:** SIMPSON/ROJAHN

Inspection Item	Types of Problems	Status S	Status U	Observation
Well Tag	Is it in-place, legible	✓		PAINTED ON PVC
Well security	Condition protective case, cap, lock	✓		NO OUTER CASE, PVC ONLY
Well pad	Concrete or ~~gravel &~~ condition	✓		LOOSE/ROCKS
Well seal	Condition of...	✓		
Area Immediately around well pad	Record any evidence of/or standing water in area of well	✓		
Dedicated sampling equipment	Condition of...	—	—	NA
PVC Riser	Condition of riser & survey reference point	✓		

Comments: WL = 15.07

BTM = 32.7

Signature(s) [illegible]

Note: S= Satisfactory, U= Unsatisfactory
Check one, if unsatisfactory explain

NSWC Crane
Field Form
Revision: 2
November, 2000

MONITORING WELL INSPECTION SHEET

NSWC Crane MGBG
JOB # 3959

Well ID: 01-19

Time: 1358 **Date:** 7.14.01 **Inspector's Name:** SIMPSON/ROJAHN

Inspection Item	Types of Problems	Status		Observation
		S	U	
Well Tag	Is it in-place, legible	✓		PAINTED ON PVC
Well security	Condition protective case, cap, lock	✓		
Well pad	Concrete or gravel & condition	✓		SMALL CONCRETE
Well seal	Condition of...	✓		
Area Immediately around well pad	Record any evidence of/or standing water in area of well	✓		
Dedicated sampling equipment	Condition of...	—	—	NA
PVC Riser	Condition of riser & survey reference point	✓		NO OUTER CASE PVC ONLY

Comments: WL = 21.84
BTM = 32.7

Signature(s) [illegible]

Note: S= Satisfactory, U= Unsatisfactory
Check one, if unsatisfactory explain

NSWC Crane
Field Form
Revision: 2
November, 2000

MONITORING WELL INSPECTION SHEET

NSWC Crane MGBG

JOB 3959

Well ID: 01 - 20

Time: 1420 **Date:** 7-14-01 **Inspector's Name:** SIMPSON / ROJAHN

Inspection Item	Types of Problems	Status		Observation
		S	U	
Well Tag	Is it in-place, legible	✓		PAINTED ON PVC
Well security	Condition protective case, cap, lock	✓		
Well pad	Concrete or gravel & condition	✓		SMALL CONCRETE
Well seal	Condition of...	✓		
Area Immediately around well pad	Record any evidence of/or standing water in area of well	✓		
Dedicated sampling equipment	Condition of...	—		NA
PVC Riser	Condition of riser & survey reference point	✓		NO OUTER CASE PVC ONLY

Comments: WL = 26.77

BTM = 34.3

Signature(s) [illegible]

Note: S= Satisfactory, U= Unsatisfactory
Check one, if unsatisfactory explain

NSWC Crane
Field Form
Revision: 2
November, 2000

MONITORING WELL INSPECTION SHEET

NSWC Crane MGBG

JOB#3959

Well ID: 01-21

Time: 1434 **Date:** 7.14-01 **Inspector's Name:** SIMPSON/ROJAHN

Inspection Item	Types of Problems	Status		Observation
		S	U	
Well Tag	Is it in-place, legible	✓		PAINTED ON PVC
Well security	Condition protective case, cap, lock	✓		
Well pad	Concrete or ~~gravel~~ & condition	✓		SMALL CONCRETE, LOOSE
Well seal	Condition of...	✓		
Area Immediately around well pad	Record any evidence of/or standing water in area of well	✓		
Dedicated sampling equipment	Condition of...	—		NA
PVC Riser	Condition of riser & survey reference point	✓		NO OUTER CASE, PVC ONLY

Comments: WL = 15.78
BTM = 41.0

Signature(s) [illegible]

Note: S= Satisfactory, U= Unsatisfactory
Check one, if unsatisfactory explain

NSWC Crane
Field Form
Revision: 2
November, 2000

MONITORING WELL INSPECTION SHEET

NSWC Crane MGBG
JOB#3959

Well ID: 01-22

Time: 1405 **Date:** 7.14.01 **Inspector's Name:** SIMPSON/ROJAHN

Inspection Item	Types of Problems	Status		Observation
		S	U	
Well Tag	Is it in-place, legible	✓		PAINTED ON PVC
Well security	Condition protective case, cap, lock	✓		
Well pad	Concrete ~~or gravel~~ & condition	✓		SMALL CONCRETE
Well seal	Condition of...	✓		
Area Immediately around well pad	Record any evidence of/or standing water in area of well	✓		
Dedicated sampling equipment	Condition of...	—	—	NA
PVC Riser	Condition of riser & survey reference point	✓		NO OUTER CASE, PVC ONLY

Comments: WL = 19.22
BTM = 37.2

Signature(s) [illegible]

Note. S= Satisfactory, U= Unsatisfactory
Check one, if unsatisfactory explain

NSWC Crane
Field Form
Revision: 2
November, 2000

MONITORING WELL INSPECTION SHEET

NSWC Crane MGBG

JOB # 3959

Well ID: 01-23

Time: 1413 **Date:** 7.14.01 **Inspector's Name:** SIMPSON/ROJAHN

Inspection Item	Types of Problems	Status S	Status U	Observation
Well Tag	Is it in-place, legible	✓		PAINTED ON PVC
Well security	Condition protective case, cap, lock	✓		
Well pad	Concrete or ~~gravel &~~ condition	✓		SMALL CONCRETE
Well seal	Condition of...	?		
Area Immediately around well pad	Record any evidence of/or standing water in area of well		✓	LARGE ~~[illegible]~~ HOLE, ON DOWN SIDE OF SLOPE 4' EAST OF WELL
Dedicated sampling equipment	Condition of...	—	NA	RUN OFF WOULD DRAIN INTO HOLE
PVC Riser	Condition of riser & survey reference point	✓		NO OUTER CASE PVC ONLY

Comments: WL = 39.36

BTM = 49.0

Signature(s) [illegible]

Note: S= Satisfactory, U= Unsatisfactory
Check one, if unsatisfactory explain

NSWC Crane
Field Form
Revision: 2
November, 2000

MONITORING WELL INSPECTION SHEET

NSWC Crane MGBG
JOB #3959

Well ID: 01-24

Time: 1429 **Date:** 7.14.01 **Inspector's Name:** SIMPSON/ROJAHN

Inspection Item	Types of Problems	Status S	Status U	Observation
Well Tag	Is it in-place, legible	✓		PAINTED ON PVC
Well security	Condition protective case, cap, lock	✓		
Well pad	Concrete or ~~gravel~~ & condition	✓		SMALL CONCRETE
Well seal	Condition of...	✓		
Area Immediately around well pad	Record any evidence of/or standing water in area of well	✓		
Dedicated sampling equipment	Condition of...	—		NA
PVC Riser	Condition of riser & survey reference point	✓		NO OUTER CASE, PVC ONLY

Comments: WL = 12.02
BTM = 33.25

Signature(s) [illegible]

Note. S= Satisfactory, U= Unsatisfactory
Check one, if unsatisfactory explain

NSWC Crane
Field Form
Revision: 2
November, 2000

MONITORING WELL INSPECTION SHEET

NSWC Crane. MGBG

JOB#3959

Well ID: 01-25

Time: 1407 Date: 7-14-01 Inspector's Name: SIMPSON/ROJAHN

Inspection Item	Types of Problems	Status		Observation
		S	U	
Well Tag	Is it in-place, legible	✓		PAINTED ON RISER PVC
Well security	Condition protective case, cap, lock	✓		
Well pad	Concrete or ~~gravel &~~ condition	✓		SMALL CONCRETE
Well seal	Condition of…	✓		
Area Immediately around well pad	Record any evidence of/or standing water in area of well	✓		
Dedicated sampling equipment	Condition of…	—		NA
PVC Riser	Condition of riser & survey reference point	✓		NO OUTER CASE, PVC ONLY

Comments: WL = 22.10

BTM = 33.2

Signature(s) [illegible]

Note. S= Satisfactory, U= Unsatisfactory
Check one, if unsatisfactory explain

NSWC Crane
Field Form
Revision. 2
November, 2000

MONITORING WELL INSPECTION SHEET

NSWC Crane MGBG

JOB # 3959

Well ID: 01-26

Time: 1704 **Date:** 7.14.01 **Inspector's Name:** SIMPSON/ROJAHN

Inspection Item	Types of Problems	Status S	Status U	Observation
Well Tag	Is it in-place, legible		✓	WE MARKED THE ID ON STICK-UP
Well security	Condition protective case, cap, lock	✓		
Well pad	Concrete or ~~gravel &~~ condition	✓		
Well seal	Condition of...	✓		
Area Immediately around well pad	Record any evidence of/or standing water in area of well	✓		
Dedicated sampling equipment	Condition of...		—	NA
PVC Riser	Condition of riser & survey reference point	✓		

Comments: WL = 36.32

BTM = 55.5

Signature(s) [illegible]

Note. S= Satisfactory, U= Unsatisfactory
Check one, if unsatisfactory explain

NSWC Crane
Field Form
Revision: 2
November, 2000

MONITORING WELL INSPECTION SHEET

NSWC Crane MGBG

JOB# 3959

Well ID: 01-27

Time: 1658 **Date:** 7.14.01 **Inspector's Name:** SIMPSON/ROJAHN

Inspection Item	Types of Problems	Status		Observation
		S	U	
Well Tag	Is it in-place, legible	✓		PAINTED ON PVC
Well security	Condition protective case, cap, lock	✓		NO OUTER CASE PVC ONLY
Well pad	Concrete or ~~gravel~~ & condition	✓		LOOSE, BROKEN
Well seal	Condition of...	✓		
Area Immediately around well pad	Record any evidence of/or standing water in area of well	✓		
Dedicated sampling equipment	Condition of...	—	—	NA
PVC Riser	Condition of riser & survey reference point	✓		

Comments: WL = 25.39

BTM = 43.5

Signature(s) [illegible]

Note: S= Satisfactory, U= Unsatisfactory
Check one, if unsatisfactory explain

NSWC Crane
Field Form
Revision: 2
November, 2000

MONITORING WELL INSPECTION SHEET

NSWC Crane MGBG

JOB #3959

Well ID: 01C01

Time: 1648

Date: 7.14.01

Inspector's Name: SIMPSON/ROJAHN

Inspection Item	Types of Problems	Status		Observation
		S	U	
Well Tag	Is it in-place, legible	✓		
Well security	Condition protective case, cap, lock	✓		
Well pad	Concrete or ~~gravel~~ & condition	✓		SMALL CONCRETE
Well seal	Condition of...	✓		
Area Immediately around well pad	Record any evidence of/or standing water in area of well	✓		
Dedicated sampling equipment	Condition of...	—	—	NA
PVC Riser	Condition of riser & survey reference point	✓		

Comments: WL >>100' WILL CHECK 7.15.01 - 139.02' 7.15.01 @ 0820

BTM = 165'

DEEP WELL

Signature(s) [illegible]

Note: S= Satisfactory, U= Unsatisfactory
Check one, if unsatisfactory explain

NSWC Crane
Field Form
Revision: 2
November, 2000

APPENDIX B-2

MONITORING WELL DEVELOPMENT RECORDS

EXISTING

MONITORING WELL DEVELOPMENT RECORD

Well: WES-1-1-81
Site: MGBG
Date Installed: NA
Date: 08-12-01
Dev. Method: Surged & Pumped
Pump Type: WHALE

Depth to Bottom (ft.): 51.0
Static Water Level Before (ft.): 28.88
Static Water Level After (ft.): 44.84
Screen Length (ft.): ~10
One Well Vol: 3.6 gal
Casing ID (in.): 2 inch, PVC

Personnel: KM/TR
Drilling Co.: —
Project Name: NSWC Crane
Project Numb: 3959

FINISH CLEAN-UP 1610 HRS

Time	Cumulative Water Volume (Gal)	Water Level Readings (Ft below TOC)	Temperature (Degrees C)	pH	Specific Conductance (Units mS/cm)	Turbidity (NTU)	Remarks (odor, color, etc.)
1535	0	28.88	—	—	—	—	Start SURGE
1540	0	28.88	—	—	—	—	Start PURGE
1545	8 gal	37.10	14.69	4.08	0.961	>1000	BRN
1550	14 gal	44.76	14.06	2.26	0.986	>1000	ORANGISH BRN
1552	15 gal	42.51	—	—	—	310	Yellow BRN
1553	16 gal	—	—	—	—	140	Lt Yellow BRN
1555	18 gal	47.28	13.85	6.00*	0.947	95	Lt Yellow BRN
1600	22 gal	44.84	13.92	6.00*	0.953	33	V. Lt Yellow BRN
							PID Readings BH 0.0 PPM
							BZ 0.0 PPM

* pH paper

MW location and ID were confirmed using figures, boring logs and 1999 MW Inventory YES ✓ NO ____

Good Producer

Note: Well was installed as part of a previous RFI and is being redeveloped at this time

EXISTING

MONITORING WELL DEVELOPMENT RECORD

Well: WES-1-2-81
Site: MGBG
Date Installed: NA
Date: 8/13/01
Dev. Method: Surged & Pumped
Pump Type: WHALE

Depth to Bottom (ft.): 25.8
Static Water Level Before (ft.): 15.17
Static Water Level After (ft.): DRY
Screen Length (ft.): ~9
One Well Vol: 1.7 gal
Casing ID (in.): 2 inch, PVC

Personnel: KM/TR
Drilling Co.: —
Project Name: NSWC Crane
Project Numb 3959

SCREEN 8.24 - 17.6
FINISH CLEAN UP @ 1726 HRS

Time	Cumulative Water Volume (Gal)	Water Level Readings (Ft below TOC)	Temperature (Degrees C)	pH	Specific Conductance (Units mS/cm)	Turbidity (NTU)	Remarks (odor, color, etc.)
1634	0	15.17	—	—	—	—	START SURGE
1639	0	15.17	—	—	—	—	START PURGE
1639	1.5 gal	DRY	—	—	—	—	DRY (DARK BRN)
1644	1.5 gal	18.90	—	—	—	—	RECHARGE
1649	1.5 gal	17.57	—	—	—	—	RECHARGE
1659	1.5 gal	16.22	14.84	4.92	1.227	450	LT BRN
1659	2.25 gal	DRY	—	—	—	—	DRY
1704	2.25	18.70	—	—	—	—	RECHARGE
1709	2.25	18.00	—	—	—	—	RECHARGE
1719	2.25	17.01	14.68	5.81	1.130	75	SL. Cloudy
1719	3.0 gal	DRY	—	—	—	—	DRY
							PID Readings BH 0.0 PPM
							BZ 0.0 PPM

MW location and ID were confirmed using figures, boring logs and 1999 MW Inventory YES ✓ NO ____

Note Well was installed as part of a previous RI and is being redeveloped at this time

EXISTING

MONITORING WELL DEVELOPMENT RECORD

Well: WES-1-3-83
Site: MGBG
Date Installed: NA
Date: 8-12-01
Dev. Method: Surged & Pumped
Pump Type: WHALE

Depth to Bottom (ft.): 21.6
Static Water Level Before (ft.): 12.04
Static Water Level After (ft.): DRY
Screen Length (ft.): ~10
One Well Vol: 1.6gal
Casing ID (in.): 2 inch, PVC

Personnel: KM/TR
Drilling Co.: —
Project Name: NSWC Crane
Project Numb: 3959

FINISH CLEAN-UP @ 1655 Hrs

Time	Cumulative Water Volume (Gal)	Water Level Readings (Ft below TOC)	Temperature (Degrees C)	pH	Specific Conductance (Units mS/cm)	Turbidity (NTU)	Remarks (odor, color, etc.)
1621	0	12.04	—	—	—	—	Start Surge
1625	0	12.04	—	—	—	—	Start Purge (Dark Grey) Sulfur Odor
1626	1.5	DRY	—	—	—	—	DRY
1631	1.5	18.16	—	—	—	—	RECHARGE
1636	1.5	17.97	—	—	—	—	"
1646	1.5	17.35	20.42	6.45	0.280	>1000	" & Restart Pump
1646	1.75	DRY	—	—	—	—	Dark Greyish BRN
							PID Readings BH 1.2 PPM
							BZ 0.0 PPM

MW location and ID were confirmed using figures, boring logs and 1999 MW inventory YES ✓ NO____

Note: Well was installed as part of a previous RFI and is being redeveloped at this time

VERY POOR RECHARGE RATE !!!

EXISTING

MONITORING WELL DEVELOPMENT RECORD

Well: WES-1-4-81
Site: MGBG
Date Installed: NA
Date: 08-12-01
Dev. Method: Surged & Pumped
Pump Type: WHALE

Depth to Bottom (ft.): 34.0
Static Water Level Before (ft.): 19.22
Static Water Level After (ft.): DRY
Screen Length (ft.): ~10
One Well Vol: 2.4 gal
Casing ID (in.): 2 inch, PVC

Personnel: KM/TR
Drilling Co.: —
Project Name: NSWC Crane
Project Numb: 3959

FINISH CLEAN-UP 1806 HRS

Time	Cumulative Water Volume (Gal.)	Water Level Readings (Ft. below TOC)	Temperature (Degrees C)	pH	Specific Conductance (Units mS/cm)	Turbidity (NTU)	Remarks (odor, color, etc.)
1105	0	19.22	—	—	—	—	START SURGE
1110	0	19.22	—	—	—	—	START PUMP (DARK BRN)
1114	6.5 gal	DRY	—	—	—	—	DRY
1119	6.5	27.31	—	—	—	—	RECHARGE
1124	6.5	26.67	—	—	—	—	RECHARGE
1134	6.5	25.90	15.01	5.54	.972	>1000	" & RESTART PUMP (BRN)
1135	7.5	DRY	—	—	—	—	DRY
1140	7.5	29.00	—	—	—	—	RECHARGE
1145	7.5	28.27	—	—	—	—	RECHARGE
1155	8.0	27.32	14.66	6.61	.939	621	" & RESTART PUMP (LIGHT BRN)
1156	8.0	DRY	—	—	—	—	END DEV
							PID Readings BH 0.0 PPM
							BZ 0.0 PPM

MW location and ID were confirmed using figures, boring logs and 1999 MW inventory YES ✓ NO ____

Note Well was installed as part of a previous RFI and is being redeveloped at this time

EXISTING

MONITORING WELL DEVELOPMENT RECORD

Well: WES-1-5-81
Site: MGBG
Date Installed: NA
Date: 8/13/01
Dev. Method: Surged & Pumped
Pump Type: WHALE

Depth to Bottom (ft.): 33.6
Static Water Level Before (ft.): 17.36
Static Water Level After (ft.): DRY
Screen Length (ft.): ~9
One Well Vol: 2.6
Casing ID (in.): 2 inch, PVC

Personnel: KM / TR
Drilling Co.: —
Project Name: NSWC Crane
Project Numb 3959

SCREEN 16.18 - 25.30 @ 1627 Hrs
FINISH CLEAN-UP

Time	Cumulative Water Volume (Gal)	Water Level Readings (Ft below TOC)	Temperature (Degrees C)	pH	Specific Conductance (Units mS/cm)	Turbidity (NTU)	Remarks (odor, color, etc.)
1530	0	17.36	—	—	—	—	START SURGE
1535	0	17.36	—	—	—	—	PURGE BEGIN Greyish BRN
1537	3	DRY	—	—	—	—	DRY
1542	3	27.10	—	—	—	—	RECHARGE
1547	3	25.45	—	—	—	—	RECHARGE
1557	3	23.82	13.90	5.67	2.002	130	Sl Cloudy (Greyish)
1558	4	DRY	—	—	—	—	DRY
1603	4	22.60	—	—	—	—	RECHARGE
1608	4	27.25	—	—	—	—	RECHARGE
1618	4	26.19	13.18	5.08	1.860	110	Sl. Cloudy (Greyish)
1619	4.75	DRY	—	—	—	—	DRY
							PID Readings BH 0.0 PPM
							BZ 0.0 PPM

MW location and ID were confirmed using figures, boring logs and 1999 MW Inventory YES ✓ NO____

Note Well was installed as part of a previous RFI and is being redeveloped at this time

EXISTING

MONITORING WELL DEVELOPMENT RECORD

Well: 01-06
Site: MGBG
Date Installed: NA
Date: 7.15.01
Dev. Method: Surged & Pumped
Pump Type: WATTERIA

Depth to Bottom (ft.): 91.0
Static Water Level Before (ft.): 68.15
Static Water Level After (ft.): 80±
Screen Length (ft.):
One Well Vol:
Casing ID (In.): 2 inch, PVC

Personnel: SIMPSON/ROJAHN
Drilling Co.: —
Project Name: NSWC Crane
Project Number: N3959

NO CHANGE IN BTM.

Time	Cumulative Water Volume (Gal)	Water Level Readings (Ft below TOC)	Temperature (Degrees C)	pH	Specific Conductance (Units mS/cm)	Turbidity (NTU)	Remarks (odor, color, etc.)
1709	2.5	90±	15.1	6.55	2.273	>999	GRAY - SEWER ODOR
1720	9.0	90±	14.5	6.54	1.428	>999	LT. GRAY SEWER ODOR
1735	13.0	80±	13.1	5.87	1.508	>999	
1739	14.0	80±	12.8	5.80	1.584	>999	
1746	20.0	80±	13.1	6.32	1.649	>999	
							PUMPED DRY 5X
							RISER BROKEN, MEASUREMENTS
							FROM BGS
							PID Readings BH 1.6 PPM
							BZ 0 PPM

MW location and ID were confirmed using figures.

Note Well was installed as part of a previous RFI and is being redeveloped at this time

EXISTING

MONITORING WELL DEVELOPMENT RECORD

Well: 01-07
Site: MGBG
Date Installed: NA
Date: 7·14·01
Dev. Method: Surged & Pumped
Pump Type: 12 v. SUB. WHALER

Depth to Bottom (ft.): 20.4
Static Water Level Before (ft.): 13.72
Static Water Level After (ft.): 17.10
Screen Length (ft.):
One Well Vol: 1.1
Casing ID (in.): 2 inch, PVC

Personnel: SIMPSON/ROJAHN
Drilling Co.: —
Project Name: NSWC Crane
Project Number: N3959

BTM AFTER DEVEL. = 22.15' SOLID BTM.

Time	Cumulative Water Volume (Gal)	Water Level Readings (Ft below TOC)	Temperature (Degrees C)	pH	Specific Conductance (Units mS/cm)	Turbidity (NTU)	Remarks (odor, color, etc.)
1435	1.2	13.72	—	—	—	—	SILT IN BTM, HIGH SOLIDS
							NO READINGS
	SURGED & PUMPED NUMEROUS TIMES TO						1600
	THEN POURED A NEW PAD.						
	PUMPED VERY THICK MUD/WATER ≈ 5.5						GAL.
1725	9	GAL.	REMOVED	TOTAL			START PUMP. WL=16.13
1812	9	16.03	—	—	—	—	PUMP 1.5 GAL. CLEARING
1814	10.2	19.5	13.0	6.75	0.597	120	DRY
1822	10.4	17.10	13.1	6.17	0.582	850	DRY END DEVELOPMENT
		10.4 TOTAL REMOVED					
		KS ~~PORE~~	POOR RECOVERY				NEW RISER (2.5') ALL READINGS
							FROM GROUND SURFACE
							PID Readings BH 0.3 PPM
							BZ 0 PPM

MW location and ID were confirmed using figures.

Note. Well was installed as part of a previous RFI and is being redeveloped at this time

EXISTING

MONITORING WELL DEVELOPMENT RECORD

Well: 01 - 08
Site: MGBG
Date Installed: NA
Date: 7.16.01
Dev. Method: Surged & Pumped
Pump Type: 12V. SUB. WHALER

Depth to Bottom (ft.): 31.2
Static Water Level Before (ft.): 15.17
Static Water Level After (ft.): 15.82
Screen Length (ft.): 9'
One Well Vol: 2.6
Casing ID (in.): 2 inch, PVC

Personnel: SIMPSON/ROJAHN
Drilling Co.: —
Project Name: NSWC Crane
Project Number: N3959

PUMP RATE ≈ 1.5 GPM

Time	Cumulative Water Volume (Gal.)	Water Level Readings (Ft below TOC)	Temperature (Degrees C)	pH	Specific Conductance (Units mS/cm)	Turbidity (NTU)	Remarks (odor, color, etc.)
1618	0	15.17					START, BRN, NO ODOR
1619	1.0	~~18.01~~	14.6	6.40	0.591	>999	
1622	4.5	15.49	12.5	5.48	0.446	450	
1627	10.0	15.60	12.1	4.97	0.377	200	
1632	16.0	15.60	12.3	5.04	0.370	95	
1635	22.0	15.67	12.3	4.72	0.360	40	
1639	24.0	15.73	12.1	5.06	0.358	32	
1642	30.0	15.78	12.1	5.10	0.355	22	
1645	32.0	15.82	12.1	5.12	0.352	16	END
							1ST GOOD PRODUCER
							PID Readings BH 900 PPM
							BZ 0 PPM

MW location and ID were confirmed using figures.

Note: Well was installed as part of a previous RFI and is being redeveloped at this time.

EXISTING

MONITORING WELL DEVELOPMENT RECORD

Well: 01-09
Site: MGBG
Date Installed: NA
Date: 7-16-01
Dev. Method: Surged & Pumped
Pump Type: 12V. SUB. WHALEN

Depth to Bottom (ft.): 34.5
Static Water Level Before (ft.): 18.30
Static Water Level After (ft.): 32.0
Screen Length (ft.): 9
One Well Vol: 2.6
Casing ID (in.): 2 inch, PVC

Personnel: SIMPSON/ROJAHN
Drilling Co.: —
Project Name: NSWC Crane
Project Number: N3959

Time	Cumulative Water Volume (Gal)	Water Level Readings (Ft below TOC)	Temperature (Degrees C)	pH	Specific Conductance (Units mS/cm)	Turbidity (NTU)	Remarks (odor, color, etc.)
1710	0	18.30	—	—	—	—	START, DARK BRN/GRAY
1711	2.0	20.50	14.4	6.42	0.432	>999	SEWER ODOR
1714	4.5	21.70	12.6	5.90	0.292	>999	
1718	9.5	29.0	12.6	5.73	0.419	>999	DRY @ 1719; 10 GAL
1741	9.5	28.0	—	—	—	—	RESTART
1742	10.0	29.0	13.0	6.38	0.420	>999	DRY @ 1743 10.0 GAL
1800	10.0	29.25	—	—	—	—	RESTART
1801	10.5	32.00	13.7	6.69	0.407	>999	DRY @ 1802 10.5 GAL
							PUMPED DRY 3X
							PID Readings BH 70 PPM
							BZ 0 PPM

MW location and ID were confirmed using figures,

Note. Well was installed as part of a previous RFI and is being redeveloped at this time

EXISTING

MONITORING WELL DEVELOPMENT RECORD

Well: iWES-1-10-82
Site: MGBG
Date Installed: NA
Date: 8/12/01
Dev. Method: Surged & Pumped
Pump Type: WHALE

Depth to Bottom (ft.): 43.0
Static Water Level Before (ft.): 25.73
Static Water Level After (ft.): DRY
Screen Length (ft.): ~10
One Well Vol: 2.8 gal
Casing ID (in.): 2 inch, PVC

Personnel: KM/JR
Drilling Co.: —
Project Name: NSWC Crane
Project Numb: 3959

FINISH CLEAN UP @ 1523 HRS

Time	Cumulative Water Volume (Gal)	Water Level Readings (Ft below TOC)	Temperature (Degrees C)	pH	Specific Conductance (Units mS/cm)	Turbidity (NTU)	Remarks (odor, color, etc.)
1443	0	25.73	—	—	—	—	Start SURGE
1449	0	25.73	—	—	—	—	Start PURGE
1451	3 gal	—	14.71	6.77	0.570	>1000	— (Orange BRN)
1453	7	34.68	—	—	—	—	—
1454	8	38.25	13.01	6.05	0.617	>1000	— (Lt BRN)
1455	9	DRY	—	—	—	—	DRY
1500	9	38.63	—	—	—	—	RECHARGE
1505	9	38.20	—	—	—	—	RECHARGE
1515	9	37.43	14.00	5.88	0.606	>1000	RECHARGE & Restart PURGE
1515	9.5	DRY	—	—	—	—	DRY (Lt BRN)
							PID Readings BH 1.1 PPM
							BZ 0.0 PPM

MW location and ID were confirmed using figures, boring logs and 1999 MW inventory YES ✓ NO ____

POOR RECHARGE

Note Well was installed as part of a previous RFI and is being redeveloped at this time

EXISTING

MONITORING WELL DEVELOPMENT RECORD

Well: WES-1-11-82
Site: MGBG
Date Installed: NA
Date: 08-12-01
Dev. Method: Surged & Pumped
Pump Type: WHALE

Depth to Bottom (ft.): 22.6
Static Water Level Before (ft.): 10.89
Static Water Level After (ft.): DRY
Screen Length (ft.): ~10
One Well Vol: 1.9 gal
Casing ID (in.): 2 inch, PVC

Personnel: KM/TR
Drilling Co.: —
Project Name: NSWC Crane
Project Numb: 3959

FINISH CLEAN UP 0939 HRS

Time	Cumulative Water Volume (Gal)	Water Level Readings (Ft. below TOC)	Temperature (Degrees C)	pH	Specific Conductance (Units mS/cm)	Turbidity (NTU)	Remarks (odor, color, etc.)
0840	0	10.89	—	—	—	—	Start SURGE
0849	0	10.89	—	—	—	—	start PUMP (BRN)
0853	4.5 gal	DRY	—	—	—	—	DRY HEAVY SEDI.
0858	4.5	18.35	—	—	—	—	RECHARGE
0903	4.5	18.00	—	—	—	—	RECHARGE
0913	4.5	17.38	15.11	7.40	0.426	>1000	" & Start Pump (BRN)
0915	6.0	DRY	—	—	—	—	DRY
0920	6.0	18.74	—	—	—	—	RECHARGE
0925	6.0	18.38	—	—	—	—	RECHARGE
0930	6.0	18.11	14.50	6.72	0.407	>1000	" & Restart Pump (Lt BRN)
0931	6.5	DRY	—	—	—	—	DRY
							PID Readings BH 0.0 PPM
							BZ 0.0 PPM

MW location and ID were confirmed using figures, boring logs and 1999 MW Inventory YES ✓ NO____

Note Well was installed as part of a previous RFI and is being redeveloped at this time

EXISTING

MONITORING WELL DEVELOPMENT RECORD

Well: WES-1-12-83
Site: MGBG
Date Installed: NA
Date: 08-12-01
Dev. Method: Surged & Pumped
Pump Type: WHALE

Depth to Bottom (ft.): 41.0
Static Water Level Before (ft.): 25.35
Static Water Level After (ft.): DRY
Screen Length (ft.): ~10
One Well Vol: 2.6
Casing ID (in.): 2 inch, PVC

Personnel: KM/TR
Drilling Co.: —
Project Name: NSWC Crane
Project Numb: 3959

FINISH CLEAN-UP 1435 Hrs

Time	Cumulative Water Volume (Gal)	Water Level Readings (Ft. below TOC)	Temperature (Degrees C)	pH	Specific Conductance (Units mS/cm)	Turbidity (NTU)	Remarks (odor, color, etc.)
1330	0	25.35	—	—	—	—	start surge
1336	0	25.35	—	—	—	—	start purge (DARK BRN)
1341	7.5 gal	DRY	—	—	—	—	DRY
1346	7.5 gal	35.82	—	—	—	—	RECHARGE
1351	7.5 gal	34.96	—	—	—	—	RECHARGE
1401	7.5 gal	33.71	13.35	6.92	0.604	>1000	" & Restart Pump
1404	9.5 gal	DRY	—	—	—	—	DRY (Greyish BRN)
1409	9.5 gal	35.50	—	—	—	—	RECHARGE
1414	9.5 gal	35.15	—	—	—	—	RECHARGE
1424	9.5 gal	34.48	12.74	5.99	0.594	160	" Restart Purge
1425	11 gal	DRY	—	—	—	—	DRY
							PID Readings BH 2.3 PPM
							BZ 0.0 PPM

MW location and ID were confirmed using figures, boring logs and 1999 MW Inventory YES ✓ NO____

Note Well was installed as part of a previous [illegible] and is being redeveloped at this time

EXISTING

MONITORING WELL DEVELOPMENT RECORD

Well: WES-1-13-83
Site: MGBG
Date Installed: NA
Date: 08-12-01
Dev. Method: Surged & Pumped
Pump Type: WHALE

Depth to Bottom (ft.): ~~38.0~~ 39.0
Static Water Level Before (ft.): 24.25
Static Water Level After (ft.): 27.44
Screen Length (ft.): ~10
One Well Vol: 2.49 gal
Casing ID (in.): 2 inch, PVC

Personnel: KM/TR
Drilling Co.: —
Project Name: NSWC Crane
Project Numb: 3959

FINISH CLEAN-UP 1310 HRS

Time	Cumulative Water Volume (Gal)	Water Level Readings (Ft below TOC)	Temperature (Degrees C)	pH	Specific Conductance (Units mS/cm)	Turbidity (NTU)	Remarks (odor, color, etc.)
1230	0	24.25	—	—	—	—	START SURGE
1240	0	24.25	—	—	—	—	Start PUMP (DARK BRN)
1245	7 gal	26.94	13.24	5.82	0.475	>1000	(BRN)
1250	15	26.92	12.83	5.41	0.356	280	(Lt. BRN)
1300	30	27.44	12.70	4.83	0.308	60	END DEV. (12.5 VOL. REMOVED) CLEAR
							PID Readings BH 0.0 PPM
							BZ 0.0 PPM

MW location and ID were confirmed using figures, boring logs and 1999 MW Inventory YES ✓ NO____

GREAT PRODUCER !!!

Note Well was installed as part of a previous RFI and is being redeveloped at this time.

EXISTING

MONITORING WELL DEVELOPMENT RECORD

Well: WES-1-14-83
Site: MGBG
Date Installed: NA
Date: 08-12-01
Dev. Method: Surged & Pumped
Pump Type: WHALE

Depth to Bottom (ft.): 39.0
Static Water Level Before (ft.): 16.23
Static Water Level After (ft.): DRY
Screen Length (ft.): ~10
One Well Vol: 3.7 gal
Casing ID (in.): 2 inch, PVC

Personnel: KM/TR
Drilling Co.: —
Project Name: NSWC Crane
Project Numb 3959

FINISH CLEAN-UP 1055 HRS

Time	Cumulative Water Volume (Gal.)	Water Level Readings (Ft below TOC)	Temperature (Degrees C)	pH	Specific Conductance (Units mS/cm)	Turbidity (NTU)	Remarks (odor, color, etc.)
0951	0 GAL.	16.23	—	—	—	—	Start SURGE
0956	0	16.23	—	—	—	—	Start PUMP (~~DARK~~ Grey)
1003	7	DRY	—	—	—	—	DRY
1008	7	35.29	—	—	—	—	RECHARGE
1013	7	33.52	—	—	—	—	RECHARGE
1023	7	33.35	14.50	6.43	1.286	>1000	Start PUMP (GREY)
1024	8	DRY	—	—	—	—	DRY
1029	8	35.85	—	—	—	—	RECHARGE
1034	8	35.36	—	—	—	—	RECHARGE
1044	8	34.29	18.95	6.10	1.278	>1000	Restart PUMP
1044	8.5	DRY	—	—	—	—	END DEV
							PID Readings BH 0.0 PPM
							BZ 0.0 PPM

MW location and ID were confirmed using figures, boring logs and 1999 MW Inventory YES ✓ NO____

Note Well was installed as part of a previous RI and is being redeveloped at this time

EXISTING

MONITORING WELL DEVELOPMENT RECORD

Well: 01 - 15
Site: MGBG
Date Installed: NA
Date: 7·16·01
Dev. Method: Surged & Pumped
Pump Type: WHALER 12V SUB.

Depth to Bottom (ft.): 39.1 *
Static Water Level Before (ft.): 25.65*
Static Water Level After (ft.): 36
Screen Length (ft.): 9'
One Well Vol: 2.19
Casing ID (in.): 2 inch, PVC

Personnel: SIMPSON/ROJAHN
Drilling Co.: —
Project Name: NSWC Crane
Project Number: N3959

Time	Cumulative Water Volume (Gal)	Water Level Readings (Ft below TOC)	Temperature (Degrees C)	pH	Specific Conductance (Units ~~ms/cm~~)	Turbidity (NTU)	Remarks (odor, color, etc.)
							BLACK (INK) @ START
0918	4.0	38±	13.4	6.36	1.279	950	DRY @ 0918 - SEWER ODOR
0942	4.2	29±	14.0	6.03	1.459	280	CLEARING - STOPPED TO RESET PUMP
0945	4.6	30±	13.1	5.85	1.555	900	
0946	5.5	29±36	—	—	—	—	DRY
1006	5.5	32.75	—	—	—	—	RESTART
1009	6.5	~~29~~36±	14.5	6.10	1.562	900	DRY
		6.5	GAL REMOVED				PUMPED DRY 4 X
							*RISER BROKEN, MEASUREMENTS
							FROM BGS
							PID Readings BH 0 PPM
							BZ 0 PPM

MW location and ID were confirmed using figures.

Note: Well was installed as part of a previous RFI and is being redeveloped at this time

EXISTING

MONITORING WELL DEVELOPMENT RECORD

Well: WES-1-16-83
Site: MGBG
Date Installed: NA
Date: 8/13/01
Dev. Method: Surged & Pumped
Pump Type: WHALE

Depth to Bottom (ft.): 41.5
Static Water Level Before (ft.): 36.03
Static Water Level After (ft.): DRY
Screen Length (ft.): ~10
One Well Vol: 0.9 gal
Casing ID (In.): 2 inch, PVC

Personnel: KM/TR
Drilling Co.: —
Project Name: NSWC Crane
Project Numb 3959
SCREEN 23.75 - 33.00
FINISH CLEAN-UP @ 1505 HRS

Time	Cumulative Water Volume (Gal)	Water Level Readings (Ft. below TOC)	Temperature (Degrees C)	pH	Specific Conductance (Units mS/cm)	Turbidity (NTU)	Remarks (odor, color, etc.)
1440	0	36.03	—	—	—	—	START SURGE
1446	0	36.03	—	—	—	—	DARK GREY
1446	0.5	DRY →	PURGED	WATER	OUT OF	SUMP ~	0.5 GAL.
			H_2O LEVEL	3'	BELOW	BOTTOM OF	SCREEN ZERO RECHARGE !!!
							PID Readings BH 1.1 PPM
							BZ 0.0 PPM

MW location and ID were confirmed using figures, boring logs and 1999 MW Inventory YES ✓ NO ____

Note: Well was installed as part of a previous RI and is being redeveloped at this time

EXISTING

MONITORING WELL DEVELOPMENT RECORD

Well: WES-1-17-83
Site: MGBG
Date Installed: NA
Date: 8/13/01
Dev. Method: Surged & Pumped
Pump Type: WHALE

Depth to Bottom (ft.): 41.0
Static Water Level Before (ft.): 21.61
Static Water Level After (ft.): 29.90
Screen Length (ft.): ~10
One Well Vol: 3.2
Casing ID (in.): 2 inch, PVC

Personnel: KM/TR
Drilling Co.: —
Project Name: NSWC Crane
Project Numb 3959
SCREEN 23.25 – 32.55
FINISH CLEAN-UP @ 1134 Hrs

Time	Cumulative Water Volume (Gal)	Water Level Readings (Ft below TOC)	Temperature (Degrees C)	pH	Specific Conductance (Units mS/cm)	Turbidity (NTU)	Remarks (odor, color, etc.)
1052	0	21.61	—	—	—	—	START SURGE
1104	0	21.61	—	—	—	—	START PURGE
1109	4	29.27	15.18	2.37	0.872	>1000	BRN
1114	17	29.41	13.79	*6.00	0.767	>1000	BRN
1119	25	29.79	13.54	*6.00	0.747	65	CLEAR
1122	30	29.90	—	—	—	45	CLEAR
							PID Readings BH 0.4 PPM
							BZ 0.0 PPM

MW location and ID were confirmed using figures, boring logs and 1999 MW Inventory YES ✓ NO ____

Note Well was installed as part of a previous RFI and is being redeveloped at this time

1999!
GREAT Producer!!!

EXISTING

MONITORING WELL DEVELOPMENT RECORD

Well: WES 1-18-83
Site: MGBG
Date Installed: NA
Date: 8-11-01
Dev. Method: Surged & Pumped
Pump Type: WHALE

Depth to Bottom (ft.): 32.0
Static Water Level Before (ft.): 15.07
Static Water Level After (ft.): DRY
Screen Length (ft.): 10
One Well Vol: 2.8 gal
Casing ID (in.): 2 Inch, PVC

Personnel: T. ROJAHN
Drilling Co.: —
Project Name: NSWC Crane
Project Numb: 3959

1140 Hrs FINISH CLEAN UP

Time	Cumulative Water Volume (Gal)	Water Level Readings (Ft below TOC)	Temperature (Degrees C)	pH	Specific Conductance (Units mS/cm)	Turbidity (NTU)	Remarks (odor, color, etc.)
1014	0	15.07	—	—	—	—	START SURGE
1021	0	15.07	—	—	—	—	START PUMP 5 LPM (BRN)
1028	8 gal	DRY	—	—	—	—	DRY (8 GAL MEAS.)
1033	8	27.48	—	—	—	—	RECHARGE
1038	8	27.00	—	—	—	—	"
1048	8	26.34	—	—	—	—	"
1049	8	26.34	14.62	4.94	0.824	71100	RESTART PUMP (LT. BRN)
1052	10	DRY	—	—	—	—	STOP PUMP
1112	10	27.20	14.74	2.87	0.742	360	RESTART PUMP
1113	11	DRY					END DEV.
							PID Readings BH 0.0 PPM
							BZ 0.0 PPM

MW location and ID were confirmed using figures, boring logs and 1999 MW Inventory YES ✓ NO ____

Note: Well was installed as part of a previous RFI and is being redeveloped at this time

EXISTING

MONITORING WELL DEVELOPMENT RECORD

Well: 01-19
Site: MGBG
Date Installed: NA
Date: 7.16.01
Dev. Method: Surged & Pumped
Pump Type: 12 V. SUB. WHALER

Depth to Bottom (ft.): 32.7
Static Water Level Before (ft.): 21.83
Static Water Level After (ft.): 30
Screen Length (ft.): 9'
One Well Vol: 1.8
Casing ID (in.): 2 inch, PVC

Personnel: SIMPSON/ROJAHN
Drilling Co.: —
Project Name: NSWC Crane
Project Number: N3959

Time	Cumulative Water Volume (Gal)	Water Level Readings (Ft below TOC)	Temperature (Degrees C)	pH	Specific Conductance (Units ~~mS/cm~~)	Turbidity (NTU)	Remarks (odor, color, etc.)
1035	0	21.8	—	—	—	—	START, TAN, SLIGHT SEWER ODOR
1036	1	25.0	16.5	5.92	1.209	>999	
1039	4	30±	—	—	—	—	DRY
1100	4	27.0	~~15.9~~	—	—	—	RESTART
1101	4.5	30±	15.9	6.02	1.501	850	DRY
1120	4.5	28.15	—	—	—	—	RESTART
1121	5.0	30±	15.6	5.81	1.192	500	DRY
		5.0	GAL. TOTAL REMOVED				PUMP DRY 3X
							PID Readings BH 11.6 PPM
							BZ 0 PPM

MW location and ID were confirmed using figures.

Note. Well was installed as part of a previous RFI and is being redeveloped at this time.

EXISTING

MONITORING WELL DEVELOPMENT RECORD

340 CHECKED

Well: WES-1-20-83
Site: MGBG
Date Installed: NA
Date: 8/13/01
Dev. Method: Surged & Pumped
Pump Type: WHALE

Depth to Bottom (ft.): ~~39.1~~
Static Water Level Before (ft.): 27.62
Static Water Level After (ft.): DRY
Screen Length (ft.): ~10
One Well Vol: 1 gal
Casing ID (in.): 2 inch, PVC

Personnel: KM / TR
Drilling Co.: —
Project Name: NSWC Crane
Project Numb: 3959
SCREEN 21.35 - 30.69
FINISH CLEAN-UP @ 1300 Hrs

Time	Cumulative Water Volume (Gal)	Water Level Readings (Ft below TOC)	Temperature (Degrees C)	pH	Specific Conductance (Units mS/cm)	Turbidity (NTU)	Remarks (odor, color, etc.)
1148	0	27.62	—	—	—	—	START SURGE
1155	0	27.62	—	—	—	—	START PURGE
1156	1	DRY	—	—	—	—	DARK GREY
1201	1	30.36	—	—	—	—	RECHARGE
1206	1	29.82	—	—	—	—	RECHARGE
1216	1	28.38	15.64	5.47	1.828	170	RECHARGE + START PUMP (clear)
1216	1.5	DRY	—	—	—	—	DRY
1221	1.5	30.51	—	—	—	—	RECHARGE
1224	1.5	29.93	—	—	—	—	RECHARGE
1236	1.5	28.64	15.19	5.59	1.739	80	RECHARGE + START PUMP (clear)
1236	2.0	DRY	—	—	—	—	DRY
1251	2.0	29.42	15.84	5.68	1.730	27	RECHARGE + START PUMP (clear)
1251	2.25	DRY	—	—	—	—	DRY (END DEV)
							PID Readings BH 0.0 PPM
							BZ 0.0 PPM

MW location and ID were confirmed using figures, boring logs and 1999 MW Inventory YES ✓ NO ____

Note Well was installed as part of a previous RFI and is being redeveloped at this time

EXISTING

MONITORING WELL DEVELOPMENT RECORD

Well: 01-21
Site: MGBG
Date Installed: NA
Date: 7·16·01
Dev. Method: Surged & Pumped
Pump Type: _____

Depth to Bottom (ft.): 41.0
Static Water Level Before (ft.): 17.17
Static Water Level After (ft.): 38.0
Screen Length (ft.): 9'
One Well Vol: 3.9
Casing ID (in.): 2 inch, PVC

Personnel: SIMPSON/ROJAHN
Drilling Co.: —
Project Name: NSWC Crane
Project Number: N3959

Time	Cumulative Water Volume (Gal.)	Water Level Readings (Ft below TOC)	Temperature (Degrees C)	pH	Specific Conductance (Units mS/cm)	Turbidity (NTU)	Remarks (odor, color, etc.)
1329	0	17.17	15.5	6.61	0.903	>999	START, BLACK, SLIGHT SEWER ODOR
1331	3.5	27.00	13.9	6.27	0.520	>999	BRN. + CHEM. SMELL
1336	8.0	32.00	13.5	6.06	0.908	>999	"
1340	10.5	40±	—	—	—	—	DRY
1400	10.5	30.01	—	—	—	—	RESTART
1402	12.0	34.21	12.9	4.95	0.886	550	
1403	13.0	40±	12.4	4.99	0.886	>999	DRY
1422	13.0	30.60	—	—	—	—	START
1423	14.0	33.22	13.0	5.40	0.895	170	
1426	17.0	38.0	—	—	—	—	DRY
							PUMPED DRY 3 X
							PID Readings BH 80 PPM
							BZ 0 PPM

MW location and ID were confirmed using figures.

Note Well was installed as part of a previous RFI and is being redeveloped at this time

EXISTING

MONITORING WELL DEVELOPMENT RECORD

Well: WES-1-22-83
Site: MGBG
Date Installed: NA
Date: 8-13-01
Dev. Method: Surged & Pumped
Pump Type: WHALE

Depth to Bottom (ft.): 38.0
Static Water Level Before (ft.): 19.29
Static Water Level After (ft.): DRY
Screen Length (ft.): ~9
One Well Vol: ~ 2.85 gal
Casing ID (in.): 2 inch, PVC

Personnel: KM/TR
Drilling Co.: —
Project Name: NSWC Crane
Project Numb: 3959
SCREEN 20.5 - 29.65
FINISH CLEAN-UP @ 1425 HRS

Time	Cumulative Water Volume (Gal)	Water Level Readings (Ft below TOC)	Temperature (Degrees C)	pH	Specific Conductance (Units mS/cm)	Turbidity (NTU)	Remarks (odor, color, etc.)
1310	0	19.29	—	—	—	—	START SURGE
1325	0	19.29	—	—	—	—	START PUMP (LT BROWN)
1330	8	30.00	14.31	6.27	1.154	>1000	LT BROWN
1332	10	DRY	—	—	—	—	DRY
1336	10	31.47	—	—	—	—	RECHARGE
1341	10	29.98	—	—	—	—	RECHARGE
1351	10	28.38	13.57	6.37	1.035	500	RECHARGE + START PUMP (LT BROWN)
1354	14	DRY	—	—	—	—	DRY
1359	14	31.82	—	—	—	—	RECHARGE
1404	14	30.78	—	—	—	—	RECHARGE
1414	14	28.02	13.86	6.62	1.046	340	RECHARGE + START PUMP
1417	17	DRY	—	—	—	—	DRY END DEV
							PID Readings BH 10.5 PPM
							BZ 0.0 PPM

MW location and ID were confirmed using figures, boring logs and 1999 MW inventory YES ✓ NO____

Note: Well was installed as part of a previous RI and is being redeveloped at this time

EXISTING-

MONITORING WELL DEVELOPMENT RECORD

Well: 01-23
Site: MGBG
Date Installed: NA
Date: 7.15.01
Dev. Method: Surged & Pumped
Pump Type: 12 V SUB. WATER

Depth to Bottom (ft.): 49.0
Static Water Level Before (ft.): 39.36
Static Water Level After (ft.): 45+
Screen Length (ft.): 9
One Well Vol: 1.6 GAL
Casing ID (in.): 2 inch, PVC

Personnel: SIMPSON/ROJAHN
Drilling Co.: —
Project Name: NSWC Crane
Project Number: N3959

NO CHANGE IN BTM. MEASUREMENT

Time	Cumulative Water Volume (Gal)	Water Level Readings (Ft below TOC)	Temperature (Degrees C)	pH	Specific Conductance (Units ~~MS/CM~~)	Turbidity (NTU)	Remarks (odor, color, etc.)
1048	0	39.36	—	—	—	—	START, TAN
1053	3.5	47 ±	15.2	6.33	2.496	230	DRY STOP PUMP
1105	3.5	45+	14.6	6.25	0.412	850	DRY AFTER 800 MLS
1124	4.0	45+	14.2	6.01	2.218	550	RESTART = <.5 GAL DRY
		POOR	PRODUCER,	MAY	BE	TOUGH	TO
		SAMPLE,	RESTRICTION	+	LOW	VOL.	
							OBSTRUCTION @ 13'
							COULD NOT SURGE WITH
							SURGE BLOCK
							PID Readings BH 0 PPM
							BZ 0 PPM

MW location and ID were confirmed using figures.

Note: Well was installed as part of a previous RFI and is being redeveloped at this time

EXISTING

MONITORING WELL DEVELOPMENT RECORD

Well: 01-24
Site: MGBG
Date Installed: NA
Date: 7.16.01
Dev. Method: Surged & Pumped
Pump Type: 12 V SUB. WHALEN

Depth to Bottom (ft.): 33.25
Static Water Level Before (ft.): 14.32
Static Water Level After (ft.): 30
Screen Length (ft.): 10'
One Well Vol: 3.1
Casing ID (in.): 2 inch, PVC

Personnel: SIMPSON/ROJAHN
Drilling Co.: —
Project Name: NSWC Crane
Project Number: N3959

Time	Cumulative Water Volume (Gal)	Water Level Readings (Ft. below TOC)	Temperature (Degrees C)	pH	Specific Conductance (Units mS/cm)	Turbidity (NTU)	Remarks (odor, color, etc.)
1452	0	14.32	—	—	—	>999	DRK. GRAY, SEWER/CHEM. ODOR
1455	3.0	25.00	14.2	6.26	0.436	>999	
1456	4.0	29.00	12.6	5.88	0.413	>999	
1458	6.5	30.16	12.4	5.07	0.448	>999	DRY @ 1459
1520	6.5	25.40	—	—	—	—	RESTART
1522	7.5	27.30	14.1	5.97	0.437	190	CLEARING
1523	8.0	29.5	12.4	5.56	0.406	256	DRY @ 1524
1543	8.0	26.38	—	—	—	—	RESTART
1545	8.5	28.00	13.8	5.51	0.412	95	
1546	9.0	31.00	13.1	5.32	0.412	105	DRY
							PID Readings BH 1800 PPM
							BZ 0 PPM

MW location and ID were confirmed using figures.

Note Well was installed as part of a previous RFI and is being redeveloped at this time.

EXISTING

MONITORING WELL DEVELOPMENT RECORD

Well: WES-1-25-83
Site: MGBG
Date Installed: NA
Date: 8/13/01
Dev. Method: Surged & Pumped
Pump Type: WHALE

Depth to Bottom (ft.): 34.2
Static Water Level Before (ft.): 21.74
Static Water Level After (ft.): DRY
Screen Length (ft.): ~8.4
One Well Vol: 2.0
Casing ID (in.): 2 inch, PVC

Personnel: KM / TR
Drilling Co.: —
Project Name: NSWC Crane
Project Numb: 3959
Screen 17.42 - 25.79
FINISH CLEAN-UP @ 1025 HRS

Time	Cumulative Water Volume (Gal)	Water Level Readings (Ft. below TOC)	Temperature (Degrees C)	pH	Specific Conductance (Units mS/cm)	Turbidity (NTU)	Remarks (odor, color, etc.)
0904	0	21.74	—	—	—	—	START SURGE
0909	0	21.74	—	—	—	—	START PURGE (DARK GREY)
0913	6 gal	DRY	—	—	—	—	DRY
0918	6	27.64	—	—	—	—	RECHARGE
0923	6	26.88	—	—	—	—	RECHARGE
0933	6	25.35	13.60	6.51	1.150	>1000	RESTART PUMP (GREYISH BRN)
0935	8.5	DRY	—	—	—	—	DRY
0940	8.5	28.30	—	—	—	—	RECHARGE
0945	8.5	27.22	—	—	—	—	RECHARGE
0950	8.5	25.98	13.27	6.05	1.144	>1000	RESTART PUMP (GREYISH BRN)
0957	11	DRY	—	—	—	—	DRY
1012	11	26.63	12.88	5.96	1.134	>1000	RESTART PUMP
1014	13	DRY	—	—	—	—	DRY
							PID Readings BH 0.5 PPM
							BZ 0.0 PPM

MW location and ID were confirmed using figures, boring logs and 1999 MW Inventory YES ✓ NO ____

Note Well was installed as part of a previous RFI and is being redeveloped at this time

EXISTING

MONITORING WELL DEVELOPMENT RECORD

Well: WES-1-26-83
Site: MGBG
Date Installed: NA
Date: 8-11-01
Dev. Method: Surged & Pumped
Pump Type: WHALE

Depth to Bottom (ft.): 58.0
Static Water Level Before (ft.): 36.34
Static Water Level After (ft.): DRY
Screen Length (ft.): ~10'
One Well Vol: 3.5 gal
Casing ID (in.): 2 inch, PVC

Personnel: KM/TR
Drilling Co.: —
Project Name: NSWC Crane
Project Numb 3959

FINISH CLEAN-UP @ 1810 HRS

Time	Cumulative Water Volume (Gal)	Water Level Readings (Ft below TOC)	Temperature (Degrees C)	pH	Specific Conductance (Units mS/cm)	Turbidity (NTU)	Remarks (odor, color, etc.)
1611	0	—	—	—	—	—	Start SURGE
1622	0	36.34	—	—	—	—	Start Pump Dark Grey
1640	119AL	DRY	—	—	—	—	Stop PUMP
1645	11	50.60	—	—	—	—	RECHARGE
1650	11	48.88	—	—	—	—	"
1700	11	47.17	—	—	—	—	"
1700	11	47.17	14.83	5.95	1.179	>1000	GREY
1707	15.5	DRY	—	—	—	—	DRY
1712	15.5	50.28	—	—	—	—	RECHARGE
1717	15.5	49.47	—	—	—	—	"
1727	15.5	47.28	—	—	—	—	"
1727	15.5	47.28	14.09	5.92	1.118	>1000	Grey
1734	19.5	DRY	—	—	—	—	DRY
1754	19.5	47.51	13.67	5.93	1 096	>1000	Grey
1800	23	DRY	—	—	—	—	Grey PID Readings BH PPM
							BZ PPM

MW location and ID were confirmed using figures, boring logs and 1999 MW inventory YES ✓ NO____

Note Well was installed as part of a previous RFI and is being redeveloped at this time

EXISTING

MONITORING WELL DEVELOPMENT RECORD

Well: WES-1-27-83
Site: MGBG
Date Installed: NA
Date: 8-11-01
Dev. Method: Surged & Pumped
Pump Type: WHALE

Depth to Bottom (ft.): 43.0
Static Water Level Before (ft.): 24.91
Static Water Level After (ft.): DRY
Screen Length (ft.): 10'
One Well Vol: 2.9 gal
Casing ID (in.): 2 inch, PVC

Personnel: K.M. / T.R.
Drilling Co.: —
Project Name: NSWC Crane
Project Numb 3959

FINISH CLEAN UP - 1601 Hrs

Time	Cumulative Water Volume (Gal)	Water Level Readings (Ft below TOC)	Temperature (Degrees C)	pH	Specific Conductance (Units mS/cm)	Turbidity (NTU)	Remarks (odor, color, etc.)
1450	0	24.91	—	—	—	—	Start SURGE
1457	0	24.91	—	—	—	—	Start PUMP Grey BRN (SHEEN)
1504	9 gal	DRY	—	—	—	—	DRY
1508	9	38.76	—	—	—	—	RECHARGE
1514	9	37.58	—	—	—	—	"
1524	9	36.84	—	—	—	—	"
1526	10.5	DRY	—	—	—	—	Restart Pump (SHEEN) Greyish BRN
1531	10.5	39.05	—	—	—	—	RECHARGE
1536	10.5	38.85	—	—	—	—	"
1546	10.5	36.94	—	—	—	—	"
1548	11.5	36.94	14.45	6.26	1.132	600	Restart Lt. Greyish BRN
1550	11.5	DRY	—	—	—	—	DRY
							PID Readings BH 0.0 PPM
							BZ 0.0 PPM

MW location and ID were confirmed using figures, boring logs and 1999 MW Inventory YES ✓ NO____

Note. Well was installed as part of a previous RFI and is being redeveloped at this time

EXISTING

MONITORING WELL DEVELOPMENT RECORD

Well: 01C01
Site: MGBG
Date Installed: NA
Date: 7.15.01
Dev. Method: Surged & Pumped
Pump Type: WATTERRIA

Depth to Bottom (ft.): 165.0
Static Water Level Before (ft.): 139.02
Static Water Level After (ft.): 139.02
Screen Length (ft.): NA
One Well Vol: 4.2
Casing ID (in.): 2 inch, PVC

Personnel: SIMPSON/ROSAHN
Drilling Co.: —
Project Name: NSWC Crane
Project Number: N3959

NO CHANGE IN BTM AFTER DEV.

Time	Cumulative Water Volume (Gal.)	Water Level Readings (Ft below TOC)	Temperature (Degrees C)	pH	Specific Conductance (Units mS/cm)	Turbidity (NTU)	Remarks (odor, color, etc.)
0855	0	139.02	—	—	—	~~50~~	CLEAR TURNING GRAY
0859	5.5	163 ±	17.8	5.49	0.562	50	DRY, AFTER 5.5 GAL
0910	5.5	—	—	—	—	—	
0912	8.5	163 ±	17.7	5.60	0.851	>999	DRY, AT 8.5 (3 MORE GAL)
0924	8.5	—	—	—	—	—	
0928	11.0	163 ±	14.3	5.55	0.611	>999	DRY, 2.5 ADDITIONAL GAL
0945	11.0	—	—	—	—	—	
0949	13.0	163 ±	15.2	5.61	0.602	>999	DRY, 2.0 ADDITIONAL GAL
1000	→	139.02	RECOVERED TO				
							PUMPED DRY 4X
		13.0+	GAL. PURGED				
							NO WATER LEVEL MEASUREMENTS
							WHILE PUMPING, PROBE WILL NOT FIT PAST
							PID Readings BH 1.2 PPM CONNECTION
							BZ 0 PPM

MW location and ID were confirmed using figures.

Note Well was installed as part of a previous RFI and is being redeveloped at this time

BACKGROUND WELL

MONITORING WELL DEVELOPMENT RECORD

Well: 01T02
Site: MGBG
Date Installed: ~~NA~~ 9-8-01
Date: 9-9-01
Dev. Method: Surged & Pumped
Pump Type: WATTERA / ~~SURGE~~ BAILER

Depth to Bottom (ft.): 72.3
Static Water Level Before (ft.): 65.4
Static Water Level After (ft.): —
Screen Length (ft.): 10
One Well Vol: 1.1 GALLON
Casing ID (in.): 2 inch, PVC

Personnel: WUDKWYCH
Drilling Co.: DUNCAN BROS.
Project Name: NSWC Crane
Project Number: 3959

Time	Cumulative Water Volume (Gal)	Water Level Readings (Ft below TOC)	Temperature (Degrees C)	pH	Specific Conductance (Units mS/cm)	Turbidity (NTU)	Remarks (odor, color, etc.)
1330							START PUMPING
1400	4	71.3					GO GET BAILER
1457	5		16.8	6.95	2.68	999	
1502	5½						BAILED DRY
1522		71.65					BROWN DIRTY COLOR
1537		71.3					
1629		70.3					
1637	6						DRY
							PID Readings BH — PPM
							BZ — PPM

MW location and ID were confirmed using figures, boring logs and 1999 MW Inventory ~~YES~~ ____ ~~NO~~ ____ NA

~~Note: Well was installed as part of a previous RFI and is being redeveloped at this time~~

DAY 2, ADDITIONAL DEVELOPMENT

Tetra Tech NUS, Inc.

MONITORING WELL DEVELOPMENT RECORD

Well: 01T02
Site: MGBG
Date Installed: 9.8.01
Date Developed: 9.9.01
Dev. Method: ~~PUMPED~~/BAILED
Pump Type: NA

Depth to Bottom (ft.): 72.3
Static Water Level Before (ft.): 65.63
Static Water Level After (ft.): DRY
Screen Length (ft.): 10
Specific Capacity:
Casing ID (in.): 2" PVC

Responsible Personnel: K. SIMPSON
Drilling Co.: DUNCAN BROS.
Project Name: NSWC CRANE
Project Number: 3959

(VOL = 1.1 GAL 9.9.01)

Time	Estimated Sediment Thickness (Ft.)	Cumulative Water Volume (Gal.)	Water Level Readings (Ft. below TOC)	Temperature (Degrees C)	pH	Specific Conductance (Units ~~MS~~/cm)	Turbidity (NTU)	Remarks (odor, color, etc.)
0920	0	—	65.63	—	—	—	—	START BAILING
0935	↓	1	68.00	14.0	6.4	3.33	752	
0951		2.5	70.04	13.9	5.9	3.35	67	DRY
								END DEVELOPMENT

Tetra Tech NUS, Inc.

MONITORING WELL DEVELOPMENT RECORD

Well: 01T03
Site: MGBG
Date Installed: 6-3-02
Date Developed: 6-11-02
Dev. Method: PUMP/SURGE
Pump Type: SUBMERSIBLE

Depth to Bottom (ft.): 154' BGS
Static Water Level Before (ft.): 139.36
Static Water Level After (ft.):
Screen Length (ft.): 10'
Specific Capacity: NA
Casing ID (in.): 2" ID

Responsible Personnel: Conti
Drilling Co.: Bowser-Morner, Inc.
Project Name: Crane
Project Numbe N3959

TURB < 10 NTU
pH = .1, SC & TEMP ± 3%

Time	Estimated Sediment Thickness (Ft.)	Cumulative Water Volume (Gal.)	Water Level Readings (Ft. below TOC)	Temperature (Degrees C)	pH	Specific Conductance (Units ____)	Turbidity (NTU)	Remarks (odor, color, etc)
1225	—	START	PUMP					SMALLER [illegible]
1230	—	HAD TROUBLE W/ PUMP HOSE - TORN						PROBE - GETS HUNG UP AT 120 - 130 - CANT GET W.L.
1255	START	PUMP	AGAIN					
1300	—	≈ 10		20.5	6.74	.729	—	BRN - TURBID
1310		PUMP DRY AFTER 3 GALLONS ±						
		@ 1330						
1330		13	DRY	—	—	—	—	
1400		15	DRY	19.5	6.46	.772	—	
1415		17	DRY	18.0	6.69	.782	—	
1430		19	"	18.0	6.79	.756	888	
1445		21	"	17.9	6.74	.758	800	DONE DEVELOPING
								@ 1445 ±

Tetra Tech NUS, Inc.

MONITORING WELL DEVELOPMENT RECORD

Well: 01T04
Site: MGBG
Date Installed: 6-4-02
Date Developed: 6-10-02
Dev. Method: PUMP/SURGE
Pump Type: SUBMERSIBLE

Depth to Bottom (ft.): 15.1 (GS)
Static Water Level Before (ft.): 138.06 TOC
Static Water Level After (ft.):
Screen Length (ft.): 10
Specific Capacity: NA
Casing ID (in.): 2" ID

Responsible Personnel: Conti
Drilling Co.: Bowser-Morner, Inc.
Project Name: Crane
Project Numbe N3959

TURB <10 NTU

pH = .1, SC & TEMP ± 3%

Time	Estimated Sediment Thickness (Ft.)	Cumulative Water Volume (Gal.)	Water Level Readings (Ft. below TOC)	Temperature (Degrees C)	pH	Specific Conductance (Units mS/cm)	Turbidity (NTU)	Remarks (odor, color, etc)
1645	NA	–	138.06	15.03	7.59	.464	–	YELLOW BRN - TURBID
1655	–	20	–	16.52	7.36	.478	750	2 GPM - CANT GET WL.
1705	–	40	–	16.08	7.37	.472	90	WL IS AT PUMP LEVEL, WHICH IS ON BOTM
1715	–	60	141.5	15.77	7.34	.448	700	HAD TO SLOW DOWN PUMP
1725	–	70	–	17.72	7.28	.513	23	AS IT WAS GOING DRY ≈ 1 GPM
1735	–	80	–	15.88	7.35	.443	90	"
1745	–	90	145.9	16.20	7.30	.475	20	"
1755	–	100	–	15.91	7.30	.471	11	"
1805	–	110	–	16.04	7.34	.452	10	"
1815	–	120	≈149.00	16.00	7.30	.456	10	"

Tetra Tech NUS, Inc.

MONITORING WELL DEVELOPMENT RECORD

Well: 01T05
Site: MGBG
Date Installed: 6-5-02
Date Developed: 6-11-02
Dev. Method: PUMP/ SURGE
Pump Type: SUBMERSIBLE

Depth to Bottom (ft.): 31
Static Water Level Before (ft.): 16.75
Static Water Level After (ft.):
Screen Length (ft.): 10'
Specific Capacity: —
Casing ID (in.): 2" ID.

Responsible Personnel: Conti
Drilling Co.: Bowser-Morner, Inc.
Project Name: Crane
Project Numbe N3959

TURB < 10 NTU
pH = .1, SC & TEMP ± 3%

Time	Estimated Sediment Thickness (Ft.)	Cumulative Water Volume (Gal.)	Water Level Readings (Ft. below TOC)	Temperature (Degrees C)	pH	Specific Conductance (Units mS/cm)	Turbidity (NTU)	Remarks (odor, color, etc.)
0925	START	PUMP.	—	—	—	—	—	YELLOW ISH TURBID
0930	—		16.75	18.47	6.18	2.126	—	1/2 GPM " "
0950	—	10		20.98	5.91	2.023	—	START @ 1GPM - DROPPED DOWN TO PUMP RATE
1000	—	15	29.50	21.05	5.83	2.023	—	1/2 GPM → 1/4 GPM
1050	—	20	30.50	21.90	5.55	2.019	—	THEN GOT DRY
								FROM 1000 TO 1050 JUST KEPT PUMPING DRY,
								THEN - RE-PUMP WATER STILL TURBID
								STOP @ 1050 HRS

APPENDIX B-3

ANOMALY EXCAVATION
WITH
TEST PIT LOGS
AND
SOIL SAMPLE LOG SHEETS

Tetra Tech NUS, Inc.

TEST PIT LOG

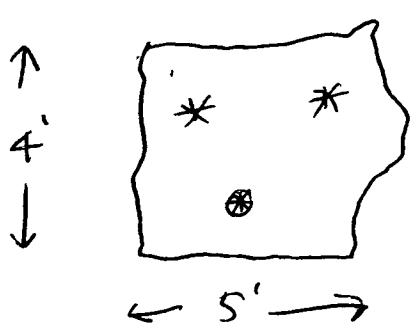
ANOMALY EXCAVATION

PROJECT NAME: NSWC CRANE, IN
PROJECT NUMBER: CTO 158 #3959
LOCATION: MGBG
TEST PIT No.: 01TPS
DATE: 8-25-01
GEOLOGIST: K. SIMPSON

Depth (Ft.)	Lithology Change (Depth/Ft.)	MATERIAL DESCRIPTION: Soil/Waste Characteristics (lithology, density, color, etc.)	USCS	Remarks	PID/FID READING: Source (ppm)	PID/FID READING: BZ (ppm)
0		DRY, SILT TR. F. SAND	SM	TR ROOTS	SEE SCREENING	
0.5		SOME ROOTS, TR LIME	↓		LOGS	
1.0	TD 1.0'	STONE GRAVEL				
		REMOVED 1 SMALL PIECE OF FENCE POST				
		PIT CLEAR & COMPLETE @ 1052				

N ↑

TEST PIT CROSS SECTION AND / OR PLAN VIEW



1' DEEP

* COMP. SAMPLE

⊛ COMP + ENCORE SAMPLE

SAMPLE ID = 01TPS 04

REMARKS: S = SMALL PIT

PHOTO LOG: PHOTOS TAKEN

GEOPHY. ANOMALY EXCAVATION SAMPLING

SOIL SAMPLE LOG SHEET

Project Site Name: NSWC Crane, IN
Project No.: CTO 158 N3959

Sample ID No.: 01TPS04
Sample Location: 01TPS
Sampled By: R. SIMPSON
C.O.C. No.:

[] Surface Soil
[X] Subsurface Soil
[] Sediment
[X] Other: TEST PIT
[] QA Sample Type:

Type of Sample:
[X] Low Concentration
[] High Concentration

GRAB SAMPLE DATA:

	Depth	Color	Description (Sand, Silt, Clay, Moisture, etc.)
Date:			
Time:			
Method:			
Monitor Reading (ppm):			

COMPOSITE SAMPLE DATA:

	Time	Depth	Color	Description (Sand, Silt, Clay, Moisture, etc.)
Date. 8·26·01	1320	1-1.5'	BRN	SAME AS 01TPL01
Method: STAINLES TROWEL	↓	↓	↓	
Monitor Readings (Range in ppm). SEE TP LOGS 0 - 8·26·01				

PPM

SAMPLE COLLECTION INFORMATION: ENCORE, 3-8 OZ, 1-2 OZ

Analysis	Container Requirements	Collected	Other
Appendix XI VOCs	(4) Encore samplers	✓	
HD	(1) 2 oz glass jar	✓	
Thorium	(1) 8 oz glass	✓	
Added gamma spectrometry to thorium container (check collected block).....			
Appendix XI SVOC, PNA, ~~Herbicide, Pesticide/PCBs~~	(1) 8 oz glass	✓	
Explosives, TAL Metals (plus Sr and Sn) PH	(1) 8 oz glass	✓	
~~Added pH and OEO to metals container (check collected~~ block)...			
Added ~~TOC to metals~~ container (~~Check~~ collected block).			

OBSERVATIONS / NOTES:

VOC COLLECTED AS GRAB

MIXED IN S.S. BOWL

MAP:

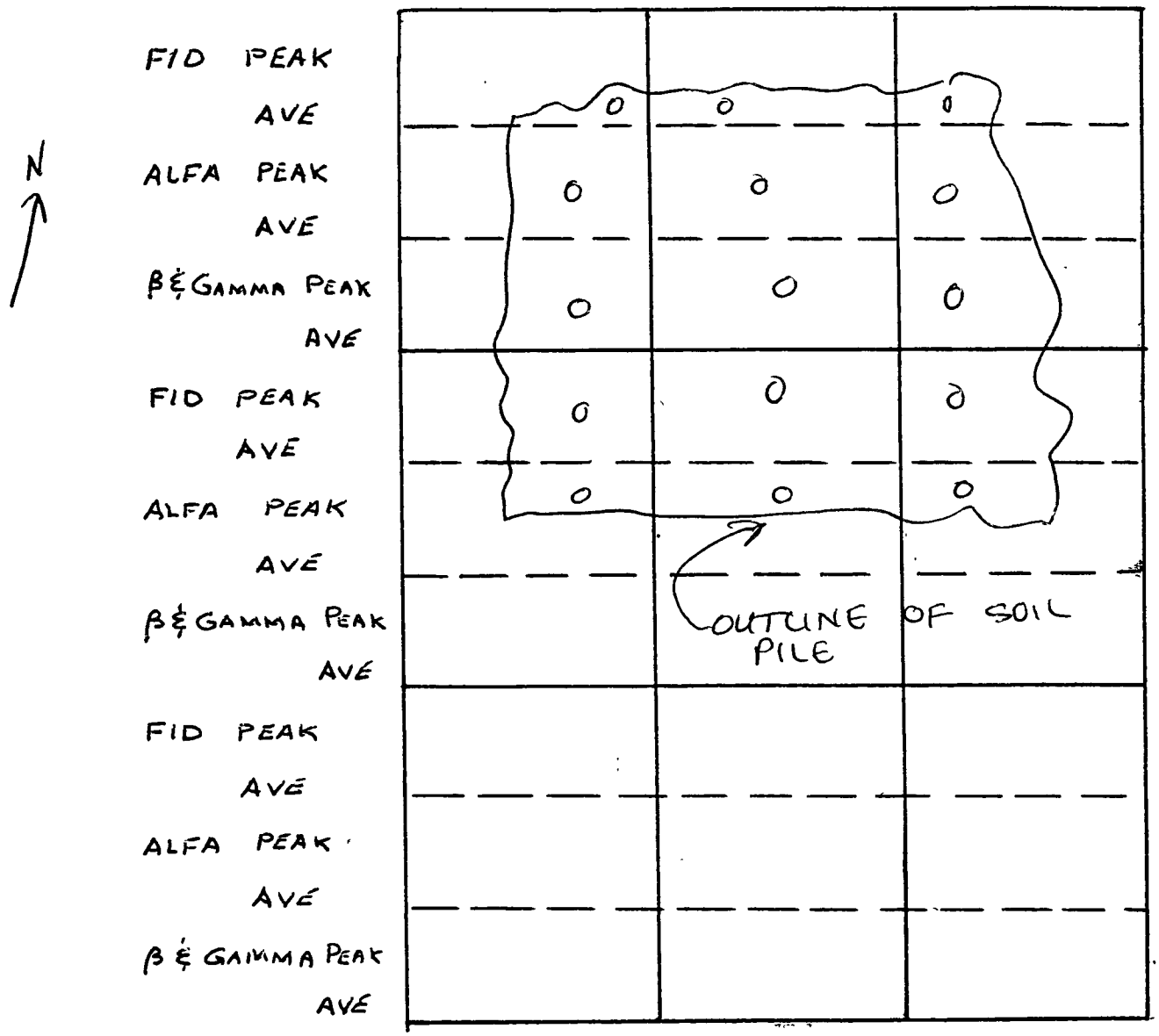
Circle if Applicable:

MS/MSD	Duplicate ID No.:
—	—

Signature(s): [illegible]

NSWC CRANE MGBG CTO 158

TEST PIT # 01TPS LIFT ID (DEPTH) 1.0



COMMENTS: ALL ZEROS / BACKGROUND

PIT READINGS @ SAMPLE LOCATIONS
O_s / BACKGROUND

8.25.01
@ 1055

R. SIMPSON

Tetra Tech NUS, Inc.

TEST PIT LOG

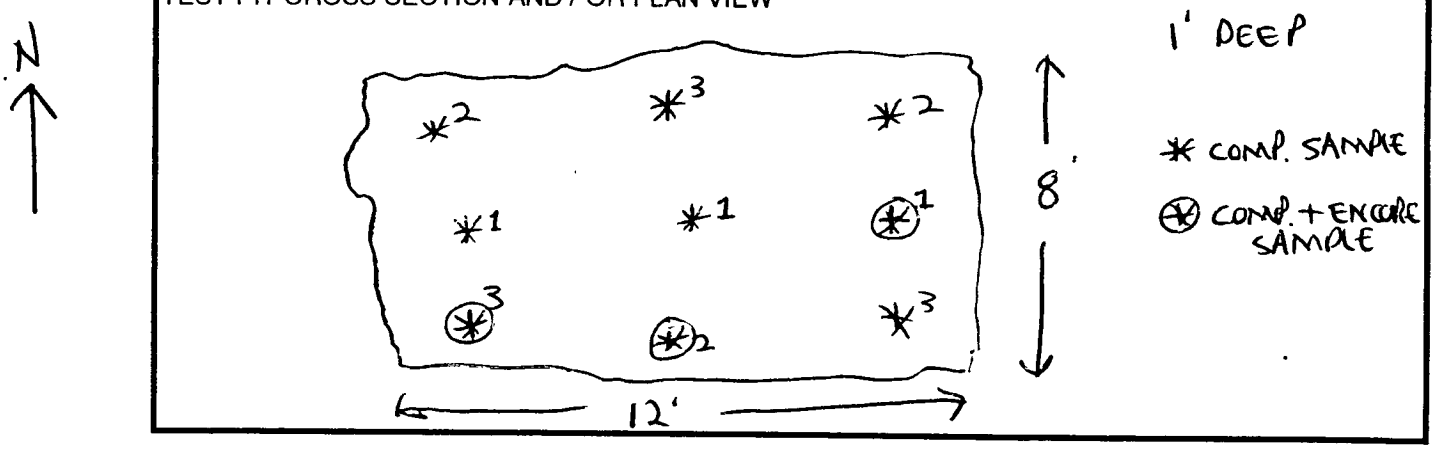
ANOMALY EXCAVATION

PROJECT NAME: NSWC CRANE, IN
PROJECT NUMBER: CTO 158 #3959
LOCATION: MGBG

TEST PIT No.: 01TPL
DATE: 8-25-01
GEOLOGIST: K. SIMPSON

Depth (Ft.)	Lithology Change (Depth/Ft.)	MATERIAL DESCRIPTION: Soil/Waste Characteristics (lithology, density, color, etc.)	USCS	Remarks	PID/FID READING: Source (ppm)	PID/FID READING: BZ (ppm)
0		DRY, SILT TR. F. SAND	SM	TR ROOTS	SEE	
0.5		SOME ROOTS TR. SAND	↓		SCREENING	
1.0	TD 1.0'	STONE & GRAVEL				LOG
		REMOVED 2 10X1.3'				
		(PSP) PERFORATED STEEL PLATING				
		& ≈12 NAILS				
		PIT CLEAR & COMPLETE				
		@ 1033				

TEST PIT CROSS SECTION AND / OR PLAN VIEW



REMARKS: L = LARGE PIT

PHOTO LOG: PHOTOS TAKEN

GEOPHY. ANOMALY EXCAVATION SAMPLING

SOIL SAMPLE LOG SHEET

Project Site Name: NSWC Crane, IN
Project No.: CTO 158 N3959

[] Surface Soil
[X] Subsurface Soil
[] Sediment
[X] Other:
[] QA Sample Type:

Sample ID No.: 01TPL 01
Sample Location: 01TPL
Sampled By: R. SIMPSON & TR
C.O.C. No.:

Type of Sample:
[X] Low Concentration
[] High Concentration

GRAB SAMPLE DATA:

	Depth	Color	Description (Sand, Silt, Clay, Moisture, etc.)
Date			
Time			
Method			
Monitor Reading (ppm):			

COMPOSITE SAMPLE DATA:

Date	Time	Depth	Color	Description (Sand, Silt, Clay, Moisture, etc.)
8-26-01	1255	1-1.5'	BRN	MOIST SILT TR. F. SAND
Method. STAINLESS	↓		↓	TR GRAVEL (LIMESTONE)
TROWEL				TR SANDSTONE FRAGS
Monitor Readings				TR ROOTS
(Range in ppm)				
SEE TP				
LOGS				
0-8-26-01				

PPM -

SAMPLE COLLECTION INFORMATION: ENCORE 3-8OZ, 1-2OZ.

Analysis	Container Requirements	Collected	Other
Appendix XI VOCs	(4) Encore samplers	✓	
HD	(1) 2 oz glass jar	✓	
Thorium	(1) 8 oz glass	✓	
Added gamma spectrometry to thorium container (check collected block)			
Appendix XI SVOC, PNA, ~~Herbicide, Pesticide/PCBs~~	(1) 8 oz glass	✓	
Explosives, TAL Metals (plus Sr and Sn) PH	(1) 8 oz glass	✓	
~~Added pH and CEC to metals container (check collected block)~~			
Added TOC to metals container (check collected block)			

OBSERVATIONS / NOTES:

VOC COLLECTED AS GRAB
MIXED IN-SITU (COMPS.) &
WITH SS. BOWL

MAP:

SAMPLE TIME # = 1255

Circle if Applicable:

MS/MSD

Duplicate ID No.:

Signature(s):

GEOPHY. ANOMALY EXCAVATION SAMPLING

SOIL SAMPLE LOG SHEET

Project Site Name: NSWC Crane, IN
Project No.: CTO 158 N3959

[] Surface Soil
[X] Subsurface Soil
[] Sediment
[X] Other:
[] QA Sample Type:

Sample ID No.: 01TPL02
Sample Location: 01TPL
Sampled By: K. SIMPSON & TR
C.O.C. No.:

Type of Sample:
[X] Low Concentration
[] High Concentration

GRAB SAMPLE DATA:

Date:	Depth	Color	Description (Sand, Silt, Clay, Moisture, etc.)
Time:			
Method:			
Monitor Reading (ppm):			

COMPOSITE SAMPLE DATA:

Date: 8-26-01 1300	Time	Depth	Color	Description (Sand, Silt, Clay, Moisture, etc.)
	1300	1-1.5'	BRN	SAME AS 01TPL01
Method: STAINLESS TROWEL	↓	↓	↓	
Monitor Readings (Range in ppm). SEE TP LOGS 0-8-26-01				
PPM				

SAMPLE COLLECTION INFORMATION: ENCORE, 3-8 OZ, 1-2 OZ

Analysis	Container Requirements	Collected	Other
Appendix XI VOCs	(4) Encore samplers	✓	
HD	(1) 2 oz glass jar	✓	
Thorium	(1) 8 oz glass	✓	
Added gamma spectrometry to thorium container (check collected block)			
Appendix XI SVOC, PNA, ~~Herbicide, Pesticide/PCBs~~	(1) 8 oz glass	✓	
Explosives, TAL Metals (plus Sr and Sn) PH	(1) 8 oz glass	✓	
~~Added pH and CEC to metals container (check~~ collected block)			
~~Added TOC to metals~~ container (check collected block)			

OBSERVATIONS / NOTES:

VOC COLLECTED AS GRAB

MAP:

Circle If Applicable:

MS/MSD	Duplicate ID No.:
—	—

Signature(s):

GEOPHY. ANOMALY EXCAVATION SAMPLING

SOIL SAMPLE LOG SHEET

Project Site Name: NSWC Crane, IN
Project No.: CTO 158 N3959

[] Surface Soil
[X] Subsurface Soil
[] Sediment
[X] Other: TEST PIT
[] QA Sample Type:

Sample ID No.: 01TPL03
Sample Location: 01TPL
Sampled By: R. SIMPSON
C.O.C. No.:

Type of Sample:
[X] Low Concentration
[] High Concentration

GRAB SAMPLE DATA:

Date:	Depth	Color	Description (Sand, Silt, Clay, Moisture, etc.)
Time			
Method:			
Monitor Reading (ppm):			

COMPOSITE SAMPLE DATA:

Date 8-26-01 1310	Time	Depth	Color	Description (Sand, Silt, Clay, Moisture, etc.)
	1310	1-1.5'	BRN	SAME AS 01TPL01
Method STAINLESS TROWEL	↓	↓	↓	
Monitor Readings (Range in ppm): SEE TP LOGS				
0-826.01				

PPM =

SAMPLE COLLECTION INFORMATION: ENCORE, 3-8 OZ, 1-2 OZ

Analysis	Container Requirements	Collected	Other
Appendix XI VOCs	(4) Encore samplers	✓	
HD	(1) 2 oz glass jar	✓	
Thorium	(1) 8 oz glass	✓	
Added gamma spectrometry to thorium container (check collected block).....			
Appendix XI SVOC, PNA, ~~Herbicide, Pesticide/PCB~~s	(1) 8 oz glass	✓	
Explosives, TAL Metals (plus Sr and Sn) PH	(1) 8 oz glass	✓	
~~Added pH and GEO to metals container (check collected~~ block)...			
~~Added TOC to metals~~ container (check collected block).			

OBSERVATIONS / NOTES:

VOC COLLECTED AS GRAB

MAP:

Circle if Applicable:

MS/MSD

Duplicate ID No.:

Signature(s):

LARGE EXCAVATION

pg 1 of 1

NSWC CRANE MGBG CTO 158

TEST PIT # 01TPL LIFT ID (DEPTH) 0.5'

N

FID PEAK	0	0	0
AVE			
ALFA PEAK	0	0	0
AVE			
β & GAMMA PEAK	BG	BG	BG
AVE			
FID PEAK	0	0	0
AVE			
ALFA PEAK	0	0	0
AVE			
β & GAMMA PEAK	BG	BG	
AVE			
FID PEAK	0	0	
AVE			
ALFA PEAK	0		
AVE			
β & GAMMA PEAK			
AVE			

OUTLINE OF SOIL PILE

COMMENTS: FID NO HITS, ALL 0

BG = BACKGROUND

PIT READINGS @ SAMPLE LOCATIONS
O_s / BACKGROUND

8-25-01
@ 0950

K. SIMPSON

APPENDIX B-4

GROUND WATER SAMPLE LOG SHEETS

GROUND WATER SAMPLE LOG FORM

Project Site Name	NSWC CRANE, IN	Sample ID No :	01GW0101
Project No.	CTO 158 N3959	Sample Location.	WES-1-1-81
		Sampled By	T. ROJAHN
		C.O C. No	

pH PAPER = 6.0

SAMPLING DATA:

Date 9-06-01	Color	pH	S.C.	Temp.	Turbidity	DO	ORP	Odor
Time-Start 1250 End 1752	Visual	Standard	mS/cm	Degrees C	NTU	mg/l	mV	
Method Bladder	CLEAR	6.56	1.007	15.38	4.7	0.55	393	NONE

PURGE DATA: 6.00

Date 9-06-01	Total Well Depth (TD) 51.0	End Purge (hrs)	1245
Method Bladder	Static Water Level (WL) 28.95	Total Purge Time (min).	130
Well Casing 2" PVC	Start Purge (hrs) 1035	Total Vol Purged (gal)	6.3
One Casing Volume(gal) 3.6			

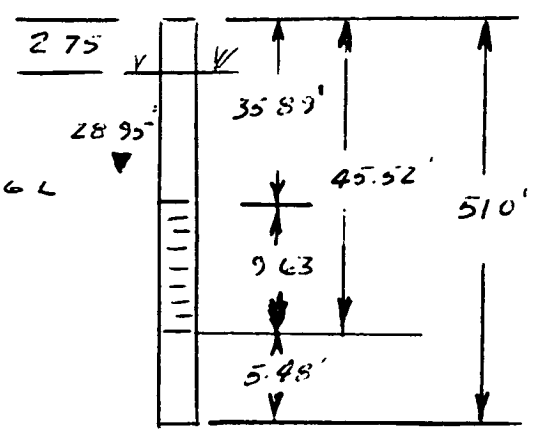
SAMPLE COLLECTION INFORMATION:

Analysis	Preservative	Container Requirements	MS/MSD	Collected	DUP
Appendix IX VOCs	HCl/4°C	(3) 40 ml VOA Vials	✓	✓	✓
Appendix IX SVOCs	4°C	(2) 1 L Amber Glass	✓	✓	✓
PNA	4°C	(2) 1 L Amber Glass	✓	✓	✓
Appendix IX Pesticides/PCBs	4°C	(2) 1 L Amber Glass	✓	✓	✓
Appendix IX Herbicides	4°C	(1) 1 L Amber Glass	✓	✓	✓
Explosives	4°C	(1) 1 L Amber Glass	✓	✓	✓
HD	4°C	(1) 40 ml VOA Vials	✓	✓	✓
TAL Total Metals, plus Sr and Sn	HNO_3/4°C	(1) 500 ml Polyethylene	✓	✓	✓
TAL Disolved Metals, plus Sr and Sn	HNO_3/4°C	(1) 500 ml Polyethylene			
Total Thorium Isotopes	HNO_3/4°C	(1) 1 L Amber Glass		✓	✓
Dissolved Thorium Isotopes	HNO_3/4°C	(1) 1 L Amber Glass			
Gross Alfa/Gross Beta	HNO_3/4°C	(2) 1 L Amber Glass		✓	✓
TOC	H_2SO_4/4°C	(1) 500 ml Polyethylene		✓	✓
Note: Dissolved metals and dissolved thorium only collected if Turb. is >5 NTUs				NA	

OBSERVATIONS / NOTES:

PID reading in PVC riser pipe =	0.0	(ppm)
PID reading in Breathing Zone =	0.0	(ppm)

9.63 ÷ 2 = 4.82
35.83 + 4.82 = 40.71 Pump Intake ~
51 - 28.95 = 22.05 x .163 = 3.6 gal or 13.6 L



QA Samples Collected:

MS/MSD	Duplicate ID No.:	Signature(s):
YES	FD090601 01	[signature]

LOW FLOW PURGE DATA SHEET

PROJECT SITE NAME: NSWC Crane, IN
PROJECT NUMBER: 3959

WELL ID.: WES-1-1-81
DATE: 9/6/01

Time (Hrs.)	Water Level (Ft. below TOC)	Pump Rate (mL/Min.)	pH (S.U.)	S. Cond. (mS/cm)	Turb. (NTU)	DO (mg/L)	Temp. (Celcius)	ORP mV	Comments
1035	28.95	—	—	—	—	—	—	—	Start PUMPING
1045	29.07	100	5.05	1.208	75	2.25	17.31	54	1000ml V. SL. CLOUDY
1055	29.10	100	4.12	1.203	60	1.21	17.22	164	2000ml " " "
* 1105	29.23	200	2.96	1.161	50	1.33	15.68	259	4000ml CLEAR
1115	29.38	200	2.37	1.097	29	1.18	15.53	331	6000ml CLEAR
1125	29.52	200	2.26	1.061	23	1.20	15.41	358	8000ml CLEAR
1135	29.55	200	2.97	1.017	20	1.13	15.23	362	10000 CLEAR
1145	29.55	200	3.46	1.008	14	1.05	15.21	357	12000 CLEAR
* 1155	29.57	200	3.63	1.003	11	1.07	15.19	361	14000 CLEAR
1205	29.59	200	3.61	1.004	8.9	1.01	15.19	368	16000 CLEAR
1215	29.61	200	3.60	1.006	7.4	0.95	15.18	374	18000 CLEAR
1225	29.64	200	3.59	1.004	6.5	0.95	15.27	382	20000 CLEAR
1235	29.63	200	3.67	1.006	5.8	0.95	15.33	387	22000 CLEAR
1245	29.63	200	3.56	1.007	4.7	0.95	15.38	393	24000 CLEAR
1250									Start SAMPLING

SIGNATURE: [signature]

* pH PAPER = 6.0

PAGE 2 OF 2

GROUND WATER SAMPLE LOG FORM

Project Site Name	NSWC CRANE, IN	Sample ID No	016W0201
Project No	CTO 158 N3959	Sample Location	WES-1-2-81
		Sampled By	K. MARQUIS
		C.O.C No.	

SAMPLING DATA:

	Color	pH	S.C.	Temp.	Turbidity	DO	ORP	Odor
Date 9.8.01	Visual	Standard	mS/cm	Degrees C	NTU	mg/l	mV	
Time-Start 1105 End 1310								
Method PERISTALTIC	CLEAR	6.17	1.659	17.5	3.3	1.6	480	CHEM. ?

PURGE DATA:

Date 9/8/01	Total Well Depth (TD)	25.8	End Purge (hrs) 1105
Method PERISTALTIC	Static Water Level (WL)	15.34	Total Purge Time (min) 80
Well Casing 2" PVC	Start Purge (hrs)	2945	Total Vol Purged (gal) 1.8
One Casing Volume(gal) 1.7			

SAMPLE COLLECTION INFORMATION:

Analysis	Preservative	Container Requirements	Collected
Appendix IX VOCs	HCl/4°C	(3) 40 ml VOA Vials	✓
Appendix IX SVOCs	4°C	(2) 1 L Amber Glass	✓
PNA	4°C	(2) 1 L Amber Glass	✓
Appendix IX Pesticides/PCBs	4°C	(2) 1 L Amber Glass	✓
Appendix IX Herbicides	4°C	(1) 1 L Amber Glass	✓
Explosives	4°C	(1) 1 L Amber Glass	✓
HD	4°C	(1) 40 ml VOA Vials	✓
TAL Total Metals, plus Sr and Sn	HNO_3/4°C	(1) 500 ml Polyethylene	✓
~~TAL Dissolved Metals~~, plus Sr and Sn	HNO_3/4°C	(1) 500 ml Polyethylene	—
Total Thorium Isotopes	HNO_3/4°C	(1) 1 L Amber Glass	✓
~~Dissolved Thorium Isotopes~~	HNO_3/4°C	(1) 1 L Amber Glass	—
Gross Alfa/Gross Beta	HNO_3/4°C	(2) 1 L Amber Glass	✓
TOC	H_2SO_4/4°C	(1) 500 ml Polyethylene	✓
Note: Dissolved metals and dissolved thorium only collected if Turb. is >5 NTUs			NA

OBSERVATIONS / NOTES:

PID reading in PVC riser pipe = Ø (ppm)

PID reading in Breathing Zone = Ø (ppm)

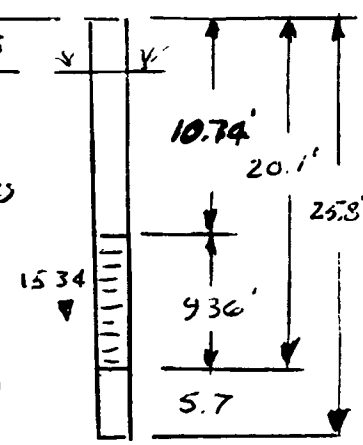
TOP of SCREEN = 10.74
BOTTOM of SCREEN = 20.1

25.8 − 15.34 = 10.46 X .163 = 1.7 GAL OR 6.45 LITERS

20.1 − 15.34 = 4.76 SAT SCREEN

10.74 + 4.68 = 15.42 CENTER of SCREEN

15.34 + 2.38 = 17.72 CENTER of SAT SCREEN
PLACE HOSE INLET.



QA Samples Collected:

MS/MSD	Duplicate ID No.:	Signature(s):

LOW FLOW PURGE DATA SHEET

PROJECT SITE NAME: NSWC Crane, IN
PROJECT NUMBER: 3959

WELL ID.: 01 MW 02
DATE: 9-8-01

Time (Hrs.)	Water Level (Ft. below TOC)	Pump Rate (mL/Min.)	pH (S.U.)	S. Cond. (mS/cm)	Turb. (NTU)	DO (mg/L)	Temp. (Celcius)	ORP mV	Comments
0945	15.34	140							START PURGE CLEAR,
0950	16.14	80	6.15	1.633	6.9	3.39	16.7	225	CHEM. ODOR
1000	16.27	80	5.57	1.629	5.8	2.31	17.6	311	CHECKED PH w/ PAPER, OK
1010	16.40	80	5.68	1.632	4.7	1.79	17.6	313	
1020	16.53	80	6.17	1.635	4.6	1.75	17.4	245	
1030	16.64	80	6.17	1.644	4.4	1.59	17.4	295	
1040	16.72	80	6.18	1.648	4.3	1.62	17.5	313	
1050	16.83	80	6.18	1.657	4.3	1.59	17.5	358	
1055	16.88	80	6.18	1.658	4.0	1.62	17.5	248	
1100	16.91	80	6.17	1.659	3.6	1.58	17.5	431	
1105	16.97	80	6.17	1.659	3.3	1.60	17.5	480	END PURGE

SIGNATURE: [illegible]

BTM [illegible] 25.8'

PAGE [illegible] 2

GROUND WATER SAMPLE LOG FORM

Project Site Name	NSWC CRANE, IN	Sample ID No	01 GW03 01
Project No.	CTO 158 N3959	Sample Location	WES-1-3-81
		Sampled By	TR / KS
		C.O.C. No :	

SAMPLING DATA:

Date 9.7 & 8 01	Color	pH	S.C.	Temp.	Turbidity	DO	ORP	Odor
Time-Start SEE End Below	Visual	Standard	mS/cm	Degrees C	NTU	mg/l	mV	SLIGHT
Method PERISTALTIC	CLEAR	6.26	0.496	17.4	14	0.64	-152	SULFUR

PURGE DATA:

Date 9-6-01	Total Well Depth (TD) 21.6 (21.6)	End Purge (hrs) 1022	
Method PERISTALTIC	Static Water Level (WL) 13.33	Total Purge Time (min) 64	
Well Casing 2" PVC	Start Purge (hrs) 0918	Total Vol Purged (gal) 2	
One Casing Volume(gal) 1.3			

SAMPLE COLLECTION INFORMATION:

Analysis	Preservative	Container Requirements	DATE Collected	TIME	WL
Appendix IX VOCs	HCl/4°C	(3) 40 ml VOA Vials	9.7.01	1000	13.82
Appendix IX SVOCs	4°C	(2) 1 L Amber Glass	9.8.01	0740	4.23
PNA	4°C	(2) 1 L Amber Glass			
Appendix IX Pesticides/PCBs	4°C	(2) 1 L Amber Glass			
Appendix IX Herbicides	4°C	(1) 1 L Amber Glass			
Explosives	4°C	(1) 1 L Amber Glass			
HD	4°C	(1) 40 ml VOA Vials			
TAL Total Metals, plus Sr and Sn	HNO_3/4°C	(1) 500 ml Polyethylene	9.7.01	1000	
TAL Disolved Metals, plus Sr and Sn	HNO_3/4°C	(1) 500 ml Polyethylene	9.7.01	1000	
Total Thorium Isotopes	HNO_3/4°C	(1) 1 L Amber Glass	9.7.01	1000	
Dissolved Thorium Isotopes	HNO_3/4°C	(1) 1 L Amber Glass	9.7.01	1000	
Gross Alfa/Gross Beta	HNO_3/4°C	(2) 1 L Amber Glass	9.7.01	1000	
TOC	H_2SO_4/4°C	(1) 500 ml Polyethylene	9.8.01	0740	
Note: Dissolved metals and dissolved thorium only collected if Turb. is >5 NTUs			NA		

OBSERVATIONS / NOTES:

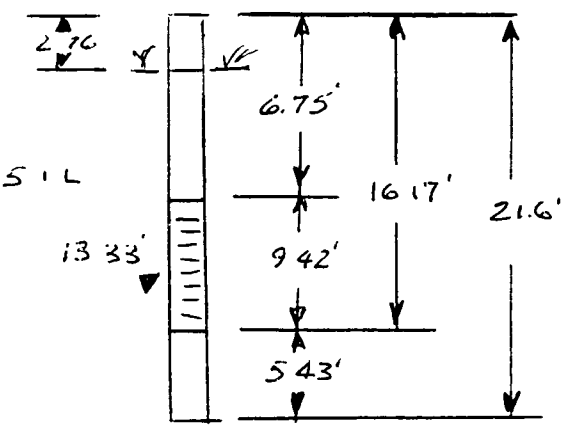
PID reading in PVC riser pipe = 0.0 (ppm)

PID reading in Breathing Zone = 0.0 (ppm)

WELL DRIES out will pump dry AND SAMPLE LATER

21.6 - 13.33 = 8.27 x .163 = 1.3941 or 5 L

1.0" ± RAIN 9.7/8.01



QA Samples Collected:

MS/MSD	Duplicate ID No.:

Signature(s): [illegible]

LOW FLOW PURGE DATA SHEET

PROJECT SITE NAME: NSWC Crane, IN
PROJECT NUMBER: 3959

WELL ID.: IVES-1-3-81
DATE: 9-6-01

Time (Hrs.)	Water Level (Ft. below TOC)	Pump Rate (mL/Min.)	pH (S.U.)	S. Cond. (mS/cm)	Turb. (NTU)	DO (mg/L)	Temp. (Celcius)	ORP mV	Comments
0922	14.76	130	6.84	0.492	45	2.67	16.3	-53	SLIGHT SULFUR ODOR
0926	15.02	100	6.54	0.481	31	1.06	16.5	-110	
0935	15.68	80	6.46	0.481	19	0.79	17.2	-148	
0945	16.70	80	6.41	0.491	19	0.62	17.3	-161	
0955	18.05	80	6.35	0.482	20	0.69	17.2	-167	
1005	19.02	80	6.32	0.482	18	0.62	17.3	-168	
1010	19.62	80	6.30	0.482	16	0.60	17.4	-165	
1015	20.04	80	6.26	0.486	14	0.84	17.4	-152	PUMPED TO PUMP INLET
									20.60 @ 1018.
									LOWERED INLET TO BTM
									& PUMP DRY.
									WILL SAMPLE AFTER
									RECHARGE

SIGNATURE: K. S. Lamp

TM = 21.6

GROUND WATER SAMPLE LOG FORM

Project Site Name	NSWC CRANE, IN	Sample ID No.	01GW0401
Project No	CTO 158 N3959	Sample Location:	WES-1-4-01
		Sampled By	T. ROJAHN
		C O.C No.	

SAMPLING DATA:

Date 8-28-01	Color	pH	S.C.	Temp.	Turbidity	DO	ORP	Odor
Time-Start 1245 End 1520	Visual	Standard	mS/cm	Degrees C	NTU	mg/l	mV	
Method SAME	CLEAR	6.70	0.922	18.7	1.5	0.63	490	NONE

PURGE DATA:

Date 08-28-01	Total Well Depth (TD)	34.0	End Purge (hrs) 1245
Method Peristaltic	Static Water Level (WL)	19.49	Total Purge Time (min) 240
Well Casing 2" PVC	Start Purge (hrs)	0845	Total Vol. Purged (gal) ~~4.8~~ 5.0 (9L)
One Casing Volume(gal) 2.4			

SAMPLE COLLECTION INFORMATION:

Analysis	Preservative	Container Requirements	Collected
Appendix IX VOCs	HCl/4°C	(3) 40 ml VOA Vials	✓
Appendix IX SVOCs	4°C	(2) 1 L Amber Glass	✓
PNA	4°C	(2) 1 L Amber Glass	✓
Appendix IX Pesticides/PCBs	4°C	(2) 1 L Amber Glass	✓
Appendix IX Herbicides	4°C	(1) 1 L Amber Glass	✓
Explosives	4°C	(1) 1 L Amber Glass	✓
HD	4°C	(1) 40 ml VOA Vials	✓
TAL Total Metals, plus Sr and Sn	HNO_3/4°C	(1) 500 ml Polyethylene	✓
~~TAL Dissolved~~ Metals, plus Sr and Sn	HNO_3/4°C	(1) 500 ml Polyethylene	NA
Total Thorium Isotopes	HNO_3/4°C	(1) 1 L Amber Glass	✓
~~Dissolved Thorium Isotopes~~	~~HNO_3/4°C~~	~~(1) 1 L Amber Glass~~	NA
Gross Alfa/Gross Beta	HNO_3/4°C	(2) 1 L Amber Glass	✓
TOC	H_2SO_4/4°C	(1) 500 ml Polyethylene	✓
Note: Dissolved metals and dissolved thorium only collected if Turb is >5 NTUs			NA

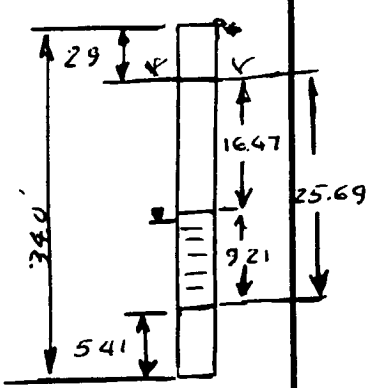
OBSERVATIONS / NOTES:

PID reading in PVC riser pipe =	0.0	(ppm)
PID reading in Breathing Zone =	0.0	(ppm)

19.37' Top of screen
28.07' bottom of screen

340 - 19.49 = 14.51 x .163 = 2.4 gal or 9L

Intake @ ~24'



QA Samples Collected:

MS/MSD	Duplicate ID No.:
—	—

Signature(s):

LOW FLOW PURGE DATA SHEET

PROJECT SITE NAME: NSWC Crane, IN
PROJECT NUMBER: 3959

WELL ID.: WES-1-4 81
DATE: 8-28-01

Time (Hrs.)	Water Level (Ft. below TOC)	Pump Rate (mL/Min.)	pH (S.U.)	S. Cond. (mS/cm)	Turb. (NTU)	DO (mg/L)	Temp. (Celcius)	ORP mV	Comments
0845	19.49	—	—	—	—	—	—	—	START PURGE
0855	19.79	150	6.81	0.939	5.1	0.73	16.37	290	1500 ML CLEAR
0905	19.95	100	6.71	0.927	7.6	0.55	16.50	324	2500 "
0915	20.13	100	6.51	0.928	5.4	0.49	16.76	351	3500 "
0925	20.30	100	6.26	0.928	4.4	0.50	17.23	373	4500 "
0935	20.42	76	6.17	0.930	3.2	0.50	17.46	391	5260 "
0945	20.55	76	6.20	0.929	3.4	0.51	17.50	401	6020 "
0955	20.67	76	6.21	0.926	3.6	0.51	17.53	407	6780 "
1005	20.78	70	6.21	0.925	3.4	0.52	17.85	411	7480 "
1015	20.90	70	6.15	0.927	4.5	0.53	17.98	417	8180 "
1025	21.00	70	6.07	0.928	2.1	0.55	18.06	424	8880 "
1035	21.12	70	6.03	0.930	2.3	0.56	18.46	431	9580 "
1045	21.24	70	5.94	0.929	2.5	0.57	18.28	437	10,280 "
1055	21.35	70	5.93	0.929	2.2	0.58	18.78	442	10980 "
1105	21.44	70	5.86	0.930	2.7	0.59	18.79	449	11680 "
1115	21.54	70	5.86	0.930	2.7	0.60	18.90	451	12380 "
1125	21.69	70	5.54	0.931	2.5	0.62	18.97	460	13080 SUN ON CELL, TEMP↑
1135	21.82	70	5.90	0.945	2.1	0.69	20.00	496	13780 CLEAR
1145	21.88	70	6.01	0.930	1.8	0.70	18.95	513	14480 "
1155	21.99	70	6.65	0.925	2.0	0.61	18.99	429	15180 "
1205	22.14	70	6.71	0.923	2.4	0.57	18.97	418	15930 "
1215	22.19	75	6.68	0.923	2.9	0.61	19.09	464	16680 "
1225	22.30	75	6.69	0.922	2.3	0.63	18.93	484	17430 "
1235	22.38	75	6.70	0.922	1.7	0.64	18.86	488	18180 "
1245	22.46	75	6.70	0.922	1.5	0.63	18.65	490	18930 START SAMPLING

SIGNATURE: [signature]

MIN VOL = 9L

GROUND WATER SAMPLE LOG FORM

Project Site Name	NSWC CRANE, IN	Sample ID No	01-GW-05-01
Project No	CTO 158 N3959	Sample Location	WES-1-5-R1
		Sampled By	K. MARQUIS
		C O.C No	

SAMPLING DATA:

Date 9/19/01	Color	pH	S.C.	Temp.	Turbidity	DO	ORP	Odor
Time-Start 0800 End 1002	Visual	Standard	mS/cm	Degrees C	NTU	mg/l	mV	
Method: Peristaltic	CLEAR	6.00	2.370	15.46	2.6	2.37	490.4	NONE

PURGE DATA:

Date 9-18-01	Total Well Depth (TD) 33.6	End Purge (hrs) 1710
Method Peristaltic	Static Water Level (WL) 17.73	Total Purge Time (min) 120
Well Casing 2" PVC	Start Purge (hrs) 1510	Total Vol Purged (gal) 4.76
One Casing Volume(gal) 2.6		

SAMPLE COLLECTION INFORMATION:

Analysis	Preservative	Container Requirements	Collected
Appendix IX VOCs	HCl/4°C	(3) 40 ml VOA Vials	✓ 9/19/01
Appendix IX SVOCs	4°C	(2) 1 L Amber Glass	✓ 9/19/01
PNA	4°C	(2) 1 L Amber Glass	✓ 9/19/01
Appendix IX Pesticides/PCBs	4°C	(2) 1 L Amber Glass	✓ 9/19/01
Appendix IX Herbicides	4°C	(1) 1 L Amber Glass	✓ 9/19/01
Explosives	4°C	(1) 1 L Amber Glass	✓ 9/19/01
HD	4°C	(1) 40 ml VOA Vials	✓ 9/19/01
TAL Total Metals, plus Sr and Sn	HNO_3/4°C	(1) 500 ml Polyethylene	✓ 9/19/01
TAL Disolved Metals, plus Sr and Sn	HNO_3/4°C	(1) 500 ml Polyethylene	
Total Thorium Isotopes	HNO_3/4°C	(1) 1 L Amber Glass	✓ 9/19/01
Dissolved Thorium Isotopes	HNO_3/4°C	(1) 1 L Amber Glass	
Gross Alfa/Gross Beta	HNO_3/4°C	(2) 1 L Amber Glass	✓ 9/19/01
TOC	H_2SO_4/4°C	(1) 500 ml Polyethylene	✓ 9/19/01
Note: Dissolved metals and dissolved thorium only collected if Turb is >5 NTUs			NA

OBSERVATIONS / NOTES:

PID reading in PVC riser pipe = Ø (ppm)

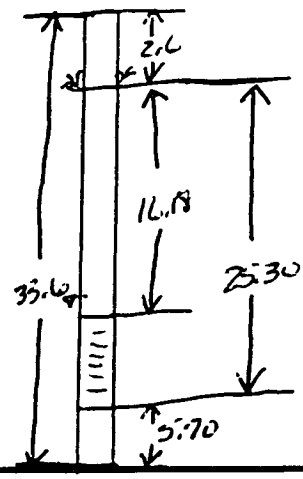
PID reading in Breathing Zone = Ø (ppm)

TOP of SCREEN = 18.78
BOTTOM of SCREEN = 27.90

33.6 - 17.73 = 15.87 x .153 = 2.6 GAL or 9.8 LITERS

27.90 - 17.73 = 10.17 SAT SCREEN

18.78 + 5.01 = 23.79 DUTHRE



QA Samples Collected:

MS/MSD	Duplicate ID No.:	Signature(s):
✓	✓	

* PURGED ON 9/18/01

* SAMPLED ON 9/19/01

LOW FLOW PURGE DATA SHEET

PROJECT SITE NAME: NSWC Crane, IN
PROJECT NUMBER: 3959

WELL ID.: WES-1-5-81
DATE: 9-18-01

Time (Hrs.)	Water Level (Ft. below TOC)	Pump Rate (mL/Min.)	pH (S.U.)	S. Cond. (mS/cm)	Turb. (NTU)	DO (mg/L)	Temp. (Celcius)	ORP mV	Comments
1510	17.73	—	—	—	—	—	—	—	START PURGE
1520	19.26	75	6.34	2.324	2.3	1.67	15.76	227.5	750 mL (DROPPED BELOW TOP of screen)
1530	19.74	75	6.21	2.343	2.3	1.78	15.67	373 +	1,500 mL
1540	20.22	75	6.11	2.342	1.4	1.72	15.59	416.0	2,250 mL
1550	20.66	75	6.03	2.341	1.8	1.64	15.47	439.2	3,000 mL
1600	21.12	75	6.03	2.341	2.2	1.60	15.47	456.1	3,750 mL
1610	21.56	75	6.03	2.343	2.2	1.68	15.49	471.9	4,500 mL
1620	22.14	75	6.02	2.356	2.2	2.31	15.48	482.5	5,250 mL
1630	22.51	75	6.00	2.370	2.2	2.37	15.46	490.4	6,000 mL (DROPPED TO INTAKE,
1630	—	—	—	—	—	—	—	—	LOWER INTAKE AND PUMPING DRY)
1640	23.57	300	—	—	—	—	—	—	9,000 mL
1650	26.54	300	—	—	—	—	—	—	12,000 mL
1700	29.65	300	—	—	—	—	—	—	15,000 mL
1710	DRY	300	—	—	—	—	—	—	18,000 mL
		STOP				PURGE			
									*WILL SAMPLE ON 09/19/01
9/19/01 ← 0840	—	100	—	—	2.6	—	—	—	CHECKED TURB.

SIGNATURE: [signature]

GROUND WATER SAMPLE LOG FORM

Project Site Name: NSWC CRANE, IN
Project No.: CTO 158 N3959

Sample ID No.: 01GW0601
Sample Location: 01MW06
Sampled By: K. SIMPSON/K. MARRIONS
C.O.C. No.:

SAMPLING DATA:

	Color	pH	S.C.	Temp.	Turbidity	DO	ORP	Odor
Date 9/4/01	Visual	Standard	mS/cm	Degrees C	NTU	mg/l	mV	
Time-Start: 1625 End 1835								
Method: BLADDER, LOW FLOW	CLEAR	5.25	1.670	14.62	2.6	0.64	109.0	NONE

PURGE DATA:

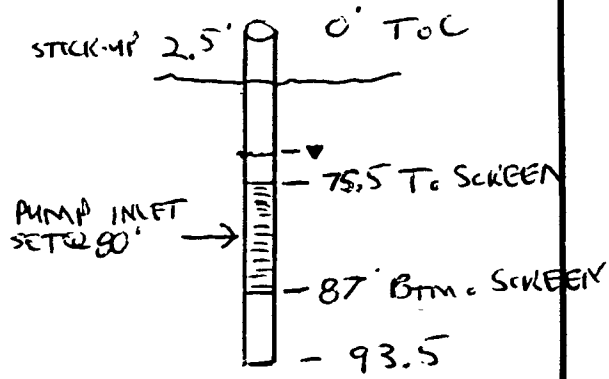
Date 09/04/01	Total Well Depth (TD) 93.5	End Purge (hrs). 1625
Method: BLADDER, LOW FLOW	Static Water Level (WL): 71.03	Total Purge Time (min): 140
Well Casing. 2" PVC	Start Purge (hrs): 1405	Total Vol. Purged (gal): 3.7
One Casing Volume(gal): 3.6		

SAMPLE COLLECTION INFORMATION:

Analysis	Preservative	Container Requirements	Collected
Appendix IX VOCs	HCl/4°C	(3) 40 ml VOA Vials	✓
Appendix IX SVOCs	4°C	(2) 1 L Amber Glass	✓
PNA	4°C	(2) 1 L Amber Glass	✓
Appendix IX Pesticides/PCBs	4°C	(2) 1 L Amber Glass	✓
Appendix IX Herbicides	4°C	(1) 1 L Amber Glass	✓
Explosives	4°C	(1) 1 L Amber Glass	✓
HD	4°C	(1) 40 ml VOA Vials	✓
TAL Total Metals, plus Sr and Sn	HNO_3/4°C	(1) 500 ml Polyethylene	✓
TAL Disolved Metals, plus Sr and Sn	HNO_3/4°C	(1) 500 ml Polyethylene	
Total Thorium Isotopes	HNO_3/4°C	(1) 1 L Amber Glass	✓
Dissolved Thorium Isotopes	HNO_3/4°C	(1) 1 L Amber Glass	
Gross Alfa/Gross Beta	HNO_3/4°C	(2) 1 L Amber Glass	✓
TOC	H_2SO_4/4°C	(1) 500 ml Polyethylene	✓
Note: Dissolved metals and dissolved thorium only collected if Turb. is >5 NTUs			NA

OBSERVATIONS / NOTES:

PID reading in PVC riser pipe = 0 (ppm)
PID reading in Breathing Zone = 0 (ppm)



QA Samples Collected:

MS/MSD	Duplicate ID No.:

Signature(s): [illegible]

LOW FLOW PURGE DATA SHEET

PROJECT SITE NAME: NSWC Crane, IN
PROJECT NUMBER: 3959

WELL ID.: 01MW06 [redacted] KM
DATE: 9/4/01

Time (Hrs.)	Water Level (Ft. below TOC)	Pump Rate (mL/Min.)	pH (S.U.)	S. Cond. (mS/cm)	Turb. (NTU)	DO (mg/L)	Temp. (Celcius)	ORP mV	Comments
1405	71.03								START PURGED
1415	71.39	100	6.11	1.702	80	4.03	16.54	27.03	1000ML
1425	71.42	100	5.28	1.689	45	1.78	15.28	22.7	2000ML (CLEAR)
1435	71.45	100	5.26	1.682	24	1.39	15.14	29.9	3000ML
1445	71.48	100	5.37	1.677	21	1.14	14.84	34.4	4000ML
1455	71.48	100	5.45	1.672	15	1.02	14.72	39.3	5000ML
1505	71.48	100	5.39	1.670	13	0.92	14.96	50.5	6000ML
1515	71.46	100	5.32	1.670	7.8	0.88	15.11	61.5	7000ML
1525	71.46	100	5.15	1.670	6.5	0.83	14.96	78.3	8000ML
1535	71.46	100	5.06	1.671	5.4	0.78	15.00	92.5	9000ML
1545	71.48	100	5.11	1.674	4.8	0.74	14.82	101.8	10,000ML
1555	71.49	100	5.21	1.670	3.4	0.71	14.67	107.3	11,000ML
1605	71.51	100	5.21	1.670	3.3	0.70	14.60	107.9	12,000ML
1615	71.51	100	5.24	1.670	2.7	0.69	14.61	108.0	13,000ML
1625	71.51	100	5.25	1.670	2.6	0.69	14.62	109.0	14,000ML
1625			END	PURGE		START	SAMPLING		

SIGNATURE: [signature]

GROUND WATER SAMPLE LOG FORM

Project Site Name	NSWC CRANE, IN	Sample ID No :	01-GW-07-01
Project No	CTO 158 N3959	Sample Location	WES-1-7-82
		Sampled By	K. MARINIS
		C.O.C No.	

SAMPLING DATA:

Date 9/18/01	Color	pH	S.C.	Temp.	Turbidity	DO	ORP	Odor
Time-Start 0955 End 1045	Visual	Standard	mS/cm	Degrees C	NTU	mg/l	mV	
Method PERISTALTIC	CLEAR	6.90	0.518	13.82	4.7	0.58	221.5	NONE

PURGE DATA:

Date 9-18-01	Total Well Depth (TD) 24.65	End Purge (hrs) 0955
Method PERISTALTIC	Static Water Level (WL) 17.55	Total Purge Time (min) 115
Well Casing 2" PVC	Start Purge (hrs) 0805	Total Vol. Purged (gal). 1.78
One Casing Volume(gal) 1.16		

SAMPLE COLLECTION INFORMATION:

Analysis	Preservative	Container Requirements	Collected
Appendix IX VOCs	HCl/4°C	(3) 40 ml VOA Vials	✓
Appendix IX SVOCs	4°C	(2) 1 L Amber Glass	
PNA	4°C	(2) 1 L Amber Glass	
Appendix IX Pesticides/PCBs	4°C	(2) 1 L Amber Glass	
Appendix IX Herbicides	4°C	(1) 1 L Amber Glass	
Explosives	4°C	(1) 1 L Amber Glass	
HD	4°C	(1) 40 ml VOA Vials	
TAL Total Metals, plus Sr and Sn	HNO_3/4°C	(1) 500 ml Polyethylene	✓
TAL Disolved Metals, plus Sr and Sn	HNO_3/4°C	(1) 500 ml Polyethylene	
Total Thorium Isotopes	HNO_3/4°C	(1) 1 L Amber Glass	
Dissolved Thorium Isotopes	HNO_3/4°C	(1) 1 L Amber Glass	
Gross Alfa/Gross Beta	HNO_3/4°C	(2) 1 L Amber Glass	✓
TOC	H_2SO_4/4°C	(1) 500 ml Polyethylene	
Note: Dissolved metals and dissolved thorium only collected if Turb. is >5 NTUs			NA

OBSERVATIONS / NOTES:

PID reading in PVC riser pipe = Ø (ppm)

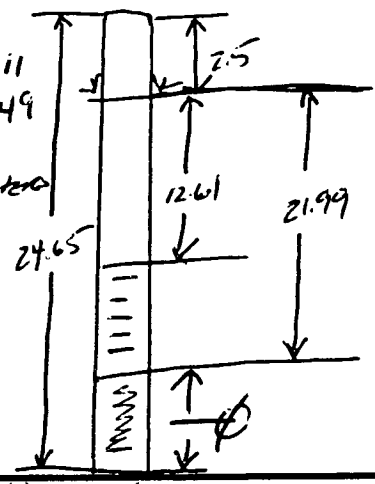
PID reading in Breathing Zone = Ø (ppm)

TOP of SCREEN = 15.11
BOTTOM of SCREEN = 24.49

24.65 - 17.55 = 7.1 x .163 = 1.16 gal or 4.38 Liters

24.49 - 17.55 = 6.94

17.55 + 3.49 = 21.02 INTAKE



QA Samples Collected:

MS/MSD	Duplicate ID No.:	Signature(s):

LOW FLOW PURGE DATA SHEET

PROJECT SITE NAME: NSWC Crane, IN
PROJECT NUMBER: 3959

WELL ID.: WES-1-7-82
DATE: 9-18 2001

Time (Hrs.)	Water Level (Ft. below TOC)	Pump Rate (mL/Min.)	pH (S.U.)	S. Cond. (mS/cm)	Turb. (NTU)	DO (mg/L)	Temp. (Celcius)	ORP mV	Comments
0805	17.55	—	—	—	—	—	—	—	START PURGE
0815	18.15	100	7.85	1.306	65	1.08	13.76	39.5	1000 mL
0825	18.37	75	7.60	0.890	60	0.99	13.81	73.0	1750 mL
0835	18.49	75	7.21	0.519	45	0.87	13.82	108.5	2,500 mL
0845	18.65	75	7.01	0.381	18	0.76	13.81	174.0	3,250 mL
0855	18.72	50	7.02	0.380	16	0.75	13.79	201.0	3,750 mL
0905	18.75	50	6.94	0.413	14	0.69	13.81	215.1	4,250 mL
0915	18.83	50	6.94	0.456	8.9	0.53	13.90	238.5	4,750 mL
0925	18.98	50	6.93	0.463	9.1	0.47	13.91	226.5	5,250 mL
0935	18.94	50	6.92	0.510	7.8	0.40	13.86	217.5	5,750 mL
0945	18.98	50	6.91	0.516	7.0	0.40	13.84	217.3	6,250 mL
0950	19.01	50	6.91	0.517	6.6	0.39	13.85	220.1	6,500 mL
0955	19.03	50	6.90	0.518	4.9	0.38	13.86	221.5	6,750 mL
0955	START SAMPLING								

SIGNATURE: [illegible]

GROUND WATER SAMPLE LOG FORM

Project Site Name	NSWC CRANE, IN	Sample ID No :	01-GW-08-01
Project No.	CTO 158 N3959	Sample Location	WES-1-8-02
		Sampled By:	K MARQUIS
		C O C No.	

SAMPLING DATA:

Date 9-18-01	Color	pH	S.C.	Temp.	Turbidity	DO	ORP	Odor
Time-Start 1305 End 1425	Visual	Standard	mS/cm	Degrees C	NTU	mg/l	mV	
Method PERISTALTIC	CLEAR	6.28	0.546	14.31	5.0	0.31	31.6	NONE

PURGE DATA:

Date 9-18-01	Total Well Depth (TD) 31.2	End Purge (hrs) 1305	
Method PERISTALTIC	Static Water Level (WL) 15.91	Total Purge Time (min) 120	
Well Casing 2" PVC	Start Purge (hrs) 1105	Total Vol Purged (gal) 2.64	
One Casing Volume(gal) 2.5			

SAMPLE COLLECTION INFORMATION:

Analysis	Preservative	Container Requirements	Collected
Appendix IX VOCs	HCl/4°C	(3) 40 ml VOA Vials	✓ x3
Appendix IX SVOCs	4°C	(2) 1 L Amber Glass	
PNA	4°C	(2) 1 L Amber Glass	
Appendix IX Pesticides/PCBs	4°C	(2) 1 L Amber Glass	
Appendix IX Herbicides	4°C	(1) 1 L Amber Glass	
Explosives	4°C	(1) 1 L Amber Glass	
HD	4°C	(1) 40 ml VOA Vials	
TAL Total Metals, plus Sr and Sn	HNO_3/4°C	(1) 500 ml Polyethylene	✓ x3
TAL Disolved Metals, plus Sr and Sn	HNO_3/4°C	(1) 500 ml Polyethylene	
Total Thorium Isotopes	HNO_3/4°C	(1) 1 L Amber Glass	
Dissolved Thorium Isotopes	HNO_3/4°C	(1) 1 L Amber Glass	
Gross Alfa/Gross Beta	HNO_3/4°C	(2) 1 L Amber Glass	✓ x3
TOC	H_2SO_4/4°C	(1) 500 ml Polyethylene	
Note: Dissolved metals and dissolved thorium only collected if Turb. is >5 NTUs			NA

OBSERVATIONS / NOTES:

PID reading in PVC riser pipe = ∅ (ppm)

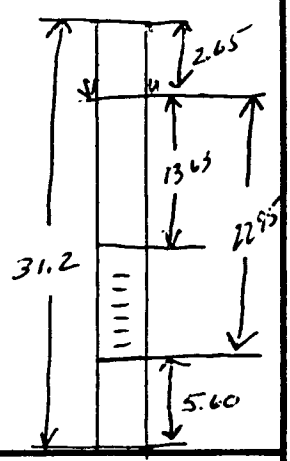
PID reading in Breathing Zone = ∅ (ppm)

TOP of screen = 16.28
BOTTOM of screen = 25.60

31.2 − 15.91 = 15.29 × .163 = 2.5 gal or 9.43 liters

25.60 − 15.91 = 9.69 SAT SCREEN

15.91 + 4.85 = 20.76 INTAKE



QA Samples Collected:

MS/MSD	Duplicate ID No.:	Signature(s):
YES	∅	

LOW FLOW PURGE DATA SHEET

PROJECT SITE NAME: NSWC Crane, IN
PROJECT NUMBER: 3959

WELL ID.: WES-1-S-82
DATE: 9-18-01

Time (Hrs.)	Water Level (Ft. below TOC)	Pump Rate (mL/Min.)	pH (S.U.)	S. Cond. (mS/cm)	Turb. (NTU)	DO (mg/L)	Temp. (Celcius)	ORP mV	Comments
1105	15.91	—	—	—	—	—	—	—	START PURGE
1115	15.91	100	6.82	0.564	30	0.68	14.37	46.9	1,000mL
1125	15.91	100	6.71	0.563	50	0.54	14.10	49.1	2,000mL
1135	15.91	100	6.61	0.557	34	0.49	14.41	47.7	3,000mL
1145	15.91	100	6.61	0.554	30	0.43	14.47	44.9	4,000mL
1155	15.41	100	6.55	0.552	30	0.40	14.36	44.1	5,000mL
1205	15.91	100	6.23	0.542	22	1.09	14.59	31.2	6,000mL (CLEANED FLOW THRU CELL)
1215	15.91	100	6.28	0.547	18	0.42	14.36	42.4	7,000mL
1225	15.91	100	6.28	0.547	15	0.40	14.40	39.3	8,000mL
1235	15.91	100	6.28	0.546	10	0.39	14.38	35.7	9,000mL
1240	15.91	100	6.28	0.546	8.7	0.39	14.39	39.1	9,500mL
1245	15.91	100	6.28	0.547	8.1	0.38	14.38	39.5	10,000mL
1255	15.91	100	6.28	0.546	7.1	0.39	14.39	39.2	11,000mL
1305	15.91	100	6.28	0.546	5.0	0.39	14.39	39.6	12,000mL
	STOP	PURGE				START	SAMPLING		
1425	15.91	600	—	—	—	—	—	—	PUMP TEST (START RUN)
1430	15.95	600	—	—	—	—	—	—	3,000mL
1435	15.97	600	—	—	—	—	—	—	6,000mL
1440	16.01	600	—	—	—	—	—	—	9,000mL (STOP PUMP)
1445	15.94	—	—	—	—	—	—	—	
1450	15.92	—	—	—	—	—	—	—	
1455	15.91	—	—	—	—	—	—	—	

SIGNATURE: [signature]

GROUND WATER SAMPLE LOG FORM

Project Site Name	NSWC CRANE, IN	Sample ID No	01-GW-09-01
Project No	CTO 158 N3959	Sample Location	WES-1-9-82
		Sampled By.	K MARQUIS
		C O.C No.	

SAMPLING DATA:

	Color	pH	S.C.	Temp.	Turbidity	DO	ORP	Odor
Date 9/7/01	Visual	Standard	mS/cm	Degrees C	NTU	mg/l	mV	
Time-Start 1155 End 1225								
Method BLADDER	Clear	4.41	0.272	15.40	4.8	0.71	618.1	NONE

PURGE DATA:

Date 9/7/01	Total Well Depth (TD) 35.00	End Purge (hrs) 1155
Method BLADDER	Static Water Level (WL) 20.32	Total Purge Time (min) 155
Well Casing 2" PVC	Start Purge (hrs) 0930	Total Vol. Purged (gal) 3.84
One Casing Volume(gal) 2.4		

SAMPLE COLLECTION INFORMATION:

Analysis	Preservative	Container Requirements	Collected
Appendix IX VOCs	HCl/4°C	(3) 40 ml VOA Vials	✓
Appendix IX SVOCs	4°C	(2) 1 L Amber Glass	
PNA	4°C	(2) 1 L Amber Glass	
Appendix IX Pesticides/PCBs	4°C	(2) 1 L Amber Glass	
Appendix IX Herbicides	4°C	(1) 1 L Amber Glass	
Explosives	4°C	(1) 1 L Amber Glass	
HD	4°C	(1) 40 ml VOA Vials	
TAL Total Metals, plus Sr and Sn	HNO_3/4°C	(1) 500 ml Polyethylene	✓
TAL Disolved Metals, plus Sr and Sn	HNO_3/4°C	(1) 500 ml Polyethylene	
Total Thorium Isotopes	HNO_3/4°C	(1) 1 L Amber Glass	
Dissolved Thorium Isotopes	HNO_3/4°C	(1) 1 L Amber Glass	
Gross Alfa/Gross Beta	HNO_3/4°C	(2) 1 L Amber Glass	✓
TOC	H_2SO_4/4°C	(1) 500 ml Polyethylene	
Note: Dissolved metals and dissolved thorium only collected if Turb. is >5 NTUs			NA

OBSERVATIONS / NOTES:

PID reading in PVC riser pipe = 35.1 (ppm)

PID reading in Breathing Zone = Ø (ppm)

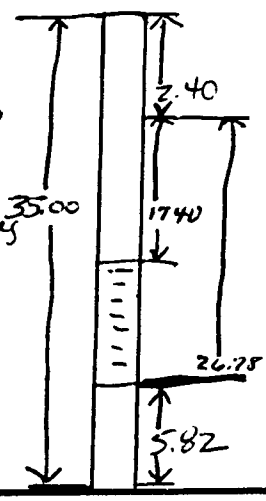
TOP of SCREEN = 19.80

BOTTOM of SCREEN = 29.18

35.00 − 20.32 = 14.68 X .163 = 24 gal or 9.1 liters

29.18 − 20.32 = 8.86 SAT SCREEN

19.80 + 4.69 = 24.49 INTAKE PLACEMENT



QA Samples Collected:

MS/MSD	Duplicate ID No.:

Signature(s):

LOW FLOW PURGE DATA SHEET

PROJECT SITE NAME: NSWC Crane, IN
PROJECT NUMBER: 3959

WELL ID.: WES-1-9-82
DATE: 9/7/01

Time (Hrs.)	Water Level (Ft. below TOC)	Pump Rate (mL/Min.)	pH (S.U.)	S. Cond. (mS/cm)	Turb. (NTU)	DO (mg/L)	Temp. (Celcius)	ORP mV	Comments
0930	20.32								START PURGE
0940	20.45	100	6.62	0.418	>1000	1.68	15.15	295.4	1000ML (BRN)
0950	20.68	100	5.73	0.344	270	1.17	14.86	458.8	2000ML (CLEARED FLOW THRU CELL)
1000	20.86	100	5.47	0.275	95	1.49	15.22	508.3	3,000ML
1010	21.00	100	5.28	0.268	50	1.17	15.17	533.3	4,000ML
1020	21.23	100	5.13	0.267	39	0.87	15.03	550.7	5,000ML
1030	21.38	100	4.99	0.266	27	0.88	15.07	564.5	6,000ML
1040	21.57	100	4.88	0.264	20	0.75	15.10	575.3	7,000ML
1050	21.67	100	4.86	0.265	20	0.77	15.20	580.0	8,000ML
1100	21.85	100	4.72	0.266	15	0.75	15.20	588.4	9,000ML
1110	22.00	100	4.62	0.267	13	0.75	15.34	595.4	10,000ML
1120	22.12	100	4.43	0.269	9.2	0.75	15.22	605.4	11,000ML
1130	22.22	100	4.42	0.271	8.4	0.74	15.51	609.4	12,000ML
1140	22.43	100	4.42	0.273	7.0	0.72	15.34	613.1	13,000ML
1150	22.53	100	4.41	0.272	5.1	0.71	15.40	617.5	14,000ML
1155	22.62	100	4.41	0.272	4.8	0.71	15.40	618.1	14,500ML
1155			STOP	PURGE			START	SAMPLING	

SIGNATURE: [signature]

GROUND WATER SAMPLE LOG FORM

Project Site Name: NSWC CRANE, IN
Project No.: CTO 158 N3959

9/8/01 - W.L. 26.69
Turb = 13

Sample ID No.: 01GW1001
Sample Location: WES-1-10-82
Sampled By: T. Rushan
C.O.C No.:

SAMPLING DATA:

Date 09-09-01	Color	pH	S.C.	Temp.	Turbidity	DO	ORP	Odor
Time-Start. 0855 End 0918	Visual	Standard	mS/cm	Degrees C	NTU	mg/l	mV	
Method SAME	CLEAR	6.33	0.698	21.09	8.9	0.72	71	None

PURGE DATA:

Date 09-07-01	Total Well Depth (TD) 43.5	End Purge (hrs) 1930
Method Bladder	Static Water Level (WL) 26.06	Total Purge Time (min) 240
Well Casing 2" PVC	Start Purge (hrs) 1010	Total Vol Purged (gal): 4.4
One Casing Volume(gal): 2.8		4Hr PURGE

SAMPLE COLLECTION INFORMATION:

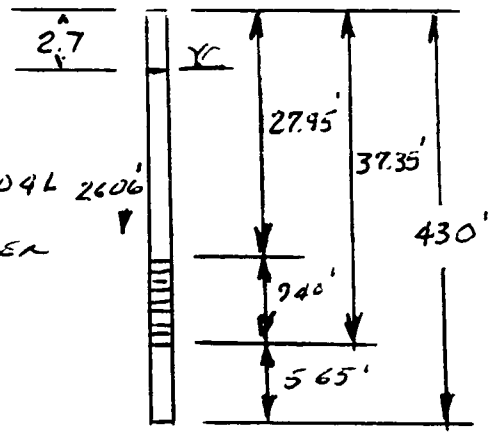
Analysis	Preservative	Container Requirements	Collected
Appendix IX VOCs	HCl/4°C	(3) 40 ml VOA Vials	✓
Appendix IX SVOCs	4°C	(2) 1 L Amber Glass	
PNA	4°C	(2) 1 L Amber Glass	
Appendix IX Pesticides/PCBs	4°C	(2) 1 L Amber Glass	
Appendix IX Herbicides	4°C	(1) 1 L Amber Glass	
Explosives	4°C	(1) 1 L Amber Glass	
HD	4°C	(1) 40 ml VOA Vials	
TAL Total Metals, plus Sr and Sn	HNO_3/4°C	(1) 500 ml Polyethylene	✓
TAL Disolved Metals, plus Sr and Sn	HNO_3/4°C	(1) 500 ml Polyethylene	✓
Total Thorium Isotopes	HNO_3/4°C	(1) 1 L Amber Glass	
Dissolved Thorium Isotopes	HNO_3/4°C	(1) 1 L Amber Glass	
Gross Alfa/Gross Beta	HNO_3/4°C	(2) 1 L Amber Glass	✓
TOC	H_2SO_4/4°C	(1) 500 ml Polyethylene	
Note: Dissolved metals and dissolved thorium only collected if Turb. is >5 NTUs			NA

OBSERVATIONS / NOTES:

PID reading in PVC riser pipe = 0.0 (ppm)
PID reading in Breathing Zone = 0.0 (ppm)

94 - 2 = 47'
27.95 + 4.7 = 32.65 Pump Intake
430' - 26.06 = 16.94 x 1.63 = 27.61 Gal 104L

Will sample after well recovers over night due to dropping water level below top of screen.



QA Samples Collected:

MS/MSD	Duplicate ID No.:

Signature(s): Tony Rush

LOW FLOW PURGE DATA SHEET

PROJECT SITE NAME: NSWC Crane, IN
PROJECT NUMBER: 3959

WELL ID.: WES-1-10-82
DATE: 9-07-01

Time (Hrs.)	Water Level (Ft. below TOC)	Pump Rate (mL/Min.)	pH (S.U.)	S. Cond. (mS/cm)	Turb. (NTU)	DO (mg/L)	Temp. (Celcius)	ORP mV	Comments
1010	26.06	—	—	—	—	—	—	—	Start Pump
1020	26.91	120	6.44	0.721	150	1.13	17.10	327	1200mL SI Cloudy
1030	27.14	40	6.47	0.725	130	1.27	18.98	337	1600ml " "
1040	27.43	60	6.37	0.723	110	1.28	19.69	352	2200ml " "
1050	27.66	60	6.42	0.723	70	1.44	20.20	362	2800ml " "
1100	27.80	60	6.46	0.724	60	1.43	20.58	365	3400ml " "
* 1110	27.95	50	6.52	0.723	60	1.39	20.82	366	3900ml " "
1120	27.78	—	—	—	—	—	—	—	Stop Pump MEAS 10min RECHARGE (.17
1130	27.64	—	—	—	—	—	—	—	RECHARGE (.14)
** 1140	27.86	50	6.59	0.738	50	1.54	21.30	339	4400ml CLEAR
1150	28.20	90	6.27	0.714	39	1.41	18.16	344	5300ml "
1200	28.25	90	6.18	0.702	28	1.27	17.93	354	6200ml "
1210	28.34	90	6.15	0.699	24	1.24	18.02	348	7100ml "
1220	28.43	90	6.12	0.697	21	1.21	18.13	342	8000ml "
1230	28.75	90	6.09	0.694	11	1.11	18.11	319	8900ml "
1240	29.05	90	6.08	0.693	9.6	1.04	18.02	286	9800ml "
1250	29.27	90	6.05	0.688	7.9	0.97	17.89	272	10700ml "
1300	29.38	90	6.04	0.690	7.8	0.90	18.31	231	11600ml "
1310	29.49	90	6.02	0.691	7.9	0.89	18.43	227	12500ml "
1320	29.78	90	6.00	0.685	8.7	0.83	18.47	206	13400ml "
1330	29.95	60	6.10	0.685	9.0	0.81	18.95	194	14000ml "
1340	30.16	65	6.12	0.685	11.0	0.84	19.16	172	14650ml "
1350	30.26	40	6.22	0.689	11	0.80	20.77	144	15050ml "
1400	30.32	42	6.32	0.695	8.7	0.77	21.61	114	15470ml "
1410	30.42	40	6.33	0.694	9.4	0.76	21.92	108	15870ml "
1420	30.50	44	6.33	0.700	11	0.75	21.71	84	16310ml "
1430	30.57	44	6.33	0.698	8.9	0.72	21.89	71	16750ml "
									4Hrs of Purging

SIGNATURE: [illegible]

* WATER LEVEL @ top of SCREEN
** TO EFFE[illegible]LY PURGE WELL - WILL CONTINUE PAGE [illegible]
to purge until stabilization & then Allow [illegible]

SAMPLE ID 01GW1101

NSWC Crane
Field Form
Revision 1
October 2000

GROUND WATER SAMPLE LOG FORM

Project Site Name	NSWC CRANE, IN	Sample ID No	WES-1-11-82
Project No.	CTO 158 N3959	Sample Location	WES-1-11-82
		Sampled By	KM/FW
		C O C No	

SAMPLING DATA:

	Color	pH	S.C.	Temp.	Turbidity	DO	ORP	Odor
Date 8/22/01	Visual	Standard	mS/cm	Degrees C	NTU	mg/l	mV	
Time-Start 1815 End 2020								
Method PERISTALIC	CLEAR	5.74	0.444	17.15	27	1.01	444.8	NONE

PURGE DATA:

Date 8/22/01	Total Well Depth (TD) 22.6	End Purge (hrs) 1813
Method PERISTALIC	Static Water Level (WL) 10.95	Total Purge Time (min) 240 min
Well Casing 2" PVC	Start Purge (hrs) 1413	Total Vol Purged (gal) 6.34 GAL.
One Casing Volume(gal) 1.9		

SAMPLE COLLECTION INFORMATION:

Analysis	Preservative	Container Requirements	Collected
Appendix IX VOCs	HCl/4°C	(3) 40 ml VOA Vials	✓
Appendix IX SVOCs	4°C	(2) 1 L Amber Glass	✓
PNA	4°C	(2) 1 L Amber Glass	✓
Appendix IX Pesticides/PCBs	4°C	(2) 1 L Amber Glass	✓
Appendix IX Herbicides	4°C	(1) 1 L Amber Glass	✓
Explosives	4°C	(1) 1 L Amber Glass	✓
HD	4°C	(1) 40 ml VOA Vials	✓
TAL Total Metals, plus Sr and Sn	HNO_3/4°C	(1) 500 ml Polyethylene	✓
TAL Disolved Metals, plus Sr and Sn	HNO_3/4°C	(1) 500 ml Polyethylene	✓
Total Thorium Isotopes	HNO_3/4°C	(1) 1 L Amber Glass	✓
Dissolved Thorium Isotopes	HNO_3/4°C	(1) 1 L Amber Glass	✓
Gross Alfa/Gross Beta	HNO_3/4°C	(2) 1 L Amber Glass	✓
TOC	H_2SO_4/4°C	(1) 500 ml Polyethylene	N/A
Note: Dissolved metals and dissolved thorium only collected if Turb is >5 NTUs			NA

OBSERVATIONS / NOTES:

PID reading in PVC riser pipe = Ø NA (ppm)
PID reading in Breathing Zone = Ø (ppm)
→ NO READINGS TAKEN KES

READING OF 0 PPM DURING DEVELOPMENT

QA Samples Collected:

MS/MSD	Duplicate ID No.:	Signature(s):

LOW FLOW PURGE DATA SHEET

PROJECT SITE NAME: NSWC Crane, IN
PROJECT NUMBER: 3959

WELL ID.: WES-1-11-82
DATE: 8/22/2001

Time (Hrs.)	Water Level (Ft. below TOC)	Pump Rate (mL/Min.)	pH (S.U.)	S. Cond. (mS/cm)	Turb. (NTU)	DO (mg/L)	Temp. (Celcius)	ORP mV	Comments
1413	10.95	100	—	—	—	—	—	—	START PURGE
1423	11.30	100	5.77	0.459	169	4.37	17.26	245.2	1,000 mL
1433	11.51	100	5.49	0.447	137	3.85	17.19	317.8	2000 mL
1443	11.75	100	4.97	0.275	111	3.59	17.45	342.7	3,000 mL
1453	12.28	100	4.78	0.239	87	3.99	17.94	418.9	4,000 mL
1503	12.84	100	4.69	0.233	67	3.92	18.36	457.8	5,000 mL
1513	13.62	100	4.39	0.253	44	3.57	18.67	473.5	6,000 mL
1523	13.92	100	4.58	0.279	37	3.05	18.28	430.9	7,000 mL
1533	14.03	100	4.14	0.290	40	3.04	18.22	485.5	8,000 mL
1543	14.17	100	4.25	0.310	42	1.98	19.82	494.0	9,000 mL
1553	14.23	100	3.89	0.325	42	1.92	19.06	512.9	10,000 mL
1603	14.00	100	3.89	0.325	38	1.72	19.05	522.3	11,000 mL
1613	14.16	100	2.50	0.350	36	1.64	19.40	548.3	12,000 mL
1623	14.39	100	2.51	0.356	35	1.28	17.59	556.3	13,000 mL
1633	14.56	100	3.40	0.355	32	1.40	18.19	528.7	14,000 mL
1643	14.66	100	4.02	0.368	33	1.41	18.49	484.7	15,000 mL
1653	14.78	100	4.56	0.378	33	1.35	18.29	457.0	16,000 mL
1703	14.92	100	5.03	0.388	36	0.38	17.65	457.2	17,000 mL
1713	15.04	100	5.20	0.396	36	0.89	17.20	434.6	18,000 mL
1723	15.22	100	5.42	0.412	38	1.02	17.40	432.0	19,000 mL
1733	15.44	100	5.49	0.421	37	1.03	17.12	435.9	20,000 mL
1743	15.14	100	5.89	0.421	36	0.93	17.85	433.9	21,000 mL
1753	15.31	100	5.71	0.434	27	0.89	17.20	436.3	22,000 mL
1803	15.48	100	5.69	0.435	26	0.91	17.20	440.5	23,000 mL
1813	15.61	100	5.74	0.444	27	1.01	17.15	444.8	24,000 mL
1815				START SAMPLING					

SIGNATURE:

GROUND WATER SAMPLE LOG FORM

Project Site Name	NSWC CRANE, IN	Sample ID No.	01GW1201
Project No	CTO 158 N3959	Sample Location	WES-1-12-81
		Sampled By	T ROJAHN
		C.O.C No.	

SAMPLING DATA:

Date 9/5/01	Color	pH	S.C.	Temp.	Turbidity	DO	ORP	Odor
Time-Start 1240 End 1347	Visual	Standard	mS/cm	Degrees C	NTU	mg/l	mV	
Method BLADDER	CLEAR	5.59	0.643	18.30	41	1.56	466	NONE

PURGE DATA:

Date 9-05-01	Total Well Depth (TD)	41.00	End Purge (hrs) 1235
Method BLADDER	Static Water Level (WL)	26.39	Total Purge Time (min) 180
Well Casing 2" PVC	Start Purge (hrs)	0935	Total Vol Purged (gal) 2.5
One Casing Volume(gal) 2.4			

SAMPLE COLLECTION INFORMATION:

Analysis	Preservative	Container Requirements	Collected
Appendix IX VOCs	HCl/4°C	(3) 40 ml VOA Vials	✓
Appendix IX SVOCs	4°C	(2) 1 L Amber Glass	
PNA	4°C	(2) 1 L Amber Glass	
Appendix IX Pesticides/PCBs	4°C	(2) 1 L Amber Glass	
Appendix IX Herbicides	4°C	(1) 1 L Amber Glass	
Explosives	4°C	(1) 1 L Amber Glass	
HD	4°C	(1) 40 ml VOA Vials	
TAL Total Metals, plus Sr and Sn	HNO_3/4°C	(1) 500 ml Polyethylene	✓
TAL Disolved Metals, plus Sr and Sn	HNO_3/4°C	(1) 500 ml Polyethylene	
Total Thorium Isotopes	HNO_3/4°C	(1) 1 L Amber Glass	
Dissolved Thorium Isotopes	HNO_3/4°C	(1) 1 L Amber Glass	
Gross Alfa/Gross Beta	HNO_3/4°C	(2) 1 L Amber Glass	✓
TOC	H_2SO_4/4°C	(1) 500 ml Polyethylene	
Note: Dissolved metals and dissolved thorium only collected if Turb. is >5 NTUs			NA

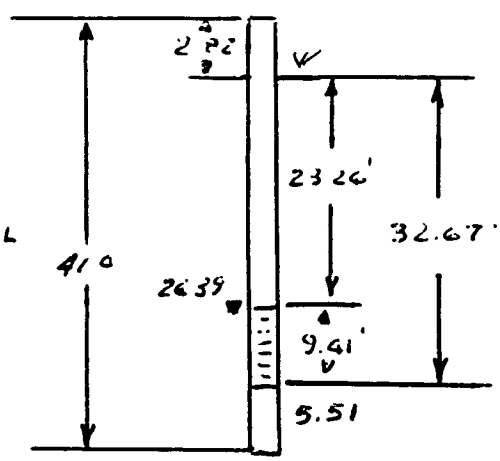
OBSERVATIONS / NOTES:

PID reading in PVC riser pipe = 0.0 (ppm)

PID reading in Breathing Zone = 0.0 (ppm)

Top of Screen : 26.08
Bottom " : 35.49
Intake @ 31.0'

41.0 - 26.39 = 14.61 x .163 = 2.4 gal or 9L



QA Samples Collected:

MS/MSD	Duplicate ID No.:

Signature(s): Tay Rojahn

LOW FLOW PURGE DATA SHEET

PROJECT SITE NAME: NSWC Crane, IN
PROJECT NUMBER: 3959

WELL ID.: WES 1-12-81
DATE: 09-05-01

Time (Hrs.)	Water Level (Ft below TOC)	Pump Rate (mL/Min.)	pH (S.U.)	S. Cond. (mS/cm)	Turb. (NTU)	DO (mg/L)	Temp. (Celcius)	ORP mV	Comments
		—	—	—	—	—	—	—	START PURGE
0935	26.39	100	6.69	0.692	90	2.81	14.79	317	1000ML SI CLOUDY
0945	26.51	50	6.72	0.687	75	2.64	15.76	338	1500ML " "
0955	26.58	50	6.74	0.685	55	2.58	16.53	354	2000ML CLEAR
1005	26.63	50	6.67	0.680	40	2.66	16.85	360	2500ML "
1015	26.68	50	5.85	0.679	32	2.62	18.07	404	3000ML SUN ON CELL
1025	26.74	50	5.75	0.676	28	2.57	17.86	428	3500ML CLEAR
1035	26.77	50	5.50	0.676	22	2.50	18.38	443	4000ML "
1045	26.82	50	5.65	0.672	15	2.29	17.78	457	4500ML "
1055	26.87	50	5.90	0.665	12	2.18	17.63	455	5000ML "
1105	26.92	50	6.11	0.662	10	2.10	17.66	452	5500ML "
1115	26.97	50	6.13	0.661	8.9	2.10	17.88	451	6000ML "
1125	26.98	50	5.81	0.659	7.9	1.98	18.03	455	6500ML "
1135	27.03	50	5.75	0.660	6.5	2.00	18.40	461	7000ML "
1145	27.06	50	5.51	0.660	6.4	1.83	18.87	473	7500ML "
1155	27.10	50	5.62	0.652	5.3	1.68	18.48	477	8000ML "
1205	27.13	50	5.90	0.649	4.6	1.66	18.27	433	8500ML "
1215	27.18	50	5.84	0.644	4.1	1.59	18.20	460	9000ML "
1225	27.22	50	5.87	0.643	4.1	1.56	18.30	466	9500ML "
1235	27.25	50							START SAMPLING
1240									

SIGNATURE: Troy Rogers

GROUND WATER SAMPLE LOG FORM

Project Site Name	NSWC CRANE, IN	Sample ID No	01GW1301
Project No	CTO 158 N3959	Sample Location	WES-1-13 BS
		Sampled By	T. RUMANN
		C O C. No..	

SAMPLING DATA:

	Color	pH	S.C.	Temp.	Turbidity	DO	ORP	Odor
Date 09-05-01	Visual	Standard	mS/cm	Degrees C	NTU	mg/l	mV	
Time-Start 1750 End 2020								
Method BLADDER	CLEAR	6.44	0.608	16.34	6.0	0.38	206	NONE

PURGE DATA:

Date 9-5-01	Total Well Depth (TD) 28.80	End Purge (hrs) 1745
Method BLADDER	Static Water Level (WL) 24.50	Total Purge Time (min) 240
Well Casing 2" PVC	Start Purge (hrs) 1445	Total Vol. Purged (gal) 6.3
One Casing Volume(gal) 2.3		

SAMPLE COLLECTION INFORMATION:

Analysis	Preservative	Container Requirements	Collected
Appendix IX VOCs	HCl/4°C	(3) 40 ml VOA Vials	✓
Appendix IX SVOCs	4°C	(2) 1 L Amber Glass	
PNA	4°C	(2) 1 L Amber Glass	
Appendix IX Pesticides/PCBs	4°C	(2) 1 L Amber Glass	
Appendix IX Herbicides	4°C	(1) 1 L Amber Glass	
Explosives	4°C	(1) 1 L Amber Glass	
HD	4°C	(1) 40 ml VOA Vials	
TAL Total Metals, plus Sr and Sn	HNO_3/4°C	(1) 500 ml Polyethylene	✓
TAL Disolved Metals, plus Sr and Sn	HNO_3/4°C	(1) 500 ml Polyethylene	✓
Total Thorium Isotopes	HNO_3/4°C	(1) 1 L Amber Glass	
Dissolved Thorium Isotopes	HNO_3/4°C	(1) 1 L Amber Glass	
Gross Alfa/Gross Beta	HNO_3/4°C	(2) 1 L Amber Glass	✓
TOC	H_2SO_4/4°C	(1) 500 ml Polyethylene	
Note: Dissolved metals and dissolved thorium only collected if Turb. is >5 NTUs			NA

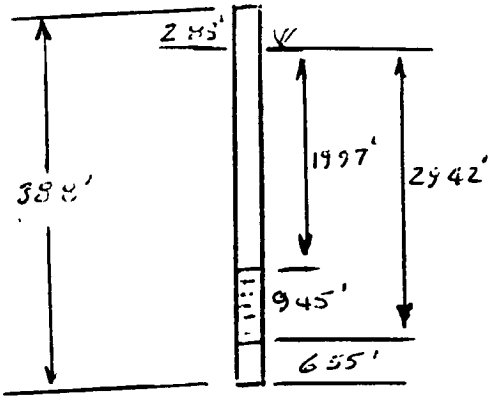
OBSERVATIONS / NOTES:

PID reading in PVC riser pipe = 0.0 (ppm)

PID reading in Breathing Zone = 0.0 (ppm)

TOP OF SCREEN = 22.80
BOTTOM " = 32.25'

38.8 - 24.5 = 14.3 x .163 = 2.3 gal / OZ & 8 OZ
32.25 - 24.5 = 7.75 SAT SCREEN
24.5 + 3.9 = 28.4 INTAKE MID SCREEN



QA Samples Collected:

MS/MSD	Duplicate ID No.:
—	FD090501 01 & -F

Signature(s): Terry Rogers

LOW FLOW PURGE DATA SHEET

PROJECT SITE NAME: NSWC Crane, IN
PROJECT NUMBER: 3959

WELL ID.: WES 1-13 83
DATE: 9-5-01

Time (Hrs.)	Water Level (Ft. below TOC)	Pump Rate (mL/Min.)	pH (S.U.)	S. Cond. (mS/cm)	Turb. (NTU)	DO (mg/L)	Temp. (Celcius)	ORP mV	Comments
1445	24.50	—	—	—	—	—	—	—	START PURGE
1455	24.60	100	6.37	0.369	220	2.53	16.66	320	1000ML BROWNISH TINT
1505	24.62	100	6.44	0.411	240	1.19	17.04	363	2000 " "
1515	24.62	100	5.94	0.645	150	0.71	15.60	402	3000 " "
1525	24.66	100	5.93	0.635	80	0.66	15.72	416	4000 V.SL Cloudy
1535	24.65	100	5.93	0.632	66	0.58	15.66	401	5000 " " "
1545	24.67	100	5.90	0.625	50	0.71	15.65	384	6000 CLEAR
* 1555	24.65	100	5.93	0.621	39	0.64	15.74	370	7000 "
1605	24.66	100	6.03	0.626	33	0.70	16.11	341	8000 "
1615	24.68	100	5.97	0.627	26	0.41	15.99	317	9000 "
1625	24.68	100	5.99	0.628	18	0.38	16.02	303	10000 "
1635	24.69	100	6.03	0.628	14	0.35	16.17	281	11000 "
1645	24.68	100	6.08	0.627	11	0.36	16.35	262	12000 "
1655	24.68	100	6.12	0.626	10	0.35	16.57	253	13000 "
1705	24.68	100	6.17	0.626	9.5	0.34	16.59	242	14000 "
1715	24.68	100	6.19	0.624	9.6	0.40	16.51	239	15000 "
1725	24.68	100	6.22	0.622	8.8	0.40	16.64	240	16000 "
1735	24.68	100	6.23	0.620	8.1	0.40	16.71	234	17000 "
1745	24.68	100	6.24	0.618	7.5	0.40	16.67	230	18000 "
1755	24.68	100	6.28	0.616	6.8	0.40	16.63	228	19000 "
1705	24.68	100	6.30	0.615	5.8	0.40	16.65	224	20000 "
1715	24.68	100	6.33	0.613	5.5	0.38	16.62	225	21000 "
1725	24.68	100	6.37	0.612	6.1	0.39	16.64	212	22000 "
1735	24.68	100	6.41	0.610	6.9	0.39	16.52	210	23000 "
1745	24.68	100	6.44	0.608	6.0	0.38	16.34	206	24000 "
1750									START SAMPLING

SIGNATURE: Terry Rogers

* CLEAN CELL

PAGE 2

GROUND WATER SAMPLE LOG FORM

Project Site Name	NSWC CRANE, IN	Sample ID No.	01GW1401
Project No	CTO 158 N3959	Sample Location	WES-1-14-03
		Sampled By	FW
		C O C No.	

SAMPLING DATA:

Date 8-24-01	Color	pH	S.C.	Temp.	Turbidity	DO	ORP	Odor
Time-Start 0800 End 0825	Visual	Standard	mS/cm	Degrees C	NTU	mg/l	mV	
Method LOW FLOW	CLEAR	6.50	1.47	16.50	4	0.09	-156	—

PURGE DATA:

Date 8-23-01	Total Well Depth (TD) 39	End Purge (hrs) 0800	
Method LOW FLOW	Static Water Level (WL) 16.17	Total Purge Time (min) 179	
Well Casing 2" PVC	Start Purge (hrs) 1338	Total Vol. Purged (gal) 4.7	
One Casing Volume(gal) 3.7			

SAMPLE COLLECTION INFORMATION:

Analysis	Preservative	Container Requirements	Collected
Appendix IX VOCs	HCl/4°C	(3) 40 ml VOA Vials	✓
Appendix IX SVOCs	4°C	(2) 1 L Amber Glass	
PNA	4°C	(2) 1 L Amber Glass	
Appendix IX Pesticides/PCBs	4°C	(2) 1 L Amber Glass	
Appendix IX Herbicides	4°C	(1) 1 L Amber Glass	
Explosives	4°C	(1) 1 L Amber Glass	
HD	4°C	(1) 40 ml VOA Vials	
TAL Total Metals, plus Sr and Sn	HNO_3/4°C	(1) 500 ml Polyethylene	✓
TAL Disolved Metals, plus Sr and Sn	HNO_3/4°C	(1) 500 ml Polyethylene	
Total Thorium Isotopes	HNO_3/4°C	(1) 1 L Amber Glass	
Dissolved Thorium Isotopes	HNO_3/4°C	(1) 1 L Amber Glass	
Gross Alfa/Gross Beta	HNO_3/4°C	(2) 1 L Amber Glass	✓
TOC	H_2SO_4/4°C	(1) 500 ml Polyethylene	
Note: Dissolved metals and dissolved thorium only collected if Turb. is >5 NTUs			NA

OBSERVATIONS / NOTES:

PID reading in PVC riser pipe =	48	(ppm)
PID reading in Breathing Zone =	0	(ppm)

PUMPED WATER LEVEL BELOW TOP OF SCREEN 8 23 01
STOPPED PURGE.
RESTART 8.24.00 PURGE & SAMPLE AS PER WP

QA Samples Collected:		Signature(s):
MS/MSD	Duplicate ID No.:	
—	—	

LOW FLOW PURGE DATA SHEET

PROJECT SITE NAME: NSWC Crane, IN
PROJECT NUMBER: 3959

WELL ID.: WES-1-14-83
DATE: 8-23-01

Time (Hrs.)	Water Level (Ft. below TOC)	Pump Rate (mL/Min.)	pH (S.U.)	S. Cond. (mS/cm)	Turb. (NTU)	DO (mg/L)	Temp. (Celcius)	ORP mV	Comments
1338	16.17								START
1348	17.61	100	5.88	1.58	66	0.89	18.63	-63.1	
1358	18.56	100	5.83	1.57	46	0.06	17.77	-107.5	
1408	19.63	100	5.88	1.51	40	0.07	17.40	-127.5	
1418	20.65	100	5.84	1.48	41	0.22	17.68	-137.8	
1428	21.45	100	5.81	1.46	34	0.24	17.90	-137	
1438	22.20	100	5.87	1.45	27	0.19	17.93	-132	
1448	22.85	100	5.70	1.42	19	0.11	17.72	-115	
1458	23.44	100	5.71	1.40	15	0.06	18.63	-114	
1508	23.45	100	5.73	1.38	17	0.02	18.10	-109	*STOP PURGING CLEANED CELL
1620	20.00	—	—	—	—	—	—	—	RESUME PURGING
1640	20.80	100	5.84	1.54	~~32~~ 19	0.34	-109	-17.68	
1650	21.75	100	5.70	1.45	14	0.04	17.27	-104	
1700	22.90	100	5.73	1.41	12	0.03	17.11	-101	
1710	23.20	100	5.81	1.39	11.7	0.06	17.03	-124	
1720	23.78	100	5.88	1.38	10	0.09	16.43	-124	
0721	16.45								START PURGING 8-24-01
0731	17.44	95	6.54	1.54	14	1.93	17.00	-77	
0736	17.83		6.56	1.50	11	0.41	16.68	-107	
0741	18.44		6.53	1.48	5	0.36	16.35	-137	
0746	18.97		6.56	1.48	4	0.23	16.32	-144	
0751	19.45		6.54	1.47	4	0.10	16.29	-149	
0756	20.08		6.54	1.47	4	0.13	16.42	-155	
0800	21.32		6.50	1.47	4	0.08	16.50	-156	

* WATER LEVEL @ TOP OF SCREEN (~24.1)

SIGNATURE: [illegible]

PAGE 2 OF 2

GROUND WATER SAMPLE LOG FORM

Project Site Name	NSWC CRANE, IN	Sample ID No	01-GW-15-01
Project No.	CTO 158 N3959	Sample Location	WES-1-15-83
		Sampled By	K MARQUIS
		C O.C. No	

SAMPLING DATA:

Date 9-5-01	Color	pH	S.C.	Temp.	Turbidity	DO	ORP	Odor
Time-Start 0945 End 1020	Visual	Standard	mS/cm	Degrees C	NTU	mg/l	mV	
Method BLADDER	Clear	6.59	1.352	14.74	3.9	0.70	75.2	None

PURGE DATA:

Date	9-5-01	Total Well Depth (TD)	40.0	End Purge (hrs)	0945
Method	BLADDER	Static Water Level (WL)	28.56	Total Purge Time (min)	70
Well Casing	2" PVC	Start Purge (hrs)	0835	Total Vol. Purged (gal)	1.86
One Casing Volume(gal)	1.86				

SAMPLE COLLECTION INFORMATION:

Analysis	Preservative	Container Requirements	Collected
Appendix IX VOCs	HCl/4°C	(3) 40 ml VOA Vials	✓
Appendix IX SVOCs	4°C	(2) 1 L Amber Glass	
PNA	4°C	(2) 1 L Amber Glass	
Appendix IX Pesticides/PCBs	4°C	(2) 1 L Amber Glass	
Appendix IX Herbicides	4°C	(1) 1 L Amber Glass	
Explosives	4°C	(1) 1 L Amber Glass	
HD	4°C	(1) 40 ml VOA Vials	
TAL Total Metals, plus Sr and Sn	HNO_3/4°C	(1) 500 ml Polyethylene	✓
TAL Disolved Metals, plus Sr and Sn	HNO_3/4°C	(1) 500 ml Polyethylene	
Total Thorium Isotopes	HNO_3/4°C	(1) 1 L Amber Glass	
Dissolved Thorium Isotopes	HNO_3/4°C	(1) 1 L Amber Glass	
Gross Alfa/Gross Beta	HNO_3/4°C	(2) 1 L Amber Glass	✓
TOC	H_2SO_4/4°C	(1) 500 ml Polyethylene	
Note: Dissolved metals and dissolved thorium only collected if Turb. is >5 NTUs			NA

OBSERVATIONS / NOTES:

PID reading in PVC riser pipe = 0.0 (ppm)

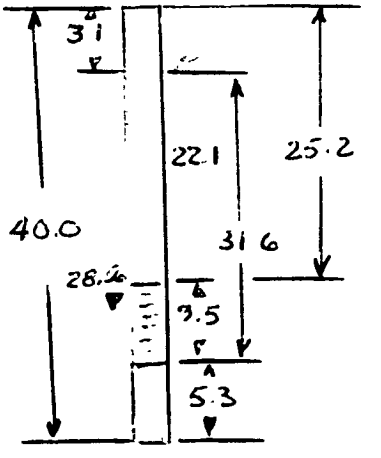
PID reading in Breathing Zone = 0.0 (ppm)

Top of Screen = 25.2
Bottom " = 34.7

6.14' of SAT screen

Pump Intake = 28.56 + 3.07 = 31.63'

40' - 28.56 = 11.44 x .163 = 1.86 gal or 7.1L



QA Samples Collected:

MS/MSD	Duplicate ID No.:	Signature(s):

LOW FLOW PURGE DATA SHEET

PROJECT SITE NAME: NSWC Crane, IN
PROJECT NUMBER: 3959

WELL ID.: 01MW15
DATE: 09/05/2001

Time (Hrs.)	Water Level (Ft. below TOC)	Pump Rate (mL/Min.)	pH (S.U.)	S. Cond. (mS/cm)	Turb. (NTU)	DO (mg/L)	Temp. (Celcius)	ORP mV	Comments
0830	28.56								START PURGE
0845	28.78	100	6.84	1.629	70	1.47	14.97	82.6	1,000 ML
0855	28.95	100	6.75	1.517	33	1.14	14.69	80.2	2,000 ML
0905	29.12	100	6.71	1.448	17	0.91	14.68	78.5	3,000 ML
0915	29.28	100	6.68	1.403	6.6	0.85	14.74	77.2	4,000 ML
0925	29.42	100	6.65	1.349	4.4	0.72	14.72	75.2	5,000 ML
0935	29.55	100	6.64	1.351	4.5	0.75	14.79	75.1	6,000 ML
0945	29.68	100	6.59	1.356	3.9	0.71	14.74	75.2	7,000 ML
0945		END PURGE					START SAMPLING		

SIGNATURE: [signature]

GROUND WATER SAMPLE LOG FORM

Project Site Name	NSWC CRANE, IN	Sample ID No.	01GW16 01
Project No	CTO 158 N3959	Sample Location	01MW16
		Sampled By	K. SIMPSON
		C O C No..	

SAMPLING DATA:

Date 9.5.01	Color	pH	S.C.	Temp.	Turbidity	DO	ORP	Odor
Time-Start End	Visual	Standard	mS/cm	Degrees C	NTU	mg/l	mV	
Method								

PURGE DATA:

Date	Total Well Depth (TD)	End Purge (hrs)
Method	Static Water Level (WL)	Total Purge Time (min)
Well Casing 2" PVC	Start Purge (hrs)	Total Vol Purged (gal)
One Casing Volume(gal)		

SAMPLE COLLECTION INFORMATION:

DRY SAMPLE NO

Analysis	Preservative	Container Requirements	Collected
Appendix IX VOCs	HCl/4°C	(3) 40 ml VOA Vials	
Appendix IX SVOCs	4°C	(2) 1 L Amber Glass	
PNA	4°C	(2) 1 L Amber Glass	
Appendix IX Pesticides/PCB	4°C	(1) 1 L Amber Glass	
Appendix IX Herbicides	4°C	(1) 1 L Amber Glass	
Explosives	4°C	(1) 1 L Amber Glass	
HD	4°C	(1) 40 ml VOA Vials	
TAL Total Metals plus V and Sn	HNO_3/4°C	(1) 500 ml Polyethylene	
TAL Dissolved Metals, plus V and Sn	HNO_3/4°C	(1) 500 ml Polyethylene	
Total Thorium Isotopes	HNO_3/4°C	(1) 1 L Amber Glass	
Dissolved Thorium Isotopes	HNO_3/4°C	(1) 1 L Amber Glass	
Gross Alfa/Gross Beta	HNO_3/4°C	(2) 1 L Amber Glass	
TOC	H_2SO_4/4°C	(1) 500 ml Polyethylene	
Note: Dissolved metals and dissolved thorium only collected if Turb. is >5 NTUs			NA

OBSERVATIONS / NOTES:

PID reading in PVC riser pipe =	0	(ppm)
PID reading in Breathing Zone =	0	(ppm)

9.5.01 @ 1905 DRY TO BTM

~~WEKS~~ BTM = 41.60' T PVC

QA Samples Collected:

MS/MSD	Duplicate ID No.:

Signature(s):

GROUND WATER SAMPLE LOG FORM

Project Site Name	NSWC CRANE, IN	Sample ID No :	01GW17 01
Project No .	CTO 158 N3959	Sample Location:	01-17
		Sampled By	RS
		C.O.C No.	

SAMPLING DATA:

	Color	pH	S.C.	Temp.	Turbidity	DO	ORP	Odor
Date 9.19.01	Visual	Standard	mS/cm	Degrees C	NTU	mg/l	mV	
Time-Start: 1430 End: 1823								
Method BLADDER low FLOW	CLEAR	5.54	0.524	16.5	3.7	2.82	474	NONE

PURGE DATA:

Date 9.19.01	Total Well Depth (TD)	41.00	End Purge (hrs) 1430
Method BLADDER low FLOW	Static Water Level (WL)	21.85	Total Purge Time (min) 115
Well Casing 2" PVC	Start Purge (hrs)	1235	Total Vol Purged (gal): 3.2
One Casing Volume(gal) 3.1			

SAMPLE COLLECTION INFORMATION:

Analysis	Preservative	Container Requirements	Collected
Appendix IX VOCs	HCl/4°C	(3) 40 ml VOA Vials	✓
Appendix IX SVOCs	4°C	(2) 1 L Amber Glass	✓
PNA	4°C	(2) 1 L Amber Glass	✓
Appendix IX Pesticides/PCBs	4°C	(2) 1 L Amber Glass	✓
Appendix IX Herbicides	4°C	(1) 1 L Amber Glass	✓
Explosives	4°C	(1) 1 L Amber Glass	✓
HD	4°C	(1) 40 ml VOA Vials	— SAMPLED 9.11.01
TAL Total Metals, plus Sr and Sn	HNO_3/4°C	(1) 500 ml Polyethylene	✓
TAL Disolved Metals, plus Sr and Sn	HNO_3/4°C	(1) 500 ml Polyethylene	— NA
Total Thorium Isotopes	HNO_3/4°C	(1) 1 L Amber Glass	✓
Dissolved Thorium Isotopes	HNO_3/4°C	(1) 1 L Amber Glass	— NA
Gross Alfa/Gross Beta	HNO_3/4°C	(2) 1 L Amber Glass	✓
TOC	H_2SO_4/4°C	(1) 500 ml Polyethylene	— NA
Note: Dissolved metals and dissolved thorium only collected if Turb is >5 NTUs			NA

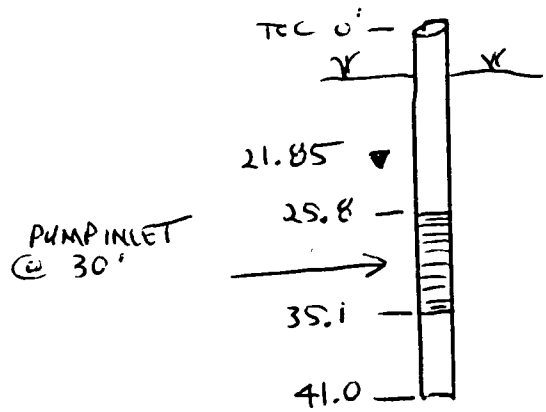
OBSERVATIONS / NOTES:

PID reading in PVC riser pipe =	0	(ppm)
PID reading in Breathing Zone =	0	(ppm)

2X VOL COLLECTED FOR DUP.

THIS WELL WAS SAMPLED 9.11.01, THE SAMPLES DID NOT REACH THE LAB DUE TO THE TERRORIST ATTACK ON THE U.S, 9/11 SAMPLES WERE PITCHED

3 WELLS TOTAL 17, 22 & 24 PITCHED



QA Samples Collected:

MS/MSD	Duplicate ID No.:	Signature(s):
—	YES FD091901 01	[illegible]

LOW FLOW PURGE DATA SHEET

PROJECT SITE NAME: NSWC Crane, IN
PROJECT NUMBER: 3959

WELL ID.: 01-17
DATE: 9.19.01

Time (Hrs.)	Water Level (Ft. below TOC)	Pump Rate (mL/Min.)	pH (S.U.)	S. Cond. (mS/cm)	Turb. (NTU)	DO (mg/L)	Temp. (Celcius)	ORP mV	PUMP RATE 200 FOR 1ST 5 MIN. Comments
1235	21.85	100							START PURGE
1240	22.35	105	6.98	1.090	198	9.65	16.8	291	
1250	22.35		6.09	0.833	96	4.36	15.2	357	
1300	22.22		6.02	0.826	28	3.92	16.1	379	
1310	22.28		5.98	0.827	25	3.61	16.2	402	
1320	22.30		5.51	0.833	16	3.40	16.4	423	
1330			5.53	0.828	13	3.20	16.4	449	
1340			5.52	0.828	11	3.07	16.5	458	
1350			5.52	0.826	10	2.98	16.5	465	
1400	22.32		5.51	0.825	9.2	2.91	16.5	469	
1410	22.30		5.51	0.824	8.0	2.91	16.5	469	
1420			5.52	0.824	6.4	2.81	16.4	473	
1425			5.53	0.823	4.0	2.81	16.5	473	
1430			5.54	0.824	3.7	2.82	16.5	474	END PURGE
1825	22.50	650							START "MINI" PUMP TES
1830	23.38								
1835	23.97								STOP PUMP
1840	23.00	0							
1845	22.67								
1850	22.50								

SIGNATURE: [illegible]

GROUND WATER SAMPLE LOG FORM

Project Site Name: NSWC CRANE, IN
Project No: CTO 158 N3959

Sample ID No.: 01-GW-18-01
Sample Location: WCS-1-18-83
Sampled By: M. MARKUS
C.O.C. No.:

SAMPLING DATA:

	Color	pH	S.C.	Temp.	Turbidity	DO	ORP	Odor
Date 9/20/01	Visual	Standard	mS/cm	Degrees C	NTU	mg/l	mV	
Time-Start 0745 End 1000								
Method PERISTALTIC	CLEAR	6.94	0.768	16.77	31	0.86	93.8	NONE

PURGE DATA:

Date 9/19/01	Total Well Depth (TD) 32.0	End Purge (hrs) 1252
Method PERISTALTIC	Static Water Level (WL) 15.35	Total Purge Time (min). 132
Well Casing 2" PVC	Start Purge (hrs) 1040	Total Vol. Purged (gal): 11.9
One Casing Volume(gal) 2.7		

SAMPLE COLLECTION INFORMATION:

Analysis	Preservative	Container Requirements	Collected
Appendix IX VOCs	HCl/4°C	(3) 40 ml VOA Vials	✓ 9/20/01
Appendix IX SVOCs	4°C	(2) 1 L Amber Glass	✓ 9/20/01
PNA	4°C	(2) 1 L Amber Glass	✓ 9/20/01
Appendix IX Pesticides/PCBs	4°C	(2) 1 L Amber Glass	✓ 9/20/01
Appendix IX Herbicides	4°C	(1) 1 L Amber Glass	✓ 9/20/01
Explosives	4°C	(1) 1 L Amber Glass	✓ 9/20/01
HD	4°C	(1) 40 ml VOA Vials	✓ 9/20/01
TAL Total Metals, plus Sr and Sn	HNO_3/4°C	(1) 500 ml Polyethylene	✓ 9/20/01
TAL Disolved Metals, plus Sr and Sn	HNO_3/4°C	(1) 500 ml Polyethylene	✓ 9/20/01
Total Thorium Isotopes	HNO_3/4°C	(1) 1 L Amber Glass	✓ 9/20/01
Dissolved Thorium Isotopes	HNO_3/4°C	(1) 1 L Amber Glass	✓ 9/20/01
Gross Alfa/Gross Beta	HNO_3/4°C	(2) 1 L Amber Glass	✓ 9/20/01
TOC	H_2SO_4/4°C	(1) 500 ml Polyethylene	—
Note: Dissolved metals and dissolved thorium only collected if Turb. is >5 NTUs			NA

OBSERVATIONS / NOTES:

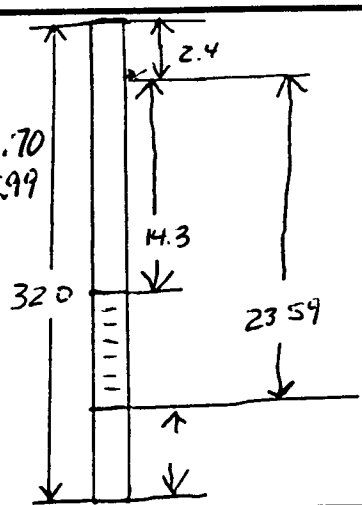
PID reading in PVC riser pipe = Ø (ppm)
PID reading in Breathing Zone = Ø (ppm)

TOP of SCREEN = 16.70
BOTTOM of SCREEN = 25.99

32 − 15.35 = 16.65 x .163 = 2.71 GAL OR 10.3 LITERS

25.99 − 15.35 = 10.64 SAT SCREEN

16.70 + 5.35 = 22.05 INTAKE



QA Samples Collected:

MS/MSD: ✓
Duplicate ID No.:

Signature(s):

* PURGED ON 9/19/01

* SAMPLED ON 9/20/01

LOW FLOW PURGE DATA SHEET

PROJECT SITE NAME: NSWC Crane, IN
PROJECT NUMBER: 3959

WELL ID.: WES-1-18-83
DATE: 9/19/01

Time (Hrs.)	Water Level (Ft. below TOC)	Pump Rate (mL/Min.)	pH (S.U.)	S. Cond. (mS/cm)	Turb. (NTU)	DO (mg/L)	Temp. (Celcius)	ORP mV	Comments
1040	15.35	—	—	—	—	—	—	—	START PURGE
1050	15.61	90	7.09	0.763	21	1.27	16.97	80.7	900 mL
1100	15.91	90	7.18	0.763	50	0.82	16.83	91.4	1,800 mL
1110	16.04	80	7.09	0.765	45	0.69	16.92	95.0	2,600 mL
1120	16.33	80	7.00	0.764	50	0.67	16.84	97.3	3,400 mL
1130	16.47	80	7.00	0.763	45	0.71	16.93	95.3	4,260 mL
1140	16.64	75	6.95	0.771	39	2.75	16.78	64.2	4,950 mL (Cleaned Flow Thru Cell)
1150	16.79	75	6.94	0.768	50	0.86	16.77	93.8	5,700 mL (Fell Below Top of Screen)
1150	—	—	—	—	—	—	—	—	(Stop Pump to Let Recover)
1200	16.69	—	—	—	—	—	—	—	" " " "
1210	16.63	—	—	—	—	—	—	—	(Not Recovering Will Pump Dry)
1220	20.03	940	—	—	—	—	—	—	15,100 mL
1230	22.25	940	—	—	—	—	—	—	24,500 mL
1240	26.78	940	—	—	—	—	—	—	33,900 mL
1250	30.21	940	—	—	—	—	—	—	43,300 mL
1252	DRY	940	—	—	—	—	—	—	45,180 mL
1252			STOP	PURGE					
9/20/01 → 0910	—	—	—	—	31	—	—	—	Checked Turb.

SIGNATURE: [signature]

GROUND WATER SAMPLE LOG FORM

Project Site Name	NSWC CRANE, IN	Sample ID No.	01GW1901
Project No	CTO 158 N3959	Sample Location	01-19
		Sampled By	KS
		C O C No..	

SAMPLING DATA:

Date 9-18-01	Color	pH	S.C.	Temp.	Turbidity	DO	ORP	Odor
Time-Start 1520 End 1610	Visual	Standard	mS/cm	Degrees C	NTU	mg/l	mV	
Method BLADDER	CLEAR	6.43	1.162	16.8	3.4	2.07	434	NONE

PURGE DATA:

Date 9-18-01	Total Well Depth (TD) 32.7	End Purge (hrs) 1510
Method: BLADDER - low flow	Static Water Level (WL) 22.04	Total Purge Time (min) 240
Well Casing 2" PVC	Start Purge (hrs) 1110	Total Vol Purged (gal). 4.4
One Casing Volume(gal) 1.7		

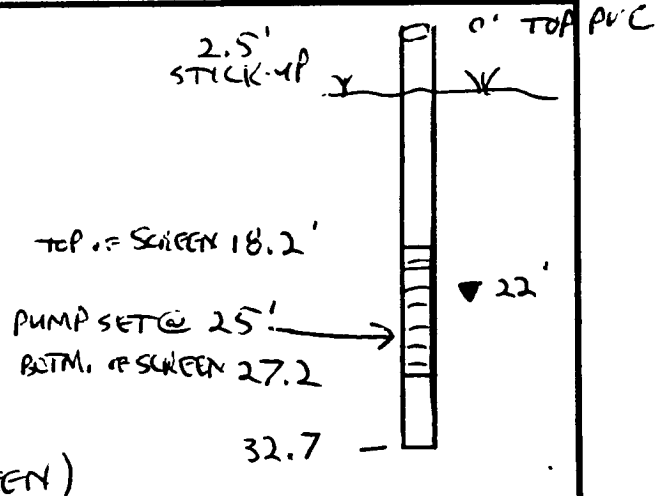
SAMPLE COLLECTION INFORMATION:

Analysis	Preservative	Container Requirements	Collected
Appendix IX VOCs	HCl/4°C	(3) 40 ml VOA Vials	✓
Appendix IX SVOCs	4°C	(2) 1 L Amber Glass	
PNA	4°C	(2) 1 L Amber Glass	
Appendix IX Pesticides/PCBs	4°C	(2) 1 L Amber Glass	
Appendix IX Herbicides	4°C	(1) 1 L Amber Glass	
Explosives	4°C	(1) 1 L Amber Glass	
HD	4°C	(1) 40 ml VOA Vials	
TAL Total Metals, plus Sr and Sn	HNO_3/4°C	(1) 500 ml Polyethylene	✓
TAL Disolved Metals, plus Sr and Sn	HNO_3/4°C	(1) 500 ml Polyethylene	
Total Thorium Isotopes	HNO_3/4°C	(1) 1 L Amber Glass	
Dissolved Thorium Isotopes	HNO_3/4°C	(1) 1 L Amber Glass	
Gross Alfa/Gross Beta	HNO_3/4°C	(2) 1 L Amber Glass	✓
TOC	H_2SO_4/4°C	(1) 500 ml Polyethylene	
Note: Dissolved metals and dissolved thorium only collected if Turb. is >5 NTUs			NA

OBSERVATIONS / NOTES:

PID reading in PVC riser pipe =	10.0	(ppm)
PID reading in Breathing Zone =	0	(ppm)

PURGED 4 HRS & SAMPLED AS PER FSP



QA Samples Collected:

MS/MSD	Duplicate ID No.:

Signature(s): [signature]

LOW FLOW PURGE DATA SHEET

PROJECT SITE NAME: NSWC Crane, IN
PROJECT NUMBER: 3959

WELL ID.: 01-19
DATE: 9-18-01

Time (Hrs.)	Water Level (Ft. below TOC)	Pump Rate (mL/Min.)	pH (S.U.)	S. Cond. (mS/cm)	Turb. (NTU)	DO (mg/L)	Temp. (Celcius)	ORP mV	Comments
1110	22.04	100	—	—	—	—	—	—	START PURGE
1120	22.33	100	6.67	1.204	78	5.05	16.2	275	NO ODOR, CLOUDY
1130	22.59	90	6.46	1.175	80	4.27	16.4	324	
1140	22.85	75	6.43	1.171	82	4.24	16.2	349	
1150	23.06	75	6.45	1.170	75	4.24	16.5	361	
1155	23.18	75	6.47	1.172	70	4.22	16.6	366	
1200	23.25	75	6.48	1.173	57	4.19	16.7	368	
1210	23.47	75	6.46	1.174	42	4.02	16.8	377	
1220	23.65	75	6.45	1.175	35	3.83	16.8	384	
1230	23.78	70	6.42	1.175	29	3.77	16.7	390	
1240	23.87	70	6.40	1.173	22	3.69	16.7	396	
1250	24.00	70	6.39	1.173	16	3.61	16.7	401	CLEARING
1300	24.13	70	6.38	1.174	11	3.46	16.8	405	
1310	24.22	70	6.40	1.175	7.6	3.39	16.8	409	
1320	24.31	70	6.40	1.175	6.6	3.29	16.8	412	
1330	24.44	70	6.39	1.173	6.2	3.15	16.8	414	
1340	24.48	70	6.36	1.172	4.6	3.08	16.8	419	
1345	24.53	70	6.32	1.170	4.6	3.01	16.8	422	
1355	24.58	70	6.34	1.170	4.8	2.91	16.8	425	
1405	24.67	70	6.35	1.166	3.9	2.77	16.8	427	
1415	24.74	70	6.36	1.167	2.9	2.57	16.9	429	
1425	24.79	70	6.39	1.166	2.2	2.38	16.9	431	
1435	24.89	70	6.41	1.164	2.2	2.20	16.9	430	
1445	24.92	70	6.41	1.162	2.2	2.14	16.9	432	
1455	24.95	70	6.42	1.161	2.6	2.11	16.9	433	
1505	25.01	70	6.43	1.162	3.4	2.07	16.9	434	END PURGE 1510
									STOP PUMP TO CHECK
									RECHARGE
									24.76' @ 1520

SIGNATURE: [illegible]

GROUND WATER SAMPLE LOG FORM

Project Site Name	NSWC CRANE, IN	Sample ID No	016W2001
Project No	CTO 158 N3959	Sample Location	01-20
		Sampled By	RS
		C O.C No.	

SAMPLING DATA:

	Color	pH	S.C.	Temp.	Turbidity	DO	ORP	Odor
Date 9.20.01	Visual	Standard	mS/cm	Degrees C	NTU	mg/l	mV	
Time-Start 1020 End 1630								
Method: BLADDER LOW FLOW	CLEAR	7.14	1.567	15.0	11	2.67	327	NONE

PURGE DATA:

Date 9.19.01	Total Well Depth (TD) 34.0	End Purge (hrs) 1140
Method BLADDER, LOW FLOW	Static Water Level (WL) 29.05	Total Purge Time (min) 36
Well Casing. 2" PVC	Start Purge (hrs) 1104	Total Vol Purged (gal) 0.8
One Casing Volume(gal) 0.8		

SAMPLE COLLECTION INFORMATION:

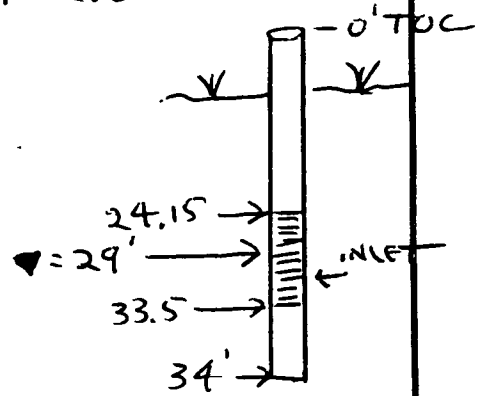
Analysis	Preservative	Container Requirements	Collected
Appendix IX VOCs	HCl/4°C	(3) 40 ml VOA Vials	✓
Appendix IX SVOCs	4°C	(2) 1 L Amber Glass	
PNA	4°C	(2) 1 L Amber Glass	
Appendix IX Pesticides/PCBs	4°C	(2) 1 L Amber Glass	
Appendix IX Herbicides	4°C	(1) 1 L Amber Glass	
Explosives	4°C	(1) 1 L Amber Glass	
HD	4°C	(1) 40 ml VOA Vials	
TAL Total Metals, plus Sr and Sn	HNO_3/4°C	(1) 500 ml Polyethylene	✓
TAL Disolved Metals, plus Sr and Sn	HNO_3/4°C	(1) 500 ml Polyethylene	✓
Total Thorium Isotopes	HNO_3/4°C	(1) 1 L Amber Glass	
Dissolved Thorium Isotopes	HNO_3/4°C	(1) 1 L Amber Glass	
Gross Alfa/Gross Beta	HNO_3/4°C	(2) 1 L Amber Glass	✓
TOC	H_2SO_4/4°C	(1) 500 ml Polyethylene	
Note: Dissolved metals and dissolved thorium only collected if Turb is >5 NTUs			NA

OBSERVATIONS / NOTES:

PID reading in PVC riser pipe = 0 (ppm)
PID reading in Breathing Zone = 0 (ppm)

STICK-UP = 2.8'

9.20.01 @ 1015 WL = 29.38
9.20.01 @ 1030 TURB = 11.6
DRY @ 1044 - STOP PUMP
RESTART @ 1615 WL = 30.82
21.5 L EACH TIME



PUMP INLET @ 32.5'

QA Samples Collected:		Signature(s):
MS/MSD	Duplicate ID No.:	

PURGED 9.19.01
SAMPLED 9.20.01

LOW FLOW PURGE DATA SHEET

PROJECT SITE NAME: NSWC Crane, IN
PROJECT NUMBER: 3959

WELL ID.: 01-20
DATE: 9-19-01

Time (Hrs.)	Water Level (Ft. below TOC)	Pump Rate (mL/Min.)	pH (S.U.)	S. Cond. (mS/cm)	Turb. (NTU)	DO (mg/L)	Temp. (Celcius)	ORP mV	Comments
1109	29.05	100							START PURGE
1110	29.40	80	7.32	1.709	36	4.76	15.6	268	CLEAR, NO ODOR
1120	30.62	80	7.21	1.623	16	2.49	14.9	305	
1130	31.72	80	7.16	1.579	11	2.20	14.9	320	
1140	32.50	80	7.14	1.567	11	2.67	15.0	327	DRY TO PUMP INLET
									END PURGE

SIGNATURE: [illegible]

INLET 32.5'

GROUND WATER SAMPLE LOG FORM

Project Site Name	NSWC CRANE, IN	Sample ID No	01-GW-21-01
Project No	CTO 158 N3959	Sample Location	WES-1-21-83
		Sampled By	R MARQUIS
		C.O.C. No.	

SAMPLING DATA:

Date 9/5/01	Color	pH	S.C.	Temp.	Turbidity	DO	ORP	Odor
Time-Start 1400 End 1435	Visual	Standard	mS/cm	Degrees C	NTU	mg/l	mV	
Method Bladder Pump/Low Flow	CLEAR	5.61	1.100	14.73	4.2	1.19	28.1	NONE

PURGE DATA:

Date 9/5/01	Total Well Depth (TD) 43.7	End Purge (hrs) 1400
Method Bladder Pump/Low Flow	Static Water Level (WL) 17.65	Total Purge Time (min) 165
Well Casing 2" PVC	Start Purge (hrs) 1115	Total Vol Purged (gal) 4.36
One Casing Volume(gal): 4.25		

SAMPLE COLLECTION INFORMATION:

Analysis	Preservative	Container Requirements	Collected
Appendix IX VOCs	HCl/4°C	(3) 40 ml VOA Vials	✓
Appendix IX SVOCs	4°C	(2) 1 L Amber Glass	
PNA	4°C	(2) 1 L Amber Glass	
Appendix IX Pesticides/PCBs	4°C	(2) 1 L Amber Glass	
Appendix IX Herbicides	4°C	(1) 1 L Amber Glass	
Explosives	4°C	(1) 1 L Amber Glass	
HD	4°C	(1) 40 ml VOA Vials	
TAL Total Metals, plus Sr and Sn	HNO_3/4°C	(1) 500 ml Polyethylene	✓
TAL Disolved Metals, plus Sr and Sn	HNO_3/4°C	(1) 500 ml Polyethylene	
Total Thorium Isotopes	HNO_3/4°C	(1) 1 L Amber Glass	
Dissolved Thorium Isotopes	HNO_3/4°C	(1) 1 L Amber Glass	
Gross Alfa/Gross Beta	HNO_3/4°C	(2) 1 L Amber Glass	✓
TOC	H_2SO_4/4°C	(1) 500 ml Polyethylene	
Note: Dissolved metals and dissolved thorium only collected if Turb. is >5 NTUs			NA

OBSERVATIONS / NOTES:

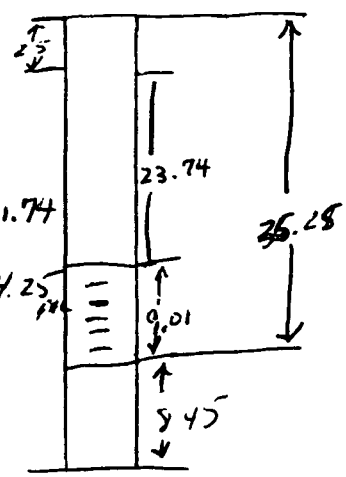
PID reading in PVC riser pipe = 1.7 (ppm)

PID reading in Breathing Zone = Ø (ppm)

TOP of SCREEN = 26.24
BOTTOM " = 35.25

PUMP INTAKE = 26.24 + 4.5 = 31.74

43.7 − 17.65 = 26.05 x .163 = 4.25



QA Samples Collected:

MS/MSD	Duplicate ID No.:	Signature(s):

LOW FLOW PURGE DATA SHEET

PROJECT SITE NAME: NSWC Crane, IN
PROJECT NUMBER: 3959

WELL ID.: NES-1-21-83
DATE: 9/5/01

Time (Hrs.)	Water Level (Ft. below TOC)	Pump Rate (mL/Min.)	pH (S.U.)	S. Cond. (mS/cm)	Turb. (NTU)	DO (mg/L)	Temp. (Celcius)	ORP mV	Comments
1115	17.65								START PURGE
1125	18.51	100	6.59	1.192	130	9.50	15.76	25.3	1,000 mL
1135	18.79	100	6.14	1.190	55	7.32	15.16	25.8	2,000 mL
1145	18.87	100	6.09	1.189	30	6.10	15.19	30.5	3,000 mL
1155	18.94	100	6.05	1.186	25	5.28	15.15	33.8	4,000 mL
1205	18.99	100	5.95	1.174	19	4.37	15.11	33.6	5,000 mL
1215	18.99	100	5.92	1.167	13	3.15	15.20	33.0	6,000 mL
1225	19.01	100	5.84	1.153	13	2.80	15.06	30.7	7,000 mL
1235	19.11	100	5.77	1.148	10	1.72	15.06	30.1	8,000 mL
1245	19.16	100	5.72	1.135	10	1.78	14.98	28.5	9,000 mL
1255	19.11	100	5.68	1.125	10	1.55	14.95	28.5	10,000 mL
1305	19.19	100	5.70	1.109	7.4	1.89	14.99	30.1	11,000 mL
1315	19.22	100	5.60	1.115	4.5	1.42	14.85	31.0	12,000 mL
1325	19.22	100	5.53	1.110	4.5	1.28	14.63	28.2	13,000 mL
1335	19.22	100	5.57	1.103	4.4	1.20	14.74	28.2	14,000 mL
1345	19.22	100	5.59	1.102	4.1	1.19	14.73	28.1	15,000 mL
1355	19.22	100	5.60	1.101	4.1	1.18	14.74	28.3	16,000 mL
1400	19.22	100	5.61	1.100	4.2	1.19	14.73	28.1	16,500 mL
1400	STOP PURGE				START SAMPLING				

SIGNATURE: [signature]

GROUND WATER SAMPLE LOG FORM

Project Site Name	NSWC CRANE, IN	Sample ID No	01-GW-22-01
Project No	CTO 158 N3959	Sample Location	WES-1-22-85
		Sampled By	K MARQUIS
		C O.C. No.:	

SAMPLING DATA:

Date 9/19/01	Color	pH	S.C.	Temp.	Turbidity	DO	ORP	Odor
Time-Start: 1630 End 1700	Visual	Standard	mS/cm	Degrees C	NTU	mg/l	mV	
Method PERISTALIC	CLEAR	6.41	1.281	16.46	1.7	1.55	511.0	NONE

PURGE DATA:

Date 9/19/01	Total Well Depth (TD) 38.00	End Purge (hrs): 1630
Method PERISTALIC	Static Water Level (WL) 19.14	Total Purge Time (min) 180
Well Casing 2" PVC	Start Purge (hrs) 1330	Total Vol. Purged (gal): 3.25
One Casing Volume(gal): 3.07		

SAMPLE COLLECTION INFORMATION:

Analysis	Preservative	Container Requirements	Collected
Appendix IX VOCs	HCl/4°C	(3) 40 ml VOA Vials	✓
Appendix IX SVOCs	4°C	(2) 1 L Amber Glass	
PNA	4°C	(2) 1 L Amber Glass	
Appendix IX Pesticides/PCBs	4°C	(2) 1 L Amber Glass	
Appendix IX Herbicides	4°C	(1) 1 L Amber Glass	
Explosives	4°C	(1) 1 L Amber Glass	
HD	4°C	(1) 40 ml VOA Vials	
TAL Total Metals, plus Sr and Sn	HNO_3/4°C	(1) 500 ml Polyethylene	✓
TAL Disolved Metals, plus Sr and Sn	HNO_3/4°C	(1) 500 ml Polyethylene	
Total Thorium Isotopes	HNO_3/4°C	(1) 1 L Amber Glass	
Dissolved Thorium Isotopes	HNO_3/4°C	(1) 1 L Amber Glass	
Gross Alfa/Gross Beta	HNO_3/4°C	(2) 1 L Amber Glass	✓
TOC	H_2SO_4/4°C	(1) 500 ml Polyethylene	
Note. Dissolved metals and dissolved thorium only collected if Turb. is >5 NTUs			NA

OBSERVATIONS / NOTES:

PID reading in PVC riser pipe = 1.5 (ppm)

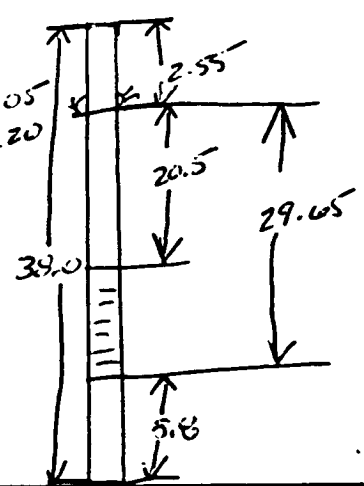
PID reading in Breathing Zone = Ø (ppm)

Top of screen = 23.05
Bottom of screen = 32.20

38.0 − 19.14 = 18.86 × .163 = 3.07 GAL OR 11.63 LITERS

32.20 − 19.14 = 13.06 SAT SCREEN

23.05 + 6.53 = 29.58 DUTAGE



QA Samples Collected:

MS/MSD	Duplicate ID No.:	Signature(s):

LOW FLOW PURGE DATA SHEET

PROJECT SITE NAME: NSWC Crane, IN
PROJECT NUMBER: 3959

WELL ID.: WES-1-22-83
DATE: 9/19/01

Time (Hrs.)	Water Level (Ft. below TOC)	Pump Rate (mL/Min.)	pH (S.U.)	S. Cond. (mS/cm)	Turb. (NTU)	DO (mg/L)	Temp. (Celcius)	ORP mV	Comments
1330	19.14	—	—	—	—	—	—	—	START PURGE
1340	19.92	100	6.42	1.303	8.9	3.21	17.08	294.1	1000mL
1350	19.82	50	6.06	1.307	4.9	3.16	17.95	377.5	1500mL
1400	19.81	50	6.50	1.308	4.1	2.44	18.25	433.5	2000mL
1410	19.81	50	6.50	1.308	5.5	2.15	18.21	451.0	2500mL
1420	19.81	50	6.50	1.308	4.9	2.04	18.00	476.9	3,000mL
1430	19.83	50	6.50	1.305	7.2	1.95	17.87	480.6	3500mL
1440	19.81	50	6.49	1.302	4.5	1.89	17.79	481.5	4,000mL
1450	19.81	50	6.50	1.304	3.7	1.90	17.71	481.7	4500mL
1500	19.81	50	6.50	1.300	3.6	1.88	17.72	486.5	5,000mL
1510	19.79	50	6.50	1.298	3.8	1.86	17.73	495.5	5,500mL
1520	19.78	50	6.50	1.296	3.2	1.34	17.74	499.0	6,000 mL
1530	19.93	90	6.49	1.291	2.2	1.81	16.94	503.5	6,900mL
1540	20.00	90	6.41	1.281	2.5	1.69	16.54	511.1	7,800mL
1550	20.04	90	6.41	1.283	2.2	1.63	16.51	512.5	8,700mL
1600	20.10	90	6.40	1.279	1.7	1.58	16.42	512.4	9,600mL
1610	20.12	90	6.40	1.279	1.7	1.57	16.41	513.0	10,500mL
1620	20.11	90	6.41	1.281	1.7	1.53	16.45	512.0	11,400mL
1630	20.12	90	6.41	1.281	1.7	1.55	16.46	511.0	12,300mL
1630				STOP	PURGE				

SIGNATURE: [signature]

GROUND WATER SAMPLE LOG FORM

Project Site Name	NSWC CRANE, IN	Sample ID No	01-GW-23-01
Project No	CTO 158 N3959	Sample Location	WES-1-23-83
		Sampled By	K. MARQUIS
		C O C No.	

SAMPLING DATA:

	Color	pH	S.C.	Temp.	Turbidity	DO	ORP	Odor
Date 9/7/01	Visual	Standard	mS/cm	Degrees C	NTU	mg/l	mV	
Time-Start 0810 End 0850								
Method BLADDER	CLEAR	4.99	2.161	17.79	30	1.58	433.2	NONE

PURGE DATA:

Date 9/6/01	Total Well Depth (TD) 48.00	End Purge (hrs) 1640
Method BLADDER	Static Water Level (WL) 39.69	Total Purge Time (min): 75
Well Casing 2" PVC	Start Purge (hrs) 1525	Total Vol Purged (gal): 1.6
One Casing Volume(gal): 1.4		

SAMPLE COLLECTION INFORMATION:

Analysis	Preservative	Container Requirements	Collected
Appendix IX VOCs	HCl/4°C	(3) 40 ml VOA Vials	✓ 9/7/01
Appendix IX SVOCs	4°C	(2) 1 L Amber Glass	
PNA	4°C	(2) 1 L Amber Glass	
Appendix IX Pesticides/PCBs	4°C	(2) 1 L Amber Glass	
Appendix IX Herbicides	4°C	(1) 1 L Amber Glass	
Explosives	4°C	(1) 1 L Amber Glass	
HD	4°C	(1) 40 ml VOA Vials	
TAL Total Metals, plus Sr and Sn	HNO_3/4°C	(1) 500 ml Polyethylene	✓ 9/7/01
TAL Disolved Metals, plus Sr and Sn	HNO_3/4°C	(1) 500 ml Polyethylene	✓ 9/7/01
Total Thorium Isotopes	HNO_3/4°C	(1) 1 L Amber Glass	
Dissolved Thorium Isotopes	HNO_3/4°C	(1) 1 L Amber Glass	
Gross Alfa/Gross Beta	HNO_3/4°C	(2) 1 L Amber Glass	✓ 9/7/01
TOC	H_2SO_4/4°C	(1) 500 ml Polyethylene	
Note: Dissolved metals and dissolved thorium only collected if Turb. is >5 NTUs			NA

OBSERVATIONS / NOTES:

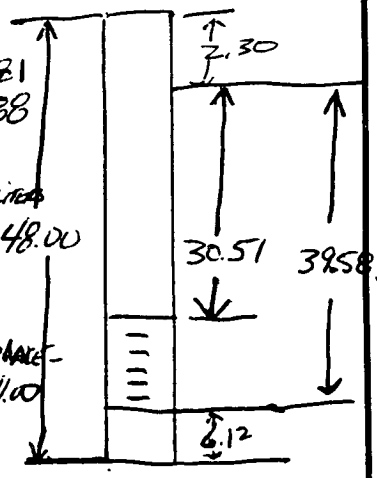
PID reading in PVC riser pipe =	0	(ppm)
PID reading in Breathing Zone =	0	(ppm)

TOP of SCREEN = 32.81
Bottom " " = 41.88

48.00 - 39.69 = 8.31 x .163 = 1.4 GAL OR 5.22 LITERS

41.88 - 39.69 = 2.19 SAT SCREEN

32.81 + 4.54 = 37.35 + 4.53 = 41.88 = INTAKE PLACEMENT @ 41.00



QA Samples Collected:		Signature(s):
MS/MSD	Duplicate ID No.:	

* PURGED DRY ON 09/06/2001

* SAMPLED ON 09/07/2001

LOW FLOW PURGE DATA SHEET

PROJECT SITE NAME: NSWC Crane, IN
PROJECT NUMBER: 3959

WELL ID.: WES-1-23-83
DATE: 9/6/01

Time (Hrs.)	Water Level (Ft. below TOC)	Pump Rate (mL/Min.)	pH (S.U.)	S. Cond. (mS/cm)	Turb. (NTU)	DO (mg/L)	Temp. (Celcius)	ORP mV	Comments
1525	34.69								START PURGE
1535	40.01	100	5.39	2.186	60	2.87	17.80	496.8	1000mL
1545	40.33	100	4.74	2.184	26	1.96	16.41	535.5	2000mL
1555	40.91	100	4.80	2.181	20	1.61	16.36	457.0	3000mL
1600	No Reading	25	4.99	2.161	30	1.58	17.99	433.2	3,125mL (DROPPED below screen)
									STOP PUMP)
1605	41.99								LOWERED PUMP INTO
									SUMP AND PURGED ALL
									WATER
1640									PURGED DRY: TOTAL=6,000mL
									STOPPED

SIGNATURE: [signature]

GROUND WATER SAMPLE LOG FORM

Project Site Name	NSWC CRANE, IN	Sample ID No	01-GW-24-01
Project No.	CTO 158 N3959	Sample Location	WES-24-BS
		Sampled By	K. MARLINS
		C O.C No.	

SAMPLING DATA:

	Color	pH	S.C.	Temp.	Turbidity	DO	ORP	Odor
Date 9/20/01	Visual	Standard	mS/cm	Degrees C	NTU	mg/l	mV	
Time-Start 1455 End 1534								
Method PORTABLE	CLEAR	6.69	0.674	15.02	2.0	0.54	76.5	NONE

PURGE DATA:

Date 9/20/01	Total Well Depth (TD) 33.4	End Purge (hrs) 1455
Method PORTABLE	Static Water Level (WL) 14.92	Total Purge Time (min) 160
Well Casing 2" PVC	Start Purge (hrs) 1155	Total Vol. Purged (gal) 3.09
One Casing Volume(gal)		

SAMPLE COLLECTION INFORMATION:

Analysis	Preservative	Container Requirements	Collected
Appendix IX VOCs	HCl/4°C	(3) 40 ml VOA Vials	✓
Appendix IX SVOCs	4°C	(2) 1 L Amber Glass	
PNA	4°C	(2) 1 L Amber Glass	
Appendix IX Pesticides/PCBs	4°C	(2) 1 L Amber Glass	
Appendix IX Herbicides	4°C	(1) 1 L Amber Glass	
Explosives	4°C	(1) 1 L Amber Glass	
HD	4°C	(1) 40 ml VOA Vials	
TAL Total Metals, plus Sr and Sn	HNO_3/4°C	(1) 500 ml Polyethylene	✓
TAL Disolved Metals, plus Sr and Sn	HNO_3/4°C	(1) 500 ml Polyethylene	
Total Thorium Isotopes	HNO_3/4°C	(1) 1 L Amber Glass	
Dissolved Thorium Isotopes	HNO_3/4°C	(1) 1 L Amber Glass	
Gross Alfa/Gross Beta	HNO_3/4°C	(2) 1 L Amber Glass	✓
TOC	H_2SO_4/4°C	(1) 500 ml Polyethylene	
Note: Dissolved metals and dissolved thorium only collected if Turb. is >5 NTUs			NA

OBSERVATIONS / NOTES:

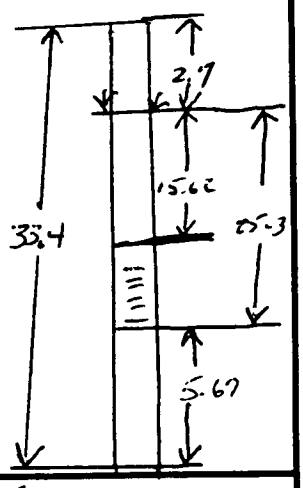
PID reading in PVC riser pipe =	9.8	(ppm)
PID reading in Breathing Zone =	Ø	(ppm)

TOP of SCREEN = 18.32
BOTTOM of SCREEN = 27.73

33.4 − 14.92 = 18.48 × .163 = 3.01 or 11.4 LITERS

27.73 − 14.92 = 12.81 SAT SCREEN

18.32 + 4.61 = 22.93 SAND SCREEN INTAKE



QA Samples Collected:

MS/MSD	Duplicate ID No.:

Signature(s):

LOW FLOW PURGE DATA SHEET

PROJECT SITE NAME: NSWC Crane, IN
PROJECT NUMBER: 3959

WELL ID.: WES-1-24-93
DATE: 9/20/01

Time (Hrs.)	Water Level (Ft. below TOC)	Pump Rate (mL/Min.)	pH (S.U.)	S. Cond. (mS/cm)	Turb. (NTU)	DO (mg/L)	Temp. (Celcius)	ORP mV	Comments
1155	14.92	—	—	—	—	—	—	—	START PURGE
1205	16.24	120	6.65	0.570	9.9	1.74	17.03	228.6	1,200mL
1215	16.53	70	6.30	0.591	9.1	1.32	17.45	384.9	1,900mL
1225	16.98	70	6.43	0.595	6.7	0.84	17.41	75.4	2,600mL
1235	17.24	70	6.57	0.639	5.6	0.70	17.24	33.9	3,300mL
1245	17.55	70	6.77	0.676	4.0	0.63	16.52	68.0	4,000mL
1255	17.69	70	6.67	0.680	2.4	0.60	15.96	74.1	4,700mL
1305	17.84	70	6.65	0.691	1.6	0.55	15.78	80.9	5,400mL
1315	17.98	70	6.64	0.689	2.1	0.54	15.52	81.3	6,100mL
1325	18.04	70	6.65	0.691	3.2	0.50	15.37	72.8	6,800mL
1335	18.15	70	6.65	0.692	2.0	0.48	15.41	78.8	7,500mL
1345	18.22	70	6.65	0.690	2.2	0.46	15.26	79.2	8,200mL
1355	18.28	70	6.63	0.688	2.2	0.45	15.37	72.0	8,900mL
1405	18.37	70	6.61	0.684	2.2	0.44	15.26	76.0	9,600mL (FELL BELOW TOP OF SCREEN
1420	17.48	—	—	—	—	—	—	—	(CUT OFF pump for Recovery)
1425	17.22	—	—	—	—	—	—	—	(LET Recover for 20min)(START Purge)
1435	17.86	70	6.69	0.678	2.0	0.58	15.60	81.3	10,300mL
1445	18.02	70	6.70	0.679	1.2	0.56	15.05	79.1	11,000mL
1455	18.20	70	6.69	0.679	2.0	0.54	15.02	78.5	11,700mL
STOP PURGE						START SAMPLING			

SIGNATURE:

GROUND WATER SAMPLE LOG FORM

Project Site Name	NSWC CRANE, IN	Sample ID No	01GW125 01
Project No	CTO 158 N3959	Sample Location	WES-1-25-83
		Sampled By	T. ROSAHN
		C.O.C No	

2.44

SAMPLING DATA:

Date 9-8-01	Color	pH	S.C.	Temp.	Turbidity	DO	ORP	Odor
Time-Start 1315 End 1720	Visual	Standard	mS/cm	Degrees C	NTU	mg/l	mV	
Method SAME	CLEAR	6.40	1.284	20.58	5.0	0.74	433	NA

PURGE DATA:

Date 9-8-01	Total Well Depth (TD) 34.2	End Purge (hrs) 1310	
Method BLADDER	Static Water Level (WL) 21.51	Total Purge Time (min) 160	
Well Casing 2" PVC	Start Purge (hrs) 1030	Total Vol Purged (gal) 32	
One Casing Volume(gal) 2.1			

SAMPLE COLLECTION INFORMATION:

Analysis	Preservative	Container Requirements	Collected
Appendix IX VOCs	HCl/4°C	(3) 40 ml VOA Vials	✓
Appendix IX SVOCs	4°C	(2) 1 L Amber Glass	✓
PNA	4°C	(2) 1 L Amber Glass	✓
Appendix IX Pesticides/PCBs	4°C	(2) 1 L Amber Glass	✓
Appendix IX Herbicides	4°C	(1) 1 L Amber Glass	✓
Explosives	4°C	(1) 1 L Amber Glass	✓
HD	4°C	(1) 40 ml VOA Vials	✓
TAL Total Metals, plus Sr and Sn	HNO_3/4°C	(1) 500 ml Polyethylene	✓
TAL Disolved Metals, plus Sr and Sn	HNO_3/4°C	(1) 500 ml Polyethylene	
Total Thorium Isotopes	HNO_3/4°C	(1) 1 L Amber Glass	✓
Dissolved Thorium Isotopes	HNO_3/4°C	(1) 1 L Amber Glass	
Gross Alfa/Gross Beta	HNO_3/4°C	(2) 1 L Amber Glass	✓
TOC	H_2SO_4/4°C	(1) 500 ml Polyethylene	
Note: Dissolved metals and dissolved thorium only collected if Turb. is >5 NTUs			NA

OBSERVATIONS / NOTES:

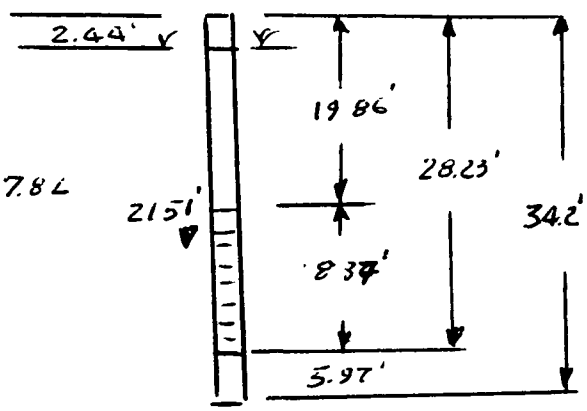
PID reading in PVC riser pipe = 0.0 (ppm)

PID reading in Breathing Zone = 0.0 (ppm)

28.23 - 21.51 = 6.72 - 2.44 = 3.36

21.51 + 3.36 = 24.87 Pump Intake

34.2' - 21.51' = 12.69 x .163 = 2.1 gal or 7.8 L



QA Samples Collected:

MS/MSD	Duplicate ID No.:
—	

Signature(s): Tyler

LOW FLOW PURGE DATA SHEET

PROJECT SITE NAME: NSWC Crane, IN
PROJECT NUMBER: 3959

WELL ID.: WES-1-25-83
DATE: 9-8-01

Time (Hrs.)	Water Level (Ft. below TOC)	Pump Rate (mL/Min.)	pH (S.U.)	S. Cond. (mS/cm)	Turb. (NTU)	DO (mg/L)	Temp. (Celcius)	ORP mV	Comments
1030	21.51	—	—	—	—	—	—	—	Start Purge
1040	21.64	180	6.56	1.297	450	1.63	19.33	276	1800 mL Turbidity
1050	21.83	100	6.33	1.295	350	1.20	18.53	361	2800 "
1100	22.00	80	6.32	1.302	220	1.24	20.19	379	3600 "
1110	22.07	80	6.33	1.309	150	1.13	20.41	391	4400 Sl. Cloudy
1120	22.13	80	6.33	1.315	90	1.05	20.64	402	5200 " "
1130	22.17	60	6.40	1.307	60	0.95	20.45	407	6000 V. Sl. Cloudy
1140	22.23	65	6.44	1.305	40	1.09	20.66	408	6450 CLEAR
1150	22.26	60	6.41	1.306	25	1.07	20.97	411	7050 "
1200	22.26	60	6.44	1.303	18	0.87	20.82	416	7650 "
1210	22.28	60	6.44	1.308	20	1.05	20.25	411	8250 "
1220	22.31	68	6.34	1.295	14	0.82	20.18	423	8930 "
1230	22.32	60	6.34	1.294	12	0.92	20.51	427	9530 "
1240	22.35	63	6.34	1.294	10	0.76	20.49	430	10160 "
1250	22.33	60	6.36	1.294	7.3	0.68	20.38	431	10760 "
1300	22.36	60	6.37	1.291	5.8	0.66	20.52	432	11360 "
1310	22.37	60	6.40	1.283	5.0	0.74	20.58	433	11960 "
1315									Start Sampling

SIGNATURE: Terry Rogers

GROUND WATER SAMPLE LOG FORM

Project Site Name	NSWC CRANE, IN	Sample ID No.	01-GW-26-01
Project No	CTO 158 N3959	Sample Location	WES-1-26-03
	SEE PG 2	Sampled By	K MARQUIS
		C O.C No	

SAMPLING DATA:

	Color	pH	S.C.	Temp.	Turbidity	DO	ORP	Odor
Date 9/6/01	Visual	Standard	mS/cm	Degrees C	NTU	mg/l	mV	
Time-Start 1250 End. 1325								
Method Bladder	Clear	0.10	1.428	17.10	24	0.75	593.9	NONE

→ USE 7.00

PURGE DATA:

Date 9/6/01	Total Well Depth (TD) 58.00	End Purge (hrs) 1250	
Method Bladder	Static Water Level (WL) 36.64	Total Purge Time (min) 240	
Well Casing 2" PVC	Start Purge (hrs) 0850	Total Vol Purged (gal) 6.01	
One Casing Volume(gal) 3.5			

SAMPLE COLLECTION INFORMATION:

Analysis	Preservative	Container Requirements	Collected
Appendix IX VOCs	HCl/4°C	(3) 40 ml VOA Vials	✓
Appendix IX SVOCs	4°C	(2) 1 L Amber Glass	
PNA	4°C	(2) 1 L Amber Glass	
Appendix IX Pesticides/PCBs	4°C	(2) 1 L Amber Glass	
Appendix IX Herbicides	4°C	(1) 1 L Amber Glass	
Explosives	4°C	(1) 1 L Amber Glass	
HD	4°C	(1) 40 ml VOA Vials	
TAL Total Metals, plus Sr and Sn	HNO_3/4°C	(1) 500 ml Polyethylene	✓
TAL Disolved Metals, plus Sr and Sn	HNO_3/4°C	(1) 500 ml Polyethylene	✓
Total Thorium Isotopes	HNO_3/4°C	(1) 1 L Amber Glass	
Dissolved Thorium Isotopes	HNO_3/4°C	(1) 1 L Amber Glass	
Gross Alfa/Gross Beta	HNO_3/4°C	(2) 1 L Amber Glass	✓
TOC	H_2SO_4/4°C	(1) 500 ml Polyethylene	
Note: Dissolved metals and dissolved thorium only collected if Turb is >5 NTUs			NA

OBSERVATIONS / NOTES:

PID reading in PVC riser pipe = 20.1 (ppm)

PID reading in Breathing Zone = Ø (ppm)

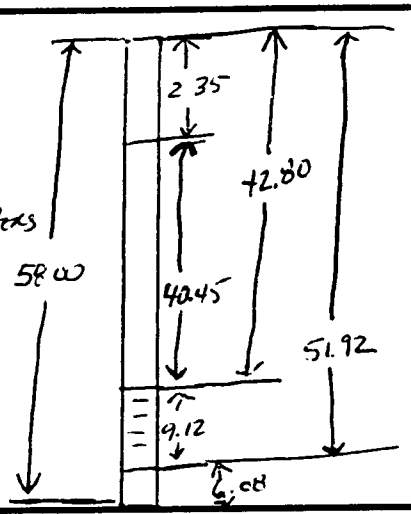
Top of SCREEN = 42.80

Bottom of SCREEN = 51.92

58.00 - 36.64 = 21.36 X .163 = 3.5 gal or 13.2 liters

42.80 + 4.56 = 47.36 PUMP INTAKE

51.92 - 36.64 = 15.78 SAT. SCREEN



QA Samples Collected:

MS/MSD	Duplicate ID No.:	Signature(s):

LOW FLOW PURGE DATA SHEET

PROJECT SITE NAME: NSWC Crane, IN
PROJECT NUMBER: 3959

WELL ID.: WES-1-26-83
DATE: 9/6/01

Time (Hrs.)	Water Level (Ft. below TOC)	Pump Rate (mL/Min.)	pH (S.U.)	S. Cond. (mS/cm)	Turb. (NTU)	DO (mg/L)	Temp. (Celcius)	ORP mV	Comments
0850	36.64	—							START PURGE
0900	37.84	100	6.75	1.460	>999	6.01	14.75	31.3	1000mL (BRN)
0910	38.24	100	6.58	1.451	750	4.89	14.69	21.5	2000mL
0920	38.42	100	6.52	1.450	380	2.89	14.61	20.6	3000mL
0930	38.48	100	6.47	1.452	280	3.61	14.59	20.0	4000mL
0940	38.68	100	6.40	1.450	140	2.61	14.61	17.4	5,000mL
0950	38.69	100	6.34	1.435	120	2.48	14.64	15.0	6,000mL
1000	38.73	100	6.22	1.459	120	2.38	14.88	13.3	7,000mL (CLEANED FLOW THRU CELL)
1010	38.79	100	5.98	1.457	85	1.31	15.08	5.2	8,000mL
1020	38.79	100	5.83	1.449	60	1.05	14.92	2.4	9,000mL
1030	38.83	100	5.85	1.448	45	0.93	15.08	4.6	10,000mL
1040	38.90	100	5.74	1.435	40	0.85	15.38	8.0	11,000mL
1050	38.63	75	5.63	1.433	45	0.90	15.78	14.3	11,750mL (SLOWED PUMP RATE)
1100	38.47	75	5.54	1.419	37	0.83	16.28	20.4	12,500mL
1110	38.39	75	5.56	1.418	33	0.75	16.28	20.4	13,250mL
1120	38.31	75	5.56	1.420	29	0.75	16.31	20.8	14,000mL
1130	38.25	75	5.52	1.419	29	0.69	16.54	22.4	14,750mL
1140	38.44	100	5.30	1.421	27	0.64	15.74	31.7	15,750mL (INCREASED PUMP RATE)
1150	38.64	100	5.11	1.420	26	0.59	15.55	43.7	16,750mL
1200	38.83	100	4.44	1.430	37	0.66	16.06	87.7	17,750mL
1210	38.78	100	2.73	1.430	26	0.71	16.40	298.1	18,750mL
1220	38.90	100	1.71	1.426	25	0.76	16.80	419.2	19,750mL
1230	38.86	100	0.93	1.428	34	0.73	16.64	495.1	20,750mL
1240	38.83	100	0.16	1.418	32	0.74	16.67	546.7	21,750mL
1250	38.90	100	0.10	1.428	24	0.75	17.10	593.9	22,750mL
1250	—	—	STOP PURGE	—	—	—	START SAMPLING	—	—

SIGNATURE: [signature]

TROUBLE WITH PH METER
PH MOST LIKELY ≈ 7.00

GROUND WATER SAMPLE LOG FORM

Project Site Name	NSWC CRANE, IN	Sample ID No :	01-GW-27-01
Project No	CTO 158 N3959	Sample Location:	WES-1-27-83
		Sampled By:	K. MARQUIS
		C.O.C. No..	

SAMPLING DATA:

	Color	pH	S.C.	Temp.	Turbidity	DO	ORP	Odor
Date 9/8/01	Visual	Standard	mS/cm	Degrees C	NTU	mg/l	mV	
Time-Start 0830 End 0930								
Method BLADDER	CLEAR	6.06	1.297	17.01	16	2.89	396.1	NONE

PURGE DATA:

Date 9/7/01	Total Well Depth (TD) 43.00	End Purge (hrs) 1540
Method BLADDER	Static Water Level (WL) 25.02	Total Purge Time (min) 140
Well Casing 2" PVC	Start Purge (hrs) 1320	Total Vol. Purged (gal) 7.93
One Casing Volume(gal) 2.93		

SAMPLE COLLECTION INFORMATION:

Analysis	Preservative	Container Requirements	Collected
Appendix IX VOCs	HCl/4°C	(3) 40 ml VOA Vials	✓ 09/8/01
Appendix IX SVOCs	4°C	(2) 1 L Amber Glass	
PNA	4°C	(2) 1 L Amber Glass	
Appendix IX Pesticides/PCBs	4°C	(2) 1 L Amber Glass	
Appendix IX Herbicides	4°C	(1) 1 L Amber Glass	
Explosives	4°C	(1) 1 L Amber Glass	
HD	4°C	(1) 40 ml VOA Vials	
TAL Total Metals, plus Sr and Sn	HNO_3/4°C	(1) 500 ml Polyethylene	✓ 9/8/01
TAL Disolved Metals, plus Sr and Sn	HNO_3/4°C	(1) 500 ml Polyethylene	✓ 9/8/01
Total Thorium Isotopes	HNO_3/4°C	(1) 1 L Amber Glass	
Dissolved Thorium Isotopes	HNO_3/4°C	(1) 1 L Amber Glass	
Gross Alfa/Gross Beta	HNO_3/4°C	(2) 1 L Amber Glass	✓ 9/8/01
TOC	H_2SO_4/4°C	(1) 500 ml Polyethylene	
Note: Dissolved metals and dissolved thorium only collected if Turb. is >5 NTUs			NA

OBSERVATIONS / NOTES:

PID reading in PVC riser pipe = Ø (ppm)

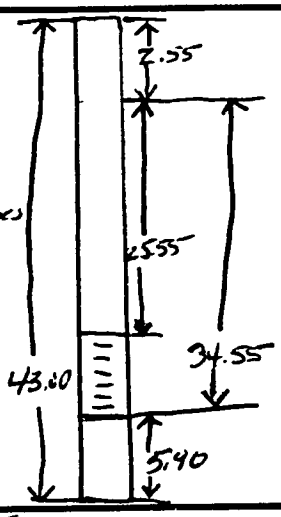
PID reading in Breathing Zone = Ø (ppm)

TOP of SCREEN = 28.10
BOTTOM of SCREEN = 37.10

43.00 − 25.02 = 17.98 X .163 = 2.93 gal or 11.1 Liters

37.10 − 25.02 = 12.08 SAT SCREEN

28.10 + 4.5 = 32.60 INTAKE of pump



QA Samples Collected:

MS/MSD | Duplicate ID No.:

Signature(s):

LOW FLOW PURGE DATA SHEET

PROJECT SITE NAME: NSWC Crane, IN
PROJECT NUMBER: 3959

WELL ID.: WES-1-27-83
DATE: 9/7/01

Time (Hrs.)	Water Level (Ft. below TOC)	Pump Rate (mL/Min.)	pH (S.U.)	S. Cond. (mS/cm)	Turb. (NTU)	DO (mg/L)	Temp. (Celcius)	ORP mV	Comments
1320	25.02								START PURGE
1330	26.26	100	5.21	1.168	>1000	3.55	16.28	392.6	1000 mL (BRN)
1340	26.67	100	4.07	1.151	950	2.38	16.10	571.2	2000 mL (BRN)
1350	27.68	100	3.69	1.159	400	2.18	16.05	596.6	3000 mL
* 1400	28.20	100	4.09	1.165	270	2.82	16.40	532.8	4000 mL (Cleaned Flow Through Cell)
1410	28.44	100	3.70	1.187	190	2.01	16.00	521.3	5000 mL
1420	28.76	250	3.16	1.110	130	3.13	14.72	528.3	7,500 mL (Increased Flow Rate)
1430	29.58	250	*7.0+	1.104	300	3.85	14.53	518.6	10,000 mL (*Checked PH with PH Str.
1440	30.03	250	*7.0+	1.132	450	2.55	14.52	515.4	12,500 mL
1450	30.59	250	*7.0+	1.154	450	1.74	14.71	514.2	15,000 mL
1500	31.81	250	*7.0+	1.150	460	1.75	14.69	513.8	17,250 mL
1500	Dropped Pump into Sump and Pump at 38 feet till Dry								
1540	STOP PURGE								TOTAL PURGED (30,000 mL)
9/8/01 → 0820	25.44								START PUMP
0830	25.81	25	6.78	1.272	400	8.31	20.68	333.5	250 mL
0840	26.36	75	6.28	1.310	180	4.03	18.08	376.9	1,000 mL
0850	26.97	75	6.06	1.297	55	2.89	17.01	396.1	1750 mL.
0850							START	Sampling	
0910					16				Checked Turb.

SIGNATURE: [signature]

* WATER LEVEL Drop Below Top of SCREEN (28.10)

GROUND WATER SAMPLE LOG FORM

Project Site Name	NSWC CRANE, IN	Sample ID No.:	016WC0101
Project No	CTO 158 N3959	Sample Location.	01C01
		Sampled By:	TR-LH
		C.O.C. No.:	

SAMPLING DATA:

	Color	pH	S.C.	Temp.	Turbidity	DO	ORP	Odor
Date 8-25-01	Visual	Standard	mS/cm	Degrees C	NTU	mg/l	mV	
Time-Start 1425 End. 1620								
Method LOW FLOW BLADDER	CLEAR	6.97	0.522	16.34	1.7	0.12	365.7	NONE

PURGE DATA:

Date 8/25/01	Total Well Depth (TD)	165.00	End Purge (hrs). 1420
Method Bladder	Static Water Level (WL)	139.30	Total Purge Time (min) 180
Well Casing. 2" PVC	Start Purge (hrs)	1120	Total Vol. Purged (gal): 6.1gal
One Casing Volume(gal) 4.2gal			

SAMPLE COLLECTION INFORMATION:

Analysis	Preservative	Container Requirements	Collected
Appendix IX VOCs	HCl/4°C	(3) 40 ml VOA Vials	✓
Appendix IX SVOCs	4°C	(2) 1 L Amber Glass	✓
PNA	4°C	(2) 1 L Amber Glass	✓
Appendix IX Pesticides/PCBs	4°C	(2) 1 L Amber Glass	✓
Appendix IX Herbicides	4°C	(1) 1 L Amber Glass	✓
Explosives	4°C	(1) 1 L Amber Glass	✓
HD	4°C	(1) 40 ml VOA Vials	✓
TAL Total Metals, plus Sr and Sn	HNO_3/4°C	(1) 500 ml Polyethylene	✓
~~TAL Disolved Metals, plus Sr and Sn~~	~~HNO_3/4°C~~	~~(1) 500 ml Polyethylene~~	
Total Thorium Isotopes	HNO_3/4°C	(1) 1 L Amber Glass	✓
~~Disolved Thorium Isotopes~~	~~HNO_3/4°C~~	~~(1) 1 L Amber Glass~~	
Gross Alfa/Gross Beta	HNO_3/4°C	(2) 1 L Amber Glass	✓
TOC	H_2SO_4/4°C	(1) 500 ml Polyethylene	✓
Note: Dissolved metals and dissolved thorium only collected if Turb. is >5 NTUs			NA

OBSERVATIONS / NOTES:

PID reading in PVC riser pipe = 2.3 (ppm)

PID reading in Breathing Zone = 0 (ppm)

165.0 - 139.3 = 25.7 x .163 = 4.2gal or 15.9L

Pump Intake @ 157' TOC

QA Samples Collected:

MS/MSD	Duplicate ID No.:
--	—

Signature(s): [signature]

pH = ± .1
DO = 10%
OTHERS = 3%
NTU = ≤5

LOW FLOW PURGE DATA SHEET

PROJECT SITE NAME: NSWC Crane, IN
PROJECT NUMBER: 3959

WELL ID.: 01-C01-93
DATE: 8/25/01

Time (Hrs.)	Water Level (Ft. below TOC)	Pump Rate (mL/Min.)	pH (S.U.)	S. Cond. (mS/cm)	Turb. (NTU)	DO (mg/L)	Temp. (Celcius)	ORP mV	Comments
1120	139.30	—	—	—	—	—	—	—	start pump
1130	139.39	120	4.20	0.797	22.7	2.46	18.83	286	1200 ML CLEAR
1140	139.39	130	3.71	0.746	11.0	1.22	18.82	393	2500 "
1150	139.39	130	*3.27	0.682	7.5	0.79	18.72	453.5	3800 "
1200	139.39	130	* —	0.659	6.0	0.65	18.73	473.4	5100 "
1210	139.34	130	~~*3.13~~	0.618	6.1	0.56	18.64	491.1	~~5250~~ 6400 "
1220	139.45	130	* —	0.598	4.0	0.49	18.41	494.8	CHANGE NITROGEN BOTTLE
1230	139.35	125	4.20	0.579	3.15	0.44	19.48	486.6	~~5485~~ 8950 CLEAR
1240	139.33	130	3.66	0.563	11.0	0.44	18.79	505.1	~~5615~~ 10250 "
1250	139.41	125	3.43	0.553	3.57	0.40	18.54	513.0	~~5740~~ 11500 "
1300	139.33	125	*7.0	0.553	2.02	0.42	19.07	522.3	~~5865~~ 12750 "
1310	139.38	130	3.50	0.542	1.96	0.35	18.08	516.0	~~5995~~ 14050 "
1320	139.40	130	3.29	0.542	2.75	0.35	18.58	518.6	~~6125~~ 15350 "
1330	139.33	130	3.46	0.537	1.80	0.33	18.40	517.2	~~6255~~ 16650 "
1340	139.40	130	*7.0	0.531	1.80	0.24	17.25	476.2	~~6385~~ 17950 "
1350	139.41	130	6.98	0.527	1.40	0.18	16.71	431.4	19250 "
NO READING TAKEN DUE TO HEAVY RAIN						—	—	→	20,550 "
1410	139.35	130	6.92	0.524	1.3	0.13	16.47	375.8	21850 "
1420	139.42	130	6.97	0.522	1.7	0.12	16.34	365.7	23150 "

MIN. VOL. = 13.9 L
* pH PAPER = 7.0

SIGNATURE: [signature]

PAGE___OF___

GROUND WATER SAMPLE LOG FORM

Project Site Name	NSWC CRANE, IN	Sample ID No.	01GWT02 01
Project No	CTO 158 N3959	Sample Location.	01T02
		Sampled By	RS
		C.O.C No.	

SAMPLING DATA:

	Color	pH	S.C.	Temp.	Turbidity	DO	ORP	Odor
Date 9-19-01					3.6			
Time-Start 0750 End 1000	Visual	Standard	mS/cm	Degrees C	NTU	mg/l	mV	
Method BLADDER PUMP	CLEAR	5.40	2.948	14.4	~~5.4~~ RS	7.67	346	NONE

PURGE DATA:

Date 9-18-01	Total Well Depth (TD) 72.30	End Purge (hrs). 0950
Method BLADDER - LOW FLOW	Static Water Level (WL) 65.26	Total Purge Time (min) 102
Well Casing 2" PVC	Start Purge (hrs) 0808	Total Vol Purged (gal). 2.2
One Casing Volume(gal): 1.2		

SAMPLE COLLECTION INFORMATION:

Analysis	Preservative	Container Requirements	Collected
Appendix IX VOCs	HCl/4°C	(3) 40 ml VOA Vials	✓
Appendix IX SVOCs	4°C	(2) 1 L Amber Glass	✓
PNA	4°C	(2) 1 L Amber Glass	✓
Appendix IX Pesticides/PCBs	4°C	(2) 1 L Amber Glass	✓
Appendix IX Herbicides	4°C	(1) 1 L Amber Glass	✓
Explosives	4°C	(1) 1 L Amber Glass	✓
HD	4°C	(1) 40 ml VOA Vials	✓
TAL Total Metals, plus Sr and Sn	HNO_3/4°C	(1) 500 ml Polyethylene	✓
TAL Disolved Metals, plus Sr and Sn	HNO_3/4°C	(1) 500 ml Polyethylene	— NA
Total Thorium Isotopes	HNO_3/4°C	(1) 1 L Amber Glass	✓
Dissolved Thorium Isotopes	HNO_3/4°C	(1) 1 L Amber Glass	— NA
Gross Alfa/Gross Beta	HNO_3/4°C	(2) 1 L Amber Glass	✓
TOC	H_2SO_4/4°C	(1) 500 ml Polyethylene	✓
Note: Dissolved metals and dissolved thorium only collected if Turb. is >5 NTUs			NA

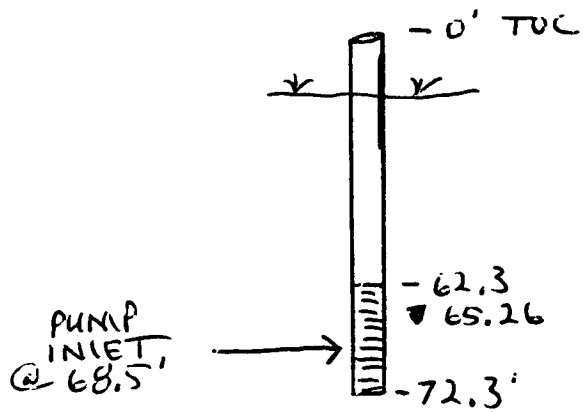
OBSERVATIONS / NOTES:

PID reading in PVC riser pipe = 0 (ppm)

PID reading in Breathing Zone = 0 (ppm)

"NEW" TETRA TECH WELL.
BACKGROUND WELL

9.19.01 @ 0740 WL = 65.68'
9.19.01 @ 0820 TURB = 3.6
PUMP RATE = 75 ML/MIN



QA Samples Collected:

MS/MSD	Duplicate ID No.:
—	—

Signature(s): [illegible]

LOW FLOW PURGE DATA SHEET

PROJECT SITE NAME: NSWC Crane, IN
PROJECT NUMBER: 3959

WELL ID.: 01TU2
DATE: 9.18.01

Time (Hrs.)	Water Level (Ft. below TOC)	Pump Rate (mL/Min.)	pH (S.U.)	S. Cond. (mS/cm)	Turb. (NTU)	DO (mg/L)	Temp. (Celcius)	ORP mV	Comments
0800	65.26	110	—	—	—	—	—	—	START PURGE
0815	65.73	80	5.47	2.913	177	9.01	15.6	277	NO ODOR, CLOUDY
0825	65.90	80	5.40	2.941	103	8.67	16.1	289	
0835	66.22	80	5.46	2.959	67	8.63	16.0	289	
0845	66.57	65	5.54	2.965	49	8.66	16.3	288	
0855	66.70	65	5.57	2.962	40	8.69	16.3	287	CLEARING
0905	66.95	65	5.66	2.909	36	8.60	16.2	294	
0915	67.18	65	5.62	2.893	32	8.43	16.1	311	
0925	67.31	65	5.60	2.903	30	8.29	16.1	322	
0935	67.60	110	5.58	2.919	30	8.15	16.1	330	TURN-UP PUMP RATE.
0940	68.00	110	5.48	2.927	31	8.27	14.6	338	PUMP DRY (TO PUMP
0945	68.28	110	5.44	2.933	41	8.04	14.5	342	INLET) SAMPLE 9.19.01
0950	68.51	110	5.40	2.948	54	7.67	14.4	346	END PURGE

SIGNATURE: [illegible]

GROUND WATER SAMPLE LOG FORM

ROUND 2

Project Site Name	NSWC CRANE, IN	Sample ID No	0164T02 02
Project No	CTO 158 N3959	Sample Location	01T02
		Sampled By	RS
		C.O.C. No.:	

SAMPLING DATA:

	Color	pH	S.C.	Temp.	Turbidity	DO	ORP	Odor
Date 9.22.01	Visual	Standard	mS/cm	Degrees C	NTU	mg/l	mV	NONE
Time-Start 1650 End 1900								
Method BLADDER	CLEAR	5.47	2.929	15.9	2.6 *	6.70	343	CLEAR

PURGE DATA:

Date 9.22-01	Total Well Depth (TD) 72.30	End Purge (hrs) 1235
Method BLADDER w/ FLOW	Static Water Level (WL) 65.48	Total Purge Time (min) 73
Well Casing 2" PVC	Start Purge (hrs) 1122	Total Vol Purged (gal) 1.9
One Casing Volume(gal): 1.2		

SAMPLE COLLECTION INFORMATION:

Analysis	Preservative	Container Requirements	Collected
Appendix IX VOCs	HCl/4°C	(3) 40 ml VOA Vials	✓
Appendix IX SVOCs	4°C	(2) 1 L Amber Glass	✓
PNA	4°C	(2) 1 L Amber Glass	✓
Appendix IX Pesticides/PCBs	4°C	(2) 1 L Amber Glass	✓
Appendix IX Herbicides	4°C	(1) 1 L Amber Glass	✓
Explosives	4°C	(1) 1 L Amber Glass	✓
HD	4°C	(1) 40 ml VOA Vials	✓
TAL Total Metals, plus Sr and Sn	HNO_3/4°C	(1) 500 ml Polyethylene	✓
TAL Disolved Metals, plus Sr and Sn	HNO_3/4°C	(1) 500 ml Polyethylene	—
Total Thorium Isotopes	HNO_3/4°C	(1) 1 L Amber Glass	✓
Dissolved Thorium Isotopes	HNO_3/4°C	(1) 1 L Amber Glass	—
Gross Alfa/Gross Beta	HNO_3/4°C	(2) 1 L Amber Glass	✓
TOC	H_2SO_4/4°C	(1) 500 ml Polyethylene	✓
Note: Dissolved metals and dissolved thorium only collected if Turb. is >5 NTUs			NA

OBSERVATIONS / NOTES:

PID reading in PVC riser pipe =	0	(ppm)
PID reading in Breathing Zone =	0	(ppm)

SEE SAMPLE NOTES
FROM 9.19.01 RD 1
ROUND 2 - 9.22.01

W/L @ 1640 = 66.02
PUMP RATE 100 ML/MIN
* TURB @ TIME OF METALS &
THORIUM COLLECTION = 2.6 NTU
NO FILTERED & COLLECTED
SAMPLES

QA Samples Collected:

MS/MSD	Duplicate ID No.:
—	—

Signature(s): [illegible]

ROUND 2

LOW FLOW PURGE DATA SHEET

PROJECT SITE NAME: NSWC Crane, IN
PROJECT NUMBER: 3959

WELL ID.: 01TO2
DATE: 9.22.01

Time (Hrs.)	Water Level (Ft. below TOC)	Pump Rate (mL/Min.)	pH (S.U.)	S. Cond. (mS/cm)	Turb. (NTU)	DO (mg/L)	Temp. (Celcius)	ORP mV	Comments
1122	65.48	100							START PURGE
1125	66.00	100	5.71	2.954	207	9.07	16.4	267	CLOUDY, NO ODOR
1135	66.33	100	5.40	2.820	108	7.21	15.6	277	
1145	66.75	100	5.41	2.783	19	8.15	15.4	314	
1155	67.32	100	5.42	2.799	12	8.03	15.4	337	
1205	67.65	100	5.41	2.830	7.9	7.74	15.4	346	
1215	68.02	100	5.41	2.854	6.2	7.40	15.5	347	
1225	68.20	100	5.42	2.843	6.4	6.99	15.8	345	
1235	68.51	100	5.42	2.929	5.7	6.70	15.9	343	DRY TO PUMP INLET END PURGE

SIGNATURE: [illegible]

Tetra Tech NUS, Inc.

GROUNDWATER SAMPLE LOG SHEET

Project Site Name: NSWC Crane
Project No.: N3959

[] Domestic Well Data
[X] Monitoring Well Data
[] Other Well Type:
[] QA Sample Type:

Sample ID No.: 01GW0102
Sample Location: WES-1-1-81
Sampled By: T. ROJAHN
C.O.C. No.: MGBG060102
Type of Sample:
[X] Low Concentration
[] High Concentration

SAMPLING DATA:

Date: 6/02/02	Color	pH	S.C.	Temp.	Turbidity	DO	ORP	Other
Time: 1030	Visual	Standard	mS/cm	°C	NTU	mg/l	mV	NA
Method BLADDER	CLEAR	5.77	0.873	14.80	4.3	1.28	+168	—

PURGE DATA:

Date: 6/02/02	Volume	pH	S.C.	Temp. (C)	Turbidity	DO	Salinity	Other
Method: BLADDER								
Monitor Reading (ppm). —								
Well Casing Diameter & Material								
Type: 2" PVC			See Low Flow Purge Data Sheets					
Total Well Depth (TD) 51.0								
Static Water Level (WL) 27.12								
One Casing Volume(gal/L) 14.7								
Start Purge (hrs) 0855								
End Purge (hrs) 1025								
Total Purge Time (min) 90								
Total Vol Purged (gal/L) 17.1								

SAMPLE COLLECTION INFORMATION:

Analysis	Preservative	Container Requirements	Collected
Appendix IX Volatiles	4°C/HCl	(3) 40ml Vails	✓
Dis Gasses (Methane, ethene & ethane)	4°C/HCl	(3) 40ml Vails	NO
Chloride	4°C	(1) 500ml HDPE	
TAL Metals Plus Strontium & Tin	4°C/HNO_3	(1) L HDPE	
Gross Alfa	4°C/HNO_3	(1) L Glass Amber	
Gross Beta	4°C/HNO_3	(1) L Glass Amber	
Total Organic Carbon	4°C/H_2SO_4	(1) 500ml Amber Glass	

OBSERVATIONS / NOTES:

TOP OF SCREEN = 35.89'
51 − 27.12 = 23.88 x 0.163 = 3.9 gal OR 14.7L
PUMP INTAKE ~ 40.7'

Circle if Applicable:

MS/MSD	Duplicate ID No.:

Signature(s): Terry Rojahn

LOW FLOW PURGE DATA SHEET

PROJECT SITE NAME: NSWC Crane, IN
PROJECT NUMBER: N3959

WELL ID.: WES-1-1-81 01GW0102
DATE: 6/02/02

Time (Hrs.)	Water Level (Ft. below TOC)	Pump Rate (mL/Min.)	pH (S.U.)	S. Cond. (mS/cm)	Turb. (NTU)	DO (mg/L)	Temp. (Celcius)	ORP mV	Comments
0855	27.12	—	—	—	—	—	—	—	START PURGE
0905	27.45	110	6.27	1.067	70	2.09	14.93	71	1100 ml sl. cloudy
0915	27.60	200	6.12	0.945	60	1.54	14.75	106	3100 v.sl. cloudy
0925	27.69	200	6.04	0.905	37	1.49	14.70	124	5100 CLEAR
0935	27.78	200	5.95	0.864	23	1.44	14.68	142	7,100 "
0945	27.84	200	5.90	0.865	13	1.40	14.69	148	9,100 "
0955	27.89	200	5.83	0.867	9.2	1.36	14.70	155	11,100 "
1005	27.91	200	5.82	0.869	7.4	1.30	14.72	159	13,100 "
1015	27.94	200	5.80	0.870	5.2	1.28	14.74	162	15,100 "
1025	27.97	200	5.77	0.873	4.3	1.28	14.80	168	17,100 "
1030									SAMPLE TIME

SIGNATURE: [signature]

Tetra Tech NUS, Inc

GROUNDWATER SAMPLE LOG SHEET

Project Site Name: NSWC Crane
Project No.: N3959

[] Domestic Well Data
[X] Monitoring Well Data
[] Other Well Type:
[] QA Sample Type:

Sample ID No.: 01GW0202
Sample Location: WES-1-2-81
Sampled By: T. ROJAHN
C.O.C No.: MGBG061402
Type of Sample:
[X] Low Concentration
[] High Concentration

SAMPLING DATA:

Date. 6-17-02	Color	pH	S.C.	Temp.	Turbidity	DO	ORP	Other
Time: 1400	Visual	Standard	mS/cm	°C	NTU	mg/l	mV	NA
Method SAME	CLEAR	5.89	0.209	15.10	2.0	7.57	488	—

PURGE DATA:

Date: 6/17/02	Volume	pH	S.C.	Temp. (C)	Turbidity	DO	Salinity	Other
Method: Peristaltic								
Monitor Reading (ppm): —								
Well Casing Diameter & Material								
Type: 2" Ø PVC			See Low Flow Purge Data Sheets					
Total Well Depth (TD) 25.8								
Static Water Level (WL) 11.22								
One Casing Volume(gal/L): 9								
Start Purge (hrs) 1215								
End Purge (hrs) 1355								
Total Purge Time (min) 100								
Total Vol Purged (gal/L): 9.3								

SAMPLE COLLECTION INFORMATION:

Analysis	Preservative	Container Requirements	Collected
Appendix IX Volatiles	4°C/HCl	(3) 40ml Vails	YES
Dis Gasses (Methane, ethene & ethane)	4°C/HCl	(3) 40ml Vails	YES
Chloride	4°C	1 L ~~(1) 500ml~~ HDPE	YES
TAL Metals Plus Strontium & Tin	4°C/HNO_3	(1) L HDPE	YES
Gross Alfa	4°C/HNO_3	(1) L Glass Amber	—
Gross Beta	4°C/HNO_3	(1) L Glass Amber	—
Total Organic Carbon	4°C/H_2SO_4	1 L ~~(1) 500ml~~ Amber Glass	YES

OBSERVATIONS / NOTES:

25.8 - 11.22 = 14.58 X 0.163 = 2.4 gal or 9 L

Circle if Applicable:		Signature(s):
MS/MSD	Duplicate ID No.:	[signature]

LOW FLOW PURGE DATA SHEET

PROJECT SITE NAME: NSWC Crane, IN
PROJECT NUMBER: N3959

WELL ID.: WES-1-2-81
DATE: 6-17-02

Time (Hrs.)	Water Level (Ft. below TOC)	Pump Rate (mL/Min.)	pH (S.U.)	S. Cond. (mS/cm)	Turb. (NTU)	DO (mg/L)	Temp. (Celcius)	ORP mV	Comments
1215	11.22	—	—	—	—	—	—	—	Start PURGE
1218	11.32	120	—	—	—	—	—	—	360 ml CLEAR
1221	11.35	120	—	—	—	—	—	—	720 "
1224	11.39	100	5.94	0.212	3.3	13.67	14.77	286	1020 "
1227	11.43	100	—	—	—	—	—	—	1320 "
1230	11.47	100	—	—	—	—	—	—	1620 "
1235	11.54	100	5.88	0.205	2.7	14.59	14.47	395	2120 "
1245	11.64	100	5.87	0.203	1.7	8.63	14.65	429	3120 "
1255	11.72	100	5.87	0.202	1.7	8.41	14.48	446	4120 "
1305	11.82	100	5.88	0.203	1.5	8.05	14.57	457	5120 "
1315	11.90	100	5.88	0.203	1.5	7.61	14.65	466	6120 "
1325	11.92	80	5.90	0.206	1.7	7.55	15.00	471	6920 "
1335	11.93	80	5.91	0.208	2.0	7.55	15.22	474	7720 "
1345	11.95	80	5.90	0.208	1.8	7.56	15.00	483	8520 "
1355	11.98	80	5.89	0.209	2.0	7.57	15.10	488	9320 "
1400								→	SAMPLE TIME

SIGNATURE: Terry Rogers

MIN VOL = 9L

SAMPLE LOG SHEET
NATURAL ATTENUATION PARAMETERS

Tetra Tech NUS, Inc

Project Site Name: NSWC Crane

Project No.: CTO 158, N3959

Sampled By. Terry Rojahn

Sample ID No.: 01GW0202

Sample Location: WES-1-2-81

Duplicate: ☐

SAMPLING DATA:

Date. 6/17/02	Color	pH	S.C.	Temp.	Turbidity	DO	ORP
Time 1400	(Visual)	(SU)	(mS/cm)	(°C)	(NTU)	(Meter, mg/l)	mV
Method Low Flow,	CLEAR	5.89	0.209	15.10	2.0	7.57	+ 488

SAMPLE COLLECTION/ANALYSIS INFORMATION:

Alkalinity: total, as $CaCO_3$, Range 10 to 1000 ppm

Equipment Chemetrics Test Kit

Analysis Time. 1453

Range Used	Range	Concentration ppm
☑	10 to 100 ppm	50
☐	50 to 500 ppm	
☐	100 to 1000 ppm	

Concentration. 50 ppm

Notes

Carbon Dioxide: CO_2, Dissolved, Range 10 - 2500 ppm

Equipment Chemetrics Test Kit

Analysis Time. 1433

Range Used	Range	Concentration ppm
☑	10 to 100 ppm	75
☐	100 to 1000 ppm	
☐	250 to 2500 ppm	

Concentration 75 ppm

Notes

Dissolved Oxygen: O_2, Range 0 - 12 ppm

Equipment: Chemetrics Test Kit

Analysis Time: 1417

Range Used:	Range	Concentration ppm
☐	0 to 1 ppm	
☑	1 to 12 ppm	4.5

Concentration 4.5 ppm

Notes

Hydrogen Sulfide: as H_2S, Range 0 - 5

Equipment. HACH HS-C

Analysis Time: 1420

Concentration: 0.0 mg/L

Notes

Tetra Tech NUS, Inc

SAMPLE LOG SHEET
NATURAL ATTENUATION PARAMETERS

Project Site Name: NSWC Crane
Project No.: CTO 158, N3959
Sampled By: Terry Rojahn

Sample ID No.: 01GW0202
Sample Location: WES-1-2-81
Duplicate: ☐

SAMPLE COLLECTION/ANALYSIS INFORMATION:

Divalent Iron: Fe^{2+}, Range 0-10 mg/L

Equipment: ~~HACH IR-18C~~ DR-850 (TR) Program 33

Analysis Time: 1500

Concentration: 0.01 mg/L

Notes:

Manganese: Mn^{2+}, Range 0-20 mg/L

Equipment: HACH DR-850 Colorimeter

Analysis Time: 1509

Program No: 41

Concentration: 0.4 mg/L

Notes:

Sulfate: SO_4^{2-}, Range 0-70 mg/L

Equipment: HACH DR-850 Colorimeter

Analysis Time: 0738 6/18/02

Program No: 92

Concentration: 25 mg/L

Notes:

Sulfide: S^{2-}, Range 0-0.7 mg/L

Equipment: HACH DR-850 Colorimeter

Analysis Time: 1517

Program No.: 93

Concentration: 0.01 mg/L

Notes.

Tetra Tech NUS, Inc.

SAMPLE LOG SHEET
NATURAL ATTENUATION PARAMETERS

Project Site Name: NSWC Crane

Project No.: CTO 158, N3959

Sampled By: Terry Rojahn

Sample ID No.: 01GW0202

Sample Location: WES-1-2-81

Duplicate: ☐

SAMPLE COLLECTION/ANALYSIS INFORMATION:

Nitrite: NO_2^--N, Range 0-0.35 mg/L

Equipment HACH DR-850 Colorimeter

Analysis Time: 1615

Program No: 62

Concentration 0.011 mg/L

Notes. *Alternate forms: NO_2 0.008 $NaNO_2$ 0.011

Nitrate: NO_3^--N, Range 0 - 0.50 mg/L

Equipment HACH DR-850 Colorimeter

Analysis Time. 1800

Program No 55

Concentration 0.02 mg/L

Nitrite Interference Treatment ☑

If results are over limit use dilution method at step 3, 5ml sample 10ml DI result X3, range up to 1.5mg/L

Notes * Alternate form NO_3 0.08

QA/QC Checklist:

All data fields have been completed as necessary ☑

Correct measurement units are cited in the SAMPLING DATA block ☑

Mulitplication is correct for each *Multiplier* table: ☑

Final calulated concentration is within the appropriate *Range Used* block: ☑

Alkalinity *Relationship* is determined appropriatly as per manufacturer instructions: ☑

QA/QC sample (e.g , Std Additions, etc.) frequency is appropriate as per the project planning documents: ☑

Nitrite Interference treatment used for Nitrate test if Nitrite was detected. ☑

Title block is initialized by person who performed the QA/QC Ckecklist: ☑

TR

Tetra Tech NUS, Inc

GROUNDWATER SAMPLE LOG SHEET

Project Site Name: NSWC Crane
Project No.: N3959

[] Domestic Well Data
[X] Monitoring Well Data
[] Other Well Type:
[] QA Sample Type:

Sample ID No.: 01GW0302
Sample Location: WES-1-3-81
Sampled By. T. ROJAHN
C O.C. No.: MGBG060102
Type of Sample:
[X] Low Concentration
[] High Concentration

SAMPLING DATA:

Date 6/01/02	Color	pH	S.C.	Temp.	Turbidity	DO	ORP	Other
Time 1805	Visual	Standard	mS/cm	°C	NTU	mg/l	mV	NA
Method SAME	CLEAR	6.58	0.207	12.77	21 @ 1805	6.77	-6	—

PURGE DATA:

Date 6/01/02	Volume	pH	S.C.	Temp. (C)	Turbidity	DO	Salinity	Other
Method PERISTALTIC								
Monitor Reading (ppm) —								
Well Casing Diameter & Material								
Type 2" PVC			See Low Flow Purge Data Sheets					
Total Well Depth (TD) 21.6								
Static Water Level (WL) 7.51								
One Casing Volume(gal/L) 8.7								
Start Purge (hrs) 0802								
End Purge (hrs) 0922								
Total Purge Time (min) 80								
Total Vol Purged (gal/L) 14								

SAMPLE COLLECTION INFORMATION:

Analysis	Preservative	Container Requirements	Collected
Appendix IX Volatiles	4°C/HCl	(3) 40ml Vails	✓
Dis Gasses (Methane, ethene & ethane)	4°C/HCl	(3) 40ml Vails	NO
Chloride	4°C	(1) 500ml HDPE	
TAL Metals Plus Strontium & Tin	4°C/HNO_3	(1) L HDPE	
Gross Alfa	4°C/HNO_3	(1) L Glass Amber	
Gross Beta	4°C/HNO_3	(1) L Glass Amber	
Total Organic Carbon	4°C/H_2SO_4	(1) 500ml Amber Glass	

OBSERVATIONS / NOTES:

WATER LEVEL BELOW top OF SCREEN
DRY OUT WELL; Sampled AFTER RECHARGED

Circle if Applicable:		Signature(s):
MS/MSD	Duplicate ID No.:	Tony Rojahn

LOW FLOW PURGE DATA SHEET

PROJECT SITE NAME: NSWC Crane, IN
PROJECT NUMBER: N3959

WELL ID.: WES-1-3-81 01GW0302
DATE: 6-01-02

Time (Hrs.)	Water Level (Ft. below TOC)	Pump Rate (mL/Min.)	pH (S.U.)	S. Cond. (mS/cm)	Turb. (NTU)	DO (mg/L)	Temp. (Celcius)	ORP mV	Comments
0802	7.51	200	—	—	—	—	—	—	
0807	8.90	200	6.37	0.176	80	2.51	13.84	-24	1000 Clear Particulate
0812	9.80	200	6.34	0.174	90	2.22	13.75	-23	2000 " "
0817	10.53	200	6.34	0.174	75	1.89	13.62	-27	3000 " "
0822	11.05	200	6.30	0.168	75	2.01	13.70	-24	4000 " "
0827	11.70	200	6.33	0.185	45	1.81	13.82	-7	5000 " "
0832	12.46	200	6.51	0.227	27	1.43	13.82	-5	6000 " —
0842	14.35	200	6.57	0.227	22	1.11	13.72	-24	8000 " —
0852	15.84	200	6.58	0.221	35	5.35	14.81	-18	10000 " —
0902	17.50	200	6.58	0.213	75	6.10	13.68	-13	12000 CLOUDY
0912	19.50	200	6.58	0.207	110	6.77	12.77	-6	14000 CLOUDY
0922	DRY	→							END PURGE
0932	20.74	→							RECHARGE
1805	16.24	→							SAMPLE TIME (21 NTUS)

SIGNATURE: Troy Agel

Tetra Tech NUS, Inc

GROUNDWATER SAMPLE LOG SHEET

Project Site Name: NSWC Crane
Project No.: N3959

[] Domestic Well Data
[X] Monitoring Well Data
[] Other Well Type:
[] QA Sample Type:

Sample ID No.: 01GW0402
Sample Location: WES-1-4-81
Sampled By: T. ROJAHN
C.O.C. No.: MGBG060102
Type of Sample:
[X] Low Concentration
[] High Concentration

SAMPLING DATA:

Date. 6/01/02	Color	pH	S.C.	Temp.	Turbidity	DO	ORP	Other
Time. 1755	Visual	Standard	mS/cm	°C	NTU	mg/l	mV	NA
Method SAME	CLEAR	6.00	1.466	16.62	0.10	5.61	575	—

PURGE DATA:

Date. 6/01/02	Volume	pH	S.C.	Temp. (C)	Turbidity	DO	Salinity	Other
Method: Peristaltic								
Monitor Reading (ppm). —								
Well Casing Diameter & Material								
Type 2" PVC			See Low Flow Purge Data Sheets					
Total Well Depth (TD) 34.00								
Static Water Level (WL) 14.84								
One Casing Volume(gal/L) 11.8								
Start Purge (hrs) 1350								
End Purge (hrs) 1750								
Total Purge Time (min) 240								
Total Vol Purged (gal/L) 23.6								

SAMPLE COLLECTION INFORMATION:

Analysis	Preservative	Container Requirements	Collected
Appendix IX Volatiles	4°C/HCl	(3) 40ml Vails	YES
Dis. Gasses (Methane, ethene & ethane)	4°C/HCl	(3) 40ml Vails	NO
Chloride	4°C	(1) 500ml HDPE	
TAL Metals Plus Strontium & Tin	4°C/HNO_3	(1) L HDPE	
Gross Alfa	4°C/HNO_3	(1) L Glass Amber	
Gross Beta	4°C/HNO_3	(1) L Glass Amber	
Total Organic Carbon	4°C/H_2SO_4	(1) 500ml Amber Glass	

OBSERVATIONS / NOTES:

34.00 - 14.84 = 19.16' x 0.163 = 3 Gal or 11.8 L
Top of Screen = 2.9 + 16.47 = 19.37'
WL above Top of Screen

Circle if Applicable:		Signature(s):
MS/MSD	Duplicate ID No.:	[signature]

LOW FLOW PURGE DATA SHEET

PROJECT SITE NAME: NSWC Crane, IN
PROJECT NUMBER: N3959

WELL ID.: WES-1-4-81
DATE: 6-01-02

Time (Hrs.)	Water Level (Ft. below TOC)	Pump Rate (mL/Min.)	pH (S.U.)	S. Cond. (mS/cm)	Turb. (NTU)	DO (mg/L)	Temp. (Celcius)	ORP mV	Comments
1350	14.84	—	—	—	—	—	—	—	Start Purge
1400	15.26	160	6.38	1.447	6.6	5.49	16.38	272	1600 CLEAR
1410	15.51	160	6.37	1.479	3.2	5.46	16.36	374	3200 "
1420	15.69	120	6.42	1.532	1.8	5.52	18.07	419	4400 "
1430	15.83	80	6.45	1.570	1.1	5.61	19.01	438	5200 "
1440	15.96	80	6.42	1.532	0.7	5.58	17.99	463	6000 "
1450	16.13	100	6.42	1.536	0.2	5.58	18.20	476	7000 "
1500	16.28	85	6.40	1.539	0.0	5.65	18.28	488	7850 "
1510	16.43	85	6.36	1.519	0.0	5.53	17.83	510	8700 "
1520	16.58	85	6.37	1.535	0.0	5.52	18.29	512	9550 "
1530	16.74	95	6.32	1.544	0.0	5.57	18.40	524	10500 "
1540	16.86	100	6.28	1.542	0.0	5.47	18.33	533	11500 "
1550	16.98	85	6.25	1.562	0.0	5.50	18.90	547	12350 "
1600	17.10	80	6.19	1.559	0.0	5.52	18.90	559	13150 "
1610	17.17	80	6.19	1.552	0.0	5.55	18.73	565	13950 "
1620	17.25	80	6.20	1.546	0.0	5.57	18.56	571	14750 "
1630	17.31	80	5.97	1.541	0.0	5.53	18.34	595	15550 "
1640	17.43	100	5.86	1.522	0.50	5.51	18.00	608	16550 "
1650	17.57	100	5.82	1.522	0.75	5.64	18.01	617	17550 "
1700	17.69	100	5.79	1.511	0.50	5.64	17.76	623	18550 "
1710	17.81	100	5.77	1.503	0.20	5.65	17.50	630	19550 "
1720	17.93	100	5.80	1.500	0.30	5.65	17.46	632	20550 "
1730	18.05	100	5.83	1.498	0.30	5.65	17.40	634	21550 "
1740	18.17	100	6.03	1.471	0.10	5.62	16.71	518	22550 "
1750	18.30	100	6.00	1.466	0.10	5.61	16.62	575	23550 "
1755									SAMPLE TIME

SIGNATURE: Troy Rogers

Tetra Tech NUS, Inc.

GROUNDWATER SAMPLE LOG SHEET

Project Site Name. NSWC Crane
Project No.: N3959

[] Domestic Well Data
[X] Monitoring Well Data
[] Other Well Type:
[] QA Sample Type:

Sample ID No.: 01GW05-02
Sample Location: WES-1-5-81
Sampled By: T. ROJAHN
C.O.C. No.: MGB6061402
Type of Sample:
[X] Low Concentration
[] High Concentration

SAMPLING DATA:

Date 6/15/02	Color	pH	S.C.	Temp.	Turbidity	DO	ORP	Other
Time 2010	Visual	Standard	mS/cm	°C	NTU	mg/l	mV	NA
Method: SAME	CLEAR	6.86	2.112	12.93	4.2	9.06	50	—

PURGE DATA:

Date: 6/15/02	Volume	pH	S.C.	Temp. (C)	Turbidity	DO	Salinity	Other
Method PERistaltic								
Monitor Reading (ppm) —								
Well Casing Diameter & Material								
Type 2" Ø PVC			See Low Flow Purge Data Sheets					
Total Well Depth (TD) 33.6								
Static Water Level (WL) 14.03								
One Casing Volume(gal/L) 12.1								
Start Purge (hrs) 0925								
End Purge (hrs): 1110								
Total Purge Time (min) 105								
Total Vol Purged (gal/L) 23.2								

SAMPLE COLLECTION INFORMATION:

Analysis	Preservative	Container Requirements	Collected
Appendix IX Volatiles	4°C/HCl	(3) 40ml Vails	YES
Dis Gasses (Methane, ethene & ethane)	4°C/HCl	(3) 40ml Vails	NO
Chloride	4°C	(1) 500ml HDPE	
TAL Metals Plus Strontium & Tin	4°C/HNO_3	(1) L HDPE	
Gross Alfa	4°C/HNO_3	(1) L Glass Amber	
Gross Beta	4°C/HNO_3	(1) L Glass Amber	
Total Organic Carbon	4°C/H_2SO_4	(1) 500ml Amber Glass	

OBSERVATIONS / NOTES:

Top of Screen = 18.78'
Intake @ ~24'
33.6 - 14.03 = 19.57 x 0.163 = 3.2 gal or 12.1 L
Purged to Dry - W.L. under bottom of screen
waited for well to recover & sampled

Circle if Applicable:		Signature(s):
MS/MSD	Duplicate ID No.:	[signature]

LOW FLOW PURGE DATA SHEET

PROJECT SITE NAME: NSWC Crane, IN
PROJECT NUMBER: N3959

WELL ID.: WES-1-5-81
DATE: 6-15-01

Time (Hrs.)	Water Level (Ft. below TOC)	Pump Rate (mL/Min.)	pH (S.U.)	S. Cond. (mS/cm)	Turb. (NTU)	DO (mg/L)	Temp. (Celcius)	ORP mV	Comments
0925	14.03	—	—	—	—	—	—	—	START PURGE
0929	15.12	150	—	—	—	—	—	—	600 ml CLEAR
0933	15.55	120	6.90	2.096	2.8	9.82	13.24	293	1080 "
0937	15.93	100	—	—	—	—	—	—	1480 "
0941	16.28	100	—	—	—	—	—	—	1880 "
0948	16.84	100	6.93	2.008	3.3	8.81	13.33	318	2580 "
0958	17.43	100	6.94	1.967	1.7	8.74	13.32	327	3380 "
1000	17.65	100	6.94	1.963	2.5	8.99	13.40	331	3780 "
1002	Lower Intake to	Dry out WEN	- WELL	historicly	dries	out	- WL. NEAR	top of	screen
1003	—	400	—	—	—	—	—	—	4580 CLEAR
1005	—	260	—	—	—	—	—	—	5100 "
1008	19.03	260	—	—	—	—	—	—	5880 "
1010	19.49	260	6.88	2.105	2.0	8.61	12.70	346	6400 "
1020	20.95	260	6.92	1.991	2.3	8.54	12.70	354	9000 "
1030	22.30	260	6.89	2.052	2.2	9.28	12.66	354	11600 "
1040	23.75	260	6.85	2.078	1.8	9.51	12.77	331	14200 "
1050	25.11	260	6.85	2.084	1.2	9.05	12.88	300	16800 "
1100	26.34	320	7.00	2.087	4.6	9.64	13.51	205	20000 "
1110	28.60	320	6.86	2.112	4.2	9.06	12.93	50	23200 "
WATER LEVEL		BELOW	bottom	OF	SCREEN				~~26400~~ " (TK)
1125	28.60	RECHARGE							turn off pump @ 1124
1127	28.14								pumping @ slower rate
1129	27.82								200ml/min
1131	27.53								
1133	—								
1135	27.06								
1140	26.60								
1145	26.10								
2010	14.95								SAMPLE TIME

SIGNATURE: Terry Pozik

MIN VOL = 12.1
WL of 17.15' = 75% RECOVERY
(17.[illegible])

Tetra Tech NUS, Inc

GROUNDWATER SAMPLE LOG SHEET

Project Site Name: NSWC Crane
Project No.: N3959

[] Domestic Well Data
[X] Monitoring Well Data
[] Other Well Type:
[] QA Sample Type:

Sample ID No.: 01GW0602
Sample Location: 01MW06
Sampled By: T. ROJAHN
C.O.C. No.: MGBG060102
Type of Sample:
[X] Low Concentration
[] High Concentration

SAMPLING DATA:

Date 6/02/02	Color	pH	S.C.	Temp.	Turbidity	DO	ORP	Other
Time. 1400	Visual	Standard	mS/cm	°C	NTU	mg/l	mV	NA
Method BLADDER	CLEAR	6.61	1.466	14.98	1.3	2.56	+142	—

PURGE DATA:

Date. 6/02/02	Volume	pH	S.C.	Temp. (C)	Turbidity	DO	Salinity	Other
Method BLADDER								
Monitor Reading (ppm): —								
Well Casing Diameter & Material								
Type: 2" PVC			See Low Flow Purge Data Sheets					
Total Well Depth (TD) 93.5								
Static Water Level (WL). 68.30								
One Casing Volume(gal/L) 15.5								
Start Purge (hrs) 1205								
End Purge (hrs): 1355								
Total Purge Time (min): 110								
Total Vol Purged (gal/L) 16.2								

SAMPLE COLLECTION INFORMATION:

Analysis	Preservative	Container Requirements	Collected
Appendix IX Volatiles	4°C/HCl	(3) 40ml Vails	YES
Dis. Gasses (Methane, ethene & ethane)	4°C/HCl	(3) 40ml Vails	NO
Chloride	4°C	(1) 500ml HDPE	↓
TAL Metals Plus Strontium & Tin	4°C/HNO_3	(1) L HDPE	↓
Gross Alfa	4°C/HNO_3	(1) L Glass Amber	↓
Gross Beta	4°C/HNO_3	(1) L Glass Amber	↓
Total Organic Carbon	4°C/H_2SO_4	(1) 500ml Amber Glass	↓

OBSERVATIONS / NOTES:

Intake of Pump @ 80'
Top of Screen 75.5'
93.5' - 68.30' = 25.2 × 0.163 = 4.1 gal or 15.5 L

Circle if Applicable:

MS/MSD	Duplicate ID No.:

Signature(s): Terry Rojahn

LOW FLOW PURGE DATA SHEET

PROJECT SITE NAME: NSWC Crane, IN
PROJECT NUMBER: N3959

WELL ID.: 01MW06 (TR) ~~01GW0601~~ (TR)
DATE: 6/02/02

Time (Hrs.)	Water Level (Ft. below TOC)	Pump Rate (mL/Min.)	pH (S.U.)	S. Cond. (mS/cm)	Turb. (NTU)	DO (mg/L)	Temp. (Celcius)	ORP mV	Comments
1205	68.30	—	—	—	—	—	—	—	START PURGE
1215	68.49	120	6.75	1.212	13	3.46	14.95	240	1200 ml CLEAR
1225	68.52	150	6.69	1.282	10	2.16	14.60	234	2700 "
1235	68.54	150	6.67	1.340	7.2	2.22	14.69	205	4200 "
1245	68.55	150	6.66	1.395	5.1	2.31	14.76	181	5700 "
1255	68.53	150	6.64	1.417	3.4	2.41	14.91	181	7200 "
1305	68.51	150	6.64	1.443	1.7	2.52	15.12	183	8700 "
1315	68.51	150	6.62	1.454	1.5	2.56	15.09	179	10200 "
1325	68.52	150	6.61	1.466	1.1	2.60	15.11	175	11700 "
1335	68.52	150	6.62	1.464	2.2	2.61	15.08	160	13200 "
1345	68.53	150	6.61	1.462	2.4	2.60	15.06	147	14700 "
1355	68.53	150	6.61	1.466	1.3	2.56	14.98	142	16200 "
1400	—	—	—	—	—	—	—	—	SAMPLE TIME

SIGNATURE: [signature]

Tetra Tech NUS, Inc

GROUNDWATER SAMPLE LOG SHEET

Project Site Name: NSWC Crane
Project No.: N3959

[] Domestic Well Data
[X] Monitoring Well Data
[] Other Well Type:
[] QA Sample Type:

Sample ID No.: 01GW0802
Sample Location: ~~06~~ WES-1-8-82
Sampled By: T. ROJAHN
C.O.C. No.: M6BG060102
Type of Sample:
[X] Low Concentration
[] High Concentration

SAMPLING DATA:

Date. 6/3/02	Color	pH	S.C.	Temp.	Turbidity	DO	ORP	Other
Time. 1035	Visual	Standard	mS/cm	°C	NTU	mg/l	mV	NA
Method SAME	CLEAR	6.75	0.404	13.29	4.2	0.73	-51	—

PURGE DATA:

Date: 6/3/02	Volume	pH	S.C.	Temp. (C)	Turbidity	DO	Salinity	Other
Method: PERISTALTIC								
Monitor Reading (ppm) —								
Well Casing Diameter & Material								
Type 2" Ø PVC			See Low Flow Purge Data Sheets					
Total Well Depth (TD) 31.20								
Static Water Level (WL) 14.30								
One Casing Volume(gal/L) 10.4								
Start Purge (hrs) 0850								
End Purge (hrs) 1030								
Total Purge Time (min) 100								
Total Vol. Purged (gal/L) 10.9								

SAMPLE COLLECTION INFORMATION:

Analysis	Preservative	Container Requirements	Collected
Appendix IX Volatiles	4°C/HCl	(3) 40ml Vails	YES
Dis Gasses (Methane, ethene & ethane)	4°C/HCl	(3) 40ml Vails	NO
Chloride	4°C	(1) 500ml HDPE	
TAL Metals Plus Strontium & Tin	4°C/HNO_3	(1) L HDPE	
Gross Alfa	4°C/HNO_3	(1) L Glass Amber	
Gross Beta	4°C/HNO_3	(1) L Glass Amber	
Total Organic Carbon	4°C/H_2SO_4	(1) 500ml Amber Glass	

OBSERVATIONS / NOTES:

31.2 - 14.30 = 16.9 x .163 = 2.8 gal or 10.4
INTAKE @ 20.76

Circle if Applicable:		Signature(s):
MS/MSD	Duplicate ID No.: FD060302	[signature]

LOW FLOW PURGE DATA SHEET

PROJECT SITE NAME: NSWC Crane, IN
PROJECT NUMBER: N3959

WELL ID.: WES-1-8-82
DATE: 6/03/02

Time (Hrs.)	Water Level (Ft. below TOC)	Pump Rate (mL/Min.)	pH (S.U.)	S. Cond. (mS/cm)	Turb. (NTU)	DO (mg/L)	Temp. (Celcius)	ORP mV	Comments
0850	14.30	—	—	—	—	—	—	—	START PURGE
0900	14.31	100	7.05	0.451	100	5.4	13.78	-56	1000 ml Orangish Tint
0910	14.32	110	7.03	0.449	55	0.66	13.83	-54	2100 v.sl Cloudy
0920	14.33	110	7.03	0.444	45	0.66	13.66	-69	3200 CLEAR
0930	14.33	110	6.95	0.438	30	0.67	13.89	-62	4300 "
0940	14.34	110	6.90	0.433	19	0.68	14.09	-57	5400 "
0950	14.34	110	6.84	0.421	15	0.74	13.62	-56	6500 "
1000	14.35	110	6.77	0.414	9.9	0.80	13.39	-55	7600 "
1010	14.35	110	6.75	0.410	7.3	0.75	13.37	-54	8700 "
1020	14.35	110	6.73	0.407	5.1	0.73	13.36	-52	9800 "
1030	14.35	110	6.75	0.404	4.2	0.73	13.29	-51	10900 "
1035	—	—	—	—	—	—	—	—	~~12000~~ SAMPLE TIME

MIN VOL = 10.9 L

SIGNATURE: Terry Rogers

Tetra Tech NUS, Inc.

GROUNDWATER SAMPLE LOG SHEET

Project Site Name: NSWC Crane
Project No.: N3959

[] Domestic Well Data
[X] Monitoring Well Data
[] Other Well Type:
[] QA Sample Type:

Sample ID No.: 01GW0902
Sample Location: WES-1-9-82
Sampled By: T. ROSAHN
C.O.C. No.: MGBG060102
Type of Sample:
[X] Low Concentration
[] High Concentration

SAMPLING DATA:

Date. 6/03/02	Color	pH	S.C.	Temp.	Turbidity	DO	ORP	Other
Time 1315	Visual	Standard	mS/cm	°C	NTU	mg/l	mV	NA
Method SAME	CLEAR	5.26	0.088	14.47	8.3	1.55	+433	—

PURGE DATA:

Date: 6/03/02	Volume	pH	S.C.	Temp. (C)	Turbidity	DO	Salinity	Other
Method: Peristaltic								
Monitor Reading (ppm) —								
Well Casing Diameter & Material								
Type: 2" ø PVC			See Low Flow Purge Data Sheets					
Total Well Depth (TD) 35.00								
Static Water Level (WL) 15.34								
One Casing Volume(gal/L) 12.1								
Start Purge (hrs): 1110								
End Purge (hrs): 1310								
Total Purge Time (min): 120								
Total Vol Purged (gal/L): 12.5								

SAMPLE COLLECTION INFORMATION:

Analysis	Preservative	Container Requirements	Collected
Appendix IX Volatiles	4°C/HCl	(3) 40ml Vails	YES
Dis Gasses (Methane, ethene & ethane)	4°C/HCl	(3) 40ml Vails	NO
Chloride	4°C	(1) 500ml HDPE	
TAL Metals Plus Strontium & Tin	4°C/HNO_3	(1) L HDPE	
Gross Alfa	4°C/HNO_3	(1) L Glass Amber	
Gross Beta	4°C/HNO_3	(1) L Glass Amber	
Total Organic Carbon	4°C/H_2SO_4	(1) 500ml Amber Glass	

OBSERVATIONS / NOTES:

INTAKE @ 24.5'
35.00 - 15.34 = 19.65 x .163 = 3.2 gal or 12.1
19.8 = TOP OF SCREEN

Circle if Applicable:

MS/MSD	Duplicate ID No.:

Signature(s): Tony Rosahn

LOW FLOW PURGE DATA SHEET

PROJECT SITE NAME: NSWC Crane, IN
PROJECT NUMBER: N3959

WELL ID.: WES-1-9-82 01GW0902
DATE: 6/03/02

Time (Hrs.)	Water Level (Ft. below TOC)	Pump Rate (mL/Min.)	pH (S.U.)	S. Cond. (mS/cm)	Turb. (NTU)	DO (mg/L)	Temp. (Celcius)	ORP mV	Comments
1110	15.34	—	—	—	—	—	—	—	START PURGE
1120	15.99	150	5.43	0.089	5.5	2.22	14.17	265	1500ml CLEAR
1130	16.22	100	5.34	0.091	2.7	1.83	15.14	299	2500ml "
1140	16.41	100	5.31	0.090	2.7	1.73	14.78	326	3500 ml "
1150	16.55	100	5.28	0.089	2.8	1.64	14.53	349	4500ml "
1200	16.72	100	5.25	0.089	4.2	1.61	14.32	379	5500ml "
1210	16.83	100	5.25	0.089	5.5	1.60	14.47	385	6500ml "
1220	16.89	100	5.27	0.089	6.0	1.58	14.61	393	7500ml "
1230	16.97	100	5.29	0.089	6.7	1.58	14.57	403	8500ml "
1240	17.05	100	5.30	0.089	7.4	1.57	14.52	415	9500ml "
1250	17.11	100	5.28	0.089	7.5	1.57	14.31	422	10500ml "
1300	17.15	100	5.27	0.088	7.7	1.56	14.09	429	11500ml "
1310	17.22	100	5.26	0.088	8.3	1.55	14.47	433	12500ml "
1315	—	—	—	—	—	—	—	—	START SAMPLING

12.1 MIN VOL IN L

SIGNATURE: [signature]

Tetra Tech NUS, Inc

GROUNDWATER SAMPLE LOG SHEET

016W1002

Project Site Name: NSWC Crane
Project No.: N3959

[] Domestic Well Data
[X] Monitoring Well Data
[] Other Well Type:
[] QA Sample Type:

Sample ID No.: 01-10
Sample Location: 01-10
Sampled By: K. SIMPSON
C.O.C. No.: MGBG 061102
Type of Sample:
[X] Low Concentration
[] High Concentration

SAMPLING DATA:

	Color	pH	S.C.	Temp.	Turbidity	DO	ORP	Other
Date: 6.11.02	Visual	Standard	mS/cm	°C	NTU	mg/l	mV	NA
Time: 1625								
Method BLADDER	CLEAR	6.87	0.82	15.1	2.4	1.76	-16	—

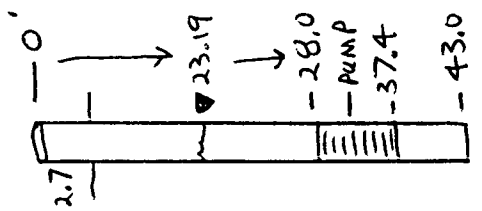
PURGE DATA:

	Volume	pH	S.C.	Temp. (C)	Turbidity	DO	Salinity	Other
Date: 6.11.02								
Method BLADDER								
Monitor Reading (ppm): —								
Well Casing Diameter & Material								
Type: 2" PVC	See Low Flow Purge Data Sheets							
Total Well Depth (TD): 43.0								
Static Water Level (WL) 23.19								
One Casing Volume(gal/L) 3.3								
Start Purge (hrs) 1224								
End Purge (hrs): 1600								
Total Purge Time (min) 216								
Total Vol Purged (gal/L) 3.4								

SAMPLE COLLECTION INFORMATION:

Analysis	Preservative	Container Requirements	Collected
Appendix IX Volatiles	4°C/HCl	(3) 40ml Vails	✓
~~Dis. Gasses (Methane, ethene & ethane)~~	~~4°C/HCl~~	~~(3) 40ml Vails~~	—
~~Chloride~~	~~4°C~~	~~(1) 500ml HDPE~~	—
~~TAL Metals Plus Strontium & Tin~~	~~4°C/HNO_3~~	~~(1) L HDPE~~	—
~~Gross Alfa~~	~~4°C/HNO_3~~	~~(1) L Glass Amber~~	—
~~Gross Beta~~	~~4°C/HNO_3~~	~~(1) L Glass Amber~~	—
~~Total Organic Carbon~~	~~4°C/H_2SO_4~~	~~(1) 500ml Amber Glass~~	—

OBSERVATIONS / NOTES:



STICK-UP = 2.7' ALL MEASUREMENTS TO TOC

Circle if Applicable:

MS/MSD | Duplicate ID No.:

Signature(s):

LOW FLOW PURGE DATA SHEET

PROJECT SITE NAME: NSWC Crane, IN
PROJECT NUMBER: N3959

WELL ID.: 01-10
DATE: 6.11.02

Time (Hrs.)	Water Level (Ft. below TOC)	Pump Rate (mL/Min.)	pH (S.U.)	S. Cond. (mS/cm)	Turb. (NTU)	DO (mg/L)	Temp. (Celcius)	ORP mV	Comments
1224	23.19	200							START PURGE
1228	24.24	100	6.82	0.955	62	2.77	15.1	48	NO ODOR, LT CLOUDY
1232	24.65	100					~~16~~		
1236	24.93	60							
1240	25.26	100	6.80	0.976	40	2.10	16.1	38	
1244	25.44	50							
1255	26.10		6.81	0.973	31	1.98	16.1	39	
1305	25.33		6.82	0.970	26	1.96	16.0	34	
1315	26.90		6.83	0.950	19	1.58	16.1	34	
1325	27.10		6.84	0.941	15	1.55	16.2	28	
1335	27.40		6.84	0.935	11	1.46	16.2	45	
1345	27.69		6.85	0.925	6.9	1.66	16.1	40	
1355	28.10		6.86	0.911	5.7	1.48	16.1	33	BELOW TOP OF SCREEN
1405	28.30		6.86	0.907	5.0	1.53	16.0	33	
1415	28.25		6.86	0.897	4.0	1.61	15.7	28	
1425	28.25		6.86	0.889	3.8	1.72	15.6	25	
1430	28.25		6.86	0.887	3.4	1.53	15.6	27	
1435	28.25		6.86	0.883	2.9	1.53	15.6	22	
1445	28.26		6.86	0.878	2.4	1.55	15.3	37	
1455	28.26		6.86	0.874	2.5	1.54	15.4	-6	T' STORM, W/ RAIN STARTING
1505	28.26		6.86	0.871	2.4	1.72	15.1	-11	
1515	28.27		6.86	0.866	2.8	1.75	14.9	-11	
1525	28.27		6.87	0.855	2.6	1.61	15.2	-11	RAIN ENDING
1535	28.27		6.87	0.825	2.7	1.85	15.2	-12	
1545	28.28		6.87	0.811	2.4	1.77	15.2	-16	
1550	28.28		6.87	0.813	2.5	1.66	15.1	-16	
1600	28.29		6.87	0.812	2.4	1.76	15.1	-16	STOP PUMP TO RECHARGE ABOVE SCREEN @ 28' THEN SAMPLE
1625	28.00								

SIGNATURE: [illegible]

Tetra Tech NUS, Inc.

GROUNDWATER SAMPLE LOG SHEET

Project Site Name: NSWC Crane
Project No.: N3959

[] Domestic Well Data
[X] Monitoring Well Data
[] Other Well Type:
[] QA Sample Type:

Sample ID No.: 01GW1102
Sample Location: WES-1-11-82
Sampled By: T. ROJAHN
C.O.C. No.: MGBG061402
Type of Sample:
[X] Low Concentration
[] High Concentration

SAMPLING DATA:

Date. 6/14/02	Color	pH	S.C.	Temp.	Turbidity	DO	ORP	Other
Time 1305	Visual	Standard	mS/cm	°C	NTU	mg/l	mV	NA
Method. SAME	CLEAR	5.32	0.065	16.17	4.4	3.55	+562	—

PURGE DATA:

Date: 6/14/02	Volume	pH	S.C.	Temp. (C)	Turbidity	DO	Salinity	Other
Method: Peristaltic								
Monitor Reading (ppm) —								
Well Casing Diameter & Material								
Type 2" ϕ PVC			See Low Flow Purge Data Sheets					
Total Well Depth (TD) 22.6								
Static Water Level (WL) 5.71								
One Casing Volume(gal/L) 10.4								
Start Purge (hrs) 1100								
End Purge (hrs) 1300								
Total Purge Time (min) 120								
Total Vol Purged (gal/L) 15.6								

SAMPLE COLLECTION INFORMATION:

Analysis	Preservative	Container Requirements	Collected
Appendix IX Volatiles	4°C/HCl	(3) 40ml Vails	YES
Dis Gasses (Methane, ethene & ethane)	4°C/HCl	(3) 40ml Vails	YES
Chloride	4°C	(1) L ~~(1) 500ml~~ HDPE	YES
TAL Metals Plus Strontium & Tin	4°C/HNO_3	(1) L HDPE	YES
Gross Alfa	4°C/HNO_3	(1) L Glass Amber	—
Gross Beta	4°C/HNO_3	(1) L Glass Amber	—
Total Organic Carbon	4°C/H_2SO_4	1 L ~~(1) 500ml Amber Glass~~ GLASS Am.	YES

OBSERVATIONS / NOTES:

22.60 - 5.71 = 16.89 × 0.163 = 2.7 gal or 10.4 L

Circle if Applicable:		Signature(s):
MS/MSD	Duplicate ID No.:	Tony Rojahn

LOW FLOW PURGE DATA SHEET

PROJECT SITE NAME: NSWC Crane, IN
PROJECT NUMBER: N3959

WELL ID.: WES-1-11-82
DATE: 6-14-02

Time (Hrs.)	Water Level (Ft. below TOC)	Pump Rate (mL/Min.)	pH (S.U.)	S. Cond. (mS/cm)	Turb. (NTU)	DO (mg/L)	Temp. (Celcius)	ORP mV	Comments
1100	5.71	—	—	—	—	—	—	—	Start PURGE
1104	5.83	170						→	680 ML SI Cloudy
1108	5.88	170						→	1360
1112	5.88	120	6.54	0.246	85	3.19	15.99	98	1840
1116	5.90	120	~~6.54~~	~~0.246~~		~~3.19~~		→	2320
1120	5.91	120	6.45	0.229	45	4.00	16.26	199	2800 CLEAR
1130	5.93	120	5.97	0.107	32	3.93	15.95	332	4000 CLEAR
1140	5.95	120	5.76	0.093	24	3.82	16.07	395	5200 CLEAR
1150	5.97	120	5.53	0.077	17	3.54	16.19	456	6400 CLEAR
1200	5.98	120	5.50	0.076	11	3.05	16.13	484	7600 CLEAR
1210	6.00	120	5.47	0.073	7.6	3.04	16.18	501	8800 CLEAR
1220	5.97	120	5.47	0.075	6.4	3.28	17.76	506	10000 CLEAR
1230	5.98	120	5.38	0.070	5.5	3.22	16.73	530	11200 CLEAR
1240	6.00	120	5.30	0.067	5.4	3.46	15.80	563	12400 CLEAR
1250	6.00	120	5.31	0.067	5.1	3.39	16.42	552	13600 CLEAR
1300	6.01	100	5.32	0.066	4.6	3.47	16.29	556	14600 CLEAR
1300	6.02	100	5.32	0.065	4.4	3.55	16.17	562	15600 CLEAR
1305								→	Start SAMPLING

MIN VOL = 10.4 L

SIGNATURE: [signature]

SAMPLE LOG SHEET
NATURAL ATTENUATION PARAMETERS

Tetra Tech NUS, Inc

Project Site Name: NSWC Crane

Project No.: CTO 158, N3959

Sampled By: Terry Rojahn & K. Simpson

Sample ID No.: 01GW1102

Sample Location: WES-1-11-82

Duplicate: ☐

SAMPLING DATA:

Date 6/14/02	Color	pH	S.C.	Temp.	Turbidity	DO	ORP
Time 1305	(Visual)	(SU)	(mS/cm)	(°C)	(NTU)	(Meter, mg/l)	mV
Method Low Flow,	CLEAR	5.32	0.065	16.17	4.4	3.55	+ 562

SAMPLE COLLECTION/ANALYSIS INFORMATION:

Alkalinity: total, as $CaCO_3$, Range 10 to 1000 ppm

Equipment: Chemetrics Test Kit

Analysis Time: 1542 (K.S)

Range Used	Range	Concentration ppm
☑	10 to 100 ppm	15
☐	50 to 500 ppm	
☐	100 to 1000 ppm	

Concentration: 15 ppm

Notes:

Carbon Dioxide: CO_2, Dissolved, Range 10 - 2500 ppm

Equipment: Chemetrics Test Kit

Analysis Time: 1536 (K.S.)

Range Used	Range	Concentration ppm
☑	10 to 100 ppm	60
☐	100 to 1000 ppm	
☐	250 to 2500 ppm	

Concentration: 60 ppm

Notes:

Dissolved Oxygen: O_2, Range 0 - 12 ppm

Equipment: Chemetrics Test Kit

Analysis Time: 1545 (K.S.)

Range Used	Range	Concentration ppm
☐	0 to 1 ppm	
☑	1 to 12 ppm	2

Concentration: 2 ppm

Notes

Hydrogen Sulfide: as H_2S, Range 0 - 5

Equipment: HACH HS-C

Analysis Time: 1548 (K.S.)

Concentration: 0.0 mg/L

Notes

Tetra Tech NUS, Inc

SAMPLE LOG SHEET
NATURAL ATTENUATION PARAMETERS

Project Site Name: NSWC Crane
Project No.: CTO 158, N3959
Sampled By: Terry Rojahn & K. Simpson

Sample ID No.: 01GW1102
Sample Location: WES-1-11-92
Duplicate: ☐

SAMPLE COLLECTION/ANALYSIS INFORMATION: 6/14/02

Divalent Iron: Fe^{2+}, Range 0-10 mg/L

Equipment: HACH IR-18C

Analysis Time: 1554 (TR)

Concentration: 0 mg/L

Notes: DR/850 Program 33 = 0.01 mg/L

Manganese: Mn^{2+}, Range 0-20 mg/L

Equipment: HACH DR-850 Colorimeter

Analysis Time: 1528 (T.R.)

Program No: 41

Concentration: 0.7 mg/L

Notes

Sulfate: SO_4^{2-}, Range 0-70 mg/L

Equipment: HACH DR-850 Colorimeter

Analysis Time: 1537 (T.R.)

Program No: 92

Concentration: 12 mg/L

Notes

Sulfide: S^{2-}, Range 0-0.7 mg/L

Equipment: HACH DR-850 Colorimeter

Analysis Time: 1548 (T.R.)

Program No.: 93

Concentration: 0.01 mg/L

Notes:

Tetra Tech NUS, Inc

SAMPLE LOG SHEET
NATURAL ATTENUATION PARAMETERS

Project Site Name: NSWC Crane

Project No.: CTO 158, N3959

Sampled By: Terry Rojahn & K. Simpson

Sample ID No.: 01GW1102

Sample Location: WES-1-11-82

Duplicate: ☐

SAMPLE COLLECTION/ANALYSIS INFORMATION: 6/14/02

Nitrite: NO_2^--N, Range 0-0 35 mg/L

Equipment: HACH DR-850 Colorimeter

Analysis Time 1655 (KS)

Program No.: 62

Concentration: 0 mg/L

Notes: Alternate forms. NO_2 0 $NaNO_2$ 0

Nitrate: NO_3^--N, Range 0 - 0.50 mg/L

Equipment: HACH DR-850 Colorimeter

Analysis Time 1725 (KS)

Program No.: 55

Concentration 0.06 mg/L

Nitrite Interference Treatment ☐

If results are over limit use dilution method at step 3, 5ml sample 10ml DI result X3, range up to 1.5mg/L

Notes: Alternate form NO_3 0.29 mg/L

QA/QC Checklist

All data fields have been completed as necessary: ☑

Correct measurement units are cited in the SAMPLING DATA block ☑ (TR)

Mulitplication is correct for each *Multiplier* table: ☑

Final calulated concentration is within the appropriate *Range Used* block: ☑

Alkalinity *Relationship* is determined appropriatly as per manufacturer instructions: ☑

QA/QC sample (e g , Std Additions, etc.) frequency is appropriate as per the project planning documents: ☑

Nitrite Interference treatment used for Nitrate test if Nitrite was detected: ☑ NA

Title block is initialized by person who performed the QA/QC Ckecklist: ☑

Tetra Tech NUS, Inc

GROUNDWATER SAMPLE LOG SHEET

Project Site Name: NSWC Crane
Project No.: N3959

[] Domestic Well Data
[X] Monitoring Well Data
[] Other Well Type:
[] QA Sample Type:

Sample ID No.: 01GW1402
Sample Location: WES-1-14-83
Sampled By: T. ROJAHN
C.O.C. No.: M6BG060402
Type of Sample:
[X] Low Concentration
[] High Concentration

SAMPLING DATA:

Date: 6/5/02	Color	pH	S.C.	Temp.	Turbidity	DO	ORP	Other
Time: 1255	Visual	Standard	mS/cm	°C	NTU	mg/l	mV	NA
Method Peristaltic	CLEAR	6.34	1.083	14.24	16	2.41	-57	—

PURGE DATA:

Date: 6/5/02	Volume	pH	S.C.	Temp. (C)	Turbidity	DO	Salinity	Other
Method: Peristaltic								
Monitor Reading (ppm). —								
Well Casing Diameter & Material								
Type 2" ø PVC			See Low Flow Purge Data Sheets					
Total Well Depth (TD) 39.0								
Static Water Level (WL). 13.65								
One Casing Volume(gal/L) 15.6								
Start Purge (hrs) 0850								
End Purge (hrs) 1250								
Total Purge Time (min) 240								
Total Vol Purged (gal/L) 24.2								

SAMPLE COLLECTION INFORMATION:

Analysis	Preservative	Container Requirements	Collected
Appendix IX Volatiles	4°C/HCl	(3) 40ml Vails	YES
Dis. Gasses (Methane, ethene & ethane)	4°C/HCl	(3) 40ml Vails	NO
Chloride	4°C	(1) 500ml HDPE	
TAL Metals Plus Strontium & Tin	4°C/HNO_3	(1) L HDPE	
Gross Alfa	4°C/HNO_3	(1) L Glass Amber	
Gross Beta	4°C/HNO_3	(1) L Glass Amber	
Total Organic Carbon	4°C/H_2SO_4	(1) 500ml Amber Glass	

OBSERVATIONS / NOTES:

Top Screen (24.1')
Intake @ 26.5'
39.0 - 13.65 = 25.35 x 0.163 = 4.1 gal or 15.6 L

Circle if Applicable:		Signature(s):
MS/MSD	Duplicate ID No.:	Tony Rojahn

LOW FLOW PURGE DATA SHEET

PROJECT SITE NAME: NSWC Crane, IN
PROJECT NUMBER: N3959

WELL ID.: WES-1-14-83
DATE: 6/05/02

Time (Hrs.)	Water Level (Ft. below TOC)	Pump Rate (mL/Min.)	pH (S.U.)	S. Cond. (mS/cm)	Turb. (NTU)	DO (mg/L)	Temp. (Celcius)	ORP mV	Comments
0850	13.65	—	—	—	—	—	—	—	START PURGE
0900	15.12	120	6.04	1.022	150	6.70	14.62	-9	1200ml Cloudy
0910	15.76	100	6.09	1.035	90	3.11	14.81	-10	2200 Sl. Cloudy
0920	16.20	100	6.12	1.043	70	2.81	14.73	-14	3200 " "
0930	16.62	100	6.17	1.056	65	2.70	14.59	-20	4200 " "
0940	16.94	100	6.25	1.058	50	2.90	14.68	-27	5200 CLEAR
0950	17.28	100	6.29	1.077	40	2.63	14.74	-36	6200 "
1000	17.59	100	6.30	1.076	33	2.54	14.68	-39	7200 "
1010	17.88	100	6.32	1.079	30	2.50	14.72	-41	8200 "
1020	18.04	100	6.32	1.081	29	2.51	14.80	-43	9200 "
1030	18.15	100	6.35	1.086	21	2.47	14.70	-46	10200 "
1040	18.31	100	6.37	1.096	21	2.48	14.84	-50	11200 "
1050	18.46	100	6.37	1.102	16	2.49	14.92	-51	12200 "
1100	18.59	100	6.37	1.100	17	2.50	14.69	-52	13200 "
1110	18.75	100	6.37	1.100	14	2.49	14.85	-53	14200 "
1120	18.92	100	6.36	1.100	14	2.49	14.92	-52	15200 "
1130	19.10	100	6.35	1.094	16	2.48	14.84	-51	16200 "
1140	19.22	100	6.36	1.101	16	2.48	15.09	-53	17200 "
1150	19.36	100	6.35	1.104	16	2.47	15.17	-54	18200 "
1200	19.50	100	6.35	1.104	15	2.46	15.12	-55	19200 "
1210	19.58	100	6.35	1.097	15	2.47	15.00	-54	20200 "
1220	19.67	100	6.34	1.097	18	2.42	14.90	-55	21200 "
1230	19.81	100	6.33	1.082	17	2.41	14.48	-53	22200 "
1240	19.91	100	6.33	1.090	16	2.40	14.29	-57	23200 "
1250	19.98	100	6.34	1.083	16	2.41	14.24	-57	24200 "
1255	—	—	—	—	—	—	—	—	SAMPLE TIME

SIGNATURE: Terry Rogers

Tetra Tech NUS, Inc.

GROUNDWATER SAMPLE LOG SHEET

Project Site Name: NSWC Crane
Project No.: N3959

[] Domestic Well Data
[X] Monitoring Well Data
[] Other Well Type:
[] QA Sample Type:

Sample ID No.: 01GW1502
Sample Location: WES-1-15-83
Sampled By: T. ROJAHN
C.O.C. No.: MGBG061402
Type of Sample:
[X] Low Concentration
[] High Concentration

SAMPLING DATA:

	Color	pH	S.C.	Temp.	Turbidity	DO	ORP	Other
Date: 6/15/02					2.0			
Time: 1410	Visual	Standard	mS/cm	°C	NTU	mg/l	mV	NA
Method: BLADDER	CLEAR	6.42	1.396	16.92	2.0 (TN)	8.35	-71	—

PURGE DATA:

	Volume	pH	S.C.	Temp. (C)	Turbidity	DO	Salinity	Other
Date: 6/15/02								
Method: BLADDER								
Monitor Reading (ppm): —								
Well Casing Diameter & Material								
Type: 2" Ø PVC			See Low Flow Purge Data Sheets					
Total Well Depth (TD): 40.0								
Static Water Level (WL). 27.05								
One Casing Volume(gal/L): 8								
Start Purge (hrs): 1208								
End Purge (hrs): 1400								
Total Purge Time (min) 117								
Total Vol. Purged (gal/L) 10.4								

SAMPLE COLLECTION INFORMATION:

Analysis	Preservative	Container Requirements	Collected
Appendix IX Volatiles	4°C/HCl	(3) 40ml Vails	YES
Dis. Gasses (Methane, ethene & ethane)	4°C/HCl	(3) 40ml Vails	YES
Chloride	4°C	1L ~~(1) 500ml~~ HDPE	YES
TAL Metals Plus Strontium & Tin	4°C/HNO_3	(1) L HDPE	YES
Gross Alfa	4°C/HNO_3	(1) L Glass Amber	NO
Gross Beta	4°C/HNO_3	(1) L Glass Amber	NO
Total Organic Carbon	4°C/H_2SO_4	1L ~~(1) 500ml~~ Amber Glass	YES

OBSERVATIONS / NOTES:

40.0 - 27.05 = 12.95 x 0.163 = 2.1 gal or 8.0 L
Pump Intake @ ~31.63'
Top of Screen = 25.2'

Circle if Applicable:

MS/MSD	Duplicate ID No.:

Signature(s):

LOW FLOW PURGE DATA SHEET

PROJECT SITE NAME: NSWC Crane, IN
PROJECT NUMBER: N3959

WELL ID.: WES-1-15-83 01GW1502
DATE: 6/15/02

Time (Hrs.)	Water Level (Ft. below TOC)	Pump Rate (mL/Min.)	pH (S.U.)	S. Cond. (mS/cm)	Turb. (NTU)	DO (mg/L)	Temp. (Celcius)	ORP mV	Comments
1208	27.05	—	—	—	—	—	—	—	Start Purge
1218	27.27	130	—	—	—	—	—	—	650 ml CLEAR
1216	27.36	140	6.53	1.712	37	10.46	14.55	68	1070 ml "
1220	27.45	100	—	—	—	—	—	—	1470 ml "
1225	27.55	100	6.55	1.683	25	10.02	14.93	-72	1970 ml "
1230	27.63	100	6.55	1.642	17	9.99	15.32	-74	2470 ml "
1240	27.71	100	6.56	1.610	14	10.15	15.24	-74	3470 ml "
1250	27.80	100	6.56	1.581	11	10.32	15.17	-76	4470 ml "
1300	27.93	100	6.56	1.468	7.1	9.34	14.77	-75	5470 ml "
1310	28.08	100	6.54	1.436	3.9	9.62	15.29	-74	6470 ml "
1320	28.13	100	6.50	1.458	2.7	9.80	15.96	-75	7470 ml "
1330	28.11	70	6.50	1.482	3.4	10.13	17.15	-77	8170 ml "
1335	28.08	50	6.49	1.490	3.2	10.25	17.48	-78	8420 ml "
1340	28.05	50	6.49	1.526	3.1	10.41	18.40	-77	8670 ml "
1345	28.06	70	6.45	1.537	3.2	10.32	16.86	-78	9020 ml "
1350	28.09	70	6.45	1.473	3.1	8.47	16.68	-76	9370 ml "
1355	28.10	70	6.45	1.433	2.1	8.40	16.90	-74	9720 ml "
1400	28.09	70	6.44	1.411	1.9	8.38	16.78	-72	10070 ml "
1405	28.10	70	6.42	1.396	2.0	8.35	16.92	-71	10420 ml "
1410	—	—	—	—	—	—	—	—	Sample Time

MIN VOL = 8.0L

SIGNATURE: [signature]

SAMPLE LOG SHEET
NATURAL ATTENUATION PARAMETERS

Tetra Tech NUS, Inc.

Project Site Name: NSWC Crane

Project No.: CTO 158, N3959

Sampled By: Terry Rojahn

Sample ID No.: OGW1502

Sample Location: WES-1-15-83

Duplicate: ☐

SAMPLING DATA:

Date: 6/15/02	Color	pH	S.C.	Temp.	Turbidity	DO	ORP
Time: 1410	(Visual)	(SU)	(mS/cm)	(^{0}C)	(NTU)	(Meter, mg/l)	mV
Method Low Flow,	CLEAR	6.42	1.396	16.92	2.0	8.35	-71

SAMPLE COLLECTION/ANALYSIS INFORMATION:

Alkalinity: total, as $CaCO_3$, Range 10 to 1000 ppm

Equipment Chemetrics Test Kit

Analysis Time. 1557

Range Used:	Range	Concentration ppm
☐	10 to 100 ppm	
☑	50 to 500 ppm	250
☐	100 to 1000 ppm	

Concentration 250 ppm

Notes:

Carbon Dioxide: CO_2, Dissolved, Range 10 - 2500 ppm

Equipment: Chemetrics Test Kit

Analysis Time. 1539

Range Used	Range	Concentration ppm
☑	10 to 100 ppm	58
☐	100 to 1000 ppm	
☐	250 to 2500 ppm	

Concentration 58 ppm

Notes

Dissolved Oxygen: O_2, Range 0 - 12 ppm

Equipment. Chemetrics Test Kit

Analysis Time 1509

Range Used.	Range	Concentration ppm
☑	0 to 1 ppm	0.3
☐	1 to 12 ppm	

Concentration 0.3 ppm

Notes

Hydrogen Sulfide: as H_2S, Range 0 - 5

Equipment HACH HS-C

Analysis Time 1532

Concentration 0.0 mg/L

Notes.

Tetra Tech NUS, Inc.

SAMPLE LOG SHEET
NATURAL ATTENUATION PARAMETERS

Project Site Name: NSWC Crane
Project No.: CTO 158, N3959
Sampled By: Terry Rojahn

Sample ID No.: 01GW1502
Sample Location: WES-1-15-83
Duplicate: ☐

SAMPLE COLLECTION/ANALYSIS INFORMATION:

Divalent Iron: Fe^{2+}, Range 0-10 mg/L

Equipment: HACH IR-18C
Analysis Time: 1505

Concentration: 8.8 mg/L

Notes: OVER the 3.3 Limit of the DR/850

Manganese: Mn^{2+}, Range 0-20 mg/L

Equipment: HACH DR-850 Colorimeter
Analysis Time: 1521
Program No: 41

Concentration: 1.7 mg/L

Notes

Sulfate: SO_4^{2-}, Range 0-70 mg/L

Equipment: HACH DR-850 Colorimeter
Analysis Time: 1735
Program No: 92

Concentration: >80 mg/L

Notes: Result over limit of Test

Sulfide: S^{2-}, Range 0-0.7 mg/L

Equipment: HACH DR-850 Colorimeter
Analysis Time: 1530
Program No.: 93

Concentration: 0.0 mg/L

Notes:

Tetra Tech NUS, Inc

SAMPLE LOG SHEET
NATURAL ATTENUATION PARAMETERS

Project Site Name: NSWC Crane

Project No.: CTO 158, N3959

Sampled By: Terry Rojahn

Sample ID No.: 01GW1502

Sample Location: WES-1-15-83

Duplicate: ☐

SAMPLE COLLECTION/ANALYSIS INFORMATION:

Nitrite: NO_2^--N, Range 0-0.35 mg/L

Equipment. HACH DR-850 Colonmeter

Analysis Time: 1752

Program No : 62

Concentration. 0.000 mg/L

Notes: Alternate forms: NO_2 0.000 $NaNO_2$ 0.000

Nitrate: NO_3^--N, Range 0 - 0.50 mg/L

Equipment HACH DR-850 Colorimeter

Analysis Time 1851

Program No.: 55

Concentration: 0.00 mg/L

Nitrite Interference Treatment ☐

If results are over limit use dilution method at step 3, 5ml sample 10ml DI result X3, range up to 1.5mg/L

Notes. Alternate form NO_3 0.00

QA/QC Checklist

All data fields have been completed as necessary: ☑

Correct measurement units are cited in the SAMPLING DATA block ☑

Mulitplication is correct for each *Multiplier* table: ☑

Final calulated concentration is within the appropriate *Range Used* block ☑

Alkalinity *Relationship* is determined appropriatly as per manufacturer instructions: ☑

QA/QC sample (e.g., Std. Additions, etc.) frequency is appropriate as per the project planning documents: ☑

Nitrite Interference treatment used for Nitrate test if Nitrite was detected ☐ NA

Title block is initialized by person who performed the QA/QC Ckecklist: ☑

TL

Tetra Tech NUS, Inc

GROUNDWATER SAMPLE LOG SHEET

Project Site Name: NSWC Crane
Project No.: N3959

[] Domestic Well Data
[X] Monitoring Well Data
[] Other Well Type:
[] QA Sample Type:

Sample ID No.: 01GW2302
Sample Location: WES-1-23-83
Sampled By: T. ROJAHN
C.O.C. No.: MGBG060402
Type of Sample:
[X] Low Concentration
[] High Concentration

SAMPLING DATA:

Date: 6/4/02	Color	pH	S.C.	Temp.	Turbidity	DO	ORP	Other
Time: 1215	Visual	Standard	mS/cm	°C	NTU	mg/l	mV	NA
Method BLADDER	CLEAR	6.28	1.648	15.91	9.1	3.01	3	—

PURGE DATA:

Date: 6/4/02	Volume	pH	S.C.	Temp. (C)	Turbidity	DO	Salinity	Other
Method BLADDER —								
Monitor Reading (ppm) —								
Well Casing Diameter & Material								
Type: 2" Ø PVC			See Low Flow Purge Data Sheets					
Total Well Depth (TD) 48.0								
Static Water Level (WL) 40.25								
One Casing Volume(gal/L) 4.8								
Start Purge (hrs) 0940								
End Purge (hrs): 1210								
Total Purge Time (min) 150								
Total Vol Purged (gal/L) 11.8								

SAMPLE COLLECTION INFORMATION:

Analysis	Preservative	Container Requirements	Collected
Appendix IX Volatiles	4°C/HCl	(3) 40ml Vails	YES
Dis. Gasses (Methane, ethene & ethane)	4°C/HCl	(3) 40ml Vails	—
Chloride	4°C	(1) 500ml HDPE	—
TAL Metals Plus Strontium & Tin	4°C/HNO_3	(1) L HDPE	~~YES~~ TS
Gross Alfa	4°C/HNO_3	(1) L ~~Glass Amber~~ HDPE	YES
Gross Beta	4°C/HNO_3	(1) L ~~Glass Amber~~ HDPE	YES
Total Organic Carbon	4°C/H_2SO_4	(1) 500ml Amber Glass	—

OBSERVATIONS / NOTES:

WL BELOW top OF SCREEN.
48 - 40.25 = 7.75 x .163 = 1.3 gal or 4.8L
Top of SCREEN = 32.81
Bottom of " = 41.88

WELL UNDER PRESSURE @ start OF PURGE

Circle if Applicable:

MS/MSD	Duplicate ID No.:

Signature(s): Tey Rojahn

LOW FLOW PURGE DATA SHEET

PROJECT SITE NAME: NSWC Crane, IN
PROJECT NUMBER: N3959

WELL ID.: WES-1-23-83
DATE: 6/4/02

Time (Hrs.)	Water Level (Ft. below TOC)	Pump Rate (mL/Min.)	pH (S.U.)	S. Cond. (mS/cm)	Turb. (NTU)	DO (mg/L)	Temp. (Celcius)	ORP mV	Comments
0940	40.25	—	—	—	—	—	—	—	Start PURGE
0950	40.35	100	6.49	1.875	140	7.76	15.83	1	1000 ml Orangish
1000	40.42	100	6.45	1.852	130	5.11	15.77	7	2000 ml "
1010	40.50	100	6.43	1.824	120	4.39	15.70	12	3000 ml "
1020	40.58	90	6.40	1.792	90	4.30	15.50	15	3900 ml Sl. CLOUDY
1030	40.66	90	6.38	1.787	77	3.97	15.78	13	4800 ml Sl. CLOUDY
1040	40.72	90	6.37	1.782	65	3.68	16.07	10	5700 ml Sl. CLOUDY
1050	40.68	60	6.35	1.769	57	3.88	16.19	7	6300 ml CLEAR
1100	40.63	60	6.34	1.756	45	4.11	16.30	5	6900 ml CLEAR
1110	40.64	70	6.32	1.738	36	3.84	16.23	4	7600 ml CLEAR
1120	40.65	70	6.32	1.723	28	3.63	16.15	4	8300 ml CLEAR
1130	40.67	70	6.31	1.706	22	3.48	16.10	3	9000 ml CLEAR
1140	40.70	70	6.30	1.687	17	3.35	16.07	3	9700 ml CLEAR
1150	40.74	70	6.29	1.672	13	3.22	16.03	2	10400 ml CLEAR
1200	40.75	70	6.29	1.662	11	3.09	16.00	2	11100 ml CLEAR
1210	40.76	70	6.28	1.648	9.1	3.01	15.91	3	11800 ml CLEAR
1215	—	—	—	—	—	—	—	—	Start SAMPLING

MIN Vol = 4.86

SIGNATURE: Terry Rogers

Tetra Tech NUS, Inc.

GROUNDWATER SAMPLE LOG SHEET

01GW2502-F

Project Site Name: NSWC Crane
Project No.: N3959

[] Domestic Well Data
[X] Monitoring Well Data
[] Other Well Type:
[] QA Sample Type:

Sample ID No.: 01GW2502
Sample Location: 01-25
Sampled By: K. SIMPSON
C.O.C. No.: MGBG061402
Type of Sample:
[X] Low Concentration
[] High Concentration

SAMPLING DATA:

Date: 6.14.02	Color	pH	S.C.	Temp.	Turbidity	DO	ORP	Other
Time: 1415	Visual	Standard	mS/cm	°C	NTU	mg/l	mV	NA
Method BLADDER	CLEAR	7.02	1.363	14.5	14	0.63	232	—

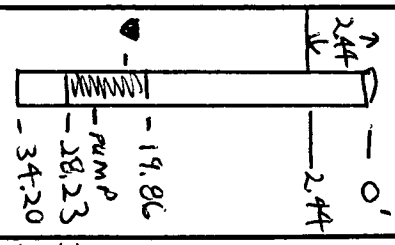
PURGE DATA:

Date: 6.14.02	Volume	pH	S.C.	Temp. (C)	Turbidity	DO	Salinity	Other
Method: BLADDER								
Monitor Reading (ppm): —								
Well Casing Diameter & Material								
Type: 2" PVC	See Low Flow Purge Data Sheets							
Total Well Depth (TD) 34.20								
Static Water Level (WL) 20.90								
One Casing Volume(gal/L) 2.2								
Start Purge (hrs) 1051								
End Purge (hrs). 1415								
Total Purge Time (min) 214								
Total Vol Purged (gal/L). 3.7								

SAMPLE COLLECTION INFORMATION:

Analysis	Preservative	Container Requirements	Collected
Appendix IX Volatiles	4°C/HCl	(3) 40ml Vails	YES
Dis. Gasses (Methane, ethene & ethane)	4°C/HCl	(3) 40ml Vails	YES
Chloride	4°C	1L ~~(1) 500ml~~ HDPE	YES
TAL Metals Plus Strontium & Tin	4°C/HNO_3	(1) L HDPE	YES
~~Gross Alfa~~	~~4°C/HNO_3~~	~~(1) L Glass Amber~~	—
~~Gross Beta~~	~~4°C/HNO_3~~	~~(1) L Glass Amber~~	—
Total Organic Carbon	4°C/H_2SO_4	1L ~~(1) 500ml~~ Amber Glass	YES
+ FIELD MNA			
DIS TAL METALS PLUS SrESN	4°C/HNO3	(1) L HDPE	YES

OBSERVATIONS / NOTES:



Circle if Applicable:

MS/MSD —

Duplicate ID No.: —

Signature(s):

LOW FLOW PURGE DATA SHEET

PROJECT SITE NAME: NSWC Crane, IN
PROJECT NUMBER: N3959

WELL ID.: 01 GW 25 02
DATE: 6-14-02

Time (Hrs.)	Water Level (Ft. below TOC)	Pump Rate (mL/Min.)	pH (S.U.)	S. Cond. (mS/cm)	Turb. (NTU)	DO (mg/L)	Temp. (Celcius)	ORP mV	Comments
1051	20.90	110	—	—	—	—	—	—	START PURGE CLEAN TO LT CLOUDY
1057	21.15	80	—	—	370	—	—	—	NO ODOR
1100	21.16	80	7.05	1.367	—	1.32	14.4	218	
1104	21.20	80	—	—	—	—	—	—	
1108	21.23	80	7.04	1.364	390	1.19	14.5	226	
1112	21.23		—	—	—	—	—	—	
1120	21.32		7.04	1.366	380	1.05	15.2	231	
1130	21.35		7.04	1.368	330	1.15	15.5	234	
1140	21.37	↓	7.04	1.365	290	0.96	15.5	236	
1150	21.43	50	7.04	1.366	200	1.06	15.5	238	
1200	21.43	50	7.04	1.366	170	1.02	15.5	237	
1210	21.44	60	7.03	1.367	150	1.09	15.5	238	
1220	21.45		7.03	1.365	105	0.91	15.4	238	
1230	21.52		7.03	1.364	75	0.84	15.3	238	
1240	21.55		7.03	1.364	65	0.94	15.1	238	
1250	21.58		7.03	1.366	50	0.72	14.9	239	
1300	21.60		7.03	1.365	40	0.90	14.7	238	
1310	21.62		7.03	1.365	33	0.74	14.7	237	
1320	21.65		7.03	1.367	29	0.92	14.6	236	
1330	21.68		7.03	1.368	24	0.82	14.2	236	
1340	21.69		7.03	1.365	18	0.99	14.3	236	
1350	21.68		7.03	1.363	14	0.74	14.4	235	
1400	21.72		7.03	1.364	14	0.66	14.6	232	
1405	21.73		7.03	1.363	12	0.69	14.6	232	
1415	21.81	↓	7.02	1.363	14	0.63	14.5	232	START SAMPLING

SIGNATURE: [illegible]

SAMPLE LOG SHEET
NATURAL ATTENUATION PARAMETERS

Tetra Tech NUS, Inc.

Project Site Name: NSWC Crane
Project No.: CTO 158, N3959
Sampled By: Terry Rojahn & K. Simpson

Sample ID No.: 01GW2502
Sample Location: WES-1-25-83
Duplicate: ☐

SAMPLING DATA:

	Color (Visual)	pH (SU)	S.C. (mS/cm)	Temp. (°C)	Turbidity (NTU)	DO (Meter, mg/l)	ORP mV
Date: 6/14/02							
Time: 1415							
Method Low Flow, BLADDER	CLEAR	7.02	1.363	14.5	14	0.63	232

SAMPLE COLLECTION/ANALYSIS INFORMATION:

Alkalinity: total, as $CaCO_3$, Range 10 to 1000 ppm

Equipment: Chemetrics Test Kit

Analysis Time: 1506

Range Used	Range	Concentration ppm
☐	10 to 100 ppm	
☑	50 to 500 ppm	250
☐	100 to 1000 ppm	

Concentration: 250 ppm

KS

Notes

Carbon Dioxide: CO_2, Dissolved, Range 10 - 2500 ppm

Equipment. Chemetrics Test Kit

Analysis Time: 1512

Range Used	Range	Concentration ppm
☑	10 to 100 ppm	25
☐	100 to 1000 ppm	
☐	250 to 2500 ppm	

Concentration 25 ppm

TK

Notes:

Dissolved Oxygen: O_2, Range 0 - 12 ppm

Equipment: Chemetrics Test Kit

Analysis Time: 1441

Range Used	Range	Concentration ppm
☑	0 to 1 ppm	0.4
☐	1 to 12 ppm	

Concentration 0.4 ppm

KS

Notes:

Hydrogen Sulfide: as H_2S, Range 0 - 5

Equipment HACH HS-C

Analysis Time. 1515

K.S

Concentration 0.0 mg/L

Notes:

Tetra Tech NUS, Inc.

SAMPLE LOG SHEET
NATURAL ATTENUATION PARAMETERS

Project Site Name: NSWC Crane
Project No.: CTO 158, N3959
Sampled By: Terry Rojahn & K. Simpson

Sample ID No.: 01GW2502
Sample Location: WES-1-25-83
Duplicate: ☐

SAMPLE COLLECTION/ANALYSIS INFORMATION: 6/14/02

Divalent Iron: Fe^{2+}, Range 0-10 mg/L

Equipment: HACH IR-18C

Analysis Time: 1452

TR

Concentration: 0.0 mg/L

Notes: Prog. 33 of Hach DR-850 Colorimeter

Manganese: Mn^{2+}, Range 0-20 mg/L

Equipment: HACH DR-850 Colorimeter

Analysis Time 1426

Program No.: 41

TR

Concentration 0.3 mg/L

Notes

Sulfate: SO_4^{2-}, Range 0-70 mg/L

Equipment: HACH DR-850 Colorimeter

Analysis Time 1440

Program No.. 92

TR

Concentration >80 mg/L

Notes: RESULT ABOVE INST./TEST LIMIT = 0.13 mg/L

Sulfide: S^{2-}, Range 0-0.7 mg/L

Equipment: HACH DR-850 Colorimeter

Analysis Time: 1450

Program No.: 93

TR

Concentration: 0.02 mg/L

Notes:

Tetra Tech NUS, Inc.

SAMPLE LOG SHEET
NATURAL ATTENUATION PARAMETERS

Project Site Name: NSWC Crane

Project No.: CTO 158, N3959

Sampled By: Terry Rojahn & K. Simpson

Sample ID No.: 01GW2502

Sample Location: WES-1-25-83

Duplicate: ☐

SAMPLE COLLECTION/ANALYSIS INFORMATION:

Nitrite: NO_2^--N, Range 0-0.35 mg/L

Equipment: HACH DR-850 Colorimeter

Analysis Time: 1655

KS

Program No.: 62

Concentration: 0 mg/L

Notes: Alternate forms: NO_2 0 $NaNO_2$ 0

Nitrate: NO_3^--N, Range 0 - 0.50 mg/L

Equipment: HACH DR-850 Colorimeter

Analysis Time: 1755

KS

Program No: 55

Concentration: 0.05 mg/L

Nitrite Interference Treatment ☐

If results are over limit use dilution method at step 3, 5ml sample 10ml DI result X3, range up to 1.5mg/L

Notes: Alternate form. NO_3 0.21 mg/L

QA/QC Checklist

TC

All data fields have been completed as necessary: ☑

Correct measurement units are cited in the SAMPLING DATA block: ☑

Multiplication is correct for each *Multiplier* table: ☑

Final calulated concentration is within the appropriate *Range Used* block: ☑

Alkalinity *Relationship* is determined appropriatly as per manufacturer instructions: ☑

QA/QC sample (e.g , Std. Additions, etc.) frequency is appropriate as per the project planning documents: ☑

Nitrite Interference treatment used for Nitrate test if Nitrite was detected. ☐ NA

Title block is initialized by person who performed the QA/QC Checklist ☑

Tetra Tech NUS, Inc

GROUNDWATER SAMPLE LOG SHEET

Project Site Name: NSWC Crane
Project No.: N3959

[] Domestic Well Data
[X] Monitoring Well Data
[] Other Well Type:
[] QA Sample Type:

Sample ID No.: 01GW2602
Sample Location: WES-1-26-83
Sampled By: T. ROJAHN
C.O.C. No.: MGBG060402
Type of Sample:
[X] Low Concentration
[] High Concentration

SAMPLING DATA:

Date: 6/4/02	Color	pH	S.C.	Temp.	Turbidity	DO	ORP	Other
Time: 1800	Visual	Standard	mS/cm	°C	NTU	mg/l	mV	NA
Method. BLADDER	CLEAR	6.34	1.129	15.42	16	2.66	+7	—

PURGE DATA:

Date: 6/4/02	Volume	pH	S.C.	Temp. (C)	Turbidity	DO	Salinity	Other
Method: BLADDER								
Monitor Reading (ppm): —								
Well Casing Diameter & Material								
Type: 2" Ø PVC			See Low Flow Purge Data Sheets					
Total Well Depth (TD): 58.0								
Static Water Level (WL) 35.29								
One Casing Volume(gal/L) 14								
Start Purge (hrs): 1355								
End Purge (hrs) 1755								
Total Purge Time (min) 240								
Total Vol. Purged (gal/L) 23								

SAMPLE COLLECTION INFORMATION:

Analysis	Preservative	Container Requirements	Collected
Appendix IX Volatiles	4°C/HCl	(3) 40ml Vails	YES
Dis. Gasses (Methane, ethene & ethane)	4°C/HCl	(3) 40ml Vails	NO
Chloride	4°C	(1) 500ml HDPE	
TAL Metals Plus Strontium & Tin	4°C/HNO_3	(1) L HDPE	
Gross Alfa	4°C/HNO_3	(1) L Glass Amber	
Gross Beta	4°C/HNO_3	(1) L Glass Amber	
Total Organic Carbon	4°C/H_2SO_4	(1) 500ml Amber Glass	

OBSERVATIONS / NOTES:

Top of SCREEN = 42.80'
PUMP INTAKE = 47.36
58.0 - 35.29 = 22.71 × 0.163 = 3.7 gal or 14L

Circle if Applicable:		Signature(s):
MS/MSD	Duplicate ID No.:	[signature]

LOW FLOW PURGE DATA SHEET

PROJECT SITE NAME: NSWC Crane, IN
PROJECT NUMBER: N3959

WELL ID.: WES-1-26-83
DATE: 6/04/02

Time (Hrs.)	Water Level (Ft. below TOC)	Pump Rate (mL/Min.)	pH (S.U.)	S. Cond. (mS/cm)	Turb. (NTU)	DO (mg/L)	Temp. (Celcius)	ORP mV	Comments
1355	35.29	—	—	—	—	—	—	—	Start PURGE
1405	36.38	100	6.54	1.224	950	3.63	16.69	-61	1000ml Grayish
1415	36.89	100	6.45	1.235	550	2.96	17.17	-43	2000ml "
1425	37.01	100	6.41	1.262	340	3.20	17.77	-37	3000ml "
1435	37.09	100	6.32	1.241	310	3.13	17.26	-29	4000ml "
1445	37.24	100	6.26	1.220	180	3.10	16.79	-20	5000ml CLOUDY
1455	37.32	100	6.31	1.225	150	3.04	17.11	-20	6000ml "
1505	37.40	100	6.37	1.229	110	5.01	17.51	-21	7000ml Sl. Cloudy — CLEAN FLOW CELL
1515	37.42	100	6.26	1.214	90	3.89	17.20	-10	8000ml " "
1525	37.44	100	6.16	1.198	75	2.92	16.88	0	9000ml " "
1535	37.51	100	6.13	1.187	65	2.85	16.64	+5	10000ml " "
1545	37.58	100	6.11	1.179	55	2.78	16.42	+9	11000ml " "
1555	37.66	100	6.11	1.170	50	2.76	16.35	+12	12000ml CLEAR
1605	37.74	100	6.10	1.167	45	2.74	16.24	+16	13000ml CLEAR
1615	37.80	100	6.10	1.160	41	2.71	16.07	+19	14000ml CLEAR
1625	37.86	100	6.10	1.153	38	2.69	15.91	+19	15000ml CLEAR
1635	37.90	100	6.14	1.141	34	2.60	15.68	+18	16000ml CLEAR
1645	37.96	100	6.16	1.135	30	2.54	15.49	+17	17000ml CLEAR
1655	37.95	100	6.24	1.134	30	2.47	15.51	+13	18000ml CLEAR
1705	37.95	100	6.24	1.135	30	2.49	15.56	+13	19000ml CLEAR
1715	37.94	80	6.26	1.136	23	2.65	15.83	+11	19800ml CLEAR
1725	37.94	80	6.28	1.140	17	2.71	15.84	+10	20600ml CLEAR
1735	37.94	80	6.30	1.136	17	2.66	15.75	+10	21400ml CLEAR
1745	37.94	80	6.32	1.132	17	2.62	15.69	+9	22200ml CLEAR
1755	37.95	80	6.34	1.129	16	2.66	15.42	+7	23000ml CLEAR
1800	—	—	—	—	—	—	—	—	Start Sampling

SIGNATURE: Terry Rozeski

Tetra Tech NUS, Inc

GROUNDWATER SAMPLE LOG SHEET

Project Site Name: NSWC Crane
Project No.: N3959

[] Domestic Well Data
[X] Monitoring Well Data
[] Other Well Type:
[] QA Sample Type:

Sample ID No.: 01GWC0102
Sample Location: 01C01
Sampled By: T. ROJAHN
C.O.C. No.: MGBG061102
Type of Sample:
[X] Low Concentration
[] High Concentration

SAMPLING DATA:

	Color	pH	S.C.	Temp.	Turbidity	DO	ORP	Other
Date: 6/11/02	Visual	Standard	mS/cm	°C	NTU	mg/l	mV	NA
Time: 1315								
Method BLADDER	CLEAR	6.80	0.394	16.42	0.60	2.28	565	—

PURGE DATA:

Date 6/11/02	Volume	pH	S.C.	Temp. (C)	Turbidity	DO	Salinity	Other
Method BLADDER								
Monitor Reading (ppm) —								
Well Casing Diameter & Material								
Type: 2" Ø PVC			See Low Flow Purge Data Sheets					
Total Well Depth (TD) 165.0								
Static Water Level (WL) 138.64								
One Casing Volume(gal/L) 16.3								
Start Purge (hrs) 1100								
End Purge (hrs). 1310								
Total Purge Time (min) 130								
Total Vol Purged (gal/L) 18.4								

SAMPLE COLLECTION INFORMATION:

Analysis	Preservative	Container Requirements	Collected
Appendix IX Volatiles	4°C/HCl	(3) 40ml Vials	YES
Dis Gasses (Methane, ethene & ethane)	4°C/HCl	(3) 40ml Vials	NO
Chloride	4°C	(1) 500ml HDPE	↓
TAL Metals Plus Strontium & Tin	4°C/HNO_3	(1) L HDPE	↓
Gross Alfa	4°C/HNO_3	(1) L Glass Amber	↓
Gross Beta	4°C/HNO_3	(1) L Glass Amber	↓
Total Organic Carbon	4°C/H_2SO_4	(1) 500ml Amber Glass	↓

OBSERVATIONS / NOTES:

165.0 - 138.64 = 26.36 x 0.163 = 4.3 gal or 16.3
Pump Intake @ 157' below TOC
1

Circle if Applicable:

MS/MSD	Duplicate ID No.:

Signature(s): Terry Rojahn

LOW FLOW PURGE DATA SHEET

PROJECT SITE NAME: NSWC Crane, IN
PROJECT NUMBER: N3959

WELL ID.: 01GWC01 01
DATE: 6/11/02

Time (Hrs.)	Water Level (Ft. below TOC)	Pump Rate (mL/Min.)	pH (S.U.)	S. Cond. (mS/cm)	Turb. (NTU)	DO (mg/L)	Temp. (Celcius)	ORP mV	Comments
1100	138.64	—	—	—	—	—	—	—	START PURGE
1107	138.68	50	—	—	—	—	—	—	350 ml CLEAR
1110	138.68	50	7.14	0.602	36	9.02	20.71	186	500 ml "
1114	138.68	50	—	—	—	—	—	—	700 ml "
1118	138.68	80	—	—	—	—	—	—	1020 ml "
1120	138.70	80	7.05	0.609	8.9	6.88	19.53	223	1180 ml "
1125	138.70	80	—	—	—	—	—	—	1580 ml "
1130	138.74	160	6.98	0.505	5.2	4.46	15.98	326	2380 ml "
1135	138.74	160	—	—	—	—	—	—	3180 ml "
1140	138.74	160	7.02	0.438	2.1	3.07	15.78	419	3980 ml "
1150	138.71	160	7.07	0.415	1.7	2.85	16.16	456	5580 ml "
1200	138.73	160	7.05	0.407	1.5	2.77	16.17	481	7180 ml "
1210	138.74	160	7.02	0.397	1.3	2.72	16.20	504	8780 ml "
1220	138.70	160	7.02	0.398	1.0	2.61	16.53	515	10380 ml "
1230	138.70	160	6.99	0.397	0.80	2.57	16.72	530	11980 ml "
1240	138.72	160	6.95	0.399	0.60	2.54	16.89	541	13580 ml "
1250	138.72	160	6.90	0.397	0.45	2.54	16.47	555	15180 ml "
1300	138.72	160	6.90	0.395	0.60	2.39	16.30	561	16780 ml "
1310	138.72	160	6.90	0.394	0.60	2.28	16.42	565	18380 ml "
1315	—	—	—	—	—	—	—	—	START SAMPLING

SIGNATURE: Tony Rogers

Tetra Tech NUS, Inc

GROUNDWATER SAMPLE LOG SHEET

Project Site Name: NSWC Crane
Project No.: N3959

[] Domestic Well Data
[X] Monitoring Well Data
[] Other Well Type:
[] QA Sample Type:

Sample ID No.: 01GWT0203-F 01GWT0203
Sample Location: 01T02
Sampled By: T. ROJAHN
C.O.C. No.: MGBG061102
Type of Sample:
[X] Low Concentration
[] High Concentration

SAMPLING DATA:

	Color Visual	pH Standard	S.C. mS/cm	Temp. °C	Turbidity NTU	DO mg/l	ORP mV	Other NA
Date: 6/12/02								
Time: 0900								
Method BLADDER	CLEAR	5.68	2.686	14.99	18	10.17	98	—

T @ sample time

PURGE DATA:

	Volume	pH	S.C.	Temp. (C)	Turbidity	DO	Salinity	Other
Date: 6/12/02								
Method: BLADDER								
Monitor Reading (ppm) —								
Well Casing Diameter & Material								
Type: 2" ø PVC			See Low Flow Purge Data Sheets					
Total Well Depth (TD) 72.30								
Static Water Level (WL): 65.12								
One Casing Volume(gal/L): 4.4								
Start Purge (hrs): 1353								
End Purge (hrs) 1545								
Total Purge Time (min) 112								
Total Vol Purged (gal/L): 10.0								

SAMPLE COLLECTION INFORMATION:

Analysis	Preservative	Container Requirements	Collected
Appendix IX Volatiles	4°C/HCl	(3) 40ml Vails	YES
Dis Gasses (Methane, ethene & ethane)	4°C/HCl	(3) 40ml Vails	
Chloride	4°C	(1) L ~~(1) 500ml~~ HDPE	
TAL Metals Plus Strontium & Tin	4°C/HNO_3	(1) L HDPE	
Gross Alfa	4°C/HNO_3	(1) L ~~Glass Amber~~ HDPE	
Gross Beta	4°C/HNO_3	(1) L ~~Glass Amber~~ HDPE	
Total Organic Carbon	4°C/H_2SO_4	(1) 250ml ~~(1) 500ml~~ Amber Glass	
Dis Metals + Sr & Sn	4°C/HNO_3	(1) L HDPE	YES

OBSERVATIONS / NOTES:

72.30 - 65.12 = 7.18 x 0.163 = 1.17 gal or 4.4 L
PUMP BELOW / @ PUMP INTAKE

Circle if Applicable:

MS/MSD	Duplicate ID No.:

Signature(s): [signature]

LOW FLOW PURGE DATA SHEET

PROJECT SITE NAME: NSWC Crane, IN
PROJECT NUMBER: N3959

WELL ID.: 01T02
DATE: 6/11/02

Time (Hrs.)	Water Level (Ft. below TOC)	Pump Rate (mL/Min.)	pH (S.U.)	S. Cond. (mS/cm)	Turb. (NTU)	DO (mg/L)	Temp. (Celcius)	ORP mV	Comments
1353	65.12	—	—	—	—	—	—	—	Start PURGE
1356	65.55	150	—	—	—	—	—	—	450 ml CLEAR
1359	65.88	150	5.33	2.669	3.7	7.88	15.59	153	900 "
1402	66.13	150	—	—	—	—	—	—	1350 "
1405	66.35	150	—	—	—	—	—	—	1800 "
1410	66.60	100	5.14	2.649	7.7	9.71	15.78	270	2300 "
1415	66.73	100	—	—	—	—	—	—	2800 "
1420	66.90	100	5.20	2.688	6.4	10.95	16.49	314	3300 "
1430	67.19	100	5.25	2.665	6.2	10.82	16.18	315	4300 "
1440	67.53	82	5.31	2.659	5.6	10.43	15.79	296	5120 "
1450	67.83	82	5.37	2.654	6.4	10.16	15.46	260	5940 "
1500	68.23	82	5.44	2.653	7.2	10.15	15.13	210	6760 "
1510	68.88	82	5.52	2.663	9.5	10.15	14.98	153	7580 "
1520	69.10	82	5.61	2.672	11	10.17	14.83	117	8400 "
1530	HEAVY RAIN	82	—	—	—	—	—	—	9220 (HEAVY RAIN MISSED READING)
1540	<70.33	82	5.68	2.686	18	10.17	14.99	98	10040 CLEAR
1545	DRY	→							DRY
1555	~~70.33~~ 69.60	—	—	—	—	—	—	—	RECOVERY
1600	69.49	—	—	—	—	—	—	—	"
1605	69.35	—	—	—	—	—	—	—	"
1610	69.11	—	—	—	—	—	—	—	"
1620	68.85	—	—	—	—	—	—	—	"
1635	68.60	—	—	—	—	—	—	—	"
1645	68.40	—	—	—	—	—	—	—	"

SIGNATURE: Terry Rogers

SAMPLE LOG SHEET
NATURAL ATTENUATION PARAMETERS

Tetra Tech NUS, Inc.

Project Site Name: NSWC Crane

Project No.: CTO 158, N3959

Sampled By: Terry Rojahn & K. Simpson

Sample ID No.: 01GWT0203

Sample Location: 01-T02

Duplicate: ☐

SAMPLING DATA:

Date. 6-12-02	Color	pH	S.C.	Temp.	Turbidity	DO	ORP
Time 0900	(Visual)	(SU)	(mS/cm)	(°C)	KS (NTU)	(Meter, mg/l)	mV
Method Low Flow, BLADDER	CLEAR	5.68	2.686	14.99	11 ~~18~~	10.17	+ 98

SAMPLE COLLECTION/ANALYSIS INFORMATION:

Alkalinity: total, as $CaCO_3$, Range 10 to 1000 ppm

Equipment: Chemetrics Test Kit

Analysis Time: 0900 (KS)

Range Used	Range	Concentration ppm
☐	10 to 100 ppm	
☑	50 to 500 ppm	120
☐	100 to 1000 ppm	

Concentration 120 ppm

Notes.

Carbon Dioxide: CO_2, Dissolved, Range 10 - 2500 ppm

Equipment Chemetrics Test Kit

Analysis Time. 0908 (KS)

Range Used	Range	Concentration ppm
☐	10 to 100 ppm	
☑	100 to 1000 ppm	350
☐	250 to 2500 ppm	

Concentration 350 ppm

Notes:

Dissolved Oxygen: O_2, Range 0 - 12 ppm

Equipment. Chemetrics Test Kit

Analysis Time: 0912 (KS)

Range Used.	Range	Concentration ppm
☑	0 to 1 ppm	>1
☑	1 to 12 ppm	1.5

Concentration 1.5 ppm

Notes

Hydrogen Sulfide: as H_2S, Range 0 - 5

Equipment. HACH HS-C

Analysis Time: 0917 (KS)

Concentration 0.0 mg/L

Notes

7 5-8

Tetra Tech NUS, Inc

SAMPLE LOG SHEET
NATURAL ATTENUATION PARAMETERS

Project Site Name: NSWC Crane
Project No.: CTO 158, N3959
Sampled By: Terry Rojahn & K Simpson 6.12.02

Sample ID No.: 01GWT02 03
Sample Location: 01-T02
Duplicate: ☐

SAMPLE COLLECTION/ANALYSIS INFORMATION:

Divalent Iron: Fe^{2+}, Range 0-10 mg/L

Equipment: HACH IR-18C

Analysis Time: 0940 (KS)

Concentration: 8.5 mg/L

Notes:

Manganese: Mn^{2+}, Range 0-20 mg/L

Equipment: HACH DR-850 Colorimeter

Program No.: 41

Analysis Time: 0955 (KS)

Concentration: >47.5 MNO4 mg/L

47.5 · LIMIT OF METER

Notes: > 22.0 mg/L Mn^{2+} ✓

Sulfate: SO_4^{2-}, Range 0-70 mg/L

Equipment: HACH DR-850 Colorimeter

Program No: 92

Analysis Time: 1010 (KS)

Concentration: > 80 mg/L

80 = METER LIMIT

Notes: SO4

Sulfide: S^{2-}, Range 0-0.7 mg/L

Equipment: HACH DR-850 Colorimeter

Program No.: 93

Analysis Time: 1018 (KS)

Concentration: 0.04 mg/L

Notes.

Tetra Tech NUS, Inc

SAMPLE LOG SHEET
NATURAL ATTENUATION PARAMETERS

Project Site Name: NSWC Crane

Project No.: CTO 158, N3959

Sampled By: Terry Rojahn & K. Simpson 6-12-02

Sample ID No.: 01GWT0203

Sample Location: 01-T02

Duplicate: ☐

SAMPLE COLLECTION/ANALYSIS INFORMATION:

Nitrite: NO_2^--N, Range 0-0.35 mg/L

Equipment. HACH DR-850 Colorimeter

Program No.: 62

Concentration. 0.00 mg/L

Analysis Time: 0805 6/13/02 TR

Notes: Alternate forms: NO_2 0.00 $NaNO_2$ 0.00

Nitrate: NO_3^--N, Range 0 - 0.50 mg/L

Equipment HACH DR-850 Colorimeter

Program No: 55

Concentration 0.01 mg/L

Analysis Time 0836 6/13/02 TR

Nitrite Interference Treatment: ☐

If results are over limit use dilution method at step 3, 5ml sample 10ml DI result X3, range up to 1.5mg/L

Notes. Alternate form NO_3 0.04

QA/QC Checklist

All data fields have been completed as necessary. ☑

Correct measurement units are cited in the SAMPLING DATA block. ☑ TR

Mulitplication is correct for each *Multiplier* table: ☑

Final calulated concentration is within the appropriate *Range Used* block: ☑

Alkalinity *Relationship* is determined appropriatly as per manufacturer instructions: ☑

QA/QC sample (e.g., Std. Additions, etc.) frequency is appropriate as per the project planning documents: ☑

Nitrite Interference treatment used for Nitrate test if Nitrite was detected: ☐ NA

Title block is initialized by person who performed the QA/QC Ckecklist: ☑

Tetra Tech NUS, Inc

GROUNDWATER SAMPLE LOG SHEET

Project Site Name: NSWC Crane
Project No.: N3959

[] Domestic Well Data
[X] Monitoring Well Data
[] Other Well Type:
[] QA Sample Type:

Sample ID No.: GW 01T0301
Sample Location: 01T03
Sampled By: T. ROJAHN
C.O.C. No.: MGBG061402
Type of Sample:
[X] Low Concentration
[] High Concentration

SAMPLING DATA:

Date: 6/17/02	Color	pH	S.C.	Temp.	Turbidity	DO	ORP	Other
Time: 1045	Visual	Standard	mS/cm	°C	NTU	mg/l	mV	NA
Method SAME	CLEAR	7.23	0.739	13.90	2.7	7.72	+404	—

PURGE DATA:

Date. 6/17/02	Volume	pH	S.C.	Temp. (C)	Turbidity	DO	Salinity	Other
Method. BLADDER								
Monitor Reading (ppm) —								
Well Casing Diameter & Material								
Type 2" Ø PVC			See Low Flow Purge Data Sheets					
Total Well Depth (TD) 156.4								
Static Water Level (WL) 139.86								
One Casing Volume(gal/L) 10.6								
Start Purge (hrs) 0847								
End Purge (hrs): 1040								
Total Purge Time (min) 113								
Total Vol Purged (gal/L) 11.7								

SAMPLE COLLECTION INFORMATION:

Analysis	Preservative	Container Requirements	Collected
Appendix IX Volatiles	4°C/HCl	(3) 40ml Vails	YES
Dis Gasses (Methane, ethene & ethane)	4°C/HCl	(3) 40ml Vails	
Chloride	4°C	1 L ~~(1) 500ml~~ HDPE	
TAL Metals Plus Strontium & Tin	4°C/HNO_3	(1) L HDPE	
Gross Alfa	4°C/HNO_3	(1) L ~~Glass Amber~~ HDPE	
Gross Beta	4°C/HNO_3	(1) L ~~Glass Amber~~ HDPE	
Total Organic Carbon	4°C/H_2SO_4	1 L ~~(1) 500ml~~ Amber Glass	

OBSERVATIONS / NOTES:

Top of Screen = 146.4
156.4 - 139.16 = 17.24 x 0.163 = 2.8 gal or 10.6 L
Intake @ 151.5'

Circle if Applicable:		Signature(s):
MS/MSD	Duplicate ID No.:	[signature]

LOW FLOW PURGE DATA SHEET

PROJECT SITE NAME: NSWC Crane, IN
PROJECT NUMBER: N3959

WELL ID.: 01T03
DATE: 6/17/02

Time (Hrs.)	Water Level (Ft. below TOC)	Pump Rate (mL/Min.)	pH (S.U.)	S. Cond. (mS/cm)	Turb. (NTU)	DO (mg/L)	Temp. (Celcius)	ORP mV	Comments
0847	139.16	—	—	—	—	—	—	—	Start Purge
0850	139.83	150	—	—	—	—	—	—	450 ml CLEAR
0853	139.88	130	—	—	—	—	—	—	840 CLEAR
0856	139.88	70	7.62	0.778	—	12.10	14.65	350	1050 CLEAR
0859	139.95	70	—	—	—	—	—	—	1260 CLEAR
0902	139.95	70	—	—	—	—	—	—	1470 CLEAR
0905	139.95	70	7.55	0.778	27	7.73	14.37	360	1680 CLEAR
0910	139.88	70	7.39	0.778	23	9.35	14.01	368	2030 CLEAR
0920	139.96	100	7.31	0.770	14	9.13	13.85	375	3030 CLEAR
0930	139.95	100	7.31	0.763	15	7.18	13.87	379	4030 CLEAR
0940	139.97	110	7.30	0.758	8.4	7.40	13.86	383	5130 CLEAR
0950	139.95	110	7.28	0.753	6.7	7.27	13.88	387	6230 CLEAR
1000	139.95	110	7.28	0.748	4.8	7.09	13.84	389	7330 CLEAR
1010	140.07	110	7.23	0.744	3.5	9.30	13.82	396	8430 CLEAR
1020	140.10	110	7.23	0.742	3.1	8.38	13.94	399	9530 CLEAR
1030	140.10	110	7.23	0.739	3.2	7.99	13.90	402	10630 CLEAR
1040	140.09	110	7.23	0.739	2.7	7.72	13.90	404	11730 CLEAR
1045									Start Sampling

SIGNATURE: [signature]

MIN VOL = 10.6 L
TOP OF SCREEN = ~ 146.4

SAMPLE LOG SHEET
NATURAL ATTENUATION PARAMETERS

Tetra Tech NUS, Inc

Project Site Name: NSWC Crane
Project No.: CTO 158, N3959
Sampled By: Terry Rojahn

Sample ID No.: 01GWT0301
Sample Location: 01T03
Duplicate: ☐

SAMPLING DATA:

Date: 6/17/02	Color	pH	S.C.	Temp.	Turbidity	DO	ORP
Time: 1045	(Visual)	(SU)	(mS/cm)	(°C)	(NTU)	(Meter, mg/l)	mV
Method Low Flow,	CLEAR	7.23	0.739	13.90	2.7	7.72	+404

SAMPLE COLLECTION/ANALYSIS INFORMATION:

Alkalinity: total, as $CaCO_3$, Range 10 to 1000 ppm

Equipment Chemetrics Test Kit

Analysis Time 1200

Range Used	Range	Concentration ppm
☐	10 to 100 ppm	
☑	50 to 500 ppm	275
☐	100 to 1000 ppm	

Concentration 275 ppm

Notes

Carbon Dioxide: CO_2, Dissolved, Range 10 - 2500 ppm

Equipment: Chemetrics Test Kit

Analysis Time 1150

Range Used:	Range	Concentration ppm
☑	10 to 100 ppm	18
☐	100 to 1000 ppm	
☐	250 to 2500 ppm	

Concentration 18 ppm

Notes

Dissolved Oxygen: O_2, Range 0 - 12 ppm

Equipment: Chemetrics Test Kit

Analysis Time. 1143

Range Used	Range	Concentration ppm
☑	0 to 1 ppm	0.7
☐	1 to 12 ppm	

Concentration 0.7 ppm

Notes:

Hydrogen Sulfide: as H_2S, Range 0 - 5

Equipment: HACH HS-C

Analysis Time. 1141

Concentration 0.0 mg/L

Notes

Tetra Tech NUS, Inc

SAMPLE LOG SHEET
NATURAL ATTENUATION PARAMETERS

Project Site Name: NSWC Crane
Project No.: CTO 158, N3959
Sampled By: Terry Rojahn

Sample ID No.: 016WT0301
Sample Location: 01T03
Duplicate: ☐

SAMPLE COLLECTION/ANALYSIS INFORMATION:

Divalent Iron: Fe^{2+}, Range 0-10 mg/L

Equipment: ~~HACH IR-18C~~ PROGRAM 33

Analysis Time: 1132

Concentration 0.01 mg/L

Notes: HACH DR-850 Colorimeter

Manganese: Mn^{2+}, Range 0-20 mg/L

Equipment: HACH DR-850 Colorimeter

Analysis Time: 1116

Program No 41

Concentration 0.3 mg/L

Notes

Sulfate: SO_4^{2-}, Range 0-70 mg/L

Equipment HACH DR-850 Colorimeter

Analysis Time 0727 6/18/02

Program No 92

Concentration >80 mg/L

Notes: Results above limit of Colorimeter Test Kit

Sulfide: S^{2-}, Range 0-0.7 mg/L

Equipment: HACH DR-850 Colorimeter

Analysis Time: 1125

Program No . 93

Concentration: 0.00 mg/L

Notes:

Tetra Tech NUS, Inc.

SAMPLE LOG SHEET
NATURAL ATTENUATION PARAMETERS

Project Site Name: NSWC Crane

Project No.: CTO 158, N3959

Sampled By. Terry Rojahn

Sample ID No.: 01GWT0301

Sample Location: 01T03

Duplicate: ☐

SAMPLE COLLECTION/ANALYSIS INFORMATION:

Nitrite: NO_2^--N, Range 0-0.35 mg/L

Equipment. HACH DR-850 Colorimeter

Analysis Time. 1614

Program No · 62

Concentration. 0.003 mg/L

Notes Alternate forms· NO_2 0.008 $NaNO_2$ 0.013

Nitrate: NO_3^--N, Range 0 - 0.50 mg/L

Equipment HACH DR-850 Colorimeter

Analysis Time 1651

Program No · 55

Concentration 0.07 mg/L

Nitrite Interference Treatment· ☑

If results are over limit use dilution method at step 3, 5ml sample 10ml DI result X3, range up to 1.5mg/L

Notes Alternate form NO_3 0.32

QA/QC Checklist

All data fields have been completed as necessary· ☑

Correct measurement units are cited in the SAMPLING DATA block ☑

Mulitplication is correct for each *Multiplier* table ☑

Final calulated concentration is within the appropriate *Range Used* block. ☑

Alkalinity *Relationship* is determined appropriatly as per manufacturer instructions: ☑

QA/QC sample (e g., Std. Additions, etc.) frequency is appropriate as per the project planning documents· ☑

Nitrite Interference treatment used for Nitrate test if Nitrite was detected ☑

Title block is initialized by person who performed the QA/QC Ckecklist: ☑

Tetra Tech NUS, Inc.

GROUNDWATER SAMPLE LOG SHEET

Project Site Name: NSWC Crane
Project No.: N3959

[] Domestic Well Data
[X] Monitoring Well Data
[] Other Well Type:
[] QA Sample Type:

Sample ID No.: 01GWT04 ~~02~~ 01 KS
Sample Location: 01T04
Sampled By: R. SIMPSON
C.O.C. No.: MGBG061402
Type of Sample: ROUND 1
[X] Low Concentration NEW "T" WELL
[] High Concentration

SAMPLING DATA:

	Color Visual	pH Standard	S.C. mS/cm	Temp. °C	Turbidity NTU	DO mg/l	ORP mV	Other NA
Date: 6.15.02								
Time: 1050								
Method: BLADDER	CLEAR	7.45	0.482	13.4	0.7	2.63	272	—

PURGE DATA:

Date: 6.15.02	Volume	pH	S.C.	Temp. (C)	Turbidity	DO	Salinity	Other
Method: BLADDER								
Monitor Reading (ppm): —								
Well Casing Diameter & Material Type: 2" PVC								
Total Well Depth (TD) 155±	151 - MEASURED + 2.8 = 153.80							
Static Water Level (WL). 136.48								
One Casing Volume(gal/L) 3.0								
Start Purge (hrs) 0921								
End Purge (hrs) 1050								
Total Purge Time (min) 89								
Total Vol Purged (gal/L): 5.2								

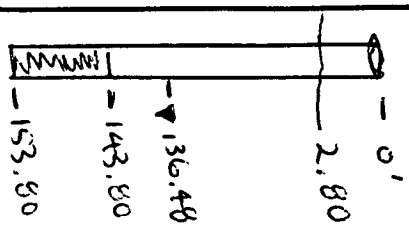
See Low Flow Purge Data Sheets

SAMPLE COLLECTION INFORMATION:

Analysis	Preservative	DUP	Container Requirements	MS/MSD	TOTAL ~~Collected~~
Appendix IX Volatiles	4°C/HCl	3	+ 3 ~~(3)~~ 40ml Vails	+ 6	12
Dis Gasses (Methane, ethene & ethane)	4°C/HCl	3	+ (3) 40ml Vails	—	6
Chloride	4°C	1	+ 1L ~~(1) 500ml~~ HDPE	+ 1	3
TAL Metals Plus Strontium & Tin	4°C/HNO_3	1	+ (1) L HDPE	+ 2	4
Gross Alfa	4°C/HNO_3	1	+ (1) L ~~Glass Amber~~ HDPE	—	2
Gross Beta	4°C/HNO_3	1	+ (1) L ~~Glass Amber~~ HDPE	—	2
Total Organic Carbon	4°C/H_2SO_4	1	+ 1L ~~(1) 500ml~~ Amber Glass	—	2

OBSERVATIONS / NOTES:

NEED TO FROM DEVEL. SHEET. PUMP IN WELL ≈ 5' OFF BTM, METER WILL NOT PASS PUMP TOP OF PUMP @ 151' TOC



Circle if Applicable:

MS/MSD	Duplicate ID No.:
YES	FD 061502 01

Signature(s): [illegible]

LOW FLOW PURGE DATA SHEET

PROJECT SITE NAME: NSWC Crane, IN
PROJECT NUMBER: N3959

WELL ID.: 01T04
DATE: 6-15-02

Time (Hrs.)	Water Level (Ft. below TOC)	Pump Rate (mL/Min.)	pH (S.U.)	S. Cond. (mS/cm)	Turb. (NTU)	DO (mg/L)	Temp. (Celcius)	ORP mV	Comments
0921	136.48	220							START PURGE, CLEAR,
0924	136.62								NO ODOR
0928	136.64		7.36	0.462	6.9	4.42	13.6	289	
0932	136.64								
0936	136.64								
0940			7.44	0.462	6.2	3.47	13.4	285	
0950			7.45	0.465	4.9	3.43	13.4	282	
1000			7.45	0.468	4.6	2.95	13.4	281	
1010			7.45	0.471	3.4	2.98	13.4	279	
1020			7.45	0.474	2.3	2.81	13.4	277	
1030			7.45	0.479	1.2	2.96	13.4	275	
1040			7.46	0.481	0.6	2.69	13.4	273	
1050			7.45	0.482	0.7	2.63	13.4	272	END PURGE
									— SAMPLE —

SIGNATURE: [illegible]

SAMPLE LOG SHEET
NATURAL ATTENUATION PARAMETERS

Tetra Tech NUS, Inc.

Project Site Name: NSWC Crane
Project No CTO 158, N3959
Sampled By: Terry Rojahn / KES

Sample ID No.: 01G4T04 01
Sample Location: 01-T04
Duplicate: ☐

SAMPLING DATA:

Date. 6-15-02	Color	pH	S.C.	Temp.	Turbidity	DO	ORP
Time: 1050	(Visual)	(SU)	(mS/cm)	(°C)	(NTU)	(Meter, mg/l)	mV
Method Low Flow, BLADDER	CLEAR	7.45	0.482	13.4	0.7	2.63	272

SAMPLE COLLECTION/ANALYSIS INFORMATION:

Alkalinity: total, as $CaCO_3$, Range 10 to 1000 ppm

Equipment: Chemetrics Test Kit

Analysis Time 1235

Range Used	Range	Concentration ppm
☐	10 to 100 ppm	
☑	50 to 500 ppm	150
☐	100 to 1000 ppm	

Concentration 150 ppm

Notes

Carbon Dioxide: CO_2, Dissolved, Range 10 - 2500 ppm

Equipment: Chemetrics Test Kit

Analysis Time 1215

Range Used	Range	Concentration ppm
☑	10 to 100 ppm	12
☑	100 to 1000 ppm	<100
☐	250 to 2500 ppm	

Concentration 12 ppm

Notes:

Dissolved Oxygen: O_2, Range 0 - 12 ppm

Equipment: Chemetrics Test Kit

Analysis Time 1149

Range Used	Range	Concentration ppm
☐	0 to 1 ppm	
☑	1 to 12 ppm	2

Concentration: 2 ppm

Notes

Hydrogen Sulfide: as H_2S, Range 0 - 5

Equipment HACH HS-C

Analysis Time 1155

Concentration 0.0 mg/L

Notes

TR 58

Tetra Tech NUS, Inc

SAMPLE LOG SHEET
NATURAL ATTENUATION PARAMETERS

Project Site Name: NSWC Crane
Project No.: CTO 158, N3959
Sampled By: Terry Rojahn / RES

Sample ID No.: 016W T0401
Sample Location: 01T04
Duplicate: ☐

SAMPLE COLLECTION/ANALYSIS INFORMATION:

Divalent Iron: Fe^{2+}, Range 0-10 mg/L

Equipment: HACH IR-18C

Analysis Time. 1158

Concentration: 0 mg/L

Notes. USING DR 850 METER 0.01 mg/L

Manganese: Mn^{2+}, Range 0-20 mg/L

Equipment: HACH DR-850 Colorimeter

Analysis Time 1255

Program No 41

Concentration 0.0 mg/L

Notes

Sulfate: SO_4^{2-}, Range 0-70 mg/L

Equipment HACH DR-850 Colorimeter

Analysis Time 1824 (TR)

Program No . 92

Concentration 54 mg/L

Notes DUP 48 @ 1725

Sulfide: S^{2-}, Range 0-0.7 mg/L

Equipment HACH DR-850 Colorimeter

Analysis Time 1246

Program No. 93

Concentration. 0.00 mg/L

Notes

Tetra Tech NUS, Inc

SAMPLE LOG SHEET
NATURAL ATTENUATION PARAMETERS

Project Site Name: NSWC Crane

Project No.: CTO 158, N3959

Sampled By: Terry Rojahn /RES

Sample ID No.: 01GWT04 01

Sample Location: 01T04

Duplicate: ☐

SAMPLE COLLECTION/ANALYSIS INFORMATION:

Nitrite: NO_2^--N, Range 0-0.35 mg/L

Equipment: HACH DR-850 Colorimeter

Analysis Time: 1753 (TR)

Program No: 62

Concentration: 0.000 mg/L

DUP 0.000

Notes: Alternate forms: NO_2 0.000 $NaNO_2$ 0.000

Nitrate: NO_3^--N, Range 0 - 0 50 mg/L

Equipment: HACH DR-850 Colorimeter

Analysis Time: 1823 (TR)

Program No: 55

Concentration: 0.29 mg/L

Nitrite Interference Treatment: ☐

If results are over limit use dilution method at step 3, 5ml sample 10ml DI result X3, range up to 1.5mg/L

Notes: Alternate form: NO_3 1.28

QA/QC Checklist

All data fields have been completed as necessary: ☑

Correct measurement units are cited in the SAMPLING DATA block: ☑ (TR)

Mulitplication is correct for each *Multiplier* table: ☑

Final calulated concentration is within the appropriate *Range Used* block. ☑

Alkalinity *Relationship* is determined appropriatly as per manufacturer instructions: ☑

QA/QC sample (e.g , Std. Additions, etc.) frequency is appropriate as per the project planning documents: ☑

Nitrite Interference treatment used for Nitrate test if Nitrite was detected: ☑ NA

Title block is initialized by person who performed the QA/QC Ckecklist: ☑

SAMPLE LOG SHEET
NATURAL ATTENUATION PARAMETERS

Tetra Tech NUS, Inc

Project Site Name: NSWC Crane
Project No.: CTO 158, N3959
Sampled By: Terry Rojahn / KES

Sample ID No.: FD 06150201
Sample Location: 01TW04
Duplicate: ☑

SAMPLING DATA:

Date. 6·15·02	Color	pH	S.C.	Temp.	Turbidity	DO	ORP
Time: 0000	(Visual)	(SU)	(mS/cm)	(°C)	(NTU)	(Meter, mg/l)	mV
Method Low Flow, BLADDER							

SAMPLE COLLECTION/ANALYSIS INFORMATION:

Alkalinity: total, as $CaCO_3$, Range 10 to 1000 ppm

Equipment: Chemetrics Test Kit

Analysis Time 1235

Range Used	Range	Concentration ppm
☐	10 to 100 ppm	
☑	50 to 500 ppm	175
☐	100 to 1000 ppm	

Concentration 175 ppm

Notes:

Carbon Dioxide: CO_2, Dissolved, Range 10 - 2500 ppm

Equipment: Chemetrics Test Kit

Analysis Time. 1215

Range Used	Range	Concentration ppm
☑	10 to 100 ppm	13
☐	100 to 1000 ppm	
☐	250 to 2500 ppm	

Concentration 13 ppm

Notes

Dissolved Oxygen: O_2, Range 0 - 12 ppm

Equipment Chemetrics Test Kit

Analysis Time. 1149

Range Used	Range	Concentration ppm
☐	0 to 1 ppm	
☑	1 to 12 ppm	2

Concentration 2 ppm

Notes

Hydrogen Sulfide: as H_2S, Range 0 - 5

Equipment HACH HS-C

Analysis Time 1155

Concentration 00 mg/L

Notes

KEJ

Tetra Tech NUS, Inc

SAMPLE LOG SHEET
NATURAL ATTENUATION PARAMETERS

Project Site Name: NSWC Crane
Project No.: CTO 158, N3959
Sampled By: Terry Rojahn / RES

Sample ID No: FD 061502 01
Sample Location: 01T04
Duplicate: ☑

SAMPLE COLLECTION/ANALYSIS INFORMATION:

Divalent Iron: Fe^{2+}, Range 0-10 mg/L

Equipment. HACH IR-18C

Analysis Time. 1158

Concentration. 0 mg/L

Notes: USING DR 850 METER 0.01 MG/L

Manganese: Mn^{2+}, Range 0-20 mg/L

Equipment: HACH DR-850 Colorimeter

Analysis Time: 1255

Program No. 41

Concentration. 0.0 mg/L

Notes

Sulfate: SO_4^{2-}, Range 0-70 mg/L

Equipment: HACH DR-850 Colorimeter

Analysis Time. 1725

Program No. 92

Concentration: 48 mg/L

Notes:

Sulfide: S^{2-}, Range 0-0.7 mg/L

Equipment: HACH DR-850 Colorimeter

Analysis Time. 1246

Program No.: 93

Concentration 0 mg/L

Notes

Tetra Tech NUS, Inc

SAMPLE LOG SHEET
NATURAL ATTENUATION PARAMETERS

Project Site Name: NSWC Crane
Project No.: CTO 158, N3959
Sampled By: Terry Rojahn / RES

Sample ID No. FD0615020I
Sample Location: 01T04
Duplicate: ☑

SAMPLE COLLECTION/ANALYSIS INFORMATION:

Nitrite: NO_2^--N, Range 0-0.35 mg/L

Equipment. HACH DR-850 Colorimeter
Program No : 62
Concentration 0.000 mg/L

Analysis Time. 1755 (TR)

Notes: Alternate forms: NO_2 0.000 $NaNO_2$ 0.000

Nitrate: NO_3^--N, Range 0 - 0.50 mg/L

TO LATE TO RUN DUP ON NITRATE
RAN DUP ON (OUT OF HOLD TIME) 01GWT0501

Equipment. HACH DR-850 Colorimeter
Program No 55
Concentration ——— mg/L

Analysis Time: ———

Nitrite Interference Treatment ☐

If results are over limit use dilution method at step 3, 5ml sample 10ml DI result X3, range up to 1 5mg/L

Notes Alternate form: NO_3 ———

QA/QC Checklist:

All data fields have been completed as necessary: ☑
Correct measurement units are cited in the SAMPLING DATA block: ☑
Mulitplication is correct for each *Multiplier* table: ☑
Final calulated concentration is within the appropriate *Range Used* block. ☑
Alkalinity *Relationship* is determined appropriatly as per manufacturer instructions: ☑
QA/QC sample (e.g , Std Additions, etc) frequency is appropriate as per the project planning documents: ☑
Nitrite Interference treatment used for Nitrate test if Nitrite was detected. ☐ N/A
Title block is initialized by person who performed the QA/QC Ckecklist: ☑

Tetra Tech NUS, Inc

GROUNDWATER SAMPLE LOG SHEET

Project Site Name: NSWC Crane
Project No.: N3959

[] Domestic Well Data
[X] Monitoring Well Data
[] Other Well Type:
[] QA Sample Type:

Sample ID No.: 01GWT05 01
Sample Location: 01 T05
Sampled By: K. SIMPSON
C.O.C. No.: MGBG 061402 PAGE 2 of 2
Type of Sample:
[X] Low Concentration
[] High Concentration

SAMPLING DATA:

Date: 6·15·02	Color	pH	S.C.	Temp.	Turbidity	DO	ORP	Other
Time: 1917	Visual	Standard	mS/cm	°C	NTU	mg/l	mV	NA
Method. PERISTALTIC	CLEAR	5.77	2.610	13.8	2.3	3.92	228	—

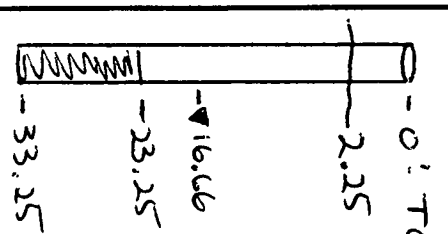
PURGE DATA:

Date: 6·15-02	Volume	pH	S.C.	Temp. (C)	Turbidity	DO	Salinity	Other
Method: PERISTALTIC								
Monitor Reading (ppm) —								
Well Casing Diameter & Material								
Type: 2" PVC	See Low Flow Purge Data Sheets							
Total Well Depth (TD) 33.25								
Static Water Level (WL) 16.66								
One Casing Volume(gal/L) 2.5								
Start Purge (hrs) 1517								
End Purge (hrs) 1917								
Total Purge Time (min) 240								
Total Vol Purged (gal/L) 5.1								

SAMPLE COLLECTION INFORMATION:

Analysis	Preservative	Container Requirements	Collected
Appendix IX Volatiles	4°C/HCl	(3) 40ml Vails	✓
Dis Gasses (Methane, ethene & ethane)	4°C/HCl	(3) 40ml Vails	✓
Chloride	4°C	1 L ~~(1) 500ml~~ HDPE	✓
TAL Metals Plus Strontium & Tin	4°C/HNO_3	(1) L HDPE	✓
Gross Alfa	4°C/HNO_3	(1) L ~~Glass Amber~~ HDPE	✓
Gross Beta	4°C/HNO_3	(1) L ~~Glass Amber~~ HDPE	✓
Total Organic Carbon	4°C/H_2SO_4	1 L ~~(1) 500ml~~ Amber Glass	✓

OBSERVATIONS / NOTES:



Circle if Applicable:

MS/MSD	Duplicate ID No.:
—	—

Signature(s):

LOW FLOW PURGE DATA SHEET

PROJECT SITE NAME: NSWC Crane, IN
PROJECT NUMBER: N3959

WELL ID.: 01T05
DATE: 6-15-02

Time (Hrs.)	Water Level (Ft. below TOC)	Pump Rate (mL/Min.)	pH (S.U.)	S. Cond. (mS/cm)	Turb. (NTU)	DO (mg/L)	Temp. (Celcius)	ORP mV	Comments
1517	16.66	150							START PURGE, CLEAR
1521	17.20	↓	5.77	3.042	8.3	6.18	14.00	244	NO ODOR
1525	17.25	95							
1529	17.37	↓							
1533	17.46	↓	5.76	3.039	8.6	5.54	14.3	239	
1537	17.53	80							
1540	17.61		5.77	3.000	9.2	4.94	14.7	239	
1550	17.73		5.78	2.941	6.9	4.83	14.7	239	
1600	17.80		5.78	2.876	6.9	5.05	14.5	240	
1610	17.96		5.78	2.796	6.9	4.81	14.3	242	
1620	18.04		5.78	2.723	6.2	4.58	14.3	243	
1630	18.17		5.78	2.693	5.4	4.52	14.3	244	
1640	18.26		5.78	2.657	4.6	4.52	14.2	246	
TR TO 3245 1650	18.33		5.78	2.623	4.3	4.59	14.2	246	
1700	18.39		5.79	2.606	4.2	4.43	14.3	246	
1710	18.45		5.79	2.589	3.9	4.66	14.2	246	
1720	18.53		5.79	2.568	3.9	4.46	14.0	246	
1730	18.56		5.78	2.583	4.0	4.34	14.0	246	
1740	18.60		5.79	2.604	4.2	4.36	14.0	246	
1750	18.65		5.78	2.616	3.1	4.39	14.1	245	
1800	18.71		5.78	2.625	2.9	4.35	14.1	245	
1810	18.77		5.78	2.622	2.6	4.38	14.0	244	
1820	18.81		5.78	2.627	2.3	4.37	14.0	243	
1830	18.84		5.78	2.631	2.1	4.30	13.8	242	
1840	18.89		5.77	2.623	2.2	4.21	13.9	236	
1850	18.93		5.77	2.619	2.4	4.20	13.9	231	
1900	18.96		5.77	2.616	2.6	4.03	13.8	229	
1910	19.00		5.77	2.612	2.4	3.94	13.8	228	
1917	19.04	↓	5.77	2.610	2.3	3.92	13.8	228	END PURGE - 4 HRS SAMPLE

SIGNATURE: [illegible]

TOP OF SCREEN 23.25

SAMPLE LOG SHEET
NATURAL ATTENUATION PARAMETERS

Tetra Tech NUS, Inc

Project Site Name: NSWC Crane
Project No.: CTO 158, N3959
Sampled By: Terry Rojahn / RES

Sample ID No.: 016WT05 01
Sample Location: 01T05
Duplicate: ☐

SAMPLING DATA:

Date: 6-15-02	Color	pH	S.C.	Temp.	Turbidity	DO	ORP
Time: 1917	(Visual)	(SU)	(mS/cm)	(°C)	(NTU)	(Meter, mg/l)	mV
Method. Low Flow, PERISTALTIC	CLEAR	5.77	2.610	13.8	2.3	3.92	228

SAMPLE COLLECTION/ANALYSIS INFORMATION:

Alkalinity: total, as $CaCO_3$, Range 10 to 1000 ppm

Equipment: Chemetrics Test Kit

Analysis Time 1933

Range Used:	Range	Concentration ppm
☑	10 to 100 ppm	70
☐	50 to 500 ppm	
☐	100 to 1000 ppm	

Concentration: 70 ppm

Notes:

Carbon Dioxide: CO_2, Dissolved, Range 10 - 2500 ppm

Equipment: Chemetrics Test Kit

Analysis Time: 1925

Range Used	Range	Concentration ppm
☑	10 to 100 ppm	>100
☑	100 to 1000 ppm	225
☐	250 to 2500 ppm	

Concentration 225 ppm

Notes:

Dissolved Oxygen: O_2, Range 0 - 12 ppm

Equipment Chemetrics Test Kit

Analysis Time. 1917

Range Used	Range	Concentration ppm
☐	0 to 1 ppm	
☑	1 to 12 ppm	3

Concentration 3 ppm

Notes:

Hydrogen Sulfide: as H_2S, Range 0 - 5

Equipment. HACH HS-C

Analysis Time. 1917

Concentration 0.0 mg/L

Notes:

Tetra Tech NUS, Inc.

SAMPLE LOG SHEET
NATURAL ATTENUATION PARAMETERS

Project Site Name. NSWC Crane
Project No.: CTO 158, N3959
Sampled By: Terry Rojahn/KES

Sample ID No.: 01GWT05 01
Sample Location: 01 T05
Duplicate: ☐

SAMPLE COLLECTION/ANALYSIS INFORMATION:

Divalent Iron: Fe^{2+}, Range 0-10 mg/L

Equipment: HACH IR-18C

Analysis Time: 1920

Concentration: 0.07 mg/L

Notes:

Manganese: Mn^{2+}, Range 0-20 mg/L

Equipment: HACH DR-850 Colorimeter

Analysis Time 1934

Program No. 41

Concentration. 6.2 mg/L

Notes.

Sulfate: SO_4^{2-}, Range 0-70 mg/L

6.16.02

Equipment HACH DR-850 Colorimeter

Analysis Time. 0800

Program No 92

Concentration. >80 mg/L LIMIT

Notes

Sulfide: S^{2-}, Range 0-0.7 mg/L

Equipment HACH DR-850 Colorimeter

Analysis Time 1943

Program No.: 93

Concentration: 0.00 mg/L

Notes

Tetra Tech NUS, Inc.

SAMPLE LOG SHEET
NATURAL ATTENUATION PARAMETERS

Project Site Name: NSWC Crane
Project No.: CTO 158, N3959
Sampled By: Terry Rojahn /KES

Sample ID No.: 01GWT05 01
Sample Location: 01T05
Duplicate: ☐

SAMPLE COLLECTION/ANALYSIS INFORMATION:

Nitrite: NO_2^--N, Range 0-0.35 mg/L — 6.16.02

Equipment: HACH DR-850 Colorimeter — Analysis Time: 0810

Program No.: 62

Concentration: 0.002 mg/L

Notes — Alternate forms: NO_2 0.006 $NaNO_2$ 0.008 mg/L

Nitrate: NO_3^--N, Range 0 - 0.50 mg/L — 6.16.02

Equipment: HACH DR-850 Colorimeter — Analysis Time: 0833

Program No.: 55

Concentration: 0.09 mg/L DUP = 0.09

Nitrite Interference Treatment: ☐

If results are over limit use dilution method at step 3, 5ml sample 10ml DI result X3, range up to 1.5mg/L

Notes. — Alternate form NO_3 0.38 DUP = 0.39

QA/QC Checklist:

All data fields have been completed as necessary. ☑
Correct measurement units are cited in the SAMPLING DATA block: ☑
Mulitplication is correct for each *Multiplier* table: ☑
Final calulated concentration is within the appropriate *Range Used* block ☑
Alkalinity *Relationship* is determined appropriatly as per manufacturer instructions: ☑
QA/QC sample (e.g , Std. Additions, etc.) frequency is appropriate as per the project planning documents: ☑
Nitrite Interference treatment used for Nitrate test if Nitrite was detected: ☑
Title block is initialized by person who performed the QA/QC Ckecklist ☑

APPENDIX B-5

WATER LEVEL MEASURMENT SHEETS
AND
HYDRAULIC CONDUCTIVITY AND SEEPAGE VELOCITY CALCULATIONS

WATER LEVEL MEASUREMENT SHEET

Project Name: NSWC Crane
Location: Crane, IN
Weather Conditions: SUNNY 75°F
NO RAIN OVER THE LAST 4 DAYS

Project No.: CTO 158 # N3959
Personnel: KEITH S. KEN M.
Measuring Device: SLOPE INDICATOR
Remarks:

Well ID	Date	Time	Water Level *	Thickness of Free Product	PID Reading ppm RP	PID Reading ppm BZ	Comments
01T02	9.17.01	1350	65.37	NA	0	0	NEW WELL BTM = 72.82
01C01		1445	139.53		—		
01-01		1354	28.90		—		
01-02		1400	15.59		—		
01-03		1453	12.83		—		
01-04		1356	20.01		—		
01-05		1357	17.83		0	0	
01-06		1411	71.12		—		NEW PVC RISER
01-07		1415	17.55		0	0	" " "
01-08		1414	15.87		0	0	
01-09		1409	20.54		—		(20.54)
01-10		1403	26.15		—		

* All measurements to the nearest 0.01 foot

Signature(s): [illegible]

14.7

NSWC Crane
Field Form
Revision 1
October 2000

WATER LEVEL MEASUREMENT SHEET

Project Name: NSWC Crane
Location: Crane, IN
Weather Conditions: SUNNY 75°F

Project No.: CTO 158 # N3959
Personnel: KEITH S. KEN M.
Measuring Device: SLOPE INDICATOR
Remarks:

Well ID	Date	Time	Water Level *	Thickness of Free Product	PID Reading ppm RP	PID Reading ppm BZ	Comments
01-11	9.17.01	1401	11.17	NA	—	—	
01-12		1407	26.39		—	—	
01-13		1405	24.67		—	—	
01-14		1450	16.41		—	—	
01-15		1435	28.56		—	—	
01-16		1424	DRY		—	—	BTM = 42.25±
01-17		1449	22.26		—	—	
01-18		1442	15.54		0	0	
01-19		1434	22.04		0	0	
01-20		1421	29.13		0	0	
01-21		1417	17.81		—	—	
01-22		1431	19.39		—	—	

* All measurements to the nearest 0.01 foot

Signature(s): [illegible]

WATER LEVEL MEASUREMENT SHEET

Project Name: NSWC Crane
Location: Crane, IN
Weather Conditions: SUNNY 75°F

Project No.: CTO 158 # N3959
Personnel: KEITH S. KEN M.
Measuring Device: SLOPE INDICATOR
Remarks:

Well ID	Date 9.17.01	Time	Water Level *	Thickness of Free Product	PID Reading ppm RP	PID Reading ppm BZ	Comments
01 - 23	9.17.01	1429	40.89	NA	—	—	
01 - 24	↓	1419	14.89	↓	—	—	
01 - 25	↓	1432	21.71	↓	—	—	
01 - 26	↓	1438	36.54	↓	—	—	
01 - 27	↓	1441	25.22	↓	—	—	

* All measurements to the nearest 0.01 foot

Signature(s): [illegible]

NSWC Crane
Field Form
Revision 1

WATER LEVEL MEASUREMENT SHEET

Project Name: NSWC Crane
Location: Crane, IN
Weather Conditions: SUNNY 75°F

Project No.: CTO ~~10 # 7141~~ 159 N3960
Personnel: SIMPSON / ROJAHN / CONTI
Measuring Device: HERON & SLOPE IND
Remarks:

Well ID	Date	Time	Water Level *	Thickness of Free Product	PID Reading ppm RP	PID Reading ppm BZ	Comments
01C01	6-17-02	0833	138.42	—	—		
01-01		0816	27.13	—	—		
01-02		0824	11.17	—	—		
01-03		0826	5.27	—	—		
01-04		0819	15.39	—	—		
01-05		0822	14.17	—	—		
01-06		0923	68.77	—	—		
01-07		0915	14.71	—	—		
01-08		0918	12.74	—	—		
01-09		0920	12.92	—	—		
01-10		0926	22.96	—	—		
01-11		~~0824~~ 0825	7.03	—	—		(@0825)

* All measurements to the nearest 0.01 foot

Signature(s): KED

WATER LEVEL MEASUREMENT SHEET

Project Name: NSWC Crane
Location: Crane, IN
Weather Conditions: SUNNY 75°F

Project No.: CTO ~~10 # 7141~~ 159 N3960
Personnel: SIMPSON/ROJANN/CONTI
Measuring Device: HERON/SLOPE IND.
Remarks:

Well ID	Date	Time	Water Level *	Thickness of Free Product	PID Reading ppm RP	PID Reading ppm BZ	Comments
01-12	6.17.02	0933	23.59	—			
01-13		0931	21.58	—			
01-14		0940	13.36	—			
01-15		0845	22.22	—			
01-16		0900	35.14	—			
01-17		0835	19.44	—			
01-18		0830	12.78	—			
01-19		0847	20.85	—			
01-20		0857	23.30	—			
01-21		0909	14.96	—			RISER UNDER PRESSURE WHEN U PLUG REMOVED
01-22		0849	18.23	—			
01-23		0855	38.67	—			

* All measurements to the nearest 0.01 foot

Signature(s): KEJ

WATER LEVEL MEASUREMENT SHEET

Project Name: NSWC Crane
Location: Crane, IN
Weather Conditions: SUNNY 75°F

Project No.: CTO ~~10 # 7141~~ 159 N3960
Personnel: SIMPSON / ROJAHN / CONTI
Measuring Device: HERON / SLOPE IND.
Remarks:

Well ID	Date	Time	Water Level *	Thickness of Free Product	PID Reading ppm RP	PID Reading ppm BZ	Comments
01-24	6-17-02	0906	11.43	—			
01-25		0851	20.92	—			
01-26		0949	35.68	—			
01-27		0942	24.10	—			
01 T03		0844	139.16	—			
01T04		0839	137.97	—			BTM = 153.10
01T05		0956	16.84	—			
01T02		0810	65.25	—			

* All measurements to the nearest 0 01 foot

Signature(s): K SB

HYDRAULIC CONDUCTIVITY CALCULATIONS

ANALYSIS OF LOW-FLOW PURGING TESTS

Hydraulic conductivity values were estimated from the low flow purge data collected during groundwater sampling events rounds 1 and 2 using the Ogden field method (Kasenow and Pare, 1995) and the Jacob straight-line method (Fetter, 1988). Discharge (Q), drawdown (s), and elapsed time values were derived from the low-flow purge data sheets see Attachment 1. Wells 01-C01 and 01T04 had insufficient drawdown for evaluation, and well 01-16 was dry. However, the drawdown vs. time plots are provided in this appendix. The aquifer thickness at each well was approximated from the cross sections by using the distance between the water level in the well to the underlying shale bed or the bottom of the well boring. If the well was not on a cross section then the aquifer thickness from the nearest well was used.

Ogden Field Method Evaluation

Hand calculation using the Ogden field method (Kasenow and Pare, 1995) was completed for monitoring well 01-01 (WES-1-1-81), see Attachment 2. Attachment 2 also includes the Ogden field method explanation and associated cross-reference table providing the correction factors needed for the Ogden field method. The calculation for the remaining wells were carried out on an Excel spread sheet provided on Attachment 3.

Jacob Straight-line Method Evaluation

Hand calculation using the Jacob straight-line method was completed for monitoring well 01-01 (WES-1-1-81), see Attachment 4. Attachment 4 also includes the drawdown vs. time plots generated from the drawdown data provided in Attachment 1. The calculation for the remaining wells were carried out on an Excel spread sheet provided on Attachment 5.

Evaluation Results

A comparison was made between the two analytical methods by plotting the resulting hydraulic conductivity values derived from each method on log-log graph provided as Attachment 6. The plot shows that the two methods have fair correlation suggesting the assumptions made for the Ogden method are reasonable, and that the resulting values are good to the order of magnitude to estimate the aquifer hydraulic conductivity. When a well was tested twice or two different methods were used to estimate the hydraulic conductivity the resulting values were arithmetically averaged for the well. Table 1, attached, provides a summary of the results.

A geometric mean value for shallow water bearing zone hydraulic conductivity was calculated to be 7.92 X 10^{-6} cm/sec. The deep water bearing zone has a hydraulic conductivity value of 9.45 X 10^{-5} cm/sec. However, wells installed in this deeper zone had insufficient drawdown, suggesting that the hydraulic conductivity may be slightly higher then the calculated value.

TABLE 1
ANALYSIS OF LOW-FLOW PURGING DATA RESULTS SUMMARY
HYDRAULIC CONDUCTIVITY (CM/SEC)

Well #	Round 1		Round 2 or Test 2		Average	
	Ogden	Straight-line	Ogden	Straight-line	Ogden	Straight-line
Shallow Wells						
01-01	6.24E-05	2.92E-05	na	na	6.24E-05	2.92E-05
01-02	2.10E-06	1.02E-05	2.48E-05	2.26E-05	1.34E-05	1.64E-05
01-03	na	9.51E-07	na	na	na	9.51E-07
01-04	2.61E-06	2.11E-06	2.99E-06	3.02E-06	2.80E-06	2.56E-06
01-05	na	1.43E-06	na	na	na	1.43E-06
01-07	2.26E-06	7.96E-06	na	na	2.26E-06	7.96E-06
01-09	5.55E-06	5.30E-06	na	na	5.55E-06	5.30E-06
01-10	1.18E-06	2.52E-06	na	na	1.18E-06	2.52E-06
01-11	2.07E-06	3.13E-06	na	na	2.07E-06	3.13E-06
01-12	1.18E-05	9.09E-06	na	na	1.18E-05	9.09E-06
01-13	2.05E-04	2.16E-04	na	na	2.05E-04	2.16E-04
01-14	na	1.67E-06	na	1.54E-06	na	1.61E-06
01-15	1.18E-05	8.87E-06	1.55E-05	1.95E-05	1.37E-05	1.42E-05
01-17	2.99E-05	6.37E-05	na	na	2.99E-05	6.37E-05
01-18	2.64E-06	6.58E-06	na	na	2.64E-06	6.58E-06
01-19	3.13E-06	4.73E-06	na	na	3.13E-06	4.73E-06
01-20	na	2.36E-06	na	na	na	2.36E-06
01-21	8.02E-06	2.52E-05	na	na	8.02E-06	2.52E-05
01-22	1.46E-05	7.77E-06	na	na	1.46E-05	7.77E-06
01-23	na	4.94E-06	na	na	na	4.94E-06
01-24	na	5.17E-06	na	na	na	5.17E-06
01-25	1.68E-05	2.07E-05	na	na	1.68E-05	2.07E-05
01-26	3.80E-06	1.89E-05	na	na	3.80E-06	1.89E-05
01-27	na	5.04E-06	na	5.17E-06	na	5.11E-06
01T02	na	9.99E-06	na	9.71E-06	na	9.85E-06
01T05 rd2	na	na	6.19E-06	8.55E-06	6.19E-06	8.55E-06
				Geometric mean =	8.18E-06	7.66E-06
				Site geometric mean =	**7.92E-06**	
Deep Wells						
01-06	7.46E-05	na	na	2.23E-04	7.46E-05	2.23E-04
01T03 rd2	na	na	2.24E-05	9.83E-05	2.24E-05	9.83E-05
				Geometric mean =	4.09E-05	1.48E-04
				Site geometric mean =	**9.45E-05**	

na - not available

ATTACHMENT 1

ROUND 1
LOW FLOW PURGE DATA SHEET

Well ID: WES-1-1-81
Date: 9/6/2001

Time (Hours)	Distance to Water (Feet)	Pump Rate (mL/Min)	Elapsed time	drawdown
1035	28.95	---	0	0.00
1045	29.07	100	10	0.12
1055	29.10	100	20	0.15
1105	29.23	200	30	0.28
1115	29.38	200	40	0.43
1125	29.52	200	50	0.57
1135	29.55	200	60	0.60
1145	29.55	200	70	0.60
1155	29.57	200	80	0.62
1205	29.59	200	90	0.64
1215	29.61	200	100	0.66
1225	29.64	200	110	0.69
1235	29.63	200	120	0.68
1245	29.63	200	130	0.68
1250	---	---		

Average = 184.6153846

Well ID: 01MW02
Date: 9/8/2001

Time (Hours)	Distance to Water (Feet)	Pump Rate (mL/Min)	Elapsed time	drawdown
945	15.34	140	0	0
950	16.14	80	5	0.80
1000	16.27	80	15	0.93
1010	16.40	80	25	1.06
1020	16.53	80	35	1.19
1030	16.64	80	45	1.30
1040	16.72	80	55	1.38
1050	16.83	80	65	1.49
1055	16.88	80	70	1.54
1100	16.91	80	75	1.57
1105	16.97	80	80	1.63

Average = 85.45454545

Well ID: WES-1-3-81
Date: 9/6/2001

Time (Hours)	Distance to Water (Feet)	Pump Rate (mL/Min)	Elapsed time	drawdown
922	14.76	130	0	0
926	15.02	100	4	0.26
935	15.68	80	13	0.92
945	16.70	80	23	1.94
955	18.05	80	33	3.29
1005	19.02	80	43	4.26
1010	19.62	80	48	4.86
1015	20.04	80	53	5.28

Average = 88.75

ROUND 1
LOW FLOW PURGE DATA SHEET

Well ID: WES-1-4-81
Date: 8/28/2001

Time (Hours)	Distance to Water (Feet)	Pump Rate (mL/Min)	Elapsed time	drawdown
845	19.49	---	0	0
855	19.79	150	10	0.30
905	19.95	100	20	0.46
915	20.13	100	30	0.64
925	20.30	100	40	0.81
935	20.42	76	50	0.93
945	20.55	76	60	1.06
955	20.67	76	70	1.18
1005	20.78	70	80	1.29
1015	20.90	70	90	1.41
1025	21.00	70	100	1.51
1035	21.12	70	110	1.63
1045	21.24	70	120	1.75
1055	21.35	70	130	1.86
1105	21.44	70	140	1.95
1115	21.54	70	150	2.05
1125	21.69	70	160	2.20
1135	21.82	70	170	2.33
1145	21.88	70	180	2.39
1155	21.99	70	190	2.50
1205	22.14	70	200	2.65
1215	22.19	75	210	2.70
1225	22.30	75	220	2.81
1235	22.38	75	230	2.89
1245	22.46	75	240	2.97

Average = 78.66666667

Well ID: WES-1-5-81
Date: 9/18/2001

Time (Hours)	Distance to Water (Feet)	Pump Rate (mL/Min)	Elapsed time	drawdown
1510	17.73	---	0	0
1520	19.26	75	10	1.53
1530	19.74	75	20	2.01
1540	20.22	75	30	2.49
1550	20.66	75	40	2.93
1600	21.12	75	50	3.39
1610	21.56	75	60	3.83
1620	22.14	75	70	4.41
1630	22.51	75	80	4.78
1630	---	---	80	#VALUE!
1640	23.51	300	90	5.78
1650	26.54	300	100	8.81
1700	29.65	300	110	11.92
1710	DRY	300	120	

Average = 75

ROUND 1
LOW FLOW PURGE DATA SHEET

Well ID: 01MW06
Date: 9/4/2001

Time (Hours)	Distance to Water (Feet)	Pump Rate (mL/Min)	Elapsed time	drawdown
1405	71.03	---	0	0
1415	71.39	100	10	0.36
1425	71.42	100	20	0.39
1435	71.45	100	30	0.42
1445	71.48	100	40	0.45
1455	71.48	100	50	0.45
1505	71.48	100	60	0.45
1515	71.46	100	70	0.43
1525	71.46	100	80	0.43
1535	71.46	100	90	0.43
1545	71.48	100	100	0.45
1555	71.48	100	110	0.45
1605	71.51	100	120	0.48
1615	71.51	100	130	0.48
1625	71.51	100	140	0.48
1625	---	100	140	

Average = 100

Well ID: WES-1-7-82
Date: 9/18/2001

Time (Hours)	Distance to Water (Feet)	Pump Rate (mL/Min)	Elapsed time	drawdown
805	17.55	---	0	0
815	18.15	100	10	0.60
825	18.37	75	20	0.82
835	18.49	75	30	0.94
845	18.65	75	40	1.10
855	18.72	50	50	1.17
905	18.75	50	60	1.20
915	18.83	50	70	1.28
925	18.98	50	80	1.43
935	18.94	50	90	1.39
945	18.98	50	100	1.43
950	19.01	50	105	1.46
955	19.03	50	110	1.48
955	---	---	110	

Average = 56.81818182

Well ID: WES-1-8-82
Date: 9/18/2001

Time (Hours)	Distance to Water (Feet)	Pump Rate (mL/Min)	Elapsed time	drawdown
1105	15.91	---	0	0
1115	15.91	100	10	0.00
1125	15.91	100	20	0.00
1135	15.91	100	30	0.00
1145	15.91	100	40	0.00
1155	15.91	100	50	0.00
1205	15.91	100	60	0.00
1215	15.91	100	70	0.00
1225	15.91	100	80	0.00
1235	15.91	100	90	0.00
1240	15.91	100	95	0.00
1245	15.91	100	100	0.00
1255	15.91	100	110	0.00
1305	15.91	100	120	0.00

Average = 100

Well ID: WES-1-8-82
Date: 9/18/2001 - SECOND TEST

Time (Hours)	Distance to Water (Feet)	Pump Rate (mL/Min)	Elapsed time	drawdown
1425	15.91	600	0	0
1430	15.95	600	5	0.04
1435	15.97	600	10	0.06
1440	16.01	600	15	0.10
1445	15.94	---		
1450	15.92	---		
1455	15.91	---		

Average = 600

Well ID: WES-1-9-82
Date: 9/7/2001

Time (Hours)	Distance to Water (Feet)	Pump Rate (mL/Min)	Elapsed time	drawdown
930	20.32	---	0	0.00
940	20.45	100	10	0.13
950	20.68	100	20	0.36
1000	20.86	100	30	0.54
1010	21.00	100	40	0.68
1020	21.23	100	50	0.91
1030	21.38	100	60	1.06
1040	21.57	100	70	1.25
1050	21.67	100	80	1.35
1100	21.85	100	90	1.53
1110	22.00	100	100	1.68
1120	22.12	100	110	1.80
1130	22.22	100	120	1.90
1140	22.43	100	130	2.11
1150	22.53	100	140	2.21
1155	22.62	100	145	2.30
1155	---	---	145	

Average = 100

ROUND 1
LOW FLOW PURGE DATA SHEET

Well ID: WES-1-10-82
Date: 9/7/2001

Time (Hours)	Distance to Water (Feet)	Pump Rate (mL/Min)	Elapsed time	drawdown
1010	26.06	---	0	0.00
1020	26.91	120	10	0.85
1030	27.14	40	20	1.08
1040	27.43	60	30	1.37
1050	27.66	60	40	1.60
1100	27.80	60	50	1.74
1110	27.95	50	60	1.89
1120	27.78	---	70	1.72
1130	27.64	---	80	1.58
1140	27.86	50	90	1.80
1150	28.20	90	100	2.14
1200	28.25	90	110	2.19
1210	28.34	90	120	2.28
1220	28.43	90	130	2.37
1230	28.75	90	140	2.69
1240	29.05	90	150	2.99
1250	29.27	90	160	3.21
1300	29.38	90	170	3.32
1310	29.49	90	180	3.43
1320	29.78	90	190	3.72
1330	29.95	60	200	3.89
1340	30.16	65	210	4.10
1350	30.26	40	220	4.20
1400	30.32	42	230	4.26
1410	30.42	40	240	4.36
1420	30.50	44	250	4.44
1430	30.57	44	260	4.51

Average = 71.38888889

ROUND 1
LOW FLOW PURGE DATA SHEET

Well ID: WES-1-11-82
Date: 8/22/2001

Time (Hours)	Distance to Water (Feet)	Pump Rate (mL/Min)	Elapsed time	drawdown
1413	10.95	100	0	0.00
1423	11.30	100	10	0.35
1433	11.51	100	20	0.56
1443	11.75	100	30	0.80
1453	12.28	100	40	1.33
1503	13.04	100	50	2.09
1513	13.62	100	60	2.67
1523	13.92	100	70	2.97
1533	14.03	100	80	3.08
1543	14.17	100	90	3.22
1553	14.23	100	100	3.28
1603	14.00	100	110	3.05
1613	14.16	100	120	3.21
1623	14.39	100	130	3.44
1633	14.56	100	140	3.61
1643	14.66	100	150	3.71
1653	14.78	100	160	3.83
1703	14.92	100	170	3.97
1713	15.04	100	180	4.09
1723	15.22	100	190	4.27
1733	15.44	100	200	4.49
1743	15.14	100	210	4.19
1753	15.31	100	220	4.36
1803	15.48	100	230	4.53
1813	15.61	100	240	4.66
1815	---	---	242	

Average = 100

ROUND 1
LOW FLOW PURGE DATA SHEET

Well ID: WES-1-12-82
Date: 9/5/2001

Time (Hours)	Distance to Water (Feet)	Pump Rate (mL/Min)	Elapsed time	drawdown
935	26.39	---	0	0.00
945	26.51	100	10	0.12
955	26.58	50	20	0.19
1005	26.63	50	30	0.24
1015	26.68	50	40	0.29
1025	26.74	50	50	0.35
1035	26.77	50	60	0.38
1045	26.82	50	70	0.43
1055	26.87	50	80	0.48
1105	26.92	50	90	0.53
1115	26.97	50	100	0.58
1125	26.98	50	110	0.59
1135	27.03	50	120	0.64
1145	27.06	50	130	0.67
1155	27.10	50	140	0.71
1205	27.13	50	150	0.74
1215	27.18	50	160	0.79
1225	27.22	50	170	0.83
1235	27.25	50	180	0.86
1240	---	---	185	

Average = 52.77777778

Well ID: WES-1-13-82
Date: 9/5/2001

Time (Hours)	Distance to Water (Feet)	Pump Rate (mL/Min)	Elapsed time	drawdown
1445	24.50	---	0	0.00
1455	24.60	100	10	0.10
1505	24.62	100	20	0.12
1515	24.62	100	30	0.12
1525	24.66	100	40	0.16
1535	24.65	100	50	0.15
1545	24.67	100	60	0.17
1555	24.65	100	70	0.15
1605	24.66	100	80	0.16
1615	24.68	100	90	0.18
1625	24.68	100	100	0.18
1635	24.68	100	110	0.18
1645	24.68	100	120	0.18
1655	24.68	100	130	0.18
1705	24.68	100	140	0.18
1715	24.68	100	150	0.18
1725	24.68	100	160	0.18
1735	24.68	100	170	0.18
1745	24.68	100	180	0.18
1755	24.68	100	190	0.18
1805	24.68	100	200	0.18
1815	24.68	100	210	0.18
1825	24.68	100	220	0.18
1835	24.68	100	230	0.18
1845	24.68	100	240	0.18
1850	---	---	245	

Average = 100

Well ID: WES-1-14-83
Date: 8/23/2001

Time (Hours)	Distance to Water (Feet)	Pump Rate (mL/Min)	Elapsed time	drawdown
1338	16.17	---	0	0.00
1348	17.61	100	10	1.44
1358	18.56	100	20	2.39
1408	19.65	100	30	3.48
1418	20.65	100	40	4.48
1428	21.45	100	50	5.28
1438	22.20	100	60	6.03
1448	22.85	100	70	6.68
1458	23.44	100	80	7.27
1508	23.95	100	90	7.78
1630	20.00	---	172	3.83
1640	20.80	100	182	4.63
1650	21.75	100	192	5.58
1700	22.90	100	202	6.73
1710	23.20	100	212	7.03
1720	23.78	100	222	7.61

Average = 100

Well ID: WES-1-14-83
Date: 8/24/2001 - SECOND TEST

Time (Hours)	Distance to Water (Feet)	Pump Rate (mL/Min)	Elapsed time	drawdown
721	16.45	---	0	0.00
731	17.44	95	10	0.99
736	17.83	95	15	1.38
741	18.44	95	20	1.99
746	18.97	95	25	2.52
751	19.45	95	30	3.00
756	20.68	95	35	4.23
800	21.32	95	39	4.87

Average = 95

Well ID: 01MW15
Date: 9/5/2001

Time (Hours)	Distance to Water (Feet)	Pump Rate (mL/Min)	Elapsed time	drawdown
835	28.56	---	0	0.00
845	28.78	100	10	0.22
855	28.95	100	20	0.39
905	29.12	100	30	0.56
915	29.28	100	40	0.72
925	29.42	100	50	0.86
935	29.55	100	60	0.99
945	29.68	100	70	1.12
945	---	---	70	

Average = 100

Well ID: 01MW16
Date: 9/5/2001

Time (Hours)	Distance to Water (Feet)	Pump Rate (mL/Min)

DRY - NO SAMPLE

Well ID: 01-17
Date: 9/19/2001

Time (Hours)	Distance to Water (Feet)	Pump Rate (mL/Min)	Elapsed time	drawdown
1235	21.85	100	0	0.00
1240	22.35	105	5	0.50
1250	22.35	105	15	0.50
1300	22.22	105	25	0.37
1310	22.28	105	35	0.43
1320	22.30	105	45	0.45
1330	22.30	105	55	0.45
1340	22.30	105	65	0.45
1350	22.30	105	75	0.45
1400	22.32	105	85	0.47
1410	22.30	105	95	0.45
1420	22.30	105	105	0.45
1425	22.30	105	110	0.45
1430	22.30	105	115	0.45

Average = 105

ROUND 1
LOW FLOW PURGE DATA SHEET

Well ID: 01-17
Date: 9/19/2001 - SECOND TEST

Time (Hours)	Distance to Water (Feet)	Pump Rate (mL/Min)	Elapsed time	drawdown
1825	22.5	650	0	0.00
1830	23.38	650	5	0.88
1835	23.97	650	10	1.47
1840	23	0	15	
1845	22.67	0	20	
1850	22.5	0	25	

Average = 650

Well ID: WES-1-17-83
Date: 9/11/2001

Time (Hours)	Distance to Water (Feet)	Pump Rate (mL/Min)	Elapsed time	drawdown
850	22.15	---	0	0.00
900	22.56	120	10	0.41
910	22.67	120	20	0.52
920	22.68	100	30	0.53
930	22.68	100	40	0.53
940	22.72	100	50	0.57
950	22.77	100	60	0.62
1000	22.77	100	70	0.62
1010	22.77	100	80	0.62
1020	22.77	100	90	0.62
1030	22.73	75	100	0.58
1040	22.77	100	110	0.62
1050	22.76	100	120	0.61
1055	---	---		

Average= 101.25

Well ID: WES-1-18-83
Date: 9/19/2001

Time (Hours)	Distance to Water (Feet)	Pump Rate (mL/Min)	Elapsed time	drawdown
1040	15.35	---	0	0.00
1050	15.61	90	10	0.26
1100	15.91	90	20	0.56
1110	16.04	80	30	0.69
1120	16.33	80	40	0.98
1130	16.47	80	50	1.12
1140	16.64	75	60	1.29
1150	16.79	75	70	1.44
1150	---	---	70	#VALUE!
1200	16.69	---	80	1.34
1210	16.63	---	90	1.28
1220	20.03	940	100	4.68
1230	22.25	940	110	6.90
1240	26.78	940	120	11.43
1250	30.21	940	130	14.86
1252	DRY	940	132	#VALUE!
1252	---	---	132	

Average= 81.42857143

ROUND 1
LOW FLOW PURGE DATA SHEET

Well ID: 01-19
Date: 9/18/2001

Time (Hours)	Distance to Water (Feet)	Pump Rate (mL/Min)	Elapsed time	drawdown
1110	22.04	100	0	0.00
1120	22.33	100	10	0.29
1130	22.59	90	20	0.55
1140	22.85	75	30	0.81
1150	23.06	75	40	1.02
1155	23.18	75	45	1.14
1200	23.25	75	50	1.21
1210	23.47	75	60	1.43
1220	23.65	75	70	1.61
1230	23.78	70	80	1.74
1240	23.87	70	90	1.83
1250	24.00	70	100	1.96
1300	24.13	70	110	2.09
1310	24.22	70	120	2.18
1320	24.31	70	130	2.27
1330	24.44	70	140	2.40
1340	24.48	70	150	2.44
1345	24.53	70	155	2.49
1355	24.58	70	165	2.54
1405	24.67	70	175	2.63
1415	24.74	70	185	2.70
1425	24.79	70	195	2.75
1435	24.89	70	205	2.85
1445	24.92	70	215	2.88
1455	24.95	70	225	2.91
1505	25.01	70	235	2.97

Average= 74.23076923

Well ID: 01-20
Date: 9/19/2001

Time (Hours)	Distance to Water (Feet)	Pump Rate (mL/Min)	Elapsed time	drawdown
1104	29.05	100	0	0.00
1110	29.40	80	6	0.35
1120	30.62	80	16	1.57
1130	31.72	80	26	2.67
1140	32.50	80	36	3.45

Average= 80

Well ID: WES-1-21-83
Date: 9/5/2001

Time (Hours)	Distance to Water (Feet)	Pump Rate (mL/Min)	Elapsed time	drawdown
1115	17.65	---	0	0.00
1125	18.51	100	10	0.86
1135	18.79	100	20	1.14
1145	18.87	100	30	1.22
1155	18.94	100	40	1.29
1205	18.99	100	50	1.34
1215	18.99	100	60	1.34
1225	19.01	100	70	1.36
1235	19.11	100	80	1.46
1245	19.16	100	90	1.51
1255	19.11	100	100	1.46
1305	19.19	100	110	1.54
1315	19.22	100	120	1.57
1325	19.22	100	130	1.57
1335	19.22	100	140	1.57
1345	19.22	100	150	1.57
1355	19.22	100	160	1.57
1400	19.22	100	165	1.57
1400	---	---	165	

Average= 100

Well ID: WES-1-22-83
Date: 9/19/2001

Time (Hours)	Distance to Water (Feet)	Pump Rate (mL/Min)	Elapsed time	drawdown
1330	19.14	---	0	0.00
1340	19.92	100	10	0.78
1350	19.82	50	20	0.68
1400	19.81	50	30	0.67
1410	19.81	50	40	0.67
1420	19.81	50	50	0.67
1430	19.83	50	60	0.69
1440	19.81	50	70	0.67
1450	19.81	50	80	0.67
1500	19.81	50	90	0.67
1510	19.79	50	100	0.65
1520	19.78	50	110	0.64
1530	19.93	90	120	0.79
1540	20.00	90	130	0.86
1550	20.04	90	140	0.90
1600	20.10	90	150	0.96
1610	20.12	90	160	0.98
1620	20.11	90	170	0.97
1630	20.12	90	180	0.98
1630	---	---	180	

Average= 68.33333333

Well ID: WES-1-23-83
Date: 9/6/2001

Time (Hours)	Distance to Water (Feet)	Pump Rate (mL/Min)	Elapsed time	drawdown
1525	39.69	---	0	0.00
1535	40.01	100	10	0.32
1545	40.33	100	20	0.64
1555	40.91	100	30	1.22
1600	NO READING	25	35	#VALUE!
1605	41.99	---	40	
1640	---	---	75	

Average= 100

Well ID: WES-1-24-83
Date: 9/20/2001

Time (Hours)	Distance to Water (Feet)	Pump Rate (mL/Min)	Elapsed time	drawdown
1155	14.92	---	0	0.00
1205	16.24	120	10	1.32
1215	16.53	70	20	1.61
1225	16.98	70	30	2.06
1235	17.24	70	40	2.32
1245	17.55	70	50	2.63
1255	17.69	70	60	2.77
1325	17.84	70	90	2.92
1315	17.98	70	80	3.06
1325	18.04	70	90	3.12
1335	18.15	70	100	3.23
1345	18.22	70	110	3.30
1355	18.28	70	120	3.36
1405	18.37	70	130	3.45
1420	17.48	---	145	2.56
1425	17.22	---	150	2.30
1435	17.86	70	160	2.94
1445	18.02	70	170	3.10
1455	18.20	70	180	3.28

Average= 73.125

ROUND 1
LOW FLOW PURGE DATA SHEET

Well ID: WES-1-25-83
Date: 9/8/2001

Time (Hours)	Distance to Water (Feet)	Pump Rate (mL/Min)	Elapsed time	drawdown
1030	21.51	---	0	0.00
1040	21.64	180	10	0.13
1050	21.83	100	20	0.32
1100	22.00	80	30	0.49
1110	22.07	80	40	0.56
1120	22.13	80	50	0.62
1130	22.17	60	60	0.66
1140	22.23	65	70	0.72
1150	22.26	60	80	0.75
1200	22.26	60	90	0.75
1210	22.28	60	100	0.77
1220	22.31	68	110	0.80
1230	22.32	60	120	0.81
1240	22.35	63	130	0.84
1250	22.33	60	140	0.82
1300	22.36	60	150	0.85
1310	22.37	60	160	0.86
1315	---	---	165	

Average= 67.73333333

Well ID: WES-1-26-83
Date: 9/6/2001

Time (Hours)	Distance to Water (Feet)	Pump Rate (mL/Min)	Elapsed time	drawdown
850	36.64	---	0	0.00
900	37.84	100	10	1.20
910	38.24	100	20	1.60
920	38.42	100	30	1.78
930	38.48	100	40	1.84
940	38.68	100	50	2.04
950	38.69	100	60	2.05
1000	38.73	100	70	2.09
1010	38.79	100	80	2.15
1020	38.79	100	90	2.15
1030	38.83	100	100	2.19
1040	38.90	100	110	2.26
1050	38.63	75	120	1.99
1100	38.47	75	130	1.83
1110	38.39	75	140	1.75
1120	38.31	75	150	1.67
1130	38.25	75	160	1.61
1140	38.44	100	170	1.80
1150	38.64	100	180	2.00
1200	38.83	100	190	2.19
1210	38.78	100	200	2.14
1220	38.90	100	210	2.26
1230	38.86	100	220	2.22
1240	38.83	100	230	2.19
1250	38.90	100	240	2.26
1250	---	---	240	

ROUND 1
LOW FLOW PURGE DATA SHEET

Average= 94.79166667

Well ID: WES-1-27-83
Date: 9/7/2001

Time (Hours)	Distance to Water (Feet)	Pump Rate (mL/Min)	Elapsed time	drawdown
1320	25.02	---	0	0.00
1330	26.26	100	10	1.24
1340	26.67	100	20	1.65
1350	27.68	100	30	2.66
1400	28.20	100	40	3.18
1410	28.44	100	50	3.42
1420	28.76	250	60	3.74
1430	29.58	250	70	4.56
1440	30.03	250	80	5.01
1450	30.59	250	90	5.57
1500	31.81	250	100	6.79
1500	---	---	100	
1540	---	---	140	

Average= 175

Well ID: WES-1-27-83
Date: 9/8/2001 - SECOND TEST

Time (Hours)	Distance to Water (Feet)	Pump Rate (mL/Min)	Elapsed time	drawdown
820	25.44	---	0	0.00
830	25.81	25	10	0.37
840	26.36	75	20	0.92
850	26.87	75	30	1.43
850	---	---	30	

Average= 58.33333333

Well ID: 01-C01-93
Date: 8/25/2001

Time (Hours)	Distance to Water (Feet)	Pump Rate (mL/Min)	Elapsed time	drawdown
1120	139.30	---	0	0.00
1130	139.39	120	10	0.09
1140	139.39	130	20	0.09
1150	139.39	130	30	0.09
1200	139.39	130	40	0.09
1210	139.34	130	50	0.04
1220	139.45	130	60	0.15
1230	139.35	125	70	0.05
1240	139.33	130	80	0.03
1250	139.41	125	90	0.11
1300	139.33	125	100	0.03
1310	139.38	130	110	0.08
1320	139.40	130	120	0.10
1330	139.33	130	130	0.03
1340	139.40	130	140	0.10
1350	139.41	130	150	0.11
1410	139.35	130	170	0.05
1420	139.42	130	180	0.12

Average= 128.5294118

ROUND 1
LOW FLOW PURGE DATA SHEET

Well ID: 01T02
Date: 9/18/2001

Time (Hours)	Distance to Water (Feet)	Pump Rate (mL/Min)	Elapsed time	drawdown
808	65.26	110	0	0.00
815	65.73	80	7	0.47
825	65.90	80	17	0.64
835	66.22	80	27	0.96
845	66.57	65	37	1.31
855	66.70	65	47	1.44
905	66.95	65	57	1.69
915	67.18	65	67	1.92
925	67.31	65	77	2.05
935	67.60	110	87	2.34
940	68.00	110	92	2.74
945	68.28	110	97	3.02
950	68.51	110	102	3.25

Average= 70.625

Well ID: 01T02 - ROUND 2
Date: 9/22/2001

Time (Hours)	Distance to Water (Feet)	Pump Rate (mL/Min)	Elapsed time	drawdown
1122	65.48	100	0	0.00
1125	66.00	100	3	0.52
1135	66.33	100	13	0.85
1145	66.75	100	23	1.27
1155	67.32	100	33	1.84
1205	67.65	100	43	2.17
1215	68.02	100	53	2.54
1225	68.20	100	63	2.72
1235	68.51	100	73	3.03

Average= 100

ROUND 2
LOW FLOW PURGE DATA

Well ID: 01T03
Date: 6/17/2002

Time (hh:mm)	Distance to Water (Feet)	Pump Rate (mL/Min)	Elasped time (hh:mm)	drawdown (Feet)
8:47	139.16	---	0:00	0.00
8:50	139.83	150	0:03	0.67
8:53	139.88	130	0:06	0.72
8:56	139.88	70	0:09	0.72
8:59	139.95	70	0:12	0.79
9:02	139.95	70	0:15	0.79
9:05	139.95	70	0:18	0.79
9:10	139.88	70	0:23	0.72
9:20	139.96	100	0:33	0.80
9:30	139.95	100	0:43	0.79
9:40	139.97	110	0:53	0.81
9:50	139.95	110	1:03	0.79
10:00	139.95	110	1:13	0.79
10:10	140 07	110	1:23	0.91
10:20	140.10	110	1:33	0.94
10:30	140.10	110	1:43	0.94
10:40	140.09	110	1:53	0.93
10:45	---	---	1:58	---

Average= 100

Well ID: 01T04
Date: 6/15/2002

Time (hh:mm)	Distance to Water (Feet)	Pump Rate (mL/Min)	Elasped time (hh:mm)	drawdown (Feet)
9:21	136.48	220	0:00	0.00
9:24	136.62	220	0:03	0.14
9:28	136 64	220	0:07	0.16
9:32	136.64	220	0:11	0.16
9:36	136.64	220	0:15	0.16
9:40	136.64	220	0:19	0.16
9:50	136.64	220	0:29	0.16
10:00	136.64	220	0:39	0.16
10.10	136.64	220	0:49	0.16
10:20	136.64	220	0:59	0.16
10:30	136.64	220	1:09	0.16
10:40	136.64	220	1:19	0.16
10:50	136.64	220	1:29	0.16

Average= 220

ROUND 2
LOW FLOW PURGE DATA

Well ID: 01T05
Date: 6/15/2002

Time (hh:mm)	Distance to Water (Feet)	Pump Rate (mL/Min)	Elasped time (hh:mm)	drawdown (Feet)
15:17	16.66	150	0:00	0.00
15:21	17.20	150	0:04	0.54
15:25	17.25	95	0:08	0.59
15:29	17.37	95	0:12	0.71
15:33	17.46	95	0:16	0.80
15:37	17.53	80	0:20	0.87
15:40	17.61	80	0:23	0.95
15:50	17.73	80	0:33	1.07
16:00	17.80	80	0:43	1 14
16:10	17.96	80	0:53	1.30
16:20	18.04	80	1:03	1.38
16:30	18.17	80	1:13	1.51
16:40	18.26	80	1:23	1.60
16:50	18.33	80	1:33	1.67
17:00	18.39	80	1:43	1.73
17:10	18 45	80	1:53	1.79
17:20	18.53	80	2:03	1.87
17:30	18.56	80	2:13	1.90
17:40	18.60	80	2:23	1.94
17:50	18.65	80	2:33	1.99
18:00	18.71	80	2:43	2.05
18:10	18.77	80	2:53	2.11
18:20	18.81	80	3:03	2.15
18:30	18.84	80	3:13	2.18
18.40	18.89	80	3:23	2.23
18:50	18.93	80	3.33	2.27
19:00	18.96	80	3:43	2.30
19:10	19.00	80	3:53	2.34
19:17	19.04	80	4:00	2.38

Average= 86.37931034

Well ID: WES-1-2-81
Date: 6/17/2002

Time (hh:mm)	Distance to Water (Feet)	Pump Rate (mL/Min)	Elasped time (hh:mm)	drawdown (Feet)
12:15	11.22	---	0:00	0.00
12:18	11.32	120	0:03	0.10
12:21	11.35	120	0:06	0.13
12:24	11.39	100	0:09	0.17
12:27	11.43	100	0:12	0.21
12:30	11.47	100	0:15	0.25
12:35	11.54	100	0:20	0.32
12:45	11.64	100	0:30	0.42
12:55	11.72	100	0:40	0.50
13:05	11.82	100	0:50	0.60
13:15	11.90	100	1:00	0.68
13:25	11.92	80	1:10	0.70
13:35	11.93	80	1:20	0.71
13:45	11.95	80	1:30	0.73
13:55	11.98	80	1:40	0.76
14:00	---	---	1:45	---

Average= 97.14285714

ROUND 2
LOW FLOW PURGE DATA

Well ID: WES-1-4-81
Date: 6/1/2002

Time (hh:mm)	Distance to Water (Feet)	Pump Rate (mL/Min)	Elasped time (hh:mm)	drawdown (Feet)
13:50	14.84	---	0:00	0.00
14:00	15.26	160	0:10	0.42
14:10	15.51	160	0:20	0.67
14:20	15.69	120	0:30	0.85
14:30	15.83	80	0:40	0.99
14:40	15.96	80	0:50	1.12
14:50	16 13	100	1:00	1.29
15:00	16.28	85	1:10	1.44
15:10	16.43	85	1:20	1.59
15:20	16.58	85	1:30	1.74
15:30	16.74	95	1:40	1.90
15.40	16.86	100	1:50	2.02
15:50	16.98	85	2.00	2.14
16·00	17.10	80	2:10	2.26
16:10	17.17	80	2:20	2.33
16.20	17.25	80	2:30	2.41
16:30	17.31	80	2:40	2.47
16:40	17.43	100	2:50	2.59
16:50	17.57	100	3:00	2.73
17:00	17.69	100	3:10	2.85
17:10	17.81	100	3:20	2.97
17:20	17.93	100	3:30	3.09
17:30	18.05	100	3:40	3.21
17:40	18.17	100	3:50	3.33
17:50	18.30	100	4:00	3.46
17:55	---	---	4:05	---

Average= 98.125

Well ID: WES-1-15-83
Date: 6/15/2002

Time (hh:mm)	Distance to Water (Feet)	Pump Rate (mL/Min)	Elasped time (hh:mm)	drawdown (Feet)
12:08	27.05	---	0:00	0.00
12.13	27.27	130	0:05	0.22
12:16	27.36	140	0:08	0.31
12:20	27.45	100	0:12	0.40
12:25	27.55	100	0:17	0.50
12:30	27.63	100	0:22	0.58
12:40	27.71	100	0:32	0.66
12:50	27.80	100	0:42	0.75
13:00	27.93	100	0:52	0.88
13:10	28.08	100	1:02	1.03
13:20	28.13	100	1:12	1.08
13:30	28.11	70	1:22	1.06
13:35	28.08	50	1:27	1.03
13:40	28 05	50	1:32	1.00
13:45	28.06	70	1:37	1.01
13:50	28.09	70	1:42	1.04
13:55	28.10	70	1:47	1.05
14·00	28.09	70	1:52	1.04
14:05	28.10	70	1:57	1.05
14.10	---	---	2:02	---

Average= 88.33333333

ATTACHMENT 2

ATTACHMENT 2

TETRA TECH NUS, INC. **CALCULATION WORKSHEET**

CLIENT: NAVY SOUTH DIV.	JOB NUMBER: 4267
SUBJECT: ESTIMATING HYDRAULIC CONDUCTIVITY USING OGDEN FIELD METHODS	
BASED ON: OGDEN FIELD METHOD FROM M. KASENOW & P. PARE	DRAWING NUMBER:
BY: FRED W. RAMSER; CHECKED BY: TR 8/7/02	APPROVED BY: ; DATE:

A. EQ:

1) $uW(u) = \frac{1.87\,Sr^2}{114.6\,Qt}$ (dimensionless) (1)

2) $T = \frac{1.87\,Sr^2}{ut}$ (gpd/ft) (2)

WHERE:

Q = PUMPING RATE (gpm)
r = WELL RADIUS (feet)
s = DRAWDOWN (feet)
t = PUMPING TIME (DAYS)
S = STORAGE COEFFICIENT
u = THEIS CORRECTION FACTOR
uW(u) = OGDEN CORRECTION FACTOR
T = TRANSMISSIVITY gpd/ft

3) $K = T/b$

b = AQUIFER THICKNESS (ESTIMATED FROM CROSS SECTIONS)

B. WELL 01-01 (WES-1-1-81)

Q = 200 ml/min
r = 3" = 3/12 = 0.25 feet
s = 0.68 feet
t = 130 min
S = 0.2 (UNCONFINED SANDSTONE)
b = 30 ft

1) CONV

$Q = 200\,ml/min \times \frac{1\,l}{1000\,ml} \times \frac{1\,gal}{3.785412\,l} =$
$Q = 0.05283$ gpm

$t = 130\,min \times \frac{1\,hr}{60\,min} \times \frac{1\,day}{24\,hr}$
$= 0.0902778$ days

CLIENT NAVY SOUTH DIV		JOB NUMBER	
SUBJECT			
BASED ON OGDEN FIELD METHOD		DRAWING NUMBER	
BY FRED W. RAMSER	CHECKED BY TR 8/7/02	APPROVED BY	DATE

B. (CONT)

2) SUB

(eq1) $uW(u) = \frac{(1.87)(0.2)(0.68)(0.25)^2}{(114.6)(0.05283)(0.0902778)}$

$= \frac{0.015895}{0.5465705095 4}$

$uW(u) = 2.91 \times 10^{-2}$ ∴

FROM TABLE PAGE A –

$u = 6.52 \times 10^{-3}$

3) SUB

(eq2) $T = \frac{(1.87)(0.2)(0.25)^2}{(6.52\times10^{-3})(0.0902778)}$

$= \frac{0.023375}{5.88611256\times10^{-4}}$

$T = 39.712$ gpd/ft

4) eq3 $K = T/b$

sub:

$K = \frac{39.712 \text{ gpd/ft}}{30 \text{ ft}}$

$K = 1.323$ gpd/ft^2

$K = 1.323\left(\frac{gal}{day}\cdot\frac{1}{ft^2}\right) \times \frac{ft^3}{7.48 gal} \times \frac{12 in}{1 ft} \times \frac{2.54 cm}{1 in} \times \frac{1 day}{24 hr} \times \frac{1 hr}{60 min} \times \frac{1 min}{60 sec}$

$K = 6.24 \times 10^{-5}$ cm/sec

CLIENT NAVY SOUTH DI.		JOB NUMBER	
SUBJECT			
BASED ON		DRAWING NUMBER	
BY	CHECKED BY TR 8/7/02	APPROVED BY	DATE

C. PURGE DATA COLLECTED FROM THE REMAINING WELLS WERE EVALUATED USING THIS METHOD. THE COMPUTATION WAS DONE ON AN EXCEL SPREAD SHEET ATTACHED.

OGDEN'S METHOD

L. Ogden (1965) developed a simple and relatively accurate method to approximate transmissivity in production or observation wells utilizing a **single drawdown and the Theis solution.** The Theis equations are manipulated and equated to solve for **uW(u)**. **u** is then identified from a table, and transmissivity is calculated utilizing the Theis equation that operates with **u**. The method has seen little use, because a convenient u, uW(u) table was never developed. Your author has completed that task (so have Kruseman and de Ridder, 1990). The table in Appendix A can be used with the following equations:

$$uW(u) = \frac{1.87Ssr^2}{114.6Qt} = \text{dimensionless} \qquad (1)$$

$$T = \frac{1.87Sr^2}{ut} = \text{gpd / ft} \qquad (2)$$

where

Q = the pumping rate in gallons per minute,
r = the observation well distance or pumping well radius in feet,
s = the drawdown in feet,
t = the pumping time in days,
S = the storage coefficient, which is dimensionless,
u = Theis dimensionless correction factor, and
uW(u) = Ogden dimensionless correction factor.

u	W(u)	uW(u)	Z(u)
2.5000E-03	5.4200E+00	1.3550E-02	8.7250E-01
2.6000E-03	5.3800E+00	1.3988E-02	8.7159E-01
2.7000E-03	5.3400E+00	1.4418E-02	8.7070E-01
2.8000E-03	5.3000E+00	1.4840E-02	8.6984E-01
2.9000E-03	5.2700E+00	1.5283E-02	8.6899E-01
3.0000E-03	5.2300E+00	1.5690E-02	8.6816E-01
3.1000E-03	5.2000E+00	1.6120E-02	8.6735E-01
3.2000E-03	5.1700E+00	1.6544E-02	8.6656E-01
3.3000E-03	5.1400E+00	1.6962E-02	8.6579E-01
3.4000E-03	5.1100E+00	1.7374E-02	8.6502E-01
3.5000E-03	5.0800E+00	1.7780E-02	8.6428E-01
3.6000E-03	5.0500E+00	1.8180E-02	8.6354E-01
3.7000E-03	5.0300E+00	1.8611E-02	8.6282E-01
3.8000E-03	5.0000E+00	1.9000E-02	8.6211E-01
3.9000E-03	4.9700E+00	1.9383E-02	8.6141E-01
4.0000E-03	4.9500E+00	1.9800E-02	8.6073E-01
4.1000E-03	4.9200E+00	2.0172E-02	8.6005E-01
4.2000E-03	4.9000E+00	2.0580E-02	8.5939E-01
4.3000E-03	4.8800E+00	2.0984E-02	8.5873E-01
4.4000E-03	4.8500E+00	2.1340E-02	8.5809E-01
4.5000E-03	4.8300E+00	2.1735E-02	8.5745E-01
4.6000E-03	4.8100E+00	2.2126E-02	8.5682E-01
4.7000E-03	4.7900E+00	2.2513E-02	8.5620E-01
4.8000E-03	4.7700E+00	2.2896E-02	8.5559E-01
4.9000E-03	4.7500E+00	2.3275E-02	8.5499E-01
5.0000E-03	4.7300E+00	2.3650E-02	8.5439E-01
5.1000E-03	4.7100E+00	2.4021E-02	8.5396E-01
5.2000E-03	4.6900E+00	2.4388E-02	8.5345E-01
5.3000E-03	4.6700E+00	2.4751E-02	8.5288E-01
5.4000E-03	4.6500E+00	2.5110E-02	8.5223E-01
5.5000E-03	4.6300E+00	2.5465E-02	8.5152E-01
5.6000E-03	4.6100E+00	2.5816E-02	8.5110E-01
5.7000E-03	4.6000E+00	2.6220E-02	8.5061E-01
5.8000E-03	4.5800E+00	2.6564E-02	8.5007E-01
5.9000E-03	4.5600E+00	2.6904E-02	8.4946E-01
6.0000E-03	4.5400E+00	2.7240E-02	8.4880E-01
6.1000E-03	4.5300E+00	2.7633E-02	8.4839E-01
6.2000E-03	4.5100E+00	2.7962E-02	8.4792E-01
6.3000E-03	4.5000E+00	2.8350E-02	8.4740E-01
6.4000E-03	4.4800E+00	2.8672E-02	8.4684E-01
6.5000E-03	4.4700E+00	2.9055E-02	8.4622E-01
6.6000E-03	4.4500E+00	2.9370E-02	8.4522E-01
6.7000E-03	4.4400E+00	2.9748E-02	8.4537E-01
6.8000E-03	4.4200E+00	3.0056E-02	8.4487E-01
6.9000E-03	4.4100E+00	3.0429E-02	8.4433E-01
7.0000E-03	4.3900E+00	3.0730E-02	8.4375E-01
7.1000E-03	4.3800E+00	3.1098E-02	8.4336E-01
7.2000E-03	4.3600E+00	3.1392E-02	8.4293E-01
7.3000E-03	4.3500E+00	3.1755E-02	8.4245E-01
7.4000E-03	4.3400E+00	3.2116E-02	8.4194E-01

u	W(u)	uW(u)	Z(u)
7.5000E-03	4.3200E+00	3.2400E-02	8.4139E-01
7.6000E-03	4.3100E+00	3.2756E-02	8.4101E-01
7.7000E-03	4.3000E+00	3.3110E-02	8.4059E-01
7.8000E-03	4.2800E+00	3.3384E-02	8.4014E-01
7.9000E-03	4.2700E+00	3.3733E-02	8.3965E-01
8.0000E-03	4.2600E+00	3.4080E-02	8.3912E-01
8.1000E-03	4.2500E+00	3.4425E-02	8.3875E-01
8.2000E-03	4.2300E+00	3.4686E-02	8.3834E-01
8.3000E-03	4.2200E+00	3.5026E-02	8.3791E-01
8.4000E-03	4.2100E+00	3.5364E-02	8.3744E-01
8.5000E-03	4.2000E+00	3.5700E-02	8.3694E-01
8.6000E-03	4.1900E+00	3.6034E-02	8.3657E-01
8.7000E-03	4.1800E+00	3.6366E-02	8.3618E-01
8.8000E-03	4.1600E+00	3.6608E-02	8.3575E-01
8.9000E-03	4.1500E+00	3.6935E-02	8.3530E-01
9.0000E-03	4.1400E+00	3.7260E-02	8.3482E-01
9.1000E-03	4.1300E+00	3.7583E-02	8.3447E-01
9.2000E-03	4.1200E+00	3.7904E-02	8.3408E-01
9.3000E-03	4.1100E+00	3.8223E-02	8.3368E-01
9.4000E-03	4.1000E+00	3.8540E-02	8.3324E-01
9.5000E-03	4.0900E+00	3.8855E-02	8.3278E-01
9.6000E-03	4.0800E+00	3.9168E-02	8.3243E-01
9.7000E-03	4.0700E+00	3.9479E-02	8.3206E-01
9.8000E-03	4.0600E+00	3.9788E-02	8.3166E-01
9.9000E-03	4.0500E+00	4.0095E-02	8.3124E-01
1.0000E-02	4.0400E+00	4.0400E-02	8.3080E-01
1.1000E-02	3.9400E+00	4.3340E-02	8.2700E-01
1.2000E-02	3.8600E+00	4.6320E-02	8.2340E-01
1.3000E-02	3.7800E+00	4.9140E-02	8.1997E-01
1.4000E-02	3.7100E+00	5.1940E-02	8.1668E-01
1.5000E-02	3.6400E+00	5.4600E-02	8.1352E-01
1.6000E-02	3.5700E+00	5.7120E-02	8.1048E-01
1.7000E-02	3.5100E+00	5.9670E-02	8.0754E-01
1.8000E-02	3.4600E+00	6.2280E-02	8.0469E-01
1.9000E-02	3.4100E+00	6.4790E-02	8.0194E-01
2.0000E-02	3.3500E+00	6.7000E-02	7.9925E-01
2.1000E-02	3.3100E+00	6.9510E-02	7.9665E-01
2.2000E-02	3.2600E+00	7.1720E-02	7.9410E-01
2.3000E-02	3.2200E+00	7.4060E-02	7.9162E-01
2.4000E-02	3.1800E+00	7.6320E-02	7.8920E-01
2.5000E-02	3.1400E+00	7.8500E-02	7.8683E-01
2.6000E-02	3.1000E+00	8.0600E-02	7.8451E-01
2.7000E-02	3.0600E+00	8.2620E-02	7.8224E-01
2.8000E-02	3.0300E+00	8.4840E-02	7.8001E-01
2.9000E-02	2.9900E+00	8.6710E-02	7.7782E-01
3.0000E-02	2.9600E+00	8.8800E-02	7.7567E-01
3.1000E-02	2.9300E+00	9.0830E-02	7.7356E-01
3.2000E-02	2.9000E+00	9.2800E-02	7.7149E-01
3.3000E-02	2.8700E+00	9.4710E-02	7.6944E-01
3.4000E-02	2.8400E+00	9.6560E-02	7.6743E-01

u	W(u)	uW(u)	Z(u)
3.5000E-02	2.8100E+00	9.8350E-02	7.6545E-01
3.6000E-02	2.7800E+00	1.0008E-01	7.6350E-01
3.7000E-02	2.7600E+00	1.0212E-01	7.6158E-01
3.8000E-02	2.7300E+00	1.0374E-01	7.5968E-01
3.9000E-02	2.7100E+00	1.0569E-01	7.5781E-01
4.0000E-02	2.6800E+00	1.0720E-01	7.5597E-01
4.1000E-02	2.6600E+00	1.0906E-01	7.5414E-01
4.2000E-02	2.6300E+00	1.1046E-01	7.5234E-01
4.3000E-02	2.6100E+00	1.1223E-01	7.5056E-01
4.4000E-02	2.5900E+00	1.1396E-01	7.4880E-01
4.5000E-02	2.5700E+00	1.1565E-01	7.4707E-01
4.6000E-02	2.5500E+00	1.1730E-01	7.4535E-01
4.7000E-02	2.5300E+00	1.1891E-01	7.4365E-01
4.8000E-02	2.5100E+00	1.2048E-01	7.4197E-01
4.9000E-02	2.4900E+00	1.2201E-01	7.4030E-01
5.0000E-02	2.4700E+00	1.2350E-01	7.3866E-01
5.1000E-02	2.4500E+00	1.2495E-01	7.3733E-01
5.2000E-02	2.4300E+00	1.2636E-01	7.3586E-01
5.3000E-02	2.4100E+00	1.2773E-01	7.3426E-01
5.4000E-02	2.3900E+00	1.2906E-01	7.3252E-01
5.5000E-02	2.3800E+00	1.3090E-01	7.3066E-01
5.6000E-02	2.3600E+00	1.3216E-01	7.2936E-01
5.7000E-02	2.3400E+00	1.3338E-01	7.2795E-01
5.8000E-02	2.3300E+00	1.3514E-01	7.2642E-01
5.9000E-02	2.3100E+00	1.3629E-01	7.2477E-01
6.0000E-02	2.3000E+00	1.3800E-01	7.2302E-01
6.1000E-02	2.2800E+00	1.3908E-01	7.2175E-01
6.2000E-02	2.2600E+00	1.4012E-01	7.2039E-01
6.3000E-02	2.2500E+00	1.4175E-01	7.1892E-01
6.4000E-02	2.2300E+00	1.4272E-01	7.1735E-01
6.5000E-02	2.2200E+00	1.4430E-01	7.1569E-01
6.6000E-02	2.2100E+00	1.4586E-01	7.1445E-01
6.7000E-02	2.1900E+00	1.4673E-01	7.1313E-01
6.8000E-02	2.1800E+00	1.4824E-01	7.1172E-01
6.9000E-02	2.1600E+00	1.4904E-01	7.1022E-01
7.0000E-02	2.1500E+00	1.5050E-01	7.0863E-01
7.1000E-02	2.1400E+00	1.5194E-01	7.0743E-01
7.2000E-02	2.1200E+00	1.5264E-01	7.0615E-01
7.3000E-02	2.1100E+00	1.5403E-01	7.0478E-01
7.4000E-02	2.1000E+00	1.5540E-01	7.0334E-01
7.5000E-02	2.0900E+00	1.5675E-01	7.0182E-01
7.6000E-02	2.0700E+00	1.5732E-01	7.0065E-01
7.7000E-02	2.0600E+00	1.5862E-01	6.9940E-01
7.8000E-02	2.0500E+00	1.5990E-01	6.9808E-01
7.9000E-02	2.0400E+00	1.6116E-01	6.9669E-01
8.0000E-02	2.0300E+00	1.6240E-01	6.9523E-01
8.1000E-02	2.0200E+00	1.6362E-01	6.9408E-01
8.2000E-02	2.0000E+00	1.6400E-01	6.9287E-01
8.3000E-02	1.9930E+00	1.6542E-01	6.9159E-01
8.4000E-02	1.9820E+00	1.6649E-01	6.9025E-01

u	W(u)	uW(u)	Z(u)
8.5000E-02	1.9710E+00	1.6754E-01	6.8884E-01
8.6000E-02	1.9600E+00	1.6856E-01	6.8772E-01
8.7000E-02	1.9500E+00	1.6965E-01	6.8654E-01
8.8000E-02	1.9390E+00	1.7063E-01	6.8529E-01
8.9000E-02	1.9290E+00	1.7168E-01	6.8399E-01
9.0000E-02	1.9190E+00	1.7271E-01	6.8263E-01
9.1000E-02	1.9090E+00	1.7372E-01	6.8153E-01
9.2000E-02	1.8990E+00	1.7471E-01	6.8038E-01
9.3000E-02	1.8890E+00	1.7568E-01	6.7917E-01
9.4000E-02	1.8790E+00	1.7663E-01	6.7791E-01
9.5000E-02	1.8690E+00	1.7756E-01	6.7659E-01
9.6000E-02	1.8600E+00	1.7856E-01	6.7552E-01
9.7000E-02	1.8510E+00	1.7955E-01	6.7439E-01
9.8000E-02	1.8410E+00	1.8042E-01	6.7321E-01
9.9000E-02	1.8320E+00	1.8137E-01	6.7199E-01
1.0000E-01	1.8230E+00	1.8230E-01	6.7071E-01
1.1000E-01	1.7370E+00	1.9107E-01	6.5936E-01
1.2000E-01	1.6600E+00	1.9920E-01	6.4852E-01
1.3000E-01	1.5890E+00	2.0657E-01	6.3811E-01
1.4000E-01	1.5240E+00	2.1336E-01	6.2810E-01
1.5000E-01	1.4640E+00	2.1960E-01	6.1844E-01
1.6000E-01	1.4090E+00	2.2544E-01	6.0910E-01
1.7000E-01	1.3580E+00	2.3086E-01	6.0006E-01
1.8000E-01	1.3100E+00	2.3580E-01	5.9128E-01
1.9000E-01	1.2650E+00	2.4035E-01	5.8276E-01
2.0000E-01	1.2230E+00	2.4460E-01	5.7447E-01
2.1000E-01	1.1830E+00	2.4843E-01	5.6640E-01
2.2000E-01	1.1450E+00	2.5190E-01	5.5853E-01
2.3000E-01	1.1100E+00	2.5530E-01	5.5085E-01
2.4000E-01	1.0760E+00	2.5824E-01	5.4335E-01
2.5000E-01	1.0440E+00	2.6100E-01	5.3603E-01
2.6000E-01	1.0140E+00	2.6364E-01	5.2886E-01
2.7000E-01	9.8500E-01	2.6595E-01	5.2185E-01
2.8000E-01	9.5700E-01	2.6796E-01	5.1499E-01
2.9000E-01	9.3100E-01	2.6999E-01	5.0827E-01
3.0000E-01	9.0600E-01	2.7180E-01	5.0168E-01
3.1000E-01	8.8200E-01	2.7342E-01	4.9522E-01
3.2000E-01	8.5800E-01	2.7456E-01	4.8888E-01
3.3000E-01	8.3600E-01	2.7588E-01	4.8319E-01
3.4000E-01	8.1500E-01	2.7710E-01	4.7622E-01
3.5000E-01	7.9400E-01	2.7790E-01	4.7090E-01
3.6000E-01	7.7400E-01	2.7864E-01	4.6483E-01
3.7000E-01	7.5500E-01	2.7935E-01	4.5933E-01
3.8000E-01	7.3700E-01	2.8006E-01	4.5312E-01
3.9000E-01	7.1900E-01	2.8041E-01	4.4757E-01
4.0000E-01	7.0200E-01	2.8080E-01	4.4278E-01
4.1000E-01	6.8600E-01	2.8126E-01	4.3737E-01
4.2000E-01	6.7000E-01	2.8140E-01	4.3134E-01
4.3000E-01	6.5500E-01	*2.8165E-01	4.2620E-01
4.4000E-01	6.4000E-01	2.8160E-01	4.2049E-01

ATTACHMENT 3

ATTACHMENT 3

WELL NO. / ROUND NO.	DRAW DOWN (FT)	FLOW RATE (ML/MIN)	TIME (MIN.)	FLOW RATE (GPM)	TIME (DAYS)	uW(u)	THEIS CORRECTION FACTOR (u)	TRANS-MISSIVITY T (GPD/FT)	AQUIFER THICKNESS (ft)	HYDRAULIC CONDUCTIVITY K (GPD/FT^2)	Ogden Method K (CM/SEC) slow purge
01-01/1	0.68	200	130	0.052832	0.0902778	2.91E-02	6.52E-03	3.97E+01	30	1 32	6.24E-05
01-02/1	1.63	80	80	0.0211328	0.0555556	2.83E-01	4.30E-01	9.78E-01	22	0.04	2.10E-06
01-02/2	0.76	97	100	0.02562352	0 0694444	8 71E-02	2.91E-02	1.16E+01	22	0.53	2 48E-05
01-03/1	5 28	80	53	0.0211328	0.0368056	1.38E+00	na	na	30	na	na
01-04/1	2.97	78	240	0.02060448	0.1666667	1.76E-01	9.40E-02	1.49E+00	27	0 06	2 61E-06
01-04/2	3.46	98	240	0.02588768	0.1666667	1.64E-01	8.20E-02	1.71E+00	27	0.06	2.99E-06
01-05/1	4.78	75	80	0 019812	0 0555556	8.86E-01	na	na	22	na	na
01-06/1	0 45	100	60	0.026416	0.0416667	8 34E-02	2.73E-02	2.05E+01	13	1.58	7.46E-05
01-07/1	1.48	57	110	0.01505712	0.0763889	2.62E-01	2 55E-01	1.20E+00	25	0.05	2 26E-06
01-09/1	2.3	100	145	0.026416	0.1006944	1 76E-01	9.40E-02	2 47E+00	21	0.12	5.55E-06
01-10/1	4.51	71	260	0 01875536	0.1805556	2.72E-01	3 05E-01	4 24E-01	17	0 02	1.18E-06
01-11/1	4.66	100	240	0.026416	0.1666667	2.16E-01	1.45E-01	9.67E-01	22	0.04	2.07E-06
01-12/1	0.86	50	180	0.013208	0.125	1.06E-01	3 95E-02	4.73E+00	19	0 25	1.18E-05
01-13/1	0.18	100	100	0.026416	0.0694444	2 00E-02	4.08E-03	8.25E+01	19	4.34	2.05E-04
01-14/1	7.78	100	90	0 026416	0.0625	9.61E-01	na	na	20	na	na
10-14tst2/1	4.87	95	39	0.0250952	0.0270833	1.46E+00	na	na	20	na	na
01-15/1	1.12	100	70	0 026416	0 0486111	1.78E-01	9.60E-02	5.01E+00	20	0 25	1.18E-05
01-15/2	1.05	88	117	0.02324608	0.08125	1.13E-01	4 38E-02	6 57E+00	20	0.33	1.55E-05
01-17/1	0 62	101	60	0 02668016	0 0416667	1.14E-01	4.43E-02	1.27E+01	20	0.63	2.99E-05
01-18/1	1.44	81	70	0.02139696	0 0486111	2.82E-01	4 30E-01	1.12E+00	20	0.06	2.64E-06
01-19/1	2 97	74	235	0.01954784	0 1631944	1 90E-01	1.08E-01	1.33E+00	20	0.07	3.13E-06
01-20/1	3.45	80	36	0.0211328	0 025	1.33E+00	na	na	20	na	na
01-21/1	1 57	100	120	0 026416	0 0833333	1.45E-01	6 60E-02	4 25E+00	25	0.17	8.02E-06
01-22/1	0.98	68	180	0.01796288	0 125	8.90E-02	3.02E-02	6.19E+00	20	0 31	1.46E-05
01-23/1	1.22	100	30	0.026416	0 0208333	4 52E-01	na	na	20	na	na
01-24/1	3 45	70	130	0 0184912	0.0902778	4.22E-01	na	na	20	na	na
01-25/1	0.86	68	160	0 01796288	0 1111111	8 79E-02	2 96E-02	7.11E+00	20	0.36	1.68E-05
01-26/1	2.26	95	110	0.0250952	0.0763889	2.40E-01	1.90E-01	1.61E+00	20	0.08	3.80E-06
01-27/1	6.79	175	100	0 046228	0.0694444	4 31E-01	na	na	20	na	na
01-27tst2/1	1.43	75	30	0.019812	0.0208333	7.07E-01	na	na	20	na	na
01T02/1	3.25	70	102	0.0184912	0.0708333	5.06E-01	na	na	10	na	na
01T02/2	3 03	100	73	0.026416	0 0506944	4.62E-01	na	na	10	na	na
01T03/2	0.93	100	113	0 026416	0 0784722	9.15E-02	3.14E-02	9 49E+00	20	0.47	2.24E-05
01T05/2	2.38	86	240	0.02271776	0.1666667	1.28E-01	5.34E-02	2.63E+00	20	0.13	6.19E-06

na - not applicable, there is no Theis Correction Factor (u) for the uW(u) solution.
tst2 - Test 2, in some cases the well was purged twice during the same sample round

ATTACHMENT 4

ATTACHMENT 4

TETRA TECH NUS, INC. **CALCULATION WORKSHEET** PAGE 1 OF 2

CLIENT NAVY SOUTH DIVISION	JOB NUMBER
SUBJECT ESTIMATEING HYDRAULIC COND. USING PURGE DATA/ STRAIGHT-LINE METHOD	
BASED ON JACOB STRAIGHT-LINE METHOD	DRAWING NUMBER
BY FWRAMSER / CHECKED BY TR 8/7/02	APPROVED BY / DATE

A. 1) EQ: $T = \frac{2.3Q}{4\pi(h_o - h)}$ (1) FROM FETTER 1988

WHERE Q = PUMPING RATE (ft^3/min)

$(h_o - h)$ = DRAWDOWN OVER ONE LOG SCALE (feet)

T = TRANSMISSIVITY (ft^2/min)

2) $K = T/b$

b = AQUIFER THICKNESS (ESTIMATED FROM CROSS-SECTIONS)

B. WELL 01-01 (WES-1-1-81)

$h_o - h = 0.92 - 0.17 = \underline{0.75\ ft}$ FROM PLOT

$Q = 200\ ml/min$ CONV: TO ft^3/min

$$Q = 200\frac{ml}{min} \times \frac{1\ l}{1000\ ml} \times \frac{1\ gal}{3.785412\ l} \times \frac{ft^3}{7.48\ gal} = \underline{7.06342346 \times 10^{-3}\ ft^3/min}$$

1) SUB $T = \frac{2.3(.00706)}{4\pi(0.75)}$

$T = 1.72 \times 10^{-3}\ ft^2/min$

2) $K = T/b$

SUB $K = \frac{1.72 \times 10^{-3}\ ft^2/min}{30\ ft}$

$K = 5.74 \times 10^{-5}\ ft/min$

ATTACHMENT 4

TETRA TECH NUS, INC. **CALCULATION WORKSHEET**

CLIENT: NAVY SOUTH DIV	JOB NUMBER:
SUBJECT: ESTIMATING HYDRAULIC CONDUCTIVITY	
BASED ON: JACOB STRAIGHT-LINE	DRAWING NUMBER:
BY: FRED W. RAMSER / CHECKED BY: TR 8/7/02	APPROVED BY: / DATE:

3) CONV.

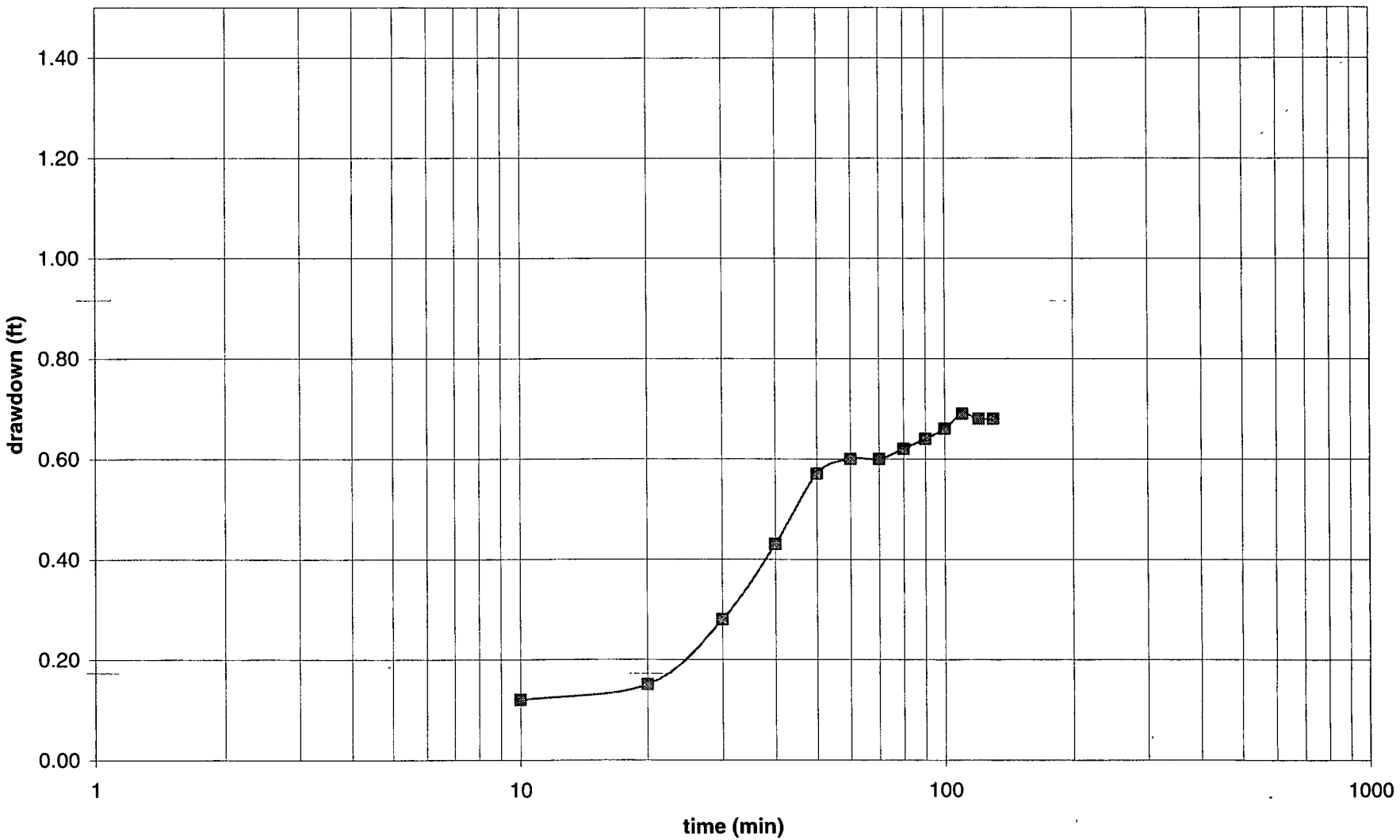
$$K = 5.74 \times 10^{-5} \frac{\cancel{ft}}{\cancel{min}} \times \frac{12\cancel{in}}{1\cancel{ft}} \times \frac{2.54cm}{1\cancel{in}} \times \frac{1\cancel{min}}{60sec}$$

$$K = 2.92 \times 10^{-5} \ cm/sec$$

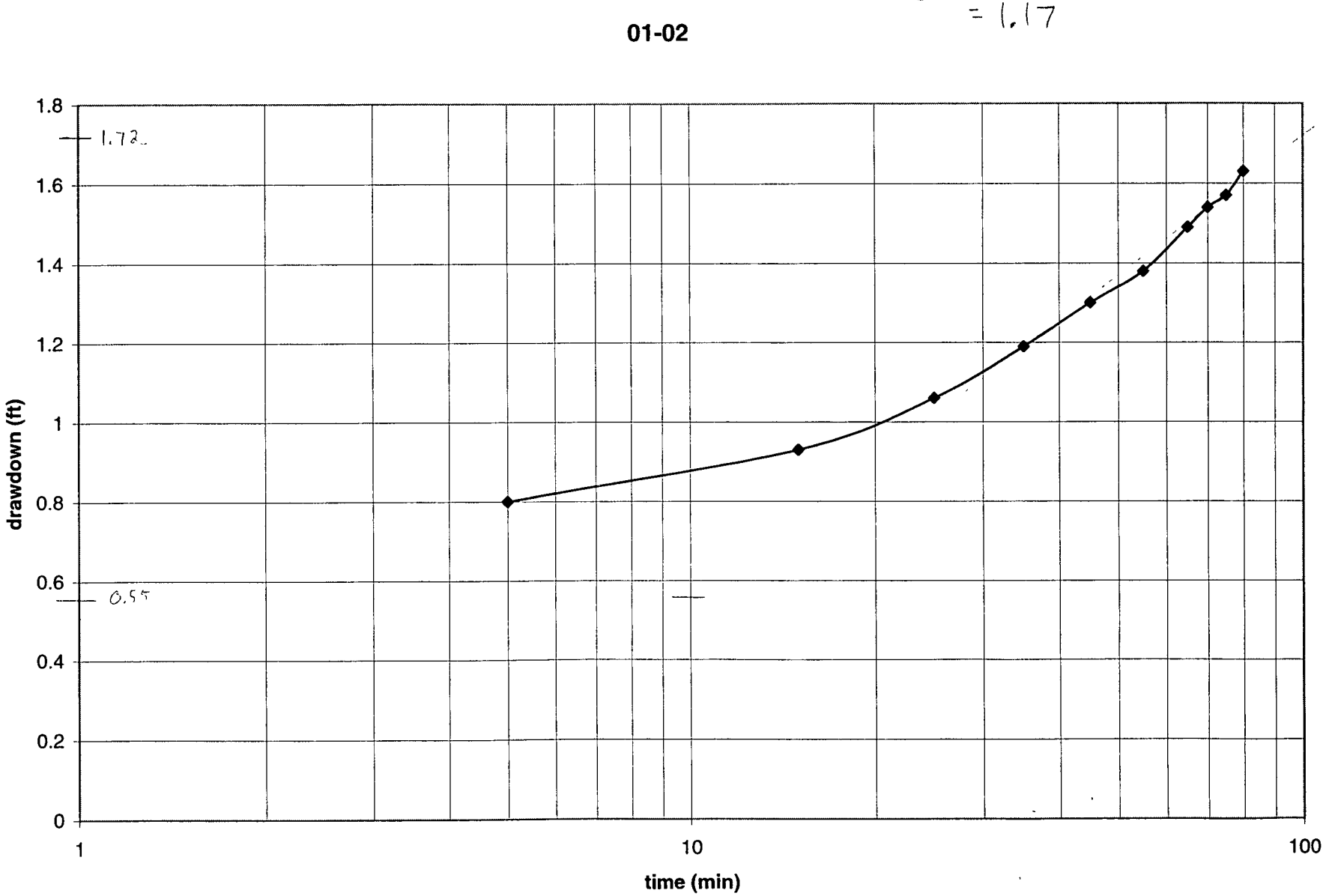
4) PURGE DATA FROM THE REMAINING WELLS WERE EVALUATED AND THE COMPUTATION WAS DONE ON AN EXCEL SPREAD SHEET ATTACHED.

Q = 3000 ml/min
dh = 0.92 - 0.17 = 0.75

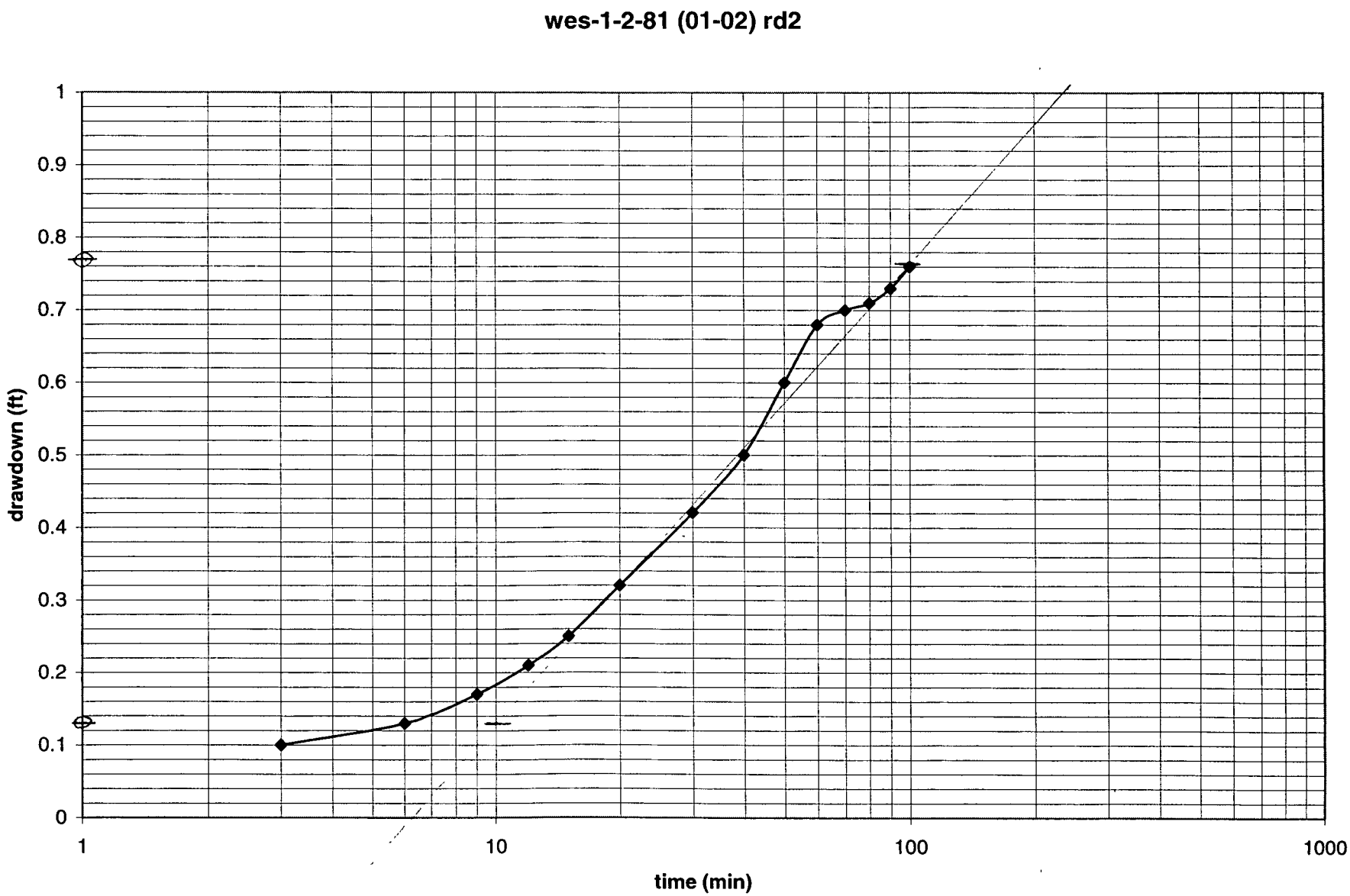
01-01



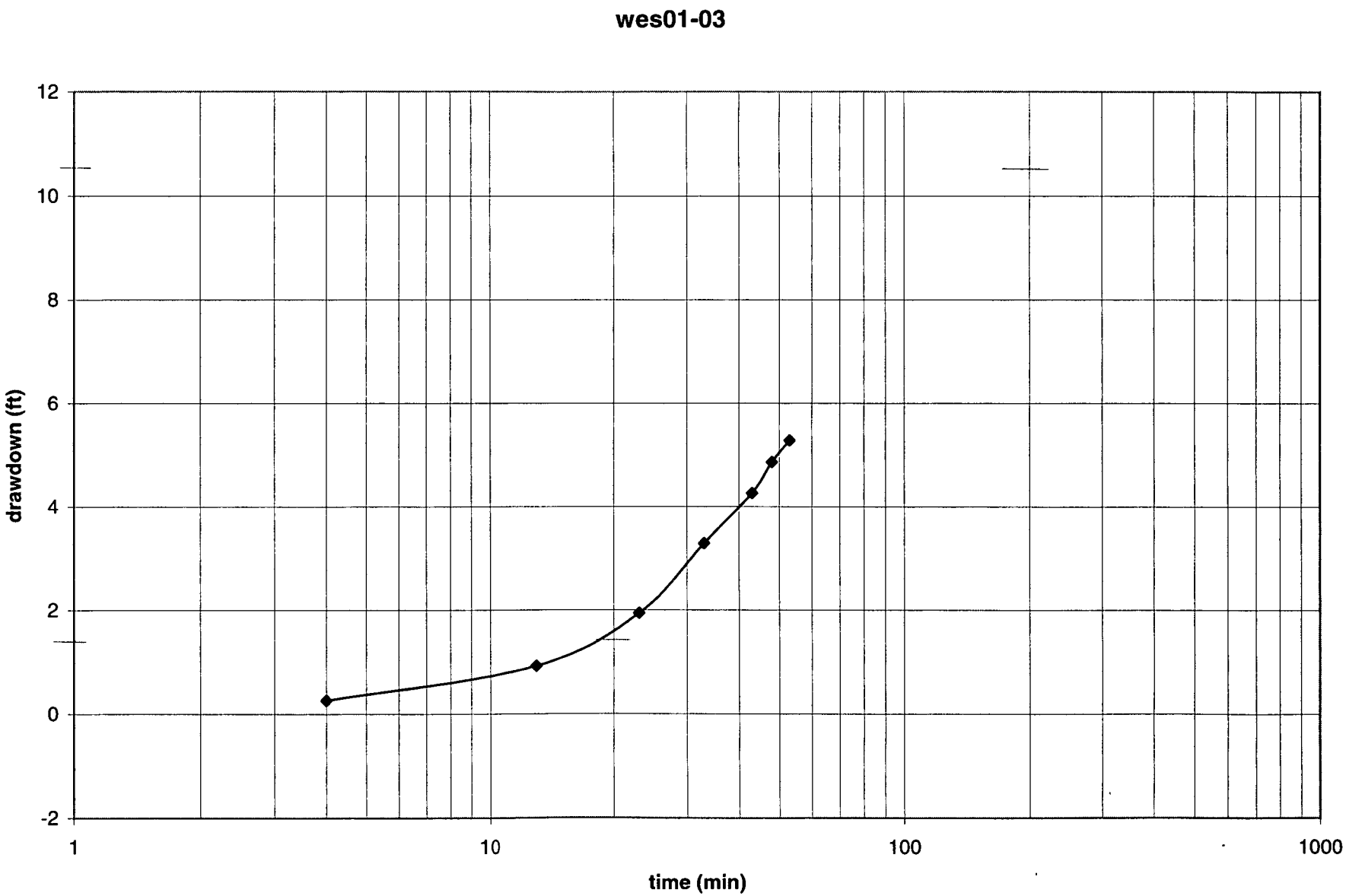
Q = 80 ml/min
dh = 1.72 - 0.55
= 1.17



Q = 97 ml/min
Δh = 0.77 - 0.13 = 0.64

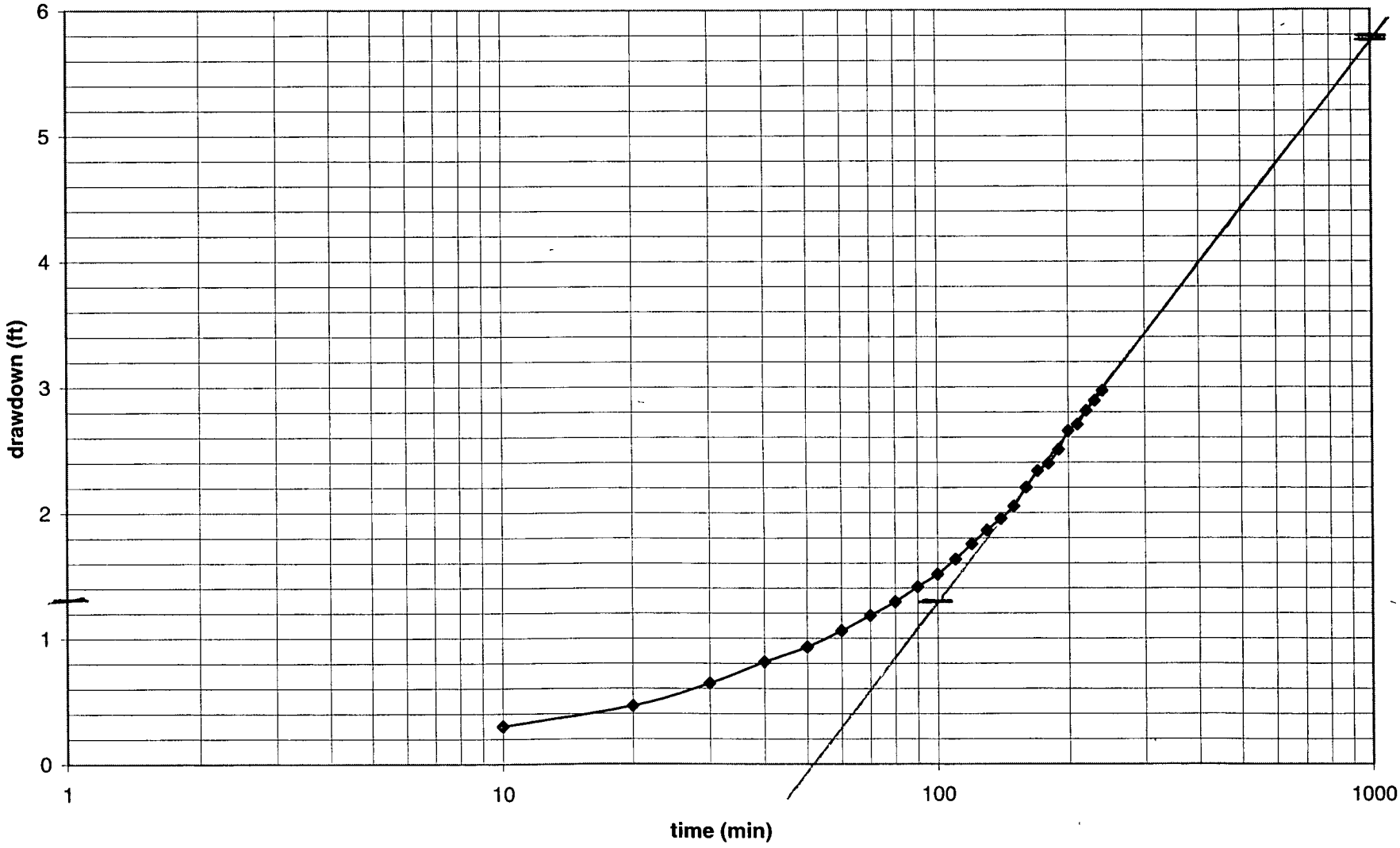


Q = 80 mL/min
dh = 10.5 - 1.3 = 9.2

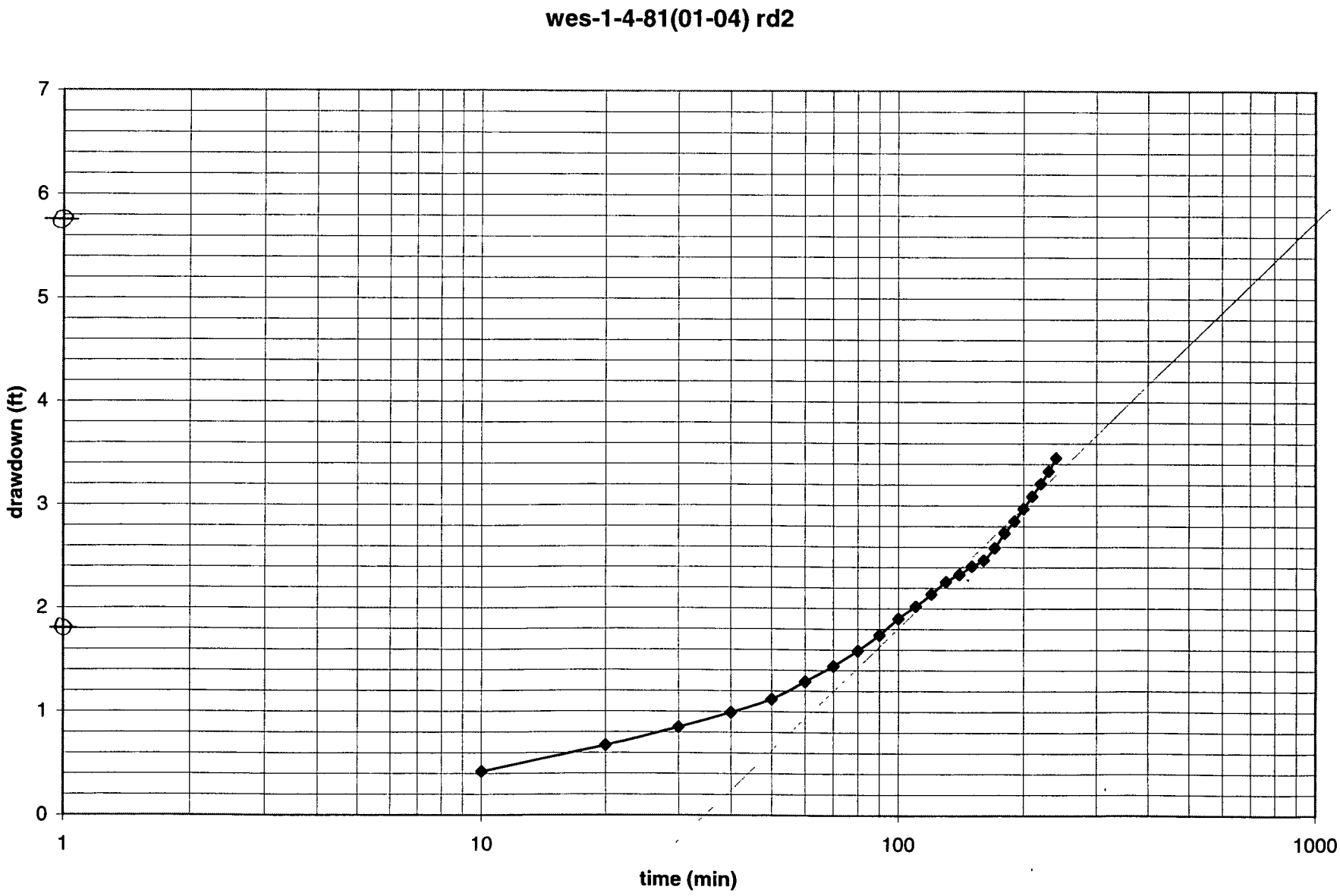


dh = 5.80 − 1.3 = 4.5
Q = 78

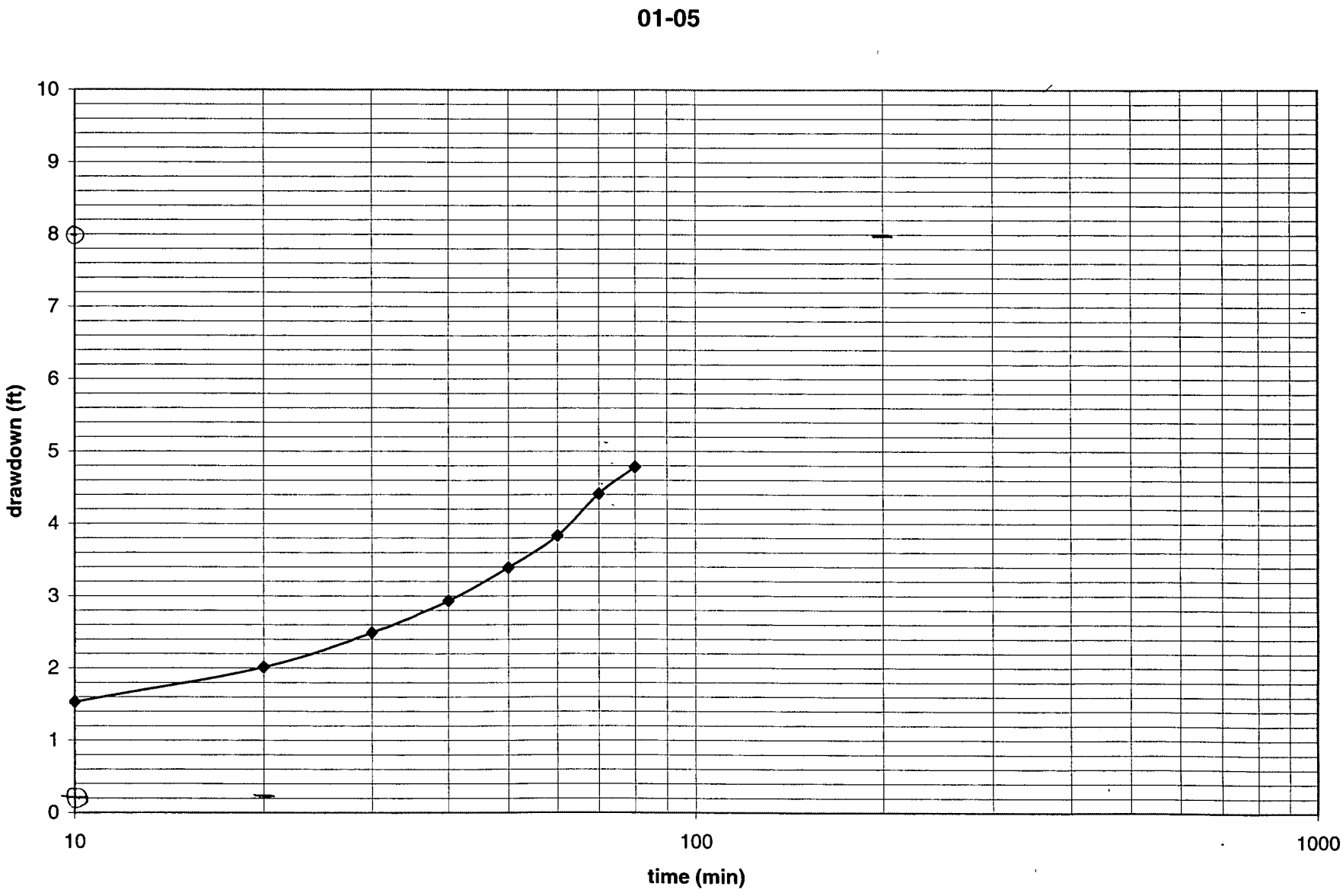
01-04



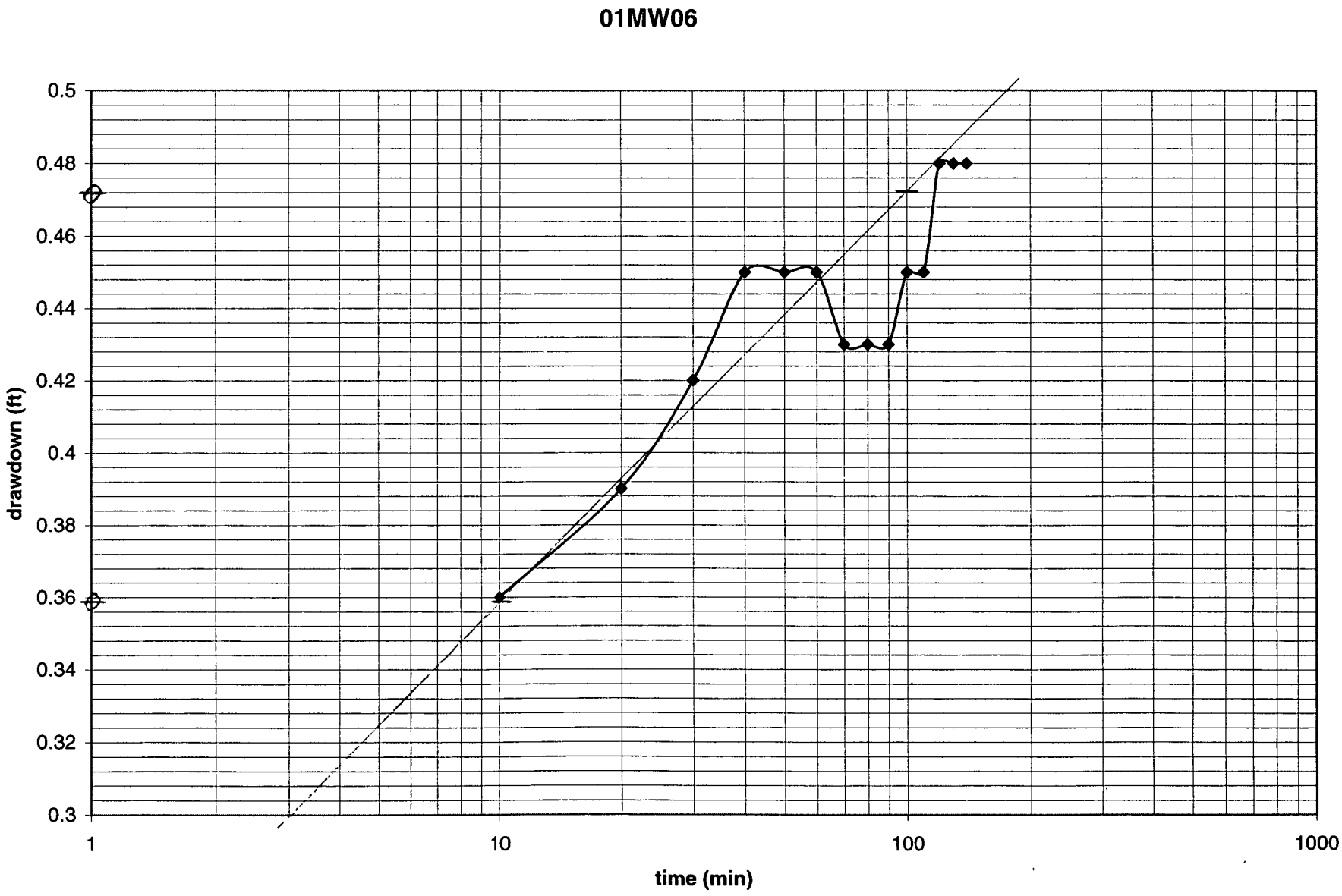
Q = 98 ml/min
Δh = 5.75 - 1.8 = 3.95



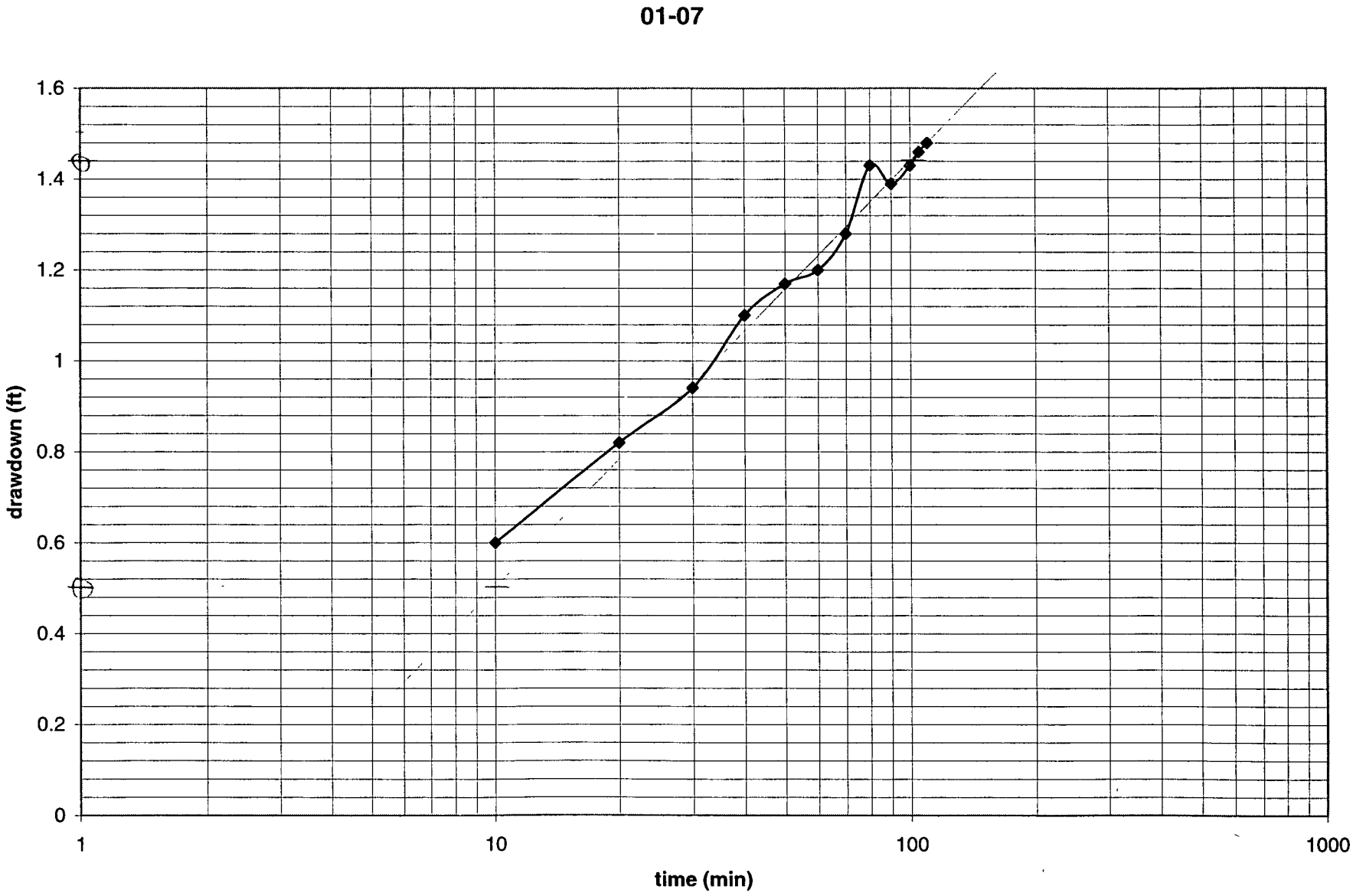
dh = 8.0 - 0.2 = 8
Q = 75 ml/min



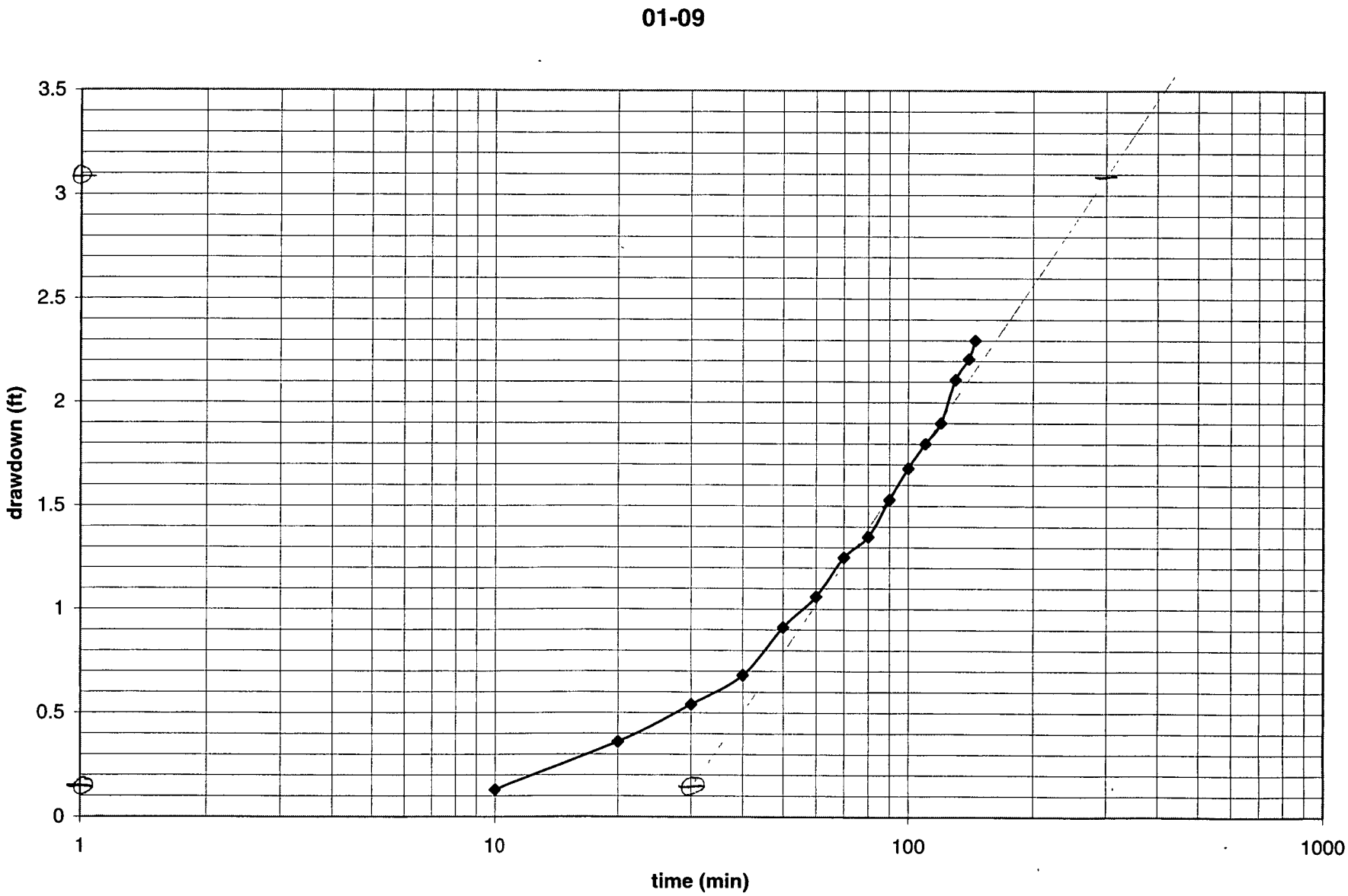
Q = 100 ml/min
Δh = 0.472 - 0.359
Δh = 0.113



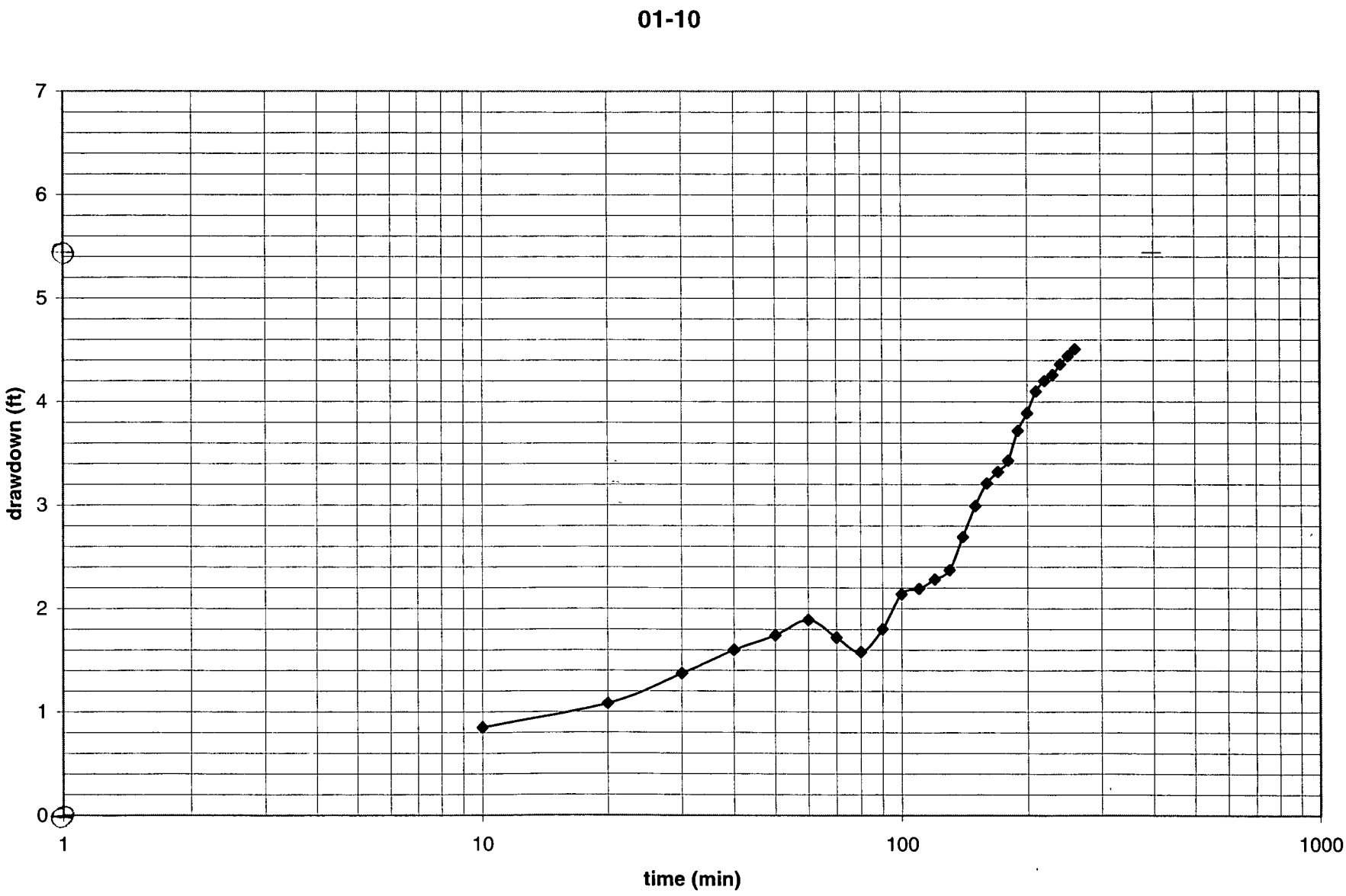
dh = 1.44 - 0.5[illegible] 0.94
Q = 57 ml/min



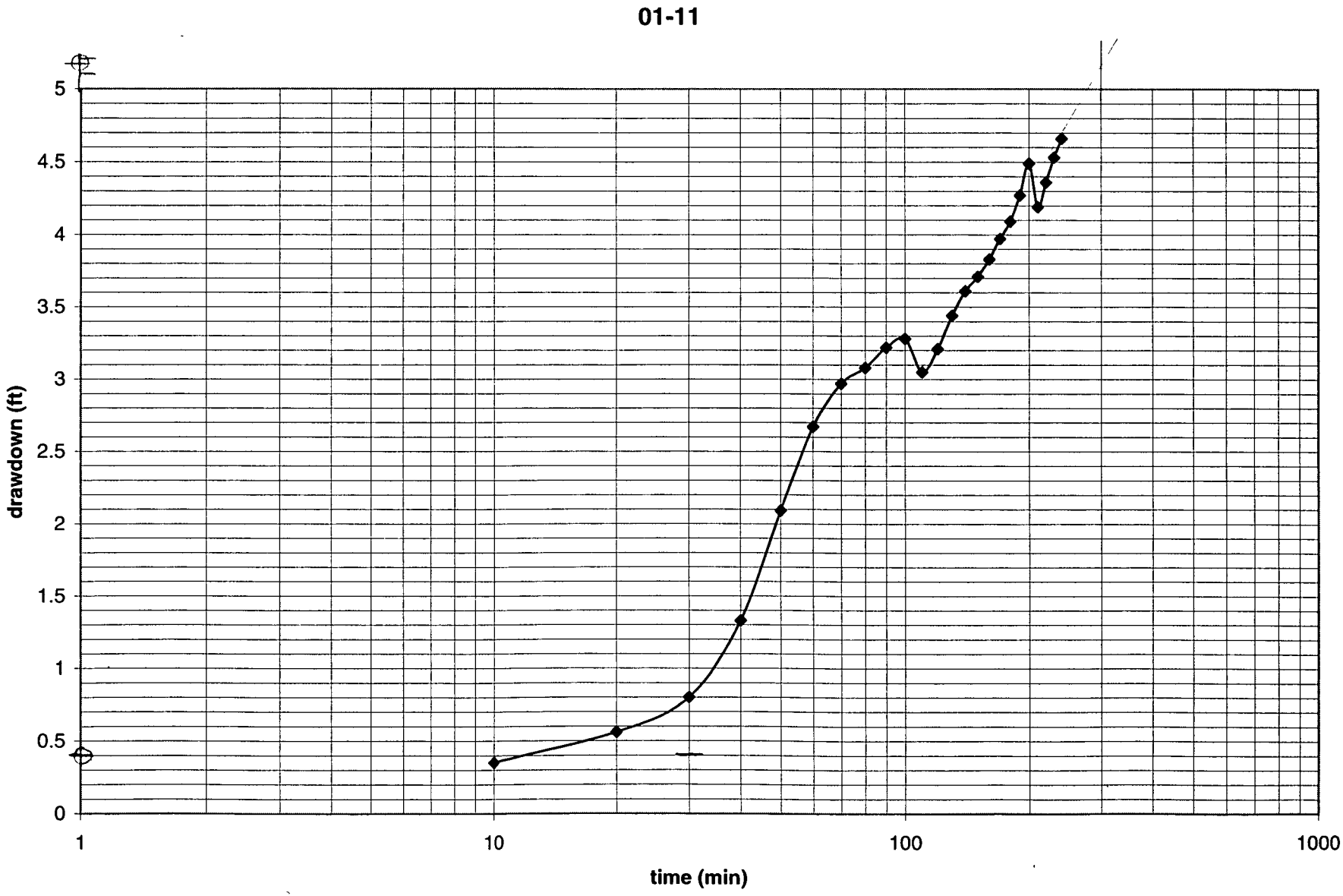
dh = 3.1 - 0.15
dh = 2.95
Q = 100



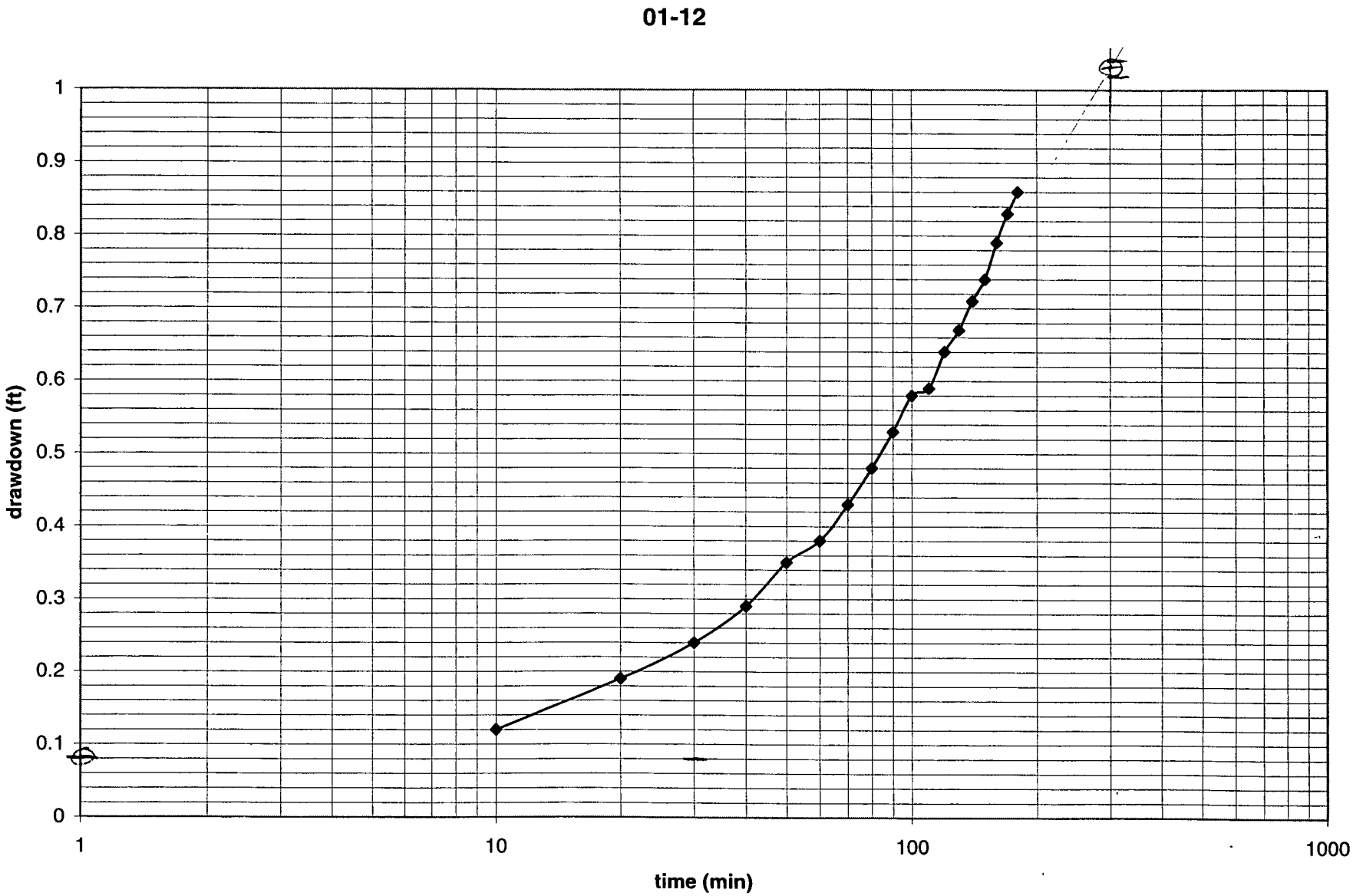
Q = 71
dh = 5.45



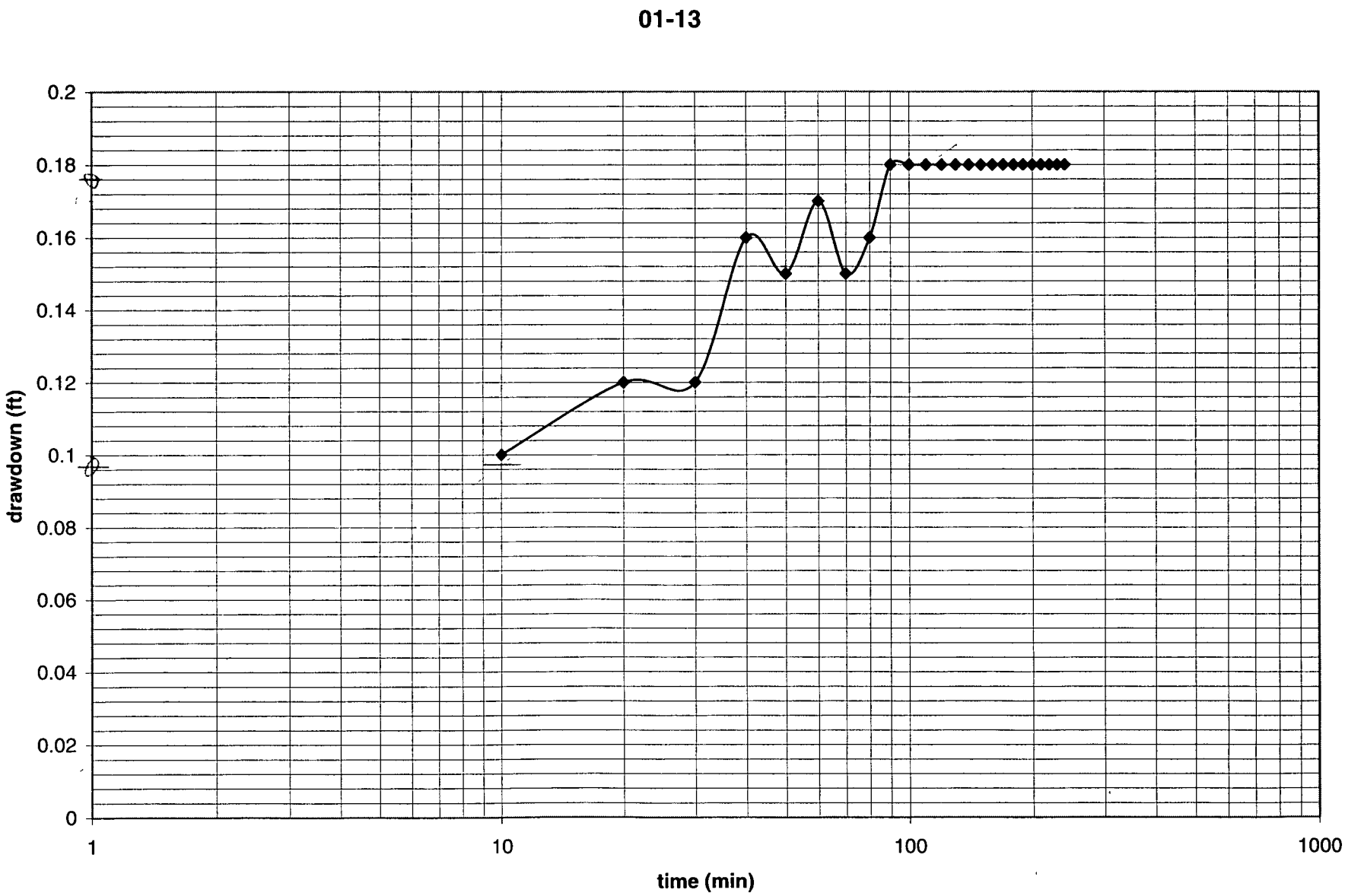
dh = 5.16 - 0.4 = 4.76
Q = 100



dh = 1.03 − 0.08 = 0.95
Q = 50 ml/min

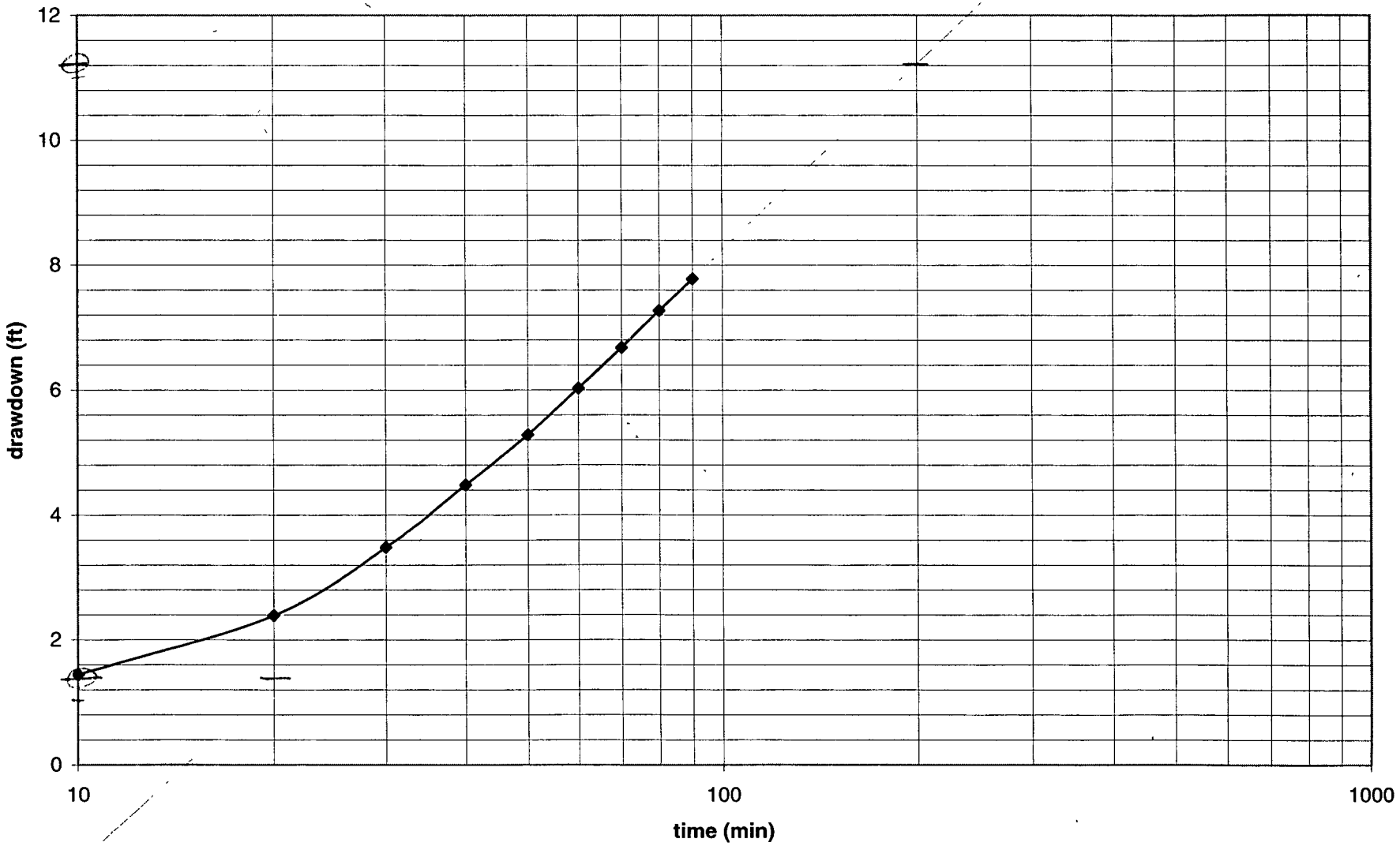


dh = 0.176 - 0.096
= 0.08
Q = 100

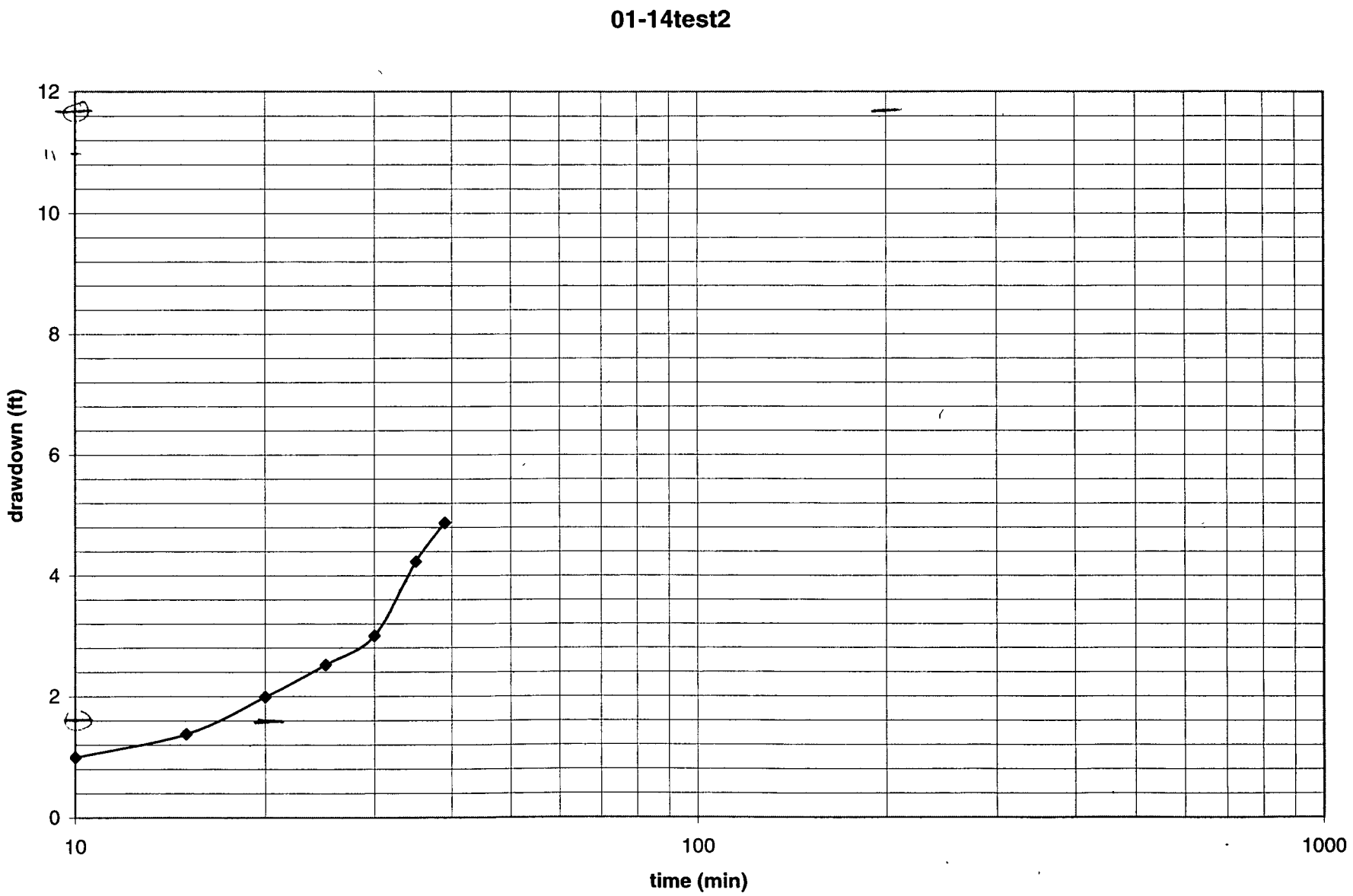


dh = 11.2 - 1.4 = 9.8 ft
Q = 100

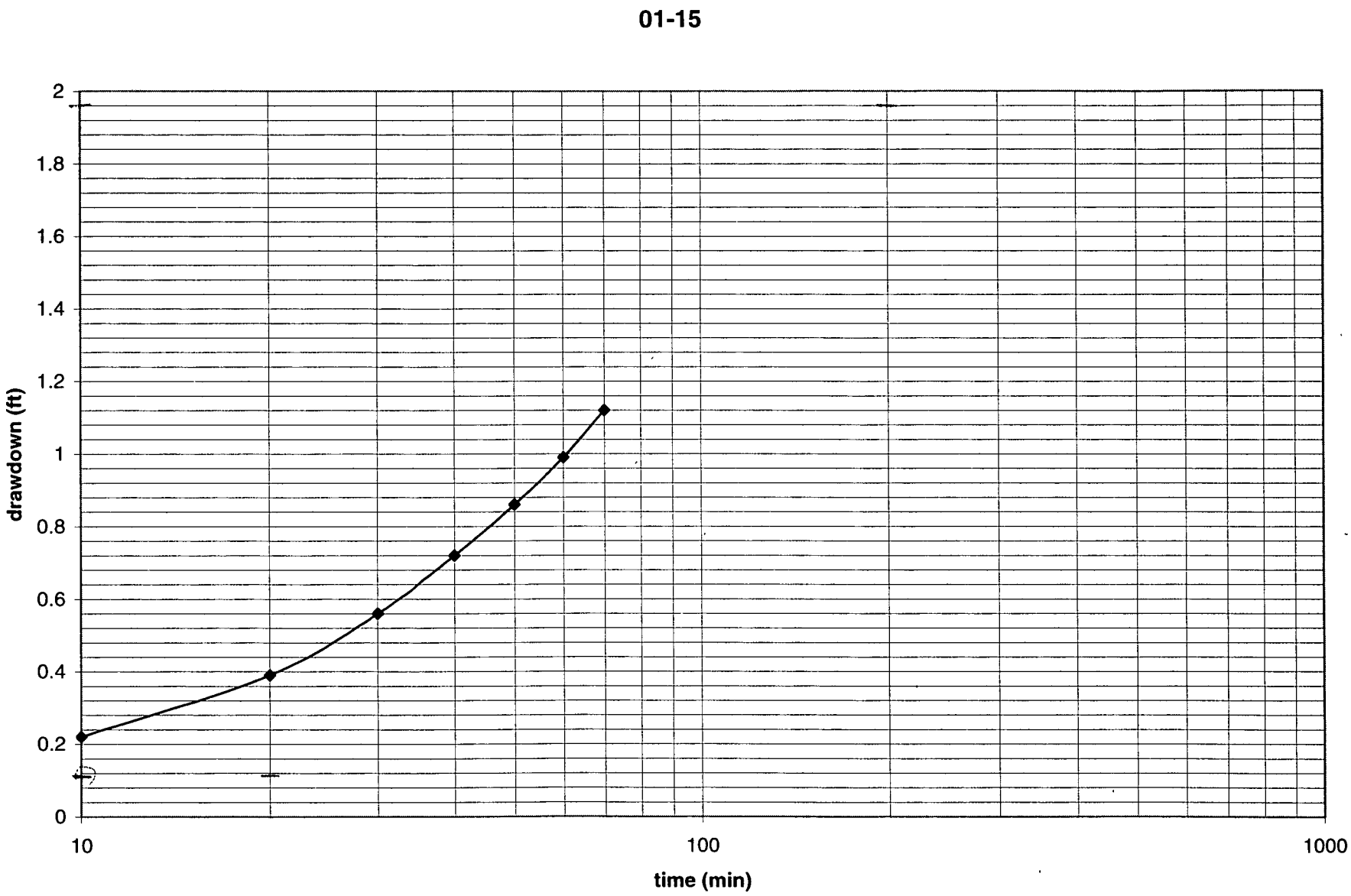
01-14



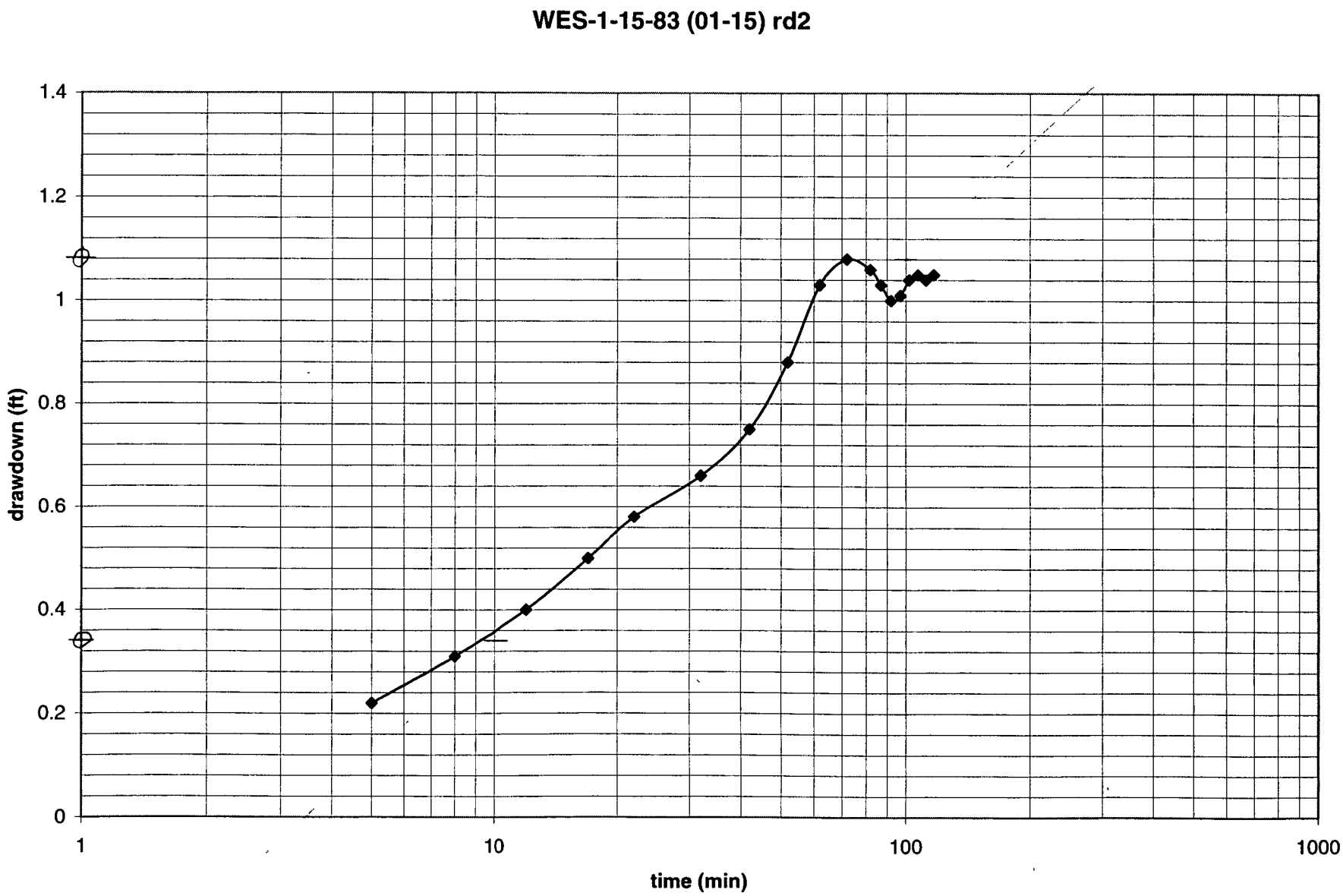
dh = 11.7 − 1.6 = 10.1
Q = 95



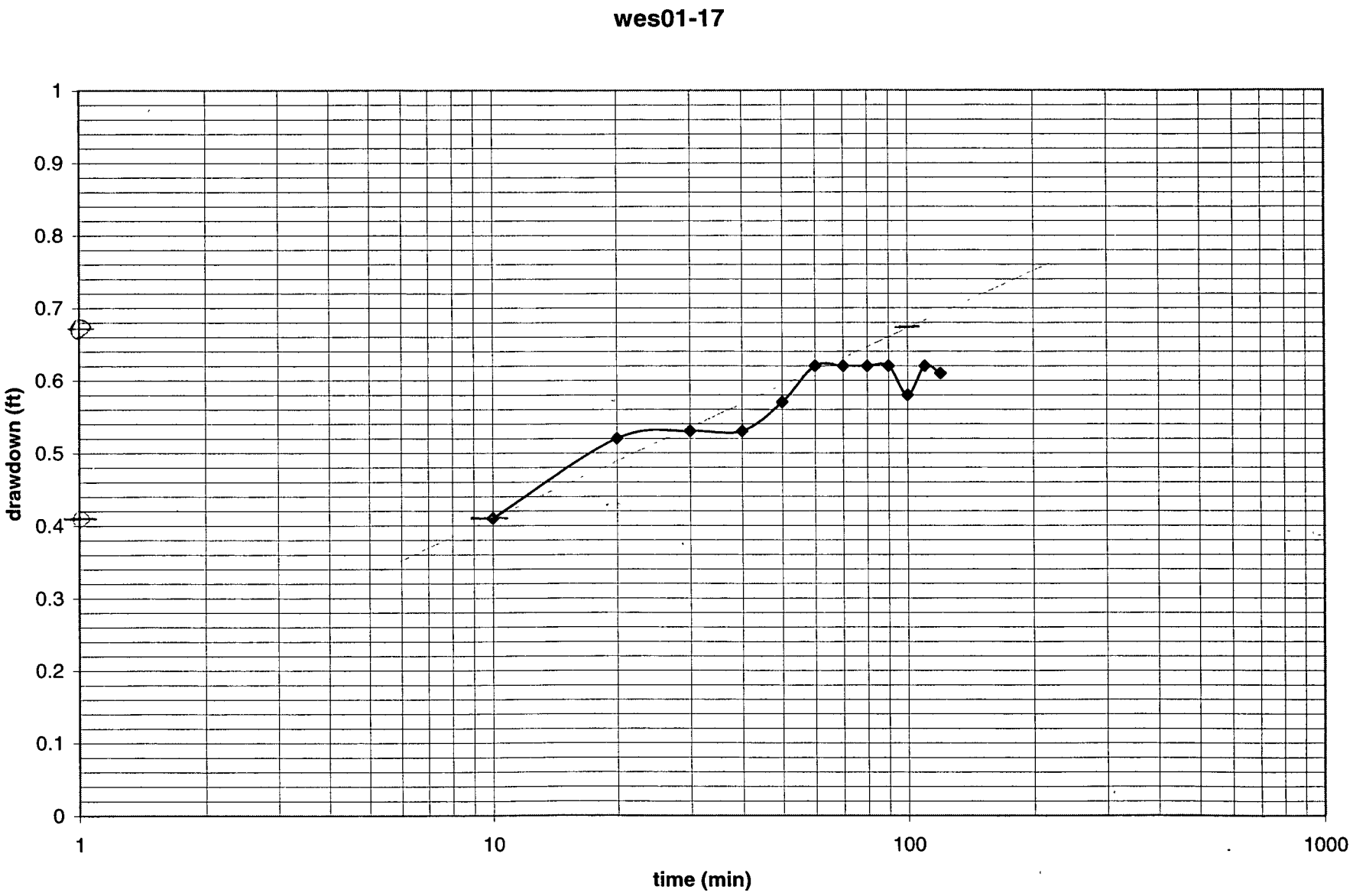
dh - 1.96 - 0.11
- 1.85 ft
Q = 100 ml/min



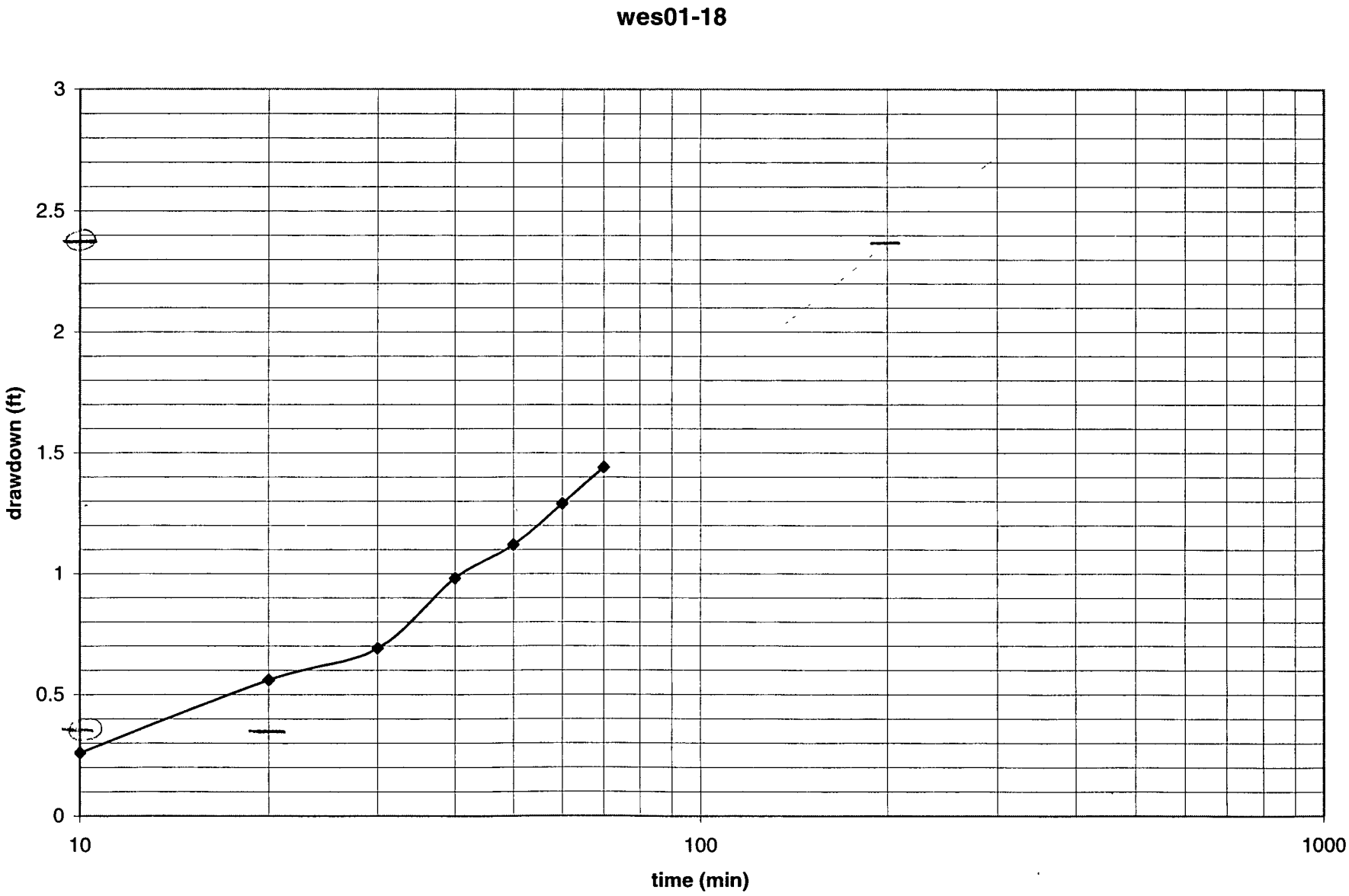
Q = 88 ml/min
Δh = 1.08 − 0.34 = 0.74



dh = 0.67 - 0.41
= 0.26
Q = 101

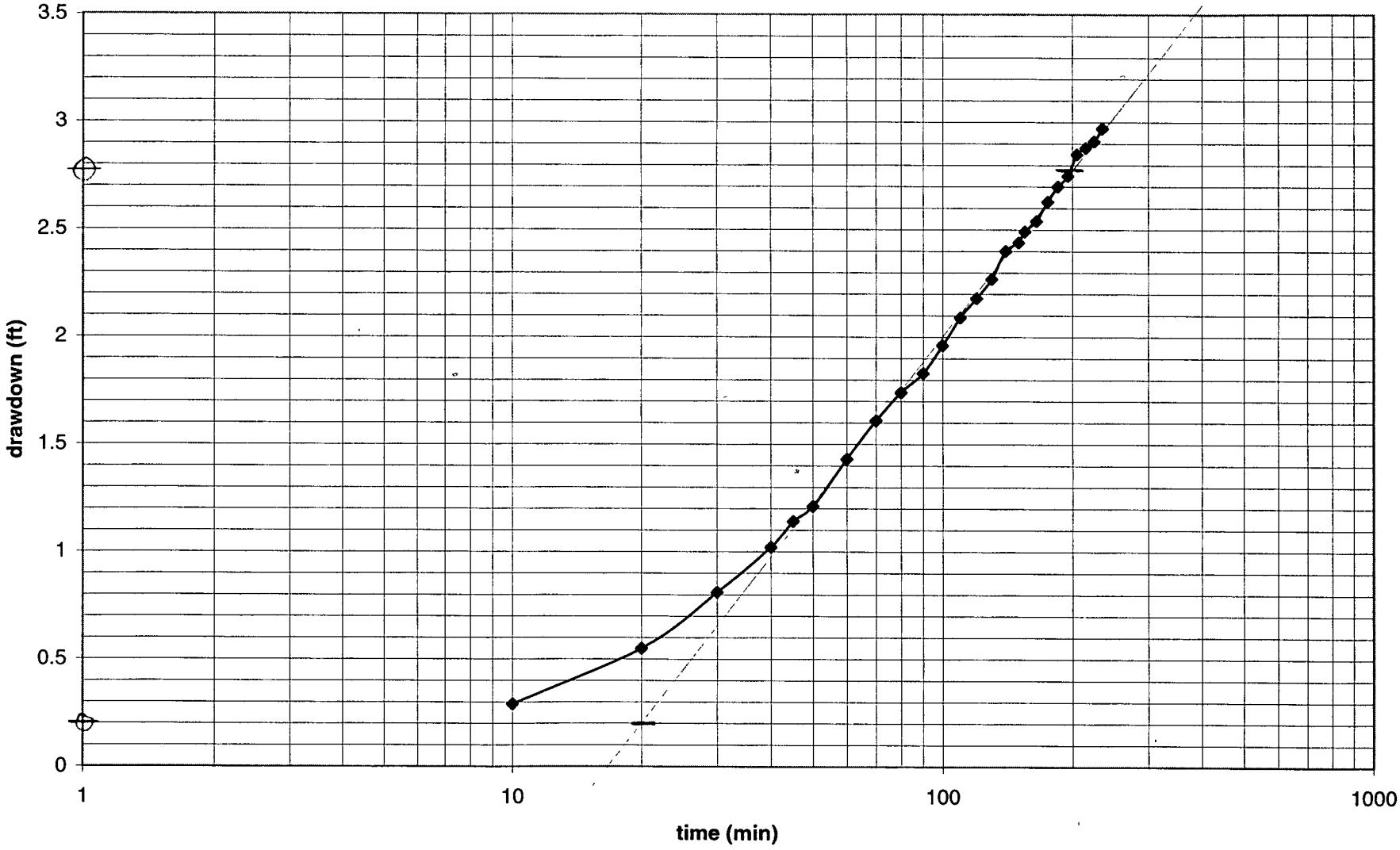


dh = 2.37 - 0.35
= 2.02
Q = 81 m-l/min



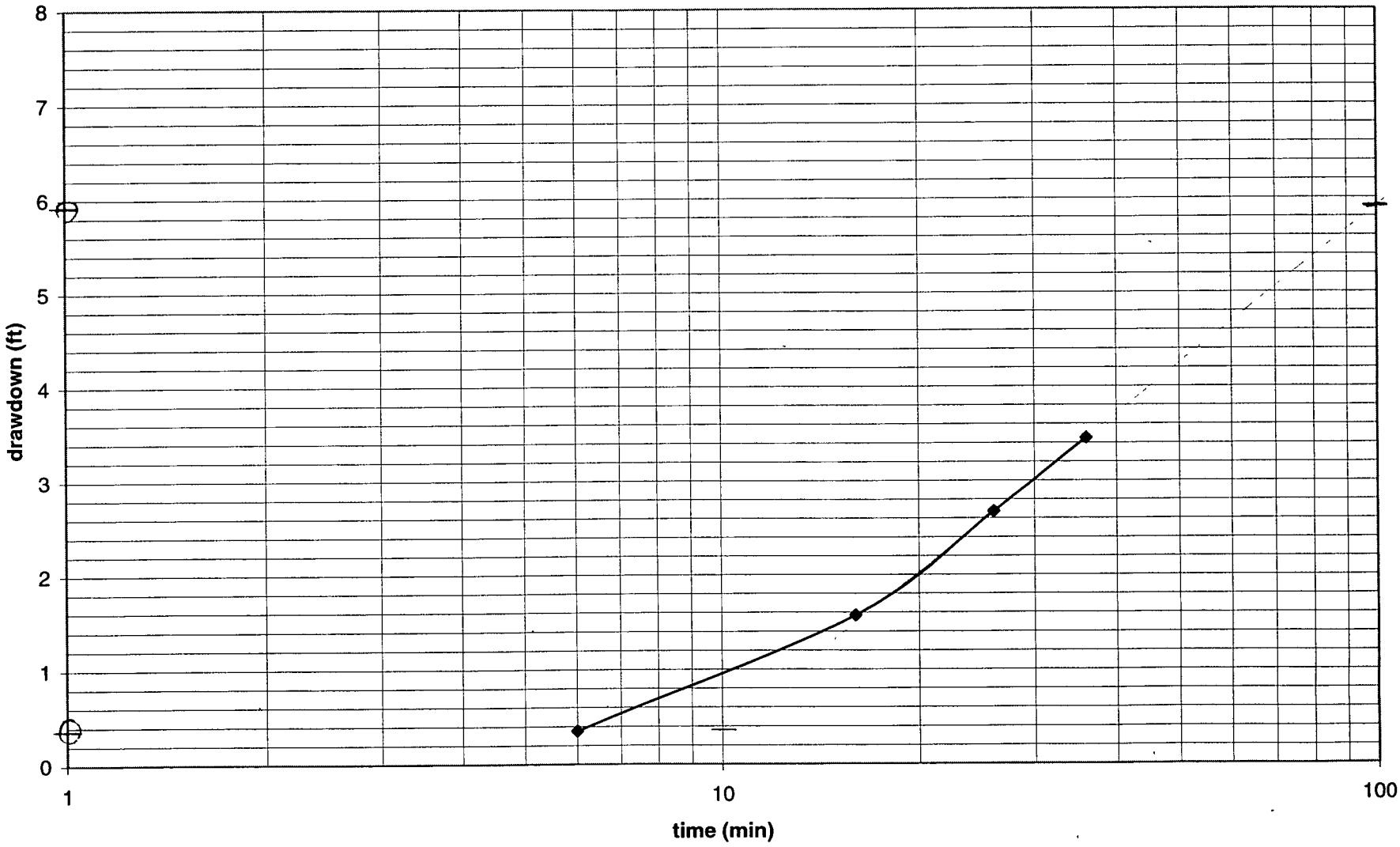
dh = 2.77 - 0.2
= 2.57 ft
Q = 74

01-19

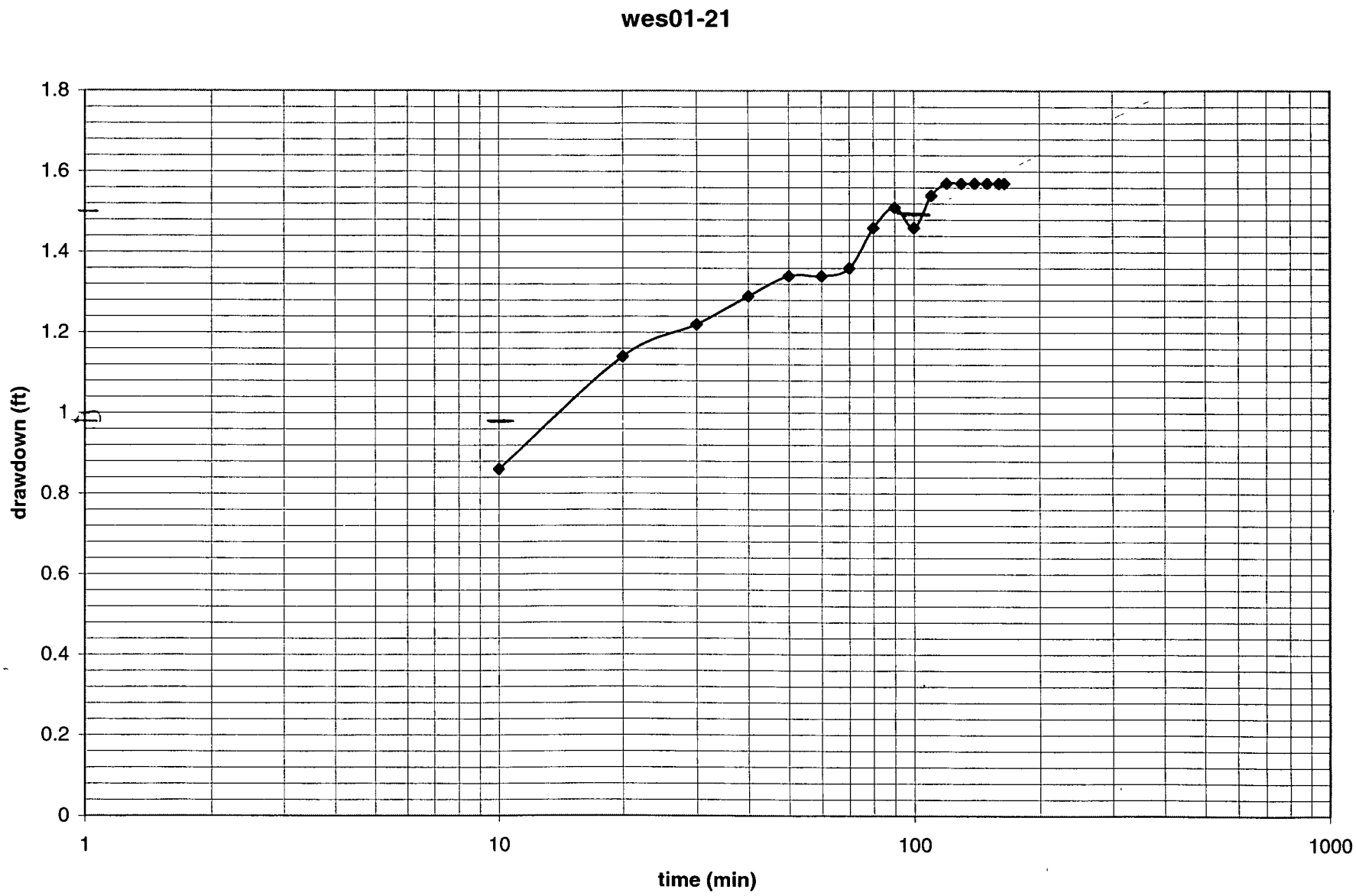


dh = 5.91 - 0.35
= 5.56
Q = 80

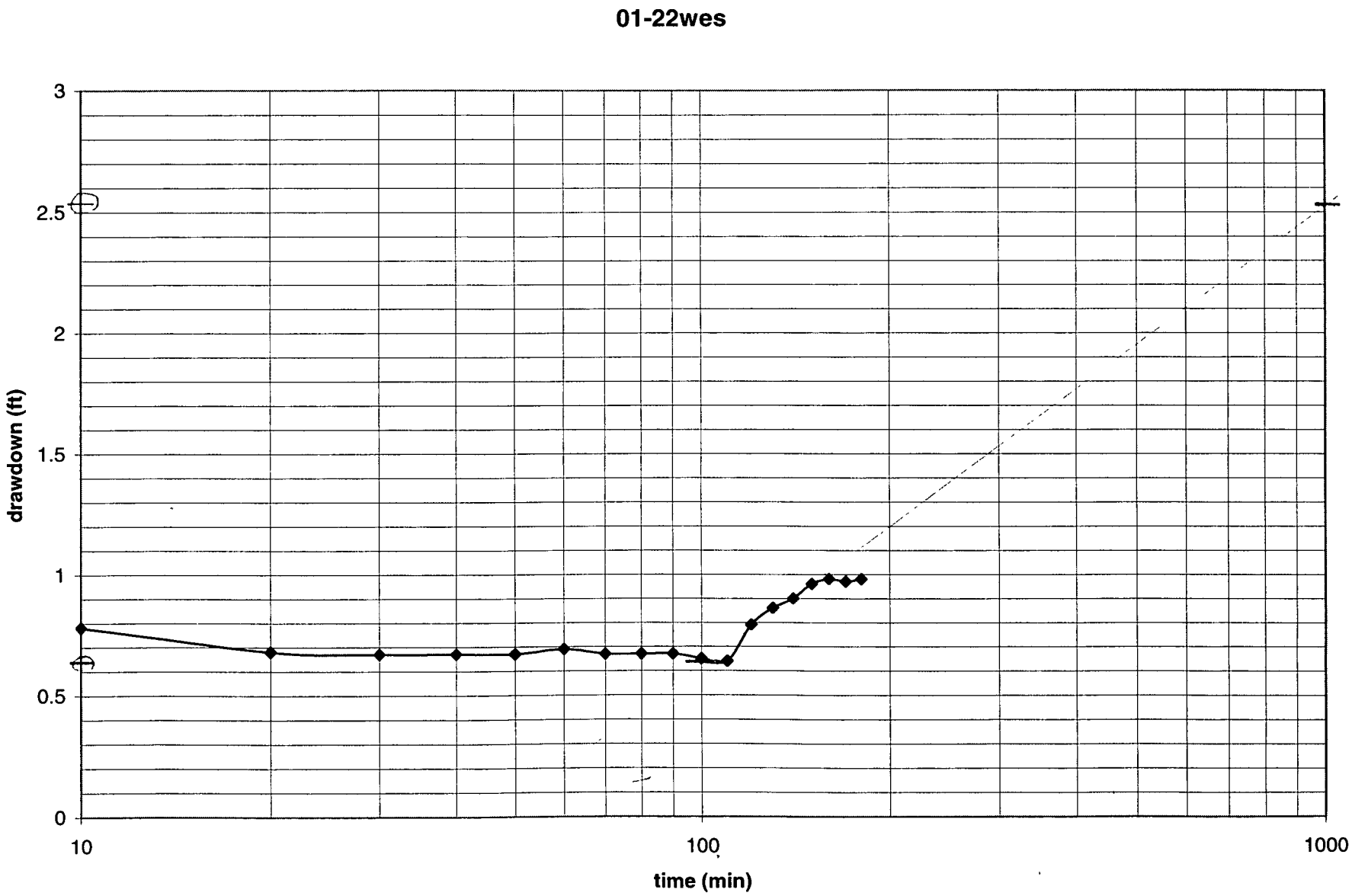
01-20



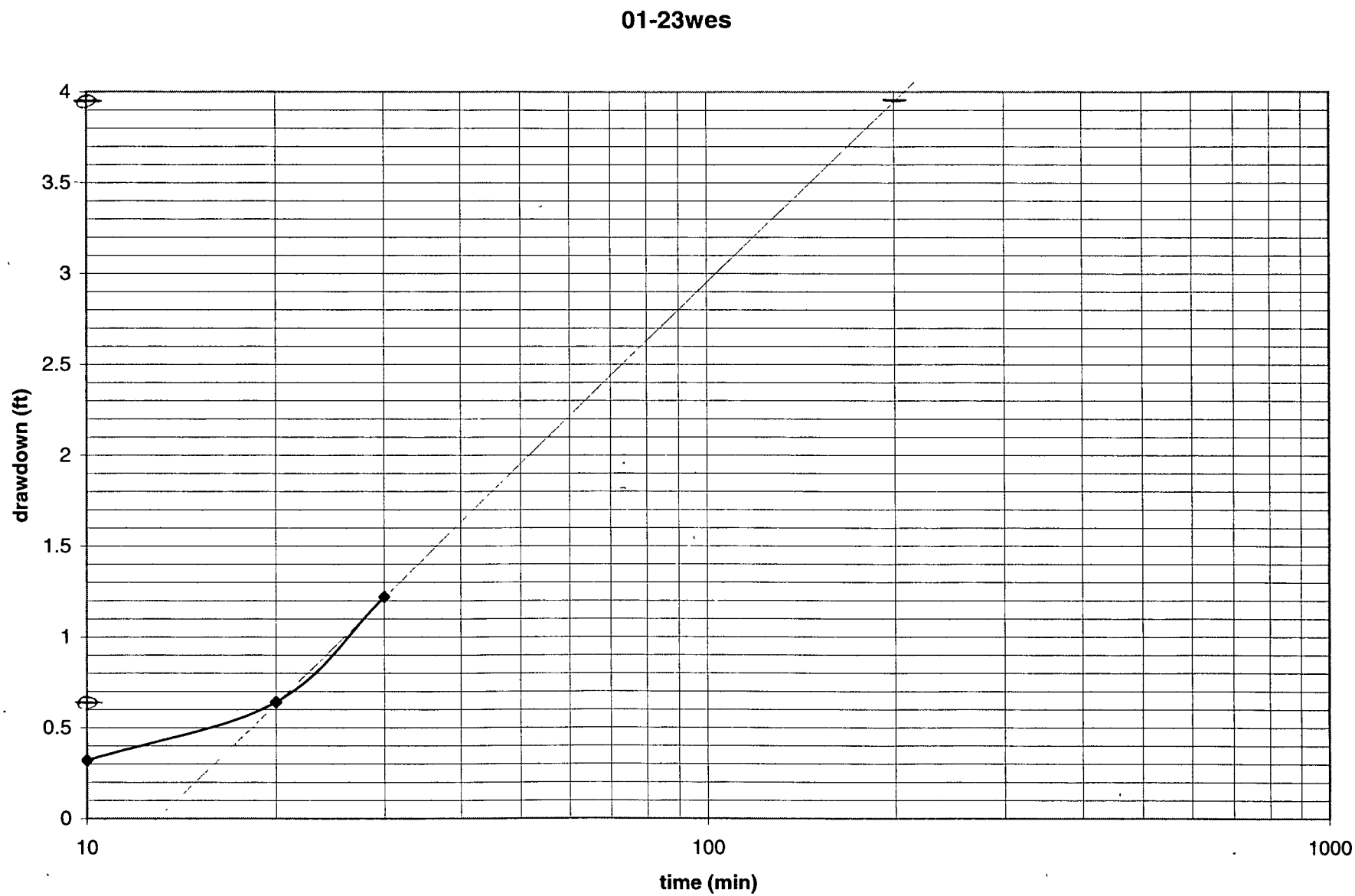
Q = 100
dh = 1.5 - 0.98
= 0.52



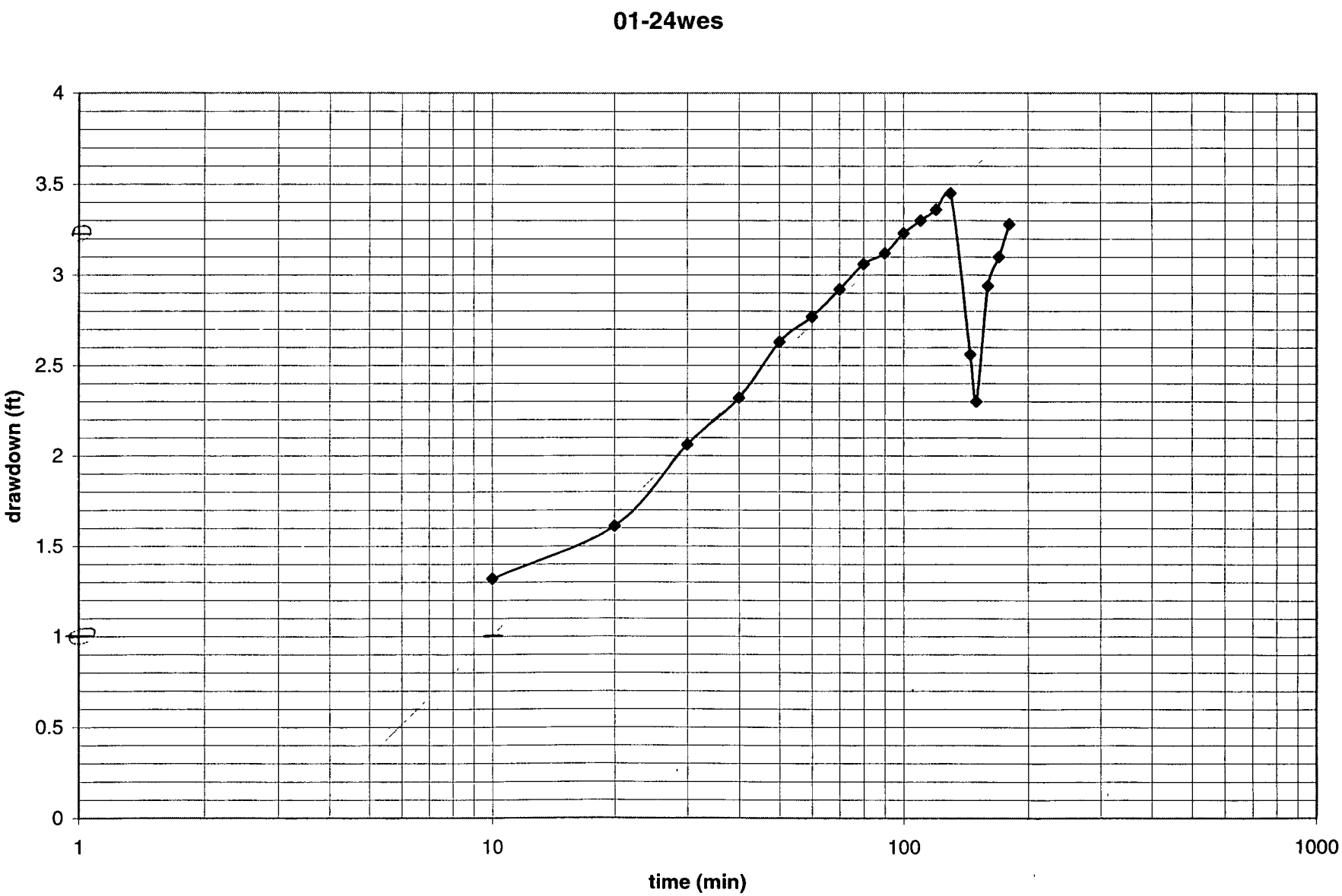
dh = 2.53 - 0.63
= 1.9
Q = 90



dh = 3.95 [illegible].63
= 3.32
Q = 100

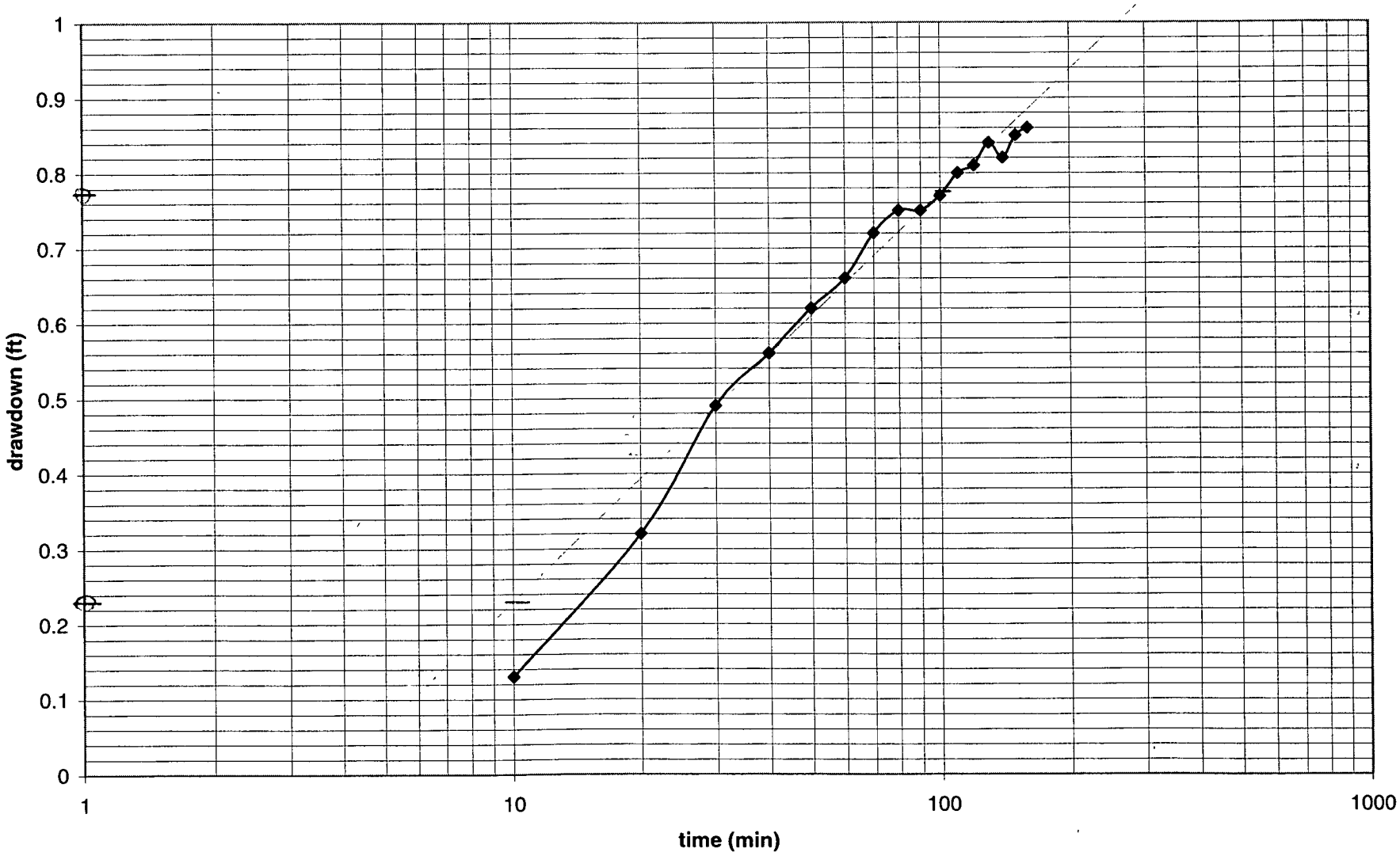


dh = 3.22 - 1.0
= 2.22
Q = 70 ml/min

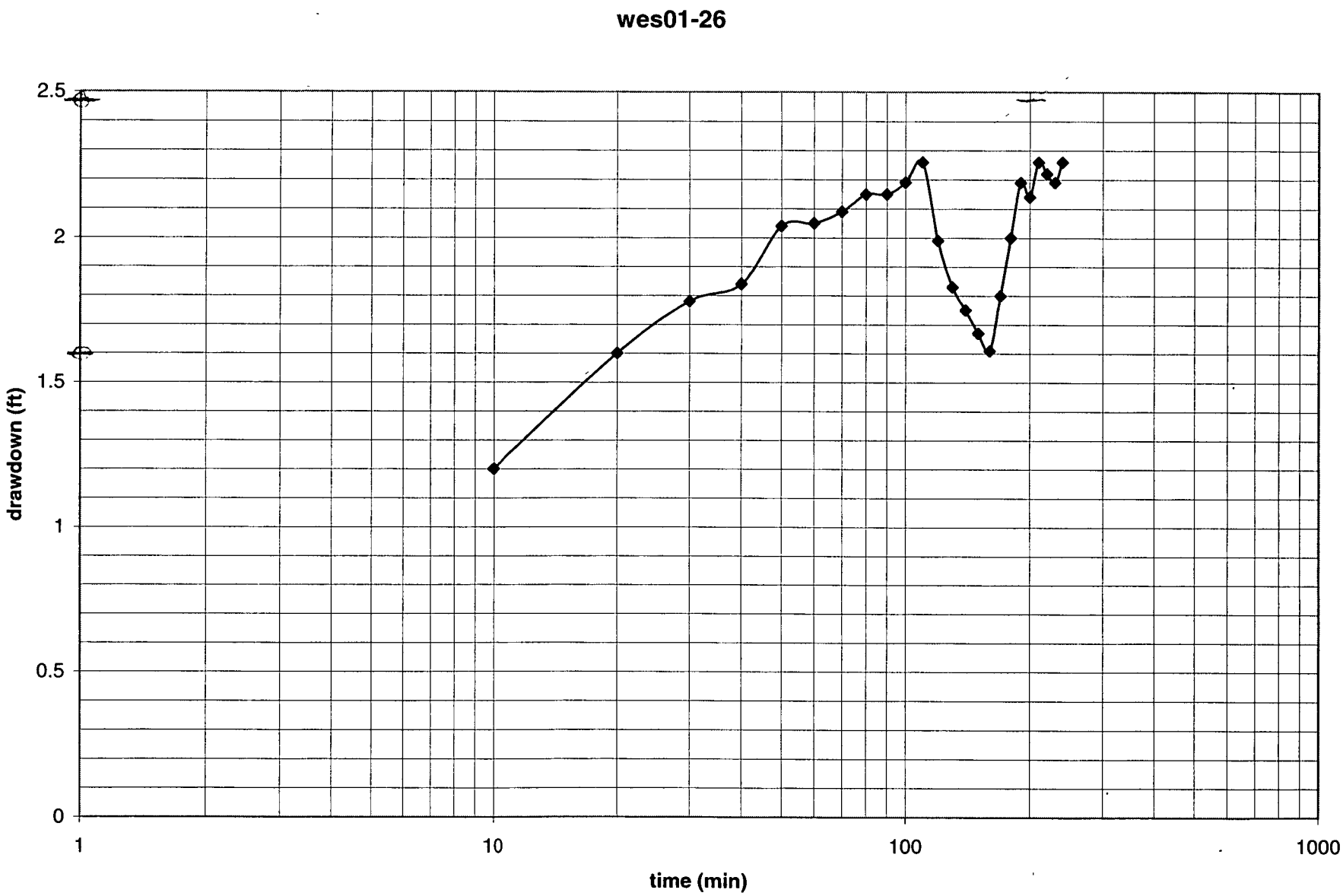


dh = 0.77 − 0.23
= 0.54

Q = 68



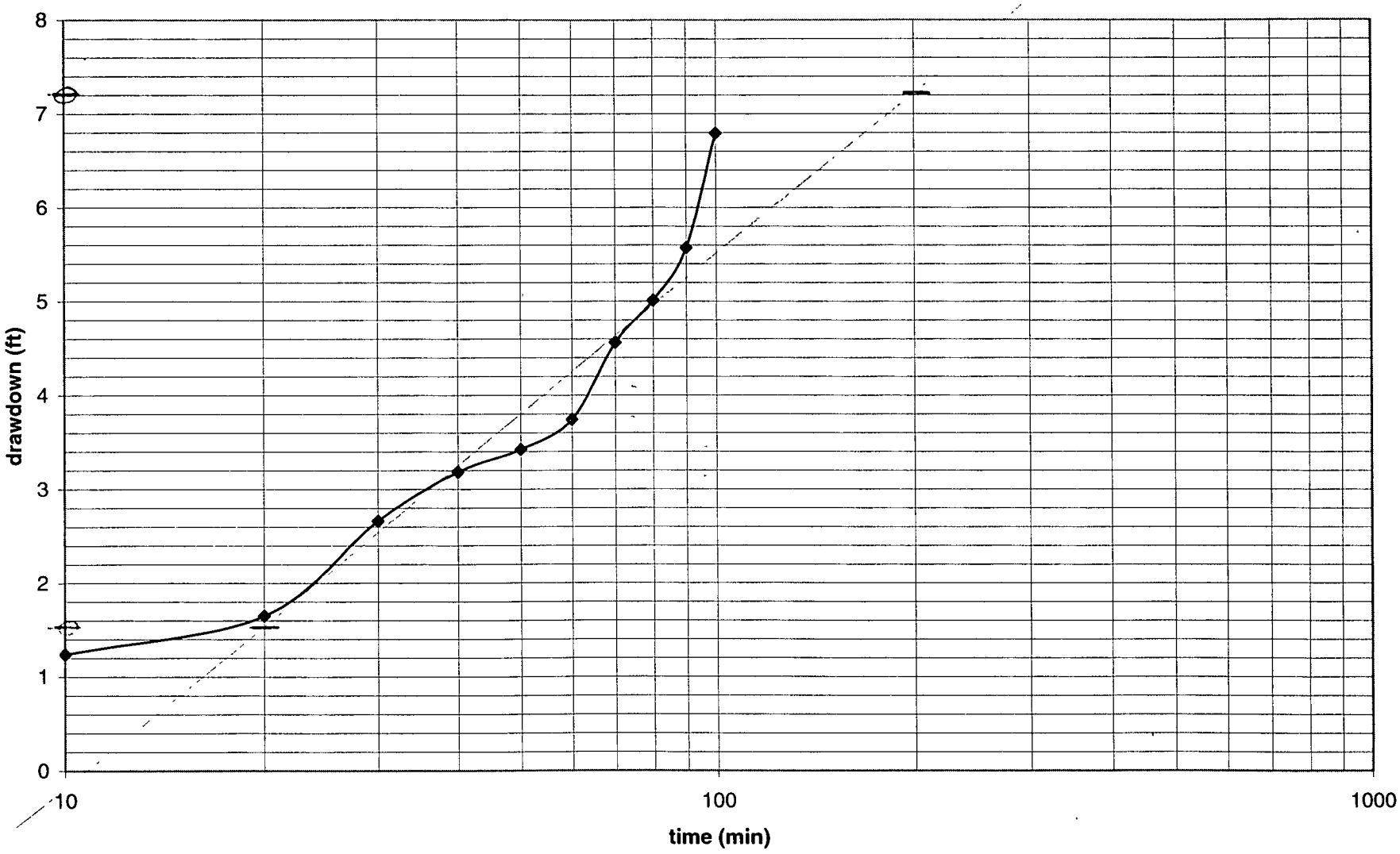
dh = 2.47 − 1.6
= .87 ft
Q = 100 ml/min



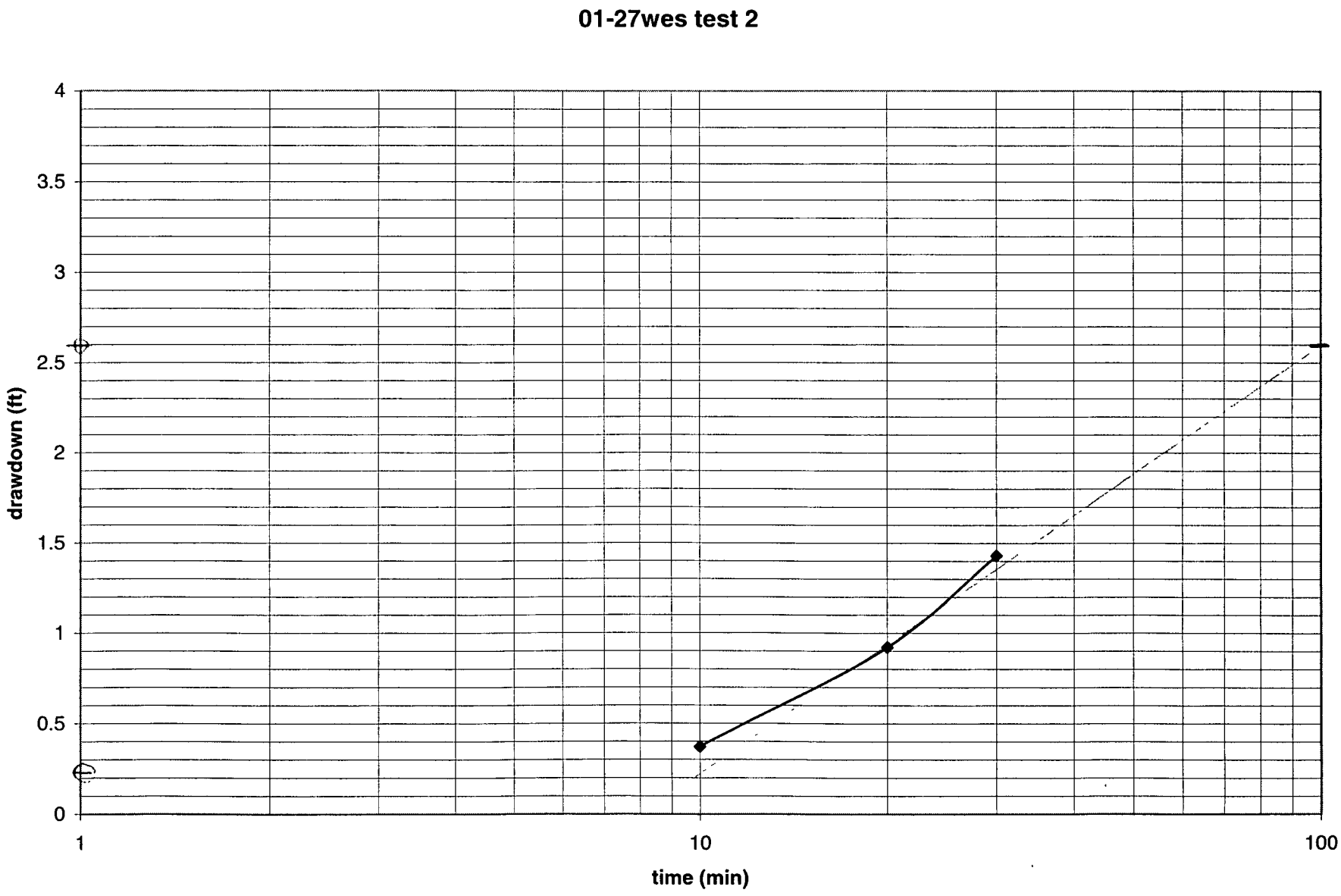
Q = 175

dh = 7.2 − 1.5

= 5.7 ft

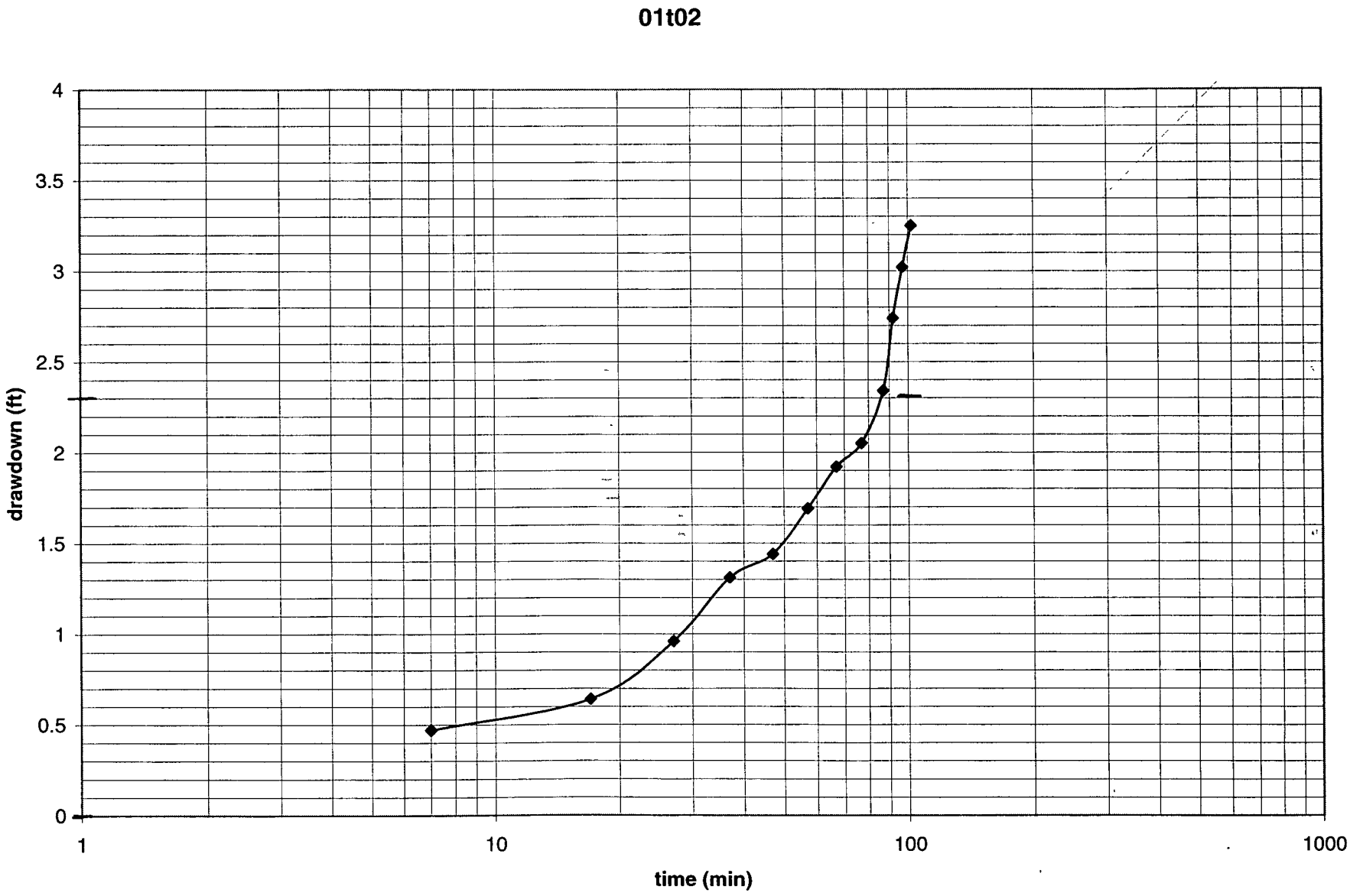


dh = 2.6 - 0.22
= 2.38 ft
Q - 75

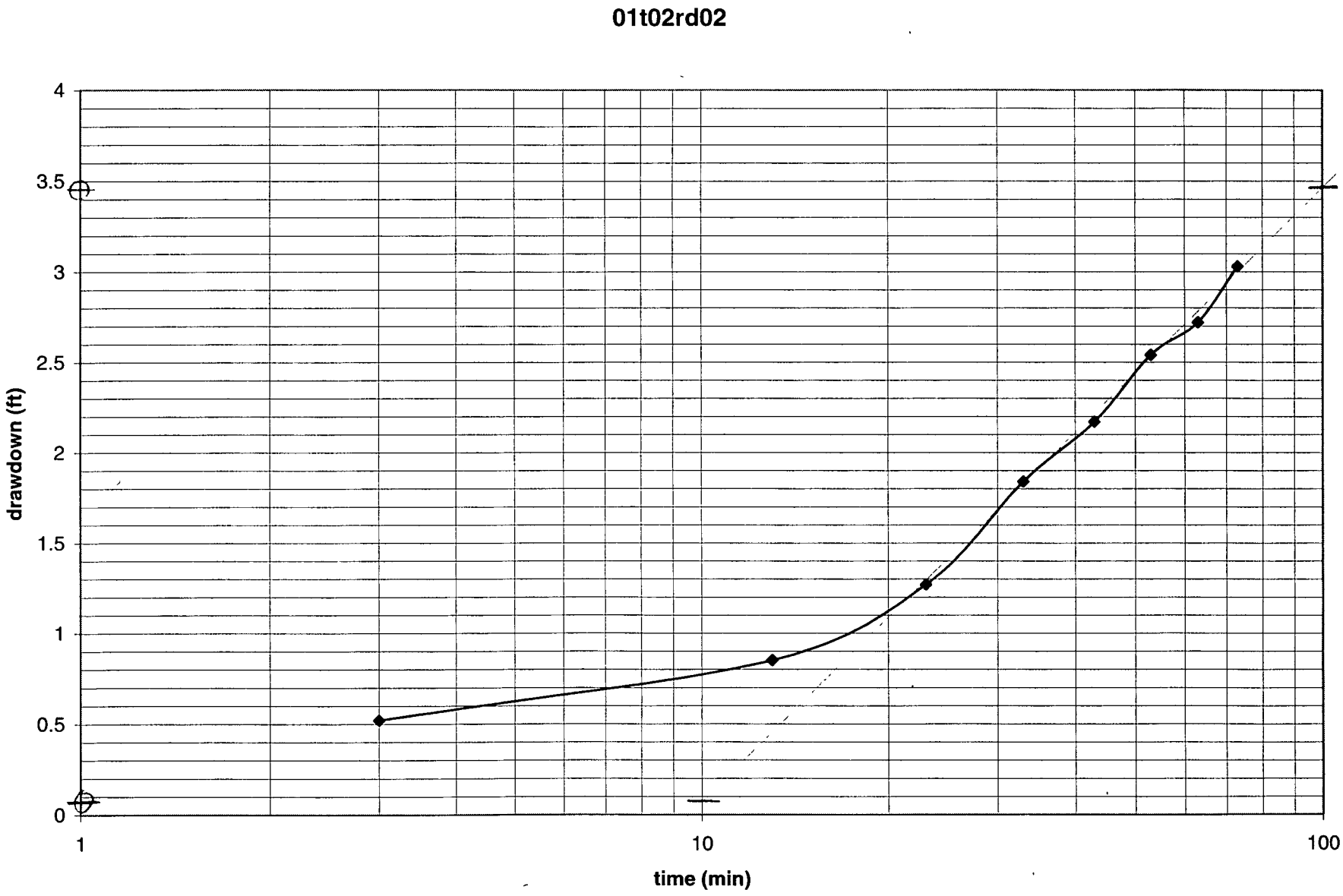


dh = 2.3 - 0 = 2[illegible] ft

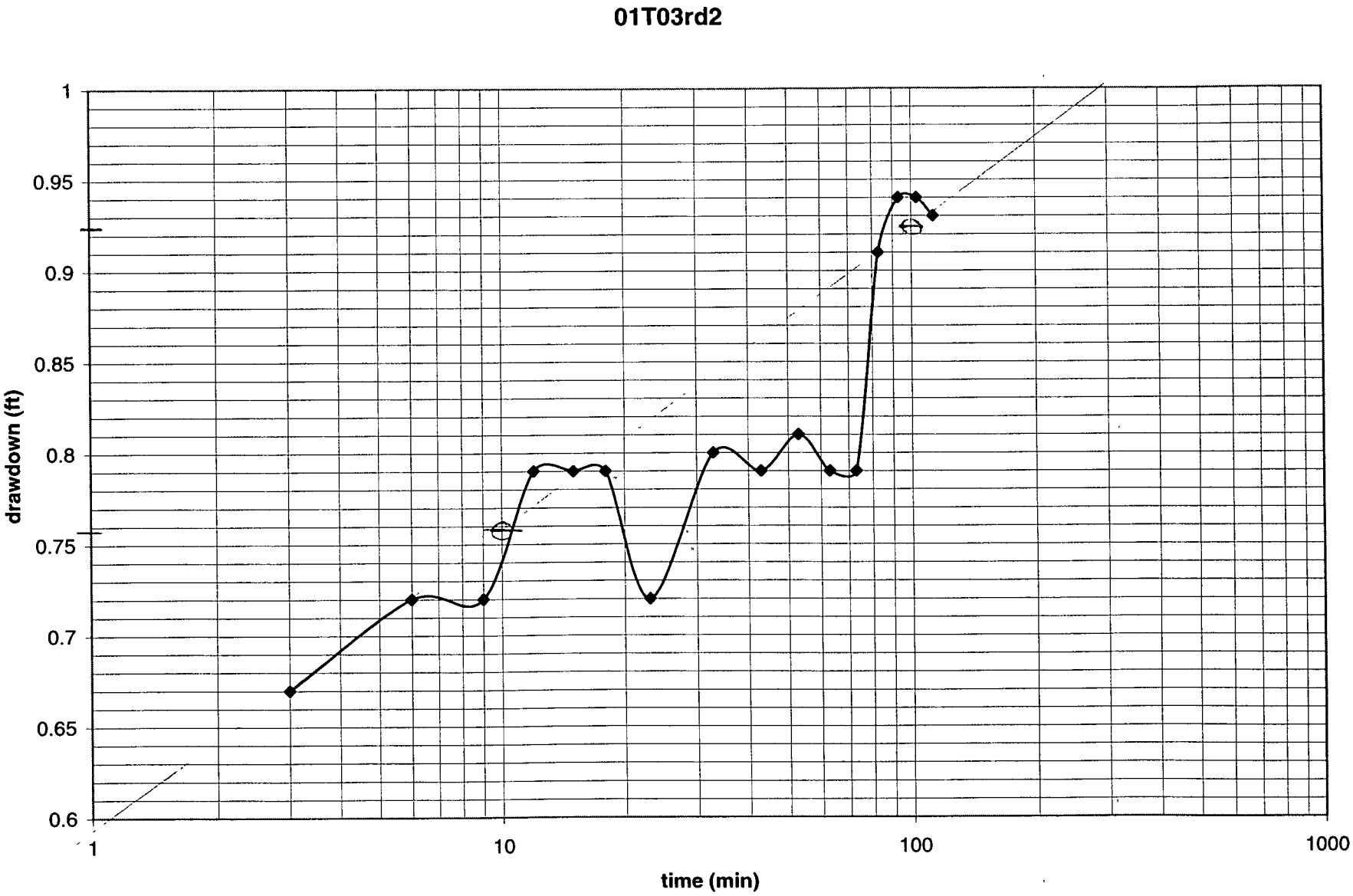
Q = 70 mL/min



Q = 100
dh = 3.45 − 0.07
= 3.38 ft

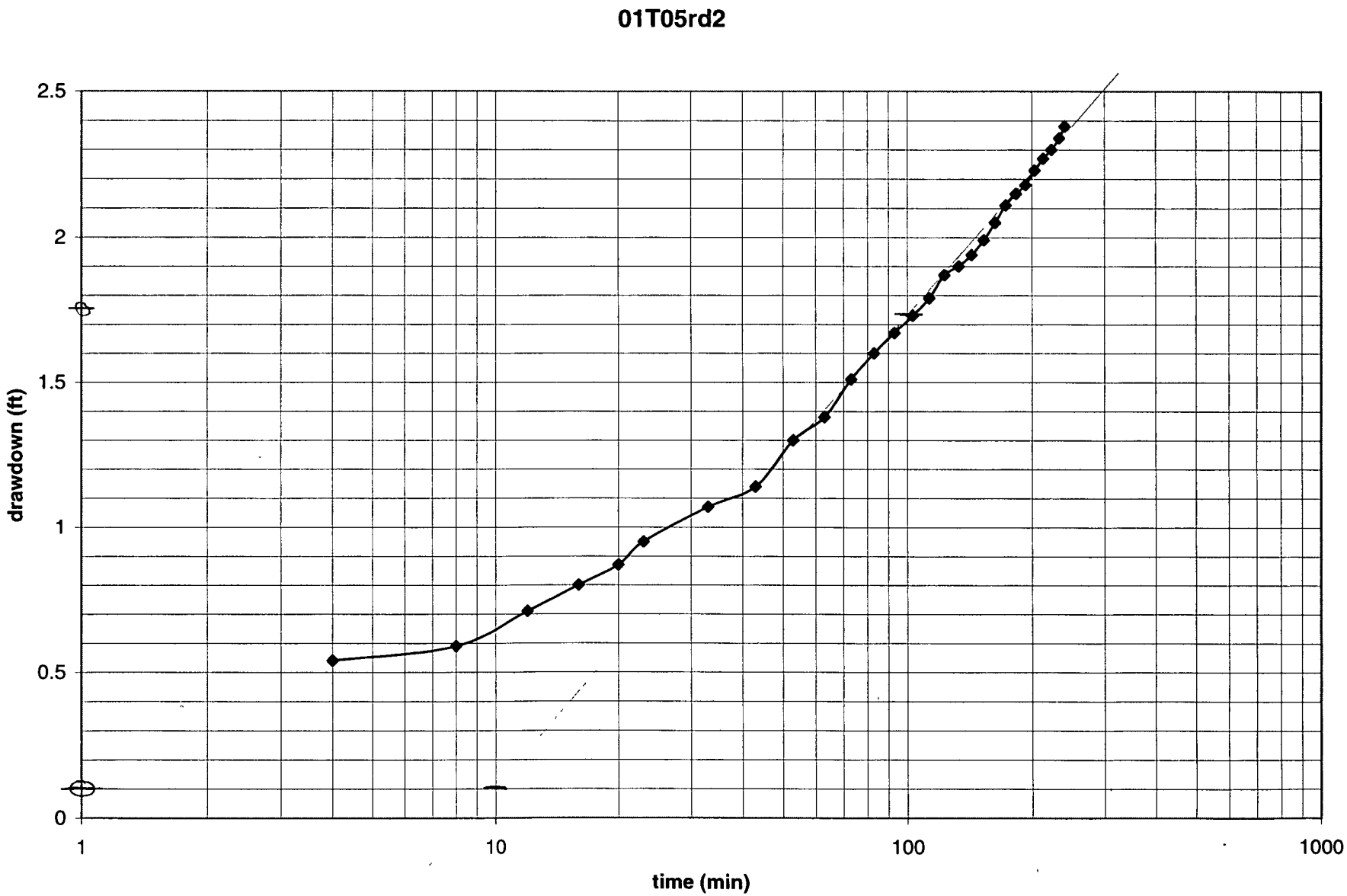


Q = 100
Δh = 0.925 - 0.758
Δh = 0.167 ft

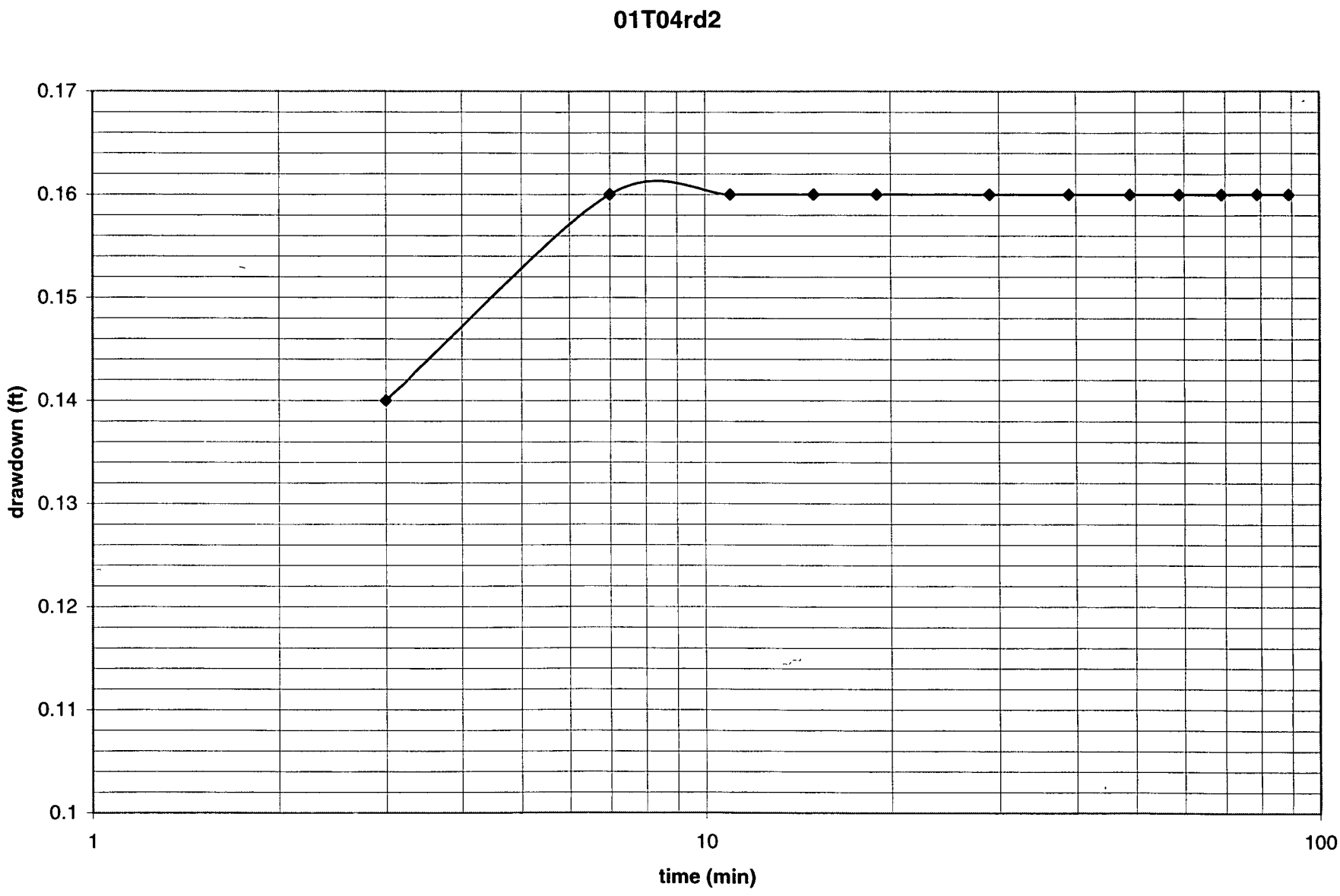


Q = 80

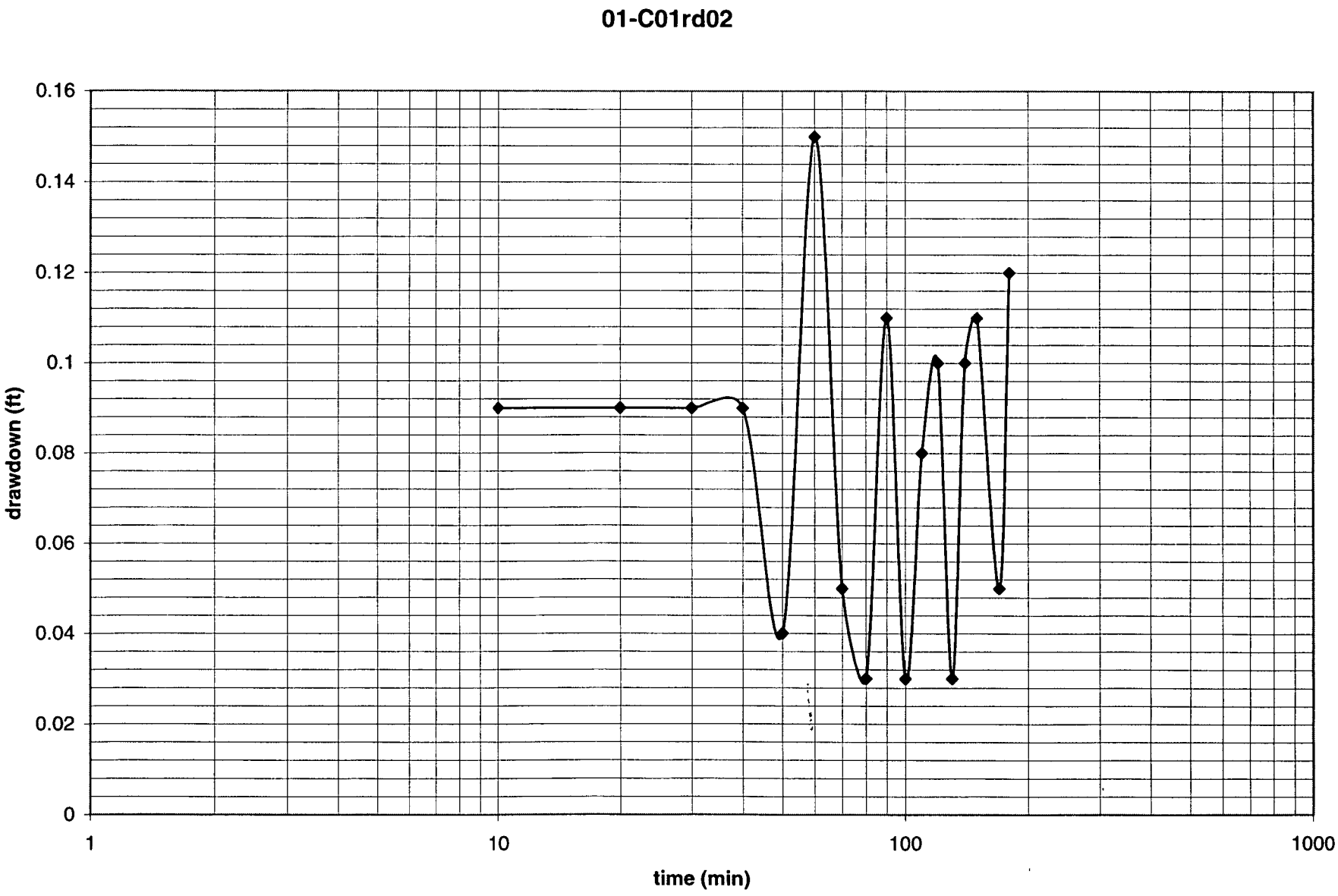
$\Delta h = 1.75 - 0.1 = 1.65$



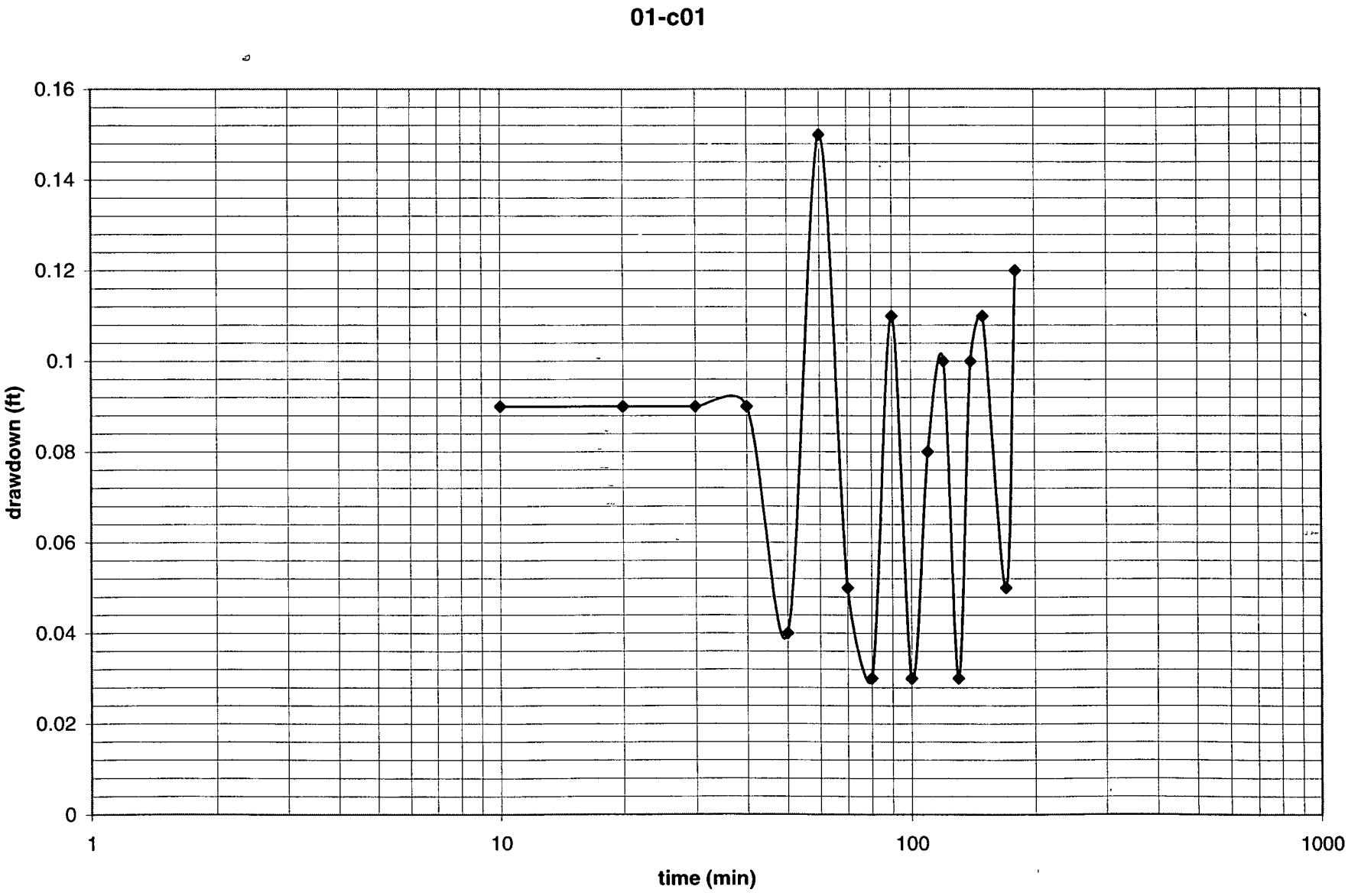
NA


01T04rd2
0.17
0.16
0.15
0.14
0.13
0.12
0.11
0.1
drawdown (ft)
1
10
100
time (min)

NA


01-C01rd02
0.16
0.14
0.12
0.1
0.08
0.06
0.04
0.02
0
drawdown (ft)
1
10
100
1000
time (min)

NA


01-c01
0.16
0.14
0.12
0.1
0.08
0.06
0.04
0.02
0
drawdown (ft)
1
10
100
1000
time (min)

ATTACHMENT 5

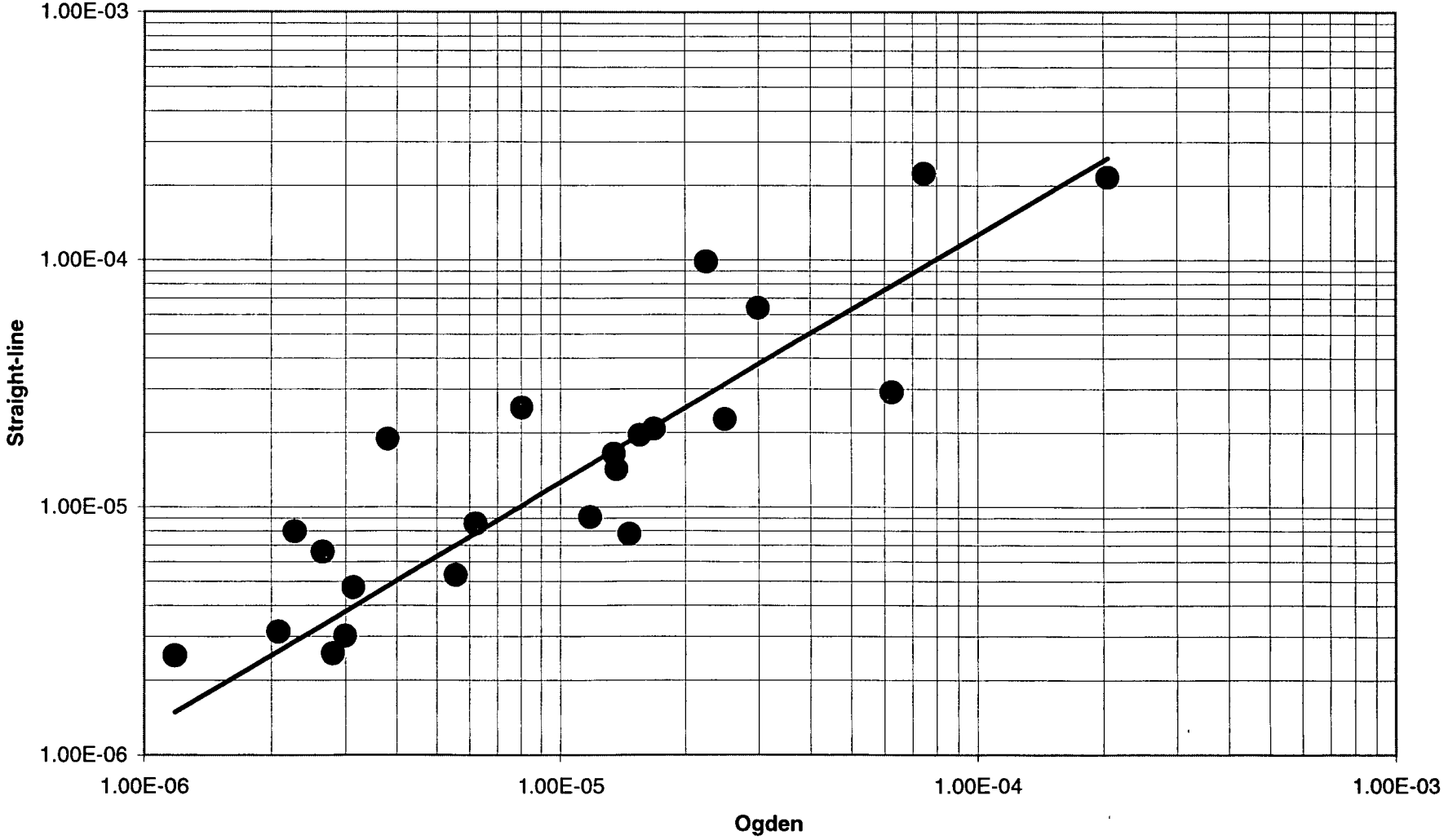
ATTACHMENT 5

Well No./ Round No.	Q (ml/min)	Q (ft3/min)	d(ho - h) (feet)	Transmissivity T (ft2/min)	Aquifer Thickness	Hydrualic Conductivity ft/min (Straight Line Method)	Hydraulic Conductivity cm/sec (Straight Line Method)
01-01/1	200	0.00706	0.750	1.72E-03	30	5.74E-05	2.92E-05
01-02/1	80	0.002824	1.170	4.42E-04	22	2.01E-05	1.02E-05
01-02/2	97	0.003424	0.640	9.79E-04	22	4.45E-05	2.26E-05
01-03/1	80	0.002824	9.200	5.62E-05	30	1.87E-06	9.51E-07
01-04/1	78	0.002753	4.500	1.12E-04	27	4.15E-06	2.11E-06
01-04/2	98	0.003459	3.950	1.60E-04	27	5.94E-06	3.02E-06
01-05/1	75	0.002648	7.800	6.21E-05	22	2.82E-06	1.43E-06
01-06/1	100	0.00353	0.113	5.72E-03	13	4.40E-04	2.23E-04
01-07/1	57	0.002012	0.940	3.92E-04	25	1.57E-05	7.96E-06
01-09/1	100	0.00353	2.950	2.19E-04	21	1.04E-05	5.30E-06
01-10/1	71	0.002506	5.450	8.42E-05	17	4.95E-06	2.52E-06
01-11/1	100	0.00353	4.760	1.36E-04	22	6.17E-06	3.13E-06
01-12/1	50	0.001765	0.950	3.40E-04	19	1.79E-05	9.09E-06
01-13/1	100	0.00353	0.080	8.08E-03	19	4.25E-04	2.16E-04
01-14/1	100	0.00353	9.800	6.59E-05	20	3.30E-06	1.67E-06
10-14tst2/1	95	0.003354	10.100	6.08E-05	20	3.04E-06	1.54E-06
01-15/1	100	0.00353	1.850	3.49E-04	20	1.75E-05	8.87E-06
01-15/2	88	0.003106	0.740	7.68E-04	20	3.84E-05	1.95E-05
01-17/1	101	0.003565	0.260	2.51E-03	20	1.25E-04	6.37E-05
01-18/1	81	0.002859	2.020	2.59E-04	20	1.30E-05	6.58E-06
01-19/1	74	0.002612	2.570	1.86E-04	20	9.30E-06	4.73E-06
01-20/1	80	0.002824	5.560	9.30E-05	20	4.65E-06	2.36E-06
01-21/1	100	0.00353	0.520	1.24E-03	25	4.97E-05	2.52E-05
01-22/1	90	0.003177	1.900	3.06E-04	20	1.53E-05	7.77E-06
01-23/1	100	0.00353	3.320	1.95E-04	20	9.73E-06	4.94E-06
01-24/1	70	0.002471	2.220	2.04E-04	20	1.02E-05	5.17E-06
01-25/1	68	0.0024	0.540	8.14E-04	20	4.07E-05	2.07E-05
01-26/1	100	0.00353	0.870	7.43E-04	20	3.71E-05	1.89E-05
01-27/1	175	0.006178	5.700	1.98E-04	20	9.92E-06	5.04E-06
01-27tst2/1	75	0.002648	2.380	2.04E-04	20	1.02E-05	5.17E-06
01T02/1	70	0.002471	2.300	1.97E-04	10	1.97E-05	9.99E-06
01T02/2	100	0.00353	3.380	1.91E-04	10	1.91E-05	9.71E-06
01T03/2	100	0.00353	0.167	3.87E-03	20	1.93E-04	9.83E-05
01T05/2	86	0.003036	1.650	3.37E-04	20	1.68E-05	8.55E-06

tst2 - Test 2, in some cases the well was purged twice during the same sampling round.

ATTACHMENT 6

COMPARISON BETWEEN THE OGDEN AND STRAIGHT-LINE METHODS HYDRAULIC CONDUCTIVITY (CM/SEC) SWMU 1



SEEPAGE VELOCITY CALCULATIONS

CLIENT Navy South Division		JOB NUMBER	
SUBJECT Seepage Velocity - Crane In MGBG			
BASED ON Fetter, Freeze & Cherry		DRAWING NUMBER	
BY SRA	CHECKED BY	APPROVED BY JPO	DATE 9/25/03

Shallow Groundwater

$V_s = Ki/N$, where:

V_s = Groundwater seepage velocity in feet/day
K = Horizontal hydraulic conductivity in feet/day
i = Hydraulic Gradient (feet/feet)
N = effective porosity

Estimated Site Conditions:

$K = 7.92 \times 10^{-6}$ cm/sec

$$K = \frac{7.92 \times 10^{-6}\ \text{cm}}{\text{sec}} \times \frac{86400\ \text{sec}}{\text{day}} \times \frac{1\ \text{ft}}{30.48\ \text{cm}}$$

$$\boxed{K = 2.25 \times 10^{-2}\ \text{feet/day}}$$

$N = 0.005$ (assumed fracture volume per unit volume of bedrock mass)

① $i = 0.3$ (North)

Find V_s:

$$V_s = (2.25 \times 10^{-2}\ \text{ft/day})(0.3\ \text{ft/ft}) / 0.005$$

$$\boxed{= 1.35\ \text{feet/day}}$$

② $i = 0.05$ (southeast), K & N as above

$$V_s = (2.25 \times 10^{-2}\ \text{ft/day})(0.05\ \text{ft/ft}) / 0.005$$

$$\boxed{= 0.225\ \text{ft/day}}$$

CLIENT Navy South Division		JOB NUMBER	
SUBJECT Seepage Velocity - Crane In MGBG			
BASED ON Fetter, Freeze & Cherry		DRAWING NUMBER	
BY SRA	CHECKED BY	APPROVED BY JPO	DATE 9/25/03

Deep Groundwater

$V_s = Ki/N$, where defined as on page 1

Estimated Site Conditions:

$K = 9.45 \times 10^{-5}$ cm/sec

$$K = \frac{9.45 \times 10^{-5}\ \text{cm}}{\text{sec}} \times \frac{86400\ \text{sec}}{\text{day}} \times \frac{1\ \text{ft}}{30.48\ \text{cm}}$$

$K = 2.68 \times 10^{-1}$ ft/day

$N = 0.005$ (assumed fracture volume per unit volume of bedrock mass)

$i = 0.005$ ft/ft

Find V_s: $V_s = (2.68 \times 10^{-1}\ \text{ft/day})(0.005)/0.005$

$$\boxed{V_s = 0.268\ \text{ft/day}}$$

As comparison to published $N = 0.0167$ from the Indiana Geological Survey Analysis of the Beech Creek Limestone

$V_s = (2.68 \times 10^{-1}\ \text{ft/day})(0.005)/0.0167$

$$\boxed{V_s = 8.0 \times 10^{-2}\ \text{ft/day}}$$

* Based on site conditions, use $i = 0.005$, $N = 0.005$ result of V_s for deep groundwater

APPENDIX B-6

SOIL SAMPLE LOG SHEETS

SOIL SAMPLE LOG SHEET

Project Site Name: NSWC Crane, IN
Project No.: CTO 158 N3959

[✓] Surface Soil
[ ] Subsurface Soil
[ ] Sediment
[ ] Other:
[ ] QA Sample Type:

Sample ID No.: 01SS010002
Sample Location: 01SB01
Sampled By: TR
C.O.C. No.:

Type of Sample:
[X] Low Concentration
[ ] High Concentration

GRAB SAMPLE DATA:

	Depth	Color	Description (Sand, Silt, Clay, Moisture, etc.)
Date 8-26-01 Time. 1130 Method: DPT Monitor Reading (ppm):	0-2	BRN	SILTY CLAY DAMP GRAVEL ROOTS

COMPOSITE SAMPLE DATA:

	Time	Depth	Color	Description (Sand, Silt, Clay, Moisture, etc.)
Date				
Method				
Monitor Readings (Range in ppm).				

SAMPLE COLLECTION INFORMATION:

Analysis	Container Requirements	Collected	Other
Appendix XI VOCs	(4) Encore samplers	✓	
HD	(1) 2 oz glass jar	✓	
Thorium	(1) 8 oz glass	✓	
Added gamma spectrometry to thorium container (check collected block).			
Appendix XI SVOC, PNA, Herbicide, Pesticide/PCBs	(1) 8 oz glass	✓	
Explosives, TAL Metals (plus Sr and Sn)	(1) 8 oz glass	✓	
Added pH and CEC to metals container (check collected block)		✓	
Added TOC to metals container (check collected block)..			

OBSERVATIONS / NOTES:

MAP:

Circle if Applicable:

MS/MSD	Duplicate ID No.:
—	—

Signature(s): [signature]

SOIL SAMPLE LOG SHEET

Project Site Name: NSWC Crane, IN
Project No.: CTO 158 N3959

[] Surface Soil
[✓] Subsurface Soil
[] Sediment
[] Other:
[] QA Sample Type:

Sample ID No.: 0153 010606
Sample Location: 015B01
Sampled By: TR
C.O.C. No.:

Type of Sample:
[X] Low Concentration
[] High Concentration

GRAB SAMPLE DATA:

	Depth	Color	Description (Sand, Silt, Clay, Moisture, etc.)
Date 8-26-01 Time 1145 Method DPT Monitor Reading (ppm) 0	2-6	BRN	CLAY / SILTY CLAY ~~OP~~ DAMP

COMPOSITE SAMPLE DATA:

Date	Time	Depth	Color	Description (Sand, Silt, Clay, Moisture, etc.)
Method				
Monitor Readings (Range in ppm)				

SAMPLE COLLECTION INFORMATION:

Analysis	Container Requirements	Collected	Other
Appendix XI VOCs	(4) Encore samplers	✓	
HD	(1) 2 oz glass jar	✓	
Thorium	(1) 8 oz glass	✓	
Added gamma spectrometry to thorium container (check collected block).....		✓	
Appendix XI SVOC, PNA, Herbicide, Pesticide/PCBs	(1) 8 oz glass	✓	
Explosives, TAL Metals (plus Sr and Sn)	(1) 8 oz glass	✓	
Added pH and CEC to metals container (check collected block).....		✓	
Added TOC to metals container (check collected block).....			

OBSERVATIONS / NOTES:

MAP:

Circle if Applicable:

MS/MSD	Duplicate ID No.:

Signature(s): [illegible]

SOIL SAMPLE LOG SHEET

Project Site Name: NSWC Crane, IN
Project No.: CTO 158 N3959

[] Surface Soil
[✓] Subsurface Soil
[] Sediment
[] Other:
[] QA Sample Type:

Sample ID No.: 015B010610
Sample Location: 013B01
Sampled By: TR
C.O.C. No.:

Type of Sample:
[X] Low Concentration
[] High Concentration

GRAB SAMPLE DATA:

	Depth	Color	Description (Sand, Silt, Clay, Moisture, etc.)
Date: 8-26-01	—	—	—
Time NA			
Method DPT			
Monitor Reading (ppm):			

COMPOSITE SAMPLE DATA:

~~Date:~~	Time	Depth	Color	Description (Sand, Silt, Clay, Moisture, etc.)
Method				
Monitor Readings (Range in ppm):				

SAMPLE COLLECTION INFORMATION:

Analysis	Container Requirements	Collected	Other
Appendix XI VOCs	(4) Encore samplers	✓	
HD	(1) 2 oz glass jar	✓	
Thorium	(1) 8 oz glass	✓	
Added gamma spectrometry to thorium container (check collected block)			
Appendix XI SVOC, PNA, [redacted]	(1) 8 oz glass	✓	
Explosives, TAL Metals (plus Sr and Sn)	(1) 8 oz glass	✓	
Added pH and CEC to metals container (check collected block)		✓	
Added TOC to metals container (check collected block)			

OBSERVATIONS / NOTES:

NO SAMPLE COLLECTED
REFUSAL @ 6'

MAP:

Circle if Applicable:

MS/MSD	Duplicate ID No.:
—	—

Signature(s): [illegible]

SOIL SAMPLE LOG SHEET

Project Site Name: NSWC Crane, IN
Project No.: CTO 158 N3959

[✓] Surface Soil
[] Subsurface Soil
[] Sediment
[] Other:
[] QA Sample Type:

Sample ID No.: 015502-0002
Sample Location: 015502
Sampled By: TR
C.O.C. No.:

Type of Sample:
[X] Low Concentration
[] High Concentration

GRAB SAMPLE DATA:

	Depth	Color	Description (Sand, Silt, Clay, Moisture, etc.)
Date 8-26-01 Time 0935 Method. DPT Monitor Reading (ppm): 0	0-2	ORG GRY	CLAY DRY MOTTLED

COMPOSITE SAMPLE DATA:

Date	Time	Depth	Color	Description (Sand, Silt, Clay, Moisture, etc.)
Method:				
Monitor Readings (Range in ppm):				

SAMPLE COLLECTION INFORMATION:

Analysis	Container Requirements	Collected	Other
Appendix XI VOCs	(4) Encore samplers	✓	
HD	(1) 2 oz glass jar	✓	
Thorium	(1) 8 oz glass	✓	
Added gamma spectrometry to thorium container (check collected block)			
Appendix XI SVOC, PNA, Herbicide, Pesticide/PCBs	(1) 8 oz glass	✓	
Explosives, TAL Metals (plus Sr and Sn)	(1) 8 oz glass	✓	
Added pH and CEC to metals container (check collected block)			
Added TOC to metals container (check collected block)			

OBSERVATIONS / NOTES:

MAP:

Circle if Applicable:

MS/MSD

Duplicate ID No.:

Signature(s): [illegible]

SOIL SAMPLE LOG SHEET

Project Site Name: NSWC Crane, IN
Project No.: CTO 158 N3959

[] Surface Soil
[✓] Subsurface Soil
[] Sediment
[] Other:
[] QA Sample Type:

Sample ID No.: 015B020206
Sample Location: 015B02
Sampled By: TR
C.O.C. No.:

Type of Sample:
[X] Low Concentration
[] High Concentration

GRAB SAMPLE DATA:

	Depth	Color	Description (Sand, Silt, Clay, Moisture, etc.)
Date: 8-26-01 Time: 0950 Method: DPT Monitor Reading (ppm): 0	2-6	ORG BRN	SILT + CLAY DRY T- SAND

COMPOSITE SAMPLE DATA:

Date:	Time	Depth	Color	Description (Sand, Silt, Clay, Moisture, etc.)
Method:				
Monitor Readings (Range in ppm)				

SAMPLE COLLECTION INFORMATION:

Analysis	Container Requirements	Collected	Other
Appendix XI VOCs	(4) Encore samplers	✓	
HD	(1) 2 oz glass jar	✓	
Thorium	(1) 8 oz glass	✓	
Added gamma spectrometry to thorium container (check collected block).		✓	
Appendix XI SVOC, PNA, Herbicide, Pesticide/PCBs	(1) 8 oz glass	✓	
Explosives, TAL Metals (plus Sr and Sn)	(1) 8 oz glass	✓	
Added pH and CEC to metals container (check collected block).			
Added TOC to metals container (check collected block)			

OBSERVATIONS / NOTES:

MAP:

Circle if Applicable:

MS/MSD	Duplicate ID No.:

Signature(s):

SOIL SAMPLE LOG SHEET

Project Site Name: NSWC Crane, IN
Project No.: CTO 158 N3959

[] Surface Soil
[✓] Subsurface Soil
[] Sediment
[] Other:
[] QA Sample Type:

Sample ID No.: 015B020610
Sample Location: 015B02
Sampled By: TR
C.O.C. No.:

Type of Sample:
[X] Low Concentration
[] High Concentration

GRAB SAMPLE DATA:

	Depth	Color	Description (Sand, Silt, Clay, Moisture, etc.)
Date 8-26-01	6-9.5	ORG GRY	DRY SILT
Time 1000			
Method DPT			
Monitor Reading (ppm) 0			

COMPOSITE SAMPLE DATA:

	Time	Depth	Color	Description (Sand, Silt, Clay, Moisture, etc.)
Date				
Method				
Monitor Readings (Range in ppm):				

SAMPLE COLLECTION INFORMATION:

Analysis	Container Requirements	Collected	Other
Appendix XI VOCs	(4) Encore samplers	✓	
HD	(1) 2 oz glass jar	✓	
Thorium	(1) 8 oz glass	✓	
Added gamma spectrometry to thorium container (check collected block).....			
Appendix XI SVOC, PNA, [redacted]	(1) 8 oz glass	✓	
Explosives, TAL Metals (plus Sr and Sn)	(1) 8 oz glass	✓	
Added pH and CEC to metals container (check collected block)			
Added TOC to metals container (check collected block).....			

OBSERVATIONS / NOTES:

MAP:

Circle if Applicable:

MS/MSD	Duplicate ID No.:
—	—

Signature(s):

SOIL SAMPLE LOG SHEET

Project Site Name: NSWC Crane, IN
Project No.: CTO 158 N3959

[✓] Surface Soil
[] Subsurface Soil
[] Sediment
[] Other:
[] QA Sample Type:

Sample ID No.: 0155030002
Sample Location: 015803
Sampled By: TR
C.O.C. No.:

Type of Sample:
[X] Low Concentration
[] High Concentration

GRAB SAMPLE DATA:

	Depth	Color	Description (Sand, Silt, Clay, Moisture, etc.)
Date 8-26-01 Time 1100 Method: DPT Monitor Reading (ppm) 0	0-2	BRN ORG	SILTY CLAY DRY ROOTS

COMPOSITE SAMPLE DATA:

Date	Time	Depth	Color	Description (Sand, Silt, Clay, Moisture, etc.)
Method				
Monitor Readings (Range in ppm)				

SAMPLE COLLECTION INFORMATION:

Analysis	Container Requirements	Collected	Other
Appendix XI VOCs	(4) Encore samplers	✓	
HD	(1) 2 oz glass jar	✓	
Thorium	(1) 8 oz glass	✓	
Added gamma spectrometry to thorium container (check collected block)..			
Appendix XI SVOC, PNA, Herbicide, Pesticide/PCBs	(1) 8 oz glass	✓	
Explosives, TAL Metals (plus Sr and Sn)	(1) 8 oz glass	✓	
Added pH and CEC to metals container (check collected block)..		✓	
Added TOC to metals container (check collected block)			

OBSERVATIONS / NOTES:

MAP:

Circle if Applicable:

MS/MSD	Duplicate ID No.:
—	—

Signature(s):

SOIL SAMPLE LOG SHEET

Project Site Name: NSWC Crane, IN
Project No.: CTO 158 N3959

[] Surface Soil
[✓] Subsurface Soil
[] Sediment
[] Other:
[] QA Sample Type:

Sample ID No.: 0150030206
Sample Location: 0151303
Sampled By: TR
C.O.C. No.:

Type of Sample:
[X] Low Concentration
[] High Concentration

GRAB SAMPLE DATA:

	Depth	Color	Description (Sand, Silt, Clay, Moisture, etc.)
Date. 8-26-01 Time: 1105 Method: DPT Monitor Reading (ppm):	2-6	BRN ORG	SILT + CLAY DRY

COMPOSITE SAMPLE DATA:

Date	Time	Depth	Color	Description (Sand, Silt, Clay, Moisture, etc.)
Method.				
Monitor Readings (Range in ppm)				

SAMPLE COLLECTION INFORMATION:

Analysis	Container Requirements	Collected	Other
Appendix XI VOCs	(4) Encore samplers	✓	
HD	(1) 2 oz glass jar	✓	
Thorium	(1) 8 oz glass	✓	
Added gamma spectrometry to thorium container (check collected block)..		✓	
Appendix XI SVOC, PNA, Herbicide, Pesticide/PCBs	(1) 8 oz glass	✓	
Explosives, TAL Metals (plus Sr and Sn)	(1) 8 oz glass	✓	
Added pH and CEC to metals container (check collected block).....			
Added TOC to metals container (check collected block).....			

OBSERVATIONS / NOTES:

MAP:

Circle if Applicable:

MS/MSD	Duplicate ID No.:

Signature(s):

SOIL SAMPLE LOG SHEET

Project Site Name: NSWC Crane, IN
Project No.: CTO 158 N3959

Sample ID No.: 0155040002
Sample Location: 0156304
Sampled By: TR
C.O.C. No.:

[X] Surface Soil
[X] Subsurface Soil
[] Sediment
[] Other:
[] QA Sample Type:

Type of Sample:
[X] Low Concentration
[] High Concentration

GRAB SAMPLE DATA:

	Depth	Color	Description (Sand, Silt, Clay, Moisture, etc.)
Date 8-26-01			
Time: 0900	0-2	BRN ORG	CLAY DRY
Method: DPT			W/ S-SILT ROOTS
Monitor Reading (ppm)			

COMPOSITE SAMPLE DATA:

Date	Time	Depth	Color	Description (Sand, Silt, Clay, Moisture, etc.)
Method				
Monitor Readings (Range in ppm):				

SAMPLE COLLECTION INFORMATION:

Analysis	Container Requirements	Collected	Other
Appendix XI VOCs	(4) Encore samplers	✓	
HD	(1) 2 oz glass jar	✓	
Thorium	(1) 8 oz glass	✓	
Added gamma spectrometry to thorium container (check collected block)			
Appendix XI SVOC, PNA, Herbicide, Pesticide/PCBs	(1) 8 oz glass	✓	
Explosives, TAL Metals (plus Sr and Sn)	(1) 8 oz glass	✓	
Added pH and CEC to metals container (check collected block)			
Added TOC to metals container (check collected block)			

OBSERVATIONS / NOTES:

MAP:

Circle if Applicable:

MS/MSD YES

Duplicate ID No.:

Signature(s):

FW

SOIL SAMPLE LOG SHEET

Project Site Name: NSWC Crane, IN
Project No.: CTO 158 N3959

[] Surface Soil
[X] Subsurface Soil
[] Sediment
[] Other:
[] QA Sample Type:

Sample ID No.: 015B040206
Sample Location: 015B04
Sampled By: JR
C.O.C. No.:

Type of Sample:
[X] Low Concentration
[] High Concentration

GRAB SAMPLE DATA:

	Depth	Color	Description (Sand, Silt, Clay, Moisture, etc.)
Date: 8-26-01			
Time: 0910	2-6	ORG	SILT + CLAY
Method: DPT			S-SAND DRY
Monitor Reading (ppm):			

COMPOSITE SAMPLE DATA:

Date	Time	Depth	Color	Description (Sand, Silt, Clay, Moisture, etc.)
Method.				
Monitor Readings (Range in ppm):				

SAMPLE COLLECTION INFORMATION:

Analysis	Container Requirements	Collected	Other
Appendix XI VOCs	(4) Encore samplers	✓	
HD	(1) 2 oz glass jar	✓	
Thorium	(1) 8 oz glass	✓	
Added gamma spectrometry to thorium container (check collected block)		✓	
Appendix XI SVOC, PNA, Herbicide, Pesticide/PCBs	(1) 8 oz glass	✓	
Explosives, TAL Metals (plus Sr and Sn)	(1) 8 oz glass	✓	
Added pH and CEC to metals container (check collected block)			
Added TOC to metals container (check collected block)			

OBSERVATIONS / NOTES:

MAP:

Circle if Applicable:

MS/MSD	Duplicate ID No.:
—	—

Signature(s): [illegible]

FW

SOIL SAMPLE LOG SHEET

Project Site Name: NSWC Crane, IN
Project No.: CTO 158 N3959

[] Surface Soil
[X] Subsurface Soil
[] Sediment
[] Other:
[] QA Sample Type:

Sample ID No.: 01SB040610
Sample Location: 01SB04
Sampled By: TR-RS
C.O.C. No.:

Type of Sample:
[X] Low Concentration
[] High Concentration

GRAB SAMPLE DATA:

	Depth	Color	Description (Sand, Silt, Clay, Moisture, etc.)
Date: 8-26-01 Time: 0925 Method: DPT Monitor Reading (ppm).	6-10	ORG GRY	SILT DRY T-F SAND

COMPOSITE SAMPLE DATA:

	Time	Depth	Color	Description (Sand, Silt, Clay, Moisture, etc.)
Date				
Method:				
Monitor Readings (Range in ppm)				

SAMPLE COLLECTION INFORMATION:

Analysis	Container Requirements	Collected	Other
Appendix XI VOCs	(4) Encore samplers	✓	
HD	(1) 2 oz glass jar	✓	
Thorium	(1) 8 oz glass	✓	
Added gamma spectrometry to thorium container (check collected block).....			
Appendix XI SVOC, PNA, H[redacted]	(1) 8 oz glass	✓	
Explosives, TAL Metals (plus Sr and Sn)	(1) 8 oz glass	✓	
Added pH and CEC to metals container (check collected block)			
Added TOC to metals container (check collected block).			

OBSERVATIONS / NOTES:

MAP:

Circle if Applicable:

MS/MSD —

Duplicate ID No.: FD083601-01

Signature(s): [illegible] FW

SOIL SAMPLE LOG SHEET

Project Site Name: NSWC Crane, IN
Project No.: CTO 158 N3959

[✓] Surface Soil
[] Subsurface Soil
[] Sediment
[] Other:
[] QA Sample Type:

Sample ID No.: 0155050002
Sample Location: 015805
Sampled By: TR
C.O.C. No.:

Type of Sample:
[X] Low Concentration
[] High Concentration

GRAB SAMPLE DATA:

	Depth	Color	Description (Sand, Silt, Clay, Moisture, etc.)
Date 8-26-01 Time 1430 Method: DPT Monitor Reading (ppm): 0	0-2	BRN	SILT DRY S-CLAY ROOTS

COMPOSITE SAMPLE DATA:

Date	Time	Depth	Color	Description (Sand, Silt, Clay, Moisture, etc.)
Method				
Monitor Readings (Range in ppm).				

SAMPLE COLLECTION INFORMATION:

Analysis	Container Requirements	Collected	Other
Appendix XI VOCs	(4) Encore samplers	✓	
HD	(1) 2 oz glass jar	✓	
Thorium	(1) 8 oz glass	✓	
Added gamma spectrometry to thorium container (check collected block)			
Appendix XI SVOC, PNA, Herbicide, Pesticide/PCBs	(1) 8 oz glass	✓	
Explosives, TAL Metals (plus Sr and Sn)	(1) 8 oz glass	✓	
Added pH and CEC to metals container (check collected block)		✓	
Added TOC to metals container (check collected block)			

OBSERVATIONS / NOTES:

MAP:

Circle if Applicable:

MS/MSD	Duplicate ID No.:
—	—

Signature(s): [illegible]

SOIL SAMPLE LOG SHEET

Project Site Name: NSWC Crane, IN
Project No.: CTO 158 N3959

[] Surface Soil
[✓] Subsurface Soil
[] Sediment
[] Other:
[] QA Sample Type:

Sample ID No.: 015B050206
Sample Location: 015B05
Sampled By: TR
C.O.C. No.:

Type of Sample:
[X] Low Concentration
[] High Concentration

GRAB SAMPLE DATA:

	Depth	Color	Description (Sand, Silt, Clay, Moisture, etc.)
Date 8-26-01 Time 1445 Method DPT Monitor Reading (ppm) 0	2-6	DRG BRN	SILT + fgr sand DRY

COMPOSITE SAMPLE DATA:

Date	Time	Depth	Color	Description (Sand, Silt, Clay, Moisture, etc.)
Method				
Monitor Readings (Range in ppm)				

SAMPLE COLLECTION INFORMATION:

Analysis	Container Requirements	Collected	Other
Appendix XI VOCs	(4) Encore samplers	✓	
HD	(1) 2 oz glass jar	✓	
Thorium	(1) 8 oz glass	✓	
Added gamma spectrometry to thorium container (check collected block)...			
Appendix XI SVOC, PNA, Herbicide, Pesticide/PCBs	(1) 8 oz glass	✓	
Explosives, TAL Metals (plus Sr and Sn)	(1) 8 oz glass	✓	
Added pH and CEC to metals container (check collected block)		✓	
Added TOC to metals container (check collected block)...			

OBSERVATIONS / NOTES:

MAP:

Circle if Applicable:

MS/MSD

Duplicate ID No.:

Signature(s):

SOIL SAMPLE LOG SHEET

Project Site Name: NSWC Crane, IN
Project No.: CTO 158 N3959

[] Surface Soil
[✓] Subsurface Soil
[] Sediment
[] Other:
[] QA Sample Type:

Sample ID No.: 015B050610
Sample Location: 015B05
Sampled By: TR
C.O.C. No.:

Type of Sample:
[X] Low Concentration
[] High Concentration

GRAB SAMPLE DATA:

	Depth	Color	Description (Sand, Silt, Clay, Moisture, etc.)
Date 8-26-01	6-8.5	BRN ORL	SILT + F. SAND DRY
Time 1455			
Method DPJ			
Monitor Reading (ppm) 0			

COMPOSITE SAMPLE DATA:

Date	Time	Depth	Color	Description (Sand, Silt, Clay, Moisture, etc.)
Method:				
Monitor Readings (Range in ppm)				

SAMPLE COLLECTION INFORMATION:

Analysis	Container Requirements	Collected	Other
Appendix XI VOCs	(4) Encore samplers	✓	
HD	(1) 2 oz glass jar	✓	
Thorium	(1) 8 oz glass	✓	
Added gamma spectrometry to thorium container (check collected block)			
Appendix XI SVOC, PNA, ~~Herbicide, Pesticide/PCB~~	(1) 8 oz glass	✓	
Explosives, TAL Metals (plus Sr and Sn)	(1) 8 oz glass	✓	
Added pH and CEC to metals container (check collected block)			
Added TOC to metals container (check collected block)			

OBSERVATIONS / NOTES:

MAP:

Circle if Applicable:

MS/MSD

Duplicate ID No.:

Signature(s):

SOIL SAMPLE LOG SHEET

Project Site Name: NSWC Crane, IN
Project No.: CTO 158 N3959

Sample ID No.: 01-SS-060002
Sample Location: 015306
Sampled By: TR
C.O.C. No.:

- [x] Surface Soil
- [ ] Subsurface Soil
- [ ] Sediment
- [ ] Other:
- [ ] QA Sample Type:

Type of Sample:
- [X] Low Concentration
- [ ] High Concentration

GRAB SAMPLE DATA:

	Depth	Color	Description (Sand, Silt, Clay, Moisture, etc.)
Date 8-27-01 Time 0855 Method: DPT Monitor Reading (ppm): 0	0-2	DRK BRN	SILT DRY

COMPOSITE SAMPLE DATA:

Date.	Time	Depth	Color	Description (Sand, Silt, Clay, Moisture, etc.)
Method.				
Monitor Readings (Range in ppm).				

SAMPLE COLLECTION INFORMATION:

Analysis	Container Requirements	Collected	Other
Appendix XI VOCs	(4) Encore samplers	✓	
HD	(1) 2 oz glass jar	✓	
Thorium	(1) 8 oz glass	✓	
Added gamma spectrometry to thorium container (check collected block)..			
Appendix XI SVOC, PNA, Herbicide, Pesticide/PCBs	(1) 8 oz glass	✓	
Explosives, TAL Metals (plus Sr and Sn)	(1) 8 oz glass	✓	
Added pH and CEC to metals container (check collected block)..			
Added TOC to metals container (check collected block)			

OBSERVATIONS / NOTES:

MAP:

Circle if Applicable:

MS/MSD	Duplicate ID No.:
—	—

Signature(s): [illegible]

SOIL SAMPLE LOG SHEET

Project Site Name: NSWC Crane, IN
Project No.: CTO 158 N3959

[] Surface Soil
[✓] Subsurface Soil
[] Sediment
[] Other:
[] QA Sample Type:

Sample ID No.: 015806 0206
Sample Location: 015806
Sampled By: TR
C.O.C. No.:

Type of Sample:
[X] Low Concentration
[] High Concentration

GRAB SAMPLE DATA:

	Depth	Color	Description (Sand, Silt, Clay, Moisture, etc.)
Date 8-27-01 Time 1000 Method DPT Monitor Reading (ppm): 0	2-6	ORG BRN	SILT + CLAY DRY

COMPOSITE SAMPLE DATA:

	Time	Depth	Color	Description (Sand, Silt, Clay, Moisture, etc.)
Date:				
Method.				
Monitor Readings (Range in ppm).				

SAMPLE COLLECTION INFORMATION:

Analysis	Container Requirements	Collected	Other
Appendix XI VOCs	(4) Encore samplers	✓	
HD	(1) 2 oz glass jar	✓	
Thorium	(1) 8 oz glass	✓	
Added gamma spectrometry to thorium container (check collected block)			
Appendix XI SVOC, PNA, Herbicide, Pesticide/PCBs	(1) 8 oz glass	✓	
Explosives, TAL Metals (plus Sr and Sn)	(1) 8 oz glass	✓	
Added pH and CEC to metals container (check collected block)			
Added TOC to metals container (check collected block)			

OBSERVATIONS / NOTES:

MAP:

Circle if Applicable:

MS/MSD	Duplicate ID No.:
—	—

Signature(s): [illegible]

SOIL SAMPLE LOG SHEET

Project Site Name: NSWC Crane, IN
Project No.: CTO 158 N3959

[] Surface Soil
[✓] Subsurface Soil
[] Sediment
[] Other:
[] QA Sample Type:

Sample ID No.: 01SB060610
Sample Location: 01SB06
Sampled By: FW
C.O.C. No.:

Type of Sample:
[X] Low Concentration
[] High Concentration

GRAB SAMPLE DATA:

	Depth	Color	Description (Sand, Silt, Clay, Moisture, etc.)
Date 8-27-01 Time 1015 Method: DPT Monitor Reading (ppm) 0	6-10	ORG GRY	SILT + CLAY WEATHERED BEDROCK DRY

COMPOSITE SAMPLE DATA:

Date	Time	Depth	Color	Description (Sand, Silt, Clay, Moisture, etc.)
Method				
Monitor Readings (Range in ppm)				

SAMPLE COLLECTION INFORMATION:

Analysis	Container Requirements	Collected	Other
Appendix XI VOCs	(4) Encore samplers	✓	
HD	(1) 2 oz glass jar	✓	
Thorium	(1) 8 oz glass	✓	
Added gamma spectrometry to thorium container (check collected block)...			
Appendix XI SVOC, PNA, ~~Herbicide, Pesticide/PCBs~~	(1) 8 oz glass	✓	
Explosives, TAL Metals (plus Sr and Sn)	(1) 8 oz glass		
Added pH and CEC to metals container (check collected block).....			
Added TOC to metals container (check collected block).....			

OBSERVATIONS / NOTES:

MAP:

Circle if Applicable:

MS/MSD

Duplicate ID No.:

Signature(s): FW

SOIL SAMPLE LOG SHEET

Project Site Name: NSWC Crane, IN
Project No.: CTO 158 N3959

[✓] Surface Soil
[] Subsurface Soil
[] Sediment
[] Other:
[] QA Sample Type:

Sample ID No.: 0155070002
Sample Location: 015B07
Sampled By: TR
C.O.C. No.:

Type of Sample:
[X] Low Concentration
[] High Concentration

GRAB SAMPLE DATA:

	Depth	Color	Description (Sand, Silt, Clay, Moisture, etc.)
Date 8-27-01 Time. 0920 Method: DPT Monitor Reading (ppm): 0	0-2	BRN ORG	CLAYEY SILT DRY

COMPOSITE SAMPLE DATA:

Date	Time	Depth	Color	Description (Sand, Silt, Clay, Moisture, etc.)
Method:				
Monitor Readings (Range in ppm).				

SAMPLE COLLECTION INFORMATION:

Analysis	Container Requirements	Collected	Other
Appendix XI VOCs	(4) Encore samplers	✓	
HD	(1) 2 oz glass jar	✓	
Thorium	(1) 8 oz glass	✓	
Added gamma spectrometry to thorium container (check collected block)..			
Appendix XI SVOC, PNA, Herbicide, Pesticide/PCBs	(1) 8 oz glass	✓	
Explosives, TAL Metals (plus Sr and Sn)	(1) 8 oz glass	✓	
Added pH and CEC to metals container (check collected block)		✓	
Added TOC to metals container (check collected block)..			

OBSERVATIONS / NOTES:

MAP:

Circle if Applicable:

MS/MSD —

Duplicate ID No.: FD082701-01

Signature(s): [illegible]

SOIL SAMPLE LOG SHEET

Project Site Name: NSWC Crane, IN
Project No.: CTO 158 N3959

[] Surface Soil
[✓] Subsurface Soil
[] Sediment
[] Other:
[] QA Sample Type:

Sample ID No.: 015B070206
Sample Location: 015B07
Sampled By: TR
C.O.C. No.:

Type of Sample:
[X] Low Concentration
[] High Concentration

GRAB SAMPLE DATA:

	Depth	Color	Description (Sand, Silt, Clay, Moisture, etc.)
Date: 8-27-01 Time: 0940 Method: DPT Monitor Reading (ppm):	2-5	BRN ORG	SILT S-CLAY PIECES OF SANDSTONE

COMPOSITE SAMPLE DATA:

	Time	Depth	Color	Description (Sand, Silt, Clay, Moisture, etc.)
Date				
Method				
Monitor Readings (Range in ppm)				

SAMPLE COLLECTION INFORMATION:

Analysis	Container Requirements	Collected	Other
Appendix XI VOCs	(4) Encore samplers	✓	
HD	(1) 2 oz glass jar	✓	
Thorium	(1) 8 oz glass	✓	
Added gamma spectrometry to thorium container (check collected block)			
Appendix XI SVOC, PNA, Herbicide, Pesticide/PCBs	(1) 8 oz glass	✓	
Explosives, TAL Metals (plus Sr and Sn)	(1) 8 oz glass	✓	
Added pH and CEC to metals container (check collected block)		✓	
Added TOC to metals container (check collected block)			

OBSERVATIONS / NOTES:

MAP:

Circle if Applicable:

MS/MSD

Duplicate ID No.:

Signature(s):

SOIL SAMPLE LOG SHEET

Project Site Name: NSWC Crane, IN
Project No.: CTO 158 N3959

Sample ID No.: 01-SS-08-0002
Sample Location: 015B08
Sampled By: TR
C.O.C. No.:

[X] Surface Soil
[ ] Subsurface Soil
[ ] Sediment
[ ] Other:
[ ] QA Sample Type:

Type of Sample:
[X] Low Concentration
[ ] High Concentration

GRAB SAMPLE DATA:

	Depth	Color	Description (Sand, Silt, Clay, Moisture, etc.)
Date: 8-21-01 Time. 1655 Method: DPT Monitor Reading (ppm)	0-2	BRN	SILT

COMPOSITE SAMPLE DATA:

	Time	Depth	Color	Description (Sand, Silt, Clay, Moisture, etc.)
Date.				
Method.				
Monitor Readings (Range in ppm).				

SAMPLE COLLECTION INFORMATION:

Analysis	Container Requirements	Collected	Other
Appendix XI VOCs	(4) Encore samplers	✓	
HD	(1) 2 oz glass jar	✓	
Thorium	(1) 8 oz glass	✓	
Added gamma spectrometry to thorium container (check collected block)			
Appendix XI SVOC, PNA, Herbicide, Pesticide/PCBs	(1) 8 oz glass	✓	
Explosives, TAL Metals (plus Sr and Sn)	(1) 8 oz glass	✓	
Added pH and CEC to metals container (check collected block)			
Added TOC to metals container (check collected block)			

OBSERVATIONS / NOTES:

MAP:

Circle if Applicable:

MS/MSD

Duplicate ID No.: FD082101-01

Signature(s): [illegible]

SOIL SAMPLE LOG SHEET

Project Site Name: NSWC Crane, IN
Project No.: CTO 158 N3959

[] Surface Soil
[✓] Subsurface Soil
[] Sediment
[] Other:
[] QA Sample Type:

Sample ID No.: 01-SB-08-0206
Sample Location: 015B08
Sampled By: FR
C.O.C. No.:

Type of Sample:
[X] Low Concentration
[] High Concentration

GRAB SAMPLE DATA:

	Depth	Color	Description (Sand, Silt, Clay, Moisture, etc.)
Date 8-21-01	2-6	ORG GREY	SILT ORY F.GR. SAND
Time 1720			
Method: DPT			
Monitor Reading (ppm):			

COMPOSITE SAMPLE DATA:

	Time	Depth	Color	Description (Sand, Silt, Clay, Moisture, etc.)
Date				
Method.				
Monitor Readings (Range in ppm).				

SAMPLE COLLECTION INFORMATION:

Analysis	Container Requirements	Collected	Other
Appendix XI VOCs	(4) Encore samplers	✓	
HD	(1) 2 oz glass jar	✓	
Thorium	(1) 8 oz glass	✓	
Added gamma spectrometry to thorium container (check collected block)			
Appendix XI SVOC, PNA, Herbicide, Pesticide/PCBs	(1) 8 oz glass	✓	
Explosives, TAL Metals (plus Sr and Sn)	(1) 8 oz glass	✓	
Added pH and CEC to metals container (check collected block)...			
Added TOC to metals container (check collected block)..			

OBSERVATIONS / NOTES:

MAP:

Circle if Applicable:

MS/MSD	Duplicate ID No.:
—	—

Signature(s): [signature]

SOIL SAMPLE LOG SHEET

Project Site Name: NSWC Crane, IN
Project No.: CTO 158 N3959

[] Surface Soil
[✓] Subsurface Soil
[] Sediment
[] Other:
[] QA Sample Type:

Sample ID No.: 01-SB-08-0610
Sample Location: 013808
Sampled By: TR
C.O.C. No.:

Type of Sample:
[X] Low Concentration
[] High Concentration

GRAB SAMPLE DATA:

	Depth	Color	Description (Sand, Silt, Clay, Moisture, etc.)
Date: 8-21-01 Time: 1745 Method: DPT Monitor Reading (ppm):	6-10	GREY ORG	WEATHERED SANDSTONE

COMPOSITE SAMPLE DATA:

	Time	Depth	Color	Description (Sand, Silt, Clay, Moisture, etc.)
Date				
Method:				
Monitor Readings (Range in ppm)				

SAMPLE COLLECTION INFORMATION:

Analysis	Container Requirements	Collected	Other
Appendix XI VOCs	(4) Encore samplers	✓	
HD	(1) 2 oz glass jar	✓	
Thorium	(1) 8 oz glass	✓	
Added gamma spectrometry to thorium container (check collected block)			
Appendix XI SVOC, PNA, [redacted]	(1) 8 oz glass	✓	
Explosives, TAL Metals (plus Sr and Sn)	(1) 8 oz glass	✓	
Added pH and CEC to metals container (check collected block)			
Added TOC to metals container (check collected block)			

OBSERVATIONS / NOTES:

MAP:

Circle if Applicable:

MS/MSD

Duplicate ID No.:

Signature(s):

SOIL SAMPLE LOG SHEET

Project Site Name: NSWC Crane, IN
Project No.: CTO 158 N3959

Sample ID No.: 0155090002
Sample Location: 015309
Sampled By: TR
C.O.C. No.:

- [x] Surface Soil
- [ ] Subsurface Soil
- [ ] Sediment
- [ ] Other:
- [ ] QA Sample Type:

Type of Sample:
- [X] Low Concentration
- [ ] High Concentration

GRAB SAMPLE DATA:

	Depth	Color	Description (Sand, Silt, Clay, Moisture, etc.)
Date: 8-26-01 Time 1400 Method: DPT Monitor Reading (ppm)	0-2	BRN	SILT CLAY DAMP ROOTS

COMPOSITE SAMPLE DATA:

	Time	Depth	Color	Description (Sand, Silt, Clay, Moisture, etc.)
Date.				
Method.				
Monitor Readings (Range in ppm)				

SAMPLE COLLECTION INFORMATION:

Analysis	Container Requirements	Collected	Other
Appendix XI VOCs	(4) Encore samplers	✓	
HD	(1) 2 oz glass jar	✓	
Thorium	(1) 8 oz glass	✓	
Added gamma spectrometry to thorium container (check collected block)			
Appendix XI SVOC, PNA, Herbicide, Pesticide/PCBs	(1) 8 oz glass	✓	
Explosives, TAL Metals (plus Sr and Sn)	(1) 8 oz glass	✓	
Added pH and CEC to metals container (check collected block)			
Added TOC to metals container (check collected block)			

OBSERVATIONS / NOTES:

MAP:

Circle if Applicable:

MS/MSD	Duplicate ID No.:
—	

Signature(s):

SOIL SAMPLE LOG SHEET

Project Site Name: NSWC Crane, IN
Project No.: CTO 158 N3959

[] Surface Soil
[✓] Subsurface Soil
[] Sediment
[] Other:
[] QA Sample Type:

Sample ID No.: 015B090206
Sample Location: 015B09
Sampled By: TR
C.O.C. No.:

Type of Sample:
[X] Low Concentration
[] High Concentration

GRAB SAMPLE DATA:

	Depth	Color	Description (Sand, Silt, Clay, Moisture, etc.)
Date 8-26-01 Time 1415 Method: DPT Monitor Reading (ppm)	2-6	BRN	SILT + CLAY DRY

COMPOSITE SAMPLE DATA:

Date.	Time	Depth	Color	Description (Sand, Silt, Clay, Moisture, etc.)
Method				
Monitor Readings				
(Range in ppm).				

SAMPLE COLLECTION INFORMATION:

Analysis	Container Requirements	Collected	Other
Appendix XI VOCs	(4) Encore samplers	✓	
HD	(1) 2 oz glass jar	✓	
Thorium	(1) 8 oz glass	✓	
Added gamma spectrometry to thorium container (check collected block)..			
Appendix XI SVOC, PNA, Herbicide, Pesticide/PCBs	(1) 8 oz glass	✓	
Explosives, TAL Metals (plus Sr and Sn)	(1) 8 oz glass	✓	
Added pH and CEC to metals container (check collected block)....			
Added TOC to metals container (check collected block)..			

OBSERVATIONS / NOTES:

MAP:

Circle if Applicable:

MS/MSD	Duplicate ID No.:
—	FD082601-02

Signature(s): [illegible]

SOIL SAMPLE LOG SHEET

Project Site Name: NSWC Crane, IN
Project No.: CTO 158 N3959

[✓] Surface Soil
[] Subsurface Soil
[] Sediment
[] Other:
[] QA Sample Type:

Sample ID No.: 0155100002
Sample Location: 015310
Sampled By: TR
C.O.C. No.:

Type of Sample:
[X] Low Concentration
[] High Concentration

GRAB SAMPLE DATA:

	Depth	Color	Description (Sand, Silt, Clay, Moisture, etc.)
Date. 8-27-01	0-2	BRN	SILT Roots
Time. 0845		ORL	S-CLAY gravel dry
Method DPT			
Monitor Reading (ppm): 0			

COMPOSITE SAMPLE DATA:

	Time	Depth	Color	Description (Sand, Silt, Clay, Moisture, etc.)
Date				
Method				
Monitor Readings (Range in ppm)				

SAMPLE COLLECTION INFORMATION:

Analysis	Container Requirements	Collected	Other
Appendix XI VOCs	(4) Encore samplers	✓	
HD	(1) 2 oz glass jar	✓	
Thorium	(1) 8 oz glass	✓	
Added gamma spectrometry to thorium container (check collected block)			
Appendix XI SVOC, PNA, Herbicide, Pesticide/PCBs	(1) 8 oz glass	✓	
Explosives, TAL Metals (plus Sr and Sn)	(1) 8 oz glass	✓	
Added pH and CEC to metals container (check collected block)			
Added TOC to metals container (check collected block)			

OBSERVATIONS / NOTES:

MAP:

Circle if Applicable:

MS/MSD YES

Duplicate ID No.:

Signature(s):

SOIL SAMPLE LOG SHEET

Project Site Name: NSWC Crane, IN
Project No.: CTO 158 N3959

[] Surface Soil
[✓] Subsurface Soil
[] Sediment
[] Other:
[] QA Sample Type:

Sample ID No.: 015B100206
Sample Location: 015B10
Sampled By: TR
C.O.C. No.:

Type of Sample:
[X] Low Concentration
[] High Concentration

GRAB SAMPLE DATA:

	Depth	Color	Description (Sand, Silt, Clay, Moisture, etc.)
Date 8-27-01 Time 0905 Method DPT Monitor Reading (ppm): 0.1	2-6	BRN ORG	SILT + CLAY DRY

COMPOSITE SAMPLE DATA:

Date	Time	Depth	Color	Description (Sand, Silt, Clay, Moisture, etc.)
Method.				
Monitor Readings (Range in ppm).				

SAMPLE COLLECTION INFORMATION:

Analysis	Container Requirements	Collected	Other
Appendix XI VOCs	(4) Encore samplers	✓	
HD	(1) 2 oz glass jar	✓	
Thorium	(1) 8 oz glass	✓	
Added gamma spectrometry to thorium container (check collected block).			
Appendix XI SVOC, PNA, Herbicide, Pesticide/PCBs	(1) 8 oz glass	✓	
Explosives, TAL Metals (plus Sr and Sn)	(1) 8 oz glass	✓	
Added pH and CEC to metals container (check collected block)...			
Added TOC to metals container (check collected block)....			

OBSERVATIONS / NOTES:

MAP:

Circle if Applicable:

MS/MSD

Duplicate ID No.:

Signature(s): [illegible]

SOIL SAMPLE LOG SHEET

Project Site Name: NSWC Crane, IN
Project No.: CTO 158 N3959

Sample ID No.: 01-SS-11-002
Sample Location: 01SB11
Sampled By: TR
C.O.C. No.:

- [x] Surface Soil
- [ ] Subsurface Soil
- [ ] Sediment
- [ ] Other:
- [ ] QA Sample Type:

Type of Sample:
- [X] Low Concentration
- [ ] High Concentration

GRAB SAMPLE DATA:

	Depth	Color	Description (Sand, Silt, Clay, Moisture, etc.)
Date 8-22-01 Time 0915 Method DPT Monitor Reading (ppm) 3.4	0-2	BRN	SILT ROOTS DRY

COMPOSITE SAMPLE DATA:

	Time	Depth	Color	Description (Sand, Silt, Clay, Moisture, etc.)
Date				
Method				
Monitor Readings (Range in ppm)				

SAMPLE COLLECTION INFORMATION:

Analysis	Container Requirements	Collected	Other
Appendix XI VOCs	(4) Encore samplers	✓	
HD	(1) 2 oz glass jar	✓	
Thorium	(1) 8 oz glass	✓	
Added gamma spectrometry to thorium container (check collected block)			
Appendix XI SVOC, PNA, Herbicide, Pesticide/PCBs	(1) 8 oz glass	✓	
Explosives, TAL Metals (plus Sr and Sn)	(1) 8 oz glass	✓	
Added pH and CEC to metals container (check collected block)			
Added TOC to metals container (check collected block)			

OBSERVATIONS / NOTES:

MAP:

Circle if Applicable:

MS/MSD

Duplicate ID No.:

Signature(s):

SOIL SAMPLE LOG SHEET

Project Site Name: NSWC Crane, IN
Project No.: CTO 158 N3959

[] Surface Soil
[✓] Subsurface Soil
[] Sediment
[] Other:
[] QA Sample Type:

Sample ID No.: 01-SB-11-0206
Sample Location: 01SB11
Sampled By: TR
C.O.C. No.:

Type of Sample:
[X] Low Concentration
[] High Concentration

GRAB SAMPLE DATA:

	Depth	Color	Description (Sand, Silt, Clay, Moisture, etc.)
Date 8-22-01	2-6	ORG GREY	SILT S-CLAY + SAND DRY
Time 0925			
Method OPT			
Monitor Reading (ppm)			

COMPOSITE SAMPLE DATA:

	Time	Depth	Color	Description (Sand, Silt, Clay, Moisture, etc.)
Date.				
Method.				
Monitor Readings (Range in ppm):				

SAMPLE COLLECTION INFORMATION:

Analysis	Container Requirements	Collected	Other
Appendix XI VOCs	(4) Encore samplers	✓	
HD	(1) 2 oz glass jar	✓	
Thorium	(1) 8 oz glass	✓	
Added gamma spectrometry to thorium container (check collected block).			
Appendix XI SVOC, PNA, Herbicide, Pesticide/PCBs	(1) 8 oz glass	✓	
Explosives, TAL Metals (plus Sr and Sn)	(1) 8 oz glass	✓	
Added pH and CEC to metals container (check collected block)..			
Added TOC to metals container (check collected block).			

OBSERVATIONS / NOTES:

MAP:

Circle if Applicable:

MS/MSD

Duplicate ID No.:

Signature(s):

SOIL SAMPLE LOG SHEET

Project Site Name: NSWC Crane, IN
Project No.: CTO 158 N3959

[] Surface Soil
[✓] Subsurface Soil
[] Sediment
[] Other:
[] QA Sample Type:

Sample ID No.: 01-SB-11-0610
Sample Location: 01SB11
Sampled By: TR
C.O.C. No.:

Type of Sample:
[X] Low Concentration
[] High Concentration

GRAB SAMPLE DATA:

	Depth	Color	Description (Sand, Silt, Clay, Moisture, etc.)
Date 8-22-01	6-10	ORG GREY	SANDY SILT DRY
Time 0940			
Method DPT			
Monitor Reading (ppm) 0			

COMPOSITE SAMPLE DATA:

	Time	Depth	Color	Description (Sand, Silt, Clay, Moisture, etc.)
Date				
Method				
Monitor Readings (Range in ppm).				

SAMPLE COLLECTION INFORMATION:

Analysis	Container Requirements	Collected	Other
Appendix XI VOCs	(4) Encore samplers	✓	
HD	(1) 2 oz glass jar	✓	
Thorium	(1) 8 oz glass	✓	
Added gamma spectrometry to thorium container (check collected block)			
Appendix XI SVOC, PNA, Herbicides, Pesticides/PCBs	(1) 8 oz glass	✓	
Explosives, TAL Metals (plus Sr and Sn)	(1) 8 oz glass	✓	
Added pH and CEC to metals container (check collected block)			
Added TOC to metals container (check collected block)			

OBSERVATIONS / NOTES:

MAP:

Circle if Applicable:

MS/MSD	Duplicate ID No.:
—	—

Signature(s): [signature]

SOIL SAMPLE LOG SHEET

Project Site Name: NSWC Crane, IN
Project No.: CTO 158 N3959

[] Surface Soil
[X] Subsurface Soil
[] Sediment
[] Other:
[] QA Sample Type:

Sample ID No.: 015S120002
Sample Location: 015B12
Sampled By: KS - TR
C.O.C. No.:

Type of Sample:
[X] Low Concentration
[] High Concentration

GRAB SAMPLE DATA:

	Depth	Color	Description (Sand, Silt, Clay, Moisture, etc.)
Date: 8-25-01 Time: 1305 Method: DPT Monitor Reading (ppm)	0-2	BRN	DAMP, TR ROOTS, SILT TR F. SAND

COMPOSITE SAMPLE DATA:

Date:	Time	Depth	Color	Description (Sand, Silt, Clay, Moisture, etc.)
Method:				
Monitor Readings (Range in ppm):				

SAMPLE COLLECTION INFORMATION:

Analysis	Container Requirements	Collected	Other
Appendix XI VOCs	(4) Encore samplers	✓	
HD	(1) 2 oz glass jar	✓	
Thorium	(1) 8 oz glass	✓	
Added gamma spectrometry to thorium container (check collected block)....			
Appendix XI SVOC, PNA, Herbicide, Pesticide/PCBs	(1) 8 oz glass	✓	
Explosives, TAL Metals (plus Sr and Sn)	(1) 8 oz glass	✓	
Added pH and CEC to metals container (check collected block)..			
Added TOC to metals container (check collected block)			

OBSERVATIONS / NOTES:

MAP:

Circle if Applicable:

MS/MSD	Duplicate ID No.:
—	—

Signature(s): KS / SL

SOIL SAMPLE LOG SHEET

Project Site Name: NSWC Crane, IN
Project No.: CTO 158 N3959

[] Surface Soil
[X] Subsurface Soil
[] Sediment
[] Other:
[] QA Sample Type:

Sample ID No.: 01SB120206
Sample Location: 01SB12
Sampled By: RS/TR
C.O.C. No.:

Type of Sample:
[X] Low Concentration
[] High Concentration

GRAB SAMPLE DATA:

	Depth	Color	Description (Sand, Silt, Clay, Moisture, etc.)
Date 8·25·01 Time 1320 Method DPT Monitor Reading (ppm):	02-06	ORN - BRN	CLAY SOME SAND MOIST MOTTLED GRAY/BRN

COMPOSITE SAMPLE DATA:

Date	Time	Depth	Color	Description (Sand, Silt, Clay, Moisture, etc.)
Method				
Monitor Readings (Range in ppm)				

SAMPLE COLLECTION INFORMATION:

Analysis	Container Requirements	Collected	Other
Appendix XI VOCs	(4) Encore samplers	✓	
HD	(1) 2 oz glass jar	✓	
Thorium	(1) 8 oz glass	✓	
Added gamma spectrometry to thorium container (check collected block)..			
Appendix XI SVOC, PNA, Herbicide, Pesticide/PCBs	(1) 8 oz glass	✓	
Explosives, TAL Metals (plus Sr and Sn)	(1) 8 oz glass	✓	
Added pH and CEC to metals container (check collected block)			
Added TOC to metals container (check collected block)			

OBSERVATIONS / NOTES:

MAP:

Circle if Applicable:

MS/MSD	Duplicate ID No.:
—	—

Signature(s):

SOIL SAMPLE LOG SHEET

Project Site Name: NSWC Crane, IN
Project No.: CTO 158 N3959

[] Surface Soil
[X] Subsurface Soil
[] Sediment
[] Other:
[] QA Sample Type:

Sample ID No.: 01SB120610
Sample Location: 01SB12
Sampled By: KS-TR
C.O.C. No.:

Type of Sample:
[X] Low Concentration
[] High Concentration

GRAB SAMPLE DATA:

	Depth	Color	Description (Sand, Silt, Clay, Moisture, etc.)
Date: 8-25-01 Time: 1330 Method: DPT Monitor Reading (ppm):	6-10	TAN GRAY	F. TO MED SAND TR CLAY TR SANDSTONE FRAGS. (SC)

COMPOSITE SAMPLE DATA:

Date	Time	Depth	Color	Description (Sand, Silt, Clay, Moisture, etc.)
Method:				
Monitor Readings (Range in ppm)				

SAMPLE COLLECTION INFORMATION:

Analysis	Container Requirements	Collected	Other
Appendix XI VOCs	(4) Encore samplers	✓	
HD	(1) 2 oz glass jar	✓	
Thorium	(1) 8 oz glass	✓	
Added gamma spectrometry to thorium container (check collected block).....			
Appendix XI SVOC, PNA, ~~Herbicide, Pesticide/PCBs~~	(1) 8 oz glass	✓	
Explosives, TAL Metals (plus Sr and Sn)	(1) 8 oz glass	✓	
Added pH and CEC to metals container (check collected block)			
Added TOC to metals container (check collected block)			

OBSERVATIONS / NOTES:

S/B TO BEDROCK
VERY STIFF LAST 2' MAY BE WEATHERED BEDROCK
DPT RIG COULD NO PUSH PAST 10' HAVING TROUBLE PULLING DPT TOOLS

MAP:

Circle if Applicable:

MS/MSD	Duplicate ID No.:
—	—

Signature(s): KS / EL

SOIL SAMPLE LOG SHEET

Project Site Name: NSWC Crane, IN
Project No.: CTO 158 N3959

[✓] Surface Soil
[] Subsurface Soil
[] Sediment
[] Other:
[] QA Sample Type:

Sample ID No.: 01-SS-130002
Sample Location: 0151313
Sampled By: TR
C.O.C. No.:

Type of Sample:
[X] Low Concentration
[] High Concentration

GRAB SAMPLE DATA:

	Depth	Color	Description (Sand, Silt, Clay, Moisture, etc.)
Date: 8-24-01 Time: 1300 Method: DPT Monitor Reading (ppm): 0	0-2	BROWN	SILT T-CLAY DAMP ROOTS

COMPOSITE SAMPLE DATA:

Date	Time	Depth	Color	Description (Sand, Silt, Clay, Moisture, etc.)
Method				
Monitor Readings (Range in ppm)				

SAMPLE COLLECTION INFORMATION:

Analysis	Container Requirements	Collected	Other
Appendix XI VOCs	(4) Encore samplers	✓	
HD	(1) 2 oz glass jar	✓	
Thorium	(1) 8 oz glass	✓	
Added gamma spectrometry to thorium container (check collected block)			
Appendix XI SVOC, PNA, Herbicide, Pesticide/PCBs	(1) 8 oz glass	✓	
Explosives, TAL Metals (plus Sr and Sn)	(1) 8 oz glass	✓	
Added pH and CEC to metals container (check collected block)		✓	
Added TOC to metals container (check collected block)			

OBSERVATIONS / NOTES:

MAP:

Circle if Applicable:

MS/MSD

Duplicate ID No.:

Signature(s): [illegible]

SOIL SAMPLE LOG SHEET

Project Site Name: NSWC Crane, IN
Project No.: CTO 158 N3959

[] Surface Soil
[✓] Subsurface Soil
[] Sediment
[] Other:
[] QA Sample Type:

Sample ID No.: 01-SB-13-0206
Sample Location: 01SB13
Sampled By: TR
C.O.C. No.:

Type of Sample:
[X] Low Concentration
[] High Concentration

GRAB SAMPLE DATA:

	Depth	Color	Description (Sand, Silt, Clay, Moisture, etc.)
Date 8-24-01	2-6	BRN	SAND + SILT + CLAY
Time 1310		OFG	
Method DPT			DAMP
Monitor Reading (ppm):			

COMPOSITE SAMPLE DATA:

	Time	Depth	Color	Description (Sand, Silt, Clay, Moisture, etc.)
Date				
Method.				
Monitor Readings (Range in ppm)				

SAMPLE COLLECTION INFORMATION:

Analysis	Container Requirements	Collected	Other
Appendix XI VOCs	(4) Encore samplers	✓	
HD	(1) 2 oz glass jar	✓	
Thorium	(1) 8 oz glass	✓	
Added gamma spectrometry to thorium container (check collected block)			
Appendix XI SVOC, PNA, Herbicide, Pesticide/PCBs	(1) 8 oz glass	✓	
Explosives, TAL Metals (plus Sr and Sn)	(1) 8 oz glass	✓	
Added pH and CEC to metals container (check collected block).		✓	
Added TOC to metals container (check collected block).			

OBSERVATIONS / NOTES:

MAP:

Circle if Applicable:

MS/MSD

Duplicate ID No.:

Signature(s):

SOIL SAMPLE LOG SHEET

Project Site Name: NSWC Crane, IN
Project No.: CTO 158 N3959

[] Surface Soil
[✓] Subsurface Soil
[] Sediment
[] Other:
[] QA Sample Type:

Sample ID No.: 01-SB-13-060
Sample Location: 01SB13
Sampled By: TR
C.O.C. No.:

Type of Sample:
[X] Low Concentration
[] High Concentration

GRAB SAMPLE DATA:

	Depth	Color	Description (Sand, Silt, Clay, Moisture, etc.)
Date 8-24-01	6-10	ORG GRY	SILT T-CLAY DRY T-SAND
Time 1335			
Method: DPT			
Monitor Reading (ppm)			

COMPOSITE SAMPLE DATA:

Date	Time	Depth	Color	Description (Sand, Silt, Clay, Moisture, etc.)
Method:				
Monitor Readings (Range in ppm):				

SAMPLE COLLECTION INFORMATION:

Analysis	Container Requirements	Collected	Other
Appendix XI VOCs	(4) Encore samplers	✓	
HD	(1) 2 oz glass jar	✓	
Thorium	(1) 8 oz glass	✓	
Added gamma spectrometry to thorium container (check collected block)...			
Appendix XI SVOC, PNA, ~~Herbicides, Chlorinated PCBs~~	(1) 8 oz glass	✓	
Explosives, TAL Metals (plus Sr and Sn)	(1) 8 oz glass	✓	
Added pH and CEC to metals container (check collected block)			
Added TOC to metals container (check collected block)			

OBSERVATIONS / NOTES:

MAP:

Circle if Applicable:

MS/MSD

Duplicate ID No.:

Signature(s):

SOIL SAMPLE LOG SHEET

Project Site Name: NSWC Crane, IN
Project No.: CTO 158 N3959

[✓] Surface Soil
[] Subsurface Soil
[] Sediment
[] Other:
[] QA Sample Type:

Sample ID No.: 01-SS-14-0002
Sample Location: 01SB14
Sampled By: FR
C.O.C. No.:

Type of Sample:
[X] Low Concentration
[] High Concentration

GRAB SAMPLE DATA:

	Depth	Color	Description (Sand, Silt, Clay, Moisture, etc.)
Date. 8-23-01 Time 1100 Method: OPT Monitor Reading (ppm): 0.1	0-2	BROWN	CLAYEY SILT ROOTS DAMP

COMPOSITE SAMPLE DATA:

Date	Time	Depth	Color	Description (Sand, Silt, Clay, Moisture, etc.)
Method.				
Monitor Readings (Range in ppm)				

SAMPLE COLLECTION INFORMATION:

Analysis	Container Requirements	Collected	Other
Appendix XI VOCs	(4) Encore samplers	✓	
HD	(1) 2 oz glass jar	✓	
Thorium	(1) 8 oz glass	✓	
Added gamma spectrometry to thorium container (check collected block)			
Appendix XI SVOC, PNA, Herbicide, Pesticide/PCBs	(1) 8 oz glass	✓	
Explosives, TAL Metals (plus Sr and Sn)	(1) 8 oz glass	✓	
Added pH and CEC to metals container (check collected block)..			
Added TOC to metals container (check collected block).....			

OBSERVATIONS / NOTES:

MAP:

Circle if Applicable:

MS/MSD	Duplicate ID No.:
—	—

Signature(s): FR

SOIL SAMPLE LOG SHEET

Project Site Name: NSWC Crane, IN
Project No.: CTO 158 N3959

[] Surface Soil
[✓] Subsurface Soil
[] Sediment
[] Other:
[] QA Sample Type:

Sample ID No.: 01-SB-14-0206
Sample Location: 015814
Sampled By: TR
C.O.C. No.:

Type of Sample:
[X] Low Concentration
[] High Concentration

GRAB SAMPLE DATA:

	Depth	Color	Description (Sand, Silt, Clay, Moisture, etc.)
Date 8-27-01 Time 1120 Method: DPT Monitor Reading (ppm) 0.8	2-6	ORG BRN GREY	SILTY CLAY MOTTLED S-SAND DRY

COMPOSITE SAMPLE DATA:

	Time	Depth	Color	Description (Sand, Silt, Clay, Moisture, etc.)
Date				
Method:				
Monitor Readings (Range in ppm):				

SAMPLE COLLECTION INFORMATION:

Analysis	Container Requirements	Collected	Other
Appendix XI VOCs	(4) Encore samplers	✓	
HD	(1) 2 oz glass jar	✓	
Thorium	(1) 8 oz glass	✓	
Added gamma spectrometry to thorium container (check collected block).....			
Appendix XI SVOC, PNA, Herbicide, Pesticide/PCBs	(1) 8 oz glass	✓	
Explosives, TAL Metals (plus Sr and Sn)	(1) 8 oz glass	✓	
Added pH and CEC to metals container (check collected block)			
Added TOC to metals container (check collected block)..			

OBSERVATIONS / NOTES:

MAP:

Circle if Applicable:

MS/MSD

Duplicate ID No.:

Signature(s):

SOIL SAMPLE LOG SHEET

Project Site Name: NSWC Crane, IN
Project No.: CTO 158 N3959

[] Surface Soil
[✓] Subsurface Soil
[] Sediment
[] Other:
[] QA Sample Type:

Sample ID No.: 01-SB-14 0610
Sample Location: 01SB14
Sampled By: PR
C.O.C. No.:

Type of Sample:
[X] Low Concentration
[] High Concentration

GRAB SAMPLE DATA:

	Depth	Color	Description (Sand, Silt, Clay, Moisture, etc.)
Date 8-24-01 Time 1130 Method: DPT Monitor Reading (ppm):	6-8	ORG	FINE SAND + SILT DRY

COMPOSITE SAMPLE DATA:

	Time	Depth	Color	Description (Sand, Silt, Clay, Moisture, etc.)
Date				
Method				
Monitor Readings (Range in ppm).				

SAMPLE COLLECTION INFORMATION:

Analysis	Container Requirements	Collected	Other
Appendix XI VOCs	(4) Encore samplers	✓	
HD	(1) 2 oz glass jar	✓	
Thorium	(1) 8 oz glass	✓	
Added gamma spectrometry to thorium container (check collected block).			
Appendix XI SVOC, PNA, ~~Herbicide, Pesticide/PCBs~~	(1) 8 oz glass	✓	
Explosives, TAL Metals (plus Sr and Sn)	(1) 8 oz glass	✓	
Added pH and CEC to metals container (check collected block)			
Added TOC to metals container (check collected block)..			

OBSERVATIONS / NOTES:

COULD NOT GET TO 10'
PROBLEMS WITH DPT RIG

MAP:

Circle if Applicable:

MS/MSD

Duplicate ID No.:

Signature(s): [illegible]

SOIL SAMPLE LOG SHEET

Project Site Name: NSWC Crane, IN
Project No.: CTO 158 N3959

Sample ID No.: 01-SS-15-0002
Sample Location: 01SB15
Sampled By: TR
C.O.C. No.:

- [x] Surface Soil
- [ ] Subsurface Soil
- [ ] Sediment
- [ ] Other:
- [ ] QA Sample Type:

Type of Sample:
- [X] Low Concentration
- [ ] High Concentration

GRAB SAMPLE DATA:

	Depth	Color	Description (Sand, Silt, Clay, Moisture, etc.)
Date: 8-22-01 Time: 0955 Method: DPT Monitor Reading (ppm): 0.2	0-2	BRN	SILT DRY ROOTS

COMPOSITE SAMPLE DATA:

Date	Time	Depth	Color	Description (Sand, Silt, Clay, Moisture, etc.)
Method:				
Monitor Readings (Range in ppm)				

SAMPLE COLLECTION INFORMATION:

Analysis	Container Requirements	Collected	Other
Appendix XI VOCs	(4) Encore samplers	✓	
HD	(1) 2 oz glass jar	✓	
Thorium	(1) 8 oz glass	✓	
Added gamma spectrometry to thorium container (check collected block)			
Appendix XI SVOC, PNA, Herbicide, Pesticide/PCBs	(1) 8 oz glass	✓	
Explosives, TAL Metals (plus Sr and Sn)	(1) 8 oz glass	✓	
Added pH and CEC to metals container (check collected block)			
Added TOC to metals container (check collected block)			

OBSERVATIONS / NOTES:

ONLY 2 JARS FOR HD
12 ENCORES
3 - THORIUM
6 - EVERY

MAP:

Circle if Applicable:

MS/MSD YES

Duplicate ID No.:

Signature(s):

SOIL SAMPLE LOG SHEET

Project Site Name: NSWC Crane, IN
Project No.: CTO 158 N3959

[] Surface Soil
[✓] Subsurface Soil
[] Sediment
[] Other:
[] QA Sample Type:

Sample ID No.: 01-SB-15-0206
Sample Location: 015B15
Sampled By: TR
C.O.C. No.:

Type of Sample:
[X] Low Concentration
[] High Concentration

GRAB SAMPLE DATA:

	Depth	Color	Description (Sand, Silt, Clay, Moisture, etc.)
Date 8-22-01	2-6	GRN	SILT + CLAY DAMP
Time 1035			
Method: DPT			
Monitor Reading (ppm): 0.1			

COMPOSITE SAMPLE DATA:

Date	Time	Depth	Color	Description (Sand, Silt, Clay, Moisture, etc.)
Method.				
Monitor Readings (Range in ppm)				

SAMPLE COLLECTION INFORMATION:

Analysis	Container Requirements	Collected	Other
Appendix XI VOCs	(4) Encore samplers	✓	
HD	(1) 2 oz glass jar	✓	
Thorium	(1) 8 oz glass	✓	
Added gamma spectrometry to thorium container (check collected block)			
Appendix XI SVOC, PNA, Herbicide, Pesticide/PCBs	(1) 8 oz glass	✓	
Explosives, TAL Metals (plus Sr and Sn)	(1) 8 oz glass	✓	
Added pH and CEC to metals container (check collected block)			
Added TOC to metals container (check collected block)			

OBSERVATIONS / NOTES:

MAP:

Circle if Applicable:

MS/MSD

Duplicate ID No.:

Signature(s):

SOIL SAMPLE LOG SHEET

Project Site Name: NSWC Crane, IN
Project No.: CTO 158 N3959

[] Surface Soil
[✓] Subsurface Soil
[] Sediment
[] Other:
[] QA Sample Type:

Sample ID No.: 01-SB-15-0610
Sample Location: 015015
Sampled By: TR
C.O.C. No.:

Type of Sample:
[X] Low Concentration
[] High Concentration

GRAB SAMPLE DATA:

	Depth	Color	Description (Sand, Silt, Clay, Moisture, etc.)
Date 8-22-01	6-10	ORG GREY	SILT + CLAY MOTTLED DRY
Time 1050			
Method. DPT			
Monitor Reading (ppm) 0.1			

COMPOSITE SAMPLE DATA:

Date:	Time	Depth	Color	Description (Sand, Silt, Clay, Moisture, etc.)
Method				
Monitor Readings (Range in ppm).				

SAMPLE COLLECTION INFORMATION:

Analysis	Container Requirements	Collected	Other
Appendix XI VOCs	(4) Encore samplers	✓	
HD	(1) 2 oz glass jar	✓	
Thorium	(1) 8 oz glass	✓	
Added gamma spectrometry to thorium container (check collected block)....			
Appendix XI SVOC, PNA, [redacted]	(1) 8 oz glass	✓	
Explosives, TAL Metals (plus Sr and Sn)	(1) 8 oz glass	✓	
Added pH and CEC to metals container (check collected block)...			
Added TOC to metals container (check collected block)..			

OBSERVATIONS / NOTES:

DUP COLLECTED

MAP:

Circle if Applicable:

MS/MSD	Duplicate ID No.:
—	F0082201-01

Signature(s): [illegible]

SOIL SAMPLE LOG SHEET

Project Site Name: NSWC Crane, IN
Project No.: CTO 158 N3959

[✓] Surface Soil
[] Subsurface Soil
[] Sediment
[] Other:
[] QA Sample Type:

Sample ID No.: 01-SS-16-0002
Sample Location: 015016
Sampled By: TR
C.O.C. No.:

Type of Sample:
[X] Low Concentration
[] High Concentration

GRAB SAMPLE DATA:

	Depth	Color	Description (Sand, Silt, Clay, Moisture, etc.)
Date: 8-21-01	0-2	BRN	SILT gravel
Time: 1525			
Method: DPT			
Monitor Reading (ppm)			

COMPOSITE SAMPLE DATA:

	Time	Depth	Color	Description (Sand, Silt, Clay, Moisture, etc.)
Date				
Method				
Monitor Readings (Range in ppm):				

SAMPLE COLLECTION INFORMATION:

Analysis	Container Requirements	Collected	Other
Appendix XI VOCs	(4) Encore samplers	✓	
HD	(1) 2 oz glass jar	✓	
Thorium	(1) 8 oz glass	✓	
Added gamma spectrometry to thorium container (check collected block).....			
Appendix XI SVOC, PNA, Herbicide, Pesticide/PCBs	(1) 8 oz glass	✓	
Explosives, TAL Metals (plus Sr and Sn)	(1) 8 oz glass	✓	
Added pH and CEC to metals container (check collected block)			
Added TOC to metals container (check collected block).....			

OBSERVATIONS / NOTES:

MAP:

Circle if Applicable:

MS/MSD

Duplicate ID No.:

Signature(s):

SOIL SAMPLE LOG SHEET

Project Site Name: NSWC Crane, IN
Project No.: CTO 158 N3959

[] Surface Soil
[X] Subsurface Soil
[] Sediment
[] Other:
[] QA Sample Type:

Sample ID No.: 01-5316-0206
Sample Location: OS316
Sampled By: TR
C.O.C. No.:

Type of Sample:
[X] Low Concentration
[] High Concentration

GRAB SAMPLE DATA:

	Depth	Color	Description (Sand, Silt, Clay, Moisture, etc.)
Date 8-21-01 Time: 1540 Method: DPT Monitor Reading (ppm): 0	2-6	BRN ORG	SILT T-CLAY MOTTLED DRY

COMPOSITE SAMPLE DATA:

Date	Time	Depth	Color	Description (Sand, Silt, Clay, Moisture, etc.)
Method.				
Monitor Readings (Range in ppm).				

SAMPLE COLLECTION INFORMATION:

Analysis	Container Requirements	Collected	Other
Appendix XI VOCs	(4) Encore samplers	✓	
HD	(1) 2 oz glass jar	✓	
Thorium	(1) 8 oz glass	✓	
Added gamma spectrometry to thorium container (check collected block)			
Appendix XI SVOC, PNA, Herbicide, Pesticide/PCBs	(1) 8 oz glass	✓	
Explosives, TAL Metals (plus Sr and Sn)	(1) 8 oz glass	✓	
Added pH and CEC to metals container (check collected block)			
Added TOC to metals container (check collected block)			

OBSERVATIONS / NOTES:

MAP:

Circle if Applicable:

MS/MSD	Duplicate ID No.:
—	—

Signature(s):

SOIL SAMPLE LOG SHEET

Project Site Name: NSWC Crane, IN
Project No.: CTO 158 N3959

[] Surface Soil
[✓] Subsurface Soil
[] Sediment
[] Other:
[] QA Sample Type:

Sample ID No.: 01-SB-16-0610
Sample Location: 01SB16
Sampled By: TR
C.O.C. No.:

Type of Sample:
[X] Low Concentration
[] High Concentration

GRAB SAMPLE DATA:

	Depth	Color	Description (Sand, Silt, Clay, Moisture, etc.)
Date: 8-21-01	6-10	ORG GRY	FINE SAND + SILT DRY
Time: 1555			
Method: DPT			
Monitor Reading (ppm)			

COMPOSITE SAMPLE DATA:

Date	Time	Depth	Color	Description (Sand, Silt, Clay, Moisture, etc.)
Method:				
Monitor Readings (Range in ppm):				

SAMPLE COLLECTION INFORMATION:

Analysis	Container Requirements	Collected	Other
Appendix XI VOCs	(4) Encore samplers	✓	
HD	(1) 2 oz glass jar	✓	
Thorium	(1) 8 oz glass	✓	
Added gamma spectrometry to thorium container (check collected block).			
Appendix XI SVOC, PNA, [redacted]	(1) 8 oz glass	✓	
Explosives, TAL Metals (plus Sr and Sn)	(1) 8 oz glass	✓	
Added pH and CEC to metals container (check collected block).....			
Added TOC to metals container (check collected block)...			

OBSERVATIONS / NOTES:

MAP:

Circle if Applicable:

MS/MSD

Duplicate ID No.:

Signature(s):

SOIL SAMPLE LOG SHEET

Project Site Name: NSWC Crane, IN
Project No.: CTO 158 N3959

[✓] Surface Soil
[ ] Subsurface Soil
[ ] Sediment
[ ] Other:
[ ] QA Sample Type:

Sample ID No.: 01-SS-17-0002
Sample Location: 015317
Sampled By: TR
C.O.C. No.:

Type of Sample:
[X] Low Concentration
[ ] High Concentration

GRAB SAMPLE DATA:

	Depth	Color	Description (Sand, Silt, Clay, Moisture, etc.)
Date 8-24-01 Time: 1635 Method. DPT Monitor Reading (ppm)	0-2	BRN	SILT DAMP T-CLAY ROOTS

COMPOSITE SAMPLE DATA:

	Time	Depth	Color	Description (Sand, Silt, Clay, Moisture, etc.)
Date				
Method				
Monitor Readings (Range in ppm)				

SAMPLE COLLECTION INFORMATION:

Analysis	Container Requirements	Collected	Other
Appendix XI VOCs	(4) Encore samplers	✓	
HD	(1) 2 oz glass jar	✓	
Thorium	(1) 8 oz glass	✓	
Added gamma spectrometry to thorium container (check collected block)			
Appendix XI SVOC, PNA, Herbicide, Pesticide/PCBs	(1) 8 oz glass	✓	
Explosives, TAL Metals (plus Sr and Sn)	(1) 8 oz glass	✓	
Added pH and CEC to metals container (check collected block)			
Added TOC to metals container (check collected block)			

OBSERVATIONS / NOTES:

MAP:

Circle if Applicable:

MS/MSD

Duplicate ID No.:

Signature(s):

SOIL SAMPLE LOG SHEET

Project Site Name: NSWC Crane, IN
Project No.: CTO 158 N3959

[] Surface Soil
[✓] Subsurface Soil
[] Sediment
[] Other:
[] QA Sample Type:

Sample ID No.: 01-SB-17-0206
Sample Location: 01SB17
Sampled By: TR
C.O.C. No.:

Type of Sample:
[X] Low Concentration
[] High Concentration

GRAB SAMPLE DATA:

	Depth	Color	Description (Sand, Silt, Clay, Moisture, etc.)
Date: 8-24-01 Time: 1645 Method: DPT Monitor Reading (ppm):	2-6	BRN	SILT + CLAY DAMP

COMPOSITE SAMPLE DATA:

	Time	Depth	Color	Description (Sand, Silt, Clay, Moisture, etc.)
Date:				
Method:				
Monitor Readings (Range in ppm)				

SAMPLE COLLECTION INFORMATION:

Analysis	Container Requirements	Collected	Other
Appendix XI VOCs	(4) Encore samplers	✓	
HD	(1) 2 oz glass jar	✓	
Thorium	(1) 8 oz glass	✓	
Added gamma spectrometry to thorium container (check collected block)			
Appendix XI SVOC, PNA, Herbicide, Pesticide/PCBs	(1) 8 oz glass	✓	
Explosives, TAL Metals (plus Sr and Sn)	(1) 8 oz glass	✓	
Added pH and CEC to metals container (check collected block)			
Added TOC to metals container (check collected block)			

OBSERVATIONS / NOTES:

MAP:

Circle if Applicable:

MS/MSD	Duplicate ID No.:

Signature(s):

SOIL SAMPLE LOG SHEET

Project Site Name: NSWC Crane, IN
Project No.: CTO 158 N3959

[] Surface Soil
[✓] Subsurface Soil
[] Sediment
[] Other:
[] QA Sample Type:

Sample ID No.: 01-SB-17-0610
Sample Location: 01SB17
Sampled By: TR
C.O.C. No.:

Type of Sample:
[X] Low Concentration
[] High Concentration

GRAB SAMPLE DATA:

	Depth	Color	Description (Sand, Silt, Clay, Moisture, etc.)
Date 8-24-01 Time 1655 Method DPT Monitor Reading (ppm):	6 - 9.7	GRAY - ORANGE	CLAY ~~SILT~~ SOME SILT, TR SAND

COMPOSITE SAMPLE DATA:

	Time	Depth	Color	Description (Sand, Silt, Clay, Moisture, etc.)
Date				
Method				
Monitor Readings (Range in ppm)				

SAMPLE COLLECTION INFORMATION:

Analysis	Container Requirements	Collected	Other
Appendix XI VOCs	(4) Encore samplers	✓	
HD	(1) 2 oz glass jar	✓	
Thorium	(1) 8 oz glass	✓	
Added gamma spectrometry to thorium container (check collected block).			
Appendix XI SVOC, PNA, ~~Herbicides, Pesticides/PCBs~~	(1) 8 oz glass	✓	
Explosives, TAL Metals (plus Sr and Sn)	(1) 8 oz glass	✓	
Added pH and CEC to metals container (check collected block).			
Added TOC to metals container (check collected block)			

OBSERVATIONS / NOTES:

MAP:

Circle if Applicable:

MS/MSD	Duplicate ID No.:
—	—

Signature(s):

SOIL SAMPLE LOG SHEET

Project Site Name: NSWC Crane, IN
Project No.: CTO 158 N3959

[✓] Surface Soil
[] Subsurface Soil
[] Sediment
[] Other:
[] QA Sample Type:

Sample ID No.: 01-SS-18-0002
Sample Location: 015B18
Sampled By: TR
C.O.C. No.:

Type of Sample:
[X] Low Concentration
[] High Concentration

GRAB SAMPLE DATA:

	Depth	Color	Description (Sand, Silt, Clay, Moisture, etc.)
Date: 8-24-01	0-2	BRN ORG	SILT + CLAY
Time 1400			ROOTS PARP
Method. DPT			
Monitor Reading (ppm) 0			

COMPOSITE SAMPLE DATA:

Date.	Time	Depth	Color	Description (Sand, Silt, Clay, Moisture, etc.)
Method				
Monitor Readings (Range in ppm)				

SAMPLE COLLECTION INFORMATION:

Analysis	Container Requirements	Collected	Other
Appendix XI VOCs	(4) Encore samplers	✓	
HD	(1) 2 oz glass jar	✓	
Thorium	(1) 8 oz glass	✓	
Added gamma spectrometry to thorium container (check collected block)			
Appendix XI SVOC, PNA, Herbicide, Pesticide/PCBs	(1) 8 oz glass	✓	
Explosives, TAL Metals (plus Sr and Sn)	(1) 8 oz glass	✓	
Added pH and CEC to metals container (check collected block)			
Added TOC to metals container (check collected block)			

OBSERVATIONS / NOTES:

MAP:

Circle if Applicable:

MS/MSD

Duplicate ID No.:

Signature(s):

SOIL SAMPLE LOG SHEET

Project Site Name: NSWC Crane, IN
Project No.: CTO 158 N3959

[] Surface Soil
[✓] Subsurface Soil
[] Sediment
[] Other:
[] QA Sample Type:

Sample ID No.: 01-SB-18-0206
Sample Location: 01SB18
Sampled By: TR
C.O.C. No.:

Type of Sample:
[X] Low Concentration
[] High Concentration

GRAB SAMPLE DATA:

	Depth	Color	Description (Sand, Silt, Clay, Moisture, etc.)
Date: 8-24-01 Time: 1415 Method: DPT Monitor Reading (ppm): 0	2-6	ORG GRY	SILT + CLAY DRY MOTTLED

COMPOSITE SAMPLE DATA:

	Time	Depth	Color	Description (Sand, Silt, Clay, Moisture, etc.)
Date				
Method				
Monitor Readings (Range in ppm):				

SAMPLE COLLECTION INFORMATION:

Analysis	Container Requirements	Collected	Other
Appendix XI VOCs	(4) Encore samplers	✓	
HD	(1) 2 oz glass jar	✓	
Thorium	(1) 8 oz glass	✓	
Added gamma spectrometry to thorium container (check collected block)			
Appendix XI SVOC, PNA, Herbicide, Pesticide/PCBs	(1) 8 oz glass	✓	
Explosives, TAL Metals (plus Sr and Sn)	(1) 8 oz glass	✓	
Added pH and CEC to metals container (check collected block)			
Added TOC to metals container (check collected block)			

OBSERVATIONS / NOTES:

MAP:

Circle if Applicable:

MS/MSD	Duplicate ID No.:
—	—

Signature(s):

SOIL SAMPLE LOG SHEET

Project Site Name: NSWC Crane, IN
Project No.: CTO 158 N3959

[] Surface Soil
[✓] Subsurface Soil
[] Sediment
[] Other:
[] QA Sample Type:

Sample ID No.: 01-SB-18-0810
Sample Location: 013318
Sampled By: TR
C.O.C. No.:

Type of Sample:
[X] Low Concentration
[] High Concentration

GRAB SAMPLE DATA:

	Depth	Color	Description (Sand, Silt, Clay, Moisture, etc.)
Date: 8-24-01	6-8	BRN	DRY SILT
Time: 1435			S-SAND
Method: DPT			
Monitor Reading (ppm)			

COMPOSITE SAMPLE DATA:

	Time	Depth	Color	Description (Sand, Silt, Clay, Moisture, etc.)
Date:				
Method:				
Monitor Readings (Range in ppm):				

SAMPLE COLLECTION INFORMATION:

Analysis	Container Requirements	Collected	Other
Appendix XI VOCs	(4) Encore samplers	✓	
HD	(1) 2 oz glass jar	✓	
Thorium	(1) 8 oz glass	✓	
Added gamma spectrometry to thorium container (check collected block)...			
Appendix XI SVOC, PNA, Herbicide, Pesticide/PCBs	(1) 8 oz glass	✓	
Explosives, TAL Metals (plus Sr and Sn)	(1) 8 oz glass	✓	
Added pH and CEC to metals container (check collected block)			
Added TOC to metals container (check collected block)			

OBSERVATIONS / NOTES:

MAP:

Circle if Applicable:

MS/MSD

Duplicate ID No.:

Signature(s):

SOIL SAMPLE LOG SHEET

Project Site Name: NSWC Crane, IN
Project No.: CTO 158 N3959

[✓] Surface Soil
[] Subsurface Soil
[] Sediment
[] Other:
[] QA Sample Type:

Sample ID No.: 01-SS-19-0002
Sample Location: 015819
Sampled By: TR
C.O.C. No.:

Type of Sample:
[X] Low Concentration
[] High Concentration

GRAB SAMPLE DATA:

	Depth	Color	Description (Sand, Silt, Clay, Moisture, etc.)
Date 8-24-01 Time 1515 Method: DPT Monitor Reading (ppm): 0	0-2	ORG GREY	SILTY CLAY MOTTLED DRY

COMPOSITE SAMPLE DATA:

Date	Time	Depth	Color	Description (Sand, Silt, Clay, Moisture, etc.)
Method:				
Monitor Readings (Range in ppm).				

SAMPLE COLLECTION INFORMATION:

Analysis	Container Requirements	Collected	Other
Appendix XI VOCs	(4) Encore samplers	✓	
HD	(1) 2 oz glass jar	✓	
Thorium	(1) 8 oz glass	✓	
Added gamma spectrometry to thorium container (check collected block)..			
Appendix XI SVOC, PNA, Herbicide, Pesticide/PCBs	(1) 8 oz glass	✓	
Explosives, TAL Metals (plus Sr and Sn)	(1) 8 oz glass	✓	
Added pH and CEC to metals container (check collected block).....			
Added TOC to metals container (check collected block).			

OBSERVATIONS / NOTES:

MAP:

Circle if Applicable:

MS/MSD

Duplicate ID No.:

Signature(s):

SOIL SAMPLE LOG SHEET

Project Site Name: NSWC Crane, IN
Project No.: CTO 158 N3959

[] Surface Soil
[✓] Subsurface Soil
[] Sediment
[] Other:
[] QA Sample Type:

Sample ID No.: 01-SB-19-0206
Sample Location: 015B19
Sampled By: TR
C.O.C. No.:

Type of Sample:
[X] Low Concentration
[] High Concentration

GRAB SAMPLE DATA:

	Depth	Color	Description (Sand, Silt, Clay, Moisture, etc.)
Date 8-24-01	2-6	BRN ORG	SILT + CLAY DRY
Time 1525			
Method DPT			
Monitor Reading (ppm):			

COMPOSITE SAMPLE DATA:

Date	Time	Depth	Color	Description (Sand, Silt, Clay, Moisture, etc.)
Method:				
Monitor Readings (Range in ppm)				

SAMPLE COLLECTION INFORMATION:

Analysis	Container Requirements	Collected	Other
Appendix XI VOCs	(4) Encore samplers	✓	
HD	(1) 2 oz glass jar	✓	
Thorium	(1) 8 oz glass	✓	
Added gamma spectrometry to thorium container (check collected block)			
Appendix XI SVOC, PNA, Herbicide, Pesticide/PCBs	(1) 8 oz glass	✓	
Explosives, TAL Metals (plus Sr and Sn)	(1) 8 oz glass	✓	
Added pH and CEC to metals container (check collected block)			
Added TOC to metals container (check collected block)			

OBSERVATIONS / NOTES:

MAP:

Circle if Applicable:

MS/MSD	Duplicate ID No.:
—	FD 082401-01

Signature(s):

SOIL SAMPLE LOG SHEET

Project Site Name: NSWC Crane, IN
Project No.: CTO 158 N3959

[] Surface Soil
[✓] Subsurface Soil
[] Sediment
[] Other:
[] QA Sample Type:

Sample ID No.: 01-SB-19-0610
Sample Location: 015019
Sampled By: TR
C.O.C. No.:

Type of Sample:
[X] Low Concentration
[] High Concentration

GRAB SAMPLE DATA:

	Depth	Color	Description (Sand, Silt, Clay, Moisture, etc.)
Date. 8-24-01 Time 1550 Method: DPT Monitor Reading (ppm).	6-8	ORG	SILTY SAND S-CLAY ROOTS

COMPOSITE SAMPLE DATA:

	Time	Depth	Color	Description (Sand, Silt, Clay, Moisture, etc.)
Date.				
Method				
Monitor Readings (Range in ppm)				

SAMPLE COLLECTION INFORMATION:

Analysis	Container Requirements	Collected	Other
Appendix XI VOCs	(4) Encore samplers	✓	
HD	(1) 2 oz glass jar	✓	
Thorium	(1) 8 oz glass	✓	
Added gamma spectrometry to thorium container (check collected block).			
Appendix XI SVOC, PNA, ~~Herbicide, Pesticide/PCB~~	(1) 8 oz glass	✓	
Explosives, TAL Metals (plus Sr and Sn)	(1) 8 oz glass	✓	
Added pH and CEC to metals container (check collected block).			
Added TOC to metals container (check collected block).			

OBSERVATIONS / NOTES:

MAP:

Circle if Applicable:

MS/MSD	Duplicate ID No.:
—	—

Signature(s): [signature]

SOIL SAMPLE LOG SHEET

Project Site Name: NSWC Crane, IN
Project No.: CTO 158 N3959

[✓] Surface Soil
[ ] Subsurface Soil
[ ] Sediment
[ ] Other:
[ ] QA Sample Type:

Sample ID No.: 01-SS-20-0002
Sample Location: 015320
Sampled By: TR
C.O.C. No.:

Type of Sample:
[X] Low Concentration
[ ] High Concentration

GRAB SAMPLE DATA:

	Depth	Color	Description (Sand, Silt, Clay, Moisture, etc.)
Date 8-21-01 Time 1435 Method DPT Monitor Reading (ppm):	0-2	BRN	SILT ROOTS damp

COMPOSITE SAMPLE DATA:

Date	Time	Depth	Color	Description (Sand, Silt, Clay, Moisture, etc.)
Method.				
Monitor Readings (Range in ppm):				

SAMPLE COLLECTION INFORMATION:

Analysis	Container Requirements	Collected	Other
Appendix XI VOCs	(4) Encore samplers	✓	
HD	(1) 2 oz glass jar	✓	
Thorium	(1) 8 oz glass	✓	
Added gamma spectrometry to thorium container (check collected block).....			
Appendix XI SVOC, PNA, Herbicide, Pesticide/PCBs	(1) 8 oz glass	✓	
Explosives, TAL Metals (plus Sr and Sn)	(1) 8 oz glass	✓	
Added pH and CEC to metals container (check collected block)		✓	
Added TOC to metals container (check collected block)			

OBSERVATIONS / NOTES:

MAP:

Circle if Applicable:

MS/MSD	Duplicate ID No.:
—	—

Signature(s): [illegible]

SOIL SAMPLE LOG SHEET

Project Site Name: NSWC Crane, IN
Project No.: CTO 158 N3959

[] Surface Soil
[✓] Subsurface Soil
[] Sediment
[] Other:
[] QA Sample Type:

Sample ID No.: 01-SB-20-0206
Sample Location: 015020
Sampled By: TR
C.O.C. No.:

Type of Sample:
[X] Low Concentration
[] High Concentration

GRAB SAMPLE DATA:

	Depth	Color	Description (Sand, Silt, Clay, Moisture, etc.)
Date 8-21-01	2-6	BRN	SILT T-CLAY
Time 1455		ORG.	DRY T-SAND
Method: DPT			
Monitor Reading (ppm):			

COMPOSITE SAMPLE DATA:

	Time	Depth	Color	Description (Sand, Silt, Clay, Moisture, etc.)
Date				
Method:				
Monitor Readings (Range in ppm).				

SAMPLE COLLECTION INFORMATION:

Analysis	Container Requirements	Collected	Other
Appendix XI VOCs	(4) Encore samplers	✓	
HD	(1) 2 oz glass jar	✓	
Thorium	(1) 8 oz glass	✓	
Added gamma spectrometry to thorium container (check collected block).....			
Appendix XI SVOC, PNA, Herbicide, Pesticide/PCBs	(1) 8 oz glass	✓	
Explosives, TAL Metals (plus Sr and Sn)	(1) 8 oz glass	✓	
Added pH and CEC to metals container (check collected block).....		✓	
Added TOC to metals container (check collected block)			

OBSERVATIONS / NOTES:

MAP:

Circle if Applicable:

MS/MSD	Duplicate ID No.:
—	—

Signature(s): [illegible]

SOIL SAMPLE LOG SHEET

Project Site Name: NSWC Crane, IN
Project No.: CTO 158 N3959

[] Surface Soil
[✓] Subsurface Soil
[] Sediment
[] Other:
[] QA Sample Type:

Sample ID No.: 01-SB-20-0610
Sample Location: 015B20
Sampled By: TR
C.O.C. No.:

Type of Sample:
[X] Low Concentration
[] High Concentration

GRAB SAMPLE DATA:

	Depth	Color	Description (Sand, Silt, Clay, Moisture, etc.)
Date: 8-21-01 Time: 1510 Method: DPT Monitor Reading (ppm):	6-8	ORG	SAND / SILT DRY CRUMBLY

COMPOSITE SAMPLE DATA:

	Time	Depth	Color	Description (Sand, Silt, Clay, Moisture, etc.)
Date:				
Method:				
Monitor Readings (Range in ppm).				

SAMPLE COLLECTION INFORMATION:

Analysis	Container Requirements	Collected	Other
Appendix XI VOCs	(4) Encore samplers	✓	
HD	(1) 2 oz glass jar	✓	
Thorium	(1) 8 oz glass	✓	
Added gamma spectrometry to thorium container (check collected block)....			
Appendix XI SVOC, PNA, ~~Herbicide, Pesticide/PCBs~~	(1) 8 oz glass	✓	
Explosives, TAL Metals (plus Sr and Sn)	(1) 8 oz glass	✓	
Added pH and CEC to metals container (check collected block)..		✓	
Added TOC to metals container (check collected block)			

OBSERVATIONS / NOTES:

MAP:

Circle if Applicable:

MS/MSD	Duplicate ID No.:

Signature(s): [illegible]

SOIL SAMPLE LOG SHEET

Project Site Name: NSWC Crane, IN
Project No.: CTO 158 N3959

Sample ID No.: 01-SS-21-0002
Sample Location: 015B21
Sampled By: TR
C.O.C. No.:

- [x] Surface Soil
- [ ] Subsurface Soil
- [ ] Sediment
- [ ] Other:
- [ ] QA Sample Type:

Type of Sample:
- [X] Low Concentration
- [ ] High Concentration

GRAB SAMPLE DATA:

	Depth	Color	Description (Sand, Silt, Clay, Moisture, etc.)
Date. 8-21-01 Time 1045 Method DPT Monitor Reading (ppm) 0	0-2	ORG GREY	TR ROOTS, DAMP CLAY MOTTLED

COMPOSITE SAMPLE DATA:

Date	Time	Depth	Color	Description (Sand, Silt, Clay, Moisture, etc.)
Method				
Monitor Readings (Range in ppm)				

SAMPLE COLLECTION INFORMATION:

Analysis	Container Requirements	Collected	Other
Appendix XI VOCs	(4) Encore samplers		
HD	(1) 2 oz glass jar		
Thorium	(1) 8 oz glass	✓	
Added gamma spectrometry to thorium container (check collected block)			
Appendix XI SVOC, PNA, Herbicide, Pesticide/PCBs	(1) 8 oz glass		
Explosives, TAL Metals (plus Sr and Sn)	(1) 8 oz glass		
Added pH and CEC to metals container (check collected block)			
Added TOC ~~to metals container (check collected block)~~		✓	

OBSERVATIONS / NOTES:

80 TO 140 X10 RAD. METER

MAP:

ACCROSS FROM BUNKER 1405

BACKGROUND

Circle if Applicable:

MS/MSD

Duplicate ID No.:

Signature(s):

SOIL SAMPLE LOG SHEET

Project Site Name: NSWC Crane, IN
Project No.: CTO 158 N3959

[] Surface Soil
[✓] Subsurface Soil
[] Sediment
[] Other:
[] QA Sample Type:

Sample ID No.: 01-SB-21-0206
Sample Location: 065821
Sampled By: TR
C.O.C. No.:

Type of Sample:
[X] Low Concentration
[] High Concentration

GRAB SAMPLE DATA:

	Depth	Color	Description (Sand, Silt, Clay, Moisture, etc.)
Date: 8-21-01		BRN	ORG DRY
Time: 1055	←	2-6	SILT
Method: DPT			
Monitor Reading (ppm): 0			

COMPOSITE SAMPLE DATA:

	Time	Depth	Color	Description (Sand, Silt, Clay, Moisture, etc.)
Date				
Method:				
Monitor Readings (Range in ppm):				

SAMPLE COLLECTION INFORMATION:

Analysis	Container Requirements	Collected	Other
Appendix XI VOCs	(4) Encore samplers		
HD	(1) 2 oz glass jar		
Thorium	(1) 8 oz glass	✓	
Added gamma spectrometry to thorium container (check collected block)			
Appendix XI SVOC, PNA, Herbicide, Pesticide/PCBs	(1) 8 oz glass		
Explosives, TAL Metals (plus Sr and Sn)	(1) 8 oz glass		
Added pH and CEC to metals container (check collected block)			
Added TOC to metals container (check collected block)		✓	

OBSERVATIONS / NOTES:

80 to 110 x10 RAD. METER

MAP:

SEE 01-SS-21-0002

Circle if Applicable:

MS/MSD —

Duplicate ID No.: —

Signature(s):

SOIL SAMPLE LOG SHEET

Project Site Name: NSWC Crane, IN
Project No.: CTO 158 N3959

[] Surface Soil
[✓] Subsurface Soil
[] Sediment
[] Other:
[] QA Sample Type:

Sample ID No.: 01-SB-21-0610
Sample Location: 0161321
Sampled By: TR
C.O.C. No.:

Type of Sample:
[X] Low Concentration
[] High Concentration

GRAB SAMPLE DATA:

	Depth	Color	Description (Sand, Silt, Clay, Moisture, etc.)
Date 8-21-01 Time 1115 Method: DPT Monitor Reading (ppm).	6-10	ORG	FINE GR. SAND DRY

COMPOSITE SAMPLE DATA:

	Time	Depth	Color	Description (Sand, Silt, Clay, Moisture, etc.)
Date.				
Method:				
Monitor Readings (Range in ppm)				

SAMPLE COLLECTION INFORMATION:

Analysis	Container Requirements	Collected	Other
Appendix XI VOCs	(4) Encore samplers		
HD	(1) 2 oz glass jar		
Thorium	(1) 8 oz glass	✓	
Added gamma spectrometry to thorium container (check collected block)			
Appendix XI SVOC, PNA, Herbicide, Pesticide/PCBs	(1) 8 oz glass		
Explosives, TAL Metals (plus Sr and Sn)	(1) 8 oz glass		
Added pH and CEC to metals container (check collected block)			
Added TOC to metals container (check collected block)		✓	

OBSERVATIONS / NOTES:

80 TO 140 X10 RAD. METER

X VOL FOR DUP ON TOC ONLY

MAP:

SEE 01-SS-21-0002

Circle if Applicable:

MS/MSD —

Duplicate ID No.: YES

Signature(s):

FDOB2101 02

APPENDIX B-7

SURFACE WATER SAMPLE LOG SHEETS

Tetra Tech NUS, Inc.

SURFACE WATER SAMPLE LOG SHEET

Project Site Name: NSWC Crane
Project No: N3959

[X] Stream
[] Spring
[] Pond
[] Lake
[] Other:
[] QA Sample Type:

Sample ID No.: 01SW0102
Sample Location: 01SW01
Sampled By: KES/SJC
C.O.C No.:

Type of Sample:
[X] Low Concentration
[] High Concentration

SAMPLING DATA: LAMOTTE

Date: 6-17-02	Color Visual	pH Standard	S.C. mS/cm	Temp. Degrees C	Turbidity NTU	DO mg/l	Salinity %	Other NA ORP
Time: 1440								
Depth 2-4"	CLEAR	6.60	.114	17.08	5.1	6.63	—	335.9
Method. DIRECT FILL								

SAMPLE COLLECTION INFORMATION:

Analysis	Preservative	Container Requirements	Collected
Appendix IX Volatiles	4°C & HCl	(3) 40-ml vial	✓

OBSERVATIONS / NOTES:

1 → 2 GPM
EST. FLOW

SEDIMENT ALSO COLLECTED AT THIS LOCATION

MAP:

SAME AS SD01

Circle if Applicable:

MS/MSD	Duplicate ID No.:
—	—

Signature(s): SJ Conti

Tetra Tech NUS, Inc.

SURFACE WATER SAMPLE LOG SHEET

Project Site Name: NSWC Crane
Project No.: N3959

[X] Stream
[] Spring
[] Pond
[] Lake
[] Other:
[] QA Sample Type:

Sample ID No.: 01SW0202
Sample Location: 01SW02
Sampled By: KES/SJC
C.O.C. No.:

Type of Sample:
[X] Low Concentration
[] High Concentration

SAMPLING DATA: LAMOTTE

	Color Visual	pH Standard	S.C. mS/cm	Temp. Degrees C	Turbidity NTU	DO mg/l	Salinity %	Other NA ORP
Date: 6-17-02								
Time: 1405								
Depth: 2-4"	CLEAR	6.41	.121	17.53	5.4	2.94	—	278.4
Method: DIRECT FILL								

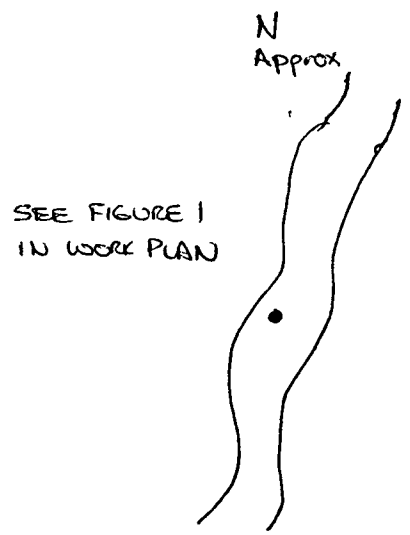
SAMPLE COLLECTION INFORMATION:

Analysis	Preservative	Container Requirements	Collected
Appendix IX Volatiles	~~40C~~ & HCl	(3) 40-ml vial	✓
	4°C		

OBSERVATIONS / NOTES:

FLOW 2 2 GPM

MAP:



Circle if Applicable:

MS/MSD: —
Duplicate ID No.: —

Signature(s): SJ Conti

Tetra Tech NUS, Inc.

SURFACE WATER SAMPLE LOG SHEET

Project Site Name: NSWC Crane
Project No.: N3959

[X] Stream
[] Spring
[] Pond
[] Lake
[] Other
[] QA Sample Type

Sample ID No.: 01SW03 02
Sample Location: 01SW03
Sampled By: KS/SC
C.O C. No.:

Type of Sample:
[X] Low Concentration
[] High Concentration

SAMPLING DATA:

	Color	pH	S.C.	Temp.	Turbidity	DO	Salinity	Other
Date. 6.17.02	Visual	Standard	mS/cm	Degrees C	NTU	mg/l	%	NA
Time. 1555								
Depth —								
Method. —								

SAMPLE COLLECTION INFORMATION:

Analysis	Preservative	Container Requirements	Collected
Appendix IX Volatiles	40C & HCl	(3) 40-ml vial	

OBSERVATIONS / NOTES:

DRY

NO SAMPLE

MAP:

COLOCATION
01SW03/01SD12

Circle if Applicable:

MS/MSD

Duplicate ID No.:

Signature(s):

Tetra Tech NUS, Inc.

SURFACE WATER SAMPLE LOG SHEET

Project Site Name: NSWC Crane
Project No.: N3959

[X] Stream
[] Spring
[] Pond
[] Lake
[] Other:
[] QA Sample Type:

Sample ID No.: 01SW04 02
Sample Location: 01SW04
Sampled By: KS/TR
C.O.C. No.:

Type of Sample:
[X] Low Concentration
[] High Concentration

SAMPLING DATA:

	Color Visual	pH Standard	S.C. mS/cm	Temp. Degrees C	Turbidity NTU	DO mg/l	Salinity %	Other NA ORP
Date: 6.18.02								
Time: 1000								
Depth: 0-4"								
Method: DIRECT FILL	CLEAR	7.08	0.114	16.4	3.8	7.59	—	+274

SAMPLE COLLECTION INFORMATION:

Analysis	Preservative	Container Requirements	Collected
Appendix IX Volatiles	4°C & HCl	(3) 40-ml vial	✓

OBSERVATIONS / NOTES:

FLOW ≈ 2 GPM

SAMPLED IN SMALL PONDED AREA

PHOTO TAKEN (2)
#96 & VIEW E
95 UPSTREAM

MAP:

SEE FIG 1 WP
SAME LOCATION AS
SUMMER 2001

Circle if Applicable:

MS/MSD

Duplicate ID No.:

Signature(s):

Tetra Tech NUS, Inc.

SURFACE WATER SAMPLE LOG SHEET

Project Site Name: NSWC Crane
Project No : N3959

[X] Stream
[] Spring
[] Pond
[] Lake
[] Other:
[] QA Sample Type:

Sample ID No.: 01SW0502
Sample Location: 01SW05
Sampled By: KES/SJC
C.O.C. No.:

Type of Sample.
[X] Low Concentration
[] High Concentration

SAMPLING DATA: LAMOTTE

	Color Visual	pH Standard	S.C. mS/cm	Temp. Degrees C	Turbidity NTU	DO mg/l	Salinity %	Other ~~NA~~ ORP
Date: 6-17-02 Time: 1600 Depth: ~~0~~ 2-4" Method: DIRECT FILL	CLEAR	6.37	.058	16.79	1.2	7.96	—	291.0

SAMPLE COLLECTION INFORMATION:

Analysis	Preservative	Container Requirements	Collected
Appendix IX Volatiles	~~40G~~ & HCl	9 ~~(3)~~ 40-ml vial	✓
	4°C	3 DUP	✓
		~~3~~ SJC	
		12 TOTAL	

OBSERVATIONS / NOTES:

STREAM FLOWING:
ABOUT 4' WIDE AND 4 TO 6 IN DEEP AT THIS POINT

MAP:

SEE FIG 1 - WORK PLAN

Circle if Applicable:

MS/MSD

Duplicate ID No.: DUP [FD06170202]

Signature(s): SJ Conti

APPENDIX B-8

SEDIMENT SAMPLE LOG SHEETS

SEDIMENT SAMPLE LOG SHEET

Project Site Name: NSWC Crane, IN
Project No.: CTO 158 N3959

[] Surface Soil
[] Subsurface Soil
[X] Sediment
[] Other:
[] QA Sample Type:

Sample ID No.: 01-SD-01
Sample Location: MGBG
Sampled By: JD / JR
C.O.C. No.:

Type of Sample:
[X] Low Concentration
[] High Concentration

GRAB SAMPLE DATA:

	Depth	Color	Description (Sand, Silt, Clay, Moisture, etc.)
Date: 8/14/01 Time 1107 Method: DIS TROWEL Monitor Reading (ppm):	0.0 - 0.5'	BRN	Silty Clay Trace Sand Some org. mat Rock Frags; moist

COMPOSITE SAMPLE DATA:

	Time	Depth	Color	Description (Sand, Silt, Clay, Moisture, etc.)
Date: NA				
Method: NA				NA
Monitor Readings (Range in ppm): NA				

SAMPLE COLLECTION INFORMATION:

Analysis	Container Requirements	Collected	Other
Appendix IX VOCs	(4) Encore samplers	✓	
HD	(1) 2 oz glass jar	✓	
Thorium	(1) 8 oz glass	✓	
Appendix IX SVOC, PNA, Herbicide, Pesticide/PCBs	(1) 8 oz glass	✓	
Explosives, TAL Metals (plus Sr and Sn) pH, CEC & TOC	(1) 8 oz glass	✓	

OBSERVATIONS / NOTES:

Collected FROM North BANK

Dry Stream BED

MAP:

SEE Fig. 4-3

Circle if Applicable:

MS/MSD	Duplicate ID No.:
—	

Signature(s):

SEDIMENT SAMPLE LOG SHEET

Project Site Name: NSWC Crane, IN
Project No.: CTO 158 N3959

[] Surface Soil
[] Subsurface Soil
[X] Sediment
[] Other:
[] QA Sample Type:

Sample ID No.: 01-SD-02
Sample Location: MGBG
Sampled By: TD / TR
C.O.C. No.:

Type of Sample:
[X] Low Concentration
[] High Concentration

GRAB SAMPLE DATA:

	Depth	Color	Description (Sand, Silt, Clay, Moisture, etc.)
Date: 8/14/01 Time: 0947 Method: dis. trowel Monitor Reading (ppm): NA	0.0-0.5'	BRN	~~Cla~~ Silty Clay; Rock Frags TR Trace roots moist

COMPOSITE SAMPLE DATA:

	Time	Depth	Color	Description (Sand, Silt, Clay, Moisture, etc.)
Date NA				
Method: NA				
Monitor Readings (Range in ppm). NA			NA	

SAMPLE COLLECTION INFORMATION:

Analysis	Container Requirements	Collected	Other
Appendix IX VOCs	(4) Encore samplers	✓	
HD	(1) 2 oz glass jar	✓	
Thorium	(1) 8 oz glass	✓	
Appendix IX SVOC, PNA, Herbicide, Pesticide/PCBs	(1) 8 oz glass	✓	
Explosives, TAL Metals (plus Sr and Sn) pH, CEC & TOC	(1) 8 oz glass	✓	

OBSERVATIONS / NOTES:

NE bank near steak
Dry stream bed

Combine

MAP:

SEE Fig 4-3

Circle if Applicable:

MS/MSD

Duplicate ID No.:

Signature(s):

SEDIMENT SAMPLE LOG SHEET

Project Site Name: NSWC Crane, IN
Project No.: CTO 158 N3959

[] Surface Soil
[] Subsurface Soil
[X] Sediment
[] Other:
[] QA Sample Type:

Sample ID No.: 01-SD-03
Sample Location: MGBG
Sampled By: TD / TR
C.O.C. No.:

Type of Sample:
[X] Low Concentration
[] High Concentration

GRAB SAMPLE DATA:

	Depth	Color	Description (Sand, Silt, Clay, Moisture, etc.)
Date: 8/14/01 Time: 1016 Method: Dis. Trowel Monitor Reading (ppm):	0.0 - 0.5'	Lt BRN w/ Grey & Yellow Mottled	Clay, trace organics & Rock Frags Moist

COMPOSITE SAMPLE DATA:

Date	Time	Depth	Color	Description (Sand, Silt, Clay, Moisture, etc.)
NA				
Method NA				
Monitor Readings (Range in ppm): NA			NA	

SAMPLE COLLECTION INFORMATION:

Analysis	Container Requirements	Collected	Other
Appendix IX VOCs	(4) Encore samplers	✓	
HD	(1) 2 oz glass jar	✓	
Thorium	(1) 8 oz glass	✓	
Appendix IX SVOC, PNA, Herbicide, Pesticide/PCBs	(1) 8 oz glass	✓	
Explosives, TAL Metals (plus Sr and Sn) pH, CEC & TOC	(1) 8 oz glass	✓	

OBSERVATIONS / NOTES:

Collected mid stream
Dry stream BED

MAP:

SEE Fig 4-3

Circle if Applicable:

MS/MSD	Duplicate ID No.:
—	—

Signature(s):

Ty Rozell

SEDIMENT SAMPLE LOG SHEET

Project Site Name: NSWC Crane, IN
Project No.: CTO 158 N3959

[] Surface Soil
[] Subsurface Soil
[X] Sediment
[] Other:
[] QA Sample Type:

Sample ID No.: 01-SD-04
Sample Location: MGBG
Sampled By: TD/TK
C.O.C. No.:

Type of Sample:
[X] Low Concentration
[] High Concentration

GRAB SAMPLE DATA:

	Depth	Color	Description (Sand, Silt, Clay, Moisture, etc.)
Date 8/14/01 Time 1045 Method: DIS TROWEL Monitor Reading (ppm):	0.0 - 0.5'	BRN	TM ~~Silty~~ SAND, moist SOME Silt & ROCK FRAGS TRACE Organic MAT.

COMPOSITE SAMPLE DATA:

Date.	Time	Depth	Color	Description (Sand, Silt, Clay, Moisture, etc.)
NA				
Method: NA				
Monitor Readings (Range in ppm): NA			NA	

SAMPLE COLLECTION INFORMATION:

Analysis	Container Requirements	Collected	Other
Appendix IX VOCs	(4) Encore samplers	✓	
HD	(1) 2 oz glass jar	✓	
Thorium	(1) 8 oz glass	✓	
Appendix IX SVOC, PNA, Herbicide, Pesticide/PCBs	(1) 8 oz glass	✓	
Explosives, TAL Metals (plus Sr and Sn) pH, CEC & TOC	(1) 8 oz glass	✓	

OBSERVATIONS / NOTES:

collected MID stream
Dry stream BED

MAP:

SEE Fig 4-3

Circle if Applicable:

MS/MSD —

Duplicate ID No.: —

Signature(s): Terry Kopcho

SEDIMENT SAMPLE LOG SHEET

Project Site Name: NSWC Crane, IN
Project No.: CTO 158 N3959

[] Surface Soil
[] Subsurface Soil
[X] Sediment
[] Other:
[] QA Sample Type:

Sample ID No.: 01-SD-05
Sample Location: MGBG
Sampled By: TD
C.O.C. No.:

Type of Sample:
[X] Low Concentration
[] High Concentration

GRAB SAMPLE DATA:

	Depth	Color	Description (Sand, Silt, Clay, Moisture, etc.)
Date 8/14/01 Time. 1410 Method: dig TROWEL Monitor Reading (ppm): N/A	0.0-0.5'	Brown	Sandy Soil w/ Some Silt; dry

COMPOSITE SAMPLE DATA:

	Time	Depth	Color	Description (Sand, Silt, Clay, Moisture, etc.)
Date. N/A				
Method N/A				
Monitor Readings (Range in ppm): N/A			NA	

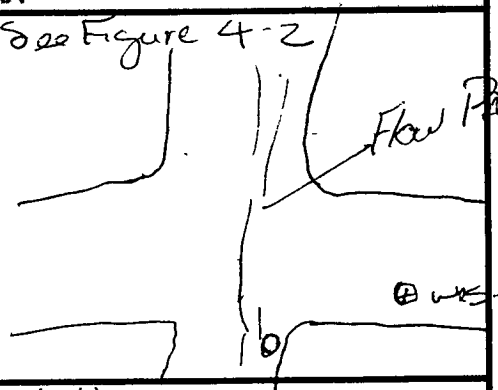
SAMPLE COLLECTION INFORMATION:

Analysis	Container Requirements	Collected	Other
Appendix IX VOCs	(4) Encore samplers	✓	
HD	(1) 2 oz glass jar	✓	
Thorium	(1) 8 oz glass	✓	
Appendix IX SVOC, PNA, Herbicide, Pesticide/PCBs	(1) 8 oz glass	✓	
Explosives, TAL Metals (plus Sr and Sn) pH, CEC & TOC	(1) 8 oz glass	✓	

OBSERVATIONS / NOTES:

MAP:

See Figure 4-2



Circle if Applicable:

MS/MSD	Duplicate ID No.:
—	—

Signature(s): [signature]

SEDIMENT SAMPLE LOG SHEET

Project Site Name: NSWC Crane, IN
Project No.: CTO 158 N3959

[] Surface Soil
[] Subsurface Soil
[X] Sediment
[] Other:
[] QA Sample Type:

Sample ID No.: 01-SD-06
Sample Location: MGTBG
Sampled By: K. MARQUIS
C.O.C. No.:

Type of Sample:
[X] Low Concentration
[] High Concentration

GRAB SAMPLE DATA:

	Depth	Color	Description (Sand, Silt, Clay, Moisture, etc.)
Date 8/14/01 Time. 1420 Method: dis. TROWEL Monitor Reading (ppm) N/A	0.0 - 0.5'	BRN	DRY, SILT, WITH ROOTS AND ROCKS, ORGANICS ON TOP.

COMPOSITE SAMPLE DATA:

	Time	Depth	Color	Description (Sand, Silt, Clay, Moisture, etc.)
Date: N/A				
Method N/A				
Monitor Readings (Range in ppm) N/A			N/A	

SAMPLE COLLECTION INFORMATION:

Analysis	Container Requirements	Collected	Other
Appendix IX VOCs	(4) Encore samplers	✓	
HD	(1) 2 oz glass jar	✓	
Thorium	(1) 8 oz glass	✓	
Appendix IX SVOC, PNA, Herbicide, Pesticide/PCBs	(1) 8 oz glass	✓	
Explosives, TAL Metals (plus Sr and Sn) pH, CEC & TOC	(1) 8 oz glass	✓	

OBSERVATIONS / NOTES:

MAP:

SEE FIG. 4-2

Circle if Applicable:

MS/MSD

Duplicate ID No.:

Signature(s):

SEDIMENT SAMPLE LOG SHEET

Project Site Name: NSWC Crane, IN
Project No.: CTO 158 N3959

[] Surface Soil
[] Subsurface Soil
[X] Sediment
[] Other:
[] QA Sample Type:

Sample ID No.: 01-SD-07
Sample Location: MGBG
Sampled By: T.ROJAHN
C.O.C. No.:

Type of Sample:
[X] Low Concentration
[] High Concentration

GRAB SAMPLE DATA:

	Depth	Color	Description (Sand, Silt, Clay, Moisture, etc.)
Date: 8/14/01 Time. 1430 Method: Dis. TROWEL Monitor Reading (ppm). NA	0. 0-0.5'	BRN - Yellow BRN	Clayey Silt trace Sand Dry Trace Org. Mat

COMPOSITE SAMPLE DATA:

Date: NA	Time	Depth	Color	Description (Sand, Silt, Clay, Moisture, etc.)
Method: NA				
Monitor Readings (Range in ppm). NA			NA	

SAMPLE COLLECTION INFORMATION:

Analysis	Container Requirements	Collected	Other
Appendix ~~X~~ VOCs	(4) Encore samplers	✓	
HD	(1) 2 oz glass jar	✓	
Thorium	(1) 8 oz glass	✓	
Appendix ~~X~~ SVOC, PNA, Herbicide, Pesticide/PCBs	(1) 8 oz glass	✓	
Explosives, TAL Metals (plus Sr and Sn) pH, CEC & TOC	(1) 8 oz glass	✓	

OBSERVATIONS / NOTES:

MAP:

SEE FIG 4-2

Circle if Applicable:

MS/MSD	Duplicate ID No.:
YES	FD081401

Signature(s):

SEDIMENT SAMPLE LOG SHEET

Project Site Name: NSWC Crane, IN
Project No.: CTO 158 N3959

[] Surface Soil
[] Subsurface Soil
[X] Sediment
[] Other:
[] QA Sample Type:

Sample ID No.: 01-SD-08
Sample Location: MGBG
Sampled By: KM/TD
C.O.C. No.:

Type of Sample:
[X] Low Concentration
[] High Concentration

GRAB SAMPLE DATA:

	Depth	Color	Description (Sand, Silt, Clay, Moisture, etc.)
Date: 8/14/01 Time: 1450 Method: dis trowel Monitor Reading (ppm): N/A	0.0 - 0.5'	BRN	SANDY CLAY, ROOTS, ROCKS, AND MOIST

COMPOSITE SAMPLE DATA:

	Time	Depth	Color	Description (Sand, Silt, Clay, Moisture, etc.)
Date: N/A				
Method: N/A				
Monitor Readings (Range in ppm) N/A			N/A	

SAMPLE COLLECTION INFORMATION:

Analysis	Container Requirements	Collected	Other
Appendix IX VOCs	(4) Encore samplers	✓	
HD	(1) 2 oz glass jar	✓	
Thorium	(1) 8 oz glass	✓	
Appendix IX SVOC, PNA, Herbicide, Pesticide/PCBs	(1) 8 oz glass	✓	
Explosives, TAL Metals (plus Sr and Sn) pH, CEC & TOC	(1) 8 oz glass	✓	

OBSERVATIONS / NOTES:

MAP:

SEE FIG 4-2

Circle if Applicable:

MS/MSD	Duplicate ID No.:
—	—

Signature(s):

Tetra Tech NUS, Inc.

SOIL & SEDIMENT SAMPLE LOG SHEET

Project Site Name. NSWC Crane
Project No.: N3959

[] Surface Soil
[] Subsurface Soil
[X] Sediment
[] Other
[] QA Sample Type.

Sample ID No.: 01SD0102
Sample Location: 01SD01
Sampled By: KES/SJC
C.O.C. No.:

Type of Sample:
[X] Low Concentration
[] High Concentration

GRAB SAMPLE DATA:

	Depth	Color	Description (Sand, Silt, Clay, Moisture, etc.)
Date: 6-17-02 Time 1035 Method. DISP. TROWEL Monitor Reading (ppm). —	0-6"	BRN	MOIST SILT, SAND, TR FINE GRAV TR. ORGANICS.

COMPOSITE SAMPLE DATA:

Date: NA	Time	Depth	Color	Description (Sand, Silt, Clay, Moisture, etc.)
	NA	NA	NA	NA
Method NA				
Monitor Readings (Range in ppm) NA				

SAMPLE COLLECTION INFORMATION:

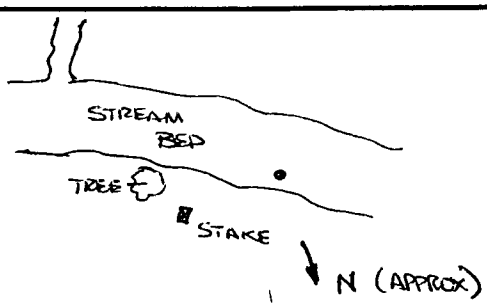
Analysis	Container Requirements	Collected	Other
Appendix IX Volatiles	(3) Encore Samplers	9	
% Moisture	(1) 2oz Jar	1	
TAL Metals plus Strontium & Tin	(1) 4oz Jar	3	
Isotopic Thorium (228, 230, 232)	(1) 8oz Jar	3	

OBSERVATIONS / NOTES:

STREAM IS FLOWING

SURFACE WATER ALSO COLLECTED AT THIS LOCATION

MAP:



Circle if Applicable:

MS/MSD

Duplicate ID No.: FD 06170201

Signature(s):

YES

Tetra Tech NUS, Inc.

SOIL & SEDIMENT SAMPLE LOG SHEET

Project Site Name: NSWC Crane
Project No.: N3959

[] Surface Soil
[] Subsurface Soil
[X] Sediment
[] Other:
[] QA Sample Type:

Sample ID No.: 01SD0302
Sample Location: 01SD03
Sampled By: KES / SJC
C.O.C. No.:

Type of Sample:
[X] Low Concentration
[] High Concentration

GRAB SAMPLE DATA:

	Depth	Color	Description (Sand, Silt, Clay, Moisture, etc.)
Date: 6-17-02 Time: 1420 Method DISP TROWEL Monitor Reading (ppm) —	0-6"	BRN	SILT-TR SAND MOIST

COMPOSITE SAMPLE DATA:

Date: NA	Time	Depth	Color	Description (Sand, Silt, Clay, Moisture, etc.)
	NA	NA	NA	NA
Method: NA				
Monitor Readings (Range in ppm) NA				

SAMPLE COLLECTION INFORMATION:

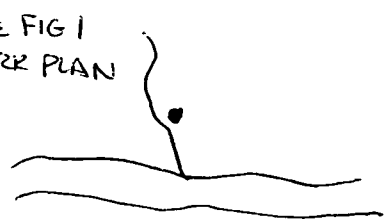
Analysis	Container Requirements	Collected	Other
Appendix IX Volatiles	(3) Encore Samplers	3	
% Moisture	(1) 2oz Jar	1	
TAL Metals plus Strontium & Tin	~~(1) 4oz Jar~~	—	
Isotopic Thorium (228, 230, 232)	~~(1) 8oz Jar~~	—	

OBSERVATIONS / NOTES:

EXISTING LOCATION - RE SAMPLE
STREAM BED IS DRY

MAP:

SEE FIG 1
WORK PLAN



Circle if Applicable:

MS/MSD —

Duplicate ID No.: —

Signature(s):

SJ Conti

Tetra Tech NUS, Inc.

SOIL & SEDIMENT SAMPLE LOG SHEET

Project Site Name. NSWC Crane
Project No.: N3959

[] Surface Soil
[] Subsurface Soil
[X] Sediment
[] Other:
[] QA Sample Type

Sample ID No : 01SD0902
Sample Location: 01SD09
Sampled By: KES/SJC
C.O.C. No.:

Type of Sample:
[X] Low Concentration
[] High Concentration

GRAB SAMPLE DATA:

	Depth	Color	Description (Sand, Silt, Clay, Moisture, etc.)
Date. 6-17-02 Time 1320 Method. DISP TROWEL Monitor Reading (ppm).	0-6"	BRN	SILT MOIST - TR ORGANIC MAT'L

COMPOSITE SAMPLE DATA:

Date: NA	Time	Depth	Color	Description (Sand, Silt, Clay, Moisture, etc.)
	NA	NA	NA	NA
Method. NA				
Monitor Readings (Range in ppm) NA				

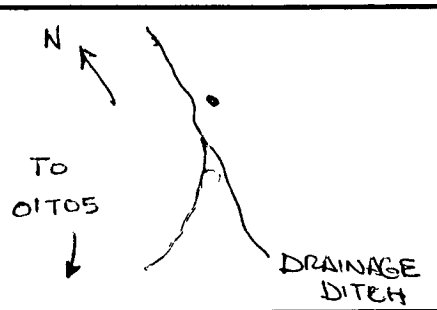
SAMPLE COLLECTION INFORMATION:

Analysis	Container Requirements	Collected	Other
Appendix IX Volatiles	(3) Encore Samplers	3	
% Moisture	(1) 2oz Jar	1	
TAL Metals plus Strontium & Tin	~~(1) 4oz Jar~~	—	
Isotopic Thorium (228, 230, 232)	~~(1) 8oz Jar~~	—	

OBSERVATIONS / NOTES:

STREAM BED IS DRY - GROUND IS MOIST DUE TO RECENT RAIN

MAP:



Circle if Applicable:

MS/MSD	Duplicate ID No.:
—	—

Signature(s):

SJ Conte

Tetra Tech NUS, Inc.

SOIL & SEDIMENT SAMPLE LOG SHEET

Project Site Name: NSWC Crane
Project No.: N3959

[] Surface Soil
[] Subsurface Soil
[X] Sediment
[] Other:
[] QA Sample Type:

Sample ID No.: 01SD1002
Sample Location: 01SD10
Sampled By: SC/KS
C.O.C. No.:

Type of Sample:
[X] Low Concentration
[] High Concentration

GRAB SAMPLE DATA:

	Depth	Color	Description (Sand, Silt, Clay, Moisture, etc.)
Date 6-17-02 Time: 1335 Method. DISP TROWEL Monitor Reading (ppm). —	0-6"	BRN	SILT - SOME FINE SAND MOIST

COMPOSITE SAMPLE DATA:

Date. NA	Time	Depth	Color	Description (Sand, Silt, Clay, Moisture, etc.)
	NA	NA	NA	NA
Method: NA				
Monitor Readings (Range in ppm) NA				

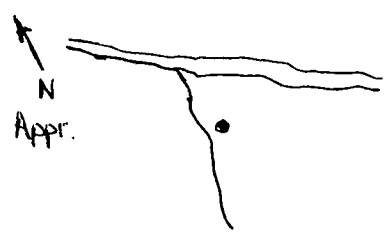
SAMPLE COLLECTION INFORMATION:

Analysis	Container Requirements	Collected	Other
Appendix IX Volatiles	(3) Encore Samplers	3	
% Moisture	(1) 2oz Jar	1	
TAL Metals plus Strontium & Tin	(1) ~~4oz Jar~~		
Isotopic Thorium (228, 230, 232)	(1) ~~8oz Jar~~		

OBSERVATIONS / NOTES:

STREAM BED IS DRY - BUT MOIST AFTER RECENT RAIN

MAP:



Circle if Applicable:

MS/MSD	Duplicate ID No.:
—	—

Signature(s): SJ Conti

Tetra Tech NUS, Inc.

SOIL & SEDIMENT SAMPLE LOG SHEET

Project Site Name: NSWC Crane
Project No.: N3959

[] Surface Soil
[] Subsurface Soil
[X] Sediment
[] Other:
[] QA Sample Type:

Sample ID No.: 01SD1102
Sample Location: 01SD11
Sampled By: KS/SC
C.O.C. No.:

Type of Sample:
[X] Low Concentration
[] High Concentration

GRAB SAMPLE DATA:

	Depth	Color	Description (Sand, Silt, Clay, Moisture, etc.)
Date 6-17-02 Time 1350 Method DISP TROWEL Monitor Reading (ppm) —	0-6"	BROWN	SILT - SOME F/C SAND MOIST.

COMPOSITE SAMPLE DATA:

Date: NA	Time	Depth	Color	Description (Sand, Silt, Clay, Moisture, etc.)
	NA	NA	NA	NA
Method NA				
Monitor Readings (Range in ppm) NA				

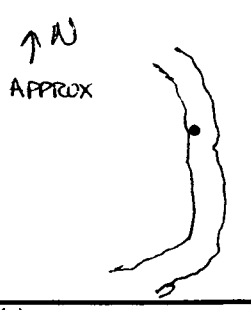
SAMPLE COLLECTION INFORMATION:

Analysis	Container Requirements	Collected	Other
Appendix IX Volatiles	(3) Encore Samplers	3	
% Moisture	(1) 2oz Jar	1	
TAL Metals plus Strontium & Tin	~~(1) 4oz Jar~~	—	
Isotopic Thorium (228, 230, 232)	~~(1) 8oz Jar~~	—	

OBSERVATIONS / NOTES:

STREAM BED DRY

MAP:



Circle if Applicable:

MS/MSD	Duplicate ID No.:
—	—

Signature(s):

SJ Conti

Tetra Tech NUS, Inc.

SOIL & SEDIMENT SAMPLE LOG SHEET

Project Site Name: NSWC Crane
Project No.: N3959

[] Surface Soil
[] Subsurface Soil
[X] Sediment
[] Other:
[] QA Sample Type:

Sample ID No.: 01SD1202
Sample Location: 01SD12
Sampled By: KES/SJC
C.O.C. No.:

Type of Sample:
[X] Low Concentration
[] High Concentration

GRAB SAMPLE DATA:

	Depth	Color	Description (Sand, Silt, Clay, Moisture, etc.)
Date 6-17-02 Time: 1540 Method DISP TROWEL Monitor Reading (ppm): —	0-6"	BROWN	SILT - TR ORGANIC MATL. MOIST

COMPOSITE SAMPLE DATA:

Date: NA	Time	Depth	Color	Description (Sand, Silt, Clay, Moisture, etc.)
	NA	NA	NA	NA
Method. NA				
Monitor Readings (Range in ppm) NA				

SAMPLE COLLECTION INFORMATION:

Analysis	Container Requirements	Collected	Other
Appendix IX Volatiles	(3) Encore Samplers	3	
% Moisture	(1) 2oz Jar	1	
TAL Metals plus Strontium & Tin	~~(1) 4oz Jar~~	—	
Isotopic Thorium (228, 230, 232)	~~(1) 8oz Jar~~	—	

OBSERVATIONS / NOTES:

SURFACE WATER LOCATION 01SW03 DRY - NOT SAMPLED

MAP:

SEE FIG 1 WORK PLAN

Circle if Applicable:

MS/MSD	Duplicate ID No.:
—	—

Signature(s): SJ Conti

APPENDIX B-9

CHAIN OF CUSTODY RECORDS

CHAIN OF CUSTODY RECORD

SWLO #1

PROJECT NO.: CTO158 #3959

SITE NAME: NSWC CRANE

SAMPLERS (SIGNATURE): Tony Rogal

STATION NO.	DATE	TIME	COMP	GRAB	STATION LOCATION	NO. OF CONTAINERS	APPENDIX IX VOCS W/HCL	APPENDIX IX SVOC	APPENDIX IX PEST	APPENDIX IX PCB	APPENDIX IX HERB	PNA	EXPLOSIVES	THORIUM W/HNO3	TOT. METALS (TAL) X SR ESN W/HNO3	REMARKS
TB	8/14/01	0900		✓	TB 081401	3	3									
RB	8/14/01	1600		✓	RB 081401	14	3	2	1	1	1	2	1	2	1	DISS. TROWEL

RELINQUISHED BY (SIGNATURE):	DATE / TIME:	RECEIVED BY(SIGNATURE):	RELINQUISHED BY (SIGNATURE):	DATE / TIME:	RECEIVED BY(SIGNATURE):
Tony Rogal	8/14/01 1830	FEDERAL EXPRESS AB# 828692055097			
RELINQUISHED BY (SIGNATURE):	DATE / TIME:	RECEIVED BY (SIGNATURE):	RELINQUISHED BY (SIGNATURE):	DATE / TIME:	RECEIVED BY(SIGNATURE):
RELINQUISHED BY (SIGNATURE):	DATE / TIME:	RECEIVED FOR LABORATORY BY (SIGNATURE):	DATE / TIME:	REMARKS:	

Order No 70440 (0693)

CHAIN OF CUSTODY RECORD

SW20 #2

PROJECT NO.: #3959 CTO 158

SITE NAME: NSWC CRANE

SAMPLERS (SIGNATURE): Terry Rogers

STATION NO.	DATE	TIME	COMP	GRAB	STATION LOCATION	NO. OF CONTAINERS	APPENDIX IX	SVC ENCORE * SEE REMARKS	THORIUM				REMARKS
—	8/14/01	0947		X	01-SD-02	7	4	2	1				
—	↓	1016		X	01-SD-03	7	4	2	1				
—		1045		X	01-SD-04	7	4	2	1				
—		1107		X	01-SD-01	7	4	2	1				
—		1410		X	01-SD-05	7	4	2	1				
—		1420		X	01-SD-06	7	4	2	1				
QA		1430		X	01-SD-07	18	12	4	2				DO MS/MSD EXCEPT: THORIUM TOC, CEC & pH
—		1450		X	01-SD-08	7	4	2	1				
DUP	↓	0000		X	FD 081401	7	4	2	1				FIELD DUP FROM 01-SD-07

RELINQUISHED BY (SIGNATURE):	DATE / TIME:	RECEIVED BY (SIGNATURE):	RELINQUISHED BY (SIGNATURE):	DATE / TIME:	RECEIVED BY (SIGNATURE):
Terry Rogers	8/14/01 1830	FEDERAL EXPRESS AB# 828692055097			
RELINQUISHED BY (SIGNATURE):	DATE / TIME:	RECEIVED BY (SIGNATURE):	RELINQUISHED BY (SIGNATURE):	DATE / TIME:	RECEIVED BY (SIGNATURE):
RELINQUISHED BY (SIGNATURE):	DATE / TIME:	RECEIVED FOR LABORATORY BY (SIGNATURE):	DATE / TIME:	REMARKS: *Appendix IX VOCs, PNA, HERB, Pest & PCBs Also, Explosives, TAL Metals (plus Sn & Sr), pH, TOC & CEC	

Order No. (0693)

CHAIN OF CUSTODY RECORD

QA - WATERS

PROJECT NO.: CTO 158 #3959

SITE NAME: NSWC CRANE

SAMPLERS (SIGNATURE): [signature]

STATION NO.	DATE	TIME	COMP	GRAB	STATION LOCATION	NO. OF CONTAINERS	APX IX VOC	APX IX SVOC	APX IX PEST/PCB	APX IX HERB	PNA	EXPLOSIVES	THORIUM HNO3	TOTAL TAL METALS + SR, SN	GAMMA SPEC HNO3	TOC	REMARKS
TB	8/21	0750		✓	TB082101 01	3	3										
RB	↓	0800		✓	RB082101 01	16	3	2	2	1	2	1	1	1	2	1	STAINLESS STEEL BOWL
RB	↓	0730		✓	RB082201 01	14	3	2	2	1	2	1	2	1	—	—	STAINLESS STEEL TROWEL

RELINQUISHED BY (SIGNATURE):	DATE / TIME:	RECEIVED BY (SIGNATURE):	RELINQUISHED BY (SIGNATURE):	DATE / TIME:	RECEIVED BY (SIGNATURE):
[signature]	8.22.01 1600	FEDEX			
RELINQUISHED BY (SIGNATURE):	DATE / TIME:	RECEIVED BY (SIGNATURE):	RELINQUISHED BY (SIGNATURE):	DATE / TIME:	RECEIVED BY (SIGNATURE):
RELINQUISHED BY (SIGNATURE):	DATE / TIME:	RECEIVED FOR LABORATORY BY (SIGNATURE):	DATE / TIME:	REMARKS: FEDEX AB. # 8286 9205 5384	

Order No 70440 (0693)

SOILS

CHAIN OF CUSTODY RECORD

PROJECT NO.: ET0158 #3959

SITE NAME: NSWC CRANE

SAMPLERS (SIGNATURE): [signature]

STATION NO.	DATE	TIME	COMP	GRAB	STATION LOCATION	NO. OF CONTAINERS	APX IX VOC ENCORE	THORIUM	APX IX SVOC, PNA, REST PCB, EXP METALS, PH, CEC	APX IX SVOC PNA, HERB, METALS, PEST	APX IX SVOC, PNA, EXP METALS, CEC, PH	TOC	THORIUM	REMARKS
—	8/21	1045		✓	01SS21 0002	1	—	1	—	—	—	—	—	
—		1055		✓	01SB21 0206	1	—	1	—	—	—	—	—	
—		1115		✓	01SB21 0610	1	—	1	—	—	—	—	—	
FD		0000		✓	FD 08210102	1	—	—	—	—	—	1	—	TOC ONLY DUP OF 01SB21 0610
—		1435		✓	01SS20 0002	7	4	—	2	—	—	—	1	
—		1455		✓	01SB20 0206	7	4	—	2	—	—	—	1	
—		1510		✓	01SB20 0610	7	4	—	—	—	2	—	1	
—		1525		✓	01SS16 0002	7	4	—	—	2	—	—	1	
—		1540		✓	01SB16 0206	7	4	—	—	2	—	—	1	
—		1555		✓	01SB16 0610	7	4	—	—	—	2	—	1	*
—		1655		✓	01SS08 0002	7	4	—	—	2	—	—	1	
FD		0000		✓	FD 08210101	7	4	—	—	2	—	—	1	DUP OF 01SS080002
—		1720		✓	01SB08 0206	7	4	—	—	2	—	—	1	
—	↓	1745		✓	01SB08 0610	7	4	—	—	—	2	—	1	*

RELINQUISHED BY (SIGNATURE):	DATE / TIME:	RECEIVED BY(SIGNATURE):	RELINQUISHED BY (SIGNATURE):	DATE / TIME:	RECEIVED BY(SIGNATURE):
[signature]	8-22-01 1600	FEDEX			
RELINQUISHED BY (SIGNATURE):	DATE / TIME:	RECEIVED BY (SIGNATURE):	RELINQUISHED BY (SIGNATURE):	DATE / TIME:	RECEIVED BY(SIGNATURE):
RELINQUISHED BY (SIGNATURE):	DATE / TIME:	RECEIVED FOR LABORATORY BY (SIGNATURE):	DATE / TIME:	REMARKS: AB # 8286 9205 5384 TO SWLO	

Order No. [illegible] (0693)

* DO NOT RUN CEC, PH

METALS = TAL METALS + SR & SN

CHAIN OF CUSTODY RECORD

SOILS

PROJECT NO.:	SITE NAME:
CTO 158 #3959	NSWC CRANE

SAMPLERS (SIGNATURE): [illegible]

STATION NO.	DATE	TIME	COMP	GRAB	STATION LOCATION	NO. OF CONTAINERS	APX IX VOC ENCORE	THORIUM	APX IX SVOC, PNA, HERB, PEST, PCB EXP	APX IX SVOC, PNA, HERB, METALS, PH, CEC, EXP, PCB	APX IX SVOC, PNA, EXP, METALS, CEC, PH		REMARKS
FD	8/22	0000		✓	FD082201-01	7	4	1	—	—	2		* DUP OF 01SB150610
—	↓	0915		✓	01SS110002	7	4	1	—	2	—		
—		0925		✓	01SB110206	7	4	1	—	2	—		
—		0940		✓	01SB110610	7	4	1	—	—	2		*
—		0955		✓	01SS150002	21	12	3	—	6	—		RUN ALSO MS/MSD
—		1035		✓	01SB150206	7	4	1	—	2	—		
—	↓	1050		✓	01SB150610	7	4	1	—	—	2		*

RELINQUISHED BY (SIGNATURE):	DATE / TIME:	RECEIVED BY(SIGNATURE):	RELINQUISHED BY (SIGNATURE):	DATE / TIME:	RECEIVED BY(SIGNATURE):
[illegible]	8-22-01 1600	FEDEX			
RELINQUISHED BY (SIGNATURE):	DATE / TIME:	RECEIVED BY (SIGNATURE):	RELINQUISHED BY (SIGNATURE):	DATE / TIME:	RECEIVED BY(SIGNATURE):
RELINQUISHED BY (SIGNATURE):	DATE / TIME:	RECEIVED FOR LABORATORY BY (SIGNATURE):	DATE / TIME:	REMARKS: AB# 8286 92055384 TO SWLO	

Order No. 70440 (0693)

* = DO NOT RUN PH, CEC

METALS = TAL METALS + SR & SN

TETRA TECH NUS, INC. | CHAIN OF CUSTODY | NUMBER | PAGE 1 OF 1

PROJECT NO: CT0158 #3959	SITE NAME: NSWC CRANE	PROJECT MANAGER AND PHONE NUMBER: TOM JOHNSTON	LABORATORY NAME AND CONTACT: SWLO
SAMPLERS (SIGNATURE): [signature]		FIELD OPERATIONS LEADER AND PHONE NUMBER: KEITH SIMPSON	ADDRESS:
		CARRIER/WAYBILL NUMBER: FEDEX 8286 9205 5134	CITY, STATE: BROKEN ARROW, OK

STANDARD TAT ☒
RUSH TAT ☐
☐ 24 hr. ☐ 48 hr. ☐ 72 hr. ☐ 7 day ☐ 14 day

DATE YEAR 2001	TIME	SAMPLE ID	MATRIX	GRAB (G) COMP (C)	No. OF CONTAINERS	TYPE OF ANALYSIS: APX IX VOC HCL	APX IX SVOC/PNA	PEST/PCBS	HERB.	EXPLOSIVES	TAL METALS + SR + SN	THORIUM	TOC	GROSS ALPHA, BETA	DIS. THORIUM	DIS METALS (SR & SN)	COMMENTS
CONTAINER TYPE PLASTIC (P) or GLASS (G)						G	G	G	G	G	P	G					
PRESERVATIVE USED						HCL 4°C	4°C	4°C	4°C	4°C	HNO3 4°C	H2SO4					
8/22	1450	TB08220101	AQ	G	3	3											
↓	1500	SB08220101	AQ	G	16	3	4	2	1	1	1	1	1	2	—		POTABLE WATER
	1815	01GW1101	AQ	G	15	3	4	2	1	1	1	1	—	2	—		
↓	1815	01GW1101 F	AQ	G	2	—									1	1	
8/23	1230	SB08230101	AQ	G	16	3	4	2	1	1	1	1	1	2	—		DI

1 RELINQUISHED BY [signature]	DATE 8.23.01	TIME 1630	1 RECEIVED BY FEDEX	DATE	TIME
2. RELINQUISHED BY	DATE	TIME	2 RECEIVED BY	DATE	TIME
3 RELINQUISHED BY	DATE	TIME	3 RECEIVED BY	DATE	TIME

COMMENTS

DISTRIBUTION WHITE (ACCOMPANIES SAMPLE) YELLOW (FILE COPY) PINK (FILE COPY)

3/99
FORM NO TtNUS-001

TETRA TECH NUS, INC. CHAIN OF CUSTODY | NUMBER | PAGE 1 OF 1

PROJECT NO: CT0158 #3959	SITE NAME: NSWC CRANE	PROJECT MANAGER AND PHONE NUMBER: TOM JOHNSTON	LABORATORY NAME AND CONTACT: SWLO
SAMPLERS (SIGNATURE): [signature]		FIELD OPERATIONS LEADER AND PHONE NUMBER: KEITH SIMPSON	ADDRESS
		CARRIER/WAYBILL NUMBER: FEDEX 8286 9205 5134	CITY, STATE: BROKEN ARROW, OK

STANDARD TAT ☐
RUSH TAT ☐
☐ 24 hr. ☐ 48 hr. ☐ 72 hr. ☐ 7 day ☐ 14 day

CONTAINER TYPE PLASTIC (P) or GLASS (G): G P
PRESERVATIVE USED: HCL 4°C, HNO3 4°C

DATE YEAR 2001	TIME	SAMPLE ID	MATRIX	GRAB (G) COMP (C)	No. OF CONTAINERS	TYPE OF ANALYSIS: APX IX VOC	TAL METALS + SR & SN	GROSS ALPHA / BETA						COMMENTS
8/24	0710	TB 082401 01	AQ	G	3	3	—	—	—	—	—	—	—	
↓	0800	01GW1401	AQ	G	6	3	1	2						
														9.4.01

1 RELINQUISHED BY: [signature]	DATE: 8.24.01	TIME: 1630	1 RECEIVED BY: FEDEX	DATE	TIME
2 RELINQUISHED BY	DATE	TIME	2 RECEIVED BY	DATE	TIME
3. RELINQUISHED BY	DATE	TIME	3 RECEIVED BY	DATE	TIME

COMMENTS

DISTRIBUTION WHITE (ACCOMPANIES SAMPLE) YELLOW (FIELD COPY) PINK (FILE COPY)

3/99
FORM NO TtNUS-001

TETRA TECH NUS, INC. CHAIN OF CUSTODY | NUMBER | PAGE ____ OF _____

PROJECT NO: CT0158 #3959	SITE NAME: NSWC CRANE	PROJECT MANAGER AND PHONE NUMBER: TOM JOHNSTON	LABORATORY NAME AND CONTACT: SWLO
SAMPLERS (SIGNATURE): [signature]		FIELD OPERATIONS LEADER AND PHONE NUMBER: KEITH SIMPSON	ADDRESS
		CARRIER/WAYBILL NUMBER: FEDEX	CITY, STATE: BROKEN ARROW, OK

STANDARD TAT ☐
RUSH TAT ☐
☐ 24 hr. ☐ 48 hr. ☐ 72 hr. ☐ 7 day ☐ 14 day

DATE YEAR 2001	TIME	SAMPLE ID	MATRIX	GRAB (G) COMP (C)	No. OF CONTAINERS	TYPE OF ANALYSIS: APX IX VOC	APX IX SVOC/PNA	APX IX PEST/PCB	APX IX HERB.	EXPLOSIVES	THORIUM	TAL METALS + SR & SN	GAMMA SPEC	COMMENTS
CONTAINER TYPE PLASTIC (P) or GLASS (G)						G	G	G	G	G	G	P	G	
PRESERVATIVE USED						HCL 4°C	4°C	4°C	4°C	4°C	HNO3 4°C	HNO3 4°C	4°C HNO3	
8/24	1500	TB082401 02	AQ	G	3	3								
↓	1600	RB082401 01	AQ	G	16	3	4	2	1	1	2	1	2	PLASTIC LINER

1 RELINQUISHED BY [signature]	DATE 8-25-01	TIME 1000	1 RECEIVED BY FEDEX	DATE	TIME
2 RELINQUISHED BY	DATE	TIME	2 RECEIVED BY	DATE	TIME
3 RELINQUISHED BY	DATE	TIME	3 RECEIVED BY	DATE	TIME

COMMENTS

DISTRIBUTION: WHITE (ACCOMPANIES SAMPLE) YELLOW (FIELD COPY) PINK (FILE COPY)

3/99
FORM NO TtNUS-001

TETRA TECH NUS, INC. CHAIN OF CUSTODY | NUMBER SOKS | PAGE 1 OF ____

PROJECT NO: CTO 158 #3759	SITE NAME: NSWC CRANE
PROJECT MANAGER AND PHONE NUMBER: TOM JOHNSTON	LABORATORY NAME AND CONTACT: SWLO
SAMPLERS (SIGNATURE): [signature]	FIELD OPERATIONS LEADER AND PHONE NUMBER: KEITH SIMPSON
	ADDRESS:
CARRIER/WAYBILL NUMBER: FEDEX 8286 9205 5189	CITY, STATE: BROKEN ARROW, OK

STANDARD TAT ☐
RUSH TAT ☐
☐ 24 hr. ☐ 48 hr. ☐ 72 hr. ☐ 7 day ☐ 14 day

DATE YEAR 2001	TIME	SAMPLE ID	MATRIX	GRAB (G) COMP (C)	No. OF CONTAINERS	APX IX VOC	THORIUM	APX IX SVOC, PNA, HERB, PEST, PCB, EXP METALS	APX IX SVOC, PNA, EXP. METALS	APX IX SVOC PNA, HERB, PEST, PCB, EXP, METALS, PH	APX IX SVOC, PNA, EXP. METALS, CEC, PH			COMMENTS
CONTAINER TYPE PLASTIC (P) or GLASS (G)						ENCORE	G	G	G	G	G			
PRESERVATIVE USED						4°C	4°C	4°C	4°C	4°C	4°C			
8/24	1300	01SS13 0002	S	G	7	4	1	—	—	2	—			
	1310	01SB13 0206	S	G	7	4	1	—	—	2	—			
	1355	01SB13 0610	S	G	7	4	1	—	—	—	2			
	1400	01SS18 0002	S	G	7	4	1	2	—	—	—			
	1415	01SB18 0206	S	G	7	4	1	2	—	—	—			
	1435	01SB18 0610	S	G	7	4	1	—	2	—	—			
	1515	01SS19 0002	S	G	7	4	1	—2	2 KS	—	—			
	1525	01SB19 0206	S	G	7	4	1	—2	2	—	—			
	1550	01SB19 0610	S	G	7	4	1	—	2	—	—			
	1635	01SS17 0002	S	G	7	4	1	2	—	—	—			
	1645	01SB17 0206	S	G	7	4	1	2	—	—	—			
	1655	01SB17 0610	S	G	7	4	1	—	2	—	—			
↓	0000	FD08240101	S	G	7	4	1	2	—	—	—			DUP OF 01SB19 0206

1 RELINQUISHED BY: [signature]	DATE: 8-25-01	TIME: 1600	1 RECEIVED BY: FEDEX	DATE	TIME
2 RELINQUISHED BY	DATE	TIME	2 RECEIVED BY	DATE	TIME
3 RELINQUISHED BY	DATE	TIME	3 RECEIVED BY	DATE	TIME

COMMENTS: METALS = TAL METALS + SR & SN

DISTRIBUTION WHITE (ACCOMPANIES SAMPLE) YELLOW (FIELD COPY) PINK (FILE COPY)

SOILS

TETRA TECH NUS, INC. CHAIN OF CUSTODY | NUMBER | PAGE 1 OF 1

PROJECT NO: CTO 158 #3959	SITE NAME: NSWC CRANE	PROJECT MANAGER AND PHONE NUMBER: TOM JOHNSTON	LABORATORY NAME AND CONTACT: SWLO
SAMPLERS (SIGNATURE): Keith S. Simpson		FIELD OPERATIONS LEADER AND PHONE NUMBER: KEITH SIMPSON	ADDRESS:
		CARRIER/WAYBILL NUMBER: FEDEX 8286 9205 5134	CITY, STATE: BROKEN ARROW, OK

STANDARD TAT ☐
RUSH TAT ☐
☐ 24 hr. ☐ 48 hr. ☐ 72 hr. ☐ 7 day ☐ 14 day

DATE YEAR 2001	TIME	SAMPLE ID	MATRIX	GRAB (G) COMP (C)	No. OF CONTAINERS	TYPE OF ANALYSIS: APX IX VOC	THORIUM	APX IX SVOC, PNA, PEST, PCB, EXP. METALS	APX IX SVOC, PNA, EXP. METALS					COMMENTS
CONTAINER TYPE PLASTIC (P) or GLASS (G)						ENCORE	G	G	G					
PRESERVATIVE USED						4°C	4°C	4°C	4°C					
8/24	1100	01SS140002	S	G		4	1	2	—					
	1120	01SB140206	S	G		4	1	2	—					
↓	1130	01SB140610	S	G		4	1	—	1					

	DATE	TIME		DATE	TIME
1 RELINQUISHED BY: KS/EL	8.24.01	1630	1 RECEIVED BY: FEDEX		
2 RELINQUISHED BY			2 RECEIVED BY		
3 RELINQUISHED BY			3 RECEIVED BY		

COMMENTS: METALS = TAL METALS + SR & SN

DISTRIBUTION WHITE (ACCOMPANIES SAMPLE) YELLOW (LAB COPY) PINK (FILE COPY)

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FORM NO TtNUS-001

TETRA TECH NUS, INC. CHAIN OF CUSTODY | NUMBER | PAGE 2 OF 4

PROJECT NO: CTO 158 #3959	SITE NAME: NSWC CRANE	PROJECT MANAGER AND PHONE NUMBER: TOM JOHNSTON	LABORATORY NAME AND CONTACT: SWLO
SAMPLERS (SIGNATURE): Keith S. Simpson		FIELD OPERATIONS LEADER AND PHONE NUMBER: KEITH SIMPSON	ADDRESS
		CARRIER/WAYBILL NUMBER: FEDEX 82869205 5362	CITY, STATE: BROKEN ARROW, OK

STANDARD TAT ☐
RUSH TAT ☐
☐ 24 hr. ☐ 48 hr. ☐ 72 hr. ☐ 7 day ☐ 14 day

DATE YEAR 2001	TIME	SAMPLE ID	MATRIX	GRAB (G) COMP (C)	No. OF CONTAINERS	APX IX VOC	APX IX SVOC, PNA	APX IX PEST/PCB	APX IX HERB	EXPLOSIVES	THORIUM	TAL METALS + SR & SN	GAMMA SPEC	TOC	COMMENTS
CONTAINER TYPE PLASTIC (P) or GLASS (G)						G	G	G	G	G	G	P	G	P	
PRESERVATIVE USED						HCL 4°C	4°C	4°C	4°C	4°C	HNO3 4°C	HNO3 4°C	HNO3 4°C	H2SO4	
8/25	1330	TB082501 01	AQ	G	3	3	—	—	—	—	—	—	—	—	
↓	1425	01GWC01 01	AQ	G	17	3	4	2	1	1	2	1	2	1	
8/26	1530	RB08260101	AQ	G	16	3	4	2	1	1	2	1	2	—	DPT CUTTING SHOE
8/27	1000	RB08270101	AQ	G	13	3	4	2	1	1	1	1	—	—	STAINLESS STEEL TROWEL
↓	1110	01 IDW 01	AQ	G	2	—	—	—	—	—	—	—	2	-	45 GAL TANK

1 RELINQUISHED BY: Keith S. Simpson	DATE: 8.27.01	TIME: 1630	1 RECEIVED BY: FEDEX	DATE	TIME
2 RELINQUISHED BY	DATE	TIME	2 RECEIVED BY	DATE	TIME
3 RELINQUISHED BY	DATE	TIME	3 RECEIVED BY	DATE	TIME

COMMENTS

DISTRIBUTION. WHITE (ACCOMPANIES SAMPLE) YELLOW (FIELD COPY) PINK (FILE COPY)

3/99
FORM NO TtNUS-001

SOIL

TETRA TECH NUS, INC. CHAIN OF CUSTODY | NUMBER | PAGE 1 OF 4

PROJECT NO:	SITE NAME:	PROJECT MANAGER AND PHONE NUMBER	LABORATORY NAME AND CONTACT:
CTO 158 #3959	NSWC CRANE	TOM JOHNSTON	SWLO
SAMPLERS (SIGNATURE)		FIELD OPERATIONS LEADER AND PHONE NUMBER: KEITH SIMPSON	ADDRESS
		CARRIER/WAYBILL NUMBER: FEDEX 8286 9205 5362	CITY, STATE: BROKEN ARROW OK

STANDARD TAT ☐
RUSH TAT ☐
☐ 24 hr. ☐ 48 hr. ☐ 72 hr. ☐ 7 day ☐ 14 day

DATE YEAR 2001	TIME	SAMPLE ID	MATRIX	GRAB (G) COMP (C)	No. OF CONTAINERS	APX IX VOC	THIORIUM	APX IX SVOC, PNA, HERB, PEST, PCB, EXP.	APX IX SVOC, PNA, EXP. METALS	APX IX SVOC, PNA, EXP, CEC, HERB, PEST, PCB, EXP METALS, PH	APX IX SVOC, PNA, EXP METALS	APX IX SVOC, PNA, METALS, CEC, PH		COMMENTS
CONTAINER TYPE PLASTIC (P) or GLASS (G)						ENCORE	G	G	G	G	G	G		
PRESERVATIVE USED						4°C	4°C	4°C	4°C	4°C	4°C	4°C		
9/25	1305	01SS12 0002	S	G	7	4	1	2	—	—	—	—		
↓	1320	01SB12 0206	S	G	7	4	1	2	—	—	—	—		
↓	1330	01SB12 0610	S	G	7	4	1	—	2	—	—	—		
9/26	0900	01SS04 0002	S	G	~~7~~ 21	~~4~~ 12	~~1~~ 3	~~2~~ 6	—	—	—	—		RUN ALSO MS/MSD
↓	0910	01SB04 0206	S	G	7	4	1	2	—	—	—	—		*
↓	0925	01SB04 0610	S	G	7	4	1	—	2	—	—	—		
↓	0935	01SS02 0002	S	G	7	4	1	2	—	—	—	—		
↓	0950	01SB02 0206	S	G	7	4	1	2	—	—	—	—		*
↓	1000	01SB02 0610	S	G	7	4	1	—	2	—	—	—		
↓	1100	01SS03 0002	S	G	7	4	1	—	—	2	—	—		
↓	1105	01SB03 0206	S	G	7	4	1	—	—	2	—	—		*
↓	1130	01SS01 0002	S	G	7	4	1	—	—	2	—	—		
↓	0000	FD08260101	S	G	7	4	1	—	2	—	—	—		DUP OF 01SB04 0610

	DATE	TIME		DATE	TIME
1 RELINQUISHED BY:	8-27-01	1630	1 RECEIVED BY: FEDEX		
2 RELINQUISHED BY			2 RECEIVED BY		
3 RELINQUISHED BY			3 RECEIVED BY		

COMMENTS: METALS = TAL METALS + SR & SN | * = ADD GAMMA SPEC.

DISTRIBUTION: WHITE (ACCOMPANIES SAMPLE) YELLOW (LAB COPY) PINK (FILE COPY)

FORM NO TtNUS-001 3/99

TETRA TECH NUS, INC. CHAIN OF CUSTODY | NUMBER | PAGE 3 OF 4

PROJECT NO: CTO 158 #3959	SITE NAME: NSWC CRANE
PROJECT MANAGER AND PHONE NUMBER: TOM JOHNSTON	LABORATORY NAME AND CONTACT: SWCO
SAMPLERS (SIGNATURE): [signature]	FIELD OPERATIONS LEADER AND PHONE NUMBER: KEITH SIMPSON
	ADDRESS
CARRIER/WAYBILL NUMBER: FEDEX 8286 9205 5362	CITY, STATE: BROKEN ARROW, OK

STANDARD TAT ☐
RUSH TAT ☐
☐ 24 hr. ☐ 48 hr. ☐ 72 hr. ☐ 7 day ☐ 14 day

DATE YEAR 2001	TIME	SAMPLE ID	MATRIX	GRAB (G) COMP (C)	No. OF CONTAINERS	TYPE OF ANALYSIS: APX IX VOC	THIOCYANATE	APX IX SVOC, PNA, HERB, PEST, PCB	APX IX SVOC, PNA, EXP. METALS	APX IX SVOC, PNA, HERB, PEST, PCB, METALS, PH	APX IX SVOC, PNA, EXP. METALS, CEC	APX IX SVOC, PH		COMMENTS
CONTAINER TYPE PLASTIC (P) or GLASS (G)						EXCLUDE	G	G	G	G	G	G		
PRESERVATIVE USED						4°C	4°C	4°C	4°C	4°C	4°C	4°C		
8/26	1145	01SB010206	S	G	7	4	1	—	—	2	—	—		*
	1255	01TPL01	S	C▲	7	4	1	—	—	—	—	2		
	1300	01TPL02	S	C▲	7	4	1	—	—	—	—	2		
	1310	01TPL03	S	C▲	7	4	1	—	—	—	—	2		
	1320	01TPS04	S	C▲	7	4	1	—	—	—	—	2		
	1400	01SS090002	S	G	7	4	1	2	—	—	—	—		
	1415	01SB090206	S	G	7	4	1	2	—	—	—	—		
	1430	01SS050002	S	G	7	4	1	—	~~2~~	2	—	—		
	1445	01SB050206	S	G	7	4	1	—	—	2	—	—		
	1455	01SB050610	S	G	7	4	1	—	—	—	2	—		
↓	0000	FD08260102	S	G	7	4	1	2	—	—	—	—		DUP OF 01SB090206 RUN ALSO MS/MSD
8/27	0845	01SS100002	S	G	21	12	3	6	—	—	—	—		
↓	0905	01SB100206	S	G	7	4	1	2	—	—	—	—		

1 RELINQUISHED BY [signature]	DATE 8.27.01	TIME 1630	1 RECEIVED BY FEDEX	DATE	TIME
2 RELINQUISHED BY	DATE	TIME	2 RECEIVED BY	DATE	TIME
3 RELINQUISHED BY	DATE	TIME	3 RECEIVED BY	DATE	TIME

COMMENTS METALS = TAL METALS + SR & SN | * = ADD GAMMA SPEC. | ▲ ALL TPs - VOCs GRABS, ALL OTHERS ARE COMPS.

DISTRIBUTION WHITE (ACCOMPANIES SAMPLE) YELLOW (FIELD COPY) PINK (FILE COPY)

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FORM NO TtNUS-001

TETRA TECH NUS, INC. CHAIN OF CUSTODY | NUMBER | PAGE 4 OF 4

PROJECT NO: CTO 150 #3959	SITE NAME: NSWC CRANE	PROJECT MANAGER AND PHONE NUMBER: TOM JOHNSTON	LABORATORY NAME AND CONTACT: SWLO
SAMPLERS (SIGNATURE): [signature]		FIELD OPERATIONS LEADER AND PHONE NUMBER: KEITH SIMPSON	ADDRESS:
		CARRIER/WAYBILL NUMBER: FEDEX 8286 9205 5362	CITY, STATE: BROKEN ARROW, OK

STANDARD TAT ☐
RUSH TAT ☐
☐ 24 hr. ☐ 48 hr. ☐ 72 hr. ☐ 7 day ☐ 14 day

DATE YEAR 2001	TIME	SAMPLE ID	MATRIX	GRAB (G) COMP (C)	No. OF CONTAINERS	APX IX VOC	THURIUM	APX IX SVOC, PNA, HERB. PEST, PCB, EXP., METALS	APX IX SVOC, PNA, EXP., METALS	APX IX SVOC, PNA EXP, CEC, HERB, PEST, PCB, METALS, PH	APX IX SVOC, PNA, EXP. METALS, CEC, PH			COMMENTS
CONTAINER TYPE PLASTIC (P) or GLASS (G)						G	G	G	G	G				
PRESERVATIVE USED						4°C	4°C	4°C	4°C	4°C				
8/27	0000	FD082701 01	S	G	7	4	1	—	—	2	—			DUP OF 01SS070002
	0920	01SS070002	S	G	7	4	1	—	—	2	—			
	0940	01SB070206	S	G	7	4	1	—	—	2	—			
	0955	01SS060002	S	G	7	4	1	2	—	—	—			
	1000	01SB060206	S	G	7	4	1	2	—	—	—			
	1015	01SB060610	S	G	7	4	1	—	2	—	—			
	~~1110~~	~~01IDW01~~	~~AQ~~	~~G~~	KS									

1 RELINQUISHED BY: [signature]	DATE: 8/27/01	TIME: 1630	1 RECEIVED BY: FEDEX	DATE	TIME
2 RELINQUISHED BY	DATE	TIME	2 RECEIVED BY	DATE	TIME
3 RELINQUISHED BY	DATE	TIME	3 RECEIVED BY	DATE	TIME

COMMENTS

DISTRIBUTION WHITE (ACCOMPANIES SAMPLE) YELLOW (FILE COPY) PINK (FILE COPY)

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FORM NO TtNUS-001

WATER

TETRA TECH NUS, INC. CHAIN OF CUSTODY | NUMBER | PAGE 1 OF 1

PROJECT NO: CTO 158 #3459	SITE NAME: NSWC CRANE	PROJECT MANAGER AND PHONE NUMBER: TOM JOHNSTON	LABORATORY NAME AND CONTACT: SWLO
SAMPLERS (SIGNATURE): [signature]		FIELD OPERATIONS LEADER AND PHONE NUMBER: KEITH SIMPSON	ADDRESS:
		CARRIER/WAYBILL NUMBER: FEDEX 8286 9205 5260	CITY, STATE: BROKEN ARROW, OK

STANDARD TAT ☐
RUSH TAT ☐
☐ 24 hr. ☐ 48 hr. ☐ 72 hr. ☐ 7 day ☐ 14 day

DATE YEAR 2001	TIME	SAMPLE ID	MATRIX	GRAB (G) COMP (C)	No. OF CONTAINERS	APX IX VOC	APX IX SVOC/PNA	APX IX PEST/PCB	APX IX HERB	EXPLOSIVES	THORIUM	TAL METALS + SR & SN	GAMMA	TOC	SPEC.	DIS. METALS	DIS. THORIUM	COMMENTS
CONTAINER TYPE PLASTIC (P) or GLASS (G)						G	G	G	G	G	G	P	G					
PRESERVATIVE USED						HCL 4°C	4°C	4°C	4°C	4°C	HNO3 4°C	HNO3 4°C	HNO3 4°C				N2 SPA	
9/28	0700	TB 082801 01	AQ	G	3	3	—	—	—	—	—	—	—	—	—	—	—	
↓	1245	01GW04 01	AQ	G	16	3	4	2	1	1	1	1	2	1	—	—		
↓	1530	RB 08280101	AQ	G	18	3	4	2	1	1	1	1	2	1	1	1		SILICONE + TEFLON TUBING

1 RELINQUISHED BY [signature]	DATE 8.28.01	TIME 1710	1 RECEIVED BY FEDEX	DATE	TIME
2 RELINQUISHED BY	DATE	TIME	2 RECEIVED BY	DATE	TIME
3 RELINQUISHED BY	DATE	TIME	3 RECEIVED BY	DATE	TIME

COMMENTS DISSOLVED ID END IN "F" (FILTERED)

DISTRIBUTION: WHITE (ACCOMPANIES SAMPLE) YELLOW (FIELD COPY) PINK (FILE COPY)

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FORM NO TINUS-001

WATER

TETRA TECH NUS, INC. CHAIN OF CUSTODY | NUMBER | PAGE 1 OF 1

PROJECT NO: CTO 158 #3959	SITE NAME: NSWC CRANE
PROJECT MANAGER AND PHONE NUMBER: TOM JOHNSTON	LABORATORY NAME AND CONTACT: SWLO
SAMPLERS (SIGNATURE): K. S. Simpson	FIELD OPERATIONS LEADER AND PHONE NUMBER: KEITH SIMPSON
	ADDRESS:
CARRIER/WAYBILL NUMBER: FEDEX 8286 9205 5292	CITY, STATE: BROKEN ARROW OK

STANDARD TAT ☐
RUSH TAT ☐
☐ 24 hr. ☐ 48 hr. ☐ 72 hr. ☐ 7 day ☐ 14 day

CONTAINER TYPE PLASTIC (P) or GLASS (G): G G G G G G P G P

PRESERVATIVE USED: HCL 4°C, 4°C, 4°C, 4°C, 4°C, HNO3 4°C, HNO3 4°C, HNO3, H2SO4, HNO3

DATE YEAR 2001	TIME	SAMPLE ID	MATRIX	GRAB (G) COMP (C)	No. OF CONTAINERS	TYPE OF ANALYSIS: APX IX VOC	APX IX SVOC/PNA	APX IX PEST/PCB	APX IX HERB	EXPLOSIVES	THORIUM	TAL METALS + SR & SN	GAMMA SPEC *	TOC	DISS. TAL MET + SR, SN	COMMENTS
9/4	1400	TB 090401 01	AQ	G	3	3	—	—	—	—	—	—	—	—	—	BLADDER PUMP
↓	1450	RB090401 01	AQ	G	16	3	4	2	1	1	1	1	2	1	-	↓
↓	1625	01GW06 01	AQ	G	16	3	4	2	1	1	1	1	2	1	-	
9/5	0945	01 GW 15 01	AQ	G	6	3	—	—	—	1	—	1	2	—	—	
↓	1440	01 GW 21 01	AQ	G	6	3	—	—	—	—	—	1	2	—	—	
↓	1240	01 GW 12 01	AQ	G	6	3	—	—	—	—	—	1	2	—	—	
↓	1750	01 GW 13 01	AQ	G	7	3	—	—	—	—	—	1	2	-	1	
9/5	0000	FD 090501 01	AQ	G	7	3	—	—	—	—	—	1	2	-	1	DUP OF 01 GW 13 01

	DATE	TIME		DATE	TIME
1 RELINQUISHED BY: K. S. Simpson	9.6.01	1630	1 RECEIVED BY: FEDEX		
2 RELINQUISHED BY			2 RECEIVED BY		
3. RELINQUISHED BY			3 RECEIVED BY		

COMMENTS: DISSOLVED ID ENDS IN "F" (FILTERED) | * GROSS ALPHA & BETA

DISTRIBUTION: WHITE (ACCOMPANIES SAMPLE) YELLOW (FIELD COPY) PINK (FILE COPY)

FORM NO TtNUS-001 3/99

TETRA TECH NUS, INC. | CHAIN OF CUSTODY | NUMBER | PAGE 1 OF 1

PROJECT NO: CTO 158 #3959
SITE NAME: NSWC CRANE
PROJECT MANAGER AND PHONE NUMBER: TOM JOHNSTON
LABORATORY NAME AND CONTACT: SWLO
SAMPLERS (SIGNATURE): [signature]
FIELD OPERATIONS LEADER AND PHONE NUMBER: KEITH SIMPSON
ADDRESS:
CARRIER/WAYBILL NUMBER: FEDEX 8286 9205 5318
CITY, STATE: BROKEN ARROW, OK

STANDARD TAT ☐
RUSH TAT ☐
☐ 24 hr. ☐ 48 hr. ☐ 72 hr. ☐ 7 day ☐ 14 day

DATE YEAR 2001	TIME	SAMPLE ID	MATRIX	GRAB (G) COMP (C)	No. OF CONTAINERS	TYPE OF ANALYSIS: APX IX VOC	APX IX SVOC PNA	APX IX PEST/PCB	APX IX HERBICIDES	EXPLOSIVES	THORIUM	TAL METALS + SR, SN	DISS. METALS + SR, SN	TOC	GROSS ALPHA, BETA	COMMENTS
CONTAINER TYPE PLASTIC (P) or GLASS (G)						G	G	G	G	G	P	P	P	G		
PRESERVATIVE USED						HCL 4°C	4°C	4°C	4°C	4°C	HNO3	HNO3	HNO3	H2SO4	HNO3	
9/6	1500	TB090601 01	AQ	G	3	3	—	—	—	—	—	—	—	—	—	
↓	1280	01GW26 01	AQ	G	7	3	—	—	—	—	1	1	-	2		
	0000	FD090601 01	AQ	G	16	3	4	2	1	1	1	—	1	2		DUP OF 01GW01 01
↓	1250	01GW01 01	AQ	G	~~37~~ 40 9		12	6	3	3	-1	3	—	1	2	KS (1 TOC) RUN, ALSO MS/MSD
9/7	0810	01GW23 01	AQ	G	7	3	—	—	—	—	1	1	-	2		
↓	1155	01GW09 01	AG	G	6	3	—	—	—	—	1	—	—	2		

	DATE	TIME		DATE	TIME
1 RELINQUISHED BY [signature]	9.7.01	1630	1 RECEIVED BY FEDEX		
2 RELINQUISHED BY			2 RECEIVED BY		
3 RELINQUISHED BY			3 RECEIVED BY		

COMMENTS: DISSOLVED ID ENDS IN "F" (FILTERED)

DISTRIBUTION: WHITE (ACCOMPANIES SAMPLE) YELLOW (FIELD COPY) PINK (FILE COPY)

3/99
FORM NO TtNUS-001

TETRA TECH NUS, INC. CHAIN OF CUSTODY | NUMBER | PAGE 1 OF 1

PROJECT NO: CTO 158 #3959
SITE NAME: NSWC CRANE
PROJECT MANAGER AND PHONE NUMBER: TOM JOHNSTON
LABORATORY NAME AND CONTACT: SWLO
SAMPLERS (SIGNATURE): [signature]
FIELD OPERATIONS LEADER AND PHONE NUMBER: KEITH SIMPSON
ADDRESS:
CARRIER/WAYBILL NUMBER: FEDEX
CITY, STATE: BROKEN ARROW OK

STANDARD TAT ☐
RUSH TAT ☐
☐ 24 hr. ☐ 48 hr. ☐ 72 hr. ☐ 7 day ☐ 14 day

DATE YEAR 2001	TIME	SAMPLE ID	MATRIX	GRAB (G) COMP (C)	No. OF CONTAINERS	APX IX VOC	APX IX SVOC/PNA	APX IX PEST/PCB	APX IX HERB	EXPLOSIVES	TAL METALS+SR,SN	DIS. METALS+SR,SN	THORIUM	TOC	GROSS ALPHA, BETA	DISS. THORIUM	COMMENTS
CONTAINER TYPE PLASTIC (P) or GLASS (G)						G	G	G	G	P	P	P	P	G	G		
PRESERVATIVE USED						HCL	4°C	4°C	4°C	4°C	HNO_3	HNO_3	H_2SO_4	HNO_3	HNO_3		
9/7	1430	TB090701 01	AQ	G	3	3	—	—	—	—	—	—	—	—	—		
9/7	1000	01GW03 01	AQ	G	9	3	—	—	—	1	1	1	—	2	1		2 DAYS TO SAMPLE
9/8	0740	01GW03 01	AQ	G	*~~8~~9	—	4	2	1	1	—	—	1	—	—		
	0850	01GW27 01	AQ	G	7	3	—	—	—	1	1	—	—	2	—		
	1105	01GW 02 01	AQ	G	*~~15~~16	3	4	2	1	1	1	—	1	1	2	—	
	0835	01GW 10 01	AQ	G	7	3	—	—	—	1	1	—	—	2	—		
↓	1315	01GW 25 01	AQ	G	15	3	4	2	1	1	1	—	1	—	2	—	
9/8	1500	RB 09080101	AQ	G	7	3	—	—	—	1	1	—	—	2	—		BLADDER PUMP + TUBING

	DATE	TIME		DATE	TIME
1 RELINQUISHED BY [signature]	9.10.01	1630	1 RECEIVED BY FEDEX		
2. RELINQUISHED BY			2 RECEIVED BY		
3 RELINQUISHED BY			3 RECEIVED BY		

COMMENTS: DISSOLVED ID END IN "F" (FILTERED)

DISTRIBUTION: WHITE (ACCOMPANIES SAMPLE) YELLOW (LAB COPY) PINK (FILE COPY)

FORM NO TINUS-001 3/99

TETRA TECH NUS, INC. CHAIN OF CUSTODY | NUMBER | PAGE 1 OF 1

PROJECT NO: CTO 158 #3959	SITE NAME: NSWC CRANE	PROJECT MANAGER AND PHONE NUMBER: TOM JOHNSTON	LABORATORY NAME AND CONTACT: SWLO
SAMPLERS (SIGNATURE): KH/S. Simpson		FIELD OPERATIONS LEADER AND PHONE NUMBER: KEITH SIMPSON	ADDRESS:
		CARRIER/WAYBILL NUMBER: FEDEX 828074027378	CITY, STATE: GROVE ARROW, OK

STANDARD TAT ☐
RUSH TAT ☐
☐ 24 hr. ☐ 48 hr. ☐ 72 hr. ☐ 7 day ☐ 14 day

DATE YEAR 2001	TIME	SAMPLE ID	MATRIX	GRAB (G) COMP (C)	No. OF CONTAINERS	TYPE OF ANALYSIS: APX IX VOC	TAL METALS + SR, SN	DISS. TAL METALS + SR, SN	GROSS ALPHA, BETA	APX IX SVOC/PNA	APX IX PEST/PCB	APX IX HERB	EXPLOSIVES	THORIUM	TOC	DIS. THORIUM	COMMENTS
CONTAINER TYPE PLASTIC (P) or GLASS (G)						G	P	G	G	G	G	G	P	G			
PRESERVATIVE USED						HCL 4°C	HNO3 4°C	HNO3 4°C	4°C	4°C	4°C	HNO3 4°C	H2SO4 4°C	HNO3			
9/18	0700	TB09180101	AQ	G	3	3	—	—	—	—	—	—	—	—	—		
	0955	01GW0701	AQ	G	6	3	1	-	2	—	—	—	—	—	—		
	1305	01GW0801	AQ	G	18	9	3	-	6	—	—	—	—	—	—		RUN ALSO MS/MSD
	1520	01GW1901	AQ	G	6	3	1	-	2	—	—	—	—	—	—		
9/19	0750	01GWT0201	AQ	G	16	3	1	-	2	4	2	1	1	1	1	-	
	0000	FD09190101	AQ	G	15	3	1	-	2	4	2	1	1	1	—	—	DUP OF 01GW1701
	0800	01GW0501	AQ	G	16	3	1	-	2	4	2	1	1	1	1	-	
	1430	01GW1701	AQ	G	15	3	1	-	2	4	2	1	1	1	—	—	
	1630	01GW2201	AQ	G	6	3	1	-	2	—	—	—	—	—	—		
9/20	0745	01GW1801	AQ	G	17	3	1	1	2	4	2	1	1	1	—	1	

1 RELINQUISHED BY KH/S. Simpson	DATE 9-20-01	TIME 1630	1 RECEIVED BY FEDEX	DATE	TIME
2 RELINQUISHED BY	DATE	TIME	2 RECEIVED BY	DATE	TIME
3 RELINQUISHED BY	DATE	TIME	3 RECEIVED BY	DATE	TIME

COMMENTS: DISSOLVED ID END IN "F" (FILTERED)

DISTRIBUTION: WHITE (ACCOMPANIES SAMPLE) YELLOW (FIELD COPY) PINK (FILE COPY)

3/99
FORM NO TtNUS-001

TETRA TECH NUS, INC. CHAIN OF CUSTODY | NUMBER | PAGE 1 OF 1

PROJECT NO: CTO 158 #3959	SITE NAME: NSWC CRANE	PROJECT MANAGER AND PHONE NUMBER: TOM JOHNSTON	LABORATORY NAME AND CONTACT: SWLO
SAMPLERS (SIGNATURE): [signature]		FIELD OPERATIONS LEADER AND PHONE NUMBER: KEITH SIMPSON	ADDRESS
		CARRIER/WAYBILL NUMBER: FEDEX 8290 7402 7323	CITY, STATE: BROKEN ARROW OK

STANDARD TAT ☐
RUSH TAT ☐
☐ 24 hr. ☐ 48 hr. ☐ 72 hr. ☐ 7 day ☐ 14 day

DATE YEAR 2001	TIME	SAMPLE ID	MATRIX	GRAB (G) COMP (C)	No. OF CONTAINERS	TYPE OF ANALYSIS: APX IX VOC	TAL METALS + SR, SN	GROSS ALPH. BETA	APX IX SVOC/PNA	APX IX PEST/PCB	APX IX HERB	EXPLOSIVES	THORIUM	TOC	DISS. TAL MET. + SR, SN	GAMMA SPEC	COMMENTS
CONTAINER TYPE PLASTIC (P) or GLASS (G)						G	P	G	G	G	G	G	P	P	G		
PRESERVATIVE USED						HCL 4°C	HNO3 4°C	HNO3 4°C	4°C	4°C	4°C	HNO3	H2SO4	HNO3	HNO3		
9/20	1400	TB092001 01	AQ	G	3	3											
↓	1020	01GW20 01	AQ	G	7	3	1	2						1			
↓	1455	01GW24 01	AQ	G	6	3	1	2									
9/21	1000	01IDW 02	AQ	G	2										2		BLUE 550 GAL. TANK
9/22	1650	01GWT02 02	AQ	G	16	3	1	2	4	2	1	1	1	1			RD 2

1 RELINQUISHED BY: [signature]	DATE 9.24.01	TIME 1600	1 RECEIVED BY: FEDEX	DATE	TIME
2 RELINQUISHED BY	DATE	TIME	2 RECEIVED BY	DATE	TIME
3 RELINQUISHED BY	DATE	TIME	3 RECEIVED BY	DATE	TIME

COMMENTS: DISSOLVED ID ENDS WITH "F" (FILTERED)

DISTRIBUTION: WHITE (ACCOMPANIES SAMPLE) YELLOW (LAB COPY) PINK (FILE COPY)

FORM NO TtNUS-001 3/99

TETRA TECH NUS, INC. CHAIN OF CUSTODY | NUMBER | PAGE 1 OF 1

PROJECT NO. CTO 158 #3959	SITE NAME: NSWC CRANE	PROJECT MANAGER AND PHONE NUMBER: TOM JOHNSTON	LABORATORY NAME AND CONTACT: SWLO
SAMPLERS (SIGNATURE)		FIELD OPERATIONS LEADER AND PHONE NUMBER: KEITH SIMPSON	ADDRESS
		CARRIER/WAYBILL NUMBER: FED EX 8280 7402 8190	CITY, STATE: BROKEN ARROW OK

STANDARD TAT ☐
RUSH TAT ☐
☐ 24 hr. ☐ 48 hr. ☐ 72 hr. ☐ 7 day ☐ 14 day

DATE YEAR 2001	TIME	SAMPLE ID	MATRIX	GRAB (G) COMP (C)	No. OF CONTAINERS	TYPE OF ANALYSIS: APX IX VOC	TAL METALS + SR, SN	DISS. TAL METALS + SR SN	GROSS ALPHA. BETA	APX IX SVOC/ PNA	APX IX PEST/ PCB	APX IX HERB	EXPLOSIVES	TAL METALS + SR SN	THORIUM	COMMENTS
		CONTAINER TYPE PLASTIC (P) or GLASS (G)				G	P	P	G	G	G	G	P	G		
		PRESERVATIVE USED				HCL 4°C	HNO3	HNO3	HNO3	4°C	4°C	4°C	HNO3	HNO3 4°C		
9/10	1200	TB09100101	AQ	G	3	3										
	1435	01GW2201	AQ	G	6	3	1	-	2							
↓	1545	01GW2401	AQ	G	7	3	1	1	2							
9/11	1055	01GW1701	AQ	G	16	3	1	-	2	4	2	1	1	1	1	
↓	0000	FD09110101	AQ	G	16	3	1	-	2	4	2	1	1	1	1	DUP OF 01GW1701

ALL SAMPLES ON THIS COC WERE PITCHED AND RESAMPLED
RE: OVER TEMP LIMIT (4°C) SHIPMENT TOOK 6 DAYS TO REACH LAB, DUE TO TERRORIST ATTACK ON THE US

RES

	DATE	TIME		DATE	TIME
1 RELINQUISHED BY	9.12.01	1630	1 RECEIVED BY FEDEX	9.12.01	1630
2 RELINQUISHED BY	DATE	TIME	2 RECEIVED BY	DATE	TIME
3 RELINQUISHED BY	DATE	TIME	3 RECEIVED BY	DATE	TIME

COMMENTS DISSOLVED ID END IN "F" (FILTERED)

DISTRIBUTION WHITE (ACCOMPANIES SAMPLE) YELLOW (FIELD COPY) PINK (FILE COPY)

3/99
FORM NO TtNUS-001

TETRA TECH NUS, INC. CHAIN OF CUSTODY | NUMBER MGBG060402 | PAGE 1 OF 1

PROJECT NO:	SITE NAME:	PROJECT MANAGER AND PHONE NUMBER	LABORATORY NAME AND CONTACT:
N3959	NSWC CRANE	TOM JOHNSTON (412) 921-8615	SWLO / SANDY GROVENSTEIN
SAMPLERS (SIGNATURE)		FIELD OPERATIONS LEADER AND PHONE NUMBER	ADDRESS
Terry Rogal		TERRY ROIAHN (412) 921-8857	1700 WEST ALBANY
		CARRIER/WAYBILL NUMBER	CITY, STATE
		FED EX AB # 828074028087	BROKEN ARROW, OK 74012

STANDARD TAT ☒
RUSH TAT ☐
☐ 24 hr. ☐ 48 hr. ☐ 72 hr. ☐ 7 day ☐ 14 day

DATE YEAR 2002	TIME	SAMPLE ID	MATRIX	GRAB (G) COMP (C)	No. OF CONTAINERS	TYPE OF ANALYSIS / CONTAINER TYPE PLASTIC (P) or GLASS (G)	VOCs 40ml VIAL (G)	GROSS ALFA 1L HDPE (P)	GROSS BETA 1L HDPE (P)					COMMENTS
						PRESERVATIVE USED	HCl	HNO3	HNO3					
6/4	0800	TB060402	AQ	G	3	3								TRIP BLANK
6/4	1215	01GW2302	GW	G	5	3	1	1						
6/4	1800	01GW2602	GW	G	3	3								
6/5	1255	01GW1402	GW	G	3	3								

	DATE	TIME		DATE	TIME
1 RELINQUISHED BY Terry Rogal	6/5/02	1830	1 RECEIVED BY FEDERAL EXPRESS	6/5/02	1830
2. RELINQUISHED BY	DATE	TIME	2 RECEIVED BY	DATE	TIME
3. RELINQUISHED BY	DATE	TIME	3 RECEIVED BY	DATE	TIME

COMMENTS

DISTRIBUTION: WHITE (ACCOMPANIES SAMPLE) YELLOW (FIELD COPY) PINK (FILE COPY)

3/99
FORM NO. TINUS-001

TETRA TECH NUS, INC.

CHAIN OF CUSTODY | NUMBER M6BG060102 | PAGE 1 OF 1

PROJECT NO:	SITE NAME:	PROJECT MANAGER AND PHONE NUMBER	LABORATORY NAME AND CONTACT:
N3959	NSWC CRANE	TOM JOHNSTON (412) 921-8615	SWLO / SANDY GROVENSTEIN
SAMPLERS (SIGNATURE)		FIELD OPERATIONS LEADER AND PHONE NUMBER	ADDRESS
Terry Rojahn		TERRY ROJAHN (412) 921-8857	1700 WEST ALBANY
		CARRIER/WAYBILL NUMBER	CITY, STATE
		FED. EX. AB# 8316 7333 0335	BROKEN ARROW, OK 74012

STANDARD TAT ☒
RUSH TAT ☐
☐ 24 hr. ☐ 48 hr. ☐ 72 hr. ☐ 7 day ☐ 14 day

CONTAINER TYPE PLASTIC (P) or GLASS (G): G P

PRESERVATIVE USED: HCl HNO3

TYPE OF ANALYSIS

DATE YEAR 2002	TIME	SAMPLE ID	MATRIX	GRAB (G) COMP (C)	No. OF CONTAINERS	VOCs 40ml Vials	TAL METALS PLUS SE & SN 1L HDPE							COMMENTS
6/1	0800	TB060102	AQ	G	3	3								TRIP BLANK
6/1	1755	01GW0402	GW	G	3	3								
6/1	1805	01GW0302	GW	G	3	3								
6/2	1030	01GW0102	GW	G	3	3								
6/2	1400	01GW0602	GW	G	3	3								
6/2	1530	RB060202 01	AQ	G	3	3	1							RINSATE
6/2	1550	RB060202 02	AQ	G	3	3								RINSATE
6/3	1030	01GW0802	GW	G	3	3								
6/3	0000	FD060302	GW	G	3	3								DUP OF 01GW0802
6/3	1315	01GW0902	GW	G	3	3								
6/3	1515	SB06030201	AQ	G	3	3	1							Source Blank
6/3	1530	SB06030202	AQ	G	3	3	1							Source Blank

	DATE	TIME		DATE	TIME
1 RELINQUISHED BY Terry Rojahn	6/3/02	1830	1 RECEIVED BY FED EX	6/3/02	1830
2. RELINQUISHED BY	DATE	TIME	2 RECEIVED BY	DATE	TIME
3. RELINQUISHED BY	DATE	TIME	3 RECEIVED BY	DATE	TIME

COMMENTS

DISTRIBUTION: WHITE (ACCOMPANIES SAMPLE) YELLOW (FIELD COPY) PINK (FILE COPY)

3/99
FORM NO TtNUS-001

TETRA TECH NUS, INC. CHAIN OF CUSTODY | NUMBER MGBG 061102 | PAGE 1 OF 1

PROJECT NO: N3959	SITE NAME: NSWC CRANE	PROJECT MANAGER AND PHONE NUMBER: Tom Johnston (412) 921-8615	LABORATORY NAME AND CONTACT: SWLO / Sandy Grovenstein
SAMPLERS (SIGNATURE): Terry Rojahn		FIELD OPERATIONS LEADER AND PHONE NUMBER: Terry Rojahn (412) 921-8857	ADDRESS: 1700 West Albany
		CARRIER/WAYBILL NUMBER: Fed. Ex. AB# 828074028043	CITY, STATE: Broken Arrow, OK 74012

STANDARD TAT ☒
RUSH TAT ☐
☐ 24 hr. ☐ 48 hr. ☐ 72 hr. ☐ 7 day ☐ 14 day

DATE YEAR 2002	TIME	SAMPLE ID	MATRIX	GRAB (G) COMP (C)	No. OF CONTAINERS	VOCs 40ml Vials	Dissolved Gases 40ml Vials	Chloride 1L HDPE	Total Tal Metals 1L HDPE plus Sr & Sn	Gross Alfa 1L HDPE	Gross Beta 1L HDPE	TOC 250ml HDPE	Dissolved Tal Metals plus Sr & Sn 1L HDPE	COMMENTS
CONTAINER TYPE PLASTIC (P) or GLASS (G)						G	G	P	P	P	P	P	P	
PRESERVATIVE USED						HCl	HCl	/	HNO3	HNO3	HNO3	H2SO4	HNO3	
6/11	0945	TB061102	AQ	G	3	3								Trip Blank
6/11	1315	01GWC0102	GW	G	3	3								
6/11	1625	01GW1002	GW	G	3	3								
6/12	0900	01GWT0203	GW	G	11	3	3	1	1	1	1	1	–	
6/12	0900	01GWT0203-F	GW	G	1	–	–	–	–	–	–	–	1	Field Filtered

	DATE	TIME		DATE	TIME
1 RELINQUISHED BY: Terry Rojahn	6/13/02	1830	1 RECEIVED BY: Fed. Express	6/13/02	1830
2. RELINQUISHED BY	DATE	TIME	2 RECEIVED BY	DATE	TIME
3. RELINQUISHED BY	DATE	TIME	3 RECEIVED BY	DATE	TIME

COMMENTS

DISTRIBUTION: WHITE (ACCOMPANIES SAMPLE) YELLOW (FIELD COPY) PINK (FILE COPY)

3/99
FORM NO. TtNUS-001

TETRA TECH NUS, INC. CHAIN OF CUSTODY | NUMBER MGBG 061402 | PAGE 1 OF 2

PROJECT NO:	SITE NAME:	PROJECT MANAGER AND PHONE NUMBER	LABORATORY NAME AND CONTACT:
N3959	NSWC CRANE	TOM JOHNSTON (412) 921-8615	SWLO / SANDY GROVENSTEIN
SAMPLERS (SIGNATURE)		FIELD OPERATIONS LEADER AND PHONE NUMBER: TERRY ROJAHN (412) 921-8857	ADDRESS: 1700 WEST ALBANY
Terry Rojahn		CARRIER/WAYBILL NUMBER: FED. EX. AB# 828074028801	CITY, STATE: BROKEN ARROW, OK 74012

STANDARD TAT ☒
RUSH TAT ☐
☐ 24 hr. ☐ 48 hr. ☐ 72 hr. ☐ 7 day ☐ 14 day

DATE YEAR 2002	TIME	SAMPLE ID	MATRIX	GRAB (G) COMP (C)	No. OF CONTAINERS	VOCS	40ML VIALS	DISSOLVED GASES	40ML VIALS	CHLORIDE	1L HDPE	TOC	1L GLASS AMBER	TOTAL METALS PLUS SR #SN	1L HDPE	DISTAL METALS PLUS SR #SN	1L HDPE	GROSS ALFA	1L HDPE	GROSS BETA	1L HDPE	COMMENTS
CONTAINER TYPE PLASTIC (P) or GLASS (G)							G		G		P		G		P		P		P		P	
PRESERVATIVE USED							HCl		HCl		/		H_2SO_4		HNO_3		HNO_3		HNO_3		HNO_3	
6/14	0800	TB061402	AQ	G	3	3																TRIP BLANK
6/14	1305	01GW1102	GW	G	9	3	3		1		1		1									
6/14	1415	01GW2502	GW	G	9	3	3		1		1		1									
6/14	1415	01GW2502-F	GW	G	1	–	–		–		–		–		1							FIELD FILTERED
6/14	1745	RB061402	AQ	G	4	3	–		–		–		1		–							BLADDER
6/15	0000	FD06150201	GW	G	11	3	3		1		1		1		–		1		1			DUP OF 01GWT0401
6/15	1050	01GWT0401	GW	G	20	*9	3		*2		1		*3		–		1		1			* RUN MS/MSD
6/15	1410	01GW1502	GW	G	9	3	3		1		1		1		–		–		–			
6/16	2010	01GW0502	GW	G	3	3	–		–		–		–		–		–		–			
6/16	1910	RB061602	AQ	G	4	3	–		–		–		1		–		–		–			BLADDER PUMP
6/16	1910	RB061602-F	AQ	G	1	–	–		–		–		–		1		–		–			FIELD FILTERED
6/17	1045	01GWT0301	GW	G	11	3	3		1		1		1		–		1		1			
6/17	1400	01GW0202	GW	G	9	3	3		1		1		1		–		–		–			

1 RELINQUISHED BY: Terry Rojahn	DATE: 6/17/02	TIME: 1900	1 RECEIVED BY: FEDERAL EXPRESS	DATE: 6/17/02	TIME: 1900
2. RELINQUISHED BY	DATE	TIME	2 RECEIVED BY	DATE	TIME
3. RELINQUISHED BY	DATE	TIME	3 RECEIVED BY	DATE	TIME

COMMENTS

DISTRIBUTION WHITE (ACCOMPANIES SAMPLE) YELLOW (FIELD COPY) PINK (FILE COPY)

3/99
FORM NO TtNUS-001

TETRA TECH NUS, INC.

CHAIN OF CUSTODY | NUMBER MGBG 061402 | PAGE 2 OF 2

PROJECT NO:	SITE NAME:	PROJECT MANAGER AND PHONE NUMBER	LABORATORY NAME AND CONTACT:
N3959	NSWC CRANE	TOM JOHNSTON (412) 921-8615	SWLO / SANDY GROVENSTEIN

SAMPLERS (SIGNATURE): [signature] for K.S. TC

FIELD OPERATIONS LEADER AND PHONE NUMBER: TERRY ROJAHN (412) 921-8857

ADDRESS: 1700 WEST ALBANY

CARRIER/WAYBILL NUMBER: FED. EX. AB# 828074028801

CITY, STATE: BROKEN ARROW, OK 74012

STANDARD TAT ☒
RUSH TAT ☐
☐ 24 hr. ☐ 48 hr. ☐ 72 hr. ☐ 7 day ☐ 14 day

DATE YEAR 2002	TIME	SAMPLE ID	MATRIX	GRAB (G) COMP (C)	No. OF CONTAINERS	VOCs 40ml Vials	Dissolved Gases 40ml Vials	Chloride 1L HDPE	TOC 1L Am Glass	Tot. Metals 1L HDPE plus SA & SN	Gross Alfa 1L HDPE	Gross Beta 1L HDPE	COMMENTS
CONTAINER TYPE PLASTIC (P) or GLASS (G)						G	G	P	G	P	P	P	
PRESERVATIVE USED						HCl	HCl	/	H_2SO_4	HNO_3	HNO_3	HNO_3	
6/15	1917	01GWT0501	GW	G	11	3	3	1	1	1	1	1	

	DATE	TIME		DATE	TIME
1. RELINQUISHED BY [signature]	6/17/02	1900	1 RECEIVED BY FEDERAL EXPRESS	6/17/02	1900
2. RELINQUISHED BY	DATE	TIME	2. RECEIVED BY	DATE	TIME
3. RELINQUISHED BY	DATE	TIME	3 RECEIVED BY	DATE	TIME

COMMENTS

DISTRIBUTION: WHITE (ACCOMPANIES SAMPLE) YELLOW (FIELD COPY) PINK (FILE COPY)

FORM NO. TTNUS-001 3/99

TETRA TECH NUS, INC.

CHAIN OF CUSTODY | NUMBER MGBG061702 | PAGE 1 OF 1

PROJECT NO:	SITE NAME:	PROJECT MANAGER AND PHONE NUMBER	LABORATORY NAME AND CONTACT:
N3959	NSWC CRANE	TOM JOHNSTON (412) 921-8615	SWLO / SANDY GROVENSTEIN
SAMPLERS (SIGNATURE)		FIELD OPERATIONS LEADER AND PHONE NUMBER: TERRY ROJAHN (412) 921-8857	ADDRESS: 1700 WEST ALBANY
		CARRIER/WAYBILL NUMBER: FED EX. AB# 828074028801	CITY, STATE: BROKEN ARROW, OK 74012

STANDARD TAT ☒
RUSH TAT ☐
☐ 24 hr. ☐ 48 hr. ☐ 72 hr. ☐ 7 day ☐ 14 day

DATE YEAR 2002	TIME	SAMPLE ID	MATRIX	GRAB (G) COMP (C)	No. OF CONTAINERS	VOCS	ENCORE SAMPLER	% MOISTURE 2oz JAR	TAL METALS PLUS SR & SN 4oz JAR	ISOTOPIC THORIUM 8oz JAR					COMMENTS
CONTAINER TYPE PLASTIC (P) or GLASS (G)							G	G	G	G					
PRESERVATIVE USED								1	1	1	1				
6/17	1035	01SD0102	SED.	G		*8	1	*2	*2						* DO MS/MSD
6/17	0000	FD06170201	SED.	G		4	—	1	1						DUP FROM 01SD0102

	DATE	TIME		DATE	TIME
1. RELINQUISHED BY	6/17/02	1900	1 RECEIVED BY FEDERAL EXPRESS	6/17/02	1900
2 RELINQUISHED BY	DATE	TIME	2 RECEIVED BY	DATE	TIME
3 RELINQUISHED BY	DATE	TIME	3 RECEIVED BY	DATE	TIME

COMMENTS

DISTRIBUTION WHITE (ACCOMPANIES SAMPLE) YELLOW (FIELD COPY) PINK (FILE COPY)

3/99
FORM NO TtNUS-001

TETRA TECH NUS, INC. CHAIN OF CUSTODY | NUMBER MGBG061702 | PAGE 1 OF 1

PROJECT NO: N3959	SITE NAME: NSWC CRANE	PROJECT MANAGER AND PHONE NUMBER: TOM JOHNSTON 412 921 8615	LABORATORY NAME AND CONTACT: SWLO / SANDY G.
SAMPLERS (SIGNATURE): [signature]		FIELD OPERATIONS LEADER AND PHONE NUMBER: TERRY NOJAHN 412 921 8857	ADDRESS: 1700 W. ALBANY
		CARRIER/WAYBILL NUMBER: FEDEX AB# 828074028823	CITY, STATE: BROKEN ARROW, OK 74012

STANDARD TAT ☒
RUSH TAT ☐
☐ 24 hr. ☐ 48 hr. ☐ 72 hr. ☐ 7 day ☐ 14 day

CONTAINER TYPE PLASTIC (P) or GLASS (G): G P G G

PRESERVATIVE USED: HCL 4°C 4°C 4°C

TYPE OF ANALYSIS

DATE YEAR 2002	TIME	SAMPLE ID	MATRIX	GRAB (G) COMP (C)	No. OF CONTAINERS	VOCs 40 ml VIAL	VOCs ENCORE	% MOISTURE	TAL METALS + SR, SN					COMMENTS
6/17	1200	TB 061702 01	AQ	G	3	✓	—	—	—					TRIP BLANK
	1320	01 SD 09 02	SD	G	5	—	4	1	—					
	1335	01 SD 10 02	SD	G	5	—	4	1	—					
	1350	01 SD 11 02	SD	G	5	—	4	1	—					
	1405	01 SW 02 02	SW	G	3	3	—	—	—					
	1420	01 SD 03 02	SD	G	5	—	4	1	—					
	1440	01 SW 01 02	SW	G	3	3	—	—	—					
	1540	01 SD 12 02	SD	G	5	—	4	1	—					
	1600	01 SW 05 02	SW	G	9	9	—	—	—					RUN ALSO MS/MSD
↓	0000	FD 061702 02	SW	G	3	3	—	—	—					DUP OF 01SW0502
6/19	1000	01 SW 04 02	SW	G	3	3	—	—	—					
↓	1300	RB 061902 01	RB	G	1	—	—	—	1					PLASTIC TROWEL

1 RELINQUISHED BY [signature]	DATE 6.18.02	TIME 1800	1 RECEIVED BY FEDEX	DATE 6.18.02	TIME 1800
2 RELINQUISHED BY	DATE	TIME	2 RECEIVED BY	DATE	TIME
3 RELINQUISHED BY	DATE	TIME	3 RECEIVED BY	DATE	TIME

COMMENTS

DISTRIBUTION: WHITE (ACCOMPANIES SAMPLE) YELLOW (FIELD COPY) PINK (FILE COPY)

3/99
FORM NO. TTNUS-001

APPENDIX B-10

FIELD TASK MODIFICATION REQUEST FORMS

TETRA TECH NUS
FIELD TASK MODIFICATION REQUEST FORM

NSWC CRANE, IN
Project/Installation Name

CTO 158 #3959
CTO & Project Number

082301-01
Task Mod. Number

WORK PLAN - SECT. 15
Modification To (e.g. Work Plan)

MGBG TEST PIT
Site/Sample Location

8.23.01
Date

15.7.2.3
Activity Description: IN PLACE OF HAND AUGER FOR HD, VOCs & RAD. SCREENING, SCREENING WILL BE DONE AFTER EACH BACK HOE BUCKET IS DUMPED ON THE PLASTIC SHEETING.

Reason for Change: BUY SCREENING THE EXCAVATED SOIL AFTER EACH BUCKET WILL GIVE A COMPLETE "PICTURE" OF THE MATERIAL VS A FEW HOLES USING A HAND AUGER.

Recommended Disposition: SEE ABOVE

NOTE: FIELD CREW WILL BE IN LEVEL C PROTECTION, SO THIS METHOD CAUSES NO H&S CONCERNS

K. S. Lamp
Field Operations Leader (Signature)

8.23.01
Date

Approved Disposition:

T. Schmitz
Project/Task Order Manager (Signature)

8-23-01
Date

Distribution:

Program/Project File –
Project/Task Order Manager –
Field Operations Leader –

Other:

Note back-up documentation, correspondence (emails, faxes, running notes, etc.) with the Navy and Crane, pertaining to this Field Task Modification Request Form can be found in the Tetra Tech NUS CTO 158 file

TETRA TECH NUS
FIELD TASK MODIFICATION REQUEST FORM

NSWC CRANE
Project/Installation Name

CTO158-N3959
CTO & Project Number

090501-1
Task Mod. Number

WORK PLAN
Modification To (e.g. Work Plan)

MGBG
Site/Sample Location

9-5-01
Date

Activity Description: RINSATE BLANKS FOR GROUND WATER SAMPLING

pg 4-45 FOOT NOTE 4

Reason for Change: RB WILL BE COLLECTED 1 PER EVERY 10 SAMPLES. MINIMUM ONE PER DAY WOULD BE EXCESSIVE. IT WILL TAKE APPROX. 18 DAYS TO SAMPLE ALL 30 WELL.

Recommended Disposition: RBs WILL BE COLLECTED AT A RATE OF 1/10

Field Operations Leader (Signature)

9-5-01
Date

Approved Disposition:

Project/Task Order Manager (Signature)

9-6-01
Date

Distribution:

Program/Project File –
Project/Task Order Manager –
Field Operations Leader –

Other:

Note back-up documentation, correspondence (emails, faxes, running notes, etc.) with the Navy and Crane, pertaining to this Field Task Modification Request Form can be found in the Tetra Tech NUS CTO 158 file

TETRA TECH NUS
FIELD TASK MODIFICATION REQUEST FORM

NSWC CRANE, IN	CTO 158 #3959	103001 - 03
Project/Installation Name	CTO & Project Number	Task Mod. Number
WORK PLAN	MGBG 01MWT01	10.30.01
Modification To (e.g. Work Plan)	Site/Sample Location	Date

Activity Description: INSTALLATION OF MONITORING WELL 01MWT01

Reason for Change: A BORING WAS ADVANCED TO 120' BGS AND NO WATER WAS ENCOUNTERED. THE SB WAS ALOUD TO SIT WITH NO WATER ENTERING THE SB. A CONFERENCE WAS HELD AMONG THE SITE GEOLOGIST, PROJECT GEOLOGIST AND THE TOM AND THE DISSION WAS MADE TO ABANDON THE BORING - (NOT CONVERTED INTO A MONITORING WELL)

Recommended Disposition:

and Navy (Bill Gutke) 10-30-01

Field Operations Leader (Signature) — Date: 10.30.01

Approved Disposition.

Project/Task Order Manager (Signature) — Date: 10-30-01

Distribution:

Program/Project File –
Project/Task Order Manager –
Field Operations Leader –

Other:

Note back-up documentation, correspondence (emails, faxes, running notes, etc.) with the Navy and Crane, pertaining to this Field Task Modification Request Form can be found in the Tetra Tech NUS CTO 158 file

TETRA TECH NUS
FIELD TASK MODIFICATION REQUEST FORM

NSWC CRANE, IN Project/Installation Name	CTO 158 # 3959 CTO & Project Number MGBG	103001 - 02 Task Mod. Number
WORK PLAN Modification To (e.g. Work Plan)	SURFACE WATER SAMPLING Site/Sample Location	10/30/01 Date

Activity Description: COLLECTION OF SURFACE WATER & SEEP SAMPLES. 7 LOCATIONS

SEE pg 4-46, TABLE 4-8 WP

Reason for Change: ALL LOCATIONS WERE DRY AND NO SEEPS WERE FOUND.
ALSO SEE LOG BOOK # 1340 pg 69 AND MARK-UP OF FIG. 4-3 IN CTO 158 FILE FOR SEEP SEARCH INFORMATION

Recommended Disposition:

Field Operations Leader (Signature) — Date: 10.30.01

Approved Disposition:

Project/Task Order Manager (Signature) — Date: 10-30-01

Distribution:

Program/Project File –
Project/Task Order Manager –
Field Operations Leader –

Other:

Note back-up documentation, correspondence (emails, faxes, running notes, etc.) with the Navy and Crane, pertaining to this Field Task Modification Request Form can be found in the Tetra Tech NUS CTO 158 file

TETRA TECH NUS
FIELD TASK MODIFICATION REQUEST FORM

NSWC CRANE, IN Project/Installation Name	CTO 158 #3959 CTO & Project Number MGBG	103001-01 Task Mod. Number
WORK PLAN Modification To (e.g Work Plan)	MW-01MW16 Site/Sample Location	10.30.01 Date

Activity Description: GROUND WATER SAMPLING AT 01MW16

Reason for Change. NO SAMPLE COLLECTED, WELL WAS DRY. WATER LEVEL MEASURMENT (DRY TO BTM) CHECKED 3 TIMES. DURING DEVELOPMENT, SAMPLING AND DURING WATER LEVELS MEASURMENT

Recommended Disposition: NONE - WELL CAN NOT BE SAMPLED

Field Operations Leader (Signature) — Date: 10.30.01

Approved Disposition:

Project/Task Order Manager (Signature) — Date: 10-30-01

Distribution:

Program/Project File –
Project/Task Order Manager –
Field Operations Leader –

Other:

Note back-up documentation, correspondence (emails, faxes, running notes, etc.) with the Navy and Crane, pertaining to this Field Task Modification Request Form can be found in the Tetra Tech NUS CTO 158 file

TETRA TECH NUS
FIELD TASK MODIFICATION REQUEST FORM

NSWC CRANE, IN
Project/Installation Name

CTO 158 # N3959
CTO & Project Number

110701-01
Task Mod. Number

WORK PLAN
Modification To (e.g. Work Plan)

MGBG/ DPT SAMPLING
Site/Sample Location

11.7.01
Date

Activity Description: ADVANCE 10 OF THE 20 (EVEN-NUMBERED BORINGS) TO TOP OF BEDROCK USING DIRECT PUSH TECHNOLOGY (DPT) QAPP SECT. 4.4.1 & 4.6.2

Reason for Change. — SEE ATTACHED (8.16.01) EMAIL — SELECTED 01SB01, 02, 05, 06, 08, 12, 15, 17, 18 & 20 IN ORDER TO INCREASE THE PROBABILITY OF ENCOUNTERING PERCHED GROUNDWATER

Recommended Disposition. ADVANCE THE ABOVE 10 SBs TO BEDROCK 16'±

Field Operations Leader (Signature)

11.7.01
Date

Approved Disposition

Project/Task Order Manager (Signature)

11-7-01
Date

Distribution:

Program/Project File –
Project/Task Order Manager –
Field Operations Leader –

Other:

Note back-up documentation, correspondence (emails, faxes, running notes, etc.) with the Navy and Crane, pertaining to this Field Task Modification Request Form can be found in the Tetra Tech NUS CTO 158 file

TETRA TECH NUS
FIELD TASK MODIFICATION REQUEST FORM

NSWC CRANE, IN Project/Installation Name	CTO 158 N3959 CTO & Project Number	070302-01 Task Mod. Number
ROUND 2 WORK PLAN, P91-1 Modification To (e.g. Work Plan)	MGBG STAFF GAGES Site/Sample Location	7/3/02 Date

Activity Description: STAFF GAUGES INSTALLED, SURVEYED AND MEASURED AT SURFACE WATER SAMPLING LOCATIONS

Reason for Change: FLOW RATE AND DEPTH OF STREAMS WAS VERY LOW AT ALL LOCATIONS. LESS THAN A FEW GALLONS PER MINUTE AND/OR LESS THAN ONE INCH IN DEPTH

Recommended Disposition: RECOMMEND ESTIMATING FLOW RATE IN GPM

Field Operations Leader (Signature) — Date: 7/3/02

Approved Disposition:

Project/Task Order Manager (Signature) — Date

Distribution:

Program/Project File –
Project/Task Order Manager –
Field Operations Leader –

Other.

Note back-up documentation, correspondence (emails, faxes, running notes, etc.) with the Navy and Crane, pertaining to this Field Task Modification Request Form can be found in the Tetra Tech NUS CTO 158 file

APPENDIX B-11

EQUIPMENT CALIBRATION LOGS

EQUIPMENT CALIBRATION LOG

INSTRUMENT NAME/MODEL : LA MOTTE 2020

PROJECT NAME : NSWC Crane

SERIAL NUMBER: 1737 1600

PROJECT NUMBER : CTO 158 # 3959

MANUFACTURER : LA MOTTE

CALIBRATION DATE	INITIAL SETTINGS	STANDARDS USED	PROCEDURE	ADJUSTMENTS MADE	FINAL SETTINGS	SIGNATURE	COMMENTS
8-28-01	✓	0 - 10	AS PER MANUF	10 ADJ	0-10	TRP	
9-5-01	✓	0 - 10	"	NONE	"	TRR	OK
9-6-01	✓	0-10	"	"	"	TRR	OK
9-7-01	✓	0-10	"	"	"	TRR	OK
9-8-01	✓	0-10	"	"	"	TRR	OK
9-18-01	✓	0-10	"	"	"	TRP	
9-19-01	✓	0-10	"	"	"	TRP	
9-20-01	✓	0-10	"	"	"	TRP	

Instrument Rented From: US ENVIRONMENTAL

EQUIPMENT CALIBRATION LOG

INSTRUMENT NAME/MODEL : TURBID METER 2020

PROJECT NAME : NSWC Crane

SERIAL NUMBER: 0416 4497

PROJECT NUMBER : CTO 159 3960
CTO 158 3959

MANUFACTURER : LAMOTTE

CALIBRATION DATE	INITIAL SETTINGS	STANDARDS USED	PROCEDURE	ADJUSTMENTS MADE	FINAL SETTINGS	SIGNATURE	COMMENTS
6.7.01	0 - 10	0 - 10	AS PER MANUF.	NONE	0 - 10	TKS	
6-18-01	0-10	0-10	" "	"	0-10	KMM	
7.9.01	0-10	0-10	"	"	0-10	TKS	
7-11-01	0-10	0-10	"	"	0-10	TKR	
7-12-01	0-10	0-10	"	"	0-10	TKR	
7-13-01	0-10	0-10	"	"	0-10	TKR	
7-14-01	0-10	0-10	"	"	0-10	TKR	
7.15.01	0 - 10	0 - 10	"	"	0 - 10	TKS	
7.16.01	0-10	0-10	"	"	0-10	TKS	
7.25.01	0 - 10	0 - 10	"	"	0 - 10	TKS	
7-26-01	0-10	0-10	"	"	0-10	TKR	
7-27-01	0-10	0-10	"	"	0-10	TKR	
7-28-01	0-10	0-10	"	"	0-10	TKR	
7-29-01	0-10	0-10	"	"	0-10	TKR	
8-07-01	0-10	0-10	"	"	0-10	TKR	
8-11-01	0-10	0-10	"	"	0-10	TK	
8-12-01	0-10	0-10	"	"	0-10	TK	
8-13-01	0-10	0-10	"	"	0-10	TK	
8.22.01	0 - 10	0 - 10	"	"	0-10	KS	
8.23.01	0 - 10	0 - 10	"	"	0-10	KS	
8-25-01	0 - 10	0-10	"	"	0-10	TK	
8-28-01	0-10	0-10	"	"	0-10	TK	
9-4-01	0-10	0-10	"	"	0-10	KM	
9-7-01	0-10	0-10	"	"	0-10	K	

9

Instrument Rented From: US ENVIRONMENTAL

EQUIPMENT CALIBRATION LOG

INSTRUMENT NAME/MODEL : TURBID METER 2020

PROJECT NAME : NSWC Crane

SERIAL NUMBER: 0416 4497

PROJECT NUMBER : CTO 158 3959

MANUFACTURER : LAMOTTE

CALIBRATION DATE	INITIAL SETTINGS	STANDARDS USED	PROCEDURE	ADJUSTMENTS MADE	FINAL SETTINGS	SIGNATURE	COMMENTS
9-8-01	0-10	0-10	AS PER MANUAL	NONE	0-10	[illegible]	
9-10-01	0-10	0-10	" "	"	0-10	[illegible]	
9.18.01	0-10	0-10	" "	"	0-10	[illegible]	
9.19.01	0-10	0-10	" "	"	0-10	[illegible]	
9.20.01	0-10	0-10	" "	"	0-10	[illegible]	

Instrument Rented From: US ENVIRONMENTAL

EQUIPMENT CALIBRATION LOG

INSTRUMENT NAME/MODEL : PE PHOTOVAC - 2020

PROJECT NAME : NSWC Crane

SERIAL NUMBER: ED HK 339

PROJECT NUMBER : CTO 159 # 3960

MANUFACTURER : PHOTOVAC

CALIBRATION DATE	INITIAL SETTINGS	STANDARDS USED	PROCEDURE	ADJUSTMENTS MADE	FINAL SETTINGS	SIGNATURE	COMMENTS
6.7.01	—	150/AIR	AS PER MANU.	NONE	100 PPM	RSP	CHECKED FILTER
6.8.01	—	100 PPM	"	"	"	RSP	OK
6-18-01	—	100 PPM	"	"	100 PPM	[illegible]	OK
6-19-01	—	100 PPM	"	"	100 PPM	RMB	✓
6-20-01	—	100 PPM	"	"	"	RMB	✓
6-21-01	—	100 PPM	"	"	"	RMB	✓
6-22-01	—	100 PPM	"	"	"	RMB	✓
6-23-01	—	100 PPM	"	"	"	RMB	✓
6-24-01	—	100 PPM	"	"	"	RMB	✓
6-25-01	—	100 PPM	"	"	"	RMB	✓
6.26.01	—	100 PPM	"	"	"	RSP	✓
7.10.01	—	100 PPM	"	"	"	RSP	✓
7.16.01	—	100 PPM	"	"	"	RSP	✓
7/24/01	—	100 ppm	"	"	"	[illegible]	✓ cleaned bulb
7/25/01	—	100 ppm	"	"	"	[illegible]	✓
7/26/01	—	100 ppm	"	"	"	[illegible]	✓
7/27/01	—	100 ppm	"	"	"	TLL	✓
7/28/01	—	100 ppm	"	"	"	TLL	✓
7/29/01	—	100 ppm	"	"	"	TLL	✓

Instrument Rented From: US ENVIRONMENTAL

EQUIPMENT CALIBRATION LOG

INSTRUMENT NAME/MODEL : PE PHOTOVAC, 2020

PROJECT NAME : NSWC Crane

SERIAL NUMBER: ED HF 339

PROJECT NUMBER : 3960 CTO 159

MANUFACTURER : PHOTOVAC

CALIBRATION DATE	INITIAL SETTINGS	STANDARDS USED	PROCEDURE	ADJUSTMENTS MADE	FINAL SETTINGS	SIGNATURE	COMMENTS
6.5.01	—	ISO/AIR - 100 PPM	AS PER MANU.	NONE	100 PPM	TRS	FILTER CHECKED
6-6-01	—	"	"	"	100 PPM	TRR	OK
6-7-01	—	"	"	"	"	TRR	OK
6-8-01	—	"	"	"	"	TRR	OK
7.9.01	—	100 PPM	"	"	"	TRS	OK

Instrument Rented From: US ENVIRONMENTAL

EQUIPMENT CALIBRATION LOG

INSTRUMENT NAME/MODEL : PE PHOTO VAC 2080

PROJECT NAME : NSWC Crane

SERIAL NUMBER: EDKJ 324

PROJECT NUMBER : CTO 159 N3959

MANUFACTURER : PERKIN ELMER

CALIBRATION DATE	INITIAL SETTINGS	STANDARDS USED	PROCEDURE	ADJUSTMENTS MADE	FINAL SETTINGS	SIGNATURE	COMMENTS
8-6-01	—	150/AIR	AS PER MAN	NONE	100 PPM	VL	GAS EXP. NOV 2001
		100 PPM					
8-25-01	—	100 PPM	"	"	"	TL	OK

Instrument Rented From: US ENVIRONMENTAL

EQUIPMENT CALIBRATION LOG

INSTRUMENT NAME/MODEL : FID

PROJECT NAME : NSWC Crane

SERIAL NUMBER: C2HD 310

PROJECT NUMBER : 3959

MANUFACTURER : PHOTOVAC MICRO FID

CALIBRATION DATE	INITIAL SETTINGS	STANDARDS USED	PROCEDURE	ADJUSTMENTS MADE	FINAL SETTINGS	SIGNATURE	COMMENTS
9/5/01	—	METHANE	AS PER MANU	NONE	100.9	T.R.	EXP 11/02 Lot 11-29-99
9/6/01	—	"	"	"	100.3	TR	OK
9-7-01	—	"	"	"	100.3	TR	OK
9-8-01	—	"	"	"	100.1	TR	OK
9-10-01	—	"	"	"	100.2	TR	ok
9-11-01	—	"	"	"	100.1	TR	ok

RETURNED 9-17-01

Instrument Rented From: US ENVIRONMENTAL

EQUIPMENT CALIBRATION LOG

INSTRUMENT NAME/MODEL : YSI 610

SERIAL NUMBER: 610 = 194193R
SOND = 99E0049

MANUFACTURER : YSI INC

PROJECT NAME : NSWC Crane

PROJECT NUMBER : CTO 158 #3959

	CALIBRATION DATE	INITIAL SETTINGS	STANDARDS USED	PROCEDURE	ADJUSTMENTS MADE	FINAL SETTINGS	SIGNATURE	COMMENTS
PM	8.27.01	✓	SEE RIGHT	AS PER MANU.	YES	OK	TRR	CAL. ALL PARAMETERS
								DO 100% SAT. AIR
	9-4-01	✓	"	"	"	"	TRR	7.0 PH LOT 00313 EXP 2002
	9-8-01	✓	pH 7.0 & 4.0	"	"	"	TRR	4.0 PH LOT 00223 EXP 2002
	9.18.01	✓	SEE RIGHT	"	"	"	TRR	SP. COND. 1 MS/CM
	9.19.01	✓	"	"	"	"	TRR	LOT 2478 EX 12/2001
	9.20.01	✓	"	"	"	"	TRR	ORP ZOBELL SOL.
								LOT 001237
								EX 10/2002

Instrument Rented From: US ENVIRONMENTAL

EQUIPMENT CALIBRATION LOG

INSTRUMENT NAME/MODEL : YSI 650MDS

SERIAL NUMBER: 01C0844 AC

MANUFACTURER : YSI INC.

PROJECT NAME : NSWC Crane

PROJECT NUMBER : CTO 159 JOB 3960
CTO 158 " 3959

CALIBRATION DATE	INITIAL SETTINGS	STANDARDS USED	PROCEDURE	ADJUSTMENTS MADE	FINAL SETTINGS	SIGNATURE	COMMENTS
6.5.01	✓	SEE RIGHT	AS PER MANU	YES	OK	RES/TR	CAL./CHECK
6.4.01	"	→	"	"	"	RSP	ALL PARAMETERS
							DO 100% SAT. AIR
							7.0 PH LOT 00313 EX 3/2002
							4.0 PH LOT 00223 EX 3/2002
							SP. CON. 1 MS/CM
							LOT 2478 EX 12/2001
							ORP - ZOBELL SOL.
							LOT 001237
							EX 10/2002
6-10-01	"	"	"	"	"	TR	SEE ABOVE FOR pH Comments
6-23-01					O.K.	B Bulhum	CHECKED PARAMETERS
6-24-01					O.K.	B Bulhum	CHECKED PARAMETERS
6-25-01	"	"	"	"	O.K.	B Bulhum	" "
6.26.01	"	"	"	"	OK	RSP	" "
7.9.01	"	"	"	"	OK	RSP	CAL/CHECK ALL PARAMETERS
7-13-01	"	pH 7 & 4.0	"	"	OK	TRR	Recalibrate pH
7.14.01	"	"	"	"	OK	RSP	CHECKED ALL PARAMETERS
7.15.01	"	"	"	"	OK	RSP	" "
7.16.01	"	"	"	"	OK	RSP	" "
7.24.01	"	SEE R. ABOVE	"	"	OK	RSP	CAL. & CHECKED ALL PARAMETERS
8-07-01	"	"	"	"	OK	TRR	CAL ALL PARAMETERS
8-13-01	"	"	"	"	OK	TRR	CAL pH only
8.22.01 8.22.01	"	ALL →	"	"	OK	RES/TR	CAL ALL PARAMETERS

SOND 600 XL - B-M
S.N. 99K005

Instrument Rented From: US ENVIRONMENTAL

EQUIPMENT CALIBRATION LOG

INSTRUMENT NAME/MODEL : YSI 650 MDS

PROJECT NAME : NSWC Crane

SERIAL NUMBER: 01C0844 AC

PROJECT NUMBER : CTO 158 #3959

MANUFACTURER : YSI INC.

CALIBRATION DATE	INITIAL SETTINGS	STANDARDS USED	PROCEDURE	ADJUSTMENTS MADE	FINAL SETTINGS	SIGNATURE	COMMENTS
8.23.01	✓	SEE RIGHT	AS PER MANU	YES	OK	TRL	CHECKED METER
							DO 100% SAT. AIR
							7.0 PH. LOT 00313 EX 3/2002
							4.0 PH, LOT 00223 EX 2/2002
							SP. COND. 1MS/CM
							LOT 2478 EX 12/2001
							ORP - ZOBELL SOL.
							LOT 0001237
							EX 10/2002
9/4/01	✓	SEE Comments	AS PER MANU	"	"	TRL	
9/9/01	✓	pH 7.0 & 4.0	"	"	"	TRL	
9.18.01	✓	SEE RIGHT	"	"	"	TRL	
9.19.01	✓	"	"	"	"	TRL	
9.20.01	✓	"	"	"	"	TRL	

Instrument Rented From: US ENVIRONMENTAL

EQUIPMENT CALIBRATION LOG

INSTRUMENT NAME/MODEL : PID- 2020

PROJECT NAME : NSWC Crane

SERIAL NUMBER: ED HE 343

PROJECT NUMBER : N3959

MANUFACTURER : PHOTOVAC

CALIBRATION DATE	INITIAL SETTINGS	STANDARDS USED	PROCEDURE	ADJUSTMENTS MADE	FINAL SETTINGS	SIGNATURE	COMMENTS
5/28/02	NA	ISOBUTYLENE	AS PER MANUFACTURER	NONE	NA	SJC	LOT # 00118-02 EXPIRES 5/05
5/29/02	"	"	"	"	"	SJC	
5/30/02	"	"	"	"	"	SJC	
5/31/02	"	"	"	"	"	SJC	
6/1/02	"	"	"	"	"	SJC	
6/2/02	"	"	"	"	"	SJC	
6/3/02	"	"	"	"	"	SJC	
6/4/02	"	"	"	"	"	SJC	
6/5/02	"	"	"	"	"	SJC	
6/10/02	"	"	"	"	"	SJC	
6/11/02	"	"	"	"	"	SJC	

Instrument Rented From: _____

EQUIPMENT CALIBRATION LOG

INSTRUMENT NAME/MODEL : LaMOTTE 2020 TURB

PROJECT NAME : NSWC Crane

SERIAL NUMBER: 1758 1800

PROJECT NUMBER : N3959

MANUFACTURER : LaMOTTE

CALIBRATION DATE	INITIAL SETTINGS	STANDARDS USED	PROCEDURE	ADJUSTMENTS MADE	FINAL SETTINGS	SIGNATURE	COMMENTS
6-11-02	RSP	0-10	AS PER MANUAL	4.7 TO 10	0 & 10	RSP	
6-12-02	—	0-10	"	NONE	0 & 10	TR	
6-14-02	—	0-10	"	"	0 & 10	TR	
6-15-02	—	0-10	"	"	0 & 10	TR	

Instrument Rented From: US ENVIRONMENTAL

EQUIPMENT CALIBRATION LOG

INSTRUMENT NAME/MODEL : LaMotte 2020

PROJECT NAME : NSWC Crane

SERIAL NUMBER: 2808-3701

PROJECT NUMBER : N3959

MANUFACTURER : LaMotte

CALIBRATION DATE	INITIAL SETTINGS	STANDARDS USED	PROCEDURE	ADJUSTMENTS MADE	FINAL SETTINGS	SIGNATURE	COMMENTS	
5/3/02	.25	0.00	AS/MANUAL	YES	0.00	[signature]	OK	(INST NOT USED)
6/02/02	0.00	0.00	"	NO	0.00	[signature]	OK	10 OK
6/03/02	0.00	0.00	"	NO	0.00	[signature]	OK	10 OK
6/04/02	0.00	0.00	"	NO	0.00	[signature]	OK	10 OK
6/05/02	0.00	0.00	"	NO	0.00	[signature]	OK	10 OK
6/10/02							NOT IN USE	
6/11/02	0.00	0.00	AS/MANUAL	NO	0.00	[signature]	OK	
6/12/02	0.00	0.00	"	NO	0.00	[signature]	OK	
6/14/02	0.00	0.00	"	NO	0.00	[signature]	OK	
6/15/02	0.00	0.00	"	NO	0.00	[signature]	OK	
6/17/02	0.00	0.00	"	NO	0.00	[signature]	OK	

Instrument Rented From: _____

EQUIPMENT CALIBRATION LOG

INSTRUMENT NAME/MODEL : YSI 650 MDS

PROJECT NAME : NSWC Crane

SERIAL NUMBER: 01 L 0055 AB

PROJECT NUMBER : N3959

MANUFACTURER : YSI INC

CALIBRATION DATE	INITIAL SETTINGS	STANDARDS USED	PROCEDURE	ADJUSTMENTS MADE	FINAL SETTINGS	SIGNATURE	COMMENTS
6/10/02	NA	PH 7 & 4	As/Manual	None	7.00 & 4.00	[illegible]	OK
↓	↓	Cond 1,000 µS/cm	↓	↓	1mS/cm	↓	↓
↓	↓	ORP : Zobell Sol	↓	↓	235mV	↓	↓
↓	↓	DO in Air	↓	↓		↓	↓
6/15/02	→					→	Inst Check K.S. ALL
							probes OK

Instrument Rented From: _____

EQUIPMENT CALIBRATION LOG

INSTRUMENT NAME/MODEL : YSI 6920

PROJECT NAME : NSWC Crane

SERIAL NUMBER: 99K033AC

PROJECT NUMBER : N3959

MANUFACTURER : YSI

CALIBRATION DATE	INITIAL SETTINGS	STANDARDS USED	PROCEDURE	ADJUSTMENTS MADE	FINAL SETTINGS	SIGNATURE	COMMENTS
5/31/02	TR	pH 7 & 4	As/MANUAL	NONE	7.00 & 4.00	[signature]	OK
		Cond. 1,000 uS/cm			1 mS/cm		
		ORP - Zobell Sol.			237 mV		
		DO in Air					
6/2/02	TR						CHECK PROBES AGAINST Standards - Probes OK
6/3/02	TR						
6/4/02	TR						
6/5/02	TR						Will recali next shift
6/10/02	TR	pH 7 & 4	As/MANUAL	NONE	7.00 & 4.00	[signature]	OK
		Cond 1 mS/cm			1 mS/cm		
		ORP - Zobell Sol			235 mV		
		DO in Air					
6/15/02							Inst check all probes OK (K.S.)

Inst. Not used 5/31

CALI HOLDING

Instrument Rented From: _____

APPENDIX C

SITE LOG BOOK
AND
FIELD LOG BOOKS

NSWC
CRANE, IN
MGBG
CTO 131 & 158

1340
START: 8·6·01
END:

ADD TO LOG BOOK 1340
BOOK # 1330

MGBG

— DAILY SUMMARY —

ON SITE, T FNUS; K. SIMPSON
T. ROJAHN

DEVELOPED 2 WELLS @ DBG
ALL 9 WELLS DEVELOPED

BRUSHED HOGGED MGBG SITE

WLs @ MGBG (28)

MOVED 500 GAL TANK TO MGBG
WITH IDW LABEL

SEE ALSO FIELD FORMS

TITLE NSWC CRANE

PROJECT NO. 7141

BOOK NO. 1330

SAT 7.14.01

Work continued from Page WEATHER: NICE 68 - 83°F SUNNY

0655 KS & TR @ BLD 3245 LOAD EQ. FOR GW DEVELOPMENT @ DBG

0720 TO MGBG TOOK PHOTOS OF SITE TO DBG SET-UP ON 12P3 COMPLETE DEVELOPMENT START 02-05 COMPLETE DEVELOPMENT ALL 9 WELLS COMPLETE

1030 TO BLD 3245 DECON EQ. EMPTY 300 TANK

1240 TO MGBG WITH 500 GAL TANK, TANK WILL BE LEFT @ MGBG

MET DENNY W. @ MGBG HE IS CUTTING THE AREA BETWEEN BUNKERS 1407 & 1409

WE STRAPPED 500 GAL TANK (EMPTY) TO WELL 01-17

START WL/WELL INVENTORY

1520 DENNY W. COMPLETE CUTTING OF AREA & DEPARTS SITE

TR & KS COMPLETE WL @ MGBG 28 WELLS

RETURN TO BLD 3245 CLEAN-UP

1820 TO HOME DEPOT FOR WELL REPAIR SUPPLIES

SCIENTIFIC BINDERY PRODUCTIONS CHICAGO 60605 MADE IN USA

Work continued to Page

SIGNATURE [signature] DATE 7.14.01

DISCLOSED TO AND UNDERSTOOD BY DATE WITNESS DATE

MGBG

— DAILY SUMMARY —

ON SITE, T+NUS, KEITH S.
TERRY R.

DEVELOPED 4 MW @ MGBG

REPAIRED MWs, SEE BELOW

SEE ALSO, FIELD FORMS

SUMMARY OF MGBG WELL REPAIR

01-06 - REPLACED PVC RISER, WAS BROKEN @ GROUND

01-07 - NEW CEMENT PAD & REPLACED PVC RISER
WAS BROKEN AT GRADE, BELOW PAD

01-15 - REPLACED PVC RISER, WAS BROKEN @ GROUND

01-23 LARGE HOLE 4' EAST OF WELL, FILLED WITH
3 BAGS OF BENTONITE COVERED WITH 300 LBS
OF FINE LIMESTONE GRAVEL.

MARKED ALL WELLS FOR SURVEY REFERANCE.

TITLE NSWC CRANE

PROJECT NO. 3959

BOOK NO. 1330

SUNDAY 7.15.01

Work continued from Page

WEATHER: NICE 70-85°F SUNNY

0650 KS & TR @ BLD 3245 LOAD TRUCK FOR MGBG DEVELOPMENT & WELL REPAIR

0700 TO MGBG DEVELOPED MW 01C01 USING A WATTERRA PUMP & 3/4" PE TUBING. 165' TO BTM COMPLETE DEVELOPMENT

1015 TO MW 01-23 FILLED HOLE CLOSE TO WELL 3 BAGS OF BENTONITE + 300 LBS OF FINE GRAVEL

1041 START DEVELOPMENT OF 01-23, COMPLETE 23

1150 TO BLD 3245 DECON, LUNCH, PAPER WORK

1400 LOAD TRUCK RETURN TO MGBG SET-UP TO REPAIR & DEVELOP MW 01-07

1700 @ MW 01-06 DEVELOP & REPAIR COMPLETE 01-06

1805 TO 01-07 TO COMPLETE DEVELOPMENT DUMP WATER INTO 500 GAL TANK WHICH IS BEHIND BUNKER 1409 TO BLD 3245 UNLOAD TRUCKS, CLEAN-UP

1920 DEPART SITE

SIGNATURE [signature] DATE 7.15.01

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MGBG

— DAILY SUMMARY —

ON SITE; T + NUS, KEITH S.
TERRY R.

6 MW DEVELOPED

7-16-01 @ 1810 120 GALLONS OF IDW IN 500 GAL TANK @ BUNKER 1409

SEE ALSO; FIELD FORMS

TITLE NSWC CRANE

PROJECT NO. 3459

BOOK NO. 1330

MONDAY 7.16.01

Work continued from Page WEATHER: 72-86°F SUNNY

0650 KS & TR @ BLD 3245 CLEAN EQ FROM DEVEL. ON SUNDAY RESTOCK TRUCK FOR DEV. @ MGBG

0715 KS TO TOOLTEST TO PAY DENNY FOR CUTTING MGBG. DENNY WAS NOT IN.

0740 @ BLD 3245 PAPER WORK AND CLEAN-UP

0825 KS & TR TO MGBG

SET-UP ON 01-15 SURGE & DEVELOP. REPAIRED

1015 RISER COMPLETE 01-15 MOVED TO 01-19

1125 COMPLETE 01-19 CLEAN-UP TO BLD 3245

1240 LUNCH RETURN TO MGBG

SET-UP ON WELL 01-21 FOR DEVELOPMENT

1440 COMPLETE 01-21 TO 01-24 COMPLETE 01-24

DUMP PURGE WATER SET-UP ON 01-08

1646 COMPLETE 01-08 DUMP PURGE WATER

1700 SET-UP ON 01-09 COMPLETE DEVELOPMENT

1810 DUMP PURGE WATER, TO BLD 3245 DECON, PAPER WORK

1900 DEPART SITE

Work continued to Page

SCIENTIFIC BINDERY PRODUCTIONS CHICAGO 60605 MADE IN USA

SIGNATURE

DATE 7.16.01

DISCLOSED TO AND UNDERSTOOD BY DATE WITNESS DATE

BOOK 1330

— DAILY SUMMARY —

ON SITE; T + NUS: KEITH S.
TERRY R.

LAY-OUT @ MGBG

TITLE NWSC CRANE

PROJECT NO. 3959

BOOK NO. 1330

TUESDAY 7.17.01

Work continued from Page WEATHER: OVERCAST 70-86°F

0700 RS & TR PREP FOR SITE LAY-OUT @ MGBG
SBs & MW + SW/SDs
TALKED WITH TOM BRENT KICK-OFF MEETING
FOR THE MGBG WILL BE TUESDAY 8.7.01
0815 TO MGBG
LUNCH @ 1240 TO BLD 3245 PHONE CALLS
1330 RETURN TO MGBG TO LAY-OUT MW
COMPLETE LAY-OUT OF SB, MW & SD
NEED TO LAY-OUT 3 SW 01SW3, 4 & 5
TO BLD 3245 UNLOAD TRUCK
1650 DEPART SITE

SCIENTIFIC BINDERY PRODUCTIONS CHICAGO 60605 MADE IN USA

Work continued to Page

SIGNATURE

DATE 7.17.01

DISCLOSED TO AND UNDERSTOOD BY DATE WITNESS DATE

LOG BOOK 1340
7.28.01

Simpson, Keith

From: Francis, Mark
Sent: Thursday, July 19, 2001 1:56 PM
To: Simpson, Keith
Subject: FW: Discussion with Keith

THX,
Mark Francis
Tetra Tech NUS
Pittsburgh PA
412-921-8544/412-921-4040 fax
<FrancisM@TtNUS.com>
http://www.tetratech.com

SEE BELOW FOR WORK COMPLETED 7.15/16/17.01
DETAILS IN LOG BOOK #1330 PGS 166 → 171

-----Original Message-----

From: **Johnston, Tom**
Sent: Tuesday, July 17, 2001 11:31 PM
To: Francis, Mark
Cc: Simpson, Keith
Subject: RE: Discussion with Keith

Mark,

This IS good news. I'll want to put this info in the weekly.

-----Original Message-----

From: **Francis, Mark**
To: Johnston, Tom
Sent: 7/17/01 4:18 PM
Subject: Discussion with Keith
Importance: High

TJ,

Just in case you're reading your email, I talked with Keith on 7/17/01 in the pm and here are the highlights:

- Things are going good - getting ahead of the game
- Brush-hogged about 7 acres - 6-foot high weeds - $400 for the work
- Conducted the well inventory
- Performed water level measurements
- 3 risers were broken on wells - they were repaired
- 1 well pad was re-poured
- 1 well had a large hole in the ground about 4 feet away - this was filled in w/ bentonite and then gravel
- developed 10 monitoring wells
- The 500-gallon and 300 gallon poly tanks were moved to the MGBG
- the 500 gallon tank has ~120 gallons in it now from initial site activities
- laid out 21 soil boring locations
- began laying out 6 well locations
- If time permits - 5 surface water and 8 sediment locations will be laid out, however 7/18/01 is the end of the shift - anything not completed will carry over to the next shift

THX,
Mark

TITLE NSWC CRANE

PROJECT NO. 3959

BOOK NO. 1340

SATURDAY 7.28.01

Work continued from Page WEATHER: 68-83°F OVERCAST 0.25" RAIN IN AFTERNOON

1015 KEITH SIMPSON & TERRY ROJAHN FROM DBG TO MGBG TO LAY-OUT 3 SW LOCATIONS, 01SW03, 04 & 05. RAIN DURING LAY-OUT 0.25" & NO FLOW @ 02SW03 & 04 < 1 GPM @ 02SW05

1315 SEE FIG. 4-3. COMPLETE LAY-OUT RETURN TO DBG. SPENT THE REST OF THE DAY @ DBG SITE SEE LOG BOOK # 1330

SCIENTIFIC BINDERY PRODUCTIONS CHICAGO 60605 MADE IN USA

Work continued to Page

SIGNATURE [signature] **DATE** 7.28.01

DISCLOSED TO AND UNDERSTOOD BY **DATE** **WITNESS** **DATE**

B 100 P ©

MONDAY 7.30.01

Work continued from Page

1130 KEITH SIMPSON & TERRY ROJAHN TO FIRE HOUSE ON BASE TALKED WITH LARRY WEBB (854-5607) ABOUT OUR HOT WORK PERMIT (FIRE INSPECTION). THE REQUIRMENTS ARE: AFTER THE 2 TRAILERS ARE SET-UP & THE GEN. CALL 854-1235 AND ASK FOR THE PERMIT. EVERYTHING NEEDS TO BE SET-UP BUT DO NOT RUN THE GENERATOR UNTIL YOU HAVE THE PERMIT.

— REQUIRMENTS FOR THE GENERATOR —

- 20X20' GRAVEL PAD IN THE WORKS
  TOM BRENT WILL HAVE PW DO THIS
- FIRE EXTINGUISHER - 20LB. ABC 2A 80BC RATING
- NO FUEL CANS STORED ON SITE
  BRING FUEL TO SITE EMPTY CAN
  THE STORE CAN ON TRUCK
- CHECK LIST FOR DAILY CHECKS OF:
  GEN, FUEL LEAKS, WIRE + HOOK-UP
  FIRE EX.
- GEN. CAN ONLY BE RUN WHEN WE ARE ON MGBG SITE

IF TRAILER HAS A FUEL TANK MAKE SURE IT IS DRAINED

1340 KS & TR TO MGBG LAY-OUT AREA FOR GRAVEL PAD (20X20') FOR GEN.

1450 RETURN TO BLD 3245

MON 8-06-01 / SUMMARY:

- TRAVEL DAY
- ORGANIZE NEWLY DELIVERED SAMPLE CONTAINERS & EQ FROM FED. EX.
- CHECK GENERATOR PAD @ MG SITE
- PREP FOR KICK OFF MEETING W/ NAVY

CREW: K. MARQUIS
T. ROJAHN

END

VOID

MON 8-06-01

Work continued from Page

CREW: K. MARQUIS & T. ROJAHN

1218 Hrs - TRAVEL DAY... ARRIVE @ BLDG 3245
- OPENED delivered packages & ORGANIZED Following:
  - Some sampling containers & coolers (12)
  - HES EQ. and supplies
  - (1) PID & (2) FIDS FROM U.S. ENVIRONMENTAL
  - WET BULB - HEAT STRESS MONITOR FROM IST / RS214 (ID)
- Put PID & FIDS on charge
- ORGANIZED paperwork / forms brought FROM Pit
- WENT OVER HSP

1510 Hrs - DROVE to MGBG to check on gravel Pad FOR GENERATOR - PAD in good SHAPE; however PWs barrow pile to build pad is in the AREA where the decon trailer is to go - NEED to level out barrow pad before TRAILER ARRIVES

1600 Hrs - RETURN to BLDG 3245 will go over HSP & WP FOR tomorrows meeting.

1715 Hrs - LEFT BLDG 3245 FOR motel

END

VOID

SIGNATURE DATE

DISCLOSED TO AND UNDERSTOOD BY DATE WITNESS DATE

VOID THIS PAGE
TK 8/7/01

TUES 8-07-01 CREW: K. Marquis & T. Rojahn

Work continued from Page WEATHER - Hot & Humid High 80's

0650 HRS - Arrive @ BLDG 3245

- Work up order of EXISTING WELLS to be developed CLEAN → dirty
- PREP for KICK OFF MEETING w/ NAVY PERSONNEL

0900 Hrs - KICK OFF MEETING - SEE list of NAMES P.8
Discuss H&S ISSUES; SCH.; AND Layout
Will meet tomorrow to go to MGBG to finalize layout of TRAILERS, generator & Decon.
Pre op meeting @ 0800 Hrs 8/08/01

1005 Hrs - LEFT BLDG 3245 FOR MGBG w/
T. Brent
Ronald Zitzman } EOD, NAVY
John Lefevre
RECON SITE

1130 Hrs - LUNCH

1200 Hrs - Spoke w/ OFFICE T. JOHNSTON
Discuss EARLIER MEETING w/ NAVY

1230 Hrs - T. BRENT got CALL FROM HERTZ - they will deliver GENERATOR between 1300 & 1400 Hrs ... will WAIT FOR delivery.

- loaded EQ. IN VEHICALS FOR WELL DEVELOPMENT
- CALI. YSI & LaMotte
- Touch base w/ William Scottsman Trailer Rental — Will delivery tomorrow AFTERNOON will leave CALL ON ANSWERING MACH. @ departure - gave directions to Crane Gate on 231 S between Bloomfield & Odon

1649 Hrs - Hertz dropped OFF GENERATOR @ BLDG 3245

1700 Hrs - LEFT BLDG 3245

NOTE: Tom Dickson loaded Ryder Rental w/ supplies & EQ. AND drove to Bloomington this date.

Work continued to Page

SCIENTIFIC BINDERY PRODUCTIONS CHICAGO 60605 MADE IN USA

SIGNATURE [signature] DATE 8/7/01

DISCLOSED TO AND UNDERSTOOD BY DATE WITNESS DATE

MGBG Pre-Start Meeting - August 7, 2001			
Name	Code or Org.	Phone	Email
KEVIN Baylor	06320 (Fire Dept)	854-1235	Baylor_Kevin@Crane.Navy.mil
Ronald W Zitzman	EOD	3456	Zitzman_R@crane.navy.mil
John Lefevre ENCM	EOD	3456	lefevre_j@crane.navy.mil
KENNETH MARQUIS	TETRA TECH NUS	770 384-6964	marquisk@ttnus.com
TERRY ROJAHN	T+ NUS	412 921 8857	rojahnt@ttnus.com
John Robinson	063	5605	Robinson_John@Crane.Navy.mil
Bruce Hawkins	067	3559	hawkinsbruce@Crane.Navy.mil
Thomas J. Brent	09510	6160	brent_t@crane.navy.mil
Christine D. Freeman	09511	4423	freeman_cd@crane.navy.mil
LARRY PATTERSON	062	5642	PATTERSON_LARRY@CRANE.NAVY.MIL
Tom Johnston (by phone)	T+NUS	412/921-8615	
Bill Gates (by phone)	SDIV	583-7360	
Don Miller	067	1568	miller_don
Kirby Divine	ESO-3	1517	Divine-Kirby@crane.navy.mil

Terry Rojahn 8-07-01

VOID

CREW [illegible]

TITLE NSWC CRANE

K. Marquis (K.M)
T. Dickson (T.D)
T. Rojahn (T.R)

PROJECT NO. 3959
BOOK NO. 1340

WED. 08-08-01

Work continued from Page

Weather Hot & Humid w/ Temp High 80s

0700 Hrs - Arrive @ Pass Gate - obtain 3 wk pass for T. Dickson

0715 Hrs - Arrive @ BLDG 3245

0800 Hrs - Meet w/ Base Personal & Drive to MGBG

0820 Hrs - Arrive @ MGBG for Pre Ops Meeting

SEE P.10 for list of personnel

Action Items:

- Obtain Base Station Radio (HERO standards) Ed. Scott Req.
- Barricade off 1407 @ 251 Access Road
- Call Larry Hooten to show Barricade for access to unaffected bunkers
- No Parking @ Bunkers - Park just off Road 251
- SEE P-10 for list of Persons to call just prior to Activation (*) of Drilling/Digging
- Call for Hot Work Permits Prior to start up of Generator & Steam Gen. (Larry Webb or Barry Tedrow) ↳ SEE P.10

0905 Hrs - End Meeting

0925 Hrs - Return to BLDG 3245

Call William Scottsman for trailer ETA

Load Field Trailer supplies & Eq into Ryder Truck

Go over H&S Issues w/ T.D.

1100 Hrs - Lunch

1135 Hrs - Arrive @ Crane Gate to Escort trailers & Tanks

1204 Hrs - Tanks ~~for~~ with trailer water arrive (2 Tank w/BLD)

1) Tank for unused H_2O for Decon

2) Tank for used H_2O

Each BLDG include Tank & pump; T.D & K.M will Escort Delivery truck to MGBG; T.R. will wait for trailers

1320 Hrs - Find out Trailers came through Bloomfield Gate

1400 Hrs - Escort Trailers Arrive @ MGBG

Remainder of day - Trailers leveled, blocked & anchored

Mob Eq. & supplies mob. from Pit by TD

Measure for plumbing, initial organization, etc

1900 Hrs - Left Site

Work continued to Page

SCIENTIFIC BINDERY PRODUCTIONS CHICAGO 60605 MADE IN USA

SIGNATURE

DATE 8-8-01

DISCLOSED TO AND UNDERSTOOD BY

DATE

WITNESS

DATE

10

SUBJECT	PRE OPS MEETING		
BASED ON		DRAWING NUMBER	
BY	CHECKED BY	APPROVED BY	DATE 8-8-01

	NAME	PHONE #	ORG.
*	ED Scott	854 1154	NAVY Explosive Safety
*	Wayne McCammon	854-1226	Army Safety
*	Larry Hooten	854-3015	ARMY STORAGE
*	Gregory L. Woodward	854-5621	SECURITY
	Kenneth Meek	854-1235	Fire Dept./HAZMAT
	Kevin Baylor	854-1235	Fire Dept./HAZ Mat
	John Robinson	854-5605	Fire
**	BARRY TEDROW	854-1235 Δ	FIRE/SAFETY

*** Tetra tech PERSONNEL

NOTE:

* CALL before ACTIVATION

** CALL FOR Hot PERMITS (GENERATOR & STEAM GEN.)

*** T. DICKSON, K. MARQUIS, & T. ROJAHN OF TETRA TECH ALSO Attend. PRE-OPS MEETING

Δ CALL FOR HOT WORK PERMIT

Ty Rojahn 08/08/01

VOID

THUR. 08-09-01

Work continued from Page ~~[illegible]~~ (TR) WEATHER - Hot & Humid Temp Low 90's

0650 Hrs - Arrive on Site / BLDG 3245

Talk w/ T. Brent - Discuss Pre Ops Meeting

Issues Discussed

1) Generator PAD - Tom called PW will do today
2) Shelving from Garage & Barricades
3) Base Station Radio - HERO standards
4) Electrician - Knows Base Code

#2 - Tom said ok to use shelf & barricades in Garage

#3 - OK if Cell Phones work - don't need Base Sta. Radio

#4 - Tom is working @ finding Electrian

0745 Hrs - K.M. meet Port a John to escort to MGBG

T.D & T.R Lay out new Generator PAD for Public Works

0820 Hrs - Port-A-John set up @ MGBG / UXO surface screen (K.M.

0906 Hrs - Return to Field Office / BLDG 3245

Call Uniform Rental ; KM @ Site to direct Gen PAD Con

1030 Hrs - Arrive @ Ryder Rental drop off Ryde-Truck (TD & TR)

Pick up Enterprise Rental

Lowes - plumbing, const., elec. Eq & supplies, etc.

Kroger - Jars for soil testing HD

Sam's Club - Eq & Supplies Canopy, etc.

1500 Hrs - Arrive @ Field Office

Checkin w/ T. Brent, call T. Johnston - check in

Shawn Scaff - discuss trailer problems

1545 Hrs - Arrive @ MGBG (T.D., KM & TR.)

Unload Eq. & supplies

Work @ trailers remainder of day

1800 Hrs - Left NSWC Crane

END

SIGNATURE Tony Regil DATE 8-9-01

DISCLOSED TO AND UNDERSTOOD BY DATE WITNESS DATE

VOID THIS PAGE

FRI. 08-10-01

Work continued from Page

WEATHER: Hot & Humid High 80's Low 90's

0655 Hrs - Arrive @ BLDG 5245

- SET UP H2 Filling Station
- " " IDW Storage Area (Satellite Storage Area)
- Pump out 500 gal tank & MOVE to NEW location
  Empty 300 gal tank back into 500 gal tank
  Inside IDW Storage Area
- Spread Stone between trailers
- Stabilize steps w/ Gravel
- B&D escorted to MGBG to Estimate Electrical work
- Start Fitting plumbing between shower trailer + Fresh Water tank & Grey Water tanks
- Construct Exhaust Hood
- Build partition between break room & screening
- Const. & set up Wind socks

1806 Hrs - Left Site

1915 Hrs - Purchase - supplies, eq. & hardware
WAL-MART & LOWES

2110 Hrs - Return to Motel

END

SCIENTIFIC BINDERY PRODUCTIONS CHICAGO 60605 MADE IN USA

Work continued to Page

SIGNATURE Terry Nagel DATE 8-10-01

DISCLOSED TO AND UNDERSTOOD BY DATE WITNESS DATE

VOID THIS PAGE
TK 8/11/01

SAT 8-11-01

Work continued from Page WEATHER - 86-90°, Hot & Humid

0650 Hrs - Arrive @ site
PREP. FOR WELL DEV. (TR)
Check In w/ T. JOHNSTON @ HOME (TR)
T.D & KM leave to work on trailers @ MGBG
0830 Hrs - TR LEFT FOR MGBG

WELL DEVELOPMENT SUMMARY

WELL #	START SURGE	START DEV	END DEV	DRY out # OF TIMES	VOL. PURGED	FINISH CLEAN-UP
1-18	1014	1021	1113	3	11 gal	1140 (TR)
1-27	1450	1457	1550	3	11.5 gal	1601 KM/TR
1-26	1611	1622	1754	4	23 gal	1810 KM/TR

SUMMARY OF WORK start AND/or Completed

- GAS up TRUCK OFF BASE @ LUNCH TIME (T.R. T.D.)
- Completed plumbing Grey H_2O & FRESH H_2O to DECON TRAILER (K.M.)
- Start work on dressing AREA in dECON TRAILER (T.D)
- Completed WIRING OF Hood in SCREENING TRAILER (T.D)
- PURCHASE ADDITIONAL SUPPLIES (TD)

1530 Hrs - TD Left site FOR PURCHASING EQ & SUPPLIES
1835 Hrs - KM & TR. ARRIVE @ BLDG 3245 - drop OFF dECON Potable H_2O containers & METERS
1845 Hrs - LEFT BLDG 3245 FOR MOTEL

END

SIGNATURE DATE 8-11-01

DISCLOSED TO AND UNDERSTOOD BY DATE WITNESS DATE

VOID THIS PAGE

SUN 08-12-01

Work continued from Page

0650 Hrs - ARRIVE @ BLDG 3245

- FILL Potable H_2O containers FOR DECON OF WHALE PUMP & DI pump up SPRAYER

WELL DEVELOPMENT SUMMARY

WELL #	START SURGE	START DEV	END DEV	DRY out # OF TIMES	VOL PURGED	FINISH CLEAN-UP
1-11	0840	0849	0931	3	6.5gal	0939
1-14	0951	0956	1044	3	8.5gal	1055
1-4	1105	1110	1156	3	8.0gal	1206
1-13	1230	1240	1300	0	30.0gal	1310
1-12	1330	1336	1425	3	11.0gal	1435
1-10	1443	1449	1515	2	9.5gal	1523
1-1	1535	1540	1600	0	22.0gal	1610
1-3	1621	1625	1646	2	1.75gal	1655

Note - PUMPED out 300gal. mobile TANK into 500gal tank @ Satellite Storage Location NEXT to TRAILERS

1740 Hrs - LEFT MGBG FOR BLDG 3245 (TD & TR)

1800 Hrs - Arrive @ BLDG 3245 (" & ")

- K.M. already @ BLDG 3245 - DECON pump and FILL up potable H_2O & DI CONTAINERS FOR tomorrow's development Activities
- PAPERWORK
- Put EQ & METERS in OFFICE
- SEE H&S Logbook (TR) ~~1337~~ 1347 FOR T.D. details FOR this date

1830 Hrs - LEFT NSWC

END

MON 8-13-01

Note: 1130 → 1500 Hrs ELECTRICIANS ON site (MGBG)
Greg HALLARD & Helper (Tom)

- SEE T. DICKSONS Note book # 1347 for H&S activities this date.

- Rationnel for using B&D ELEC.
  1) Base Contractor
  2) Familiar w/ Base Elec. Codes
  3) Fire Dept. Familiar w/ B&D performance
  4) Available to start work this date

MON. 8-13-01 WEATHER:
Work continued from Page
SUNNY W/ TEMP IN LOW - MID 80's

0650 HRS - ARRIVE @ BLDG 3245
- CALI. pH ON YSI
- PRE. + DEVELOPE WELLS
- CALL ELECTRICIAN gave them the go Ahead.

WELL #	START SURGE	START DEV	END DEV	DRY OUT WELL X	VOL PURGED	FINISH CLEAN-UP
1-25	0904	0909	1014	4	13 gal	1025
1-17	1052	1104	1122	0	30 gal	1134
1-20	1148	1155	1251	4	2.25 gal	1300
1-22	1310	1325	1417	3	17 gal	1425
1-16	1440	1446	1446	(WATER LEVEL 3' below bottom OF SCREEN) 1 gal REMOVED FROM SUMP		
1-5	1530	1535	1619	3	4.75 gal	1627
1-2	1634	1639	1719	3	3.0	1726

1735 Hrs - Start pumping out mobile tank into 500 gal. tank @ Satillite Storage Location

1805 Hrs - Finish pumping out Mobile tank - put inside Satellite Storage Location (unload off Pick up Truck)

1810 Hrs - LEAVE MGBG W/ T.D.
K.M. Already left for BLDG to decon buckets beakers, pump, PVC, Etc. for storage @ BLDG 3245.

1830 Hrs - Arrive @ BLDG 3245
- UNLOAD VEHICALE
- PAPERWORK
- 500 gal storage tank & MGBG OPS SIGNES ARRIVED this date

1900 Hrs - LEFT NSWC

END

SIGNATURE [signature] DATE 8/13/01
DISCLOSED TO AND UNDERSTOOD BY DATE WITNESS DATE

TUES 8-14-01

ALSO, SEE T. DICKSON'S H&S Log book #1347 for H&S ISSUES this date

TOM EMPS FINISHED ELEC INSTALLATION this date - Employed by B&D ELEC INC

TUES 8-14-01

Work continued from Page WEATHER - SUNNY & LOW 80°s.

0648 Hrs - ARRIVE @ BLDG 3245

- PREP to SAMPLE SEDIMENT
- TALK to K. SIMPSON - discuss NEXT SHIFTS → EQ. NEEDS, RESERVATIONS, & list of things to do.

SEDI. SAMPLE SUMMARY :

SAMPLE ID	TIME	SAMPLER(S) ↓	COMENTS
TB081401	0900	(TR)	TRIP BLANK
01-SD-02	0947	(TD/TR)	Routine SAMPLE
01-SD-03	1016	(TD/TR)	" "
01-SD-04	1045	(TD/TR)	" "
01-SD-05	1107	(TD/TR)	" "
01-SD-05	1410	(TD)	" "
01-SD-06	1420	(KM)	" "
01-SD-07	1430	(TR)	MS/MSD ALSO DUP (FD081401)
01-SD-08	1450	(KM/TD)	Routine SAMPLE
RB081401	1600	(KM)	RINSATE OF DIS. TROWEL

1535 Hrs - RETURNED to BLDG 3245

- PREP SAMPLES FOR SHIPMENT (ALL OF the ABOVE)
- SHIP HDs to ECBC on FED EX AB# 8286 9205 511[illegible] ← SEE CoC ECBC #1
- SHIP ALL REMAINING PARAMETERS to SWLO VIA FED EX ~~on~~ (TR) AB# 828692055097 " " SWLO #1 & #2
- FAX ALL CoCs to Linda K.
- FAX ECBC #1 to Gail BOYNTON
- FAX SWLO #1 & #2 to SANDY GROVENSTEIN

1830 Hrs - Drop of samples @ Bloomington FED EX.

END

SIGNATURE DATE 8-14-01

DISCLOSED TO AND UNDERSTOOD BY DATE WITNESS DATE

VOID THIS PAGE
TK 8/15/01

WED 8-15-01

Work continued from Page

0655 Hrs - Arrive @ BLDG 3245
- Check in w/ office - K. Simpson
- Talk to Env. Protection to get pass for water delivery
- Paperwork
- Call Fire Dept. for Hot work Permit @ MGBG

0800 Hrs - Check on work Permit / Digging Permit for MGBG → will not be ready until Monday 20th

0815 Hrs - Stop in @ Fire Dept. check on Hot Work inspection - talk to Barry Tedrow → Steve on his way out to site

0830 Hrs - Call K Simpson to check on FED. EX. Deliveries @ SWLO & ECBE Labs
- K.M. Escort Fresh H_2O delivery to MGBG

0900 Hrs - Arrive @ MGBG (TR)
Soil jar inventory
Secure Trailers & Generator

0935 Hrs - Return to BLDG 3245 (TR & TD)
- K.M. Escort Fresh H_2O truck to Bloomington Gate & left for Airport
- TD & TR secured BLDG 3245 and left for Airport @ 1000 Hrs

END

Work continued to Page

SIGNATURE

DATE 8/15/01

DISCLOSED TO AND UNDERSTOOD BY DATE WITNESS DATE

8-20-01

— DAILY SUMMARY —

ON SITE: T+NUS; KEITH SIMPSON
TOM DICKSON (H&S)
FRANK WUDKWYCH
TERRY ROJAHN
KEN MARQUIS (UXO)
DAVE MEIER } SURVEYORS
RICH JENKS }
TONY STRATI EFS

AM TRAVEL TO SITE

UNPACK SUPPLIES
PREP FOR SAMPLING
H&S TRAINING

SEE ALSO LOG BOOK # 1347

MONDAY 8.20.01

Work continued from Page WEATHER: (CRANE) NICE 70-80°F SUNNY
KEITH SIMPSON, TERRY ROJAHN, FRANK WYDRWYCH
& TOM DICKSON AT PGH AIRPORT, TRAVEL TO
CRANE, IN.

1000 @ IND. AIRPORT MET KEN M. TO AVIS/TO HOTEL
1300 @ BASE BLD 3245 PREP FOR SHIFT.
KS TO PW PICK-UP DIG-PERMIT ALSO
STOPPED AT FIRE HOUSE DROPPED OFF CHEMICAL
INVENTORY TO SHULTZ FOR LARRY/BARRY
1500 TOM D. GAVE SURVEYS H&S TRAINING, KS GAVE
SURVEYS LIST OF POINTS & FIG. ~~OF~~ MGBG POINTS TO
BE SURVEYED
1525 TOM DICKSON GIVES H&S TRAINING
1835 COMPLETE H&S TRAINING - PREP FOR SOIL SAMPLING
1910 OFF SITE

Brent Thomas J CNIN

From: Brent Thomas J CNIN
Sent: Wednesday, August 22, 2001 11 07 AM
To: Woodward Gregory L CNIN; Duzan Jeffery D CNIN; Scott Edward B CNIN
Cc: Hunsicker James M CNIN, Freeman Christine D CNIN
Subject: RADIOS @ MGBG

As you may recall, Tetra Tech NUS is conducting investigations at the Mustard Gas Burial Grounds. They have 2 cell phones that are operational on site Also, I set them up w/2 radios that have the CAAA repeater frequency. I tested them on-site this morning and was able to reach Security. They will use these only in an emergency Please notify others who may need to be aware of this (such as the comm room).

Thanks,
Tom Brent

ADDED FOR PG 29 8.22.01

8-21-01

— DAILY SUMMARY —

ON SITE: T+NUS; TERRY R.
KEITH S.
TOM D.
REN M.
FRANK W.

RICH J. SURVEYORS
DAVE M.

TONY S. EFS

4 SBs COMPLETE
01SB08, 16, 20 & 21

SEE ALSO: COC, FIELD FORMS, LOG BOOK
#390F, 1347 & 2503

TUESDAY 8.21.01

Work continued from Page WEATHER: NICE 76-85°F

0655 ON SITE TD, TR, KM, FW & KS PREP FOR SOIL BORINGS

0700 TONY S. (EFS) ON SITE

0725 TOM D. & TONY S. TO MGBG

0800 COLLECTED RB082101 01 @ 0800 ON STAINLESS STEEL BOWL

0855 KEN M. TO SITE

0917 KS CALL LARRY @ FIRE HOUSE FOR HOT WORK PERMIT

CALLED:

SEE PG 10

ED SCOTT START-UP ≈1200 LEFT MESSAGE
WAYNE McCAMMON - OK
LARRY HOOTEN - OK
GREG WOODWARD OK
JOHN LEFEVER - LEFT MESSAGE

1030 KS, FW & TR TO SITE SET-UP ON 01SB21 X SAMPLE COLLECTED FOR TOM D. TO RUN HD BACK-

1140 GROUND, COMPLETE BORING

1200 TO LUNCH, TO BLD 3245 PICK-UP SUPPLIES RETURN TO SITE PREP. FOR 01SB08 OR 01SB20

1430 TR TD KM, FW & TONY S. START ON SB 01SB20

1445 KS TO BLD 3245 FOR PAPER WORK

PHONE CALLS TO RALPH B. & TOM J. RETURN TO

1650 MGBG SITE

1845 TONY OF SITE TO HOTEL

1905 KS TD, TR, KM & FW TO BLD 3245 CLEAN-UP DECON PAPER WORK PREP FOR SAMPLING ON WED.

2030 DEPART FOR WAL-MART & HOTEL

8.22.01

— DAILY SUMMARY —

ON SITE: T+ NUS, TERRY R.
FRANK W.
KEITH S.
REN M.
TOM D.

EFS TONY S. 0700 ARRIVE

SURVEYORS DACE M. > 0750 ARRIVE
RICH J.

TOM B. SUPPLIED US WITH 2 RADIOS FOR EMERGENCYS

2 SBs COMPLETED 01SB11 & 15

DPT RIG BROKE DOWN @ 11:00

SAMPLED MW 01GW11

4 COOLERS SHIPPED TO SWLO

1 COOLER SHIPPED TO ECBC

SEE ALSO: FIELD FORMS, COCs, LOG BOOK #390F, 1347

SHIPPED COVERALLS BACK UPS

ARBILL GLOVE & SAFETY

REF # DATE

1Z E25 E14 06 1002 4254 - 1002-4254

1Z E25 E14 06 1002 4263 - 1002-4263

GroundTrac A.R.S. Tracking Number 1Z E25 E14 06 1002 426 3 | REF #/DATE 1002-4263

GroundTrac A.R.S. Tracking Number 1Z E25 E14 06 1002 425 4 | REF #/DATE 1002 4254

WED 8.22.01

Work continued from Page WEATHER: 74-86°F SUNNY

0650 ON SITE KS, TR, TD & FW
0700 TOM D. TO MGBG SITE
COLLECTED RB08220101 ON STAINLESS STEEL TROWEL
0705 KEN M. ON SITE, FRANK & KEN PICK-UP ICE
0735 ALL TO MGBG TO PREP/START SAMPLING
KS TOOK 3 RAD. BACKGROUND READINGS, SEE T.D. NOTES
0900 TOM BRENT ON SITE, TOM LENT TT NUS 2 NAVY RADIO TO USE WHILE DRILLING & SAMPLING AT THE MGBG. GAVE TOM B. A TOUR OF SITE SET-UP TRAILER, GEN, DECON ETC.
0945 TO DEPARTS MGBG (ALSO SEE PG 25 FOR RADIO INFO.
DPT SAMPLING CONTINUES
1045 KS TO GAS UP SUV + PICK-UP LUNCH FOR A 6 OF US.
1140 RETURN TO SITE, LUNCH
1140 DPT RIG BROKE-DOWN TONY WILL TRY TO HAVE IT REPAIRED BY THUR. AM
KS @ BLD 3245 TO PACK SAMPLES FOR FEDEX
1530 COMPLETE PACKING. PAPER WORK, PREP SUPPLIES/EQUIPMENT FOR SAMPLING
1555 JOHN CALL FROM EFS HE WILL TRY TO FIX THE DPT RIG TONITE - IF NOT THERE IS NOT A RIG AVAILABLE UNTIL FRIDAY. JOHN WILL CALL TONITE AND LET US KNOW
1500 FW COLLECTED SOURCE BLANK SB08220101 FROM POTABLE WATER HOLDING TANK @ MGBG SITE THIS WATER WAS DELIVERED TO THE SITE (FROM OFF SITE) AND IS USED FOR DECON & SHOWERING
1710 ORDERED TAGS, FOR SAMPLES, CONF. # DM911449
1755 KS TO SAM's CLUB FOR SUPPLIES

8.23.01

— DAILY SUMMARY —

ON SITE: T+ NUS, KEITH S.
FRANK W.
TOM D
TERRY R.
KEN M.

EFS TONY S. AM ONLY

SURVEYORS DAVE M. > PM ONLY
RICH J.

SB 08230101 ON DI

SHIPPED 3 COOLERS TO SWLO

SEE ALSO: LOG BOOK #390F, 1347, SAMPLE LOG SHEETS & COCs

— BACKHOE —
UNITED RENTALS
BLOOMINGTON, IN
812 3360333
4:00 FRI @ CRANE GATE
GATE# 3304
MIKE HANCOCK OR
DRIVER CHRIS SHAHAN
812 327 7996

THUR 8·23·01

Work continued from Page WEATHER: LT RAIN OVERNITE 68-85°F OVERNITE

0630 KS & FW ON SITE BLD 3245

0700 TR, KM, TD ON SITE BLD 3245 PREP FOR SB SAMPLING

0735 TOM, TERRY KEN, FRANK TO MGBG

0830 CALLED LEE LECK & SHE WILL CORRECT GW LABELS FOR NEXT SHIFT

0845 TO MGBG THE DPT RIG IS NOT IN WORKING ORDER UNSAFE SEE LOG BOOK #1347 TOM D. DID A SAFETY INSPECTION I ALSO LOOK OVER THE CRACKED WELDS & LEAKING HY. FLUID LINES. TOM D SHUT

0945 KS TO BLD 3245 WILL TALK WITH TOM J. AND CHECK ON OUR OPTIONS AS FAR

1000 TOM DICKSON FIT TEST FOR EACH OF US

1130 TO LUNCH PICK-UP ICE TO BLD 3245

1230 KEN M. OFF SITE TO WASH COVERALLS.
FRANK W. TO MGBG TO START 01MW14
TR & TD PACKING SAMPLES, ALSO COLLECTED SB 082301 01 @ 1230 ON DI WATER LOT # 0510011 EXP 5/2002 NERL BRAND DI

1250 JOHN JANSCHER - EFS CALLED AND HE WILL HAVE A VAN MOUNTED GEOPROBE 54LT HERE FRIDAY @ THE SITE (MGBG) 0900 SAME OPERATOR, TONY S.
JOHN J. EFS CALLED HE WILL TRY TO LEAVE THE DPT RIG SIT ON SITE OVER THE WEEKEND IF THE EXCAVATION IS DONE EARLY WE WILL START SBs.
TR, KS, TD PREP FOR EXCAVATION ON SAT.

1615 TR & TD TO MGBG TO CHECK ON FRANK & GW SAMPLING
01MW14 PURGED POOR PRODUCER WILL SAMPLE 8·24·01

1755 DEPART SITE

8-24-01

DAILY SUMMARY

ON SITE: T+ NUS, FRANK W.
KEITH S.
KEN M.
TOM D.
TERRY R.

SURVEYORS DAVE M.
RICH J.

EPS TONY S. 0945

SAMPLED 01MW14
5 SBs COMPLETE 01SB13, 14, 17, 18 & 19

SHIPPED 1 COOLER TO SWLO & 1 TO ECBC

SEE ALSO: LOG BOOK #1347 & 390F, FIELD FORMS & COCs

FRIDAY 8.24.01

Work continued from Page WEATHER: OVERCAST 67-85°F

0635 KS & FW @ 3245 FRANK PREP. TO COMPLETE SAMPLING @ 01MW14

0730 ALL TO SITE PREP FOR SBs SAMPLING (MGBG)

0850 PREP COMPLETE WAITING ON EFS

0945 TONY S. EFS ON SITE (MGBG)

1030 KS TO PICK-UP LUNCH
OPT RIG WAS "DIRTY" WHEN IT ARRIVED AND WAS DECONED PRIOR TO START.

1300 KS TO BLD 3245 PACK SAMPLES FOR FEDEX

1600 COLLECTED RB082401 01 @1600 ON A DPT PLASTIC LINER

1650 KS TO MEET BACK HOE RENTAL CO. & TAKE BACK HOE TO MGBG

1800 AT MGBG WITH BACKHOE TO UNLOAD

1855 5 SB COMPLETE DECON AND TO B-3245 STORE SAMPLES CHARGE EQ.

1900 TONY S. OFF SITE.
THE OPT RIG WE HAD TODAY DID NOT HAVE MUCH PUSH IF WE GET A "BETTER" RIG HERE WE WILL GO BACK TO 01SB17 & 18 & TAG BED ROCK

1950 OFF SITE

8·25·01

— DAILY SUMMARY —

ON SITE; T+ NUS: KEITH S.
TOM D.
TERRY R.
KEN M.
FRANK W.
LARRY HUDGINS

NSWC CRANE TOM BRENT
0700 → 1100

EFS KEVIN RIFFE
0700 → 1500

START & COMPLETED BOTH EXCAVATIONS
01TPL & 01TPS

1 SBs COMPLETE 01SB12

1 MW SAMPLED 01MW001

SHIPPED 3 COOLERS TO SWLO

1 COOLER TO ECBC

SEE ALSO: LOG BOOK # 1347, FIELD FORMS, TEST PIT LOGS, COC

SAT. 8.25.01

Work continued from Page WEATHER: LT. RAIN OVERNITE 67-85°F

0655 ON SITE TOM D. GIVES H&S TRAINING (SEE H&S LOG BOOK

0800 TO SITE (MGBG) ALL BUT TERRY R. TERRY IS WORKING ON GW SAMPLING 01C01

0912 START EXCAVATION 01TPL

0955 BREAK FOR WATER

1015 CONTINUE EXCAVATION

1033 COMPLETE EXCAVATION ALL SCRAP REMOVED START SET-UP ON 01TPS

NOTE: 01TPL L = LARGE & S = SMALL

1043 START 01TPS

1046 PULLED A STEEL FENCE POST OUT

1052 COMPLETE 01TPS DECON CLEAN-UP LUNCH SET-UP FOR DPT WORK

1255 START SBs COMPLETE 01SB12 @ 1350

1350 RAIN & LIGHTING STARTING END SOIL BORINGS CLEAN-UP DECON

1500 KEVIN R. OFF-SITE

1550 TR COMPLETE SAMPLING OF 01MWC01

1625 RETURN TO BLD 3245 STORE SAMPLES CHARGE EQ.

1725 DEPART SITE TO WAL-MART

0.25" OF RAIN FROM 1350 → 1600

8-26-01

— DAILY SUMMARY —

ON SITE: T+ NUS: TOM D.
TERRY R.
FRANK W.
KEITH S.
KEN M.

EFS KEVIN RIFFE

SAMPLED BOTH EXCAVATION PITS
6 SBs SAMPLED/COMPLETED

SEE ALSO: LOG BOOK #1347, SAMPLE LOG SHEETS, BORING LOGS, COC

SUNDAY 8·26·01

Work continued from Page WEATHER: 0.15" RAIN OVERNITE, 63-86°F OVERCAST

0655 @ BLD 3245 (ALL 5 + KEUN) LOAD TRUCKS
0705 TO MGBG, KS @ BLD 3245 PAPER WORK
CALL TOM J. JOB · UPDATE
0920 KS TO MGBG PREP. FOR EXCAVATION SAMPLING
1050 TOOK RAD READINGS ON FULL 450 GAL IDW
TANK ALL @ BACKGROUND SEE LOG BOOK 1347
1135 KS TO PICK-UP LUNCH
1250 KS & TR SAMPLED BOTH EXCAVATIONS
3 SAMPLES @ OITPL & 1 @ OITPS
1400 KS PICK-UP ICE TO BLD 3245 SAMPLES TO FRIDGE
COC & PAPERWORK
1530 COLLECTED RB082601 01 @ 1530 ON DPT STEEL
CUTTING SHOE.
1630 TR & FW @ 3245 DECON EQ. CLEAN-UP
PAPER WORK
1720 KM & TO @ BLD 3245 CLEAN-UP
1820 DEPART SITE

SIGNATURE [signature] DATE 8·26·01
DISCLOSED TO AND UNDERSTOOD BY DATE WITNESS DATE

8-27-01

— DAILY SUMMARY —

ON SITE, T+NUS: FRANK W.
KEITH S.
TOM D.
TERRY R.
REN M.

EFS KEVIN RIFFE
SURVEYORS RICH J.
DAVE M.

SBs COMPLETED

SHIPPED 6 COOLERS TO SWLO
SHIPPED 1 COOLER TO ECBC

SEE ALSO: COCs, SAMPLE LOG SHEETS,
LOG BOOK #1347

MONDAY 8.27.01

Work continued from Page WEATHER: SUNNY 65-83°F

0640 KS & FW PREP FOR SAMPLING SBs (KEVIN ON SITE)
0655 TOM D. & TR ON SITE BLD 3245
0710 ALL, BUT KS TO MGBG
KS PAPER WORK AT BLD 3245
0730 ORDERED 3 (102 CUFT.) NITROGEN CYL. ALSO PICK-UP EMPTYS
0900 CALLED BOWSER-MORNER (DRILLING SUB.) AND DISCUSSED START DATE, EQ. ETC. TALKED WITH JIM NIDZGORSKI MATT C. NEED TO CALL HIM AND DISCUSS EQ NEEDS. JIMS EXT 272
1000 COLLECTED RB082701 01 @ 1000 ON A STAINLESS STEEL TROWEL.
1048 KS TO MGBG, SAMPLED IDW TANK FOR GAMMA SPEC.
1200 LUNCH PICK-UP ICE
1235 TR & KS PACKING SAMPLES FOR FEDEX
1410 SURVEYORS STOP @ BLD 3245 ALL WORK AT MGBG COMPLETE, THEY WILL RETURN ON 9.14.01 TO SHOOT THE 2 NEW WELLS
KM FW & TD START TO DEMOB RENTED EQ. SHIPPED SOME SUPPLIES TO POH WAREHOUSE 2 SCBA, SPILL KIT, STRECHER. 7 PACKAGES
1750 TD & TR TO SAM'S CLUB
KS & FW PREP FOR GW SAMPLING (8.28.01)
1830 KS & FW DEPART SITE

SIGNATURE [signature] DATE 8-27-01
DISCLOSED TO AND UNDERSTOOD BY DATE WITNESS DATE

8.28.01

— DAILY SUMMARY —

ON SITE, T + NUS: KEITH S.
KEN M.
TOM D.
TERRY R.

1 MW SAMPLED

2 COOLERS SHIPPED TO SWLO
1 COOLER TO ECBC

SEE ALSO: COC, LOG BOOK #1347, SAMPLE LOG SHEETS

TUES 8-28-01

Work continued from Page WEATHER: 65-84°F

0500 KS TOOK FW TO BUS SERVICE STOP, FW TO AIRPORT / PGH.

0545 KS @ BLD 3245 PREP FOR GW SAMPLING @ MGBG.

0630 TO MGBG SET-UP ON 01MW06
BLADDER PUMP CONTROL WILL NOT WORK TOUR

0900 DOWN SET-UP TO BLD 3245
RETURN CONTROL BOX TO USENVIRONMENTAL

1050 KS TO MGBG MW 01-04 TOOK OVER FOR TR

1130 TR TO LUNCH START SAMPLING 01GW04 01 @ 1245

1250 TR RETURN FROM LUNCH & BLD 3245

1315 KS TO BLD 3245 PAPER WORK

1530 COLLECTED RB082801 01 @ 1530 ON TEFLON & SILCONE TUBING + 0.45 UM FILTER USED WITH PERISTALTIC PUMP.

1530 TR COMPLETES 01MW04
PACK SAMPLE FOR FEDEX
CLEAN BLD 3245 LOCK-UP

1700 DEPART SITE

END OF SHIFT

WED 8-29-01 CHECK OUT OF HOTEL
TO AIRPORT / PGH

9.4.01

— DAILY SUMMARY —

ON SITE: T+ NUS; KEITH SIMPSON
KEN MARQUIS
TERRY ROJAHN
FRANK WUDKWYCH

BOWSER-MORNER; JON REIFER
JASON DUNN
KENT DUNCAN
JAMES VANKIRK

H&S FOR DRILLERS (FW)

1 MW SAMPLED 01MW06

SEE ALSO: LOG BOOK # 2447, 390F, 2503
COC, FIELD FORMS

TUESDAY 9.4.01

Work continued from Page WEATHER: CRANE 83°F SUNNY

0800 KS, TR & FW @ AIRPORT TO IND. PICK-UP RENTAL CARS TO CRANE

1315 KM TO MGBG START 01MW06

1340 FRANK W. TO MGBG WITH DRILLERS SUPPLIES DRUMS, PVC ETC.

1440 FRANK W. GIVES H&S (SITE SPEC.) TO DRILLERS

1540 COMPLETE H&S DRILLERS PREP. FOR TRAVEL TO SITE.

1615 @ MGBG UNLOAD EQUIPMENT. GAVE FRANK ONE OF OUR 2 NAVY RADIOS. TO BE USED WITH DRILLING OPERATIONS.

1710 TO 01MW06 & CHECK ON KEN, HELPING KEN SAMPLE 01MW06

1900 RETURN TO BLD 3245
FRANK & TR DEPART @ 1830
KS & KM UNLOAD SUVs STORE EQ. DECON PUMP

1920 DEPART SITE

IDW (WATER) 3 TANKS 450, 550 & 300 GAL.
450 FULL, 550 = 50 GAL, 300 EMPTY

SIGNATURE [signature] DATE 9.4.01

DISCLOSED TO AND UNDERSTOOD BY DATE WITNESS DATE

9-5-01

— DAILY SUMMARY —

ON SITE; TETRA TECH; KEITH S.
TERRY R.
FRANK W.
KEN M.

BOWSER-MORNER JON K.
JASON ~~DUNCAN~~ KS
KENT D.
JAMES V.

4 MWs SAMPLED; 01MW15, 21, 12 & 13
DUP ON 01GW13

SHIPPED 1 BOX OF SUPPLIES TO THE PGH WAREHOUSE, SS BOWLS, SAFETY GLASSES, REG.

SEE ALSO: LOG BOOK #s 2447, 390F, 2503
COC, FIELD FORMS

METERS USED FOR RAD. SCREENING:
- MODEL 3 SURVEY METER w/ PROBE 44-9
- MODEL 19 MICRO R METER

WED 9.5.01

Work continued from Page WEATHER: 70-83°F SUNNY

0645 @ BLD 3245 PREP FOR DRILLING & GW SAMPLING FW, TR & KS

0705 KM @ BLD 3245

0730 FRANK & DRILLERS TO MGBG FOR SET-UP ORDERED 2 CYL. OF NITROGEN FOR THUR.

0747 CALLED FOR HOT WORK PERMIT 854 1235 TALK WITH LANE AND SOMEONE FROM THE FIRE HOUSE WILL BE OUT TO MGBG @ 0930 TODAY

0825 KS PICK-UP ICE & TO MGBG

0920 FIRE INSPECTOR @ MGBG FOR HOT WORK PERMIT EVERYTHING CHECKED OUT OK PERMIT KEPT IN FW SUV.

0950 SET-UP TO START DRILLING. @ 01T02 (~~SHALLOW~~ DEEP)
01T02 IS CLOSER TO BUNKER 1405
* 01T0~~2~~1 ~~DEEP (~105'~~ SHALLOW) WILL BE ≈ 20' WEST OF 01T02. ~~THEY WILL BE SWITCHED FROM FIG. 4-57~~ NA KES WELLS ARE AS ~~SHOWN~~ ON FIG 4-3

1015 KS CHECK ON TR & KM GROUND WATER SAMPLING WELL 01GW15 SAMPLED @ 0945, KS TO BLD 3245

1100 TOM JOHNSTON CALLED IS OK TO "DUMP" CUTTINGS FROM BACKGROUND WELLS ON GROUND WATER TO SAITARY. TOM BRENT CAN CALL TOM JOHNSTON IF HE HAS QUESTIONS.

1123 KS - TALKED WITH TOM BRENT SPREAD CUTTINGS & DUMP WATER TO SANITARY AFTER SCREENING

1210 TO CAFE PICK-UP LUNCH FOR TR & FW RETURN

1235 TO MGBG TALKED WITH FRANK ABOUT "NEW" DEPTH FOR WELL, BEDROCK IS @ 30'± NOT 10', DEEP NO DEEPER THAN 120' BGS & SHALLOW WELL 65 TO 70' BGS.

1400 KS RETURNS TO ~~MGB~~ BLD 3245 PAPER WORK

* CORRECTION WELL ARE AS SHOWEN ON FIG 4-3
01T02 = DEEP & 01T01 = SHALLOW ALSO SEE TABLE 4-5

SCIENTIFIC BINDERY PRODUCTIONS CHICAGO 60605 MADE IN USA

Work continued to Page

SIGNATURE [signature] DATE 9.5.01

DISCLOSED TO AND UNDERSTOOD BY DATE WITNESS DATE

BLANK PG.
KES 9.5.01

9.5.01

Work continued from Page 45

1525 DRILLERS OFF SITE
1530 REN M. RETURN FROM MGBG 2 WELL SAMPLED
1610 REN OFF SITE TO HOTEL
FW WORKING WITH DATA LOGGER, READING MANUAL.
1655 RS TO MGBG TO CHECK ON TR
TERRY NEEDS 2 2+ HRS TO COMPLETE SAMPLING
1730 RS TO JEEP TRAIL, ABG, TO CHECK ON ACCESS FOR PROPOSED MWs
1810 RETURN TO MGBG TO HELP TR SAMPLE
TR COMPLETING 01MW13 DUP COLLECTED AT WELL 13
2030 DEPART MGBG TO BLD 3245, STORE SAMPLES CHARGE METERS
2105 OFF SITE TO HOTEL

Work continued to Page

SIGNATURE
DATE
DISCLOSED TO AND UNDERSTOOD BY DATE WITNESS DATE

9.6.01

— DAILY SUMMARY —

ON SITE; TETRA TECH: KEITH S..
TERRY R.
KEN M.
FRANK W.

BOWSER-MORNER JON K. AM ONLY
KENT D.
JAMES V.
JASON D.

SAMPLED 2 WELLS
PURGED (DRY) 2 MORE, WILL SAMPLE 9.7.01

SHIPPED 3 COOLERS TO SWO
SHIPPED 1 COOLER TO ECBC

SEE ALSO: LOG BOOK #S 2947, 390F, 2803
FIELD FORMS, COC

THUR 9.6.01

Work continued from Page WEATHER: 69 – 84°F SUNNY

0655 KS, TR, KM & FW @ BID 3245 DRILLERS TO MGBG

0700 FW TO MGBG TR & KM DECON & PREP FOR SAMPING.

0835 KS TO MGBG STOPED @ DRILL SITE 01T02 (DEEP) DOWN ≈ 62' BGS, GOING GOOD.

0920 PURGING 01MW03 PUMPED DRY CHECKED ON

1050 KM & FW TO CAFE TO PICK LUNCH-UP TOOK LUNCH TO MGBG, CHECKED ON FW, TR, KM

1300 TO BID 3245 PACK SAMPLES FOR FEDEX PAPER WORK PHONE CALLS

1630 RETURN TO MGBG CHECK ON TR, KM & FW KEN COMPLETES SAMPLING FOR DAY TO BID 3245 DECON THEN TO HOTEL

TR EXPECTS TO COMPLETE 01GW01 @ 1800

1655 KS & FW TAKE ALL 9 CORE BOXES TO BUNKER 1970 (PER TOM BRENT) CORE FROM 01T02 32' TOP OF ROCK TO 115' BGS BTM. OF HOLE.

1730 KS, FW TO BID 3245 PAPER WORK, CLEAN-UP

1820 KS TO SAM'S CLUB FW WAITING ON TR

1830 TR & FW OFF SITE

9.7.01

— DAILY SUMMARY —

ON SITE: TETRA TECH; KEITH S.
FRANK W.
TERRY R.
KEN M.

BOWSER-MORNER; KENT D.
JAMES V.
JASON D.

SAMPLED 2 MWs

SHIPPED 4 COOLERS TO SWLO

SEE ALSO: LOG BOOK #s 2447, 390F, 2503
FIELD FORMS, COCs

FEDEX FRIDAY PICK-UP # 1

FRIDAY 9.7.01

Work continued from Page WEATHER: 72 - 86°F AM SUNNY, HEAVY RAIN START @ 1610 0.75"

0655 ON SITE KS, TR, FW & KM. FAX TIME SHEETS TO PGH OFFICE
0720 FW TO MGBG & DRILLING
0740 KM TO MGBG FOR GW SAMPLING
0830 TR TO MGBG FOR GW SAMPLING
0845 KS TO MGBG CHECK WITH FRANK TO 01MW03 & SAMPLE WELL.
HELP TR & KM WITH GW SAMPLING
1100 TO CAFE FOR LUNCH FOR EVERYONE, RETURN TO MGBG
1200 PICK-UP ICE TO BLD 3245 PACK FOR FEDEX PAPER WORK & CLEAN-UP.
1550 FW @ BLD 3245 DRILLERS ARE DONE FOR TODAY.
1620 TR & KM RETURN FROM GW SAMPLING UNLOAD SUVs CLEAN-UP
1730 OFF-SITE

0.75" RAIN 1610 → 1700
RAIN STOPPED @ 1700

SIGNATURE [signature] DATE 9.7.01
DISCLOSED TO AND UNDERSTOOD BY DATE WITNESS DATE

9.8.01

— DAILY SUMMARY —

ON SITE: T+NUS; KEITH S.
TERRY R.
KEN M.
FRANK W.

BOWSER-MORNER; KENT D.
JAMES V.
JASON D.

MW's 4 SAMPLED

MW 01T02 INSTALLED
SHALLOW WELL

01T02 ON NORTH SIDE OF GRAVEL ROAD ≈ 150' WEST OF BUNKER 1405 (SEE FIG 4-3)

SEE ALSO: LOG BOOK #S, 390F, 2447, 2503, FIELD FORMS, COC

SAT. 9.8.01

Work continued from Page WEATHER: OVERCAST 0.25" RAIN OVER NITE 70-82°F

0650 KM, TR, FW & KS @ BLD 3245
0700 FW TO MGBG TO MEET DRILLERS
0710 KS TO MGBG SAMPLE 01MW03
TR & KM CAL. EQ & MAKING BOTTLE SETS
0830 KS COMPLETES SAMPLING @ 01MW03
HELPING KM @ 01MW27
0925 MOVED TO 01MW02 SET-UP & PURGE & SAMPLE
KM COMPLETES SAMPLING
1145 KS TO DRILL SITE WORKING WITH DRILLERS
DEEP WELL DID NOT MAKE ANY WATER & WAS BACKFILLED
1300 KS TO BLD 3245 DECON PUMP, SAMPLES TO FRIDGE, PAPERWORK.
1420 KM @ BLD 3245 CLEAN-UP & BOTTLE SETS
1500 RINSATE BLANK RB09080101 COLLECTED ON BLADDER PUMP & TEFLON TUBING.
1540 KS TO MGBG TO CHECK ON TR & DRILLERS
1550 KM OFF SITE
1700 FW OFF-SITE TO LOWES FOR SUPPLIES
1720 TR RETURNS TO BLD 3245 AFTER COMPLETEING 01MW25
KS PAINTER BUMPERS & WELL
1800 RETURN TO BLD 3245 WITH DRILLERS
1830 KS, TR & DRILLERS OFF SITE

9.9.01

— DAILY SUMMARY —

ON SITE, TETRA TECH, FRANK W.
TERRY R.
KEITH S.
KEN M.

BOWSER MORNER; AM ONLY
COMPLETE GROUT @ 01T01
0630 – 0730
OFF-SITE

KENT D.
JAMES V.
JASON D.

DEVELOPED "NEW" WELL 01T02
@ MGBG

RAIN 0.30" OVER NITE
0.45" 0700 → 1300
0.50" 1300 → 1820

TOTAL RAIN FALL = 1.25" OVERNITE TO 1820

HEAVY RAIN ON/OFF THRU-OUT THE DAY

ALSO SEE: WL FORMS, FIELD FORMS & COCs

SUNDAY 9.9.01

Work continued from Page WEATHER: HEAVY RAIN 67-80°F 0.30" OVERNITE

0650 KS, FW, TR & KM @ BLD 3245

WORKING ON JEEP TRAIL STORM WATER SAMPLING ALL DAY ROUND 02

TOTAL RAIN FALL 8.8 PM THRU 8.9.01 1820. = 1.25" RAIN GAUGE @ BLD 3245

SAMPLED 03SW01, 02, 03, 06 + DUP 02, 09, 15, 16, 17, 18, 19 + DUP & MS/MSD, 08, 11, 13 & 14

03SW04 WAS DRY NO FLOW

ALSO TOOK WL READINGS @ THE 7 SG & 34 WELLS

1930 OFF SITE

CTO 126 # N3960

HIGH FLOW SAMPLING (ROUND 02)
STORM EVENT

9.10.01

— DAILY SUMMARY —

ON SITE; TETRA TECH: KEITH S.
KEN M.
TERRY R.

BOWSER-MORNER: SCOTT WHITBOOK
PICK-UP SUPPLIES, DRUMS, SAND, PVC ETC.
1120 THRU 1230 @ BLD 3245 ONLY

MWs SAMPLED

SHIPPED 20 COOLERS
1 TO ECBC
1 TO APIC
4 TO SWLO
14 TO LAUCKS

SEE ALSO; FIELD FORMS, LOG BOOK 390F,
COC

MONDAY 9.10.01

Work continued from Page WEATHER: COOLER, DRY 55-78°F NICE

0650 KS KM & TR @ BLD 3245 KM TO MGBG FOR GW SAMPLING
KS & TR WORKING ON NA & PACKING & PAPER WORK FOR JEEP TRAIL SW SAMPLES
1510 COMPLETE PACKING FOR FEDEX
RUNNING MNA PARAMETERS
1640 KM RETURNED FROM MGBG TWO WELLS SAMPLED O/MW22 & 24
CLEAN EQ. & WORK AREA
1805 KM TO SAM'S CLUB FOR SUPPLIES
1905 KS & TR COMPLETE MNA FOR JT SWs
1915 DEPART SITE

9.11.01

— DAILY SUMMARY —

ON SITE; TETRA TECH; TERRY R.
KEITH S.
KEN M.

SEE ALSO: FIELD LOG BOOK 390F, 2503, COC,
FIELD FORMS

TUESDAY 9.11.01

Work continued from Page WEATHER: CLEAR 63-77°F NICE

0650 KS & TR ON SITE CAL. EQ. LOAD SUV FOR GW SAMPLING. RM LOAD SUV FOR MW SAMPLING.

0735 RM & TR TO MGBG FOR GW SAMPLING

0850 KS TO MGBG DEVELOPMENT OF OIT02

1135 KEN M. OFF-SITE TO HOTEL

— TERROKIST ATTACT ON U.S. —

MEETING @ 1200 WILL FIND OUT IF WE WE NEED TO DEPART BASE & END SHIFT.

TR IS @ MGBG SAMPLING GW

TETRA TECH OK TO WORK ON BASE TODAY

1235 KS TAKES LUNCH TO TR @ 01MW19

KS SET-UP TO PURGE 01MW05

WE ARE REQUIRED TO LEAVE THE BASE TR @ WELL 01MW17 COMPLETE. WILL SAMPLE 01MW05 NEXT SHIFT

1550 KS & TR CLEAN-UP & PREP. TO LEAVE SITE

1630 OFF-SITE

WED 9.12.01 DRIVE FROM BLOOMINGTON, IN TO PGH

TRAVEL DAY

SHIPPED 2 COOLERS FROM HOTEL TO SWLO

END OF SHIFT

9.17.01

— DAILY SUMMARY —

ON SITE, TETRA TECH: KEITH SIMPSON
KEN MARQUIS

TRAVEL TO SITE AM

ROUND OF WLs @ MGBG 29 WELLS

SAMPLES FROM MWs 01-17, 22 & 24 DID NOT REACH SWLO FOR 6+ DAYS AND WERE OVER TEMP. (22°C). WELLS WILL BE RESAMPLED THIS SHIFT

SEE ALSO:

MONDAY 9.17.01

Work continued from Page WEATHER: CRANE, NICE 68-75°F CLOUDY

0650 KS @ PGH AIRPORT
1145 KS & KM @ BLD 3245
SAMPLES SHIPPED ON 9.12.01 DID NOT REACH SWLO UNTIL TODAY TEMP IN COOLER WAS 22°F LAB PITCHED SAMPLES WE WILL RESAMPLE

1325 KS & KM TO MGBG FOR ROUND OF WLS
1540 COMPLETE WL RETURN TO 3245
SHIPPING EQ. BACK TO RENTAL CO. HORIBA, WL METER, FID
CAL. EQUIPMENT, PREP. FOR GW SAMPLING ON TUES.
1700 KM COMPLETES PREP WORK, OFF-SITE
TALKED WITH J. SCHUBERT HE WANTS US TO PICK OUT 2 WELLS THAT ARE GOOD PRODUCERS AND, AFTER SAMPLING TURN PUMP RATE-UP & PREFORM A MIN-PUMP TEST. RECORD DRAW DOWN & PUMP RATE FOR 3 READINGS SHUT PUMP OFF & RECORD RECOVERY FOR 15 MIN.
1740 KS COMPLETES PAPER WORK OFF SITE TO FED EX

9.19.01

— DAILY SUMMARY —

ON SITE: TETRA TECH, KEITH S.
KEN M.

3 MWs SAMPLIED
2 PURGED DRY, SAMPLE ON 9.19.01

MINI PUMP TEST @ 01-08, WHILE SAMPLING

SEE ALSO: COCs, FIELD FORMS, LOG BOOK 390F,

TUESDAY 9.18.01

Work continued from Page WEATHER: 0.20" RAIN OVERNITE 68-78°F

0655 KS & KM @ BLD 3245 LOAD TRUCKS FOR GW SAMPLING

0720 TO MGBG KS SET-UP ON 01TO2
PUMPED WELL DRY WILL SAMPLE AFTER RECHARGE

1005 TO BLD 3245 PICK-UP 2ND BLADDER PUMP

1045 RETURN TO MGBG SET-UP ON 01-19
START PURGE, SAMPLE 01GW1901

1620 DUMP PURGE WATER TO BLD 3245
DECON, SAMPLES TO FRIDGE, MAKE-UP BOTTLE SETS & PAPER WORK

1725 KM @ BLD 3245

1810 OFF-SITE

9-19-01

— DAILY SUMMARY —

ON SITE: TETRA TECH, KEITH S.
KEN. M.

4 MWs SAMPLED
2 PURGED ONLY

SEE ALSO: COCs, LOG BOOK 390F,
FIELD FORMS

WED 9.19.01

Work continued from Page WEATHER: 1.20" RAIN OVERNITE, 60-72°F RAIN ON/OFF THRU-OUT THE DAY TOTAL RAIN FALL 0.05"

0640 KS ON SITE LOAD TRUCK FOR GW SAMPLING.
0730 SET-UP TO SAMPLE 01T02
KM @ 01-05 TO SAMPLE, COMPLETE SAMPLING
1005 MOVE TO MW 01-20, PUMPED WELL DRY, TO PUMP
1145 INLET, WILL SAMPLE ON 9.20.01
DECON PUMP TO 01-17 SET-PURGE & SAMPLED
COLLECTED DUP FD 091901 01 @ THIS WELL
1715 KM DEPART MGBG TO BLD 3245, SAMPLES TO
FRIDGE, CLEAN-UP THEN OFF-SITE
1900 KS @ BLD 3245 UNLOAD TRUCK, CLEAN-UP
1930 OFF-SITE TO HOTEL

9.20.01

— DAILY SUMMARY —

ON SITE; TETRA TECH: KEITH S.
KEN M

3 MWs SAMPLED

7 COOLERS SHIPPED TO SWLO

SEE ALSO: COCs, LOG BOOK # 390F,
SAMPLE LOG SHEETS

THUR. 9-20-01

Work continued from Page WEATHER: OVERCAST 64-72°F

0650 @ BLD 3245 KM PREP FOR GW SAMPLING
KS PAPER WORK & PHONE CALLS
0910 KS TO MGBG SET-UP TO SAMPLE 01-20
PUMPED DRY (TO PUMP INLET) AFTER 1.5 L STOP
PUMP FOR RECHARGE WILL RETURN THIS PM
1055 TO LUNCH, PICK-UP ICE TO BLD 3245
PACK SAMPLES FOR FEDEX
1550 TO MGBG MW 01-20 CONTINUE SAMPLING
1630 COMPLETE SAMPLING CLEAN-UP TO BLD 3245
PACKING RENTAL EQ. FOR RETURN, DECON, CLEAN-UP
PAPER WORK
1750 OFF-SITE TO FEDEX

SCIENTIFIC BINDERY PRODUCTIONS CHICAGO 60605 MADE IN USA

Work continued to Page

SIGNATURE [signature] DATE 9-20-01

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9.21.01

— DAILY SUMMARY —

ON SITE: TETRA TECH: KEITH S.
KEN M.

START DEMOB

FRIDAY 9.21.01

Work continued from Page WEATHER: CLOUDY 67-77°F

0650 KS @ BLD 3245 FAX HRS IN

0830 TO MGBG & LOOK FOR SEEP TO BE SAMPLED & START DEMOB

CHECKED THE ~~THE~~ KS HILLSIDE SLOPES AROUND THE SITE FOR SEEPS (SEE MARK-UP OF FIG. 4-3) ALSO TERRY ROJAHN CHECKED DURING SD SAMPLING NO SEEP FOUND.

1000 CONTINUE DEMOB OF TRAILERS

KM SAMPLED 2ND (BLUE) 550 GAL IDW TANK IT HAS 125± GAL IN IT. IN THE TWO TANKS THERE IS A TOTAL OF ≈600 GAL OF IDW IN THE 2 TANKS ON SITE.

1100 RETURN TO BLD 3245 TRUCK LOAD OF TRASH/DEMOB MATERIAL TO DUMPSTER

1200 LUNCH

1320 TO MGBG HAK GRAY WATER TO BASE SANITARY

WORKING ON DEMOB @ MGBG ALL AFTERNOON

TO BLD 3245 STORE EQUIPMENT

1800 OFF SITE TO HOTEL

SIGNATURE [signature] DATE 9-21-01

DISCLOSED TO AND UNDERSTOOD BY DATE WITNESS DATE

9.22.01

— DAILY SUMMARY —

ON SITE, TETRA TECH: KEITH S.
KEN M.

1 (LAST) MW SAMPLED

SUNDAY TRAVEL HOME

SATURDAY 9-22-01

Work continued from Page WEATHER: SUNNY 65-78°F

0830 RETURNED ENTERPRISE RENTAL TRUCK THEN PICKED-UP @ PENSKE ONE WAY RENTAL TO TAKE WAREHOUSE EQ. BACK TO PGH.

0950 TO BLD 3245 THEN TO MGBG KEN LOADING EQ. FROM TRAILERS INTO TRUCK KS PURGING MW 01T02. START PURGE @ 1122

1240 COMPLETE PURGE DRY TO PUMP INLET WILL ALOW TO RECHARGE & SAMPLE
WORKING ON CLEAN-UP @ 3245

1620 KEN M. COMPLETES CLEAN-UP @ 3245 OFF BASE FOR HOTEL @ 1640, EARLY FLT. HOME SUNDAY.

1900 KS TO MGBG TO COMPLETE SAMPLING OF 01T02 RETURN TO BLD 3245
LOAD ALL PGH WAREHOUSE EQ. IN TO RENTAL TRUCK INVENTORY OF OUR WORK ROOM @ BLD 3245

2045 OFF-SITE

END OF SHIFT

&

MGBG ROUND 1

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PAGE No

SUBJECT

TITLE NSWC CRANE

PROJECT NO 3959

BOOK 2503

WED. 9-05-01

Work continued from Page WEATHER - Mostly Sunny Temp 80's

0655 Hrs - Arrive @ BLDG 3245
Prep for Groundwater Sampling
Cali. Turbidity Meter & FID
Assist K. Marquis set up @
~~Monitoring~~ TK WES - 1-15-83

0900 Hrs Arrive @ WES-1-12-81
Start Purge - 0935
End Purge - 1235
Vol. Purged - 2.5 gal
Start Sampling - 1240
End Sampling - 1347
Sample ID - 01GW1201

1420 Hrs - Arrive @ WES-1-13-83
Start Purge - 1445
End Purge - 1745
Vol Purge - 6.3 gal
Start Sampling - 1750
End Sampling - 2020
Sample ID - 01GW1201 & F
FD09050101 & F

2050 Hrs - Arrive @ BLDG # 3245
Refrigerate Samples
2100 Hrs - Left BLDG #3245 for Motel

SCIENTIFIC BINDERY PRODUCTIONS CHICAGO 60605

Work continued to Page

SIGNATURE Tony Rogers

DATE 9-5-01

WITNESS

DATE

TITLE NSWC CRANE

PROJECT NO. 3959

BOOK 2503

THUR 9-6-01

Work continued from Page WEATHER - MID 80'S HOT & HUMID

0700 Hrs - ARRIVE @ BLDG #3245
- CALI TURB. METER & FID
- PREP. to SAMPLE GROUND WATER
- DECON BLADDER PUMP
- SET UP PERISTALTIC PUMP @ WES-1-3-81 FOR K.S. to PURGE

1010 Hrs - ARRIVE @ WES-1-1-81
START PURGE - 1035 Hrs
END PURGE - 1245 Hrs
Vol. PURGED - 6.3 gal
START SAMPLING - 1250 Hrs
END SAMPLING - 1752 Hrs
SAMPLE ID - 01GW0101 (MS/MSD) & FD09060101
FINISH CLEAN-UP = 1801 Hrs

1823 Hrs - ARRIVE @ BLDG #3245
1830 Hrs - LEFT 3245 FOR MOTEL

SCIENTIFIC BINDERY PRODUCTIONS CHICAGO 60605

Work continued to Page

SIGNATURE

WITNESS

DATE 9-6-01

DATE

TITLE NSWC CRANE

PROJECT NO. 3959

BOOK 2503

FRI. 9-07-01

Work continued from Page WEATHER - 80'S & OVERCAST / HUMID

0700 Hrs - ARRIVE @ BLDG 3245
CALI = FID & TURBIDITY METER
PREP to SAMPLE GROUNDWATER

0940 Hrs - ARRIVE @ WES-1-10-82
START PURGE = 1010 Hrs.
END PURGE = 1430 Hrs.
PURGED WELL 4 Hrs WATER LEVEL dropped below top of WELL SCREEN - will sample tomorrow
Vol. PURGED = 4.4 gal
FINISH CLEAN UP = 1445 Hrs

1500 Hrs - ARRIVE @ WES-1-2-81
FINISH SET UP & HEAVY RAIN STORM MOVED IN - SECURED WELL & LEFT MGBG @ 1530 Hrs
K.M. will start sampling tomorrow

1550 Hrs - ARRIVE @ BLDG #3245
UNload VEHICEL to take OFF base FOR GAS

1730 Hrs - LEFT BASE

SCIENTIFIC BINDERY PRODUCTIONS CHICAGO 60605

Work continued to Page

SIGNATURE

WITNESS

DATE 9/7/01

DATE

TITLE NSWC CRANE

PROJECT NO. 3959

BOOK 2503

SAT 09-08-01

Work continued from Page WEATHER - OVERCAST

0700 Hrs - Arrive @ BLDG # 3245
- CAL. - FID, Turbidity Meter & YSIs (pH only)
- Prep. for Groundwater Sampling
- Make up bottle sets

0810 Hrs - Arrive @ MGBG

0815 Hrs - Arrive @ WES-1-10-82
Start Sampling = 0835 Hrs
END " = 0918 Hrs
Sample ID # = 01GW1001 & 01GW1001-F
Finish Clean-up 0926 Hrs
Decon Pump @ Trailers 0945

0955 Hrs - Arrive @ WES-1-25-83
Start Purge = 1030 Hrs
END Purge = 1310 Hrs
Vol. Purged = 3.2 gal
Start Sampling = 1315 Hrs
END Sampling = 1720 Hrs
Sample ID = 01GW2501
Finish-Clean up = 1730 Hrs

1750 Hrs - Arrive @ BLDG # 3245
Hrs - Left Base

SCIENTIFIC BINDERY PRODUCTIONS CHICAGO 60605

Work continued to Page

SIGNATURE

DATE 9-8-01

WITNESS

DATE

TITLE NSWC CRANE

PROJECT NO. 3959

BOOK 2503

SUN & MON 09/09 & 10/01

Work continued from Page

Work @ Jeep Trail CTO 159

09/09/01 - Sampling Surface water during storm event

09/10/01 - Shipping & Nitrate/Nitrite Analysis

END

SCIENTIFIC BINDERY PRODUCTIONS CHICAGO 60605

Work continued to Page

SIGNATURE

DATE 09/10/01

WITNESS

DATE

TITLE NSWC CRANE **PROJECT NO.** 3959

BOOK 2503

MON 9/11/01

Work continued from Page WEATHER - Mostly Sunny & 80°

0650 Hrs - Arrive @ BLDG #3245

- Cal. FID & Turbidity Meter
- Prep. to Sample Groundwater

0820 Hrs - Arrive @ MGBG WES-1-17-01

Start Purge	-	0850 Hrs
End Purge	-	1050 Hrs
Vol. Purged	-	3.2 gal
Start Sampling	-	1055 Hrs
End Sampling	-	1502 Hrs
SAMPLE ID	-	01 GW 17 01
Finish Clean up	-	1510 Hrs

1530 Hrs - Return to BLDG #3245

END

SCIENTIFIC BINDERY PRODUCTIONS CHICAGO 60605

Work continued to Page

SIGNATURE

WITNESS

DATE 9/11/01

DATE

TITLE **PROJECT NO.** 3959

BOOK 2503

Work continued from Page

SCIENTIFIC BINDERY PRODUCTIONS CHICAGO 60605

Work continued to Page

SIGNATURE

WITNESS

DATE

DATE

NSWC CRANE BOOK # [illegible]0 F UXO+

(22) 6/23/01

0700 - ARRIVED AT FEild OFFICE, LOAD OUT TRUCKS.
0745 - DEPART FEild office for JEEP TRAIL
0800 - ARRIVED AT JEEP TRAIL SET UP ON 035B09 CLEARED TO 5 FEET.
0850 REFUSAL AT 3½ FEET MOVING TO 035S37
0915 - 035S37 CLEARED TO 2 FOOT
0935 - MOVED TO 035S39 CLEARED TO 2 FEET
0955 MOVED TO 035S35 CLEARED TO 2 FOOT
1030 - MOVED TO 035S43 CLEARED TO 2 FOOT
1050 MOVED TO 035S45 CLEARED TO 2 FOOT
1105 MOVED TO 035S41 CLEARED TO 2 FOOT
1125 DEPART JEEP TRAIL for FEild OFFICE
1140 ARRIVED AT FEild office, DECON GEAR, RINSATE ON AGER'S.
1335 - DEPARTED FEild office for DUE Burial Grounds TO MARK OUT LOCATION.
1650 - RETURN TO FEild office
1745 - DEPART FOR DAY

NSWC CRANE

(23) 9/4/01

1200 - ARRIVED AT FEild OFFICE LOAD TRUCK for SLOW FLOW
1315 - DEPART FEild office for MGBG 01MW06.
1335 - ARRIVED AT 01MW06 SET UP.
1405 - START PURGE ON 01MW06.
1625 - STOP PURGE, START SAMPLING
1835 - DONE SAMPLING, CLEAN UP + LOAD GEAR.
1841 - DEPART MGBG FOR FEild office.
1859 - ARRIVED AT FEild office, UNLOAD GEAR + SAMPLES.
1910 - DEPART OFFICE FOR DAY.

NSWC CRANE

(24) 9-5-2001

0700 - ARRIVED AT FEILD OFFICE, LOAD GEAR

0744 - DEPART FEILD OFFICE FOR MGBG

0810 - ARRIVED AT MGBG 01MW15, START SETUP

0835 - START PURGE

0945 - STOP PURGE, START SAMPLING

1020 - STOP SAMPLING, DECON PUMP, AND LOAD GEAR

1055 - MOVED TO 01MW21 SET UP GEAR

1115 - START PURGE of 01MW21

1400 - DONE WITH PURGE, START SAMPLING 01MW21

1455 - SAMPLING DONE, CLEAN UP GEAR

1500 - DEPART MGBG FOR FEILD OFFICE

1525 - ARRIVED AT FEILD OFFICE, UNLOAD GEAR CLEAN + DECON PUMP.

1630 - DEPART FEILD OFFICE FOR DAY

NSWC CRANE

(25) 9-6-2001

0700 - ARRIVED AT FEILD OFFICE, LOAD GEAR

0745 - DEPARTED FEILD OFFICE FOR MGBG.

0800 - ARRIVED AT MGBG, SETUP ON WES-1-26-83

0850 - START PURGE OF WES-1-26-83.

1250 - STOP PURGE OF WES-1-26-83 START SAMPLING.

1325 - DONE SAMPLING WES-1-26-83, LOAD GEAR

1340 - DEPART MGBG FOR FEILD OFFICE, DECON PUMP AND CHECK PH METER.

1400 - ARRIVED AT FEILD OFFICE, DECON PUMP + RECAL YSI.

1435 - DEPART FEILD OFFICE FOR MGBG

1455 - ARRIVED AT MGBG SETUP ON WES-1-23-83

1525 - START PURGE

1600 - FELL BELOW SCREEN, DROPPED PUMP INTO SUMP.

1640 - SUMP DRY, PURGE DONE WILL SAMPLE ON 09/02/01.

1700 - DEPART MGBG FOR FEILD OFFICE

1720 - ARRIVED AT FEILD OFFICE UNLOAD GEAR

1750 - DEPART FOR DAY

9-7-2001

0700 - Arrived at Feild office, load gear
0740 - Depart Feild office for MGBG
0800 - Arrived at MGBG, setup on WES-1-23-83
0810 - Start sampling of WES-1-23-83
0850 - Done sampling, Decon pump and load gear.
0900 - Moving to WES-1-9-82
0930 - Start purge of WES-1-9-82
1155 - Stop purge and start sampling of WES-1-9-82
1225 - Done sampling of WES-1-9-82, load gear and Decon pump.
1320 - Setup and start purge of WES-1-27-83.
1540 - Stop purge of WES-1-27-83. Fell below screen will have to sampling on 09/08/01 in AM., load gear.
1620 - Depart MGBG for Feildoffice
1640 - Arrived at Feild office, unload gear
1720 - Depart office for Day

9-8-01

0700 - Arrived at Feild office, load gear
0745 Depart for MGBG, WES-1-27-83
0820 - Set up on WES-1-27-83, start pump.
0850 - Start sampling of WES-1-27-83
0930 - Done sampling of WES-1-27-83 load gear moving to next well
0945 - Setup on WES-1-2-81, start purge
1105 - Stop purge, start sampling of WES 1-2-81
1310 - Done sampling of WES-1-2-81 load gear
1400 - Depart MGBG for Feild office
1420 - Arrived at Feild office
1600 - Depart Feild office for Day

9-10-01

0700 - ~~Arrived~~ AT Feild office, Load Gear.
0735 - Depart for MGBG, WES-1-24-83
0800 Arrived AT WES-1-24-83, SETUP
0830 START PURGE of WES-1-24-83
1113 END PURGE of WES-1-24-83, WELL DRY, will HAVE TO SAMPLE later on 09/10/01
1130 ARRIVED AT WES-1-22-83 SETUP
1155 START PURGE of WES-1-22-83
1435 - STOP PURGE AND START sampling of WES-1-22-83
1510 - DONE SAMPLING of WES-1-22-83 LOAD GEAR
1525 - MOVED TO WES 1-24-83 TO Check WATER LEVEL. WATER LEVEL GOOD. SETUP for SAMPLING.
1545 - START SAMPLING of WES-1-24-83
1620 - DONE sampling of WES-1-24-83, LOAD GEAR.
1630 Depart MGBG for Feild office
1800 - Depart Feild office for SAM Club
1940 - ARRIVED AT HOME, END of DAY

9-11-01

0700 ARRIVED AT Feild office, LOAD GEAR
0745 - Depart Feild office for MGBG (WELL WES-1-18-83)
0805 - ARRIVED AT MGBG.
1020 - DEPARTED MGBG for Feild office
1040 - ARRIVED AT Feild office
1100 - Depart Feild office, for HOME

NSWC CRANE

(30)

9-18-01

0700 - Arrived at Feild office, Load Gear

0730 - Depart Feild office for MGBG

0750 - Arrived at MGBG set up on WES-1-7-82

0805 - Start Purge

0955 - Stop Purge, start Sampling of WES-1-7-82

1045 - Done Sampling of WES-1-7-82, Load Gear moving to WES 1-8-82

1105 - Start Purge of WES-1-8-82

1305 - Stop Purge, start Sampling of WES-1-8-82

1425 - Stop Sampling of WES-1-8-82, Start Pump Test

1455 - Stop Pump Test, Load Truck, moving to WES-1-5-81

1510 - Start Purge of WES-1-5-81

1710 - Stop Purge (Dry) will Sample 09/19/01, Load Gear, Depart for Feild office

1730 - Arrived at Feild office, Unload Gear

1800 - Depart for Day

NSWC CRANE

(31)

9-19-01

0700 - Arrived at Feild office, Load Gear

0730 - Depart Feild office for MGBG

0750 Arrived at MGBG, Setup on WES-1-5-81

0800 - Start Sampling of WES-1-5-81

1002 - Stop Sampling of WES-1-5-81, Load Gear, move to WES-1-18-83

1040 - Start Purge of WES-1-18-83

1252 - Stop Purge of WES-1-18-83 (Dry) will Sample on 9/20/01, Load Gear move to WES-1-22-83

1330 - Start Purge of WES-1-22-83

1630 - End Purge, start Sampling of WES-1-22-83

1700 - End Sampling of WES-1-22-83, Load Gear.

1710 Depart MGBG for feild office

1730 Arrived at Feild office, Unload Gear & Samples

1800 Depart for Day

NSWC CRANE

(32) 9-20-01

0700 - ARRIVED AT Feild office, LOAD GEAR
0715 Depart Feild office for MG3G
0735 ARRIVED AT MG3G, SET UP ON WES-1-18-83
0745 - START Sampling of WES-1-18-83
1000 - DONE Sampling of WES-1-18-83, LOAD GEAR
1015 - Depart MG3G for Feild office
1035 - ARRIVED AT Feild office, drop off SAMPLES
1100 - Depart for MGBG
1120 - ARRIVED AT MGBG, SET UP ON WES-1-24-83
1155 - START Purge of WES-1-24-83
1455 - END PURGE, START Sampling
1534 - END Sampling, LOAD GEAR
1540 - Depart MG3G for Feild office
1600 - ARRIVED AT Feild office, PACK GEAR for Shipment, Clean up Feild office
1735 - Depart Feild office for DAY

TITLE NSWC Crane MGBG SWMU 01/12 Contact List

PROJECT NO. 3959

BOOK NO. 1347

Work continued from Page

NAME / Position	Telephone/Fax	E-mail

SCIENTIFIC BINDERY PRODUCTIONS CHICAGO 60605 MADE IN USA

Work continued to Page

SIGNATURE DATE

DISCLOSED TO AND UNDERSTOOD BY DATE WITNESS DATE

B 100 P ©

TABLE 2-1
EMERGENCY REFERENCE
NSWC Crane, Crane, Indiana

AGENCY	TELEPHONE
Base Emergency Number (Fire Department, Security, Ambulance)	(812) 854-3300 or (812) 854-1333
Base Environmental Office	(812) 854-6160
Base Occupational Health & Safety Department – Mr. Steve Schick	(812) 854-3491
Command Duty Officer	(812) 854-1225
Bedford Ambulance	(812) 279-6545
Bloomington Hospital (Bloomington, IN) Bedford Medical Center (Bedford, IN)	(812) 336-9515 (812) 275-1200
Poison Control Center	1-800-382-9097
National Response Center	1-800-424-8802
NSWC Medical Facility	(812) 854-1220
Base Contact, Thomas Brent	(812) 854-6160
Explosive Ordnance Division, Lt. Shaunna Corcoran	(812) 854-3456
NSWC Crane Radiation Safety Officer, Eric McQueen	(812) 854-3578
Contract Task Order Manager, Thomas Johnston, Ph.D.	(412) 921-8615
Utilities – Indiana Underground Plant Protection Services (One Call)	1 (800) 382-5544
Utilities – Public Works Department	(812) 854-1834
Project Geologist, Jeff Schubert	(412) 921-8794
Field Operations Leader, Keith Simpson	(412) 921-8131
Tetra Tech NUS Office, Pittsburgh	1-800-245-2730 (412) 921-7090
Project Health and Safety Officer, Thomas M. Dickson, CSP	(412) 921-8457
CLEAN Health and Safety Manager, Matthew M. Soltis, CIH, CSP	(412) 921-8912
Ecorisk Assessment, Aaron Bernhardt	(412) 921-8433
HH Risk Assessment, Karen Smecker/Lee Ann Sinagoga	(412) 921-8893(8887)
HH Risk Assessment (radiological), Phil Young/Phil Fulmer	(803) 649-7963
Feasibility Study Engineering, Andy Kendrick	(412) 921-8623
UXO/EOD Handling/Exhumation, Phil Blackwell/Larry Hudgins	(770) 413-0965

2.9 EMERGENCY ROUTE TO HOSPITAL

Directions to the Bloomington Hospital:*

Exit NSWC Crane on H-45 through the Bloomington gate. Follow Highway 45 North to Bloomington at Highway 45 and Highway 37. Continue going straight over the overpass (Bloomfield Road). Follow Bloomfield Road North; this road turns into 2nd Street. Follow 2nd Street, hospital will be on the right (601 West 2nd Street).

Directions to Bedford Medical Center:*
Exit the base on H-58, through the Bedford Gate. Head West on State Highway 158. State Highway 158 becomes 16th Street upon entering the City of Bedford. The medical center is on the right shortly after Plaza Drive.

***NOTE:** The Bedford Gate is open only from 0600 - 0830 and 1500 - 1800 hours Monday through Friday, whereas the Bloomington Gate is open 24 hours. See Figure 2-2 and 2-3 for the routes to these hospitals.

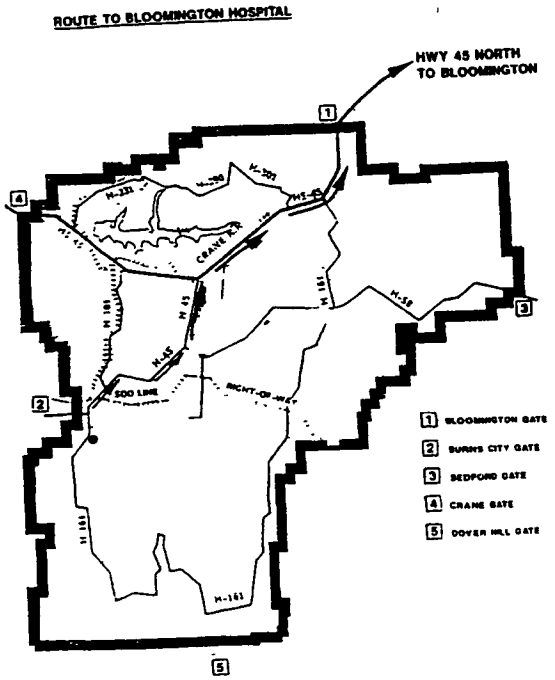
Work continued from Page Note: Drove Hospital Route 08/09/01

Thomas M. Dickson

Figure 2-2

Hospital Route Map (Bloomington Gate) (Primary)

**Note: The Bloomington Gate is open 24 hours.



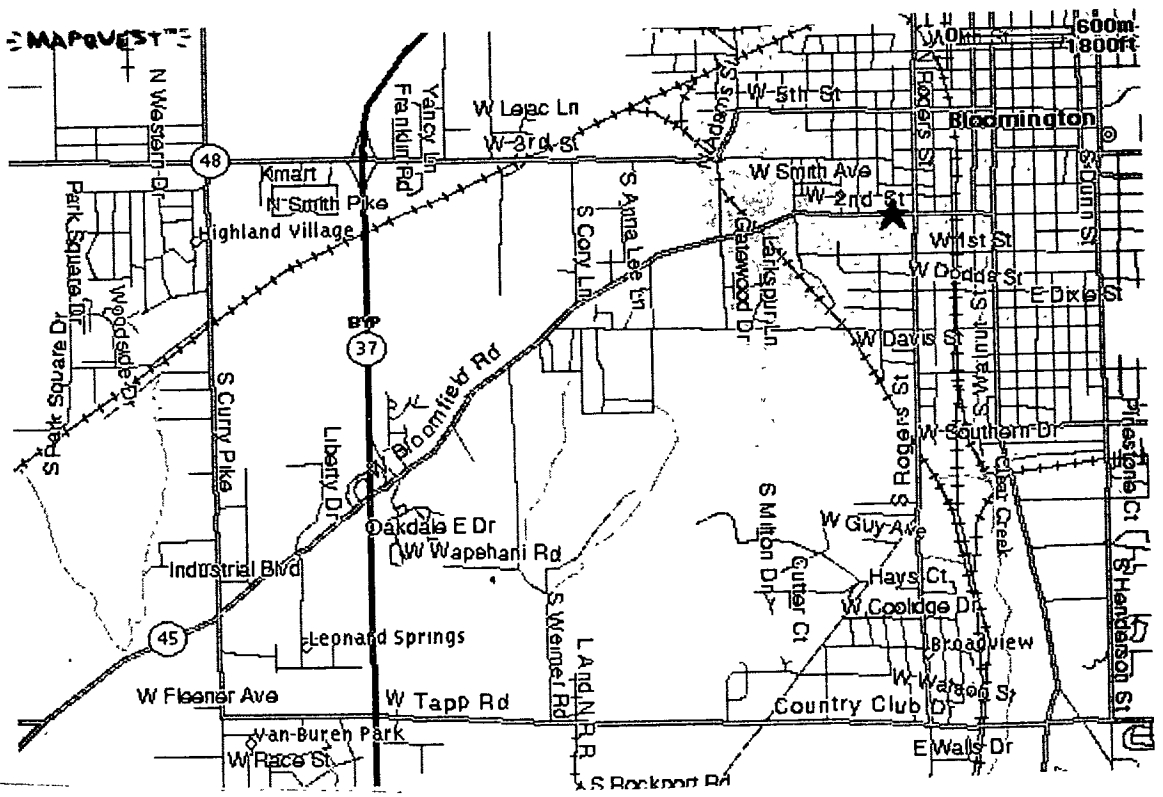
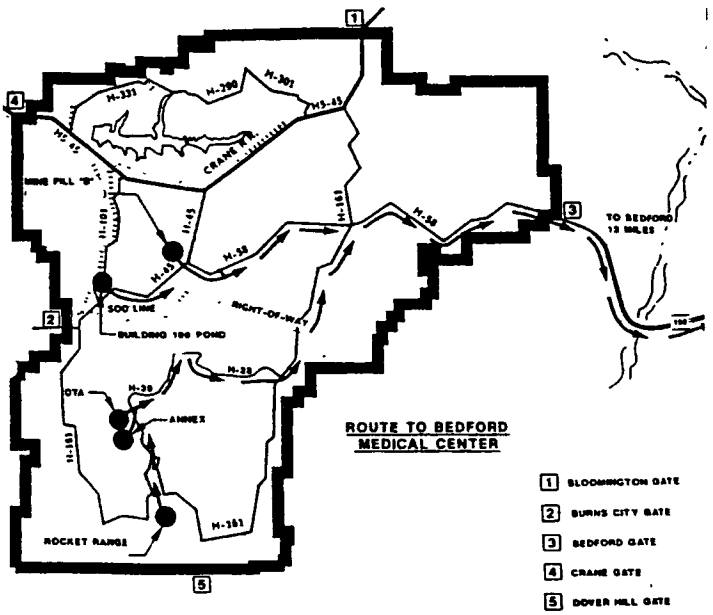
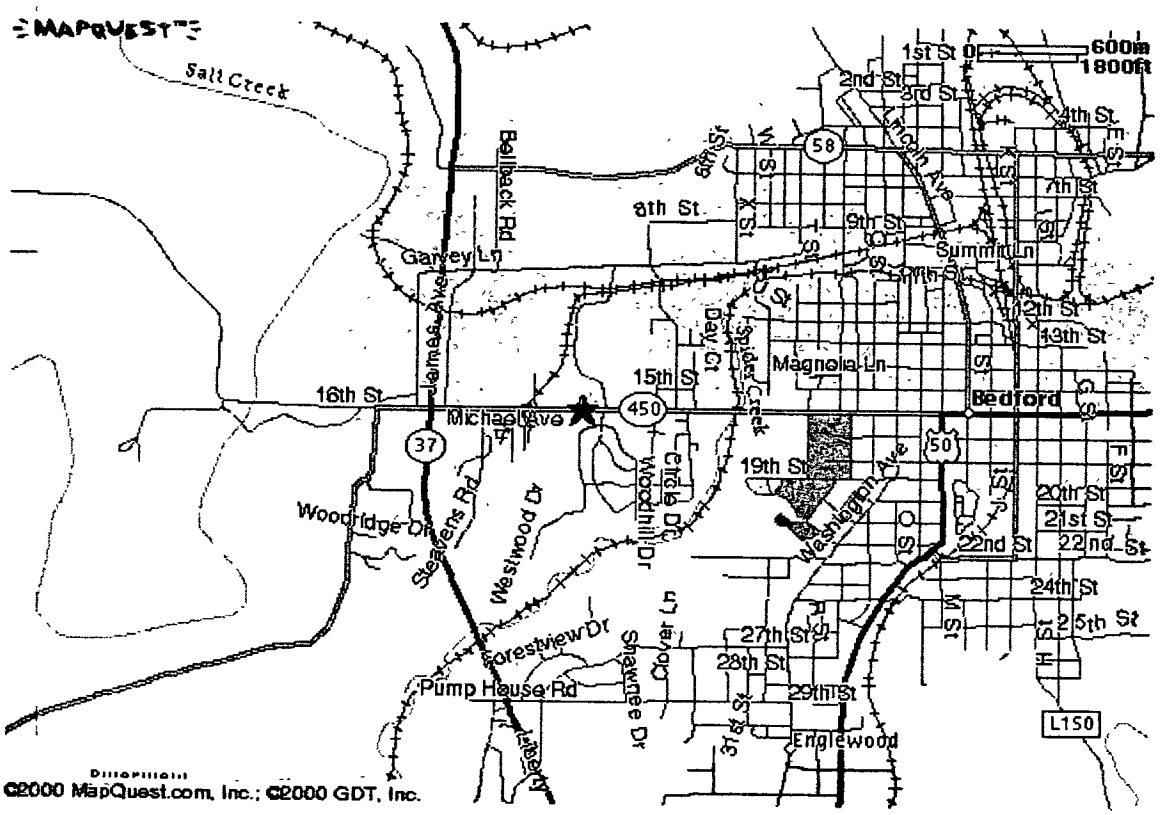


Figure 2-3

Hospital Route Map (Bedford Gate)

*Note: The Bedford Gate is open only from 0600 - 0830 and 1500 - 1800 hours; Monday through Friday.





Work continued from Page —

0650 The following personnel arrived on-site @ Bldg. 3245

Terry Roguhn (TR - FOL) Ken Marquis (KM - UXO/Field Tech.)
Tom Dickson (TD - H&S)

0730 Loaded out vehicles, Left for MGBG
The following activities were planned for 08/12/01

TR/KM - Well Development (See Logbook 1340 for Details)
(8 wells were developed)

TD - Mobilization/Demobilization activities including

- Finish Partitioning Shower Trailer - Completed
- KM Finished Fresh water hook-up
- Equipment Calibration - TD
  - microFID CZHE315 > Calibrated For Well
  - microFID CZHD310 > Development Activities
- Completed Heat Stress Screening Area Set-up
- Completed Sample Screening Set up including
  - Ventilation hood (Sides, Ovens Evaluation, Scale/Balance)
  - Cover Partitioning wall with PE Sheeting
- Inventoried PPE / Organized
- Began check out of Radiation Survey meters
- Fire Extinguisher Inspection (Units 001 & 002 ok, 003 removed from service due to damage handle)

1740 Left MGBG enroute to Bldg. 3245
1800 Arrived @ Bldg. 3245
- Placed equipment on chargers
- Unloaded vehicles

End of Day
Thomas M. Dickson

Weather A.M. Sunny mid 80's / P.M. Sunny mid 80's

SCIENTIFIC BINDERY PRODUCTIONS CHICAGO 60605 MADE IN USA

Work continued to Page —

SIGNATURE Thomas M. Dickson DATE 08/12/01

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Page Not Used
Thomas M. Jackson

Work continued from Page —

0650 Tetra Tech NUS personnel arrived on-site. Personnel on-site include

Tom Dickson (TD); Terry Rojahn (TR); Ken Marquis (KM)

Activities to be conducted include

Well Development - TR & KM

7 Wells completed

TD - Continue set up activities and oversight of Electrical installation.

1810 Left MGBG en route for Bldg 3245, break down equipment, decon, charge instruments, etc.

1900 Left NSWC

SCIENTIFIC BINDERY PRODUCTIONS CHICAGO 60605 MADE IN USA

Work continued to Page —

SIGNATURE Thomas M. Dickson

DISCLOSED TO AND UNDERSTOOD BY DATE WITNESS DATE

DATE 08/13/01

Cross Section
Page Not Used

Work continued from Page —

Travel from Pittsburgh to Indianapolis, Indiana

1300 Arrived on-site @ NSWC Crane. Personnel on-site include
TENUS Personnel
Keith Simpson (KS-FOL) Terry Rogahn (TR-Field Support)
Frank Wudkynych (FW-Geologist) Ken Marquis (KM-UXO/EOD)
Tom Dickson (TD-SSO/FSO)

Unpack and inventory arriving equipment and supplies. This includes

7 dozen Towels
7 dozen Wash cloths
15 pair of XXL Coveralls
15 pair of XXXL Coveralls
} Arrived From Cintas

TLD Badges
- Whole body
- Ring Badge

1430 Surveying Crew from Bledsoe, Tapp, & Riggert arrived on-site. Richard Jenks (RJ) and David Meier (DM). TD began site-specific training as it pertained to the surveying activities. This included completing a Safe Work Permit 08/20/01-001 for this activity in addition discussion included

- Natural hazards (Ticks, snakes, etc.)
- Slip, trip and fall
- Review of accident types for Surveying Activities (Strains, sprains, cuts, etc)

In addition to the Safe Work Permit information provided to the Survey Crew
Ticks/Lymes Disease (Signs Symptoms and Control)
Emergency Map to Hospital
Emergency Contact List
Requested that they check in when TENUS is on-site so we know their whereabouts

SIGNATURE Thomas M. Dickson
DATE Monday 08/20/01
DISCLOSED TO AND UNDERSTOOD BY DATE WITNESS DATE

Connie M. Jackson
Page Not Used

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TD continued site-specific training with KS, TR, KM, and Tony Strati (TS-DPT Operator) of EFS (Environmental Field Services, Inc.). Training focused toward DPT activities reviewing Safe Work Permit, Table 5-1 of the HASP, Safe Work Practices. Again a packet was prepared for this activity including

- Safe Work Permit
- Safe Work Practices
- Emergency Map to Hospital
- Emergency Contact List
- Chemical Inventory
- IDW Inventory

A Step by Step process was reviewed concerning arrival; PPE; monitoring; decontamination; decontamination waluation Chemical, physical, radiological hazards; Natural hazards. Discussions focused on the type of communications necessary for acquiring emergency services and how (cell phones) this would be accomplished

1845 Training concluded approximately 1845 and TS left. KM, KS, TR, FW, & TD began close out activities.

1915 Left NSWC Crane

End of Day

Work continued to Page ____

SIGNATURE Thomas M. Kuchin DATE Monday 08/20/00

DISCLOSED TO AND UNDERSTOOD BY DATE WITNESS DATE

Connor M. Dickson
Page Not Used

Work continued from Page —

0650 The following Tetra Tech NUS (TtNUS) personnel arrived on-site

Keith Simpson (KS-FOL) Terry Rogalin (TR-Field Support)
Frank Wudkwych (FW-Geologist) Ken Marquis (KM-UXO)
Tom Dickson (TD-SSO/RSO)

~~Activities to be conducted~~ TO
Environmental Field Services Inc Personnel On-site include
Tony Stratti (TS-DPT Operator)
David Meier (DM) & Richard Jenks (RJ) Bledsoe, Tappi & Riggert
Work @ MGBG after lunch
Monitoring instruments to be employed in support of 08/21/01
activities are as follows

Instrument	Serial #	Background Measurement	Source Check
microFID	CZHD310	0.4 ppm	100 ppm CH_4 in Air
"	CZHE315	0.1 ppm	See Calibration Logs
Ludlum 19	81693	250 microR/hr	+ Cesium 137
Ludlum 2221		250 " "	
		250 " "	
Scaler Rate Meter	157028		600 cpm
44-10 Probe	PR103834	10X 1000 cpm	Cesium 137
(Gamma Scintillator)		1000 cpm	+
		1000 cpm	
Ludlum Model 3	111662	0.1X ~~800-1000 cpm~~ TD	Cesium 137
44-9 Detector	PR150682	0.3 ~~800-1000~~ TD	+
		0.3 ~~800-1000~~ TD	
		0.3	
Ludlum Model 3	108044	0.0	Thor. 230
43-5 Detector	PR175660	0.0	+
		0.0	
Ludlum Model 12	167179	0.1X 800-1000 cpm	Cesium 137
44-19 Detector	PR150980	800-1000 cpm	+
		800-1000 cpm	

SCIENTIFIC BINDERY PRODUCTIONS CHICAGO 60605 MADE IN USA

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SIGNATURE Thomas M. Richard DATE Tuesday 08/21/01

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Note: 160g of Soils in Wide Mouth Pint jars heats to approximately 100-104°F in 10 minutes. This is based on a preheated oven of 150°F.

At a temperature of (preheat 160°F) soil temperatures went from 100°F - 110°F in 5 minutes

An oven set @ 10 (preheat temperature of 175°F) Heating samples over 110-115°F causes excessive moisture collection. This becomes evident when collecting HD headspace sample. Optimum temperature range is 95°F - 115°F. It usually takes 5-10 minutes for 160g to reach this temp.

TLD Badges	#
① Tony Strati	8811440B (Whole body)
Frank Wudkwych	8811438B (Whole body) Ring 575600829
Terry Rojohn	8811437B (Whole body) Ring 575600582C
Tom Dickson	8811439B (Whole body) Ring 575600782A

① Exposure Considerations for Tony Strati will also represent KM.

Work continued from Page

01SB21 was done @ 1045. No screening was performed at this location.

After lunch secondary burial area borings were initiated including

01SB20
01SB16
01SB08

} See Soil boring Field Screening Sheets for Monitoring Results

Headspace Analysis employed a number of heat durations and cycles to determine chemical contaminant existence through thermal release and collection in the headspace

~~HD~~ 01SB20 Preheat Oven 190-200°F; heat sample 10 minutes. Sample heat 140°F. This caused significant condensation when drawing HD tubes. This may compromise the integrity of the test

01SB16 Reduced Oven heat to approximately 175°F; Sample heated 5-minutes to 100~104°F. This range greatly reduced condensation.

01SB08 - Same as 01SB16

Health and Safety Issues to be addressed

- PPE Use and application during
  DPT - Need to employ butyl apron to prevent soiling of work Clothes
  Dicon - Safety Glasses under Splash Shield, butyl apron

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SIGNATURE [signature] DATE Tuesday 08/21/00

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Thomas M. Dickerson
Page Not Used

Work continued from Page 15

~~Boring~~ TO - Decontamination

~~0758~~ 20 TO

Prior to breaks (hand to mouth) personnel are to be frisked even though field screening indicated not Rad Concern.

- Heat Stress Monitoring - Was not conducted. Area measurements are indicated to the right. Based on these conditions and measurements Heat Stress monitoring was not warranted.

1910 All personnel Showered, Left MGBG enroute to 3245.

2030 Completed Paperwork left Site

End of Day

1429 WBGT 79.1°F WB 72.0°F DB 82.9°F GT 95.6 Quincy

Eleanor M. Jackson
Page not used

Work continued from Page —

0650 The following Tetra Tech NUS, Inc. (TtNUS) arrived on-site

Keith Simpson (KS-FOL) Terry Rojahn (TR-Field Support)
Frank Wudkwych (FW-Geologist) Kim Marquis (KM-UXO Support)
Tom Dickson (TD-SSO/RSO)

EFS on-site 0700
Tony Stratitis (TS DPT-Operator)

Bledsoe, Tapp & Riggert Surveyors Onsite 0745-0800
David Meier (DM) & Richard Jenks (RJ)

Supplies and monitoring instruments prepared in support of 08/22/01 activities. Instruments employed include the following

Instrument Name	Serial Number	BKgd.	
microFID	CZ HD 310		See Calibration Sheets for Info
microFID	CZ HE 315		

① Ludlum 2221 w/ 44-10 G. Scintillator (157028/PR103934) 2000cpm (x 10 scale) ~~(cpm x scale)~~

① Ludlum Model 3 w/ 44-9 Beta/Gamma Pancake (150682/11162) 0.3 mR/hr (x0.1 Scale)

② Ludlum Model 3 w/ 43-5 Alpha Scintillator (10844/PR175660) 0.0 mR/hr (x0.1 Scale)

① Source Check Cesium 137
② Source Check Thorium 230

0945 Oven Preheat to 190°F Sample 01SB11
HD - 0.0
Rad 44-10 2100 cpm background; 44-9 0.3 mR/hr 43-5 0.0 mR/hr

Sample Temp. 0-2 (100°F) 6-10 (108°F)
2-6 (110°F)

Work continued to Page 21

SIGNATURE Thomas M. Dickson DATE Wednesday 08/22/01

DISCLOSED TO AND UNDERSTOOD BY DATE WITNESS DATE

Thomas M. Richard
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0900-0930 Tom Brent (TB-Environmental) visited the Site. KS Escorted. Left site @ ~ 1000-1015 See KS Logbook.

Ambient Conditions

Wind Slight out of the South; Sunny Clear; 0911
WBGT 76.6°F WB 73.7°F DB 79.0°F GT 83.4°F

Wind-Slight out of South; Sunny Clear; 1015
WBGT 80.5°F; WB 75.8°F; DB 83.8°F; GT 91.0°F

Note: Will Engage Heat Stress Monitoring (Breaks/Lunch)

1101 01SB15 Screening Results
Oven Preheated to ~ 185-190°F
1106 Sample Temperature averaged 104°F

1045-1050 While attempting to push to bedrock (confirmed @ 12.5 feet) the probe got stuck (would not retract) when attempted the structural integrity of the extraction plate became questionable. It was attempted to use a chain and the auger cathead to extract. This resulted in causing two support braces to crack. Based on this condition this DPT Rig is restricted from further use until repaired and Re-inspected.

1130 Broke for Lunch

1200 TS began decontamination of his rig to move off site for repairs. 5-10 minutes into the task KM indicated that the TS was feeling the effects of the heat. After questioning TS concerning how he was feeling he was pull from service and instructed to get a shower (cold) to bring his body temperature down. TS had earlier experienced leg cramps but said he was fine.

Work continued to Page 23

SIGNATURE Lauren M. Richman DATE Wednesday 08/22/01

DISCLOSED TO AND UNDERSTOOD BY DATE WITNESS DATE

22

Summary Notes

TS left the site @ approximately 1245 – 1300

Surveyors left the site @ 1440

Work continued from Page 21

After Further Evaluation it was determine TS was progressing into 2nd Stage of heat exhaustion.

- Profuse Sweating
- Leg Cramps
- Body Weight loss (3 lbs in two days) indicating some dehydration but not outside action levels

Earlier attempts to combat these conditions included
- Multiple breaks
- Cooling vests, neck coolers
- White coveralls

Overall the system in place works to monitor this condition
- KM attention to his work partners condition was critical in identifying his condition

- Earlier efforts to monitor the potential increase in core temperature was unfortunately impacted by manpower restrictions

TS will be monitored closely for the next couple days regardless of ambient conditions due to the lasting effects of heat exhaustion.

~~Clean~~ Remainder of the Day:
- Cleaned up sample area, broke down equipment
- Decontaminated drill rig and sampling equipment
- Cleaned up trailers
- Hauled garbage to 3245
- Serviced EIDs
- Decontaminated sampling bowls & trowels

Left Site 1900, End of Day

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SCIENTIFIC BINDERY PRODUCTIONS CHICAGO 60605 MADE IN USA

SIGNATURE Thomas M. Nichols DATE Wednesday 08/22/01

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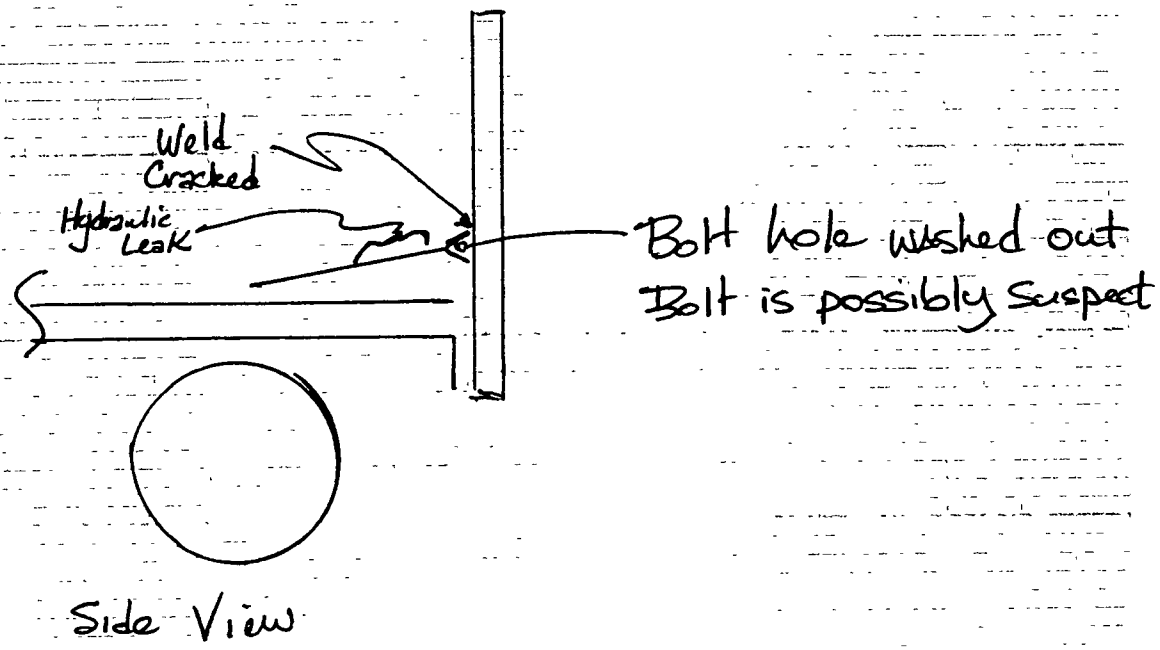
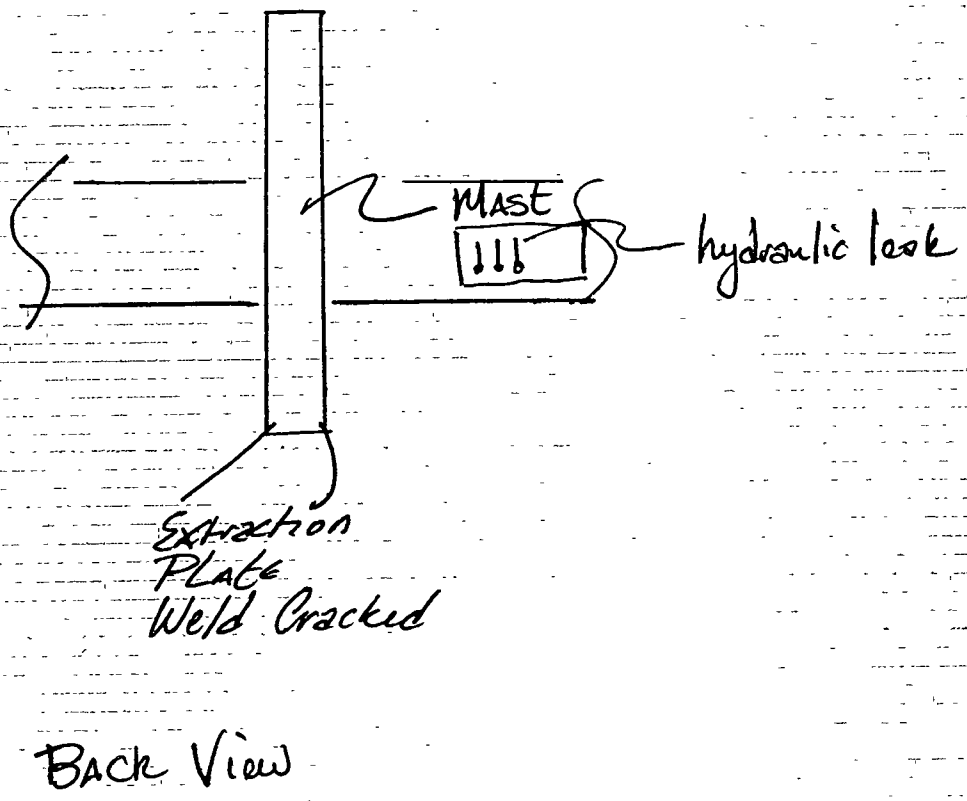

Weld
Cracked
Hydraulic
Leak
Bolt hole washed out
Bolt is possibly suspect
Side View


MAST
hydraulic leak
Extraction
Plate
Weld Cracked
BACK View

Work continued from Page —

0650 The following TetraTech NUS, Inc. (TTNUS) personnel arrived on-site:

Keith Simpson (KS-FOL) Terry Rojahn (TR-Field Support) Ken Marquis (KM-UXO Support) Frank Wiedkuych (FW-Geologist) Tom Dickson (TD-SSO/RSO)

EFS DPT Operator arrived @ MGBG @ approximately 0730. Tony Strati (TS-DPT Operator)

The following monitoring equipment was prepared for use on 08/23/01

Instrument	Serial #	
microFID	CZHD310	See Equipment Calibration Log
"	CZHE315	

0800 Began equipment inspection on DPT removed from the site on 08/22/01 due to structural deficiencies. See Page 24 for illustration. As per HASP all equipment subjected to major repairs will be re-inspected prior to being put back in service. The inspection results are indicated on the Equipment Inspection Checklist 08/23/01-001.

- Mast Ram Hydraulic Hose Leaking
- Hydraulic leak at the control panel
- Mast Ram Bracket (Still Cracked)
- Welds made in an earlier repair were unacceptable
- Extraction Plate were cracked in two places which would not support extraction of the drive rod.

Based on these findings, this rig was unacceptable and considered unsafe for use. Therefore restricted from use.

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SCIENTIFIC PRINTER PRODUCTIONS CHICAGO 60605 MADE IN USA

SIGNATURE Thomas M. Dickson DATE Thursday 08/23/01

DISCLOSED TO AND UNDERSTOOD BY DATE WITNESS DATE

Thomas M. Dickson
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Work continued from Page 25

Based on this development operations at MGBG were terminated.

1030 KS, TR, KM, FW & TD went to Bldg 3245. At this time Respiratory Protection Program Training and Fit testing was conducted. This was done in preparation for the planned excavation activities.

1145-1215 Lunch

Activities conducted remainder of the day include

- Package Samples
- Source (Deionized Water) Blank
- Review Chapter 15 of the QAPP regarding the planned excavation activities. Based on this review it has been determined to alter the screening process of the excavated soils. Instead of 3 hand auger soil borings to profile and screen the soil lifts, each bucket will be screened for radioactivity to avoid mixed wastes as it is excavated. HD screening will be completed representing the spoil piles after the excavation. See Task Modification Form for more information

1600 TR & TD went to MGBG to check on FW. FW finished purging MW14. Left MGBG @ 1730.

End of Day 1800 left Site for the day

Work continued to Page ____

SIGNATURE Thomas M. Fuchs DATE Thursday 08/23/01

DISCLOSED TO AND UNDERSTOOD BY DATE WITNESS DATE

Page Not Used

Work continued from Page —

0650 The following Tetra Tech NUS (TTNUS) personnel arrived on-site

Keith Simpson (KS-FOL) Terry Rojahn (TR-Field Support)
Ken Marquis (KM- UXO Support) Frank Wudkowych (FW-Geologist)
Tom Dickson (TD-SSO/RSO).

FW- Went to MGBG MW14 to complete sampling that began on 08/23/01

TD, TR Loaded out equipment and supplies mob to MGBG

The following equipment (monitoring instruments) were prepared for service on 08/24/01

Instrument	Serial #	
microFID	CZHD310	See Calibration sheets
microFID	CZHE315	

Ludlum 2221 w/ 44-10 Probe (157028/PR103834) √Source Check Cesium 137 Bkgd ① 3036 ② 2597 ③ 3000
BKgd = 2878 cpm
Ludlum Model 3 w/ 44-9 Probe (11162/PR150682) √Source Check Cesium 137 ① 0.3 ② 0.2 ③ 0.2
BKgd = = 0.3 mR/hr
Ludlum Model 3 w/ 43-5 Scintillator Probe (10844/PR175660) √Source Check Torium 230 ① 0.0 ② 0.0 ③ 0.0
BKgd = 0.0 mR/hr

0930 Tony Stratti (TS-DPT Operator) Arrived on-site
TD Conducted Equipment Inspection of DPT: Steam Crane
Results - Acceptable, however all parts and the truck were filthy - Requires decontamination prior to use
TR Approves use after decontamination

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SIGNATURE Thomas M. Dickson DATE Friday 08/24/01

DISCLOSED TO AND UNDERSTOOD BY DATE WITNESS DATE

Summary Notes

Ambient Conditions

Wind SE 3-5 mph; WBGT In 84.7, out 83.4°F;
WB 77.0°F; DB 86.3°F; GT 102.7°F
Cloudy 1100

Work continued from Page 29

01SB14 Commencement @ 1100

01SB14 In the oven @ 1238
Oven Preheated to 180°F
1243 002 106°F No detection of HD
0206 118°F " " " "
0610 105°F " " " "

See also Boring screening Logs
01SB13 @ 1250
1336 01SB13 in the oven
Oven Preheated to 180°F
0002 Sample 100°F NO Detection of HD
0206 " " " " " "
0610 " " " " " "

01SB18 Begin Boring @ 1350

1448 01SB18 In the Oven.
Oven preheat to 180°F
0002 Sample 94 °F No Detections of HD
0206 " 94 °F " " " "
0610 " 96 °F " " " "

01SB18 Begin Boring @ 1500

1550 01SB18 in the Oven
Oven Preheated to 180°F
0002 Sample @ 106 °F Detection of HD
0206 " " 106 °F " " " } 1600
0610 " " 112 °F " " "

SCIENTIFIC BINDERY PRODUCTIONS CHICAGO 60605 MADE IN USA

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SIGNATURE [signature] DATE Friday 08/24/04

DISCLOSED TO AND UNDERSTOOD BY DATE WITNESS DATE

Page not used
Thomas M. Spencer

Work continued from Page 31

01SB17 Began Boring @
1740 01SB17 In the Oven; Oven Preheated to 210°F
0002 Sample Temp. 100 °F No Detection of HD
0206 " " 100 °F " " " "
0610 " " 100 °F " " " "

Broke down Equipment, went back to 3245 to prep equipment for tomorrow.

1950 Left the site for the day

SCIENTIFIC BINDERY PRODUCTIONS CHICAGO 60605 MADE IN USA

Work continued to Page

SIGNATURE Thomas M. Jackson DATE Friday 08/24/01

DISCLOSED TO AND UNDERSTOOD BY DATE WITNESS DATE

B 100 P ©

Summary Notes

0911 Start Excavation
0916 Unearthed Soft terrain metal Mats
0942 PSP 2nd Piece
Break
1015 Excav. begins

1025 Ambient Cond.
WB 76.9°F GT 92.3°F
WBGT I 81.65°F O 81.0°F

LG Sample In 1043

Sample heat 100°F No HD Detection
" Alpha
" Beta/Gamma

SM Sample in 1101 out 1107
heat 106°F No HD Detection
" Alpha
" Beta/Gamma

TB left 1115

Work continued from Page —

0650 The following Tetra Tech NUS (TENUS) arrived on-site @ Bldg 3245

Keith Simpson (KS-FOL) Terry Rogaha (TR-Field Support)
Ken Marquis (KM-UXO) Larry Hudgins (LH-UXO)
Frank Wad Kurych (FW-Geologist) Tom Dickson (TD-SSO/PSO)

Kevin Riffe (KR-DPT Operator) of EFS was on-site @ 0650.

0700 Began Health and Safety training regarding the excavation of the anomalies. The following persons were in attendance

KS, KM, LH, Tom Brent (TB-NSWC Crane) and KR. TD presented

- Historical Info.
- Sequence of Events
- PPE to be employed
- Screening sequence
- Placement and screening of spoils pile
- IDW Management

The H&S training lasted for ~ 1.25 hrs which was terminated in the respiratory protection fit Testing of the MSA Advantage 1000 for the following persons

LH, TB, KR
Fit Tester - TD

All other persons were previously fit tested by TD
~0815 Went to MGBG to prepare for Anomaly Excavations. In support of this the following instruments were prepared (calibrated or source checked)

Recharge w/ hydrogen

Work continued to Page 37

SIGNATURE Conor M. Dickson DATE Saturday 08/25/01

DISCLOSED TO AND UNDERSTOOD BY DATE WITNESS DATE

SCIENTIFIC BINDERY PRODUCTIONS / CHICAGO, ILLINOIS / MADE IN USA

Summary Notes

Soil borings

1200 Decon

Setup 01SB12

1300 Start "

1359 Sample in Oven

Preheat 220°F

1345 Stop due to weather Elec. Storm heavy rain

1404 { 0002 No HD Sample Temp 98-100°F
0206
0610 }

Work continued from Page 35

Instrument	Serial #	
microFID	CZHE315	See Calibration Log Forms
"	CZHD310	

Ludlum Model 12 w/ 44-19 Gamma Scintillator (167179/PR150980) ✓Cesium 137 Source Check — Bkgd. X100 (40 cpm)

Note: Detector cable of the 2221 & 44-10 broke rendering the instrument out of service

Ludlum Model 3 w/ 44-9 Beta/Gamma Probe (11162/PR150682) ✓Cesium 137 Source Check — BKgd X0.1 (0.3 mR/hr)

Ludlum Model 3 w/ 43-5 Alpha Scintillator (10844/PR175660) ✓Thorium 230 Source Check — BKgd X0.1 (0.0)

In addition an area Wet Bulb Globe Temperature Area Heat Stress monitor was employed

PPE was provided to all persons participating in the excavation activities the sequence of events are as follows.

The Large anomaly excavation was first

Plastic was laid out to catch spoils, decontamination station was set up, the boundaries of the anomalies were identified using Schonstedt Magnetometer

0911 Start Excavation
0916 Unearthed perforated steel plates (PSP) metals matrix (the first one)
0942 The second PSP was uncovered
Break
1015 The excavation continued pulling up shards of buried wire, Once removed the

Work continued to Page 39

SCIENTIFIC SINNERY PRODUCTIONS CHICAGO 2005 MADE IN USA

SIGNATURE Thomas M. Dickson DATE Saturday 08/25/01

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LARGE EXCAVATION

NSWC CRANE MGBG CTO 158

TEST PIT # 01TPL LIFT ID 0.5' (DEPTH)

N

FID PEAK	0	0	0
AVE			
ALFA PEAK	0	0	0
AVE			
β & GAMMA PEAK	BG	BG	BG
AVE			
FID PEAK	0	0	0
AVE			
ALFA PEAK	0	0	0
AVE			
β & GAMMA PEAK	BG	BG	
AVE			
FID PEAK	0	0	
AVE			
ALFA PEAK	0		
AVE			
β & GAMMA PEAK			
AVE			

OUTLINE OF SOIL PILE

COMMENTS: FID NO HITS, ALL 0

BG = BACKGROUND

8-25-01
@ 0950

Work continued from Page 37

Excavation swept clean revealing no magnetic signal

1025 Ambient Conditions (Area)
WB 76.9°F; GT 92.3°F; WBGT In 81.65°F; WBGT Out 81°F

Upon completion of the large excavation @ 1040 a composite sample was collected from the foot print and screened for HD.

Sample In 1043
Oven Preheated to 180°F
Sample heat 100°F No HD Detected (See ~~Alpha~~ HD Screening Results on Page 38. of the Spoil Piles
1045 Excavation began @ small anomaly where a fence post was unearthed. A composite sample was collected at this location as well. (See Pg 40 Small Spoil Pile Screening Results)
Sample In Oven @ 1101 out at 1109
Sample Heat 106°F
Both sets of samples were also screened for alpha beta & gamma by preparing planchets and heating until dry.

Upon conclusion of the excavation TB left the MGBG.

1130 Broke for lunch

1200 Decontamination of the back hoe bucket and the DPT Rig (the Dodge Previously Rejected due to structural deficiencies)

Began set-up @ 01SB12

1300 Start 01SB12

Work continued to Page 44

SIGNATURE Thomas M. Jackson DATE Saturday 08/25/01

DISCLOSED TO AND UNDERSTOOD BY DATE WITNESS DATE

NSWC CRANE MGBG CTO 158

TEST PIT # 01TPS LIFT ID 1.0
(DEPTH)

N

FID PEAK			
AVE	0	0	0
ALFA PEAK	0	0	0
AVE			
β & GAMMA PEAK	0	0	0
AVE			
FID PEAK	0	0	0
AVE			
ALFA PEAK	0	0	0
AVE			
β & GAMMA PEAK			
AVE			
FID PEAK			
AVE			
ALFA PEAK			
AVE			
β & GAMMA PEAK			
AVE			

COMMENTS: ALL ZEROS

8-25-01
@ 1055

Work continued from Page 39

1359 0158 In the Oven (Preheated to 220°F)

1404 { 0002 Sample Heat 98-100°F
0206 " "
0610 " " } No HD Detected

0002 Plasachets
0206 "
0610 " } No discernible radioactivity Levels above background

Weather - Electrical Storm
Terminate work at 1355

Began clean-up activities when weather conditions permitted

KP w/ EFS Decontaminated tooling and Rig

KR left the site @ 1500

CH, TR, & KS worked on well 01GWC02.

Completed Paperwork, left MGBG at 1630. Arrived @ 3245.

Place Equipment on Charge, clean out equipment

Left the site for the day 1740.

SCIENTIFIC BINDERY PRODUCTIONS CHICAGO 60605 MADE IN USA

Work continued to Page —

SIGNATURE Thomas M. Jackson DATE Saturday 08/25/01

DISCLOSED TO AND UNDERSTOOD BY DATE WITNESS DATE

Part Not Used
Eleanor M. Jackson

Work continued from Page —

0650 The following TENUS personnel arrived on-site

Keith Simpson (KS-FOL) Terry Rojahn (TR-Field Support)
Ken Marquis (KM-UXO) Frank Wudkwych (FK-Geologist)
Tom Dickson (TD-SSO/RSO)

Kevin Riffe (KR-DPT Operator) EFS arrived on-site.

Picked up equipment @ 3245 and mobilized to MGBG.

0720 Arrived @ MGBG Began equipment preparation (Calibration, Charging, etc.)

The following equipment was prepared for activities on 08/26/01

Instrument	Serial #		
microFID	CZHD310 } See Calibration Log Sheets		
"	CZHE315 }		
Ludlum 2221 w/ 44-10 G.Scin. Probe	(157028/PR103834)	Source Check Cesium 137	Bkgd 2720 CPM
Ludlum Model 12 w/ 44-19 G. Scin. Probe	(16719/PR150980)	Source Check Cesium 137	Bkgd. 2230 CPM
Ludlum Model 3 w/ 44-9 Pancake Probe	(11162/PR150682)	Source Check Cesium 137	Bkgd 0.3 mR/hr (x0.1 Scale)
Ludlum Model 3 w/ 43-5 Alpha Scin. Probe	(108444/PR175660)	Source Check Thorium 230	Bkgd. 0.0 mR/hr (x0.1 Scale)

MSA/Auer Detector Tubes (Control # RJ1103M, Exp. Date August 2003)

Sample and Screening Station was set up to provide a central access point to 01SB01-04. These four borings are located in the primary berial area and be conducted using Level C Protection.

SCIENTIFIC BINDERY PRODUCTIONS CHICAGO 60605 MADE IN USA

Work continued to Page 45

SIGNATURE Conan M. Dickson DATE Sunday 08/26/01

DISCLOSED TO AND UNDERSTOOD BY DATE WITNESS DATE

Page Not Used
Thomas M. Dickson

Work continued from Page 43

0845 Began 01SB04
Oven Preheated to 180°F; In oven @ 1018

1025
0002 Sample Temp 100 °F HD Detection Indicated - No 0.0 Alpha 0.35 Beta/Gamma
0206 " " 104 °F " " " " 0.0 0.5
0610 " " 104 °F " " " " 0.0 0.25

Ambient Conditions
WBGT 78.8°F (In), 78.0°F (Out); WB 74.6°F; DB 78.9°F; GT 82.7°F

0928 01SB02 Began Boring
Oven Preheat 200°F; 01SB02 In Oven @ 1003

1008
0002 Sample Temp. 92 °F NO HD Detection Indicated
0206 " " 98-100 °F " " " "
0610 " " 98-100 °F " " " "

0002	0.0 mR/hr (Alpha)	0.35 mR/hr	Beta/Gamma
0206	" " "	0.4 "	"
0610	" " "	0.3 "	"

Ambient Conditions
WBGT ~~End~~ 80.8°F (In), 80.3°F (Out); WB 76.2°F; DB 84.4°F; GT 97.2°F
1050 Began Boring 01SB03
Oven Preheated to 200°F; 01SB03 In the Oven 1148

1154
0002 Sample Temp 100 °F; HD Detection Indicated - NO
0206 " " 100 °F " " " - NO
0610 No Sample Refusal (Bedrock)

	Alpha	Beta/Gamma	Bkgd
0002	0.0	0.35	Alpha 0.0 mR/hr
0206	0.0	0.35	Beta/Gamma 0.3 mR/hr

Ambient Conditions WBGT 80.6°F (In), 79.4°F (Out); WB 75.2°F; DB 81.8°F; GT 91.8°F
1120 Began Boring 01SB01
Oven Preheated to 200°F; 01SB01 In the Oven 1200

1206
0002 Sample Temp 102 °F; HD Detection Indicated - Alpha 0.0 Beta/Gamma 0.35
0206 " " 102 °F " " " - 0.0 0.35
0610 No Sample Refusal (Bedrock)

SCIENTIFIC BINDERY PRODUCTIONS CHICAGO 60605 MADE IN USA

Work continued to Page 47

SIGNATURE Thomas M. Richison DATE 08/26/91 Sunday
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Page Not used
Thomas M. Jackson

Work continued from Page 45

Borings SB01 – 04 were conducted under Level C Protection
PPE Employed
DPT Operator / Helper (WO) (KR & KM)
Cotton Coveralls
Hardhat
Ear-plugs
Nitrile Inner / Butyl Outer Gloves
Full Face MSA Advantage 1000 w/ CBA/RCA Canisters

Note: Time In Respirators 0845 – 1030
1030 – 1130

1400 Began 01SB09; 1424 01SB09 In the Oven
Oven Preheated to 200°F

			Alpha (mR/hr)	Beta/Gamma
1434	0002 Sample Temp. 108°F; HD Detection – None		0.0	0.2 mR/hr
	0206 " " 108°F; " " – None		0.0	0.3 "
	0610 Refusal (Bedrock) None			

WBGT 84.2°F (In), 82.3°F (out); WB 76.7°F; DB 83.8°F; GT 97.4°F

1430 Began 01SB05; In the Oven @ 1502

			Alpha	Beta/Gamma
1510	0002 Sample Temp. 110°F; HD Detection – No Indication		0.0 mR/hr	0.3 mR/hr
	0206 " " 110°F; HD " No "		"	0.3 "
	0610 " " 110°F HD " No "		"	0.4 "

1530 Began Breakdown, decontamination

KR & KM back-filled the Excavations and extractions of the tooling previously stuck in DPT Point 01SB15.

1730 Closed up operation @ MGBG wait-to 3245

1800 Left Site for the day

SCIENTIFIC BINDERY PRODUCTIONS CHICAGO 60605 MADE IN USA

Work continued to Page —

SIGNATURE Ronald M. Dehler DATE Sunday 08/26/01

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48 Summary Notes

PPE Employed during DPT
Operator/Helper (KR & KM)
Cotton Coveralls
Hard hat
Ear Plugs
Nitrile Inner
Butyl outer
Safety Glasses
Heat Stress Head Cover
Boot Covers

Samplers
Cotton Overalls
Nitrile Inner Gloves
Boot Covers
TLD Badges
Ring Badges

Work continued from Page —

0650 The following persons arrived on-site @ NSWC Crane

Keith Simpson (KS-FOL) Terry Rogohn (TR-Field Support)
Ken Marquis (KM-UXO) Frank Wudkwych (FW-Geologist)
Tom Dickson (TD-SSO/RSO)

Kevin Riffe (KR-DPT Operator) EFS

0740 Arrived @ MGBG began equipment preparation (calibration, charging, etc).

The following equipment was prepared for use on 08/27/01 in support of site activities.

Instrument	Serial #	
microFID	CZHD 310	See Calibration Log Sheet for more Information
"	CZHE 315	
Ludlum 2221 w/ 44-10 6 Scin. Detector	(157028/PR103834)	Source Check Cesium 137 Bkgd. 2728
Ludlum Model 12 w/ 44-19 6 Scin. Detector	(167179/PR150980)	Source Check Cesium 137 Bkgd. 2505
Ludlum Model 3 w/ 44-9 Pancake Detector	(11162/PR150682)	Source Check Cesium 137 Bkgd. 0.66 mR/hr
Ludlum Model 3 w/ 43-5 Alpha Scin Detector	(108441/PR175660)	Source Check Thorium 230 Bkgd. 0.0 mR/hr

MSA/Auer HD Detection Tubes (Control # RJ 1 103 N1) (Exp Date August 2003)

Soil Borings planned for 08/27/01

01SB10
01SB07
01SB06
} Set up site control zones and decontamination in support of Boring Completion

0838 Began 01SB10; 0900 Completed 01SB10

Ambient Conditions

WBGT 72.6°F (in), 72.5°F (out); WB 70.2°F; DB 70.8°F; GT 78.2°F

Work continued to Page 51

SIGNATURE Thomas M. Dickson DATE Monday 08/27/01

DISCLOSED TO AND UNDERSTOOD BY DATE WITNESS DATE

Page Not used
Thomas M. Jackson

Work continued from Page 49

0915 Set up and began 01SB07; Completed 01SB07 @ 0940

0945 Set up and began 01SB06; Completed 01SB06 @

Ambient Conditions
WBGT 73.5°F (In), 72.8°F (out); WB 70.4°F; DB 74.4°F; GT 80.8°F

Sample Screening

01SB10 In Preheated (220°F) Oven @ 1025

			Alpha	Beta/Gamma
1033	0002	Sample Temp. 104°F; HD Detection Indicated - No	0.0 mR/hr	0.2
	0206	" " 104°F " " " - NO	0.0 "	0.3
	0610	No Sample Bedrock @ 7.0'		

01SB07 In Preheated (200°F) Oven @ 1043

			Alpha (mR/hr)	Beta/Gamma
1050	0002	Sample Temp 100°F; HD Indicated - No	0.0	0.30
	0206	" " 100°F; HD Indicated - No	0.0	0.25
	0610	No Sample Refusal Bedrock @ 5'		

01SB06 In Preheated (200°F) Oven @ 1058

			Alpha (mR/hr)	Beta/Gamma (mR/hr)
1105	0002	Sample Temp (100°F); HD Indicated - No	0.0	0.25
	0206	" " (100°F) HD Indicated - No	0.0	0.25
	0610	" " (102°F) HD Indicated - No	0.0	0.35
		Refusal @ 10.5'		

1330 Don Miller's Guest (RASO - NSWC Crane) visited to check out radiation screening equipment and procedures ID provided step by step from sample acquisition through Screening. The visit lasted approximately 1/2 hour.

1400 - 1800 Demobilize Equipment and supplies from MGBG to Bldg 3245.

1800 Left NSWC Crane to return previously acquired supplies

1845 End of Day

Work continued to Page

SCIENTIFIC BINDERY PRODUCTIONS CHICAGO 60606 MADE IN USA

SIGNATURE Thomas M. Nelson DATE 08/27/01

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Page Not Used
Donna M. Dickson

Work continued from Page —

0650 Tom Dickson (TD), Terry Rogahn (TR) and Kim Marquis (KM) arrived on-site @ Bldg 3245 NSWC Crane.

TD & Kim packaged supplies and equipment to be returned to the warehouse, various vendors, and Pittsburgh Office.

TR set up to sample wells 04 & 24

TD & Kim took shipment to FedEx

TR returned from well 04 @ 1545. Samples were packaged and rinsate collected. Samples were taken to FEDEX @ ~1700-1730.

End of Day

SCIENTIFIC BINDERY PRODUCTIONS CHICAGO 60605 MADE IN USA

Work continued to Page —

SIGNATURE Thomas M. Dickson DATE 08/28/01

DISCLOSED TO AND UNDERSTOOD BY DATE WITNESS DATE

← END OF ROUND 1

VOID
SGC 5/28/02

START OF ROUND 2 →

Work continued from Page

AT SITE: SJC, TR } ft NUS

BOWSER-MORNER (2 MEN)
— KEN
— ADAM

AM: CLOUDY W/ RAIN IN PGH.
PM: CLOUDY — HOT-HUMID ON SITE MID 80° F

(EST)
0630 AT PGH AIRPORT — TRAVEL TO CRANE.

1100 AT FAIRFIELD INN - CANT CHECK IN YET.

(CT) 1230 AT CRANE SITE - GET BADGES — BEGIN TO OPEN UP EQUIP. CHECKED IN W/ CRIS FREEMAN. WENT W/ TR TO ESCORT GLOBAL DRILLING SUPPLIES TO OUR TEMP OFFICE — WENT TO CHECK ON DIGGING PERMITS BUT WERE NOT READY - WILL CHECK W/ DONNA ON WED.

1300 DRILLERS ARRIVE AT OUR OFFICE (BLDG 3245) UNLOAD SUPPLIES - CASING - CEMENT — ETC.

1540 ARRIVE AT MGBG W/ DRILLERS — WHO CONSTRUCTED DECON PAD — SJC/TR DROVE TO POTENTIAL NEW DRILL LOCATIONS.

1605 LV MGBG FOR BLDG 3245

1635 ARRIVE AT 3245 — PROCEED TO WRITE UP NOTES, LOAD EQUIP, ETC.

1700 (CT) LV SITE.

SJC
VOID 5/29/02

Work continued from Page

AT SITE: SJC } TT-NUS
TR. }

AM: CLOUDY - WARM HUMID. - SOME RAIN.
PM: MOSTLY CLOUDY, WARM HUMID.

0645 ARRIVE ON SITE - CALIB PID - DOZER DUE TO ARRIVE AT 0900.

0730 LOOK OVER WORK PLAN - CHECK X-SECTION FOR DEPTH OF WELL VS. LIMESTONE.

0900 DOZER NOT HERE AS OF 0900. TALK TO TOM J. RE: LABELS AND BOOTS - ALSO WILL CALL JEFF S RE DEPTH TO LIMESTONE.

1015 TOOK SAMPLE OF POLE YARD IDW FOR RALPH B. WILL SEND TO LAUCKS LAB FOR PCBS.

1030 BOC GAS DELIVERS NITROGEN (WP T SZ) 2 CYL. HAD TO GO ESCORT HIM ON/OFF SITE. (DENNIS PORTER)

1130 BACK AT FIELD OFFICE - DOZER HERE AT CRANE GATE TR TO ESCORT TO MGBG.

1200 TALKED TO MGC/JS RE: SPECIFIC DEPTH OF WELLS: NEED TO GO INTO THE LIMESTONE THAT SHOULD BE ENCOUNTERED ≈ 130 - 135' BGS - DRILL INTO THIS L.S. UNTIL WATER IS ENCOUNTERED - TRY NOT TO GO INTO THE SHALE UNIT AS PER WELL 01-06.

1240 TR RETURNS FROM MGBG AFTER ESCORTING THE DOZER TRUCK DRIVER TO THE GATE.

1330 AT FIELD OFFICE - RESUME GETTING EQUIP READY FOR DRILLING AND SAMPLING.

1400 TR CALLS DRILLER - THEY ARE ABOUT AN HOUR AWAY

1500 DRILLERS HERE - ONLY HAD TEMP BADGE - WENT AFTER PERM BADGES AT MAIN GATE

1520 TOM J. CALLS - WILL SEND OUT BETTER DRAWING OF OJT WELL LOCATIONS -- ALSO HE TALKED W/ MGC - DOZER WILL DO MOST OF THE CLEARING - AS OPPOSSED TO USING A CHAIN SAW.

1530 CONDUCT H&S TRAINING

1625 GO TO MGBG - TO LOOK AT ACCESS WITH DRILLERS

1745 ARRIVE BACK AT SITE OFFICE

1815 HEAD FOR FED EX TO DROP OFF COOLER.

1845 DROP OFF PACKAGE @ FED EX.

SJ Conti 5/29/02

Work continued from Page

AT SITE: SJC, TR } T+E NUS
J. VANKIRK, M. DUNCAN, J., J. } BM.

AM: CLOUDY, WARM, HUMID
PM: MOSTLY SUNNY, HOT, HUMID.

0645 AT SITE - CALIB PID, PERFORM RIG INSPECTION.

0730 TALK TO MGC - GAVE HIM OUR PROGRESS - SAID HE CHECK ON STATUS OF OJT WELLS.

0830 SJC AT MGBG - DRILLERS STEAM CLEAN CASING, WHILE DOZER CLEARS AREA FOR 2 DEEP WELLS.

0930 RIG MOVES INTO ~~OIOT~~ OIT03 AND SETS UP - MARK TAKES CASING BACK INTO SAME LOCATION. sjc 5/30/02

1000 STILL SETTING UP AT OIT03 LOCATION.

1005 TOOK FIRST SPLIT SPOON SAMPLE (0-2) HIT REFUSAL - TOP OF ROCK @ 7'±. USED AIR ROTARY W/ 8¾" BIT TO REAM TO 15' - ~~SET TEMP 6" Φ CASING (STEEL) TO 15'~~. sjc 5/30/02

1100 AT 15' - ~~SET TEMP 6" CASING~~ sjc 5/30/02 (CORED THRU OPEN HOLE) sjc

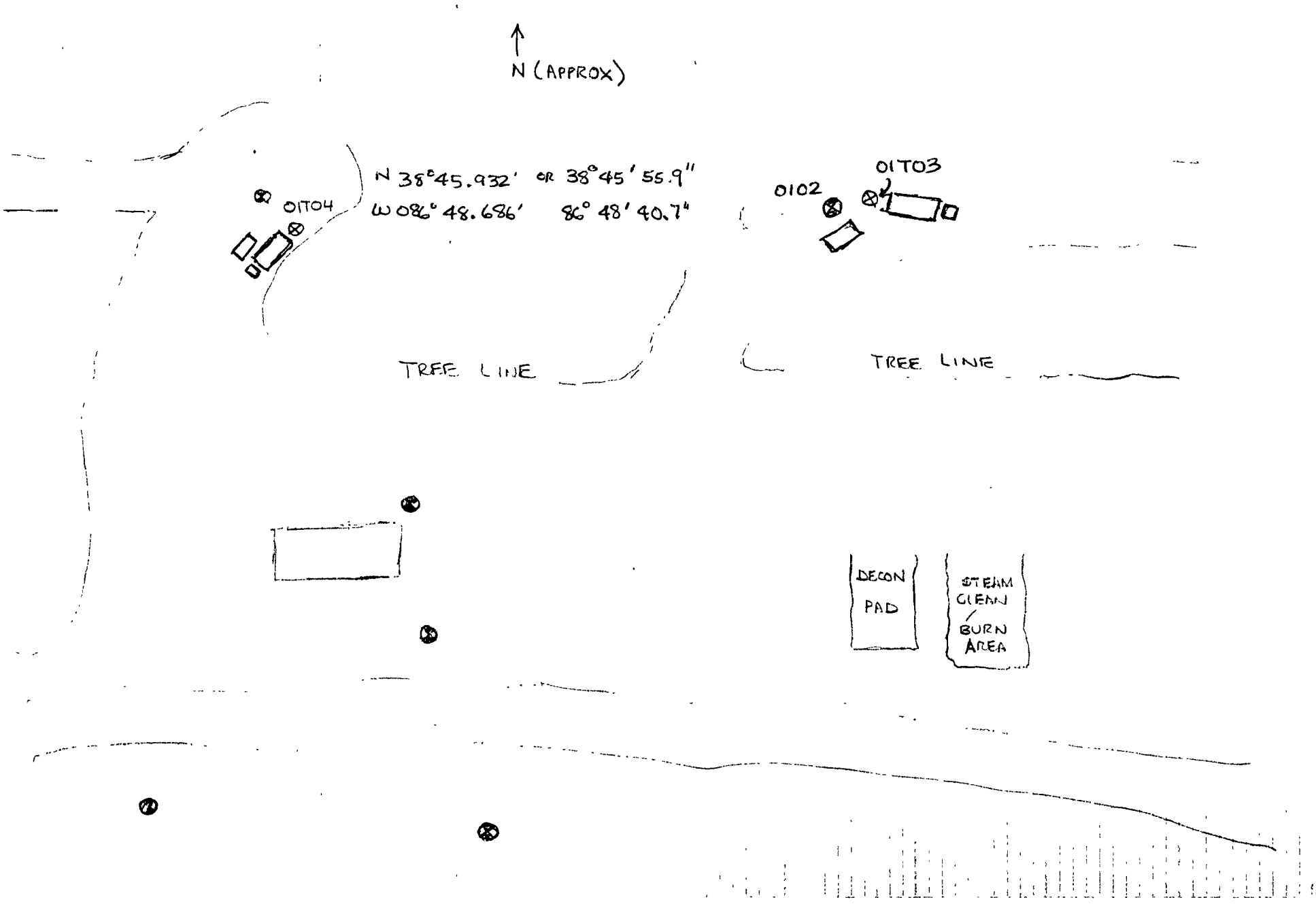
1150 START CORING W/ 5" BIT. (START @ 15') SEE BORING LOGS FOR DETAILS.

1400 DOWN TO 72.5 - SHALE - WILL SET CASING AROUND THIS DEPTH. (AFTER REAMING)

1450 START TO REAM W/ 8¾" BIT

1600 DOWN TO 72'± WILL SET 6" STEEL CASING HERE.

SIGNATURE SJ Conti DATE 5/30/02
DISCLOSED TO AND UNDERSTOOD BY DATE WITNESS DATE


N (APPROX)
N 38°45.932' OR 38°45'55.9"
W 086°48.686' 86°48'40.7"
01T04
0102
01T03
TREE LINE
TREE LINE
DECON PAD
STEAM CLEAN / BURN AREA

Work continued from Page

AT SITE: SJC: TH NUS MD
TR: " " JV
J
J
BOWER MORNER

AM: SUNNY V. WARM - HUMID
PM: " " TO CLOUDY HOT - EVE. THUNDER SHOWERS

0645 AT SITE - CALIB PID - CONDUCT BRIEF TAILGATE MEETING

0730 LV FOR MGBG.

0755 ARRV AT MGBG - DRILLERS PREPARE TO GROUT

0900 HAVING TROUBLE GETTING TREMIE PIPE DOWN THE ANNULUS DOWN ≈ 50, CANT (AS YET) GET ANY DEEPER.

1000 TREMIE GROUTED CASING IN AT 01T03 - AND WERE ABLE TO GET NEAR THE BOTTOM W/ THE TREMIE PIPE. PUMPED ≈ 90 GALLONS OF MIX INTO ANNULUS. TRIED TO CALL TOM J BACK TWICE - REGARDING OUR DRILL PROCEDURE BUT WE KEEP MISSING EACH OTHER - A MSSG ON MY CELL FROM TOM SAID THAT IF JEFF S WAS OK W/ THE PROCEDURE, THEN IT WOULD BE OK W/ TOM - YESTERDAYS CONVERSATION W/ JEFF S INDICATED THAT HE WAS IN APPROVAL OF OUR PROCEDURE.

1130 TALKED TO TOM J. - EXPLAINED OUR PROCEDURE FOR DRILLING HE WAS SATISFIED - ESP SINCE I EXPLAINED THIS TO JEFF S.

1200 RIG AT DECON PAD - HAD TO MOVE OFF OF 01T03 TO LET GROUT SET UP - THEY ALSO CLEANED UP AROUND RIG.

1245 RIG MOVING TO 01T04 LOCATION.

1300 START @ 01T04 - TOOK 3 SPOONS. HIT REF @ 6.2'± WILL REAM HOLE W/ 8 3/4" BIT. (1340) BUILD CONTAINMENT PAD AROUND HOLE W/ PLASTIC (1400)

SCIENTIFIC BINDERY PRODUCTIONS CHICAGO 60605 MADE IN USA

Work continued to Page

SIGNATURE S. Conte DATE 5/31/02

DISCLOSED TO AND UNDERSTOOD BY DATE WITNESS DATE

1610 START TO SET 6" Φ CASING

1630 CALLED JEFF S. - GAVE HIM OUR PROGRESS

1645 STILL SETTING CASING AT 01T03.

1800 CASING SET @ 72'±. DECIDE NOT TO GROUT TODAY DUE TO LATENESS.

1820 LV MGBG

1845 ARR SITE OFFICE.

1900 LV SITE

1930 GET GAS - WORK ON NOTES ETC IN ROOM.

	ITEMS	THURS
01T03	OB DRILL	15'
	4 SAMPLES	
	57.5' CORE	
	72' CASING INSTALL	

SJ Conti 5/30/02

TITLE NSWC CRANE
SAT JUNE 1 2002

PROJECT NO. N3959
BOOK NO. 1347

Work continued from Page

AT SITE SJC } Ft NUS.
TR }

AM:
PM:

VOID
SJC 6/1/02

SCIENTIFIC BINDERY PRODUCTIONS CHICAGO 60605 MADE IN USA

Work continued to Page

SIGNATURE DATE

DISCLOSED TO AND UNDERSTOOD BY DATE WITNESS DATE

FRIDAY (CONTINUED)

1415 START CORING. @ 15' W/ 5" OD BIT.
1530 CORED TO 53.5 TODAY — 15' TO 53.5 = 38.5
1600 START TO CLEAN UP. STC ON FIRE WATCH
1630 LV MGBG — GO TO FIELD OFFICE.
1700 ARR FIELD OFFICE — UNLOAD SOME EQUIP
1730 LV SITE — WORK ON LOGS, NOTES IN ROOM.

53.5
15.0
38.5
28.5
67.0
15.0
82.0

WELL NO	DATE START	DATE COMP (2002)	OB DRILL	5" CORE (ABOVE CAS)	5" CORE (BELOW CAS)	TD	6" CAS	2" WELL	SCREEN FROM	SCREEN TO	DATE DEV (2002)	PRO CAS	
01T03	5-30	6-3	15	57.5	82	155	72	154	144	154		1	
01T04	5-31	6-4	15	67.0	70	153	80	151	141	151	6/10	1	
01T05	6-4	6-5	15	—	17	32	—	31	21	31		1	

01T03
1. 15-25
2. 25-34.5
3. 34.5 → 44
4. 44.5 - 53.5
5. 53.5 - 63
6. 63 - 72.5

01T04
1. 15-25
2. 25-34.5
3. 34.5-44
4. 44-53.5
5. 53.5-63
6. 63-72.5
7. 72.5-82

Work continued from Page

AT SITE: SJC, TR } TH NUS. MD, JV, J, J } BM

AM: CLOUDY WARM HUMID
PM: MOSTLY SUNNY - V. WARM TO HOT HUMID Hi 80°s F.

0630 ARRIVE ON SITE - CALIB PID - PICK UP/LOAD EQUIP

0730 ARRIVE @ MGBG - RESUME @ 01T04. RESUME CORING FROM 53.5 → 82.0 - DECIDE TO SET 6" CAS @ 82 FT.

0900 BEGIN TO REAM HOLE TO 82' W/ 8¾" BIT. GOT DOWN TO ≈ 50' - HAD TO GET LOAD OF WATER ≈ 0930 HRS

1035 WATER ARRIVES (MARK & JASON) - DRILL CREW STEAM CLEANS CAS. LOAD CASING ON PICK-UP - TAKE TO HOLE 1115. DRILLERS TAKE SHORT BREAK @ ≈ 1125.

1145 RESUME REAMING TO 82'. PROCEED TO START SETTING CASING.

1230 SETTING 6"Φ STEEL CASING TO 82' - HAVING TROUBLE W/ SETTING CASING AT ≈ FT. HAD TO PULL CASING AND RE-DRILL. (PULLING CASING @ 1410 HRS.) RE-REAM W/ 8¾" BIT FROM ≈ 1420 TO 1500 HRS.

1500 BEGIN TO RE-SET 6"Φ CASING.

1600 CASING SET @ 80' - COULD NOT GET TO 82 - WILL BE OK AT 80'. BEGAN TO SET TREMIE PIPE. HAD SOME TROUBLE GETTING PIPE DOWN.

1700 START TO GROUT - PUMPED ≈ 100 gal of GROUT

[01T04] 6-1-02
QUANTITIES

1. Core 53.5 → ~~80~~ 82 (SJC) — 28.5'
2. SET 6" CASING TO — 80'
   ALSO GROUTED INPLACE
   53.5 → 63
   63.0 → 72.5
   72.5 → 82

Work continued to Page

SCIENTIFIC BINDERY PRODUCTIONS CHICAGO 60605 MADE IN USA

SIGNATURE SJ Gorte DATE 6-1-02
DISCLOSED TO AND UNDERSTOOD BY DATE WITNESS DATE

B 100 P ©

SAT (CONT)

1730 FINISH GROUTING - BEGIN TO REMOVE TREMIE PIPE - AND START TO CLEAN UP.
1800 LU MGBG
1820 ARRIVE SITE OFFICE
1840 LV. SITE.
1845 LU SITE GATE.

NOTE: E-MAILED OUR PROGRESS TO TOM J, MATTC, AND JEFF S. PROGRESS WAS AS OF SATURDAY. THIS WAS DONE FROM THE MOTEL SAT. NITE.

SJC 6-1-02

Work continued from Page

AT SITE: SJC, TR } T+E NUS — M. DUNCAN, J. VANCIRK, J., J. } BM

AM: OVERCAST, HOT HUMID TO SUNNY
PM: SUNNY TO CLOUDY HOT HUMID.

0645 ARRIVE AT GATE – GO TO B-3245 – CALIB PID – GET SUPPLIES

0745 ARRIVE AT MGBG – DRILLERS IN THE PROCESS OF MOVING RIG FROM 01T04 TO THE DECON PAD. @ 0825.

0915 RIG RE-SETTING AT 01T03 – WILL RESUME CORING FROM 72'±

1000 CLEANING OUT CASING W/ 5 7/8" BIT (PRIOR TO CORING)

1020 SETTING CORING TOOLS INTO HOLE (5" OD CORE BARREL).

1035 START CORING @ 73' – SEE BORING LOG FOR DETAILS AND TIMES

1400 DONE CORING AT 155' – SEE BORING LOG FOR DETAILS.

1415 MARK D WENT AFTER WATER TO CLEAN OUT CORE HOLE. DRILLER AND HELPER GET WELL MATLS READY

1520 CLEANED OUT HOLE TO 155'± WITH RODS AND WATER – BLEW WATER OUT OF HOLE – BEGIN TO PULL RODS.

1600 START TO SET 2"Φ WELL SCREEN (10'X10SL) AND RISER PIPE.

1615 HAD TO STOP DUE TO STORM

1630 RESUME SETTING RISER PIPE. SET @ 1635

1636 START TO ADD SAND PACK.

(01T03)

ITEMS	SUN
CORING 73-155	82
2" WELL INSTALL	154

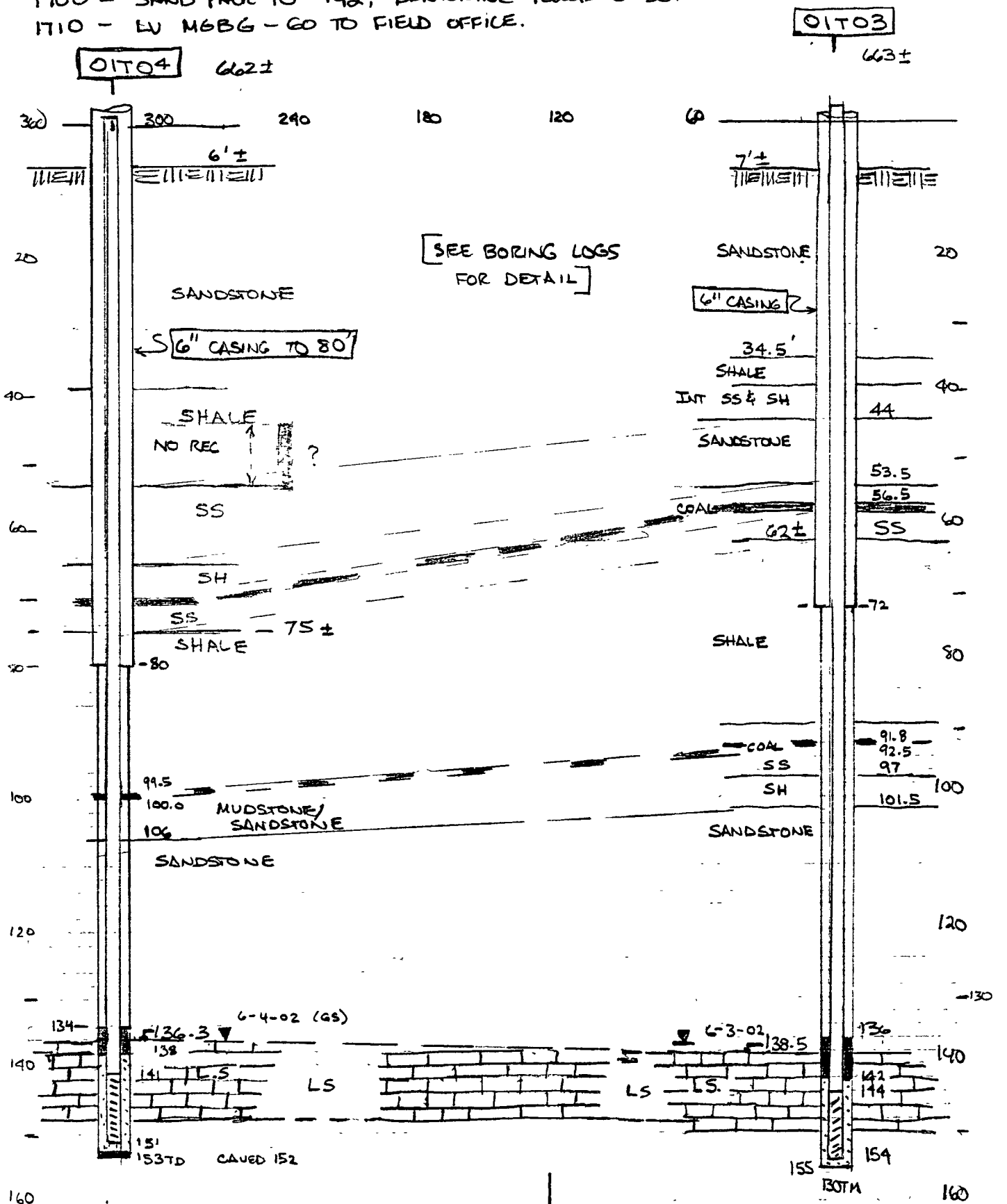
Work continued to Page

SCIENTIFIC BINDERY PRODUCTIONS CHICAGO 60605 MADE IN USA

SIGNATURE SJ Conte DATE 6-2-02

DISCLOSED TO AND UNDERSTOOD BY DATE WITNESS DATE

1700 – SAND PACK TO 142, BENTONINE PELLETS TO 136.
1710 – LV MGBG – GO TO FIELD OFFICE.



WL 136± GS 0815 6-4-02
PRIOR TO WELL PLACEMENT

WL. 139.75 6-3-02 @ 1030 HRS (TPVC)
139.70 6-5-02 @ 1036 " "

138.21 TPVC 1030 6/6/02 -2.5 TO GS.

Work continued from Page

AT SITE: SJC, TR } Tt NUS. MD, JV, J, J } B/M

AM: SUNNY V WARM HUMID
PM: " HOT HUMID 90°F.

0645 ARR. @ GATE - GO TO FIELD OFFICE - CALIB PID
LOAD UP VAN, ETC

0730 LV FOR MGBG SITE. ARR ≈ 0800 - DRILLERS PREPARE TO GROUT ANNULUS @ 01T03

0830 PREPARE CORE BOXES AND WORK ON X-SEC (PG 68)

0950 RIG MOVES OFF 01T03 TO DECON AREA.

1000 MARK DROPS OFF WELL MATS AT 01T04.

1030 WORKING ON RIG (FILTER NEEDS CHANGED)? THEN WILL DECON.

1100 MOVE RIG TO DECON PAD. START DECON RIG & TOOLS

1145 SHORT BREAK - MOVE RIG TO 01T04 ≈ 1205 HBS AND RE-SET UP RIG.

1230 WAITING FOR WATER (ARRIVES ≈ 1304) THEN CLEANED OUT HOLE W/ ROLLER BIT

1335 PUT CORING BIT ON - LOWER INTO HOLE
SEE BORING LOGS FOR DETAILS AND TIME

1700 DONE CORING AT 153'.

1730 LV MGBG

(6-3-02)

01T03-	PRO CASING	1 ea.
01T04-	CORING 83→153	70ft.

Work continued to Page

SCIENTIFIC BINDERY PRODUCTIONS CHICAGO 60605 MADE IN USA

SIGNATURE SJ Conner DATE 6/3/02

DISCLOSED TO AND UNDERSTOOD BY DATE WITNESS DATE

1750 ARRIVE SITE OFFICE.
1800 LV SITE OFFICE FOR FED EX.
1830 ARRIVE FED EX (TR, SSC) DROP OFF 1 COOLER
FINISH UP NOTES ETC IN ROOM.
NOTE CALLED JEFF S ≈ 1700 - TOLD HIM WE HIT LS AT 136.
HE SAID 15' SCREEN IS OK IF THAT IS WHAT I WANT TO USE.
I SAID I WILL CHECK THE HOLE IN THE MORNING FOR WATER
LEVEL AND DEPTH. TD IS 153. I MIGHT GO W/ 10' SCREEN
IF HOLE IS CAVED A FOOT OR 2. THEN PUT
2 OR 3' OF SAND ABOVE TOP OF SCREEN. SJC 6-3-02

Work continued from Page

AT SITE: SJC, TR } TtNUS. MD, JV, J, J } B/M

AM: SUNNY HOT HUMID.
PM: " HOT " 90°F

0630 ~~AT~~ MAIN GATE. GO TO FIELD OFFICE – LOAD VAN – DRILLERS ARRIVE ≈ 0700 – GET WATER, CEMENT, AND MISC SUPPLIES FOR SETTING WELL AT 01T04.

0745 DRILLERS ARRIVE @ MGBB – CHECKED HOLE – TD = 154' WL 136' FROM GS.

0820 START TO LOWER 10' SCREEN (2"Φ 10SL) AND RISER INTO HOLE. PLACE SAND 154 ± TO 138', PELLETS TO 134 ± BY 0900, THEN LET PELLETS HYDRATE.

1000 START TO MIX GROUT

1045 DONE GROUTING – PUMPED IN ≈ 100 GAL OF CEM/BENT MIX TO FILL ANNULUS BETWEEN THE 5" HOLE AND THE 2" RISER PIPE. CLEAN UP – TAKE SHORT BREAK

1150 TAKE RIG TO DECON PAD.

1245 DONE DECON – MOVE TO 01T05 – WAIT UNTIL MARK REGRADES SOME OF THE WET SOIL

6-4-02

1315 BACK RIG ONTO LOCATION – SET UP.

1320 TAKE S-1 SPLIT SPOON – TAKE 2 MORE – HIT REF @ 5' – ROLLER BIT TO 15' (~~43~~ ~~5~~ 6")

1345 BEGIN TO CORE @ 15'.

01T04 –	2" WELL INSTALL	151
01T04 –	PRO CASING	1
01T05 –	OB DRILL	15
SS	SAMPLES	3
	CORE 15 → 32	17'
	2" WELL	31'

Work continued to Page

SCIENTIFIC BINDERY PRODUCTIONS CHICAGO 60605 MADE IN USA

SIGNATURE S. Conte DATE 6-4-02

DISCLOSED TO AND UNDERSTOOD BY DATE WITNESS DATE

1420 AT 32'- STOP CORING WILL SET SHALLOW WELL 01T05 AT @ 31'. DRILLER LETS WATER ENTER HOLE THEN BLOW OUT W/ AIR.

1510 STILL CLEANING OUT HOLE.

1600 WELL IS SET 21 TO 31 - SAND TO 18± PELLET/CHIP TO ≈14

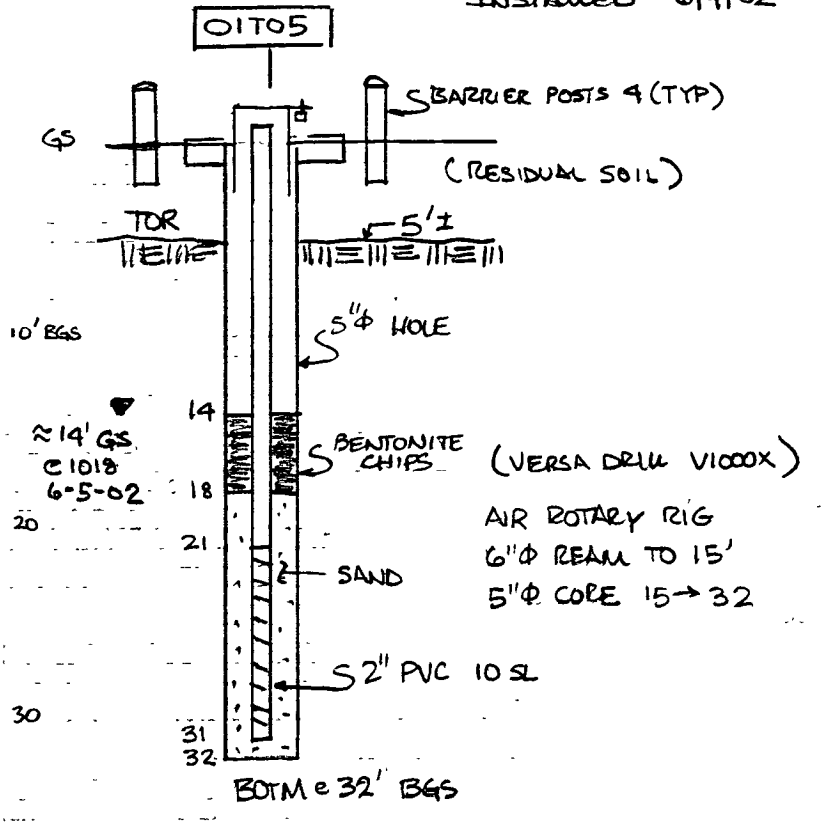
1700 BRING RIG OUT OF 01T05 - TO DECON PAD, DRILL CREW WILL GROUT IN MORNING.

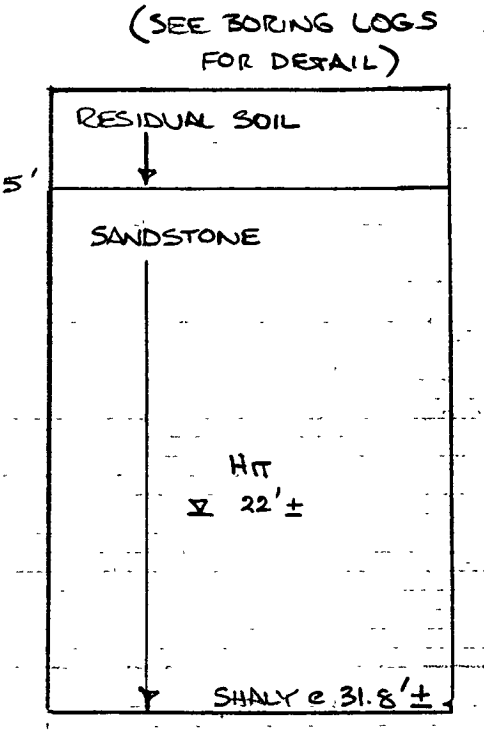
1800 LV MGBC

1830 LV FIELD OFFICE

D. Conti

INSTALLED 6/4/02





[16.86 FROM TPVC] 6-5-02 @ 1018

N.T.S.

Work continued from Page

AT SITE: SJC, TR } T+NUS
MD, JV, J, J } B-M

AM: SUNNY WARM HUMID
PM: TO CLOUDY - HOT - THUNDERSHOWERS ≈ 1330 → 1400 HRS

0630 ARRIVE @ SITE - GO TO FIELD OFFICE - CALIB PID.

0800 ARRIVE @ MGBG. DRILLERS GO TO 01T05 - GROUT ANNULUS AND PLACE PROTECTIVE CASING AND CONCRETE PAD.

1010 DRILLERS COMPLETE WELL PAD AND POSTS @ 01T05.

1018 TOOK WL @ 01T05 - WAS [16.86 TPVC].

1030 TOOK WL @ 01T04 - " [138.21 TPVC]

1036 TOOK WL @ 01T03 - " [139.70 TPVC]

1200 DRILL CREW DONE PLACING PAD AND POSTS @ 01T04 MOVED TO 01T03.

1300 DONE AT 01T03 (PAD & POSTS)

1330 WENT TO JEEP TRAIL W/ TR - PUT STAKES AT 2 PROPOSED WELL LOCATIONS.

1400 ARR @ FIELD OFFICE. CLEAN OUT VANS TAKE CARE OF SAMPLES, PAPERWORK CLEANING, ETC.

1730 LV SITE.

ITEMS (WED)

01T05 PRO CASING 1

Work continued to Page

SCIENTIFIC BINDERY PRODUCTIONS CHICAGO 60605 MADE IN USA

SIGNATURE SJ Conti DATE 6-5-02

DISCLOSED TO AND UNDERSTOOD BY DATE WITNESS DATE

VOID
6/6/02

TITLE NSWC CRANE
THUR JUNE 6 2002

PROJECT NO. N3959
BOOK NO. 1347

Work continued from Page

AT SITE: SJC : } Tt-NUS.
TR : }

AM: CLOUDY, SOME RAIN. WARM
PM: TO CLEARING WARM.

TRAVEL DAY - FROM SITE TO PGH. THEN TO OFFICE.

SCIENTIFIC BINDERY PRODUCTIONS CHICAGO 60605 MADE IN USA

Work continued to Page

SIGNATURE SJConta

DATE 6-6-02

DISCLOSED TO AND UNDERSTOOD BY DATE WITNESS DATE

VOID
SAC 6/10/02

Work continued from Page

AT SITE: SJC, TR, KES } Ft NUS MD, JV, J, J } BM

AM: SUNNY, HOT, HUMID.
PM: " " "

0630 AT PGH AIRPORT FOR FLT TO INDY.

1100 ARRIVE AT MOTEL - CHECK IN.

1300 ARRIVE AT SITE BLDG 3245 - LOAD UP VANS PREPARE FOR DEVELOPMING AND SAMPLING.

1430 SJC/TR CALIB YSI METERS

1500 DRILLERS ARRIVE - GET WATER - DRIVE TO MGBG

1600 AT MGBG - PREPARE TO DEV WELL 01T04.

1645 START PUMPING @ 01T04 - AVE 1 GPM

1815 DONE PUMPING @ 01T04 - SEE WELL DEV SHEETS FOR DETAILS

1830 LV MGBB

1856 ARRIVE FIELD OFFICE

1915 LV OFFICE

1930 ARR @ GATE

6/10/02

ITEMS

01T04 WELL DEV. 3 HRS

VOID
SJC 6/11/02

Work continued from Page

AT SITE: SJC, TR, KES } FT NOS. MD, JV, J, J } BM

AM: SUNNY V. WARM HUMID
PM: PARTLY CLDY HOT HUMID 90°F

0630 AT SITE - CALIB PID - LOAD VAN

0740 LV FIELD OFFICE - GO TO MGBG.

0800 ARR MGBG - SET UP FOR DEV AT 01T05 - WL WAS 16.75 (TPVC) PRIOR TO PUMP INSERTION.

0820 MARK DECIDES TO STRETCH HOSE TO TOP OF HILL - HAD GO GET MORE HOSE TO REACH WATER TANK.

0925 START DEV @ 01T05 - USED 2" SUB PUMP - WELL KEPT GOING DRY @ ≈ 1/2 GPM - HARD TO GET PARAMETERS - KEPT PUMPING DRY - THEN LET RECHARGE.

1100 DONE AT 01T05 - REMOVE PUMP - CLEAN UP.

1130 GO DECON.

1200 SET PUMP IN 01T03. HAD TROUBLE W/ PUMP HOSE. (TORN) HAD TO REMOVE PUMP.

1255 RESUME PUMPING - BUT WELL KEEPS GOING DRY - HAD STOP/RESTART PUMP ≈ ON 15 min int.

1445 DONE PUMPING - REMOVE PUMP.

1500 HELP TR/KES SAMPLE.

ITEMS

01T05	DEV	3 HRS
01T03	"	3 HRS

Work continued to Page

SCIENTIFIC BINDERY PRODUCTIONS CHICAGO 60605 MADE IN USA

SIGNATURE S. Carter DATE 6/11/02

DISCLOSED TO AND UNDERSTOOD BY DATE WITNESS DATE

1700 RETURN TO OFFICE.
1800 LUS B-3245
1810 ARRIVE AT MAIN GATE.

SJ Corte

Work continued from Page

AT SITE: SJC, TR, RES } TtNUS
MD, JV, J, J } B-M

AM: OVERCAST WARM HUMID
PM: " HOT HUMID.

0630 AT MAIN GATE - GO TO B3245. TR/KS PREPARE FOR SAMPLING @ MGBG.

0740 SJC CALLS JEFF S RE: SLUG TESTS, BUT HAD TO LV. MSSG. TR/KS LEFT FOR MGBG. SJC AT SITE OFFICE TO WAIT FOR DETAILS ON SLUG TESTS

0850 TOM J CALLS - GAVE HIM OUR PROGRESS - HE WILL E-MAIL THE COORD FOR SW/SED LOC TO TOM BRENT - HE WILL ALSO SEND ME INFO RE: SITES 5 & 9 WELL CONSTRUCTIONS

0950 MARK DUNCAN HERE AT OFFICE - RETURNS KEYS.

1000 PREPARE FOR WATER LEVELS

1100 START WATER LEVELS (ABG, JEEP TRAIL) CONTINUED THRU THE DAY.

2030 AT B3245 - FINISH WATER LEVELS FOR THE DAY.
LV B3245 -

2040 AT FRONT GATE.

2100 ARRIVE AT MOTEL.

VOID
SJC 6/13/02

Work continued from Page

AT SITE: SJC, TR, KES } TO NUS

AM: OVER CAST WARM - HUMID - SOME RAIN
PM: CLOUDY HOT HUMID.

0645 AT MAIN GATE.

0700 AT B3245 - PREPARE FOR MORE WATER LEVELS, SLUG TESTS ETC. TOOK WL IN THE AM - SOME RAIN. TOOK WL THAT WE EITHER MISSED OR DIDNT HAVE TIME TO GET ON WED.

1500 DONE W/ WL - TR/KS GO TO MGBG TO SPREAD HAY AND GRASS SEED. SJC WENT TO UNPACK AND PROGRAM MINI-TROLLS FOR SLUG TESTING ON FRIDAY.

1700 TR/KS ARRIVE - PACK UP COOLER FOR SHIPPING

1730 LU B3245

1800 ARR @ FED EX - ALSO EMAILED SOME INFO TO THE OFFICE

SCIENTIFIC BINDERY PRODUCTIONS CHICAGO 60605 MADE IN USA

Work continued to Page

SIGNATURE S. Conti

DATE 6/13/02

DISCLOSED TO AND UNDERSTOOD BY DATE WITNESS DATE

VOID
SJC 6/14/02

Work continued from Page

AT SITE: SJC, TR, KES } TH NUS

AM: SUNNY WARM
PM: PTLY CLOUDY WARM - BREEZY.

0645 AT GATE

0700 AT B3245 - LOAD VAN PREPARE FOR SLUG TESTS.

0800 KES TAKES ME TO SITES 5 & 9 TO SHOW ME WELL LOCATIONS.

0900 BACK @ B-3245 - HEAD TO SITE 9

0930 AT ~~0904~~ 09T01 - CAP WAS ON TIGHT - BUILT UP PRESSURE. HAD TO WAIT TIL IT RECOVERED WILL DO LATER DID NOT DECIDE TO LEAVE THIS ONE UNTIL 1030. SJC

1300 AT 0902 START @ 1320 HRS

SJC 6/4/02

AT 09T03 START @ 1505 HRS

1100 AT 0910 START @ HRS

1600 AT 09WTP4 START @ 1620 HRS

1700 GO BACK TO 09T01 - WILL RUN FALLING HEAD TEST ALL NIGHT - DUE TO SLOW RECOVERY

1740 AT BLDG 3245

1830 LU SITE

SCIENTIFIC BINDERY PRODUCTIONS CHICAGO 60605 MADE IN USA

Work continued to Page

SIGNATURE SJ Conte DATE 6/14/02

DISCLOSED TO AND UNDERSTOOD BY DATE WITNESS DATE

VOID
SC 6/15/02

Work continued from Page

AT SITE: SJC, KES, TR } Tt NUS

AM: SUNNY COOL TO WARM.
PM: " TO V WARM.

0640 AT MAIN GATE.

0650 AT B-3245- LOAD TRUCK PREPARE TO SLUG TEST

0735 STOPPED TEST AT 09 T01 - DUMPED DATA, ETC.

0800 MOVED TO 0904- TOOK WL- INSERT XD, BUT V.SLOW RECOVERY. DECIDE TO COME BACK TO

0900 AT SITE 5 0504

0935 START @ 0504

1025 START @ 0502

1130 START @ 0513

1215 AT 0503

1245 START @ 0503

1430 START @ 0509

1500 AT 0904 - WILL RUN FALLING HEAD TEST ALL NITE DUE TO SLOW REC

1615 AT B3245

VBD
6/16/02

Work continued from Page

AT SITE: SJC, KES, TR } H-NUS

AM: PARTLY CLOUDY COOL TO WARM.
PM: " "

0630 AT SITE GATE - GO TO B3245 - GET EQUIP FOR SLUG TESTS

0730 GO TO 0904 - STOP TEST AND DUMP DATA.

0835 START 0508

1015 START 0507 WAS SLOW TO RECOVER. STOP TEST ≈ 1215.

1245 AT B-3245 - BEGAN TO UNLOAD / PACK SLUG TEST EQUIPMENT

1400 DOWLOAD DATA TO FLOPPY DRIVE. FINISH PACKING EQUIPMENT.

1700 PREPARE FOR TOMORROWS ACTIVITIES, WATER LEVELS AND SAMPLING.

1800 LU SITE

Work continued to Page

SCIENTIFIC BINDERY PRODUCTIONS CHICAGO 60605 MADE IN USA

SIGNATURE

DISCLOSED TO AND UNDERSTOOD BY DATE WITNESS

DATE 6/16/02
DATE

VOID
SJC 6/17/02

END OF
ROUND 2

PAGE 91

Work continued from Page

AT SITE: SJC, KES, TR. } T&E NUS

AM: SUNNY V. WARM HUMID.
PM: " " "

0630 AT MAIN GATE - GOTO B3245.

0700 PREPARE FOR WATER LEVELS AT MGBG.

0800 START WL.

1000 FINISH WL - PREPARE TO TAKE SEDIMENTS, BUT AT FIRST LOCATION THERE WAS SW SO HAD TO GO GET BOTTLES AND EQ. FOR SURFACE WATERS - THIS WAS AT 01SD01.

1200 AT B-3245 GETTING EQUIPMENT.

1300 BACK @ MGBG - PROCEED TO TAKE SW/SED.

1500 DONE ON N. SIDE OF ROAD.

1600 WORK ON SW/SED SOUTH SIDE OF ROAD.

1800 BACK AT B 3245

1820 TRIKES GO TO FED EX. SJC STAYS TO PACK EQUIPMENT AND CLEAN UP.

2000 LV SITE

C-4 ROUND 1 - FIELD LOG BOOK

NUMBER 2447

TITLE

PROJECT NO.

BOOK

Work continued from Page

— LOG BOOK #2447 —
PAGES 1 THRU 46
OF THIS LOG BOOK
WERE USED FOR
CRANE JOB#7141

CTO 158 JOB# 3959
START ON PG 47

SCIENTIFIC BINDERY PRODUCTIONS CHICAGO 60605

Work continued to Page

SIGNATURE

DATE

WITNESS

DATE

TITLE NSWC CRANE

PROJECT NO. 3959

BOOK 2447

SUNNY 80'S

Work continued from Page 9-4-01

CTO-131
MGBG DRILLING ACTIVITY:

PERSONEL:
TTNUS FRANK WUDKUYCH (FW)
BOWSER-MORNER: JOHN KEIFER
JASON DUNN
JAMES VANKIAK
KENT DUNCAN

1430 DRILLERS ON SITE.
HEALTH + SAFETY

1540 DRILLERS GETTING WATER

1600 TAKE DRILLERS TO SITE TO
DROP OFF RIG

1730 DRILLERS LEAVE BASE FOR DAY

1830 FW LEAVES BASE FOR DAY

SCIENTIFIC BINDERY PRODUCTIONS CHICAGO 60605

Work continued to Page

SIGNATURE

DATE 9-4-01

WITNESS

DATE

TITLE NSWC CRANE

SUNNY 80'S

PROJECT NO. 3959

BOOK 2447

Work continued from Page 9-5-01

0700 FW + DRILLERS ARRIVE @ BASE
DRILLERS GET SUPPLIES + WATER

0800 ARRIVE @ SITE, BUILD DECON PAD, ETC.

0815 WAITING FOR FIRE DEPT.
DRILLERS ON STAND BY

0920 FIRE DEPT. ISSUES PERMITT

0930 STEAM CLEANING EQUIPMENT

1000 DRILLERS SET UP ON OITOD

1130 SET CASING TO 32'
HIT BEDROCK @ 30'
DRILLERS DO NOT HAVE ~~ENOUGH~~ ENOUGH CASING FOR A SECOND BORING.
JON KEIFER LEAVES TO GET MORE CASING

1200 CASING GROUTED IN PLACE

SCIENTIFIC BINDERY PRODUCTIONS CHICAGO 60605

Work continued to Page

SIGNATURE

WITNESS

DATE 9-5-01

DATE

TITLE NSWC CRANE

SUNNY 80'S

PROJECT NO. 3959

BOOK 2447

Work continued from Page 9-5-01

1230 LUNCH

1300 KEITH SIMPSON SCREENS SOIL CUTTINGS WITH RAD METERS.

1320 SOIL IS CLEAN. NO RAD
DRILLERS WILL SPREAD OUT CUTTINGS IN WOODS NEAR BORING.

1400 DRILLERS SET UP DRILL RIG FOR CORING.
JON KEIFER WILL MEET REST OF CREW @ HOTEL IN THE EVENING WITH THE CASING

1500 FW RETURNS TO FIELD OFFICE

1530 DRILLERS LEAVE BASE FOR DAY
FW @ FIELD OFFICE. LEARNING HOW TO USE THE HERMITBOOD.

1800 LEAVE BASE FOR DAY

SCIENTIFIC BINDERY PRODUCTIONS CHICAGO 60605

Work continued to Page

SIGNATURE

WITNESS

DATE 9-5-01

DATE

TITLE NSWC CRANE PROJECT NO. 3959
SUNNY 80'S BOOK 2447

Work continued from Page 9-6-01

0700 FW ARRIVES @ FIELD OFFICE

0720 FW ARRIVES @ SITE, DRILLERS ON SITE STEAM CLEANING CASING

0740 JON ~~LEAVES~~ KEIFER LEAVES BASE TO GO TO ANOTHER JOB

0800 WILL CONTINUE CORING OITOJ

1050 TO 115'
DRILLERS PULLING RODS

1115 KEN DUNCAN LEAVES BASE TO RENT GENERATOR

1130 DRILLERS GO TO FIELD OFFICE TO DUMP WATER AND FILL WATER TANK

1200 LUNCH.

1315 DRILLERS BEGIN REAMING OUT BOREHOLE W/ AIR HAMMER

SCIENTIFIC BINDERY PRODUCTIONS CHICAGO 60605

Work continued to Page

SIGNATURE FW DATE 9-6-01
WITNESS DATE

TITLE NSWC CRANE PROJECT NO. 3959
SUNNY 80'S BOOK 2447

Work continued from Page 9-6-01

1430 FINISH REAMING BOREHOLE WILL SET UP FOR PACKER TESTS

WL = 113.1' BGS

1435 CALLED JEFF SHUBERT DECIDED TO PUT 1 PACKER DOWN BOREHOLE AND LET SIT OVERNIGHT

ALSO TALKED ABOUT GOING 15' DEEPER, BUT DRILLERS DO NOT HAVE ENOUGH RODS TO GO PAST 120'

- DRILLERS SETING UP SINGLE PACKER AND WILL ISTALL IT IN THE BOREHOLE.

1630 TOP OF PACKER 90'
BOTTOM OF PACKER 93'

MONITORED ZONE 93'-115'

SCIENTIFIC BINDERY PRODUCTIONS CHICAGO 60605

Work continued to Page

SIGNATURE FW DATE 9-6-01
WITNESS DATE

TITLE NSWC CRANE
SUNNY 80'S

PROJECT NO. 3959
BOOK 2447

Work continued from Page 9-6-01

1630 WL = 113'

1700 LEAVE SITE W/ FOL
GO TO BUNKER TO DROP OFF
CORE BOXES.

1745 RETURN TO FIELD OFFICE
DO PAPERWORK
DRILLERS LEAVE BASE FOR
DAY.

WAITING FOR TERRY ROTHAN TO
RETURN FROM GROUNDWATER
SAMPLING SO WE CAN LEAVE
TOGETHER

1830 LEAVE BASE FOR DAY

SCIENTIFIC BINDERY PRODUCTIONS CHICAGO 60605

Work continued to Page

SIGNATURE
WITNESS
DATE 9-6-01
DATE

TITLE NSWC CRANE
SUNNY, HUMID, 80'S

PROJECT NO. 3959
BOOK 2447

Work continued from Page 9-7-01

0650 ARRIVE @ FIELD OFFICE

0730 ARRIVE @ SITE DO WATER LEVELS
BELOW PACKERS 113.5' 1365
ABOVE PACKERS 83.7' 065

DEEP ZONE MAKES NO WATER
10' OF WATER ON TOP OF PACKER

~~WED~~ @ BOREHOLE BASICALLY DRY

0750 DRILLERS WILL PULL PACKER.

0825 PACKERS REMOVED
WL = 109' 1365

0840 TRY TO CALL JEFF SHUBERT,
LEAVE A VOICE MAIL MESSAGE.

DRILLERS ON STANDBY

0920 K. SIMPSON ARRIVES ON SITE.
DISCUSS OPTIONS

SCIENTIFIC BINDERY PRODUCTIONS CHICAGO 60605

Work continued to Page

SIGNATURE
WITNESS
DATE 9-7-01
DATE

TITLE NSWC CRANE PROJECT NO. 3959
BOOK 2447

SUNNY 80'S

Work continued from Page 9-7-01

1015 TALKED TO TOM JOHNSTON + JEFF SHUBERT. TALKED ABOUT ~~DISCUSS~~ WHAT TO DO.

MAKE BOREHOLE THE SHALLOW WELL. BACKFILL AND SET WELL SCREEN 60'-70'

MOVE FORWARD 80'-100' FEET DRILL TO 120'. IF HOLE IS DRY, ABANDON IT.

1100 DRILLERS STEAM CLEANING AND ORDERING MORE SUPPLIES.

~~WILL CHANGE WELL AUGERS~~

~~OITOR WITH~~

1120 BORING IS DRY

DRILLERS SETTING UP ON THE NEW BORING.

SCIENTIFIC BINDERY PRODUCTIONS CHICAGO 60605

Work continued to Page

SIGNATURE

WITNESS

DATE 9-7-01

DATE

TITLE NSWC CRANE PROJECT NO. 3959
BOOK 2447

SUNNY, 80'S, HUMID

Work continued from Page 9-7-01

1145 BEGAN DRILLING 2ND BORING (OITO1)

1205 HIT BED ROCK @ 32'
WILL SET CASING TO 34'

1215 DRILLERS SETTING CASING

1240 CASING SET. WILL GROUT AFTER LUNCH

KENT DUNCAN LEAVES BASE TO PICK UP MORE WELL MATERIALS

- LUNCH

1320 DRILLERS GROUTING CASING.

1400 DRILLERS SETTING UP TO DRILL IN MORNING.

1500 DRILLERS LEAVE BASE FOR DAY

1530 FW RETURNS TO FIELD OFFICE TO DO PAPERWORK

SCIENTIFIC BINDERY PRODUCTIONS CHICAGO 60605

Work continued to Page

SIGNATURE

WITNESS

DATE 9-7-01

DATE

TITLE NSWC CRANE PROJECT NO. 3959
PARTLY CLOUDY 80'S BOOK 2447

Work continued from Page 9-8-01

CONT. WILL CONDUCT PERMEABILITY TEST

0950 INSTALL OITO2
SCREEN 70'-60'
SAND 74'-54'
BENTONITE 54'-50'

1040 WL IN OITO1 119.1' FROM TOC

5 GALLONS ~~101.0'~~ 115'
10 GALLONS ~~110.0'~~ 111.4'

1050 WL = 111.35'

1100 DRILLERS GROUTING UP OITO2

1115 WL = 111.35'

1130 DRILLERS BEGIN GROUT OITO1
DRY BOREHOLE

1200 LUNCH

SCIENTIFIC BINDERY PRODUCTIONS CHICAGO 60605

Work continued to Page

SIGNATURE [signature] DATE 9-8-01
WITNESS DATE

TITLE NSWC CRANE PROJECT NO. 3959
PARTLY CLOUDY 80'S BOOK 2447

Work continued from Page 9-8-01

1230 KEN DUNCAN LEAVES BASE TO RETURN GENERATOR AND TO BUY MORE PORTLAND FOR GROUTING BOREHOLE.

OTHER DRILLERS ARE CLEANING UP ~~PAD~~ & DIGGING OUT PAD + BUMPER POSTS AROUND OITO2.

1700 K. SIMPSON PAINT WELL CASING AND POSTS.
KENT DUNCAN NEEDS TO BUY MORE SACKRETE TO FINISH ABANDONMENT OF OITO1
WILL COMPLETE TOMMORROW

1720 FW LEAVES BASE TO GO TO LOWES TO BUY TUBING.

1830 RETURN TO HOTEL

SCIENTIFIC BINDERY PRODUCTIONS CHICAGO 60605

Work continued to Page

SIGNATURE [signature] DATE 9-8-01
WITNESS DATE

TITLE NSWC CRANE PROJECT NO. 3959

RAINING AM, SUNNY PM BOOK 2447

Work continued from Page 9-9-01

0700 ARRIVE ON BASE
DRILLERS ON SITE, FINISH
ABANDONMENT OF 01T01

0800 GOING TO COLLECT STORM
WATER SAMPLES CTO-121.
DRILLERS LEAVE BASE.

1200 LUNCH

1330 F. WUDKWYCH. WILL DEVELOP
01T02

1502 WELL IS DRY. WILL
SIT AND WAIT ON RECHARGE.

1530 STARTS RAINING.

1640 RECHARE 2' OF 1hr 35min.
BAILED DRY WILL LEAVE
SIT OVER NIGHT.

1700 SPEND REST OF DAY DO STORM
WATER SAMPLING CTO-121

SCIENTIFIC BINDERY PRODUCTIONS CHICAGO 60605

Work continued to Page

SIGNATURE

DATE 9-9-01

WITNESS

DATE

TITLE PROJECT NO.

BOOK

Work continued from Page

SCIENTIFIC BINDERY PRODUCTIONS CHICAGO 60605

Work continued to Page

SIGNATURE

DATE

WITNESS

DATE

TITLE NSWC CRANE

PROJECT NO. 5960

BOOK 2493

6·11·02

Work continued from Page

1200 KEITH SIMPSON SET-UP @ MGBG WELL 01-10 PURGE & SAMPLE

1640 COMPLETE SAMPLING @ 01-10 TO 01T02 & CHECK ON TERRY ROJAHN

SEE ALSO BOOK 1340

SCIENTIFIC BINDERY PRODUCTIONS CHICAGO 60605

Work continued to Page

SIGNATURE

WITNESS

DATE 6·11·02

DATE

TITLE NSWC CRANE

PROJECT NO. 5960

BOOK 2493

6·12·02

Work continued from Page

AM SAMPLING @ MGBG MW 01T02 WITH TERRY

1100 START WLs @ ABG, LS & DBG WITH STAX CONT'L WORKING ON WL THRU 2000

2037 DEPART SITE TO HOTEL

SEE ALSO LOG BOOK 1340 1347

SCIENTIFIC BINDERY PRODUCTIONS CHICAGO 60605

Work continued to Page

SIGNATURE

WITNESS

DATE 6·12·02

DATE

TITLE NSWC CRANE
6.13.02

PROJECT NO. 13/3960
BOOK 2493

Work continued from Page

0700 ON SITE, 45 BAILS OF STRAW DROPPED @ SITE 1 FOR RESTORATION.
WORKING ON COMPLETING W/L @ ABG, LS & DBG
1400 COMPLETE W/L
STAN WORKING ON SLUG TEST
KS & TR STARTING ON SITE RESTORATION @ MGBG
1630 TO BLD 3245
PACK FOR SWO TO FED EX

SEE ALSO LOG BOOK 1340
1347

SCIENTIFIC BINDERY PRODUCTIONS CHICAGO 60605

Work continued to Page

SIGNATURE
WITNESS

DATE 6.13.02
DATE

TITLE NSWC CRANE
FRIDAY 6.14.02

PROJECT NO. 3959
BOOK 2493

Work continued from Page

0700 @ SITE CLEAN-UP, PREP FOR GW SAMPLING
TO SITE 5 & 9 TO SHOW SJC AROUND FOR SLUG TEST
0820 KS & SC @ 3245
0850 KS TO MGBG SET UP @ 01-25 PURGE & SAMPLE
1530 COMPLETE 01-25 TO 01-11
TO HELP TR WITH MNA
1600 TO BLD 3245, CLEAN EQ.
UNLOAD TRUCKS

SEE ALSO LOG BOOK 1340

SCIENTIFIC BINDERY PRODUCTIONS CHICAGO 60605

Work continued to Page

SIGNATURE
WITNESS

DATE 6.14.02
DATE

TITLE NSWC CRANE

SAT. 6-15-02

PROJECT NO. 3959

BOOK 2493

Work continued from Page

0700 KS & TR ON SITE, CAL. EQ.
LOAD TRUCK, PHONE CALLS TO
MGBG INSTALL PUMP @ 01T03
KS TO MW 01T04 PURGE &
SAMPLE ALSO COLLECTED MS/MSD
& DUP @ THIS WELL
1310 COMPLETE SAMPLING
TO BLD 3245 CLEAN/DECON EQ.
RESTOCK TRUCK TO MGBG
01T05 SET-UP PURGE & SAMPLE
2000 COMPLETE SAMPLING TO
BLD 3245
UNLOAD TRUCK RUN MNA
2050 OFF SITE

SEE ALSO LOG BOOK 1340

SCIENTIFIC BINDERY PRODUCTIONS CHICAGO 60605

Work continued to Page

SIGNATURE

WITNESS

DATE 6-15-02

DATE

TITLE NSWC CRANE

SUN 6-16-02

PROJECT NO. 3959

BOOK 2493

Work continued from Page

0700 KS & TR @ 3245, CLEAN/
DECON EQUIPMENT
RB ON BLADDER PUMP
RUN NA
WORKING WITH TERRY R.
@ ABG & JT

SEE LOG BOOK # 1340

SCIENTIFIC BINDERY PRODUCTIONS CHICAGO 60605

Work continued to Page

SIGNATURE

WITNESS

DATE 6-16-02

DATE

TITLE NSWC CRANE
MONDAY 6.17.02

PROJECT NO. 3959
BOOK 2493

Work continued from Page

0700 ON SITE (KEITH SIMPSON)
TR, KS & SC @ BLD 3245
TO MGBG SITE WL
0750 THRU 1000
1015 KS & SC START SW/SD
SAMPLING @ MGBG
TR GW SAMPLING
1720 KS & SC RETURN TO BLD3245
6 SEDS & 3 SW SAMPLES
1825 TO FEDEX WITH SAMPLES

SEE LOG BOOK # 1340

SCIENTIFIC BINDERY PRODUCTIONS CHICAGO 60605

Work continued to Page

SIGNATURE
WITNESS

DATE 6.17.02
DATE

TITLE NSWC CRANE
TUES 6.18.02

PROJECT NO. 3959
BOOK 2493

Work continued from Page

WORKING WITH TERRY R.
TODAY

SEE LOG BOOK #
1340

SCIENTIFIC BINDERY PRODUCTIONS CHICAGO 60605

Work continued to Page

SIGNATURE
WITNESS

DATE 6-18-02
DATE

Book No. 1340

START OF ROUND 2

OTHER NOTEBOOKS:

1) GEO Notebook 1347 - S. CONTI (Site Geologist)
2) SAMPLING NB 2493 - K. SIMPSON

TITLE NSWC CRANE

PROJECT NO. 3959

BOOK NO. 1340

TUES 5/28/02

Work continued from Page

TRAVEL DAY

1230 Hrs - Arrive @ Pass Gate - S. Conti & T. Rojahn

1248 Hrs - Arrive @ 3245 BLDG - Check in w/ C. Freeman
Check & organize Fed. Ex. Deliveries

1340 Hrs - Drillers set up Personnel Arrive
Kenny Boehmer & Adam Todd

1400 Hrs - Escort Drillers supplies through Crane
Gate - Global Drilling Supplies

1425 Hrs - Check w/ Donna on Dig Permits -
NEED signed by (1) more party - should be able
to pick up permit for MGBG tomorrow

1505 Hrs - Escort Global Drilling supply truck out
Crane Gate

1510 Hrs Return to 3245 - Quick H&S tailgate &
Leave for MGBG

1540 Hrs - Arrive @ MGBG
Drillers set up Decon
S.C. & T.R. visted drilling locations

1605 Hrs - Left MGBG for BLDG 3245

1635 Hrs - Arrive @ BLDG 3245 - Paperwork

1700 Hrs - Left BLDG 3245

END

SCIENTIFIC BINDERY PRODUCTIONS CHICAGO 60605 MADE IN USA

Work continued to Page

SIGNATURE T. Rojahn

DATE 5/28/02

DISCLOSED TO AND UNDERSTOOD BY **DATE** **WITNESS** **DATE**

WED.
5/29/02 DAILY SUMMARY

1) Picked up Dig Permits for MGBG & Jeep Trail see p 77 & 78
2) Escort Dozer Delivery to MGBG - to & From Crane Gate #4
3) Hot Work Permit For MGBG - see p. 76 Meet w/ Don Mills @ Site
4) H&S Site Specific Training For Drilling Crew & S. Conti
5) Escort/Recon MGBG w/ Drillers
6) Sampled & Shipped IDW Sample From PCB Capacitor/Pole Yard For PCBs

CREWS → FOR 1st SHIFT

TT NUS
S. Conti (Geologist)
T. Rojahn (FOL)

Bowser-Morner
M. Duncan (Drilling Crew Leader)
J. VanKirk (Driller)
J. Dunn (Driller Helper)
J. Berresford (Driller Helper)

FIRE INSPECTOR:

FIRE DEPARTMENT
NAVAL SURFACE WARFARE CENTER
CRANE DIVISION
CODE 0131, BUILDING 10
300 HIGHWAY 361
CRANE IN 47522-5001

DON MILLS

Fire Inspector
PHONE: DSN 482-6019, Commercial 812-854-6019
FAX: DSN 482-4269, Commercial 812-854-4269
Email: mills_d@crane.navy.mil

Also Hot Work Permit # 854-3343

TITLE NSWC CRANE **PROJECT NO.** 3959 **75**

WED 5/29/02 **BOOK NO.** 1340

Work continued from Page

Weather - overcast, scattered showers & M10 70s

0700 Hrs - Arrive @ BLDG 3245

- Start organize NA test kits & Notebook
- Set up meeting w/ Fire Inspector for 1030 Hrs @ MGBG
- Call Public Works Digging Permits ready for OJT & MGBG picked up @ 0830 Hrs

1030 Hrs - Meet w Don Mills - Fire Inspector
All hot work to take place on gravel pad
Parking 75' from magazines

1100 Hrs - Left MGBG to meet National Rental @ Cran Gat

1128 Hrs - Arrive @ Crane Gate Escort National Rental w/ Dozer to MGBG - Drop off Dozer 1205 Hrs

1230 Hrs - Escort National Rental Driver off site (Crane Gate)

1245 Hrs - Return to BLDG 3245
Prep for H&S site specific training

1510 Hrs - H&S Training w/
S Conti - TTNUS
M Duncan
J. Bernstford
J. Dunn
J Van Kirk
} Bowser Morner

1625 Hrs - Left BLDG 3245 for MGBG
Show Drilling crew MGBG

1650 Hrs - Arrive @ MGBG
Show Drilling crew down, gravel pad for steam generator, & Well locations

1800 Hrs - Return to BLDG 3245

1815 Hrs - Check w/ Fire Dept. to see if they recharge Fire Ext. - No they do not but got info. on where to purchase same

1820 Hrs - Left Site

1850 Hrs - Drop off IDW sample @ FED.EX. in Bloomington

SIGNATURE DATE 5/29/02

DISCLOSED TO AND UNDERSTOOD BY DATE WITNESS DATE

FLAME TOOL/HOT WORK PERMIT
NSWC CRANE 11320/19 (REV. 1-02)

5/29/02

ITEM	FROM	TO	ISSUED TO
EFFECTIVE DATES	5.29.02	6.22.02	☐ NSWC ☐ CAAA ☑ CONTRACTOR ☐ TENAN
TIME	0700	1300	NAME OF TRADE/CONTRACTOR/TENANT ACTIVITY: TETRA TEC

TYPE OF EQUIPMENT TO BE USED *(Cutting Torch, Arc Welder, etc.)*

STEAM GENERATOR, CUTTING TORCH, GRINDER (WELL LOCATIONS 01T03 01T04)

PURPOSE OF USE

SAMPLE SOIL/SEDIMENT IN MUSTARD GAS AREA

WHERE USED *(Building/Structure/Other location)*

HWY 231 OFF OF HWY 161

☐ INSIDE
☑ OUTSIDE

INSTRUCTIONS OF THE FIRE SUPPRESSION/PREVENTION BRANCH, FIRE DEPARTMENT

- ☑ GENERAL FIRE PREVENTION INSTRUCTIONS ON REVERSE SIDE MUST BE COMPLIED WITH
- ☑ IN ADDITION TO THE GENERAL FIRE PREVENTION INSTRUCTIONS ON REVERSE SIDE, YOU SHALL COMPLY WITH THE FOLLOWING
- ☑ REMOVE ALL COMBUSTIBLES 35 FEET, ALL FLAMMABLE LIQUIDS 50 FEET, AND ALL EXPLOSIVES (UNLESS APPROVED TO STAY BY THE SAFETY DEPARTMENT (CAAA OR NAVY ESO) AND FIRE PREVENTION) 100 FEET FROM THE HOT WORK AREA

1) FIRE EXTINGUISHER REQUIRED WITH 30 FT OF HOT WORK OPERATION

2) NO TORCH/GRINDER OR WELDER/SPARK PRODUCING TOOL WILL BE USED AT WELL SITE IF REQUIRED MUST CALL FIRE PROTECTION TO COME ON SUPPORT AREA CAN BE USED TO BRAVO!

PERSON DESIGNATED AS FIRE WATCH *(NOT SAME PERSON AS PERMIT HOLDER)*

AS DIRECTED

REQUIRED FIRE EXTINGUISHER AT WORK SITE		OTHER FIRE PROTECTION STANDBY REQUIREMENT(S)
TYPE	SIZE	
☐ WATER ☐ CO_2 ☑ DRY CHEMICAL	20 LB ABC / WATER SUPPORT TRUCK	

I have read, understand and will comply with the above "Instructions of the Fire Suppression/Prevention Branch, Fire Department"

SIGNATURE *(Permit Holder)* — DATE: 5/29/02

HAZARDOUS AREAS ONLY

I agree that the "Instructions of the Fire Suppression/Prevention Branch, Fire Department" stated above are adequate and area is safe to work in

SIGNATURE *(Building Supervisor/Forman/Representative)* — DATE

Permission is hereby granted the Trade/Contractor/Tenant Activity named above to use specified equipment in accordance with the "Instructions of the Suppression/Prevention Branch, Fire Department as stated above

SIGNATURE *(Fire Department/Representative)* — DATE: 5-29-02

DISTRIBUTION Original *(Code 0631 File)*

Terry Pate

5/29/02

DIGGING PERMIT
WSCC 11000/3 (REV. 12/89)

3791

REQUESTED BY: Terry Pate	DATE: 5/16/02
WORK REQUEST OR E/S NO.: 38646	LOCATION: Sium 1 Mustard Gas Burial Area
WORK WILL BE PERFORMED BY: Tetra Tech NUS, Inc.	DATE (Start - on or about): 5/23/02

WORK DESCRIPTION: Installation of three (3) ground water monitoring wells, & some limited sediment sampling in the MGBA area drainage channels. See attached drawing.

EQUIPMENT TYPE

☐ HAND TOOLS ☐ CORE DRILL ☐ TRENCHER ☐ BACKHOE ☐ HEAVY EQUIPMENT

Faxed ZZ 5/16/02

UNDERGROUND UTILITIES LOCATED IN WORK SITE

UTILITY	PRESENT	MARKED	NOT LOCATED	REMARKS
COMPRESSED AIR ZZ	N/A			BA 5-21-02
ELECTRICAL	NA			5.7
FIRE ALARM ZZ	NA			[illegible]
GROUNDING ZZ	N/A			BA 5-21-02
NATURAL GAS	N/A			5/16/02 dg MAP
SECURITY ALARM ZZ Hasemann	N/A			5/16/02 JRC
SEWER	NA			5-16-02 [illegible]
STEAM	NA			[illegible]
TELEPHONE Faxed 5/16/02	NA			5-21-02
WATER	NA			5-16-02 [illegible]
[illegible] Electrical	N/A			BA 5-21-02

In addition to the general precautions for excavating where underground utilities are present, comply with the following:

PERMIT HOLDER SIGNATURE: Terry Pate	DATE: 5/29/02
DIGGING PERMIT APPROVED BY	DATE

DISTRIBUTION:

ORIGINAL - Code 0932 File

Ted Kopala
5/29/02

DIGGING PERMIT
NWSCC 11000/3 (REV. 12/89)

3792

REQUESTED BY: Terry Hale	DATE: 5/16/02
WORK REQUEST OR E/S NO: 38650	LOCATION: Swmu 3, JT-25, Oil Burn Pit
WORK WILL BE PERFORMED BY: Tetra Tech NUS, Inc.	DATE (Start - on or about): 5/23/02

WORK DESCRIPTION
Environmental investigation studies which includes drilling of 2 soil borings to install ground water monitoring wells at Swmu 3, Jeep Trail 25, Oil Burn Pit, South of the Ammunition Bunkers Gravel. Drawing attached, locations of the 2 soil borings are handwritten & highlighted.

EQUIPMENT TYPE

☐ HAND TOOLS ☐ CORE DRILL ☐ TRENCHER ☐ BACKHOE ☐ HEAVY EQUIPMENT

Faxed 22 5/16/02

UNDERGROUND UTILITIES LOCATED IN WORK SITE

UTILITY	PRESENT	MARKED	NOT LOCATED	REMARKS
COMPRESSED AIR 22	[illegible]			[illegible]
ELECTRICAL	NA			S.P.
FIRE ALARM 22	NA			[illegible]
GROUNDING 22	[illegible]			[illegible]
NATURAL GAS	N/A			5/16/02 [illegible]
SECURITY ALARM 22	N/A			5/16/02 JRK
SEWER	NA			[illegible]
STEAM	[illegible]			[illegible]
TELEPHONE Faxed 5/16/02	NA			KP 5-21-02
WATER	NA			5-20-02 [illegible]
~~22 Security Electrical~~	[illegible]			[illegible]

In addition to the general precautions for excavating where underground utilities are present, comply with the following:

PERMIT HOLDER SIGNATURE: Ted Kopala	DATE: 5/29/02
DIGGING PERMIT APPROVED BY: [illegible]	DATE: [illegible]

DISTRIBUTION:
ORIGINAL - Code 0932 File

TITLE NSWC CRANE

PROJECT NO. 3959

BOOK NO. 1340

THURS 5/30/02

Work continued from Page

WEATHER - PARTLY CLOUDY LOW 80's

0700 HRS - ARRIVE @ BLDG 3245
- PAPERWORK
- CALL FIRE INSPECTOR FOR SMOKING PERMIT - D. MILLS SAID IT WOULD BE OK TO SMOKE IN THE CENTER OF GRAVEL ROAD - PUT BUTT IN COFFEE CAN
- CHECK BOTTLES FROM SWLO & LAUCKS

0900 HRS - LEFT CRANE FOR BLOOMINGTON TO RECHARGE 2816 FIRE EXTINGUISHER @ FIRE EXT. SALES & SERV. BLOOMINGTON

1110 HRS - RETURN TO CRANE & ARRIVE @ MGBG CHECK IN W/ STAN & DROP OFF FIRE EXT @ HOT WORK AREA ~~in~~ @ GRAVEL PAD

1215 HRS - RETURN TO BLDG #3245 - CHECK IN W/ T. JOHNSTON & PICK UP LUNCH

1250 HRS - ARRIVE @ MGBG CHECK IN W/ STAN DROP OFF LUNCH

1310 HRS - CHECK OUT SITE FOR 01T05 ; PREP. TO CLEAR VEGETATION - M. DUNCAN DOZER OPERATOR

* 1330 HRS - BEGIN DOZER ACTIVITY @ 01T05 SITE
- NEED LARGE CLEARING TO MANUVER LARGE TOP HEAVY RIG - HAVE TO (TR) ~~Cut~~ CUT SLOPE TO PREVENT RIG FROM ROLLING OVER.

* 1548 HRS - FINISH CLEARING @ 01T05

1555 HRS - CHECK ON DRILLING CREW / S. CONTI

1610 HRS - WAS GOING TO CHECK OUT W/ M. DUNCAN - WHAT/HOW MUCH CLEARING WILL BE INVOLVED - M.D. WENT FOR H2O

1623 HRS - LEFT SITE (MGBG) TO FOLLOW M.D. TO MAKE SURE THAT HE COULD GET INTO BLDG 3245 TO TURN ON H2O VALVES

1645 HRS - ARRIVE @ BLDG 3245 - M.D OK C. FREEMAN STILL IN FRONT OFFICE

1718 HRS - RETURN TO MGBG - DRILLER ~~putting~~ INSTALLING CASING @ 01T03

1835 HRS - LEFT SITE

1910 HRS - STOP FOR GAS

*: PAY ITEM ALSO, SEE NOTEBOOK #1347 FOR DRILLING ACTIVITIES THIS DATE PAGE 59.

Work continued to Page

SCIENTIFIC BINDERY PRODUCTIONS CHICAGO 60605 MADE IN USA

SIGNATURE

DATE 5/30/02

DISCLOSED TO AND UNDERSTOOD BY DATE WITNESS DATE

FRI. 5/31/02 SUMMARY

- GET Drilling crews updated 8 hr REFRESHER CERTIFICATE
- TR & M DUNCAN locate 2 drilling locations @ OJT
- C. FREEMAN types WEEKEND WORK LETTER
- CONFERENCE CALL W/ PIT. OFFICE
- SEE ~~Drilling~~ S.C.'s NB # 1347 pp 61-64 FOR Drilling details

END

FRI 5/31/02
Work continued from Page WEATHER - Mostly Sunny Hot & Humid Temp MID 80s

0700 Hrs - Arrive @ BLDG 3245
- PAPERWORK
- Call BOWSER MORNER FOR Drilling Crews up dated 8 hr REFRESHER TRAINING Certificates
- Prep For Groundwater Sampling
- Check in w/ T. Johnston

0930 Hrs - RELAY T. JOHNSTON'S QUESTIONS to S. Conti Regarding Drilling status

1010 Hrs - Return to BLDG 3245
- RECEIVE 8 hr REFRESHER TRAINING Cert. FROM BOWSER FOR DRILLERS
- TALKED to T. J. - WANTS to Keep INFORMED OVER WEEKEND
  E-mail address DENDRIMER@AOL.COM
  HOME PHONE (412) 854-1052
- CALI. YSI & TURBIDITY METER
- Complete set up of MNA Kits & Analysis Notebook
- CALI. BEARINGS & DIST FOR 03T02 & 03T01 @ OJT

1227 Hrs - M. DUNCAN ARRIVED @ BLDG - Empty H_2O & go to OJT.

1335 Hrs - Arrive @ OJT
Locate APPROXIMATE LOCATIONS FOR 03T01 @ 03T02
T. Brents Locations SOMEWHAT DIFFERENT

1520 Hrs - Return to BLDG 3245 - CONFERENCE CALL W R. BASINSKI, T. JOHNSTON & A. BERNHARDT - Progress & PHOTO
- ASK C. Freeman to type weekend Letter

1600 Hrs - STAN Conti ARRIVED @ BLDG # 3245 - Drilling Crew done FOR the day

1640 Hrs - LEFT SITE FOR SAMS Club - NEED drinking H_2O

1730 Hrs - GAS VEHICLE & PURCHASE Drinking H_2O ON ride to Motel

END

SAT. 6-01-02 SUMMARY

- SAMPLED Monitoring WELLS 01-03 & 01-04
- SEE S.Cs NB #1347 PAGES 65 & 66 FOR drilling details.

END

Terry Nagel

TITLE NSWC CRANE

PROJECT NO. 3959

BOOK NO. 1340

SAT 6/01/02

Work continued from Page WEATHER - Hot & Humid High 80's Mostly Sunny

0650Hrs - Arrive @ BLDG 3245
Prep. for GW sampling

0730Hrs - Arrive @ WES-1-3-81
Start Purge @ 0802
End Purge @ 0922 well dry with slow recovery / sample later

0940Hrs - Left MGBG site to let Driller take on drilling H_2O @ BLDG 3245

1035Hrs - Drillers left BLDG 3245 for MGBG

1045Hrs - Flat tire in rental car

1115Hrs - Left BLDG for MGBG

1135Hrs - Arrive @ MGBG - take lunch w/ S.C. outside Crane Gate

1310Hrs - Return to MGBG - Check WL @ WES-1-3-81 Recovery less than 70% will sample later

1350Hrs - Start Purge @ WES-1-4-81

1750Hrs - End Purge @ WES-1-4-81
Sample WES-1-4-81 @ 1755 Hrs (01GW0402)

1805Hrs - Sample WES-1-3-81 (01GW0302)

1835Hrs - Arrive @ BLDG 3245
Drop of meters & IDW
Refrigerate samples & secure

1900Hrs - Left MGBG

END

SCIENTIFIC BINDERY PRODUCTIONS CHICAGO 60605 MADE IN USA

Work continued to Page

SIGNATURE [signature]

DATE 6/1/02

DISCLOSED TO AND UNDERSTOOD BY **DATE** **WITNESS** **DATE**

SUN. 06-02-02 SUMMARY

- SAMPLED Monitoring WELLS 01-01 & 01-06
- Collected RINSATE BLANKS RB06020201 & RB06020202
- SEE SCs NB# 1347 pages 67 & 68 for drilling Activities

END

SUN 6/02/02

Work continued from Page

WEATHER - Hot & Humid Partly Cloudy Temp High 80°

0715 Hrs - ARRIVE ON SITE
PREP to SAMPLE GW
0800 Hrs - ARRIVE @ MGBG
0855 Hrs - BEGIN PURGE @ WES-1-1-81
END PURGE @ 1025 Hrs
1030 Hrs - SAMPLE TIME FOR (01GW0102)

Trouble getting to 01MW06 - ROADS BAD
1205 Hrs - Start purge @ 01MW06
END PURGE @ 1355 Hrs
1400 Hrs - SAMPLE 01GW0602
WELL CLEAN UP
CHECK IN W/ S. Conti - Finish Drilling @ 01T03
1430 Hrs - LEFT MGBG
1500 Hrs - ARRIVE @ BLDG #3245
• PAPERWORK
1530 Hrs - Collect VOCs RINSATE OF PERISTALTIC TUBING
RB06020201
1550 Hrs - Collect VOCs RINSATE OF Bladder Pump
RB06020202
DECON both bladder Pumps FOR tomorrow
CLEAN out SUV
Dump IDW ; CHECK CALI. ON YSI probes
1740 Hrs - LEFT SITE FOR Motel

END

SIGNATURE
DATE 6/02/02
DISCLOSED TO AND UNDERSTOOD BY DATE WITNESS DATE

MON. 06-03-02 SUMMARY

- SAMPLED MONITORING WELLS 01-08 & 01-09
- COLLECTED SOURCE WATER BLANKS SB06030201 & SB06030202
- SHIPPED SAMPLES ON CoEC - MGBG060102 VIA FED EX ON AB# 8316 7333 0335
- SEE SCs NB# 1347 pages 69 & 70 FOR drilling details.

END

MON 6/03/02

Work continued from Page

WEATHER : Hot & Humid Partly Cloudy Temp 80's(H)

0705 HRS - Arrive @ BLDG # 3245
Prep to Sample GW
Check in w/ T. Brent
Check in w/ Ralph B. @ office
Call Sandy order another YSI for well dev.

0818 Hrs - Arrive @ MGBG

0850 HRS - Start Purging @ WES-1-8-82 (01GW0802)

1030 HRS - END PURGE

1035 HRS - SAMPLE TIME & Collected FD060302

1110 HRS - Start Purge @ WES-1-9-82 (01GW0902)

1310 Hrs - END PURGE

1315 Hrs - SAMPLE TIME

1400 Hrs - LEFT MGBG FOR BLDG #3245

1420 Hrs - Arrive @ BLDG # 3245
CHECK IN W/ T. JOHNSTON & R. BASINSKI

1515 Hrs - TAKE SOURCE BLANK SB06030201 - DI REAGENT GRAB

1530 Hrs - TAKE " " SB06030202 - TAP H_2O @ BLDG3245

PREP. SAMPLES FOR SHIPPING ON COC MGBG 060102
CALL SWLO SPOKE to S. Grovenstein to look for
SHIPMENT TUES - FED EX DELIVERY AB# 8316 7333 0335
CHECK YSI CALIBRATION - OK
MAKE UP VOC SETS

1805 HRS - LEFT SITE FOR FED. EX w/ S. Conti

1830 HRS - Drop OFF SAMPLES @ FED. EX.
AB# ABOVE

END

TUES 06-04-02 SUMMARY

- COLLECT SAMPLES @ MONITORING WELLS 01-23 & 01-26.
- SEE SCs NB #1347 pages 71 & 72 FOR Drilling details.

END

TUES 6/4/02

Work continued from Page

WEATHER: Hot & Humid, Partly Cloudy TEMP High 80's

0700 Hrs - ARRIVE @ BLDG #3245
PREP. FOR GW SAMPLING
TALK to K. SIMPSON REGARDING OFFICE ASSISTANCE W/ORDERING ~~ordering~~ TM SUPPLIES & PAPERWORK

0940 Hrs - Start Purge @ WES-1-23-83 (01GW2302)
1210 Hrs - END PURGE
1215 Hrs - Start SAMPLE collection

1305 Hrs - Check in w/ Drilling Crew - Finished 01T04 & mobing to 01T05

1355 Hrs - Start PURGE @ WES-1-26-83
1755 Hrs - END PURGE
1800 Hrs - Start Sample Collection (01GW2602)

1820 Hrs - LEFT MGBG
1844 Hrs - ARRIVE @ BLDG #3245
SECURE SAMPLES in Frig.
Drop off METERS, etc.
1900 Hrs - LEFT SITE

END

SCIENTIFIC BINDERY PRODUCTIONS CHICAGO 60605 MADE IN USA

Work continued to Page

SIGNATURE Ted Nagel DATE 6/4/02

DISCLOSED TO AND UNDERSTOOD BY DATE WITNESS DATE

WED 06-05-02 SUMMARY

- COLLECT SAMPLE @ MONITORING WELL 01-14
- SHIPPED SAMPLES ON COPC #MGBG060402 VIA FED EX AB# 828074028087
- SEE SCS NB #1347 page 73 for drilling details

SHIFT SUMMARY FOR Drilling

- All three wells were completed (01T03, 01T04 & 01T05) by this date
- All pads & posts were completed on this date 6-5-02.
- Drillers (NAMES SEE p.74) TRAVEL DAY
- TTNUS will travel to Pittsburgh on 6-6-02
- Drillers will return NEXT Shift FOR CLEAN-UP, Etc.

END

WED 6/05/02

Work continued from Page

WEATHER: AM Partly cloudy Temp 70's, PM Rain heavy @ times

0655 Hrs - Arrive @ BLDG #3245

Prep. to sample GW

Check in w/ T. Breant - 1) Low Boy available to mob Dozer to ABG Tubs on WED. of next week; he will check into

2) Status of ABG wells - to set up/prep for Drillers status

3) PCB Capacitor IDW - 120mg/K

K. Simpson called - can come out next shift he will do some prep. work & EQ ordering for next shift

0815 Hrs - Arrive @ MGBG

0850 Hrs - Start Purge @ WES-1-14-83 (01GW1402)

1250 Hrs - End purge

1255 Hrs - Sample Collection Time

1320 Hrs - Recon ABG w/ S. Conti - Place well location stakes

1400 Hrs - Arrive @ BLDG 3245

Paperwork & Package samples for shipping

Unload vehical

Call Southwest Labs (S Grovenstein) report shipment AB# 82807402 8087

Check in w/ T. Johnston - Progress report

1700 Hrs - Left NSWC Crane

1730 Hrs - Drop off samples @ FED. EX

END

SIGNATURE

DATE 6/5/02

DISCLOSED TO AND UNDERSTOOD BY DATE WITNESS DATE

TTNUS CREW 8 S. Conti
For 2ND SHIFT K. Simpson
T. Rojahn

MON 06-10-02 SUMMARY

- NORMAL TRAVEL DAY - NO SAMPLING
- PREP. VEHICALS FOR GROUND WATER SAMPLING
- CALIBRATE METERS
- 1500 HRS DRILLERS ARRIVE, SAME NAMES ON PAGE 74
- DEVELOPE MONITORING WELL 01T04 (SC OVERSIGHT)
- SEE ALSO PAGE 77 OF SCs NB #1347

END

TITLE NSWC CRANE

PROJECT NO. 3959

BOOK NO. 1340

MON 6/10/02 CREW S. Curti, K. Simpson & T. Rosahn

Work continued from Page

TRAVEL DAY

1300 Hrs - Arrive @ BLDG# 3245
Decon Bladder Pumps
Organize EQ.
Cali. YSI
Check in w/ Home Office - Discuss sluge tests @ SWMU 5 & 9
S.C. - worked with M. Duncan DEV. WELL 01T04

1700 Hrs - Arrive @ MGBG
Install Pump @ 01C01-93, WGS-1-10-82 & 01T02 in prep for tomorrow's sampling
Check in w/ S.C. & WELL DEV.

1805 Hrs - LEFT NSWC CRANE
Stop @ Lowes check on straw / Hay for Revegs @ MGBG - don't have straw said to check w/ Coop on Sec. street.

1900 Hrs - Stop @ COOP - close @ 1730 Hrs will come Back tomorrow @ 0730 Hrs to purchase straw, seed, Etc

END

SIGNATURE

DATE 6/0

DISCLOSED TO AND UNDERSTOOD BY DATE WITNESS DATE

TUES 06-11-02 SUMMARY

- Drilling crew & S.C. DEVELOPE WELLS (01T05 & 01T03) SEE Notebook 1347 pages 79 & 80.
- Sample MONITORING WELLS 01C01, 01-10 & (TS) ~~Start~~ purge 01T02 (will collect sample tomorrow).

END

TUES 6/11/02

Work continued from Page

WEATHER: AM Hot & Humid 80's PM scattered thunder storms 78°

0730 Hrs - Stop @ COOP to purchase straw, seed, etc.
No straw in stock - purchased seed

0835 Hrs - Arrive @ BLDG #3245
- Call other supplier for straw / hay
- Check in with R. Basinski
- Prep. to sample GW (KS & TC)
- Arrange for B. Morner to bring in truck to pick up unused supplies
- Prep - Trip Blank TB 061102 @ 0945 Hrs

1025 Hrs - Arrive @ MGBG
1100 Hrs - Start Purge @ 01C01
1318 Hrs - End Purge @ 01C01
1315 Hrs - Collect 01GWC0102

1353 Hrs - Start Purge @ 01T02
1545 Hrs - End Purge (dry out well)
1645 Hrs - Monitor Recovery for 60 min. - End recovery monitoring - will sample tomorrow (recovery to slow).
1715 Hrs - Return to BLDG #3245
- Secure samples in frig
- Drop off meters
- Check messages - Survey is coming tomorrow
Slude testing confirmed
- Start COC MGBG 061102
1745 Hrs - Left BLDG #3245

END

SIGNATURE

DATE 6/11/02

DISCLOSED TO AND UNDERSTOOD BY DATE WITNESS DATE

SUMMARY 06/12/02

- Finished sampling 01T02; Test Kits for MNA Parameters
- Started W.Ls @ OJT, ABG & DBG
- SEE NB 1347 for Drilling detailed Info. page 81
  Drilling Crew Demob this date
- K.S. did recon w/ surveyors (Ben Bledsoe Crew Boss)

END

WED. 06/12/02

Work continued from Page

Weather - OVERCAST, Hot & Humid

0700 Hrs - Arrive @ BLDG # 3245
- Arrange for pass for Dozer Pick up w/ T. Breat
- Prep. for GW & NA Sampling @ 01T02
- Check in w/ R. Basiaski

0900 Hrs - Start sampling @ 01T02
K.S. taking NA parameters

0930 Hrs - End sampling & clean up @ 01T02

1052 Hrs - Arrive @ Dye Burial Ground for water levels

1153 Hrs - Stop WLs Head to Cafe to meet S.C. & K.S.

1210 Hrs - Arrive @ Cafe.

1300 Hrs - Return to DBG to take W.L.

1540 Hrs - Finish W.L. @ DBG - Head for ABG to meet w/ SC & K.S.

1555 Hrs - Arrive @ ABG check in w/ K.S.
Take water levels @ OJT until 1800 Hrs

1812 Hrs - Arrive @ S.C. & K.S. vehicle - waited until 1840 Hrs to meet with them - then left for BLDG # 3245

1850 Hrs - Arrive @ BLDG # 3245
to wait for SC & K.S.; Paperwork; Decon M-Scope & Boots - Poison Ivy thick @ Both OJT & DBG.
Decon Pumps - will assemble tomorrow

2010 Hrs - Left BLDG for Gas Sta. & Motel
K.S & S.C. didn't come to BLDG 3245 - Called cell Phone several times No response

END

Summary 6/13/02

- Finish W.Ls @ OJT (~11 wells)
- Ran NA Nitrate/Nitrite for 01T02
- Dozer from Nations Rent - Escort pickup on & off site
- ~80% of Revegetation Activities completed @ New well sites MGDG
- S.C. worked on CTO 10 slude test prep 1/2 day SWMUs 5 & 9. (SEE NB #1347 page 83)

END

TITLE NSWC CRANE

PROJECT NO. 3959

BOOK NO. 1340

THURS 6/13/02

Work continued from Page

WEATHER: Hot & Humid Low 80°s (Rain 0830 Hrs - 1030 Hrs) SUNNY AFTERN

0700 Hrs - ARRIVE ON SITE (BLDG 3245)

- K.S. going through W.L. taken yesterday to SEE WHAT REMAINS (11 wells remain)
- T.R. Assembled bladder pumps (3)
- T.R. RAN Nitrate/Nitrite tests ON 01T02
- K.S & S.C. (0810 Hrs) LEFT to take WLs

0840 Hrs - RECEIVED CALL FROM M. DUNCAN that Nations Rent was @ CRANE gate to PICK up DOZER

0900 Hrs - Arrive @ GATE to ESCORT DOZER pick up person

0930 Hrs - Arrive @ MGBG w/ Nations RENT

1015 Hrs - Escort Nations RENT OFF NSWC CRANE

1025 Hrs - TALK w/ T. JOHNSTON - up date

1100 Hrs - LEFT FOR OJT - FOR Water LEVELS

1200 Hrs - LUNCH

1245 Hrs - Return to OJT FOR WATER LEVELS

1400 Hrs - LEFT OJT FOR MGBG
REVEGETATE Disturbed AREA (01T05)

1630 Hrs - Stop Revegetation to RETURN to BLDG #3245

1655 Hrs - ARRIVE @ BLDG #3245
PAPERWORK & PACKAGE SAMPLES FOR SHIPMENT
CoC # MGBG 061102 ON FED. EX. AB # 828074028043

1730 Hrs - LEFT NSWC CRANE FOR FED. EX.

1800 Hrs - Drop of SAMPLES @ FED. EX.

END

SCIENTIFIC BINDERY PRODUCTIONS CHICAGO 60605 MADE IN USA

Work continued to Page

SIGNATURE

DATE 6/13/02

DISCLOSED TO AND UNDERSTOOD BY

DATE

WITNESS

DATE

Summary 6/14/02

- SC, SLUG TESTING @ SWMUs 5 & 9 (SEE NB 1347 page 85)
- TR/KS - SAMPLE @ WELLS 01-11, 01-25
- Collect RINSATE BLANK RB061402

END

FRI 6/14/02
Work continued from Page

WEATHER - Partly Cloudy Mid 70°s

0700 Hrs - Arrive @ BLDG #3245
- Prep. for GW Sampling Collect TB 06/14/02 @ 0800 Hr
- Call in Hrs
- Spoke w/ M. Francis - couldn't get T.J. discussed QA QC, Etc.
- Called Lab Report Shipment C.o.C MGBG 061102 shipped 6/13/02
- Paperwork
- K.S. showed S.C. SWMUs 5 & 9 so he could start slug tests

0955 Hrs - Arrive @ MGBG
dropped bladder pumps in WES-1-15-83 & 01T04

1100 Hrs - Start purging @ WES-1-11-82

1300 Hrs - End Purge @ WES-1-11-82

1305 Hrs - Start Collection of 01GW1102

1400 Hrs - Arrive @ WES-1-25-83 to assist K.S. with MNA

1515 Hrs - Finish MNA @ WES-1-25-83

1520 Hrs - Arrive @ / Return to WES-1-11-82 to do MNA with K.S. assisting.

1554 Hrs - Finish MNA @ WES-1-11-82
Clean up @ Well

1620 Hrs - Return to BLDG #3245
Paperwork
Collect Rinsate of Bladder RB061402 @ 1745
K.S. MNA = Nitrate & Nitrite from 01GW2502 & 01GW1102
Decon Bladder Pump

1820 Hrs - Left BLDG #3245 / S.C. already off site

END

Work continued to Page

SIGNATURE Terry Rogers DATE 6/14/02

DISCLOSED TO AND UNDERSTOOD BY DATE WITNESS DATE

Summary 6/15/02

- S.L. SLUG Testing @ SWMUS 5 & 9 (SEE NB 1347 page 87)
- K.S. & T.R. Sample 01, T04, 01T05, WES-1-5-81 & WES-1-15-83

END

SAT 6/15/02

Work continued from Page

WEATHER - Partly Cloudy TEMP MID 70's

0700 Hrs - Arrive @ BLDG #3245
PREP. FOR GW SAMPLING w/ K. SIMPSON
~~CALL T. JOHN~~ (TR)
CALL T. JOHNSTON @ HOME SUMMARIES Daily Activities

0830 Hrs - Arrive @ MGBG
INSTALL BLADDER PUMP IN 01T03

0925 Hrs - Start Purge @ WES-1-5-81
END Purge @ 1110 Hrs
Pumped W.L. BELOW Bottom OF Screen
Monitored Recharge FOR 20 MIN
will sample tonight or tomorrow morning

1208 Hrs - Start Purge @ WES-1-15-83
END Purge @ 1400 Hrs

1410 Hrs - Collect sample 01GW1502 & RUN MNA

1615 Hrs - Finish up CLEAN up @ WES-1-15-83

1620 Hrs - Arrive @ 01T05 to ASSIST K.S.
- SPREAD out straw - FINISH COVERING grass SEED
- will return to BLDG to RUN Nitrate/Nitrites & Sulfate

1705 Hrs - Arrive @ BLDG 3245
RUN ABOVE NA TESTS FOR WELLS 01T04 & WES-1-15-83

1852 Hrs - LEFT 3245 FOR MGBG

1915 Hrs - Arrive @ MGBG Assist K.S. w/ MNA

2010 Hrs - SAMPLE 01GW0502 - Purged Early in the day

2034 Hrs - RETURN to BLDG 3245
Drop OFF EQ; SECURE SAMPLES

2045 Hrs - LEFT BLDG 3245

END

SIGNATURE

DATE 6/15/02

DISCLOSED TO AND UNDERSTOOD BY DATE WITNESS DATE

SUMMARY 6/16/02

- S.C. FINISH UP SLUG TEST @ SWMUS 5 & 9 & PACKAGE SLUG TEST EQ FOR SHIPPING (SEE NB 1347 p. 89)
- COLLECT RINSATE BLANKS RB061602 & RB061602-E
- K.S. & TK - TAKE PHOTOS @ ABG & OJT HABITAT, SEDI. LOCATIONS W/ LEAD CONT., SEEP, SPRINGS, ETC.

END

TITLE NSWC CRANE

PROJECT NO. 3959

BOOK NO. 1340

SUN 6/16/02

Work continued from Page WEATHER:

0700 Hrs - Arrive @ BLDG 3245

PAPERWORK; CLEAN-UP

NA TESTS RUN ON 01T05 Nitrate/Nitrite & SULFATE

DECON Bladder Pumps + NA GLASSWARE

Collect Rinsate BLANK RB061602 & RB061602-F

PREP. FOR TAKING PHOTOS @ OJT

1025 Hrs - LEFT BLDG #3245 FOR OJT

PHOTOS OF ABG

1200 Hrs - LUNCH BRAKE

1245 Hrs - Continue taking PHOTOS - Habitate, SEEPS, springs stream deposition, etc.

1600 Hrs - FINISH PHOTOGRAPHING OJT

Work on MGBG - PAPERWORK, shipping Labels, etc.

1700 Hrs - LEFT NSWC CRANE

END

SCIENTIFIC BINDERY PRODUCTIONS CHICAGO 60605 MADE IN USA

Work continued to Page

SIGNATURE

DATE 6/16/02

DISCLOSED TO AND UNDERSTOOD BY DATE WITNESS DATE

SUMMARY 6-17-02

K.S. & SC - W.L. @ MGBG
3 SW SAMPLES collected
6 SD SAMPLES collected

T.R. - W.L. @ MGBG
SAMPLED 01T03 & WES-1-2-81

PACKAGED & SHIPPED SAMPLES ON
CoPCs MGBG 061402 (GWs)
MGBG 061702 (SD)

SHIP: SLUG TEST EQ to U.S. ENVIRONMENTAL & Pittsburgh WAREHOUSE
U.S. ENV. AB# 828074028054
WAREHOUSE AB# 828074028926

SEE NB# 1347 FOR Additional INFORMATION p. 91.
END

MON 6-17-02

Work continued from Page

WEATHER: Partly Cloudy TEMP MID 70's

0700 Hrs - Arrive @ BLDG # 3245
PREP. to SAMPLE GW

0816 Hrs - BEGIN W.L. MEAS. @ MGBG w/ K.S. & S.C.
0845 Hrs - END W.L. MEAS. @ MGBG (KS & S.C will continue)
Start set up @ 01T03
0847 Hrs - Start PURGE @ 01T03
END PURGE @ 1040 Hrs
1045 Hrs - BEGIN Sampling GW 01T0301 Along w/ MNA

1215 Hrs - Start PURGE @ 01GW0202 or WES-1-2-81
1355 Hrs - END PURGE
1400 Hrs - BEGIN Sampling Along w/ MNA

1526 Hrs - LEFT MGBG for BLDG 3245
1546 Hrs - Arrive @ BLDG 3245
- RUN Nitrite & Nitrate FOR WELLS 01T03 & WES-1-2-81
- PACKAGE SAMPLES ON C of C's MGBG061402 & 061702
FOR Drop off @ FED. EX (AB# 828074028801)

1900 Hrs - Drop of samples @ FED EX (T.K & K.S); SC @ BLDG 3245

END

SCIENTIFIC BINDERY PRODUCTIONS CHICAGO 60605 MADE IN USA

Work continued to Page

SIGNATURE Terry Rogers

DATE 6-17-02

DISCLOSED TO AND UNDERSTOOD BY DATE WITNESS DATE

SUMMARY 6-18-02

- S.C. TRAVEL DAY
- Collect SW SAMPLE @ 01SW04
- FINISH REVEGETATION @ 01T05 & 01T04
- PACKAGE SAMPLES & EQ FOR SHIPMENT
- K.S. & T.R. will RETURN to Pittsburgh 06-19-02

END OF SHIFT

END OF ROUND 2 FIELD EFFORT

Page 109

TITLE NSWC CRANE

PROJECT NO. 3959

BOOK NO. 1340

TUES. 6-18-02

Work continued from Page

WEATHER: Partly Cloudy Temp MID 70'S

0700 Hrs - Arrive @ BLDG #3245

- Run Sulfate FROM 01T03 & WES-1-2-81
- Process SW & SDs collected 6-17-02
- PAPERWORK & Prep. to collect sample @ 01SW04

1000 Hrs - Collected 01SW0402 @ MG86

Finish Revegetation Activities @ Newly installed monitoring wells

1200 Hrs - Lunch

1235 Hrs - Return to BLDG #3245

- PACKAGE - EQ (RENTAL) to return to U.S. ENVIRONMENTAL AB # 828074028904
- PACKAGE - Files, PAPERWORK, NA EQ. for Return to Pittsburgh - AB # 828074028812
- PACKAGE - SAMPLES FOR SHIPMENT to SWLO AB # 828074028823
- CLEAN OFFICE & WORK SPACE @ BLDG #3245

1535 Hrs - Drop of PACKAGES @ FED. EX. Bloomington

END

SCIENTIFIC BINDERY PRODUCTIONS CHICAGO 60605 MADE IN USA

Work continued to Page

SIGNATURE

DATE 6/18/02

DISCLOSED TO AND UNDERSTOOD BY DATE WITNESS DATE

APPENDIX D

LAND SURVEY DATA

ROUND 1 SURVEY DATA
SWMU 01 - MUSTARD GAS BURIAL GROUND
CTO 158
NSWC CRANE
CRANE, INDIANA

POINT NUMBER	NORTHING NAD 83	EASTING NAD 83	GROUND ELEVATION	RISER ELEVATION	CASTING ELEVATION	DESCRIPTION
213	1280920.996	3030286.002	658.24	660.55		01MW18
214	1280957.561	3030374.330	663.96	666 23	666 31	01MWC01
215	1281059 143	3030356 811	662.12	664.61		01MW17
216	1281160.380	3030382.684	655.45	658.09		01MW14
217	1280854 507	3030671.899	676.08			01SB15
218	1280850.678	3030780 436	680.51			01SB11
219	1280731.801	3030726.220	679.35			01SB20
220	1280787.613	3030791.391	682.04			01SB16
221	1280783.771	3030832.345	682.46	685.22		01MW01
223	1280832.373	3030493.555	666.85	669.55		01MW03
226	1280951.509	3030872.768	676.26			01SB08
228	1281018.124	3030762.740	669.05	671 99		01MW04
229	1281067 658	3030660.876	665 07	667 79		01MW05
231	1281076.940	3030648.487	664.23			01SD06
232	1281092.083	3030579 126	663.56	666.03		01MW02
234	1281116 324	3030486 157	655.49	658.36		01MW11
235	1281214 709	3030613.195	635.22			01SD05
237	1281196.982	3030664 134	636.25	638.92		01MW10
238	1281229.310	3030556.689	634.17	637 06		01MW13
239	1281248.277	3030461 108	633.31	636.12		01MW12
241	1281284.750	3030686.775	609 60	612 23		01MW09
242	1281335.214	3030580.829	601.25	604 09		01MW08
244	1281351.100	3030702 748	595.38	597 98		01MW06
246	1281475.710	3030815.876	561.65			01SD04
247	1281226.262	3031281 963	576.53			01SWSD01
248	1281591.157	3030574.223	548.19			01SD03
249	1281752 506	3030508.663	539.09			01SWSD02
251	1281420 137	3030422 384	602 95	605 43		01MW07
252	1281461 037	3030334.890	603.47	606 01		01MW21
253	1281502.607	3030243.753	599.82	602.66		01MW24
255	1281389.156	3030166 807	625.41	627 88		01MW23
256	1281366.851	3030264.035	630.55	633.45		01MW20
257	1281305 770	3030359.395	641.09	644 05		01MW16
259	1281201 267	3030290.587	662.27	665 30		01MW15
260	1281236.556	3030195.625	656.44	658 92		01MW19
261	1281270.727	3030102.849	653.09	655.85		01MW22
262	1281307.384	3030007.085	653.89	656 33		01MW25
264	1281011.911	3030129.185	659.15	661 86		01MW27
267	1281189.854	3029992.386	669 73	672.30	672.42	01MW26
268	1280657.213	3030572.707	667.31			01SD08
270	1280415.906	3031462.745	697.74			01SB21
271	1280885.082	3030564.191	672.61			01SB13
272	1280860.580	3030604.244	673 15			01SB14
273	1280809 973	3030550.810	668.83			01SB18
274	1280795.500	3030668.781	673.71			01SB19
275	1280900.285	3030742.794	676.54			01SB10

ROUND 1 SURVEY DATA
SWMU 01 - MUSTARD GAS BURIAL GROUND
CTO 158
NSWC CRANE
CRANE, INDIANA

276	1280897.227	3030802.421	679.36			01SB07
277	1280992 821	3030697.421	669.77			01SB06
278	1280976.951	3030644.702	672.09			01SB04
279	1280987.759	3030613.113	672.29			01SB03
280	1281000.649	3030634.521	671.34			01SB02
281	1281020.734	3030595.673	671.44			01SB01
282	1281018 469	3030586 191	671.04			01SB09
283	1280967.616	3030516.159	671.09			01SB12
284	1281088.738	3030518.796	661.07			01SB05
285	1280903.543	3030470.250	669.02			01SB17
286	1280953.709	3030559.365	672 47			LARGE PIT
287	1280953.619	3030572.083	672 53			LARGE PIT
288	1280965.019	3030572.312	672.27			LARGE PIT
289	1280965 201	3030558.302	672.16			LARGE PIT
290	1281002.729	3030550.786	671.70			SMALL PIT
291	1281006.686	3030547.563	671.42			SMALL PIT
292	1281003 936	3030544.395	671.38			SMALL PIT
293	1280999.959	3030547.355	671.71			SMALL PIT
294	1280419 957	3031112.934	691.75			01T01
295	1280415.220	3031329.702	696.83	698 89	699.89	01MWT02

Datum Statement:
Horizontal - Indiana State Plane Coordinates, Zone 1302, NAD 83
Vertical - NAVD 88, ft. msl

Riser Elevation = top of 2" PVC riser
Casing Elevation = top of protective steel case

Surveyors: Bledsoe Tapp & Riggert, Inc.
Bloomington, IN

ROUND 2 SURVEY DATA
SWMU 01 - MUSTARD GAS BURIAL GROUND
CTO 158
NSWC CRANE
CRANE, INDIANA

POINT NUMBER	NORTHING	EASTING	GROUND ELEVATION	RISER ELEVATION	DESCRIPTION
7	1281550.552	3029971.272	639.59	641.85	01T05
10	1281586.197	3030174.327	582.76		01SD09
15	1281979.639	3030351 051	531.15		01SD11
17	1281847.941	3030378.363	538.16		01SD10
20	1281680.801	3030526.433	541.13		01SW02
26	1281222.476	3031272.374	576.28		01SW01
29	1281095 462	3030612.836	664 79	667.12	01T03
32	1281175 888	3030296 776	663 02	665.81	01T04
42	1279413.591	3030628.529	564 54		01SW04
49	1280163.375	3028794.753	515.23		01SW05
50	1280069.627	3029123.601	522.95		01SW03
50	1280069 627	3029123 601	522.95		01SD12
59	1280878.818	3030406.332	661.35		01SD07

Datum Statement:
Horizontal - Indiana State Plane Coordinates, Zone 1302, NAD 83
Vertical - NAVD 88, ft msl

Riser Elevation = Top of 2" PVC riser
Casing Elevation = Top of protective steel case.

Surveyors: Bledsoe Tapp & Riggert, Inc.
Bloomington, IN

SURVEY DATA
TETRA TECH NUS DATABASE
SWMU 01 - MUSTARD GAS BURIAL GROUND
CTO 158
NSWC CRANE
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LOCATION	GRND_SURF	LOC_	NORTHING	EASTING	HORIZ_DATU	VERT_DATUM	SURVE	SURVEYOR	TOP_CASING
01-01	682 46000	MW	460547 53940	578084 64310	NAD 27	NAVD 88	TRUE	BLEDSOE, TAPP, RIGGERT	685 22000
01-02	663 56000	MW	460855 85070	577831 42860	NAD 27	NAVD 88	TRUE	BLEDSOE, TAPP, RIGGERT	666.03000
01-03	666 85000	MW	460596 14350	577745 85550	NAD 27	NAVD 88	TRUE	BLEDSOE, TAPP, RIGGERT	669 55000
01-04	669 05000	MW	460781 89170	578015 04070	NAD 27	NAVD 88	TRUE	BLEDSOE, TAPP, RIGGERT	671.99000
01-05	665 07000	MW	460831 42540	577913 17780	NAD 27	NAVD 88	TRUE	BLEDSOE, TAPP, RIGGERT	667 79000
01-06	595 38000	MW	461114 86500	577955 05180	NAD 27	NAVD 88	TRUE	BLEDSOE, TAPP, RIGGERT	597 98000
01-07	602 95000	MW	461183 90360	577674 69060	NAD 27	NAVD 88	TRUE	BLEDSOE, TAPP, RIGGERT	605.43000
01-08	601 25000	MW	461098 97960	577833.13400	NAD 27	NAVD 88	TRUE	BLEDSOE, TAPP, RIGGERT	604 09000
01-09	609 60000	MW	461048 51610	577939 07830	NAD 27	NAVD 88	TRUE	BLEDSOE, TAPP, RIGGERT	612.23000
01-10	636 25000	MW	460960 74850	577916 43700	NAD 27	NAVD 88	TRUE	BLEDSOE, TAPP, RIGGERT	638 92000
01-11	655 49000	MW	460880 09240	577738 46030	NAD 27	NAVD 88	TRUE	BLEDSOE, TAPP, RIGGERT	658.36000
01-12	633 31000	MW	461012 04480	577713 41270	NAD 27	NAVD 88	TRUE	BLEDSOE, TAPP, RIGGERT	636.12000
01-13	634 17000	MW	460993 07670	577808 99300	NAD 27	NAVD 88	TRUE	BLEDSOE, TAPP, RIGGERT	637 06000
01-14	655 45000	MW	460924 14880	577634 98810	NAD 27	NAVD 88	TRUE	BLEDSOE, TAPP, RIGGERT	658 09000
01-15	662 27000	MW	460965 03620	577542 89210	NAD 27	NAVD 88	TRUE	BLEDSOE, TAPP, RIGGERT	665.30000
01-16	641 09000	MW	461069 53780	577611 70070	NAD 27	NAVD 88	TRUE	BLEDSOE, TAPP, RIGGERT	644 05000
01-17	662 12000	MW	460822 91310	577609 11450	NAD 27	NAVD 88	TRUE	BLEDSOE, TAPP, RIGGERT	664 61000
01-18	658 24000	MW	460684 76750	577538 30410	NAD 27	NAVD 88	TRUE	BLEDSOE, TAPP, RIGGERT	660.55000
01-19	656 44000	MW	461000 32580	577447 93120	NAD 27	NAVD 88	TRUE	BLEDSOE, TAPP, RIGGERT	658 92000
01-20	630 55000	MW	461130 61900	577516 34170	NAD 27	NAVD 88	TRUE	BLEDSOE, TAPP, RIGGERT	633.45000
01-21	603 47000	MW	461224 80350	577587 19660	NAD 27	NAVD 88	TRUE	BLEDSOE, TAPP, RIGGERT	606 01000
01-22	653 09000	MW	461034 49730	577355 15560	NAD 27	NAVD 88	TRUE	BLEDSOE, TAPP, RIGGERT	655 85000
01-23	625 41000	MW	461152 92420	577419 11440	NAD 27	NAVD 88	TRUE	BLEDSOE, TAPP, RIGGERT	627 88000
01-24	599 82000	MW	461266 37400	577496 06110	NAD 27	NAVD 88	TRUE	BLEDSOE, TAPP, RIGGERT	602 66000
01-25	653 89000	MW	461071 15440	577259 39290	NAD 27	NAVD 88	TRUE	BLEDSOE, TAPP, RIGGERT	656 33000
01-26	669 76000	MW	460953 62550	577244 69250	NAD 27	NAVD 88	TRUE	BLEDSOE, TAPP, RIGGERT	672 30000
01-27	659 15000	MW	460775 68310	577381.48910	NAD 27	NAVD 88	TRUE	BLEDSOE, TAPP, RIGGERT	661 86000
01C01	663 96000	MW	460721 33170	577626 63190	NAD 27	NAVD 88	TRUE	BLEDSOE, TAPP, RIGGERT	666 23000
01SB01	671.44000	SB	460784 50250	577847 97430	NAD 27	NAVD 88	TRUE	BLEDSOE, TAPP, RIGGERT	
01SB02	671.34000	SB	460764 41690	577886 82240	NAD 27	NAVD 88	TRUE	BLEDSOE, TAPP, RIGGERT	
01SB03	672 29000	SB	460751 52790	577865 41460	NAD 27	NAVD 88	TRUE	BLEDSOE, TAPP, RIGGERT	
01SB04	672 09000	SB	460740 71950	577897 00280	NAD 27	NAVD 88	TRUE	BLEDSOE, TAPP, RIGGERT	
01SB05	661 07000	SB	460852 50600	577771 09840	NAD 27	NAVD 88	TRUE	BLEDSOE, TAPP, RIGGERT	
01SB06	669 77000	SB	460756 58860	577949 72150	NAD 27	NAVD 88	TRUE	BLEDSOE, TAPP, RIGGERT	
01SB07	679 36000	SB	460660 99530	578054 72060	NAD 27	NAVD 88	TRUE	BLEDSOE, TAPP, RIGGERT	
01SB08	676 26000	SB	460715 27620	578125 06760	NAD 27	NAVD 88	TRUE	BLEDSOE, TAPP, RIGGERT	
01SB09	671 04000	SB	460782 23710	577838 49290	NAD 27	NAVD 88	TRUE	BLEDSOE, TAPP, RIGGERT	
01SB10	676 54000	SB	460664 05310	577995 09330	NAD 27	NAVD 88	TRUE	BLEDSOE, TAPP, RIGGERT	

Datum Statement
Horizontal -
Indiana State Plane Coordinates
Zone 1302 [illegible] 27
Vertical - N[illegible]88

SURVEY DATA
TETRA TECH NUS DATABASE
SWMU 01 - MUSTARD GAS BURIAL GROUND
CTO 158
NSWC CRANE
CRANE, INDIANA

01SB11	680 51000	SB	460614 44610	578032 73460	NAD 27	NAVD 88	TRUE	BLEDSOE, TAPP, RIGGERT	
01SB12	671.09000	SB	460731 38500	577768 46080	NAD 27	NAVD 88	TRUE	BLEDSOE, TAPP, RIGGERT	
01SB13	672 61000	SB	460648 85160	577816 49090	NAD 27	NAVD 88	TRUE	BLEDSOE, TAPP, RIGGERT	
01SB14	673 15000	SB	460624 35000	577856 54400	NAD 27	NAVD 88	TRUE	BLEDSOE, TAPP, RIGGERT	
01SB15	676 08000	SB	460618 27610	577924 19820	NAD 27	NAVD 88	TRUE	BLEDSOE, TAPP, RIGGERT	
01SB16	682 04000	SB	460551 38210	578043 68890	NAD 27	NAVD 88	TRUE	BLEDSOE, TAPP, RIGGERT	
01SB17	669 02000	SB	460667 31370	577722 55060	NAD 27	NAVD 88	TRUE	BLEDSOE, TAPP, RIGGERT	
01SB18	668 83000	SB	460573 74350	577803 11010	NAD 27	NAVD 88	TRUE	BLEDSOE, TAPP, RIGGERT	
01SB19	673 71000	SB	460559 26980	577921.07970	NAD 27	NAVD 88	TRUE	BLEDSOE, TAPP, RIGGERT	
01SB20	679 35000	SB	460495 57100	577978 51820	NAD 27	NAVD 88	TRUE	BLEDSOE, TAPP, RIGGERT	
01SB21	697 74000	SB	460179 67270	578715 03580	NAD 27	NAVD 88	TRUE	BLEDSOE, TAPP, RIGGERT	
01SD01	576 53000	SD	460990 02360	578534 26270	NAD 27	NAVD 88	TRUE	BLEDSOE, TAPP, RIGGERT	
01SD02	539 09000	SD	461516 26990	577760 97220	NAD 27	NAVD 88	TRUE	BLEDSOE, TAPP, RIGGERT	
01SD03	548 19000	SD	461354 92120	577826 53010	NAD 27	NAVD 88	TRUE	BLEDSOE, TAPP, RIGGERT	
01SD04	561 65000	SD	461239 47300	578068 18100	NAD 27	NAVD 88	TRUE	BLEDSOE, TAPP, RIGGERT	
01SD05	635 22000	SD	460978 47560	577865 49860	NAD 27	NAVD 88	TRUE	BLEDSOE, TAPP, RIGGERT	
01SD06	664 23000	SD	460840 70720	577900.78870	NAD 27	NAVD 88	TRUE	BLEDSOE, TAPP, RIGGERT	
01SD07	661 35000	SD	460642 58880	577658 63320	NAD 27	NAVD 88	TRUE	BLEDSOE, TAPP, RIGGERT	
01SD08	667 31000	SD	460420 98420	577825 00500	NAD 27	NAVD 88	TRUE	BLEDSOE, TAPP, RIGGERT	
01SD09	582 76000	SD	461349 96400	577426 63620	NAD 27	NAVD 88	TRUE	BLEDSOE, TAPP , RIGGERT	
01SD10	538 16000	SD	461611 70460	577630 67360	NAD 27	NAVD 88	TRUE	BLEDSOE, TAPP , RIGGERT	
01SD11	531 15000	SD	461743 40180	577603 36300	NAD 27	NAVD 88	TRUE	BLEDSOE, TAPP , RIGGERT	
01SD12	522 95000	SD	459833 41300	576375 90190	NAD 27	NAVD 88	TRUE	BLEDSOE, TAPP , RIGGERT	
01SW01	576 28000	SW	460986 23820	578524 67360	NAD 27	NAVD 88	TRUE	BLEDSOE, TAPP , RIGGERT	
01SW02	541 13000	SW	461444 56490	577778 74120	NAD 27	NAVD 88	TRUE	BLEDSOE, TAPP , RIGGERT	
01SW04	564 54000	SW	459177 37140	577880 81490	NAD 27	NAVD 88	TRUE	BLEDSOE, TAPP , RIGGERT	
01SW05	515 23000	SW	459927 16250	576047 05670	NAD 27	NAVD 88	TRUE	BLEDSOE, TAPP , RIGGERT	
01T01	691 75000	SBAE	460183 72640	578365 22670	NAD 27	NAVD 88	TRUE	BLEDSOE, TAPP, RIGGERT	
01T02	696 83000	MW	460178 98790	578581 99350	NAD 27	NAVD 88	TRUE	BLEDSOE, TAPP, RIGGERT	698 89000
01T03	664 79000	MW	460859 22970	577865 13810	NAD 27	NAVD 88	TRUE	BLEDSOE, TAPP , RIGGERT	
01T04	663 02000	MW	460939 65730	577549 08060	NAD 27	NAVD 88	TRUE	BLEDSOE, TAPP , RIGGERT	
01T05	639 59000	MW	461314 32070	577223 58200	NAD 27	NAVD 88	TRUE	BLEDSOE, TAPP , RIGGERT	
01TPL		TP	460723 18850	577817 64260	NAD 27	NAVD 88	FALSE		
01TPS		TP	460766 93310	577799 54140	NAD 27	NAVD 88	FALSE		

Datum Statement:
Horizontal -
Indiana State Plane Coordinates
Zone 1302, NAD 27
Vertical - NAVD 88

APPENDIX E

SUMMARY OF ANALYTICAL RESULTS

SUMMARY OF ANALYTIC RESULTS - SURFACE SOIL
CRANE 158 - MUSTARD GAS BURIAL GROUND
NSWC CRANE
CRANE, INDIANA
PAGE 1 OF 24

Location	01SB01	01SB02	01SB03	01SB04	01SB05	01SB06	01SB07	01SB08	01SB09	01SB10	01SB11	01SB12	01SB13	01SB14
Sample	01SS010002	01SS020002	01SS030002	01SS040002	01SS050002	01SS060002	01SS070002	01SS080002	01SS090002	01SS100002	01SS110002	01SS120002	01SS130002	01SS140002
Matrix	Surface Soil	Surface Soil	Surface Soil	Surface Soil	Surface Soil	Surface Soil	Surface Soil	Surface Soil	Surface Soil	Surface Soil	Surface Soil	Surface Soil	Surface Soil	Surface Soil
Depth Range	0 - 2	0 - 2	0 - 2	0 - 2	0 - 2	0 - 2	0 - 2	0 - 2	0 - 2	0 - 2	0 - 2	0 - 2	0 - 2	0 - 2
Risk	Site	Site	Site	Site	Site	Site	Site	Site	Site	Site	Site	Site	Site	Site
Soil Group	3	3	3	3	3	3	3	3	3	3	3	3	3	3
Sample Date	8/26/2001	8/26/2001	8/26/2001	8/26/2001	8/26/2001	8/27/2001	8/27/2001	8/21/2001	8/26/2001	8/27/2001	8/22/2001	8/25/2001	8/24/2001	8/24/2001
Volatile Organics (ug/kg)														
1,1,1,2-Tetrachloroethane	3 U	3 U	3 U	3 U	3 U	3 U	3 U	3 U	3 U	3 U	3 U	3 U	4 U	3 U
1,1,1-Trichloroethane	3 U	3 U	3 U	3 U	3 U	3 U	3 U	3 U	3 U	3 U	3 U	3 U	4 U	3 U
1,1,2,2-Tetrachloroethane	3 UJ	3 UJ	3 UJ	3 UJ	3 U	3 U	3 U	3 U	3 U	3 U	3 U	3 U	4 U	3 U
1,1,2-Trichloroethane	6 U	5 U	5 U	6 U	5 U	6 U	6 U	6 U	6 U	5 UJ	6 U	6 U	7 U	6 U
1,1-Dichloroethane	3 UJ	3 U	3 U	3 U	3 UJ	3 U	3 U	3 U	3 UJ	3 U	3 U	3 U	4 U	3 U
1,1-Dichloroethene	6 U	5 U	5 U	6 U	5 U	6 U	6 U	6 U	6 U	5 U	6 U	6 U	7 U	6 U
1,2,3-Trichloropropane	3 UJ	3 UJ	3 UJ	3 UJ	3 UJ	3 U	3 U	3 U	3 UJ	3 U	3 U	3 U	4 U	3 U
1,2-Dibromo-3-Chloropropane	6 UJ	5 UJ	5 UJ	6 UJ	5 UJ	6 U	6 U	6 U	6 UJ	5 UJ	6 U	6 U	7 U	6 U
1,2-Dibromoethane	3 UJ	3 UJ	3 UJ	3 UJ	3 U	3 U	3 U	3 U	3 U	3 UJ	3 U	3 U	4 U	3 U
1,2-Dichloroethane	3 U	3 U	3 U	3 U	3 U	3 U	3 U	3 U	3 U	3 U	3 U	3 U	4 U	3 U
1,2-Dichloropropane	6 U	5 U	5 U	6 U	5 U	6 U	6 U	6 U	6 U	5 U	6 U	6 U	7 U	6 U
1,4-Dioxane	560 UR	540 UR	520 UR	590 UR	510 UR	560 UR	550 UR	570 UR	600 UR	530 UR	580 UR	630 UR	730 UR	650 UR
2-Butanone	6 UJ	5 UJ	5 UJ	6 UJ	5 UJ	38	6 U	6 U	6 UJ	5 UJ	6 U	6 UJ	71 J	6 UJ
2-Hexanone	6 UJ	5 UJ	5 UJ	6 UJ	5 UJ	6 U	6 U	6 UJ	6 UJ	5 UJ	6 UJ	6 U	7 U	6 U
3-Chloropropene	6 UJ	5 UJ	5 UJ	6 UJ	5 UJ	6 U	6 U	6 UJ	6 UJ	5 UJ	6 UJ	6 UJ	7 UJ	6 UJ
4-Methyl-2-Pentanone	3 UJ	3 UJ	3 UJ	3 UJ	3 UJ	3 UJ	3 UJ	3 U	3 UJ	3 UJ	3 U	3 U	4 U	3 U
Acetone	6 UJ	5 UJ	5 UJ	6 UJ	5 UJ	680 UJ	130 J	6 UJ	6 UJ	5 UJ	6 UJ	6 U	650 U	6 UJ
Acetonitrile	220 UJ	220 UJ	210 UJ	240 UJ	200 UJ	220 UJ	220 UJ	230 UJ	240 UJ	210 UJ	230 UJ	250 UJ	290 UJ	260 UJ
Acrolein	56 UR	54 UR	52 UR	59 UR	51 UR	56 UR	55 UR	57 UR	60 UR	53 UR	58 UR	63 UR	73 UR	65 UR
Acrylonitrile	56 UJ	54 UJ	52 UJ	59 UJ	51 UJ	56 U	55 U	57 U	60 UJ	53 UJ	58 U	63 U	73 U	65 U
Benzene	3 U	3 U	3 U	3 U	3 U	3 U	3 U	3 U	3 U	3 U	3 U	3 U	4 U	3 U
Bromodichloromethane	3 U	3 U	3 U	3 U	3 U	3 U	3 U	3 U	3 U	3 U	3 U	3 U	4 U	3 U
Bromoform	3 UJ	3 U	3 UJ	3 U	3 U	3 U	3 U	3 U	3 U	3 UJ	3 U	3 U	4 U	3 U
Bromomethane	6 UJ	5 U	5 U	6 U	5 U	6 U	6 U	6 U	6 U	5 U	6 U	6 U	7 U	6 U
Carbon Disulfide	3 U	3 U	3 U	3 U	3 U	3 U	3 U	3 U	3 U	3 U	3 U	3 U	4 U	3 U
Carbon Tetrachloride	3 UJ	3 UJ	3 UJ	3 UJ	3 UJ	3 UJ	3 UJ	3 UJ	3 UJ	3 UJ	3 UJ	3 UJ	4 UJ	3 UJ
Chlorobenzene	3 U	3 U	3 U	3 U	3 U	3 U	3 U	3 U	3 U	3 U	3 U	3 U	4 U	3 U
Chlorodibromomethane	3 U	3 U	3 U	3 U	3 U	3 U	3 U	3 U	3 U	3 U	3 U	3 U	4 U	3 U
Chloroethane	6 U	5 U	5 U	6 U	5 U	6 U	6 U	6 U	6 U	5 U	6 U	6 U	7 U	6 U
Chloroform	3 U	3 U	3 U	3 U	3 U	3 U	3 U	3 U	3 U	3 U	3 U	3 U	4 U	3 U
Chloromethane	6 U	5 U	5 U	6 U	5 U	6 U	6 U	6 UJ	6 U	5 U	6 UJ	6 U	7 U	6 U
Chloroprene	6 UJ	5 UJ	5 UJ	6 UJ	5 UJ	6 UJ	6 UJ	6 UJ	6 UJ	5 UJ	6 UJ	6 UJ	7 UJ	6 UJ
Cis-1,2-Dichloroethene	6 U	5 U	5 U	6 U	5 U	6 U	6 U	6 U	6 U	5 U	6 U	6 U	7 U	6 U
Cis-1,3-Dichloropropene	3 U	3 U	3 U	3 U	3 U	3 U	3 U	3 U	3 U	3 U	3 U	3 U	4 U	3 U
Dibromomethane	6 U	5 U	5 U	6 U	5 U	6 U	6 U	6 U	6 U	5 U	6 U	6 U	7 U	6 U
Dichlorodifluoromethane	3 U	3 U	3 U	3 U	3 U	3 U	3 U	3 U	3 U	3 U	3 U	3 U	4 U	3 U
Ethyl Methacrylate	6 UJ	5 UJ	5 UJ	6 UJ	5 U	6 U	6 U	6 U	6 U	5 UJ	6 U	6 U	7 UJ	6 UJ
Ethylbenzene	3 U	3 U	3 U	3 U	3 U	3 U	3 U	3 U	3 U	3 U	3 U	3 U	4 U	3 U
Isobutanol	220 UR	220 UR	210 UR	240 UR	200 UR	220 UR	220 UR	230 UR	240 UR	210 UR	230 UR	250 UR	290 UR	260 UR
Methacrylonitrile	110 UJ	110 UJ	100 UJ	120 UJ	100 UJ	110 UJ	110 UJ	110 U	120 UJ	110 UJ	120 U	130 UJ	150 UJ	130 UJ
Methyl Iodide	6 UJ	5 U	5 U	6 UJ	5 U	6 UJ	6 UJ	6 UJ	6 U	5 UJ	6 UJ	6 UJ	7 UJ	6 UJ
Methyl Methacrylate	6 UJ	5 UJ	5 UJ	6 U	5 UJ	6 U	6 U	6 U	6 UJ	5 UJ	6 U	6 U	7 U	6 U
Methylene Chloride	6 UJ	5 UJ	5 UJ	6 U	39 U	61 J	41 J	6 UJ	25 U	13 J	6 UJ	6 UJ	9	47
Pentachloroethane	6 UJ	5 UJ	5 UJ	6 UJ	5 UJ	6 U	6 U	6 UJ	6 UJ	5 UJ	6 UJ	6 UJ	7 UJ	6 UJ
Propionitrile	110 UR	110 UR	100 UR	120 UR	100 UR	110 UR	110 UR	110 UR	120 UR	110 UR	120 UR	130 UR	150 UR	130 UR
Styrene	3 U	3 U	3 U	3 U	3 U	3 U	3 U	3 U	3 U	3 U	3 U	3 U	4 U	3 U
Tetrachloroethene	3 UJ	3 UJ	3 UJ	3 UJ	3 U	3 U	3 U	3 U	3 U	3 U	3 U	3 U	4 U	3 U
Toluene	3 U	3 U	3 U	3 U	3 U	3 U	3 U	3 U	3 U	3 UJ	3 U	3 U	2 J	3 U
Total Xylenes	3 U	3 U	3 U	3 U	3 U	3 U	3 U	3 U	3 U	3 U	3 U	3 U	4 U	3 U
Trans-1,2-Dichloroethene	6 U	5 U	5 U	6 U	5 U	6 U	6 U	6 U	6 U	5 U	6 U	6 U	7 U	6 U

Calc = Calculated Value as descibed in Section 3 4 2 1.
NA = Not Analyzed

TABLE E-1

SUMMARY OF ANALYTIC RESULTS - SURFACE SOIL
CRANE 158 - MUSTARD GAS BURIAL GROUND
NSWC CRANE
CRANE, INDIANA

Location	01SB01	01SB02	01SB03	01SB04	01SB05	01SB06	01SB07	01SB08	01SB09	01SB10	01SB11	01SB12	01SB13	01SB14
Sample	01SS010002	01SS020002	01SS030002	01SS040002	01SS050002	01SS060002	01SS070002	01SS080002	01SS090002	01SS100002	01SS110002	01SS120002	01SS130002	01SS140002
Matrix	Surface Soil	Surface Soil	Surface Soil	Surface Soil	Surface Soil	Surface Soil	Surface Soil	Surface Soil	Surface Soil	Surface Soil	Surface Soil	Surface Soil	Surface Soil	Surface Soil
Depth Range	0 - 2	0 - 2	0 - 2	0 - 2	0 - 2	0 - 2	0 - 2	0 - 2	0 - 2	0 - 2	0 - 2	0 - 2	0 - 2	0 - 2
Risk	Site	Site	Site	Site	Site	Site	Site	Site	Site	Site	Site	Site	Site	Site
Soil Group	3	3	3	3	3	3	3	3	3	3	3	3	3	3
Sample Date	8/26/2001	8/26/2001	8/26/2001	8/26/2001	8/26/2001	8/27/2001	8/27/2001	8/21/2001	8/26/2001	8/27/2001	8/22/2001	8/25/2001	8/24/2001	8/24/2001
Trans-1,3-Dichloropropene	3 U	3 U	3 U	3 U	3 U	3 U	3 U	3 U	3 U	3 U	3 U	3 U	4 U	3 U
Trans-1,4-Dichloro-2-Butene	6 U	5 U	5 U	6 UJ	5 U	6 U	6 U	6 U	6 U	5 UJ	6 U	6 U	7 U	6 U
Trichloroethene	3 U	3 U	3 U	3 U	3 U	3 U	3 U	3 U	3 U	3 U	3 U	3 U	4 U	3 U
Trichlorofluoromethane	6 U	5 U	5 U	6 U	5 U	6 UJ	6 UJ	6 U	6 U	5 UJ	6 U	6 U	7 U	6 U
Vinyl Acetate	3 U	3 U	3 U	3 U	3 U	3 U	3 U	3 U	3 U	3 U	3 U	3 U	4 U	3 U
Vinyl Chloride	6 U	5 U	5 U	6 U	5 U	6 U	6 U	6 U	6 U	5 U	6 U	6 U	7 U	6 U
Semivolatile Organics (ug/kg)														
1,2,4,5-Tetrachlorobenzene	430 U	410 U	420 U	410 U	400 U	420 U	400 U	380 U	410 U	390 U	390 U	420 U	470 U	420 U
1,2,4-Trichlorobenzene	430 U	410 U	420 U	410 U	400 U	420 U	400 U	380 U	410 U	390 U	390 U	420 U	470 U	420 U
1,2-Dichlorobenzene	220 U	210 U	210 U	210 U	200 U	210 U	200 U	190 U	210 U	200 U	200 U	210 U	240 U	210 U
1,3-Dichlorobenzene	220 U	210 U	210 U	210 U	200 U	210 U	200 U	190 U	210 U	200 U	200 U	210 U	240 U	210 U
1,4-Dichlorobenzene	220 U	210 U	210 U	210 U	200 U	210 U	200 U	190 U	210 U	200 U	200 U	210 U	240 U	210 U
1,4-Naphthoquinone	430 U	410 U	420 U	410 U	400 U	420 U	400 U	380 U	410 U	390 U	390 U	420 U	470 U	420 U
1,4-Phenylenediamine	1100 U	1000 U	1000 U	1000 U	1000 U	1100 UJ	990 UJ	950 UJ	1000 UJ	980 UJ	980 UJ	1000 U	1200 U	1000 U
1-Naphthylamine	430 U	410 U	420 U	410 U	400 U	420 U	400 U	380 U	410 U	390 U	390 U	420 U	470 U	420 U
2,2'-Oxybis(1-Chloropropane)	220 U	210 U	210 U	210 U	200 U	210 U	200 U	190 U	210 U	200 U	200 U	210 U	240 U	210 U
2,3,4,6-Tetrachlorophenol	430 U	410 U	420 U	410 U	400 U	420 U	400 U	380 U	410 U	390 U	390 U	420 U	470 U	420 U
2,4,5-Trichlorophenol	1100 U	1000 U	1000 U	1000 U	1000 U	1100 U	990 U	950 U	1000 U	980 U	980 U	1000 U	1200 U	1000 U
2,4,6-Trichlorophenol	430 U	410 U	420 U	410 U	400 U	420 U	400 U	380 U	410 U	390 U	390 U	420 U	470 U	420 U
2,4-Dichlorophenol	430 U	410 U	420 U	410 U	400 U	420 U	400 U	380 U	410 U	390 U	390 U	420 U	470 U	420 U
2,4-Dimethylphenol	430 U	410 U	420 U	410 U	400 U	420 U	400 U	380 U	410 U	390 U	390 U	420 U	470 U	420 U
2,4-Dinitrophenol	1100 U	1000 U	1000 U	1000 U	1000 U	1100 U	990 U	950 U	1000 U	980 UJ	980 U	1000 U	1200 U	1000 U
2,6-Dichlorophenol	430 U	410 U	420 U	410 U	400 U	420 U	400 U	380 U	410 U	390 U	390 U	420 U	470 U	420 U
2-Acetylaminofluorene	220 U	210 U	210 U	210 U	200 U	210 U	200 U	190 U	210 U	200 U	200 U	210 U	240 U	210 U
2-Chloronaphthalene	220 U	210 U	210 U	210 U	200 U	210 U	200 U	190 U	210 U	200 U	200 U	210 U	240 U	210 U
2-Chlorophenol	220 U	210 U	210 U	210 U	200 U	210 U	200 U	190 U	210 U	200 U	200 U	210 U	240 U	210 U
2-Methylnaphthalene	220 U	210 U	210 U	210 U	200 U	210 U	200 U	190 U	210 U	200 U	200 U	210 U	240 U	210 U
2-Methylphenol	220 U	210 U	210 U	210 U	200 U	210 U	200 U	190 U	210 U	200 U	200 U	210 U	240 U	210 U
2-Naphthylamine	220 U	210 U	210 U	210 U	200 U	210 U	200 U	190 U	210 U	200 U	200 U	210 U	240 U	210 U
2-Nitroaniline	550 U	500 U	500 U	500 U	500 U	550 U	500 U	480 U	500 U	490 U	490 U	500 U	600 U	500 U
2-Nitrophenol	430 U	410 U	420 U	410 U	400 U	420 U	400 U	380 U	410 U	390 U	390 U	420 U	470 U	420 U
2-Picoline	320 U	310 U	310 U	310 U	300 U	320 U	300 U	290 U	310 U	300 U	300 U	310 U	350 U	320 U
3,3'-Dichlorobenzidine	430 U	410 U	420 U	410 U	400 U	420 U	400 U	380 U	410 U	390 U	390 U	420 U	470 U	420 U
3,3'-Dimethylbenzidine	430 U	410 U	420 U	410 U	400 U	420 U	400 U	380 U	410 U	390 U	390 U	420 U	470 U	420 U
3-Methylcholanthrene	480 UJ	470 U	470 U	470 U	450 U	470 U	440 U	430 U	470 U	440 UJ	440 U	470 U	530 U	470 U
3-Methylphenol	220 U	210 U	210 U	210 U	200 U	210 U	200 U	190 U	210 U	200 U	200 U	210 U	240 U	210 U
3-Nitroaniline	1100 U	1000 U	1000 U	1000 U	1000 U	1100 U	990 U	950 U	1000 U	980 U	980 U	1000 U	1200 U	1000 U
4,6-Dinitro-2-Methylphenol	1100 U	1000 U	1000 U	1000 U	1000 U	1100 U	990 U	950 U	1000 U	980 U	980 U	1000 U	1200 U	1000 U
4-Aminobiphenyl	220 U	210 U	210 U	210 U	200 U	210 U	200 U	190 U	210 U	200 U	200 U	210 U	240 U	210 U
4-Bromophenyl Phenyl Ether	430 U	410 U	420 U	410 U	400 U	420 U	400 U	380 U	410 U	390 U	390 U	420 U	470 U	420 U
4-Chloro-3-Methylphenol	430 U	410 U	420 U	410 U	400 U	420 U	400 U	380 U	410 U	390 U	390 U	420 U	470 U	420 U
4-Chloroaniline	430 U	410 U	420 U	410 U	400 U	420 U	400 U	380 U	410 U	390 U	390 U	420 U	470 U	420 U
4-Chlorophenyl Phenyl Ether	220 U	210 U	210 U	210 U	200 U	210 U	200 U	190 U	210 U	200 U	200 U	210 U	240 U	210 U
4-Methylphenol	220 U	210 U	210 U	210 U	200 U	210 U	200 U	190 U	210 U	200 U	200 U	210 U	240 U	210 U
4-Nitroaniline	1100 U	1000 U	1000 U	1000 U	1000 U	1100 U	990 U	950 U	1000 U	980 U	980 U	1000 U	1200 U	1000 U
4-Nitrophenol	1100 U	1000 U	1000 U	1000 U	1000 U	1100 U	990 U	950 U	1000 U	980 U	980 U	1000 U	1200 U	1000 U
4-Nitroquinoline-1-Oxide	1100 UR	1000 UR	1000 UR	1000 UR	1000 UR	1100 UR	990 UR	950 UR	1000 UR	980 UR	980 UR	1000 UR	1200 UR	1000 UR
5-Nitro-O-Toluidine	430 U	410 U	420 U	410 U	400 U	420 U	400 U	380 U	410 U	390 U	390 U	420 U	470 U	420 U
7,12-Dimethylbenz(A)Anthracene	320 UJ	310 U	310 U	310 U	300 U	320 U	300 U	290 U	310 U	300 UJ	300 U	310 U	350 U	320 U
A,A-Dimethylphenethylamine	1100 U	1000 U	1000 U	1000 U	1000 U	1100 U	990 U	950 U	1000 U	980 U	980 U	1000 U	1200 U	1000 U
Acenaphthene	12.8 U	12.5 U	12.5 U	12.4 U	15.8	70.8	11.8 U	11.4 U	12.3 U	11.8 U	11.8 U	12.4 U	14 U	12.6 UJ

Calc = Calculated Value as described in Section 3.4.2.1
NA = Not Analyzed

TABLE E-1

SUMMARY OF ANALYTIC RESULTS - SURFACE SOIL
CRANE 158 - MUSTARD GAS BURIAL GROUND
NSWC CRANE
CRANE, INDIANA

Location	01SB01	01SB02	01SB03	01SB04	01SB05	01SB06	01SB07	01SB08	01SB09	01SB10	01SB11	01SB12	01SB13	01SB14
Sample	01SS010002	01SS020002	01SS030002	01SS040002	01SS050002	01SS060002	01SS070002	01SS080002	01SS090002	01SS100002	01SS110002	01SS120002	01SS130002	01SS140002
Matrix	Surface Soil	Surface Soil	Surface Soil	Surface Soil	Surface Soil	Surface Soil	Surface Soil	Surface Soil	Surface Soil	Surface Soil	Surface Soil	Surface Soil	Surface Soil	Surface Soil
Depth Range	0 - 2	0 - 2	0 - 2	0 - 2	0 - 2	0 - 2	0 - 2	0 - 2	0 - 2	0 - 2	0 - 2	0 - 2	0 - 2	0 - 2
Risk	Site	Site	Site	Site	Site	Site	Site	Site	Site	Site	Site	Site	Site	Site
Soil Group	3	3	3	3	3	3	3	3	3	3	3	3	3	3
Sample Date	8/26/2001	8/26/2001	8/26/2001	8/26/2001	8/26/2001	8/27/2001	8/27/2001	8/21/2001	8/26/2001	8/27/2001	8/22/2001	8/25/2001	8/24/2001	8/24/2001
Acenaphthylene	12 8 U	12 5 U	12 5 U	12 4 UR	12 1 U	12 7 U	11 8 U	11 4 UJ	12 3 U	11 8 U	11 8 UJ	12 4 U	14 U	12 6 UJ
Acetophenone	220 U	210 U	210 U	210 U	200 U	210 U	200 U	190 U	210 U	200 U	200 U	210 U	240 U	210 U
Aniline	220 U	210 U	210 U	210 U	200 U	210 U	200 U	190 U	210 U	200 U	200 U	210 U	240 U	210 U
Anthracene	12 8 U	12 5 U	12 5 U	12 4 U	12 1 U	12 7 U	11 8 U	11 4 UJ	12 3 U	11 8 U	11 8 UJ	12 4 U	14 U	12 6 UJ
Aramite	1100 U	1000 U	1000 U	1000 U	1000 U	1100 U	990 U	950 U	1000 U	980 U	980 U	1000 U	1200 U	1000 U
Benzo(A)Anthracene	12 8 U	12 5 U	12 5 U	12 4 U	12 1 U	12 7 U	11 8 U	11 4 U	12 3 U	11 8 U	11 8 U	12 4 U	14 U	12 6 UJ
Benzo(A)Pyrene	12 8 U	12 5 U	12 5 U	12 4 U	12 1 U	12 7 U	11 8 U	11 4 U	11 9 J	11 8 U	11 8 U	12 4 U	14 U	12 6 UJ
Benzo(B)Fluoranthene	12 8 U	12 5 U	12 5 U	12 4 U	12 1 U	12 7 U	11 8 U	11 4 U	12 3 U	11 8 U	11 8 U	12 4 U	14 U	12 6 UJ
Benzo(G,H,I)Perylene	12 8 U	12 5 U	12 5 U	12 4 U	12 1 U	12 7 U	11 8 U	11 4 U	11 8 J	11 8 U	11 8 U	12 4 U	14 U	12 6 UJ
Benzo(K)Fluoranthene	12 8 U	12 5 U	12 5 U	12 4 U	12 1 U	12 7 U	11 8 U	11 4 U	12 3 U	11 8 U	11 8 U	12 4 U	14 U	12 6 UJ
Benzyl Alcohol	270 U	270 U	270 U	270 U	270 U	270 U	270 U	270 U	270 U	270 U	270 U	270 U	270 U	270 U
Bis(2-Chloroethoxy)Methane	430 U	410 U	420 U	410 U	400 U	420 U	400 U	380 U	410 U	390 U	390 U	420 U	470 U	420 U
Bis(2-Chloroethyl)Ether	220 U	210 U	210 U	210 U	200 U	210 U	200 U	190 U	210 U	200 U	200 U	210 U	240 U	210 U
Bis(2-Ethylhexyl)Phthalate	220 U	210 U	210 U	210 U	200 U	210 U	200 U	190 U	420	200 U	89 J	210 U	240 U	210 U
Butyl Benzyl Phthalate	220 U	210 U	210 U	210 U	200 U	210 U	200 U	190 U	210 U	200 U	200 U	210 U	240 U	210 U
Chlorobenzilate	430 U	410 U	420 U	410 U	400 U	420 U	400 U	380 U	410 U	390 U	390 U	420 U	470 U	420 U
Chrysene	12 8 U	12 5 U	12 5 U	12 4 U	12 1 U	12 7 U	11 8 U	11 4 U	12 3 U	11 8 UJ	11 8 U	12 4 U	14 U	12 6 UJ
Di-N-Butyl Phthalate	220 U	210 U	210 U	210 U	200 U	210 UJ	200 UJ	190 U	210 U	200 UJ	200 U	210 U	240 U	210 UJ
Di-N-Octyl Phthalate	220 UJ	210 U	210 U	210 U	200 U	210 U	200 U	190 U	210 U	200 UJ	200 U	210 U	240 U	210 U
Diallate	430 U	410 U	420 U	410 U	400 U	420 U	400 U	380 U	410 U	390 U	390 U	420 U	470 U	420 U
Dibenzo(A,H)Anthracene	12 8 U	12 5 U	12 5 U	12 4 UJ	12.1 U	12 7 U	11 8 U	11 4 UJ	12 3 U	11 8 U	11 8 UJ	12 4 U	14 U	12 6 UJ
Dibenzofuran	220 U	210 U	210 U	210 U	200 U	210 U	200 U	190 U	210 U	200 U	200 U	210 U	240 U	210 U
Diethyl Phthalate	220 U	210 U	210 U	210 U	200 U	210 U	200 U	190 U	210 U	200 U	200 U	210 U	240 U	210 U
Dimethyl Phthalate	220 U	210 U	210 U	210 U	200 U	210 U	200 U	190 U	210 U	200 U	200 U	210 U	240 U	210 U
Diphenylamine	220 U	210 U	210 U	210 UJ	200 U	210 U	200 U	190 U	210 U	200 U	200 U	210 U	240 U	210 U
Ethyl Methane Sulfonate	220 U	210 U	210 U	210 U	200 U	210 U	200 U	190 U	210 U	200 U	200 U	210 U	240 U	210 U
Fluoranthene	12 8 U	12 5 U	12 5 U	12 4 U	12 1 U	12 7 U	11 8 U	11 4 U	3 98 J	11 8 U	11 8 U	12 4 U	14 U	12 6 UJ
Fluorene	12 8 U	12 5 U	12 5 U	12 4 U	12 1 U	12 7 U	11 8 U	11 4 U	12 3 U	11 8 U	11 8 U	12 4 U	14 U	12 6 UJ
Hexachlorobenzene	430 U	410 U	420 U	410 U	400 U	420 U	400 U	380 U	410 U	390 U	390 U	420 U	470 U	420 U
Hexachlorobutadiene	430 U	410 U	420 U	410 U	400 U	420 U	400 U	380 U	410 U	390 U	390 U	420 U	470 U	420 U
Hexachlorocyclopentadiene	430 U	410 U	420 U	410 UJ	400 U	420 U	400 U	380 U	410 U	390 UJ	390 U	420 U	470 U	420 U
Hexachloroethane	220 U	210 U	210 U	210 U	200 U	210 U	200 U	190 U	210 U	200 U	200 U	210 U	240 U	210 U
Hexachlorophene	17000 UJ	17000 UJ	17000 UJ	17000 U	16000 UJ	17000 UJ	16000 UJ	15000 UJ	17000 UJ	16000 UJ	16000 UJ	17000 U	19000 U	17000 U
Hexachloropropene	430 U	410 U	420 U	410 U	400 U	420 U	400 U	380 U	410 U	390 U	390 U	420 U	470 U	420 U
Indeno(1,2,3-CD)Pyrene	12 8 U	12 5 U	12 5 U	12 4 U	12 1 U	12 7 U	11 8 U	11 4 U	4 55 J	11 8 U	11 8 U	12 4 U	14 U	12 6 UJ
Isodrin	430 U	410 U	420 U	410 U	400 U	420 U	400 U	380 U	410 U	390 U	390 U	420 U	470 U	420 U
Isophorone	220 U	210 U	210 U	210 U	200 U	210 U	200 U	190 U	210 U	200 U	200 U	210 U	240 U	210 U
Isosafrole	430 U	410 U	420 U	410 U	46000	3200	400 U	380 U	410 U	390 U	2700	420 U	470 U	420 U
Kepone	1100 U	1000 U	1000 U	1000 U	1000 U	1100 U	990 U	950 U	1000 U	980 U	980 U	1000 U	1200 U	1000 U
Methapyrilene	1100 UR	1000 UR	1000 UR	1000 U	1000 UR	1100 UR	990 UR	950 U	1000 UR	980 UR	980 U	1000 UR	1200 UR	1000 UR
Methyl Methane Sulfonate	550 U	500 U	500 U	500 U	500 U	550 U	500 U	480 U	500 U	490 U	490 U	500 U	600 U	500 U
N-Nitroso-Di-N-Butylamine	430 U	410 U	420 U	410 U	400 U	420 U	400 U	380 U	410 U	390 U	390 U	420 U	470 U	420 U
N-Nitroso-Di-N-Propylamine	220 U	210 U	210 U	210 U	200 U	210 U	200 U	190 U	210 U	200 U	200 U	210 U	240 U	210 U
N-Nitrosodiethylamine	220 U	210 U	210 U	210 U	200 U	210 U	200 U	190 U	210 U	200 U	200 U	210 U	240 U	210 U
N-Nitrosodimethylamine	220 U	210 U	210 U	210 U	200 U	210 U	200 U	190 U	210 U	200 U	200 U	210 U	240 U	210 U
N-Nitrosomethylethylamine	220 U	210 U	210 U	210 U	200 U	210 U	200 U	190 U	210 U	200 U	200 U	210 U	240 U	210 U
N-Nitrosomorpholine	220 U	210 U	210 U	210 U	200 U	210 U	200 U	190 U	210 U	200 U	200 U	210 U	240 U	210 U
N-Nitrosopiperidine	430 U	410 U	420 U	410 U	400 U	420 U	400 U	380 U	410 U	390 U	390 U	420 U	470 U	420 U
N-Nitrosopyrrolidine	220 U	210 U	210 U	210 U	200 U	210 U	200 U	190 U	210 U	200 U	200 U	210 U	240 U	210 U
Naphthalene	12 8 U	12 5 U	12 5 U	12 4 UR	12 1 U	12 7 U	11 8 U	11 4 UR	12 3 U	11 8 U	11 8 UR	12 4 U	14 U	12 6 UJ
O,O,O-Triethyl Phosphorothioate	430 U	410 U	420 U	410 U	400 U	420 U	400 U	380 U	410 U	390 U	390 U	420 U	470 U	420 U

Calc = Calculated Value as described in Section 3 4 2 1
NA = Not Analyzed

TABLE E-1

SUMMARY OF ANALYTIC RESULTS - SURFACE SOIL
CRANE 158 - MUSTARD GAS BURIAL GROUND
NSWC CRANE
CRANE, INDIANA

Location	01SB01	01SB02	01SB03	01SB04	01SB05	01SB06	01SB07	01SB08	01SB09	01SB10	01SB11	01SB12	01SB13	01SB14
Sample	01SS010002	01SS020002	01SS030002	01SS040002	01SS050002	01SS060002	01SS070002	01SS080002	01SS090002	01SS100002	01SS110002	01SS120002	01SS130002	01SS140002
Matrix	Surface Soil	Surface Soil	Surface Soil	Surface Soil	Surface Soil	Surface Soil	Surface Soil	Surface Soil	Surface Soil	Surface Soil	Surface Soil	Surface Soil	Surface Soil	Surface Soil
Depth Range	0 - 2	0 - 2	0 - 2	0 - 2	0 - 2	0 - 2	0 - 2	0 - 2	0 - 2	0 - 2	0 - 2	0 - 2	0 - 2	0 - 2
Risk	Site	Site	Site	Site	Site	Site	Site	Site	Site	Site	Site	Site	Site	Site
Soil Group	3	3	3	3	3	3	3	3	3	3	3	3	3	3
Sample Date	8/26/2001	8/26/2001	8/26/2001	8/26/2001	8/26/2001	8/27/2001	8/27/2001	8/21/2001	8/26/2001	8/27/2001	8/22/2001	8/25/2001	8/24/2001	8/24/2001
O-Toluidine	220 U	210 U	210 U	210 U	200 U	210 U	200 U	190 U	210 U	200 U	200 U	210 U	240 U	210 U
P-(Dimethylamino)Azobenzene	430 U	410 U	420 U	410 U	400 U	420 U	400 U	380 U	410 U	390 U	390 U	420 U	470 U	420 U
Pentachlorobenzene	430 U	410 U	420 U	410 U	400 U	420 U	400 U	380 U	410 U	390 U	390 U	420 U	470 U	420 U
Pentachloronitrobenzene	1100 U	1000 U	1000 U	1000 U	1000 U	1100 U	990 U	950 U	1000 U	980 U	980 U	1000 U	1200 U	1000 U
Phenacetin	430 U	410 U	420 U	410 U	400 U	420 U	400 U	380 U	410 U	390 UJ	390 U	420 U	470 U	420 U
Phenanthrene	12 8 U	12 5 U	12 5 U	12 4 U	12 1 U	12 7 U	11 8 U	11 4 U	12 3 U	11 8 U	11 8 U	12 4 U	14 U	12 6 UJ
Phenol	220 U	210 U	210 U	210 U	200 U	210 U	200 U	190 U	210 U	200 U	200 U	210 U	240 U	210 U
Pronamide	430 UR	410 UR	420 UR	410 U	400 UR	420 UR	400 UR	380 UR	410 UR	390 UR	390 UR	420 UR	470 UR	420 U
Pyrene	12 8 U	12 5 U	12 5 U	14 6 J	12 1 U	12 7 U	11 8 U	11 4 U	12 3 U	11 8 U	11 8 U	12 4 U	14 U	12 6 UJ
Pyridine	220 U	220 U	220 U	220 U	220 U	220 U	220 U	220 U	220 U	220 U	220 U	220 U	240 U	220 U
Safrole	430 U	410 U	420 U	410 U	400 U	420 U	400 U	380 U	410 U	390 U	390 U	420 U	470 U	420 U
Energertics (ug/kg)														
1,3,5-Trinitrobenzene	476 U	476 U	476 U	500 U	500 U	476 U	454 U	476 U	476 U	500 U	500 U	476 U	500 U	476 U
1,3-Dinitrobenzene	476 U	476 U	476 U	500 U	500 U	476 U	454 U	476 U	476 U	500 U	500 U	476 U	500 U	476 U
2,4,6-Trinitrotoluene	476 U	476 U	476 U	500 U	500 U	476 U	454 U	476 U	476 U	500 U	500 U	476 U	500 U	476 U
2,4-Dinitrotoluene	476 U	476 U	476 U	500 U	500 U	476 U	454 U	476 U	476 U	500 U	500 U	476 U	500 U	476 U
2,6-Dinitrotoluene	476 U	476 U	476 U	500 U	500 U	476 U	454 U	476 U	476 U	500 U	500 U	476 U	500 U	476 U
2-Amino-4,6-Dinitrotoluene	476 U	476 U	476 U	500 U	500 U	476 U	454 U	476 U	476 U	500 U	500 U	476 U	500 U	476 U
2-Nitrotoluene	476 U	476 U	476 U	500 U	500 U	476 U	454 U	476 U	476 U	500 U	500 U	476 U	500 U	476 U
3-Nitrotoluene	476 U	476 U	476 U	500 U	500 U	476 U	454 U	476 U	476 U	500 U	500 U	476 U	500 U	476 U
4-Amino-2,6-Dinitrotoluene	476 U	476 U	476 U	500 U	500 U	476 U	454 U	476 U	476 U	500 U	500 U	476 U	500 U	476 U
4-Nitrotoluene	476 U	476 U	476 U	500 U	500 U	476 U	454 U	476 U	476 U	500 U	500 U	476 U	500 U	476 U
Hmx	476 U	476 U	476 U	500 U	500 U	476 U	454 U	476 U	476 U	500 U	500 U	476 U	500 U	476 U
Nitrobenzene	476 U	476 U	476 U	500 U	500 U	476 U	454 U	476 U	476 U	500 U	500 U	476 U	500 U	476 U
Rdx	476 U	476 U	476 U	500 U	500 U	476 U	454 U	476 U	476 U	500 U	500 U	476 U	500 U	476 U
Tetryl	476 U	476 U	476 U	500 U	500 U	476 U	454 U	476 U	476 U	500 U	500 U	476 U	500 U	476 U
Pesticides/PCBs (ug/kg)														
4,4'-DDD	3 2 U	3 1 U	3 1 U	3 1 U	3 U	3 2 U	2.9 U	2 9 UJ	3 1 U	3 U	2 9 U	3.1 U	3 5 U	3 1 U
4,4'-DDE	3 2 U	3 1 U	3 1 U	3 1 U	3 U	3 2 U	2 9 U	2 9 U	3 1 U	3 U	2 9 U	3 1 U	3 5 U	3.1 U
4,4'-DDT	3 2 UJ	3 1 UJ	3 1 UJ	3 1 U	3 UJ	3 2 U	2 9 U	2 9 U	3 1 UJ	3 U	2 9 U	3 1 U	3 5 U	3 1 U
Aldrin	1 7 U	1 6 U	1 6 U	1 6 U	1 6 U	1 7 U	1 5 U	1 5 U	1 6 U	1 5 U	1.5 U	1 6 U	1 8 U	1 6 U
Alpha-BHC	1 7 U	1 6 U	1 6 U	1 6 U	1 6 U	1 7 U	1 5 U	1 5 U	1 6 U	1 5 U	1 5 U	1 6 U	1 8 U	1 6 U
Alpha-Chlordane	1 7 U	1 6 U	1 6 U	1.6 U	1 6 U	1 7 U	1 5 U	1 5 U	1 6 U	1 5 U	1 5 U	1 6 U	1 8 U	1 6 U
Aroclor-1016	43 U	41 U	41 U	41 U	40 U	42 U	39 U	38 U	41 U	39 U	39 U	41 U	47 U	41 U
Aroclor-1221	43 U	41 U	41 U	41 U	40 U	42 U	39 U	38 U	41 U	39 U	39 U	41 U	47 U	41 U
Aroclor-1232	43 U	41 U	41 U	41 U	40 U	42 U	39 U	38 U	41 U	39 U	39 U	41 U	47 U	41 U
Aroclor-1242	43 U	41 U	41 U	41 U	40 U	42 U	39 U	38 U	41 U	39 U	39 U	41 U	47 U	41 U
Aroclor-1248	43 U	41 U	41 U	41 U	40 U	42 U	39 U	38 U	41 U	39 U	39 U	41 U	47 U	41 U
Aroclor-1254	43 U	41 U	41 U	41 U	40 U	42 U	39 U	38 U	41 U	39 U	39 U	41 U	47 U	41 U
Aroclor-1260	43 U	41 U	41 U	41 U	40 U	42 U	39 U	38 U	41 U	39 U	39 U	41 U	47 U	41 U
Beta-BHC	1 7 U	1 6 U	1 6 U	1 6 U	1 6 U	1 7 U	1 5 U	1 5 U	1 6 U	1 5 U	1 5 U	1 6 U	1 8 U	1 6 U
Delta-BHC	1 7 U	1 6 U	1 6 U	1 6 U	1 6 U	1 7 U	1 5 U	1 5 U	1 6 U	1 5 U	1 5 U	1 6 U	1 8 U	1 6 U
Dieldrin	3 2 U	3 1 U	3 1 U	3.1 U	3 U	3 2 U	2 9 U	2 9 U	3 1 U	3 U	2 9 U	3 1 U	3 5 U	3 1 U
Endosulfan I	1 7 U	1 6 U	1.6 U	1 6 U	1 6 U	1 7 U	1 5 U	1 5 U	1.6 U	1 5 U	1.5 U	1 6 U	1 8 U	1.6 U
Endosulfan II	3.2 UJ	3 1 UJ	3 1 UJ	3 1 U	3 U	3 2 U	2 9 U	2 9 U	3 1 UJ	3 U	2 9 U	3 1 U	3 5 U	3 1 U
Endosulfan Sulfate	3 2 U	3 1 U	3 1 U	3 1 U	3 U	3 2 U	2 9 U	2 9 U	3 1 U	3 U	2 9 U	3 1 U	3 5 U	3 1 U
Endrin	3 2 U	3 1 U	3 1 U	3 1 U	3 U	3 2 U	2 9 U	2 9 U	3 1 U	3 UJ	2 9 U	3 1 U	3 5 U	3 1 U
Endrin Aldehyde	3 2 U	3 1 U	3 1 U	3 1 U	3 U	3 2 UJ	2 9 UJ	2 9 U	3 1 U	3 UJ	2 9 U	3 1 U	3 5 U	3 1 U
Gamma-BHC (Lindane)	1 7 U	1 6 U	1 6 U	1 6 U	1 6 U	1 7 U	1 5 U	1 5 U	1 6 U	1 5 U	1 5 U	1 6 U	1 8 U	1 6 U
Gamma-Chlordane	5 6 R	1 6 U	1 6 U	0 55 J	1 6 U	1 7 U	1 5 U	1 5 U	1 6 U	3 4 R	1 5 U	0 62 J	0 89 J	0 9 J
Heptachlor	1 4 J	1 2 J	1 3 J	1 6 U	1 4 J	3 8 R	1 5 U	1 8	1 3 J	1 6	1 3 J	1 4 BU	1 5 BU	2 BU

Calc = Calculated Value as descibed in Section 3 4 2 1
NA = Not Analyzed

SUMMARY OF ANALYTIC RESULTS - SURFACE SOIL
CRANE 158 - MUSTARD GAS BURIAL GROUND
NSWC CRANE
CRANE, INDIANA
PAGE 5 OF 24

Location	01SB01	01SB02	01SB03	01SB04	01SB05	01SB06	01SB07	01SB08	01SB09	01SB10	01SB11	01SB12	01SB13	01SB14
Sample	01SS010002	01SS020002	01SS030002	01SS040002	01SS050002	01SS060002	01SS070002	01SS080002	01SS090002	01SS100002	01SS110002	01SS120002	01SS130002	01SS140002
Matrix	Surface Soil	Surface Soil	Surface Soil	Surface Soil	Surface Soil	Surface Soil	Surface Soil	Surface Soil	Surface Soil	Surface Soil	Surface Soil	Surface Soil	Surface Soil	Surface Soil
Depth Range	0 - 2	0 - 2	0 - 2	0 - 2	0 - 2	0 - 2	0 - 2	0 - 2	0 - 2	0 - 2	0 - 2	0 - 2	0 - 2	0 - 2
Risk	Site	Site	Site	Site	Site	Site	Site	Site	Site	Site	Site	Site	Site	Site
Soil Group	3	3	3	3	3	3	3	3	3	3	3	3	3	3
Sample Date	8/26/2001	8/26/2001	8/26/2001	8/26/2001	8/26/2001	8/27/2001	8/27/2001	8/21/2001	8/26/2001	8/27/2001	8/22/2001	8/25/2001	8/24/2001	8/24/2001
Heptachlor Epoxide	1 7 U	1 6 U	1 6 U	1 6 U	1 6 U	1 7 U	1 5 U	1 5 U	1 6 U	1 5 U	1 5 U	1 6 U	1 8 U	1 6 U
Methoxychlor	17 U	16 U	16 U	16 U	16 U	17 U	15 U	15 U	16 U	15 U	15 U	16 U	18 U	16 U
Toxaphene	110 U	100 U	100 U	100 U	100 U	110 U	97 U	96 U	100 U	98 U	97 U	100 U	120 U	100 U
Herbicides (ug/kg)														
2,4,5-T	13 U	12 U	13 U	12 U	12 U	13 U	12 U	12 U	12 U	12 U	22 R	12 U	14 U	13 U
2,4,5-TP (Silvex)	13 U	12 U	13 U	12 U	12 U	13 U	12 U	12 UJ	12 U	12 U	15 J	12 U	14 U	13 U
2,4-D	36 R	38 J	35 J	87 U	85 U	100 R	83 U	81 U	87 U	83 U	82 U	87 U	130	88 U
Dinoseb	26 U	25 U	25 U	25 U	24 U	25 U	24 U	23 U	25 U	24 U	23 U	25 U	57 R	25 U
Pentachlorophenol	13 U	12 U	13 U	12 U	12 U	13 U	12 U	12 U	12 U	12 U	12 U	12 U	14 U	13 U
Inorganics (mg/kg)														
Aluminum	9670 J	13200 J	13200 J	14900 J	12300 J	13700	15900	14700 J	10100 J	19400	13400 J	12700 J	12700 J	16200 J
Antimony	1 7 J	0 53 U	0 66 U	0 88 U	0 50 U	0 61 U	1 3 U	0 81 U	0.60 U	1 4 U	0 67 U	0 20 UJ	0 62 U	0 48 U
Arsenic	7 0 J	10 9 J	10 3 J	9 0 J	7 9 J	7 7 J	8 8 J	7 6	7 2 J	9 3 J	8 0	6 9 J	7 1 J	8 9 J
Barium	69 2 J	82 8 J	45 1 J	66 4	56 6 J	157	71 8	130	75 5 J	66 0	104	122	109	69 6
Beryllium	0 50 J	0 52 J	0 40 J	0 63 J	0 41 J	0 96	0 30	0 88 J	0 47 J	0 21	0 88 J	1 0 J	0 79 J	0 63 J
Cadmium	0 42 J	0 04 UJ	0 04 UJ	0 49 J	0 15 J	0 05 U	0 05 U	0 01 U	0 27 J	0 22 J	0 01 U	0 25 J	0 30 J	0 17 J
Calcium	8440 J	5010 J	510 J	1480 J	891 J	1300 J	557 J	578 J	24100 J	27900 J	678 J	1190 J	3450 J	1010 J
Chromium	13 4	17 0	17 8	17 6 J	16 2	15 8	19 1	14 7	14 5	22 8	13 4	12 2 J	13 6 J	16 8 J
Cobalt	9 9	8 2	5 1	10 9 J	5 2	20 7	10 4	12 9 J	6 5	7 2	15 5 J	17 7 J	20 2 J	8 0 J
Copper	12 1 J	16 5 J	16 5 J	14 0 J	13 9 J	10 1	15 9	12 1 J	13 1 J	18 5	11 6 J	10 1 J	8 7 J	14 5 J
Iron	16300	24600	25500	23100	20300	18100	24000	19100	18300	24700	19000	15700	16300	23500
Lead	20 4	16 2	14 7	19 0	17 2	19 0	15 5	15 0 J	13 1	17 2	16 2 J	16 1	19 0	15 6
Magnesium	1820 J	3060 J	2470 J	2160 J	1900 J	1600 J	2380 J	1890 J	3790 J	5260 J	1760 J	1360 J	2340 J	2220 J
Manganese	588 J	453 J	232 J	420 J	305 J	2010	489	920 J	369 J	380	991 J	1230 J	1270 J	291 J
Mercury	0 04 J	0 05 J	0 06 J	0 05 J	0 05 J	0 05 J	0 05 J	0 05	0 07 J	0 07 J	0 06	0 03 U	0 05 U	0 05 U
Nickel	10 1	11 9	13 9	12 4 J	11 2	16 0	13 8	15 6	10 1	13 7	13 9	13 2 J	13 8 J	12 6 J
Potassium	668 J	587 J	755 J	817 J	596 J	709 J	837 J	849 J	540 J	1310 J	674 J	672 J	671 J	846 J
Selenium	0 62 J	0 88 J	1 2 J	1 4 U	0 79 J	0 69	1 3	0 49 J	0 58 J	1 1	0 51 J	0 99 U	1 0 U	1 0 U
Silver	0 39 U	0 36 U	0 36 U	0 37 U	0 35 U	0.35 U	0 16 U	0 02 U	0 37 U	0 15 U	0 02 U	0 37 U	0 43 U	0 38 U
Sodium	355 J	350 J	296 J	325 J	219 J	614	603	386 J	290 J	648	358 J	342 J	418 J	348 J
Strontium	11 3 J	11 5 J	7 0 J	8 8 J	8 5 J	11 2 J	10 3 J	9 4 J	24 7 J	33 5 J	8 4 J	8 8 J	10 1 J	9 0 J
Thallium	0 85	1 8	2 8	2 2 J	1 8	1 4	0 57 U	0 87 J	1 2	0 55 U	1 4 J	1 0 J	1 4 J	2 6 J
Thorium	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Thorium-Calc	2 53	4 00	3 88	6 44	3 90	3 96	4 3	3 25	4 69	4 89	4 5	5 44	3 14	1 90
Tin	24 5 U	22 7 U	23 1 U	23 7 U	22 3 U	2 5 U	2 5	3 9	23 4 U	2 6	3 8	23 6 U	27 0 U	23 8 U
Vanadium	23 8	32 1	30 3	32 2	28 9	31 9	37 5	30 7 J	24 5	44 5	28 5 J	26 8	26 9	31 7
Zinc	41 7 J	50 6 J	49 3 J	49 8 J	37 9 J	55 9	57 7	51 1	41 4 J	67 8	45 2	42 4 J	41 7 J	49 8 J
Miscellaneous Parameters														
1,4-Dithiane (ug/kg)	258 U	251 U	251 U	250 U	244 U	258 U	238 U	233 U	249 U	238 U	236 U	249 U	284 U	253 U
1,4-Oxathiane (ug/kg)	258 U	251 U	251 U	250 U	244 U	258 U	238 U	233 U	249 U	238 U	236 U	249 U	284 U	253 U
Bis(2-Chloroethyl)Sulfide (ug/kg)	258 U	251 U	251 U	250 U	244 U	258 U	238 U	233 U	249 U	238 U	236 U	249 U	284 U	253 U
Cation Exchange Capacity (meq/100g	13 9	NA	12 8	NA	12 2	NA	23 4 J	NA	NA	NA	NA	NA	24 4 J	NA
pH (S U)	7 8 J	NA	5 4 J	NA	5 2 J	NA	5	NA	NA	NA	NA	NA	5.8	NA
Total Organic Carbon (mg/kg)	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Total Radiologicals (pCi/g)														
Actinium-228	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Bismuth-212	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Bismuth-214	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Cesium-137	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Cobalt-60	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Europium-154	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA

Calc = Calculated Value as described in Section 3 4 2.1
NA = Not Analyzed

TABLE E-1

SUMMARY OF ANALYTIC RESULTS - SURFACE SOIL
CRANE 158 - MUSTARD GAS BURIAL GROUND
NSWC CRANE
CRANE, INDIANA

Location	01SB01	01SB02	01SB03	01SB04	01SB05	01SB06	01SB07	01SB08	01SB09	01SB10	01SB11	01SB12	01SB13	01SB14
Sample	01SS010002	01SS020002	01SS030002	01SS040002	01SS050002	01SS060002	01SS070002	01SS080002	01SS090002	01SS100002	01SS110002	01SS120002	01SS130002	01SS140002
Matrix	Surface Soil	Surface Soil	Surface Soil	Surface Soil	Surface Soil	Surface Soil	Surface Soil	Surface Soil	Surface Soil	Surface Soil	Surface Soil	Surface Soil	Surface Soil	Surface Soil
Depth Range	0 - 2	0 - 2	0 - 2	0 - 2	0 - 2	0 - 2	0 - 2	0 - 2	0 - 2	0 - 2	0 - 2	0 - 2	0 - 2	0 - 2
Risk	Site	Site	Site	Site	Site	Site	Site	Site	Site	Site	Site	Site	Site	Site
Soil Group	3	3	3	3	3	3	3	3	3	3	3	3	3	3
Sample Date	8/26/2001	8/26/2001	8/26/2001	8/26/2001	8/26/2001	8/27/2001	8/27/2001	8/21/2001	8/26/2001	8/27/2001	8/22/2001	8/25/2001	8/24/2001	8/24/2001
Europium-155	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Lead-210	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Lead-212	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Lead-214	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Potassium-40	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Protactinium-234	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Radium-226	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Thallium-208	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Thorium-228	0 257	0 433	0 388	0 730	0 357	0 417	0 467	0 320	0 480	0 502	0 458	0 623	0 337	0 227
Thorium-230	0 0178 J	0 052 J	0 0342 U	0 621 J	0 0345 U	0 0414	0 0490	0 385 J	0 0198 J	0 0688	0 473 J	0 474 J	0 0898 U	0 0554 U
Thorium-232	0 300	0 446	0 466	0 686	0 500	0 455	0 479	0 395	0 552	0 573	0 532	0 574	0 354	0 190
Thorium-234	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Uranium-235	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA

Calc = Calculated Value as described in Section 3 4 2 1
NA = Not Analyzed

SUMMARY OF ANALYTIC RESULTS - SURFACE SOIL
CRANE 158 - MUSTARD GAS BURIAL GROUND
NSWC CRANE
CRANE, INDIANA

Location	01SB15	01SB16	01SB17	01SB18	01SB19	01SB20	01SB21	01TPL	01TPL	01TPL	01TPS	BG1SBA01
Sample	01SS150002	01SS160002	01SS170002	01SS180002	01SS190002	01SS200002	01SS210002	01TPL01	01TPL02	01TPL03	01TPS04	BG1SBA0101
Matrix	Surface Soil	Surface Soil	Surface Soil	Surface Soil	Surface Soil	Surface Soil	Surface Soil	Surface Soil	Surface Soil	Surface Soil	Surface Soil	Surface Soil
Depth Range	0 - 2	0 - 2	0 - 2	0 - 2	0 - 2	0 - 2	0 - 2	1 - 1.5	1 - 1.5	1 - 1.5	1 - 1.5	0 - 1
Risk	Site	Site	Site	Site	Site	Site	SiteBackground	Site	Site	Site	Site	Basewide Background
Soil Group	3	3	3	3	3	3	3	3	3	3	3	3
Sample Date	8/22/2001	8/21/2001	8/24/2001	8/24/2001	8/24/2001	8/21/2001	8/21/2001	8/27/2001	8/27/2001	8/27/2001	8/27/2001	11/4/1999
Volatile Organics (ug/kg)												
1,1,1,2-Tetrachloroethane	3 U	3 U	5 U	4 U	4 U	3 U	NA	3 U	3 U	3 U	3 U	NA
1,1,1-Trichloroethane	3 U	3 U	5 U	4 U	4 U	3 U	NA	3 U	3 U	3 U	3 U	NA
1,1,2,2-Tetrachloroethane	3 U	3 U	5 U	4 U	4 U	3 U	NA	3 U	3 UJ	3 UJ	3 U	NA
1,1,2-Trichloroethane	6 U	5 U	10 U	8 U	7 U	6 U	NA	5 U	6 U	5 U	6 U	NA
1,1-Dichloroethane	3 U	3 U	5 U	4 U	4 U	3 U	NA	3 UJ	3 UJ	3 UJ	3 UJ	NA
1,1-Dichloroethene	6 U	5 U	10 U	8 U	7 U	6 U	NA	5 U	6 U	5 U	6 U	NA
1,2,3-Trichloropropane	3 U	3 U	5 U	4 U	4 U	3 U	NA	3 UJ	3 UJ	3 UJ	3 UJ	NA
1,2-Dibromo-3-Chloropropane	6 U	5 U	10 U	8 U	7 U	6 U	NA	5 UJ	6 UJ	5 UJ	6 UJ	NA
1,2-Dibromoethane	3 U	3 U	5 U	4 U	4 U	3 U	NA	3 U	3 UJ	3 UJ	3 U	NA
1,2-Dichloroethane	3 U	3 U	5 U	4 U	4 U	3 U	NA	3 U	3 U	3 U	3 U	NA
1,2-Dichloropropane	6 U	5 U	10 U	8 U	7 U	6 U	NA	5 U	6 U	5 U	6 U	NA
1,4-Dioxane	600 UR	530 UR	960 UR	840 UR	680 UR	580 UR	NA	520 UR	560 UR	550 UR	570 UR	NA
2-Butanone	6 U	5 U	10 UJ	8 UJ	7 UJ	6 U	NA	5 UJ	6 UJ	5 UJ	6 UJ	NA
2-Hexanone	6 UJ	5 U	10 U	8 U	7 U	6 U	NA	5 UJ	6 UJ	5 UJ	6 UJ	NA
3-Chloropropene	6 UJ	5 UJ	10 UJ	8 UJ	7 UJ	6 UJ	NA	5 UJ	6 UJ	5 UJ	6 UJ	NA
4-Methyl-2-Pentanone	3 U	3 U	5 U	4 U	4 U	3 U	NA	3 UJ	3 UJ	3 UJ	3 UJ	NA
Acetone	6 UJ	5 UJ	750 U	180	90	21 J	NA	5 UJ	6 UJ	5 UJ	6 UJ	NA
Acetonitrile	240 UJ	210 UJ	380 UJ	330 UJ	270 UJ	230 UJ	NA	210 UJ	230 UJ	220 UJ	230 UJ	NA
Acrolein	60 UR	53 UR	96 UR	84 UR	68 UR	58 UR	NA	52 UR	56 UR	55 UR	57 UR	NA
Acrylonitrile	60 U	53 U	96 U	84 U	68 U	58 U	NA	52 UJ	56 UJ	55 UJ	57 UJ	NA
Benzene	3 U	3 U	5 U	4 U	4 U	3 U	NA	3 U	3 U	3 U	3 U	NA
Bromodichloromethane	3 U	3 U	5 U	4 U	4 U	3 U	NA	3 U	3 U	3 U	3 U	NA
Bromoform	3 U	3 U	5 U	4 U	4 U	3 U	NA	3 U	3 UJ	3 UJ	3 U	NA
Bromomethane	6 U	5 U	10 U	8 U	7 U	6 U	NA	5 U	6 UJ	5 UJ	6 U	NA
Carbon Disulfide	3 U	3 U	6	4 U	4 U	3 U	NA	3 U	3 U	3 U	3 U	NA
Carbon Tetrachloride	3 UJ	3 UJ	5 UJ	4 UJ	4 UJ	3 UJ	NA	3 UJ	3 UJ	3 UJ	3 UJ	NA
Chlorobenzene	3 U	3 U	5 U	4 U	4 U	3 U	NA	3 U	3 U	3 U	3 U	NA
Chlorodibromomethane	3 U	3 U	5 U	4 U	4 U	3 U	NA	3 U	3 U	3 U	3 U	NA
Chloroethane	6 U	5 U	10 U	8 U	7 U	6 U	NA	5 U	6 U	5 U	6 U	NA
Chloroform	3 U	3 U	5 U	4 U	4 U	3 U	NA	3 U	3 U	3 U	3 U	NA
Chloromethane	6 UJ	5 UJ	10 U	8 U	7 U	6 UJ	NA	5 U	6 U	5 U	6 U	NA
Chloroprene	6 UJ	5 UJ	10 UJ	8 UJ	7 UJ	6 UJ	NA	5 UJ	6 UJ	5 UJ	6 UJ	NA
Cis-1,2-Dichloroethene	6 U	5 U	10 U	8 U	7 U	6 U	NA	5 U	6 U	5 U	6 U	NA
Cis-1,3-Dichloropropene	3 U	3 U	5 U	4 U	4 U	3 U	NA	3 U	3 U	3 U	3 U	NA
Dibromomethane	6 U	5 U	10 U	8 U	7 U	6 U	NA	5 U	6 U	5 U	6 U	NA
Dichlorodifluoromethane	3 U	3 U	5 U	4 U	4 U	3 U	NA	3 U	3 U	3 U	3 U	NA
Ethyl Methacrylate	6 U	5 U	10 U	8 U	7 U	6 U	NA	5 U	6 UJ	5 UJ	6 U	NA
Ethylbenzene	3 U	3 U	5 U	4 U	4 U	3 U	NA	3 U	3 U	3 U	3 U	NA
Isobutanol	240 UR	210 UR	380 UR	330 UR	270 UR	230 UR	NA	210 UR	230 UR	220 UR	230 UR	NA
Methacrylonitrile	120 U	110 U	190 UJ	170 UJ	140 UJ	120 U	NA	100 UJ	110 UJ	110 UJ	110 UJ	NA
Methyl Iodide	6 UJ	5 UJ	10 UJ	8 UJ	7 UJ	6 UJ	NA	5 U	6 UJ	5 UJ	6 U	NA
Methyl Methacrylate	6 U	5 U	10 U	8 U	7 U	6 U	NA	5 UJ	6 UJ	5 UJ	6 UJ	NA
Methylene Chloride	6 UJ	2 J	14 J	13 J	7 J	15 J	NA	5 UJ	6 UJ	5 UJ	26 U	NA
Pentachloroethane	6 UJ	5 UJ	10 UJ	8 UJ	7 UJ	6 UJ	NA	5 UJ	6 UJ	5 UJ	6 UJ	NA
Propionitrile	120 UR	110 UR	190 UR	170 UR	140 UR	120 UR	NA	100 UR	110 UR	110 UR	110 UR	NA
Styrene	3 U	3 U	5 U	4 U	4 U	3 U	NA	3 U	3 U	3 U	3 U	NA
Tetrachloroethene	3 U	3 U	5 U	4 U	4 U	3 U	NA	3 U	3 UJ	3 UJ	3 U	NA
Toluene	3 U	3 U	5 U	4 U	4 U	3 U	NA	3 U	3 U	3 U	3 U	NA
Total Xylenes	3 U	3 U	5 U	4 U	4 U	3 U	NA	3 U	3 U	3 U	3 U	NA
Trans-1,2-Dichloroethene	6 U	5 U	10 U	8 U	7 U	6 U	NA	5 U	6 U	5 U	6 U	NA

Calc = Calculated Value as described in Section 3.4.2.1.
NA = Not Analyzed

TABLE E-1

SUMMARY OF ANALYTIC RESULTS - SURFACE SOIL
CRANE 158 - MUSTARD GAS BURIAL GROUND
NSWC CRANE
CRANE, INDIANA

Location	01SB15	01SB16	01SB17	01SB18	01SB19	01SB20	01SB21	01TPL	01TPL	01TPL	01TPS	BG1SBA01
Sample	01SS150002	01SS160002	01SS170002	01SS180002	01SS190002	01SS200002	01SS210002	01TPL01	01TPL02	01TPL03	01TPS04	BG1SBA0101
Matrix	Surface Soil	Surface Soil	Surface Soil	Surface Soil	Surface Soil	Surface Soil	Surface Soil	Surface Soil	Surface Soil	Surface Soil	Surface Soil	Surface Soil
Depth Range	0 - 2	0 - 2	0 - 2	0 - 2	0 - 2	0 - 2	0 - 2	1 - 1.5	1 - 1.5	1 - 1.5	1 - 1.5	0 - 1
Risk	Site	Site	Site	Site	Site	Site	SiteBackground	Site	Site	Site	Site	Basewide Background
Soil Group	3	3	3	3	3	3	3	3	3	3	3	3
Sample Date	8/22/2001	8/21/2001	8/24/2001	8/24/2001	8/24/2001	8/21/2001	8/21/2001	8/27/2001	8/27/2001	8/27/2001	8/27/2001	11/4/1999
Trans-1,3-Dichloropropene	3 U	3 U	5 U	4 U	4 U	3 U	NA	3 U	3 U	3 U	3 U	NA
Trans-1,4-Dichloro-2-Butene	6 U	5 U	10 U	8 U	7 U	6 U	NA	5 U	6 U	5 U	6 U	NA
Trichloroethene	3 U	3 U	5 U	4 U	4 U	3 U	NA	3 U	3 U	3 U	3 U	NA
Trichlorofluoromethane	6 U	5 U	10 U	8 U	7 U	6 U	NA	5 U	6 U	5 U	6 U	NA
Vinyl Acetate	3 U	3 U	5 U	4 U	4 U	3 U	NA	3 U	3 U	3 U	3 U	NA
Vinyl Chloride	6 U	5 U	10 U	8 U	7 U	6 U	NA	5 U	6 U	5 U	6 U	NA
Semivolatile Organics (ug/kg)												
1,2,4,5-Tetrachlorobenzene	400 U	410 U	540 U	380 U	420 U	420 U	NA	2000 U	400 U	410 U	420 U	NA
1,2,4-Trichlorobenzene	400 U	410 U	540 U	380 U	420 U	420 U	NA	2000 U	400 U	410 U	420 U	NA
1,2-Dichlorobenzene	200 U	210 U	270 U	190 U	210 U	210 U	NA	1000 U	200 U	210 U	210 U	NA
1,3-Dichlorobenzene	200 U	210 U	270 U	190 U	210 U	210 U	NA	1000 U	200 U	210 U	210 U	NA
1,4-Dichlorobenzene	200 U	210 U	270 U	190 U	210 U	210 U	NA	1000 U	200 U	210 U	210 U	NA
1,4-Naphthoquinone	400 U	410 U	540 U	380 U	420 U	420 U	NA	2000 U	400 U	410 U	420 U	NA
1,4-Phenylenediamine	990 UJ	1000 UJ	1300 U	940 U	1100 U	1000 UJ	NA	5000 UJ	1000 UJ	1000 UJ	1000 UJ	NA
1-Naphthylamine	400 U	410 U	540 U	380 U	420 U	420 U	NA	2000 U	400 U	410 U	420 U	NA
2,2'-Oxybis(1-Chloropropane)	200 U	210 U	270 U	190 U	210 U	210 U	NA	1000 U	200 U	210 U	210 U	NA
2,3,4,6-Tetrachlorophenol	400 U	410 U	540 U	380 U	420 U	420 U	NA	2000 U	400 U	410 U	420 U	NA
2,4,5-Trichlorophenol	990 U	1000 U	1300 U	940 U	1100 U	1000 U	NA	5000 U	1000 U	1000 U	1000 U	NA
2,4,6-Trichlorophenol	400 U	410 U	540 U	380 U	420 U	420 U	NA	2000 U	400 U	410 U	420 U	NA
2,4-Dichlorophenol	400 U	410 U	540 U	380 U	420 U	420 U	NA	2000 U	400 U	410 U	420 U	NA
2,4-Dimethylphenol	400 U	410 U	540 U	380 U	420 U	420 U	NA	2000 U	400 U	410 U	420 U	NA
2,4-Dinitrophenol	990 U	1000 U	1300 U	940 U	1100 U	1000 U	NA	5000 U	1000 U	1000 U	1000 U	NA
2,6-Dichlorophenol	400 U	410 U	540 U	380 U	420 U	420 U	NA	2000 U	400 U	410 U	420 U	NA
2-Acetylaminofluorene	200 U	210 U	270 U	190 U	210 U	210 U	NA	1000 UJ	200 U	210 U	210 U	NA
2-Chloronaphthalene	200 U	210 U	270 U	190 U	210 U	210 U	NA	1000 U	200 U	210 U	210 U	NA
2-Chlorophenol	200 U	210 U	270 U	190 U	210 U	210 U	NA	1000 U	200 U	210 U	210 U	NA
2-Methylnaphthalene	200 U	210 U	270 U	190 U	210 U	210 U	NA	1000 U	200 U	210 U	210 U	NA
2-Methylphenol	200 U	210 U	270 U	190 U	210 U	210 U	NA	1000 U	200 U	210 U	210 U	NA
2-Naphthylamine	200 U	210 U	270 U	190 U	210 U	210 U	NA	1000 U	200 U	210 U	210 U	NA
2-Nitroaniline	500 U	500 U	650 U	470 U	550 U	500 U	NA	2500 U	500 U	500 U	500 U	NA
2-Nitrophenol	400 U	410 U	540 U	380 U	420 U	420 U	NA	2000 U	400 U	410 U	420 U	NA
2-Picoline	300 U	310 U	260 U	280 U	320 U	310 U	NA	1600 U	300 U	310 U	310 U	NA
3,3'-Dichlorobenzidine	400 U	410 U	540 U	380 U	420 U	420 U	NA	2000 UJ	400 U	410 U	420 U	NA
3,3'-Dimethylbenzidine	400 U	410 U	540 U	380 U	420 U	420 U	NA	2000 UJ	400 U	410 U	420 U	NA
3-Methylcholanthrene	450 U	460 U	600 U	420 U	480 U	470 U	NA	2300 UJ	450 U	470 U	470 U	NA
3-Methylphenol	200 U	210 U	270 U	190 U	210 U	210 U	NA	1000 U	200 U	210 U	210 U	NA
3-Nitroaniline	990 U	1000 U	1300 U	940 U	1100 U	1000 U	NA	5000 U	1000 U	1000 U	1000 U	NA
4,6-Dinitro-2-Methylphenol	990 U	1000 U	1300 U	940 U	1100 U	1000 U	NA	5000 U	1000 U	1000 U	1000 U	NA
4-Aminobiphenyl	200 U	210 U	270 U	190 U	210 U	210 U	NA	1000 U	200 U	210 U	210 U	NA
4-Bromophenyl Phenyl Ether	400 U	410 U	540 U	380 U	420 U	420 U	NA	2000 U	400 U	410 U	420 U	NA
4-Chloro-3-Methylphenol	400 U	410 U	540 U	380 U	420 U	420 U	NA	2000 U	400 U	410 U	420 U	NA
4-Chloroaniline	400 U	410 U	540 U	380 U	420 U	420 U	NA	2000 U	400 U	410 U	420 U	NA
4-Chlorophenyl Phenyl Ether	200 U	210 U	270 U	190 U	210 U	210 U	NA	1000 U	200 U	210 U	210 U	NA
4-Methylphenol	200 U	210 U	270 U	190 U	210 U	210 U	NA	1000 U	200 U	210 U	210 U	NA
4-Nitroaniline	990 U	1000 U	1300 U	940 U	1100 U	1000 U	NA	5000 U	1000 U	1000 U	1000 U	NA
4-Nitrophenol	990 U	1000 U	1300 U	940 U	1100 U	1000 U	NA	5000 U	1000 U	1000 U	1000 U	NA
4-Nitroquinoline-1-Oxide	990 UR	1000 UR	1300 UR	940 UR	1100 UR	1000 UR	NA	5000 UR	1000 UR	1000 UR	1000 UR	NA
5-Nitro-O-Toluidine	400 U	410 U	540 U	380 U	420 U	420 U	NA	2000 U	400 U	410 U	420 U	NA
7,12-Dimethylbenz(A)Anthracene	300 U	310 U	260 J	280 U	320 U	310 U	NA	1500 UJ	300 U	310 U	310 U	NA
A,A-Dimethylphenethylamine	990 U	1000 U	1300 U	940 U	1100 U	1000 U	NA	5000 U	1000 U	1000 U	1000 U	NA
Acenaphthene	12.1 U	12.3 U	15.8 U	11.2 UJ	12.5 UJ	12.4 U	NA	12.3 U	12.1 U	12.5 U	12.4 U	NA

Calc = Calculated Value as described in Section 3.4.2.1.
NA = Not Applicable

TABLE E-1

SUMMARY OF ANALYTIC RESULTS - SURFACE SOIL
CRANE 158 - MUSTARD GAS BURIAL GROUND
NSWC CRANE
CRANE, INDIANA

Location	01SB15	01SB16	01SB17	01SB18	01SB19	01SB20	01SB21	01TPL	01TPL	01TPL	01TPS	BG1SBA01
Sample	01SS150002	01SS160002	01SS170002	01SS180002	01SS190002	01SS200002	01SS210002	01TPL01	01TPL02	01TPL03	01TPS04	BG1SBA0101
Matrix	Surface Soil	Surface Soil	Surface Soil	Surface Soil	Surface Soil	Surface Soil	Surface Soil	Surface Soil	Surface Soil	Surface Soil	Surface Soil	Surface Soil
Depth Range	0 - 2	0 - 2	0 - 2	0 - 2	0 - 2	0 - 2	0 - 2	1 - 1.5	1 - 1.5	1 - 1.5	1 - 1.5	0 - 1
Risk	Site	Site	Site	Site	Site	Site	SiteBackground	Site	Site	Site	Site	Basewide Background
Soil Group	3	3	3	3	3	3	3	3	3	3	3	3
Sample Date	8/22/2001	8/21/2001	8/24/2001	8/24/2001	8/24/2001	8/21/2001	8/21/2001	8/27/2001	8/27/2001	8/27/2001	8/27/2001	11/4/1999
Acenaphthylene	12 1 UJ	12 3 U	15 8 U	11 2 UJ	12 5 UJ	12 4 U	NA	12 3 U	12 1 U	12 5 U	12 4 U	NA
Acetophenone	200 U	210 U	270 U	190 U	210 U	210 U	NA	1000 U	200 U	210 U	210 U	NA
Aniline	200 U	210 U	270 U	190 U	210 U	210 U	NA	1000 U	200 U	210 U	210 U	NA
Anthracene	12 1 UJ	12 3 U	15 8 U	11 2 UJ	12 5 UJ	12 4 U	NA	12.3 U	12 1 U	12 5 U	12 4 U	NA
Aramite	990 U	1000 U	1300 U	940 U	1100 U	1000 U	NA	5000 U	1000 U	1000 U	1000 U	NA
Benzo(A)Anthracene	12 1 U	12 3 U	15 8 U	11 2 UJ	12 5 UJ	12 4 U	NA	12 3 U	12 1 U	12 5 U	12 4 U	NA
Benzo(A)Pyrene	12 1 U	12 3 U	15 8 U	11 2 UJ	12 5 UJ	12 4 U	NA	5 85 J	12 1 U	12 5 U	12 4 U	NA
Benzo(B)Fluoranthene	12 1 U	12 3 U	15 8 U	11 2 UJ	12 5 UJ	12 4 U	NA	12.3 U	12 1 U	12 5 U	12.4 U	NA
Benzo(G,H,I)Perylene	12 1 U	12 3 U	15 8 U	11 2 UJ	12 5 UJ	12.4 U	NA	9 3 J	12 1 U	12 5 U	12 4 U	NA
Benzo(K)Fluoranthene	12 1 U	12 3 U	15 8 U	11 2 UJ	12 5 UJ	12 4 U	NA	14 1 J	12 1 U	12 5 U	12.4 U	NA
Benzyl Alcohol	270 U	270 U	270 U	270 U	270 U	270 U	NA	1400 U	270 U	270 U	270 U	NA
Bis(2-Chloroethoxy)Methane	400 U	410 U	540 U	380 U	420 U	420 U	NA	2000 U	400 U	410 U	420 U	NA
Bis(2-Chloroethyl)Ether	200 U	210 U	270 U	190 U	210 U	210 U	NA	1000 U	200 U	210 U	210 U	NA
Bis(2-Ethylhexyl)Phthalate	200 U	210 U	270 U	83 J	210 U	210 U	NA	1000 U	200 U	210 U	210 U	NA
Butyl Benzyl Phthalate	200 U	210 U	270 U	190 U	210 U	210 U	NA	1000 UJ	200 U	210 U	210 U	NA
Chlorobenzilate	400 U	410 U	540 U	380 U	420 U	420 U	NA	2000 UJ	400 U	410 U	420 U	NA
Chrysene	12 1 U	12 3 U	15 8 U	11 2 UJ	12.5 UJ	12 4 U	NA	12 3 U	12 1 U	12 5 U	12 4 U	NA
Di-N-Butyl Phthalate	200 U	210 U	270 UJ	190 UJ	210 UJ	210 U	NA	1000 U	200 U	210 U	210 U	NA
Di-N-Octyl Phthalate	200 U	210 U	270 U	190 U	210 U	210 U	NA	1000 UJ	200 U	210 U	210 U	NA
Diallate	400 U	410 U	540 U	380 U	420 U	420 U	NA	2000 U	400 U	410 U	420 U	NA
Dibenzo(A,H)Anthracene	12 1 UJ	12 3 U	15 8 U	11 2 UJ	12 5 UJ	12 4 U	NA	5 76 J	12 1 U	12 5 U	12 4 U	NA
Dibenzofuran	200 U	210 U	270 U	190 U	210 U	210 U	NA	1000 U	200 U	210 U	210 U	NA
Diethyl Phthalate	200 U	210 U	270 U	190 U	210 U	210 U	NA	1000 U	200 U	210 U	210 U	NA
Dimethyl Phthalate	200 U	210 U	270 U	190 U	210 U	210 U	NA	1000 U	200 U	210 U	210 U	NA
Diphenylamine	200 U	210 U	270 U	190 U	210 U	210 U	NA	1000 U	200 U	210 U	210 U	NA
Ethyl Methane Sulfonate	200 U	210 U	270 U	190 U	210 U	210 U	NA	1000 U	200 U	210 U	210 U	NA
Fluoranthene	12 1 U	12 3 U	15 8 U	11 2 UJ	12 5 UJ	12 4 U	NA	4 39 J	12 1 U	12 5 U	12 4 U	NA
Fluorene	12 1 U	12 3 U	15 8 U	11 2 UJ	12 5 UJ	12 4 U	NA	12 3 U	12 1 U	12 5 U	12 4 U	NA
Hexachlorobenzene	400 U	410 U	540 U	380 U	420 U	420 U	NA	2000 U	400 U	410 U	420 U	NA
Hexachlorobutadiene	400 U	410 U	540 U	380 U	420 U	420 U	NA	2000 U	400 U	410 U	420 U	NA
Hexachlorocyclopentadiene	400 UJ	410 U	540 U	380 U	420 U	420 U	NA	2000 U	400 U	410 U	420 U	NA
Hexachloroethane	200 U	210 U	270 U	190 U	210 U	210 U	NA	1000 U	200 U	210 U	210 U	NA
Hexachlorophene	16000 UJ	16000 UJ	21000 U	15000 U	17000 U	17000 UJ	NA	80000 UJ	16000 UJ	17000 UJ	17000 UJ	NA
Hexachloropropene	400 U	410 U	540 U	380 U	420 U	420 U	NA	2000 U	400 U	410 U	420 U	NA
Indeno(1,2,3-CD)Pyrene	12 1 U	12.3 U	15 8 U	11 2 UJ	12 5 UJ	12 4 U	NA	4 52 J	12 1 U	12 5 U	12.4 U	NA
Isodrin	400 U	410 U	540 U	380 U	420 U	420 U	NA	2000 U	400 U	410 U	420 U	NA
Isophorone	200 U	210 U	270 U	190 U	210 U	210 U	NA	1000 U	200 U	210 U	210 U	NA
Isosafrole	400 U	410 U	540 U	410	420 U	400 J	NA	2000 U	400 U	410 U	150 J	NA
Kepone	990 U	1000 U	1300 U	940 U	1100 U	1000 U	NA	5000 UJ	1000 U	1000 U	1000 U	NA
Methapyrilene	990 U	1000 U	1300 UR	940 UR	1100 U	1000 U	NA	5000 UR	1000 UR	1000 UR	1000 UR	NA
Methyl Methane Sulfonate	500 U	500 U	650 U	470 U	550 U	500 U	NA	2500 U	500 U	500 U	500 U	NA
N-Nitroso-Di-N-Butylamine	400 U	410 U	540 U	380 U	420 U	420 U	NA	2000 U	400 U	410 U	420 U	NA
N-Nitroso-Di-N-Propylamine	200 U	210 U	270 U	190 U	210 U	210 U	NA	1000 U	200 U	210 U	210 U	NA
N-Nitrosodiethylamine	200 U	210 U	270 U	190 U	210 U	210 U	NA	1000 U	200 U	210 U	210 U	NA
N-Nitrosodimethylamine	200 U	210 U	270 U	190 U	210 U	210 U	NA	1000 U	200 U	210 U	210 U	NA
N-Nitrosomethylethylamine	200 U	210 U	270 U	190 U	210 U	210 U	NA	1000 U	200 U	210 U	210 U	NA
N-Nitrosomorpholine	200 U	210 U	270 U	190 U	210 U	210 U	NA	1000 U	200 U	210 U	210 U	NA
N-Nitrosopiperidine	400 U	410 U	540 U	380 U	420 U	420 U	NA	2000 U	400 U	410 U	420 U	NA
N-Nitrosopyrrolidine	200 U	210 U	270 U	190 U	210 U	210 U	NA	1000 U	200 U	210 U	210 U	NA
Naphthalene	12 1 UR	12 3 U	15 8 U	11 2 UJ	12 5 UJ	12 4 U	NA	12 3 U	12.1 U	12 5 U	12 4 U	NA
O,O,O-Triethyl Phosphorothioate	400 U	410 U	540 U	380 U	420 U	420 U	NA	2000 U	400 U	410 U	420 U	NA

Calc = Calculated Value as descibed in Section 3 4 2 1.
NA = Not Analyzed

TABLE E-1

SUMMARY OF ANALYTIC RESULTS - SURFACE SOIL
CRANE 158 - MUSTARD GAS BURIAL GROUND
NSWC CRANE
CRANE, INDIANA

Location	01SB15	01SB16	01SB17	01SB18	01SB19	01SB20	01SB21	01TPL	01TPL	01TPL	01TPS	BG1SBA01
Sample	01SS150002	01SS160002	01SS170002	01SS180002	01SS190002	01SS200002	01SS210002	01TPL01	01TPL02	01TPL03	01TPS04	BG1SBA0101
Matrix	Surface Soil	Surface Soil	Surface Soil	Surface Soil	Surface Soil	Surface Soil	Surface Soil	Surface Soil	Surface Soil	Surface Soil	Surface Soil	Surface Soil
Depth Range	0 - 2	0 - 2	0 - 2	0 - 2	0 - 2	0 - 2	0 - 2	1 - 1.5	1 - 1.5	1 - 1.5	1 - 1.5	0 - 1
Risk	Site	Site	Site	Site	Site	Site	SiteBackground	Site	Site	Site	Site	Basewide Background
Soil Group	3	3	3	3	3	3	3	3	3	3	3	3
Sample Date	8/22/2001	8/21/2001	8/24/2001	8/24/2001	8/24/2001	8/21/2001	8/21/2001	8/27/2001	8/27/2001	8/27/2001	8/27/2001	11/4/1999
O-Toluidine	200 U	210 U	270 U	190 U	210 U	210 U	NA	1000 U	200 U	210 U	210 U	NA
P-(Dimethylamino)Azobenzene	400 U	410 U	540 U	380 U	420 U	420 U	NA	2000 U	400 U	410 U	420 U	NA
Pentachlorobenzene	400 U	410 U	540 U	380 U	420 U	420 U	NA	2000 U	400 U	410 U	420 U	NA
Pentachloronitrobenzene	990 U	1000 U	1300 U	940 U	1100 U	1000 U	NA	5000 U	1000 U	1000 U	1000 U	NA
Phenacetin	400 U	410 U	540 U	380 U	420 U	420 U	NA	2000 U	400 U	410 U	420 U	NA
Phenanthrene	12 1 U	12 3 U	15 8 U	11 2 UJ	12 5 UJ	12 4 UR	NA	12 3 U	12 1 U	12 5 U	12 4 U	NA
Phenol	200 U	210 U	270 U	190 U	210 U	210 U	NA	1000 U	200 U	210 U	210 U	NA
Pronamide	400 UR	410 UR	540 U	380 U	420 U	420 UR	NA	2000 UR	400 UR	410 UR	420 UR	NA
Pyrene	12 1 U	12 3 U	15 8 U	11 2 UJ	12 5 UJ	12 4 U	NA	4 1 J	12 1 U	12 5 U	12 4 U	NA
Pyridine	220 U	220 U	270 U	220 U	220 U	220 U	NA	1100 U	220 U	220 U	220 U	NA
Safrole	400 U	410 U	540 U	380 U	420 U	420 U	NA	2000 U	400 U	410 U	420 U	NA
Energertics (ug/kg)												
1,3,5-Trinitrobenzene	500 U	476 U	476 U	476 U	476 U	500 U	NA	NA	NA	NA	NA	NA
1,3-Dinitrobenzene	500 U	476 U	476 U	476 U	476 U	500 U	NA	NA	NA	NA	NA	NA
2,4,6-Trinitrotoluene	500 U	476 U	476 U	476 U	476 U	500 U	NA	NA	NA	NA	NA	NA
2,4-Dinitrotoluene	500 U	476 U	476 U	476 U	476 U	500 U	NA	NA	NA	NA	NA	NA
2,6-Dinitrotoluene	500 U	476 U	476 U	476 U	476 U	500 U	NA	NA	NA	NA	NA	NA
2-Amino-4,6-Dinitrotoluene	500 U	476 U	476 U	476 U	476 U	500 U	NA	NA	NA	NA	NA	NA
2-Nitrotoluene	500 U	476 U	476 U	476 U	476 U	500 U	NA	NA	NA	NA	NA	NA
3-Nitrotoluene	500 U	476 U	476 U	476 U	476 U	500 U	NA	NA	NA	NA	NA	NA
4-Amino-2,6-Dinitrotoluene	500 U	476 U	476 U	476 U	476 U	500 U	NA	NA	NA	NA	NA	NA
4-Nitrotoluene	500 U	476 U	476 U	476 U	476 U	500 U	NA	NA	NA	NA	NA	NA
Hmx	500 U	476 U	476 U	476 U	476 U	500 U	NA	NA	NA	NA	NA	NA
Nitrobenzene	500 U	476 U	476 U	476 U	476 U	500 U	NA	NA	NA	NA	NA	NA
Rdx	500 U	476 U	476 U	476 U	476 U	500 U	NA	NA	NA	NA	NA	NA
Tetryl	500 U	476 U	476 U	476 U	476 U	500 U	NA	NA	NA	NA	NA	NA
Pesticides/PCBs (ug/kg)												
4,4'-DDD	3 U	3 U	4 U	2 8 U	3 2 U	3 1 U	NA	NA	NA	NA	NA	NA
4,4'-DDE	3 UJ	3 U	4 U	2 8 U	3 2 U	3 1 U	NA	NA	NA	NA	NA	NA
4,4'-DDT	3 U	3 U	4 U	2 8 U	3 2 U	3 1 U	NA	NA	NA	NA	NA	NA
Aldrin	1 6 U	1 6 U	2 1 U	1 5 U	1 7 U	1 6 U	NA	NA	NA	NA	NA	NA
Alpha-BHC	1 6 U	1 6 U	2 1 U	1 5 U	1 7 U	1 6 U	NA	NA	NA	NA	NA	NA
Alpha-Chlordane	1 6 U	1 6 U	2 1 U	1 5 U	1 7 U	1 6 U	NA	NA	NA	NA	NA	NA
Aroclor-1016	40 U	40 U	53 U	37 U	42 U	41 U	NA	NA	NA	NA	NA	NA
Aroclor-1221	40 U	40 U	53 U	37 U	42 U	41 U	NA	NA	NA	NA	NA	NA
Aroclor-1232	40 U	40 U	53 U	37 U	42 U	41 U	NA	NA	NA	NA	NA	NA
Aroclor-1242	40 U	40 U	53 U	37 U	42 U	41 U	NA	NA	NA	NA	NA	NA
Aroclor-1248	40 U	40 U	53 U	37 U	42 U	41 U	NA	NA	NA	NA	NA	NA
Aroclor-1254	40 U	40 U	53 U	37 U	42 U	41 U	NA	NA	NA	NA	NA	NA
Aroclor-1260	40 U	40 U	53 U	37 U	42 U	41 U	NA	NA	NA	NA	NA	NA
Beta-BHC	1 6 U	1 6 U	2 1 U	1 5 U	1 7 U	1 6 U	NA	NA	NA	NA	NA	NA
Delta-BHC	1 6 UJ	1 6 U	2 1 U	1 5 U	1 7 U	1 6 U	NA	NA	NA	NA	NA	NA
Dieldrin	3 U	3 U	4 U	2 8 U	3 2 U	3 1 U	NA	NA	NA	NA	NA	NA
Endosulfan I	1 6 U	1 6 U	2 1 U	1 5 U	1 7 U	1 6 U	NA	NA	NA	NA	NA	NA
Endosulfan II	3 U	3 U	4 U	2 8 U	3 2 U	3 1 U	NA	NA	NA	NA	NA	NA
Endosulfan Sulfate	3 U	3 U	4 U	2 8 U	3 2 U	3 1 U	NA	NA	NA	NA	NA	NA
Endrin	3 U	3 U	4 U	2 8 U	3 2 U	3 1 U	NA	NA	NA	NA	NA	NA
Endrin Aldehyde	3 U	3 U	4 U	2 8 U	3 2 U	3 1 U	NA	NA	NA	NA	NA	NA
Gamma-BHC (Lindane)	1 6 U	1 6 U	2 1 U	1 5 U	1 7 U	1 6 U	NA	NA	NA	NA	NA	NA
Gamma-Chlordane	3 R	1 6 U	1 1 J	0.71 J	0 81 J	1 6 U	NA	NA	NA	NA	NA	NA
Heptachlor	2	1 4 J	2 4 BU	1 BU	1 2 BU	2 4	NA	NA	NA	NA	NA	NA

Calc = Calculated Value as descibed in Section 3 4 2 1.
NA = Not A[illegible]d

TABLE E-1

SUMMARY OF ANALYTIC RESULTS - SURFACE SOIL
CRANE 158 - MUSTARD GAS BURIAL GROUND
NSWC CRANE
CRANE, INDIANA

Location	01SB15	01SB16	01SB17	01SB18	01SB19	01SB20	01SB21	01TPL	01TPL	01TPL	01TPS	BG1SBA01
Sample	01SS150002	01SS160002	01SS170002	01SS180002	01SS190002	01SS200002	01SS210002	01TPL01	01TPL02	01TPL03	01TPS04	BG1SBA0101
Matrix	Surface Soil	Surface Soil	Surface Soil	Surface Soil	Surface Soil	Surface Soil	Surface Soil	Surface Soil	Surface Soil	Surface Soil	Surface Soil	Surface Soil
Depth Range	0 - 2	0 - 2	0 - 2	0 - 2	0 - 2	0 - 2	0 - 2	1 - 1.5	1 - 1.5	1 - 1.5	1 - 1.5	0 - 1
Risk	Site	Site	Site	Site	Site	Site	SiteBackground	Site	Site	Site	Site	Basewide Background
Soil Group	3	3	3	3	3	3	3	3	3	3	3	3
Sample Date	8/22/2001	8/21/2001	8/24/2001	8/24/2001	8/24/2001	8/21/2001	8/21/2001	8/27/2001	8/27/2001	8/27/2001	8/27/2001	11/4/1999
Heptachlor Epoxide	1 6 U	1 6 U	2 1 U	1 5 U	1 7 U	1 6 U	NA	NA	NA	NA	NA	NA
Methoxychlor	16 U	16 U	21 U	15 U	17 U	16 U	NA	NA	NA	NA	NA	NA
Toxaphene	100 U	100 U	130 U	94 U	110 U	100 U	NA	NA	NA	NA	NA	NA
Herbicides (ug/kg)												
2,4,5-T	12 U	12 U	16 U	11 U	13 U	13 U	NA	NA	NA	NA	NA	NA
2,4,5-TP (Silvex)	5 9 J	12 U	16 U	11 U	13 U	13 U	NA	NA	NA	NA	NA	NA
2,4-D	85 U	86 U	210	69 J	90 U	88 U	NA	NA	NA	NA	NA	NA
Dinoseb	24 U	25 U	32 U	23 U	26 U	25 U	NA	NA	NA	NA	NA	NA
Pentachlorophenol	12 U	12 U	16 U	11 U	13 U	13 U	NA	NA	NA	NA	NA	NA
Inorganics (mg/kg)												
Aluminum	17200 J	12200	15300 J	9400 J	12400 J	13800	NA	9820 J	9900 J	9570 J	12400 J	8070 J
Antimony	0 89 U	0 51 U	0 36 U	0 49 U	0 55 U	0 54 U	NA	0 34 U	0 45 U	0.40 U	0 28 U	0 53 U
Arsenic	9 1	8 3	10 8 J	6 0 J	7 9 J	7 5	NA	6 9 J	6 4 J	6 2 J	7 1 J	7 9
Barium	76 2	104	169	49 9	42 9	112	NA	117 J	118 J	114 J	131 J	76 6 J
Beryllium	0 59 U	0 72 J	1 0 J	0 45 J	0 38 J	0 78 J	NA	0 93 J	0 77 J	0 86 J	0 72 J	1 4 U
Cadmium	0 01 U	0 05 UJ	1 3 J	0 09 J	0 15 J	0 05 UJ	NA	0 14 J	0 05 J	0 04 UJ	0 11 J	0.29 U
Calcium	1050 J	2520	1450 J	421 J	579 J	946	NA	12600 J	18800 J	4810 J	1120 J	5 U
Chromium	19.3	13 9	24 3 J	12 1 J	15 9 J	14 1	NA	12 8	13 1	11 5	14 0	21 7 J
Cobalt	8 3 J	11 6	18 8 J	8 8 J	3 2 J	20 3	NA	22 3	19 0	16 2	18 6	18
Copper	17 6 J	12 6 J	12 6 J	8.1 J	12 3 J	10 9 J	NA	7 4 J	7 9 J	9 1 J	10 5 J	9 8
Iron	23500	19900	24600	17200	22800	18000	NA	15400	14600	15000	17600	36200 J
Lead	12 9 J	16 5	20 0	11 4	11 0	18 1	NA	21 6	17 6	17 8	16 3	21 5 J
Magnesium	2380 J	1780	1930 J	1050 J	1850 J	1570	NA	1540 J	1830 J	1190 J	1500 J	620 J
Manganese	382 J	629	1420 J	427 J	114 J	1220	NA	1720 J	1540 J	1290 J	1070 J	1950 J
Mercury	0 07	0 07 U	0 04 U	0 04 U	0 10 U	0 05 U	NA	0 04 J	0 03 J	0 04 J	0 04 J	0 05
Nickel	12 2	11 7	16 0 J	6 9 J	8 1 J	13 4	NA	12 1	11 1	10 9	13 9	20 J
Potassium	823 J	668 J	853 J	436 J	575 J	846 J	NA	503 J	519 J	479 J	676 J	644
Selenium	0 62 J	0 38 U	1 5 U	0 68 U	0 87 U	0 49	NA	0 76 J	0 72 J	0 74 J	0 70 J	0 82 U
Silver	0 05 U	0 15 U	0 46 U	0 34 U	0 37 U	0 16 U	NA	0 37 U	0.36 U	0 37 U	0 36 U	0 05 J
Sodium	384 J	304	452 J	329 J	426 J	400	NA	336 J	283 J	351 J	297 J	2 4 U
Strontium	10 4 J	11 9 J	13 7 J	5 0 J	6 8 J	8 8 J	NA	15 9 J	20 2 J	9 5 J	12 8 J	NA
Thallium	1 5 J	1 6	2 5 J	1 9 J	2 7 J	1 6	NA	0 69	0 61 U	0 62 U	0 99	0.19 J
Thorium	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Thorium-Calc	4 04	4 58	4 2	3 57	3 56	3 70	3 59	4 73	3 76	4 11	4 32	NA
Tin	3 8	3 1	29 2 U	21 6 U	23 4 U	3 4	NA	23 2 U	23 1 U	23 7 U	22 8 U	0 63 U
Vanadium	35 7 J	28 1	36 2	24 8	30 4	28 6	NA	24 8	23 6	22 8	29 2	30 7 J
Zinc	50 9	42 5	54 9 J	25 1 J	34 3 J	45 3	NA	41 2 J	35 5 J	38 6 J	46 3 J	37 6 J
Miscellaneous Parameters												
1,4-Dithiane (ug/kg)	244 U	247 U	323 U	227 U	256 U	252 U	NA	247 U	243 U	250 U	247 U	NA
1,4-Oxathiane (ug/kg)	244 U	247 U	323 U	227 U	256 U	252 U	NA	247 U	243 U	250 U	247 U	NA
Bis(2-Chloroethyl)Sulfide (ug/kg)	244 U	247 U	323 U	227 U	256 U	252 U	NA	247 U	243 U	250 U	247 U	NA
Cation Exchange Capacity (meq/100g	NA	NA	NA	NA	NA	11 2	NA	NA	NA	NA	NA	NA
pH (S U)	NA	NA	NA	NA	NA	5 0 J	NA	7 5 J	NA	NA	NA	NA
Total Organic Carbon (mg/kg)	NA	NA	NA	NA	NA	NA	619 U	NA	NA	NA	NA	NA
Total Radiologicals (pCi/g)												
Actinium-228	NA	NA	NA	NA	NA	NA	NA	NA	0 92	0.97	NA	NA
Bismuth-212	NA	NA	NA	NA	NA	NA	NA	NA	0 91	0 94	NA	NA
Bismuth-214	NA	NA	NA	NA	NA	NA	NA	NA	0 68	0 74	NA	NA
Cesium-137	NA	NA	NA	NA	NA	NA	NA	NA	0 0359 U	0 09	NA	NA
Cobalt-60	NA	NA	NA	NA	NA	NA	NA	NA	0.0146 U	0 0162 U	NA	NA
Europium-154	NA	NA	NA	NA	NA	NA	NA	NA	0 0127 U	0 0129 U	NA	NA

Calc = Calculated Value as descibed in Section 3.4.2 1.
NA = Not Analyzed

TABLE E-1

SUMMARY OF ANALYTIC RESULTS - SURFACE SOIL
CRANE 158 - MUSTARD GAS BURIAL GROUND
NSWC CRANE
CRANE, INDIANA

Location	01SB15	01SB16	01SB17	01SB18	01SB19	01SB20	01SB21	01TPL	01TPL	01TPL	01TPS	BG1SBA01
Sample	01SS150002	01SS160002	01SS170002	01SS180002	01SS190002	01SS200002	01SS210002	01TPL01	01TPL02	01TPL03	01TPS04	BG1SBA0101
Matrix	Surface Soil	Surface Soil	Surface Soil	Surface Soil	Surface Soil	Surface Soil	Surface Soil	Surface Soil	Surface Soil	Surface Soil	Surface Soil	Surface Soil
Depth Range	0 - 2	0 - 2	0 - 2	0 - 2	0 - 2	0 - 2	0 - 2	1 - 1.5	1 - 1.5	1 - 1.5	1 - 1.5	0 - 1
Risk	Site	Site	Site	Site	Site	Site	SiteBackground	Site	Site	Site	Site	Basewide Background
Soil Group	3	3	3	3	3	3	3	3	3	3	3	3
Sample Date	8/22/2001	8/21/2001	8/24/2001	8/24/2001	8/24/2001	8/21/2001	8/21/2001	8/27/2001	8/27/2001	8/27/2001	8/27/2001	11/4/1999
Europium-155	NA	NA	NA	NA	NA	NA	NA	NA	0 0964 U	0 232 U	NA	NA
Lead-210	NA	NA	NA	NA	NA	NA	NA	NA	0 47	0 52	NA	NA
Lead-212	NA	NA	NA	NA	NA	NA	NA	NA	0.83	0.86	NA	NA
Lead-214	NA	NA	NA	NA	NA	NA	NA	NA	0 71	0.69	NA	NA
Potassium-40	NA	NA	NA	NA	NA	NA	NA	NA	9.94	9.76	NA	NA
Protactinium-234	NA	NA	NA	NA	NA	NA	NA	NA	3 12 U	2 73 U	NA	NA
Radium-226	NA	NA	NA	NA	NA	NA	NA	NA	1 56	1 68	NA	NA
Thallium-208	NA	NA	NA	NA	NA	NA	NA	NA	0 77	0 81	NA	NA
Thorium-228	0 387	0 490	0 427	0 416	0 299	0 436	0 431	0 483	0 377	0 353	0.449	NA
Thorium-230	0 562 J	0 475	0 0395 U	0 0345 U	0 0848 U	0 578	0 0764	0 0278 J	0 0179 J	0 023 J	0 0215 J	NA
Thorium-232	0 501	0 518	0 497	0 370	0 485	0 379	0 359	0 557	0 451	0 552	0 501	NA
Thorium-234	NA	NA	NA	NA	NA	NA	NA	NA	1 00	1 73	NA	NA
Uranium-235	NA	NA	NA	NA	NA	NA	NA	NA	0 12	0 14	NA	NA

Calc = Calculated Value as described in Section 3 4.2 1.
NA = Not A[illegible]ed

TABLE E-1

SUMMARY OF ANALYTIC RESULTS - SURFACE SOIL
CRANE 158 - MUSTARD GAS BURIAL GROUND
NSWC CRANE
CRANE, INDIANA

Location	BG1SBA04	BG1SBP04	BG1SBP06	BG1SBP07	BG1SBP08	BG1SBP09	BG3SBA01	BG3SBA03
Sample	BG1SBA0401	BG1SBP0401	BG1SBP0601	BG1SBP0701	BG1SBP0801	BG1SBP0901	BG3SBA0101	BG3SBA0301
Matrix	Surface Soil	Surface Soil	Surface Soil	Surface Soil	Surface Soil	Surface Soil	Surface Soil	Surface Soil
Depth Range	0 - 1	0 - 1	0 - 1	0 - 1	0 - 1	0 - 1	0 - 1	0 - 1
Risk	Basewide Background	Basewide Background	Basewide Background	Basewide Background	Basewide Background	Basewide Background	Basewide Background	Basewide Background
Soil Group	3	3	3	3	3	3	3	3
Sample Date	11/5/1999	11/6/1999	11/5/1999	11/5/1999	11/6/1999	11/6/1999	11/2/1999	11/3/1999
Volatile Organics (ug/kg)								
1,1,1,2-Tetrachloroethane	NA	NA	NA	NA	NA	NA	NA	NA
1,1,1-Trichloroethane	NA	NA	NA	NA	NA	NA	NA	NA
1,1,2,2-Tetrachloroethane	NA	NA	NA	NA	NA	NA	NA	NA
1,1,2-Trichloroethane	NA	NA	NA	NA	NA	NA	NA	NA
1,1-Dichloroethane	NA	NA	NA	NA	NA	NA	NA	NA
1,1-Dichloroethene	NA	NA	NA	NA	NA	NA	NA	NA
1,2,3-Trichloropropane	NA	NA	NA	NA	NA	NA	NA	NA
1,2-Dibromo-3-Chloropropane	NA	NA	NA	NA	NA	NA	NA	NA
1,2-Dibromoethane	NA	NA	NA	NA	NA	NA	NA	NA
1,2-Dichloroethane	NA	NA	NA	NA	NA	NA	NA	NA
1,2-Dichloropropane	NA	NA	NA	NA	NA	NA	NA	NA
1,4-Dioxane	NA	NA	NA	NA	NA	NA	NA	NA
2-Butanone	NA	NA	NA	NA	NA	NA	NA	NA
2-Hexanone	NA	NA	NA	NA	NA	NA	NA	NA
3-Chloropropene	NA	NA	NA	NA	NA	NA	NA	NA
4-Methyl-2-Pentanone	NA	NA	NA	NA	NA	NA	NA	NA
Acetone	NA	NA	NA	NA	NA	NA	NA	NA
Acetonitrile	NA	NA	NA	NA	NA	NA	NA	NA
Acrolein	NA	NA	NA	NA	NA	NA	NA	NA
Acrylonitrile	NA	NA	NA	NA	NA	NA	NA	NA
Benzene	NA	NA	NA	NA	NA	NA	NA	NA
Bromodichloromethane	NA	NA	NA	NA	NA	NA	NA	NA
Bromoform	NA	NA	NA	NA	NA	NA	NA	NA
Bromomethane	NA	NA	NA	NA	NA	NA	NA	NA
Carbon Disulfide	NA	NA	NA	NA	NA	NA	NA	NA
Carbon Tetrachloride	NA	NA	NA	NA	NA	NA	NA	NA
Chlorobenzene	NA	NA	NA	NA	NA	NA	NA	NA
Chlorodibromomethane	NA	NA	NA	NA	NA	NA	NA	NA
Chloroethane	NA	NA	NA	NA	NA	NA	NA	NA
Chloroform	NA	NA	NA	NA	NA	NA	NA	NA
Chloromethane	NA	NA	NA	NA	NA	NA	NA	NA
Chloroprene	NA	NA	NA	NA	NA	NA	NA	NA
Cis-1,2-Dichloroethene	NA	NA	NA	NA	NA	NA	NA	NA
Cis-1,3-Dichloropropene	NA	NA	NA	NA	NA	NA	NA	NA
Dibromomethane	NA	NA	NA	NA	NA	NA	NA	NA
Dichlorodifluoromethane	NA	NA	NA	NA	NA	NA	NA	NA
Ethyl Methacrylate	NA	NA	NA	NA	NA	NA	NA	NA
Ethylbenzene	NA	NA	NA	NA	NA	NA	NA	NA
Isobutanol	NA	NA	NA	NA	NA	NA	NA	NA
Methacrylonitrile	NA	NA	NA	NA	NA	NA	NA	NA
Methyl Iodide	NA	NA	NA	NA	NA	NA	NA	NA
Methyl Methacrylate	NA	NA	NA	NA	NA	NA	NA	NA
Methylene Chloride	NA	NA	NA	NA	NA	NA	NA	NA
Pentachloroethane	NA	NA	NA	NA	NA	NA	NA	NA
Propionitrile	NA	NA	NA	NA	NA	NA	NA	NA
Styrene	NA	NA	NA	NA	NA	NA	NA	NA
Tetrachloroethene	NA	NA	NA	NA	NA	NA	NA	NA
Toluene	NA	NA	NA	NA	NA	NA	NA	NA
Total Xylenes	NA	NA	NA	NA	NA	NA	NA	NA
Trans-1,2-Dichloroethene	NA	NA	NA	NA	NA	NA	NA	NA

Calc = Calculated Value as descibed in Section 3 4 2 1
NA = Not Analyzed

TABLE E-1

SUMMARY OF ANALYTIC RESULTS - SURFACE SOIL
CRANE 158 - MUSTARD GAS BURIAL GROUND
NSWC CRANE
CRANE, INDIANA

Location	BG1SBA04	BG1SBP04	BG1SBP06	BG1SBP07	BG1SBP08	BG1SBP09	BG3SBA01	BG3SBA03
Sample	BG1SBA0401	BG1SBP0401	BG1SBP0601	BG1SBP0701	BG1SBP0801	BG1SBP0901	BG3SBA0101	BG3SBA0301
Matrix	Surface Soil	Surface Soil	Surface Soil	Surface Soil	Surface Soil	Surface Soil	Surface Soil	Surface Soil
Depth Range	0 - 1	0 - 1	0 - 1	0 - 1	0 - 1	0 - 1	0 - 1	0 - 1
Risk	Basewide Background	Basewide Background	Basewide Background	Basewide Background	Basewide Background	Basewide Background	Basewide Background	Basewide Background
Soil Group	3	3	3	3	3	3	3	3
Sample Date	11/5/1999	11/6/1999	11/5/1999	11/5/1999	11/6/1999	11/6/1999	11/2/1999	11/3/1999
Trans-1,3-Dichloropropene	NA	NA	NA	NA	NA	NA	NA	NA
Trans-1,4-Dichloro-2-Butene	NA	NA	NA	NA	NA	NA	NA	NA
Trichloroethene	NA	NA	NA	NA	NA	NA	NA	NA
Trichlorofluoromethane	NA	NA	NA	NA	NA	NA	NA	NA
Vinyl Acetate	NA	NA	NA	NA	NA	NA	NA	NA
Vinyl Chloride	NA	NA	NA	NA	NA	NA	NA	NA
Semivolatile Organics (ug/kg)								
1,2,4,5-Tetrachlorobenzene	NA	NA	NA	NA	NA	NA	NA	NA
1,2,4-Trichlorobenzene	NA	NA	NA	NA	NA	NA	NA	NA
1,2-Dichlorobenzene	NA	NA	NA	NA	NA	NA	NA	NA
1,3-Dichlorobenzene	NA	NA	NA	NA	NA	NA	NA	NA
1,4-Dichlorobenzene	NA	NA	NA	NA	NA	NA	NA	NA
1,4-Naphthoquinone	NA	NA	NA	NA	NA	NA	NA	NA
1,4-Phenylenediamine	NA	NA	NA	NA	NA	NA	NA	NA
1-Naphthylamine	NA	NA	NA	NA	NA	NA	NA	NA
2,2'-Oxybis(1-Chloropropane)	NA	NA	NA	NA	NA	NA	NA	NA
2,3,4,6-Tetrachlorophenol	NA	NA	NA	NA	NA	NA	NA	NA
2,4,5-Trichlorophenol	NA	NA	NA	NA	NA	NA	NA	NA
2,4,6-Trichlorophenol	NA	NA	NA	NA	NA	NA	NA	NA
2,4-Dichlorophenol	NA	NA	NA	NA	NA	NA	NA	NA
2,4-Dimethylphenol	NA	NA	NA	NA	NA	NA	NA	NA
2,4-Dinitrophenol	NA	NA	NA	NA	NA	NA	NA	NA
2,6-Dichlorophenol	NA	NA	NA	NA	NA	NA	NA	NA
2-Acetylaminofluorene	NA	NA	NA	NA	NA	NA	NA	NA
2-Chloronaphthalene	NA	NA	NA	NA	NA	NA	NA	NA
2-Chlorophenol	NA	NA	NA	NA	NA	NA	NA	NA
2-Methylnaphthalene	NA	NA	NA	NA	NA	NA	NA	NA
2-Methylphenol	NA	NA	NA	NA	NA	NA	NA	NA
2-Naphthylamine	NA	NA	NA	NA	NA	NA	NA	NA
2-Nitroaniline	NA	NA	NA	NA	NA	NA	NA	NA
2-Nitrophenol	NA	NA	NA	NA	NA	NA	NA	NA
2-Picoline	NA	NA	NA	NA	NA	NA	NA	NA
3,3'-Dichlorobenzidine	NA	NA	NA	NA	NA	NA	NA	NA
3,3'-Dimethylbenzidine	NA	NA	NA	NA	NA	NA	NA	NA
3-Methylcholanthrene	NA	NA	NA	NA	NA	NA	NA	NA
3-Methylphenol	NA	NA	NA	NA	NA	NA	NA	NA
3-Nitroaniline	NA	NA	NA	NA	NA	NA	NA	NA
4,6-Dinitro-2-Methylphenol	NA	NA	NA	NA	NA	NA	NA	NA
4-Aminobiphenyl	NA	NA	NA	NA	NA	NA	NA	NA
4-Bromophenyl Phenyl Ether	NA	NA	NA	NA	NA	NA	NA	NA
4-Chloro-3-Methylphenol	NA	NA	NA	NA	NA	NA	NA	NA
4-Chloroaniline	NA	NA	NA	NA	NA	NA	NA	NA
4-Chlorophenyl Phenyl Ether	NA	NA	NA	NA	NA	NA	NA	NA
4-Methylphenol	NA	NA	NA	NA	NA	NA	NA	NA
4-Nitroaniline	NA	NA	NA	NA	NA	NA	NA	NA
4-Nitrophenol	NA	NA	NA	NA	NA	NA	NA	NA
4-Nitroquinoline-1-Oxide	NA	NA	NA	NA	NA	NA	NA	NA
5-Nitro-O-Toluidine	NA	NA	NA	NA	NA	NA	NA	NA
7,12-Dimethylbenz(A)Anthracene	NA	NA	NA	NA	NA	NA	NA	NA
A,A-Dimethylphenethylamine	NA	NA	NA	NA	NA	NA	NA	NA
Acenaphthene	NA	NA	NA	NA	NA	NA	NA	NA

Calc = Calculated Value as described in Section 3 4 2.1
NA = Not A[illegible]ed

TABLE E-1

SUMMARY OF ANALYTIC RESULTS - SURFACE SOIL
CRANE 158 - MUSTARD GAS BURIAL GROUND
NSWC CRANE
CRANE, INDIANA

Location	BG1SBA04	BG1SBP04	BG1SBP06	BG1SBP07	BG1SBP08	BG1SBP09	BG3SBA01	BG3SBA03
Sample	BG1SBA0401	BG1SBP0401	BG1SBP0601	BG1SBP0701	BG1SBP0801	BG1SBP0901	BG3SBA0101	BG3SBA0301
Matrix	Surface Soil	Surface Soil	Surface Soil	Surface Soil	Surface Soil	Surface Soil	Surface Soil	Surface Soil
Depth Range	0 - 1	0 - 1	0 - 1	0 - 1	0 - 1	0 - 1	0 - 1	0 - 1
Risk	Basewide Background	Basewide Background	Basewide Background	Basewide Background	Basewide Background	Basewide Background	Basewide Background	Basewide Background
Soil Group	3	3	3	3	3	3	3	3
Sample Date	11/5/1999	11/6/1999	11/5/1999	11/5/1999	11/6/1999	11/6/1999	11/2/1999	11/3/1999
Acenaphthylene	NA	NA	NA	NA	NA	NA	NA	NA
Acetophenone	NA	NA	NA	NA	NA	NA	NA	NA
Aniline	NA	NA	NA	NA	NA	NA	NA	NA
Anthracene	NA	NA	NA	NA	NA	NA	NA	NA
Aramite	NA	NA	NA	NA	NA	NA	NA	NA
Benzo(A)Anthracene	NA	NA	NA	NA	NA	NA	NA	NA
Benzo(A)Pyrene	NA	NA	NA	NA	NA	NA	NA	NA
Benzo(B)Fluoranthene	NA	NA	NA	NA	NA	NA	NA	NA
Benzo(G,H,I)Perylene	NA	NA	NA	NA	NA	NA	NA	NA
Benzo(K)Fluoranthene	NA	NA	NA	NA	NA	NA	NA	NA
Benzyl Alcohol	NA	NA	NA	NA	NA	NA	NA	NA
Bis(2-Chloroethoxy)Methane	NA	NA	NA	NA	NA	NA	NA	NA
Bis(2-Chloroethyl)Ether	NA	NA	NA	NA	NA	NA	NA	NA
Bis(2-Ethylhexyl)Phthalate	NA	NA	NA	NA	NA	NA	NA	NA
Butyl Benzyl Phthalate	NA	NA	NA	NA	NA	NA	NA	NA
Chlorobenzilate	NA	NA	NA	NA	NA	NA	NA	NA
Chrysene	NA	NA	NA	NA	NA	NA	NA	NA
Di-N-Butyl Phthalate	NA	NA	NA	NA	NA	NA	NA	NA
Di-N-Octyl Phthalate	NA	NA	NA	NA	NA	NA	NA	NA
Diallate	NA	NA	NA	NA	NA	NA	NA	NA
Dibenzo(A,H)Anthracene	NA	NA	NA	NA	NA	NA	NA	NA
Dibenzofuran	NA	NA	NA	NA	NA	NA	NA	NA
Diethyl Phthalate	NA	NA	NA	NA	NA	NA	NA	NA
Dimethyl Phthalate	NA	NA	NA	NA	NA	NA	NA	NA
Diphenylamine	NA	NA	NA	NA	NA	NA	NA	NA
Ethyl Methane Sulfonate	NA	NA	NA	NA	NA	NA	NA	NA
Fluoranthene	NA	NA	NA	NA	NA	NA	NA	NA
Fluorene	NA	NA	NA	NA	NA	NA	NA	NA
Hexachlorobenzene	NA	NA	NA	NA	NA	NA	NA	NA
Hexachlorobutadiene	NA	NA	NA	NA	NA	NA	NA	NA
Hexachlorocyclopentadiene	NA	NA	NA	NA	NA	NA	NA	NA
Hexachloroethane	NA	NA	NA	NA	NA	NA	NA	NA
Hexachlorophene	NA	NA	NA	NA	NA	NA	NA	NA
Hexachloropropene	NA	NA	NA	NA	NA	NA	NA	NA
Indeno(1,2,3-CD)Pyrene	NA	NA	NA	NA	NA	NA	NA	NA
Isodrin	NA	NA	NA	NA	NA	NA	NA	NA
Isophorone	NA	NA	NA	NA	NA	NA	NA	NA
Isosafrole	NA	NA	NA	NA	NA	NA	NA	NA
Kepone	NA	NA	NA	NA	NA	NA	NA	NA
Methapyrilene	NA	NA	NA	NA	NA	NA	NA	NA
Methyl Methane Sulfonate	NA	NA	NA	NA	NA	NA	NA	NA
N-Nitroso-Di-N-Butylamine	NA	NA	NA	NA	NA	NA	NA	NA
N-Nitroso-Di-N-Propylamine	NA	NA	NA	NA	NA	NA	NA	NA
N-Nitrosodiethylamine	NA	NA	NA	NA	NA	NA	NA	NA
N-Nitrosodimethylamine	NA	NA	NA	NA	NA	NA	NA	NA
N-Nitrosomethylethylamine	NA	NA	NA	NA	NA	NA	NA	NA
N-Nitrosomorpholine	NA	NA	NA	NA	NA	NA	NA	NA
N-Nitrosopiperidine	NA	NA	NA	NA	NA	NA	NA	NA
N-Nitrosopyrrolidine	NA	NA	NA	NA	NA	NA	NA	NA
Naphthalene	NA	NA	NA	NA	NA	NA	NA	NA
O,O,O-Triethyl Phosphorothioate	NA	NA	NA	NA	NA	NA	NA	NA

Calc = Calculated Value as described in Section 3 4 2 1
NA = Not Analyzed

TABLE E-1

SUMMARY OF ANALYTIC RESULTS - SURFACE SOIL
CRANE 158 - MUSTARD GAS BURIAL GROUND
NSWC CRANE
CRANE, INDIANA

Location	BG1SBA04	BG1SBP04	BG1SBP06	BG1SBP07	BG1SBP08	BG1SBP09	BG3SBA01	BG3SBA03
Sample	BG1SBA0401	BG1SBP0401	BG1SBP0601	BG1SBP0701	BG1SBP0801	BG1SBP0901	BG3SBA0101	BG3SBA0301
Matrix	Surface Soil	Surface Soil	Surface Soil	Surface Soil	Surface Soil	Surface Soil	Surface Soil	Surface Soil
Depth Range	0 - 1	0 - 1	0 - 1	0 - 1	0 - 1	0 - 1	0 - 1	0 - 1
Risk	Basewide Background	Basewide Background	Basewide Background	Basewide Background	Basewide Background	Basewide Background	Basewide Background	Basewide Background
Soil Group	3	3	3	3	3	3	3	3
Sample Date	11/5/1999	11/6/1999	11/5/1999	11/5/1999	11/6/1999	11/6/1999	11/2/1999	11/3/1999
O-Toluidine	NA	NA	NA	NA	NA	NA	NA	NA
P-(Dimethylamino)Azobenzene	NA	NA	NA	NA	NA	NA	NA	NA
Pentachlorobenzene	NA	NA	NA	NA	NA	NA	NA	NA
Pentachloronitrobenzene	NA	NA	NA	NA	NA	NA	NA	NA
Phenacetin	NA	NA	NA	NA	NA	NA	NA	NA
Phenanthrene	NA	NA	NA	NA	NA	NA	NA	NA
Phenol	NA	NA	NA	NA	NA	NA	NA	NA
Pronamide	NA	NA	NA	NA	NA	NA	NA	NA
Pyrene	NA	NA	NA	NA	NA	NA	NA	NA
Pyridine	NA	NA	NA	NA	NA	NA	NA	NA
Safrole	NA	NA	NA	NA	NA	NA	NA	NA
Energetics (ug/kg)								
1,3,5-Trinitrobenzene	NA	NA	NA	NA	NA	NA	NA	NA
1,3-Dinitrobenzene	NA	NA	NA	NA	NA	NA	NA	NA
2,4,6-Trinitrotoluene	NA	NA	NA	NA	NA	NA	NA	NA
2,4-Dinitrotoluene	NA	NA	NA	NA	NA	NA	NA	NA
2,6-Dinitrotoluene	NA	NA	NA	NA	NA	NA	NA	NA
2-Amino-4,6-Dinitrotoluene	NA	NA	NA	NA	NA	NA	NA	NA
2-Nitrotoluene	NA	NA	NA	NA	NA	NA	NA	NA
3-Nitrotoluene	NA	NA	NA	NA	NA	NA	NA	NA
4-Amino-2,6-Dinitrotoluene	NA	NA	NA	NA	NA	NA	NA	NA
4-Nitrotoluene	NA	NA	NA	NA	NA	NA	NA	NA
Hmx	NA	NA	NA	NA	NA	NA	NA	NA
Nitrobenzene	NA	NA	NA	NA	NA	NA	NA	NA
Rdx	NA	NA	NA	NA	NA	NA	NA	NA
Tetryl	NA	NA	NA	NA	NA	NA	NA	NA
Pesticides/PCBs (ug/kg)								
4,4'-DDD	NA	NA	NA	NA	NA	NA	NA	NA
4,4'-DDE	NA	NA	NA	NA	NA	NA	NA	NA
4,4'-DDT	NA	NA	NA	NA	NA	NA	NA	NA
Aldrin	NA	NA	NA	NA	NA	NA	NA	NA
Alpha-BHC	NA	NA	NA	NA	NA	NA	NA	NA
Alpha-Chlordane	NA	NA	NA	NA	NA	NA	NA	NA
Aroclor-1016	NA	NA	NA	NA	NA	NA	NA	NA
Aroclor-1221	NA	NA	NA	NA	NA	NA	NA	NA
Aroclor-1232	NA	NA	NA	NA	NA	NA	NA	NA
Aroclor-1242	NA	NA	NA	NA	NA	NA	NA	NA
Aroclor-1248	NA	NA	NA	NA	NA	NA	NA	NA
Aroclor-1254	NA	NA	NA	NA	NA	NA	NA	NA
Aroclor-1260	NA	NA	NA	NA	NA	NA	NA	NA
Beta-BHC	NA	NA	NA	NA	NA	NA	NA	NA
Delta-BHC	NA	NA	NA	NA	NA	NA	NA	NA
Dieldrin	NA	NA	NA	NA	NA	NA	NA	NA
Endosulfan I	NA	NA	NA	NA	NA	NA	NA	NA
Endosulfan II	NA	NA	NA	NA	NA	NA	NA	NA
Endosulfan Sulfate	NA	NA	NA	NA	NA	NA	NA	NA
Endrin	NA	NA	NA	NA	NA	NA	NA	NA
Endrin Aldehyde	NA	NA	NA	NA	NA	NA	NA	NA
Gamma-BHC (Lindane)	NA	NA	NA	NA	NA	NA	NA	NA
Gamma-Chlordane	NA	NA	NA	NA	NA	NA	NA	NA
Heptachlor	NA	NA	NA	NA	NA	NA	NA	NA

Calc = Calculated Value as descibed in Section 3 4 2 1
NA = Not [illegible]ed

TABLE E-1

SUMMARY OF ANALYTIC RESULTS - SURFACE SOIL
CRANE 158 - MUSTARD GAS BURIAL GROUND
NSWC CRANE
CRANE, INDIANA

Location	BG1SBA04	BG1SBP04	BG1SBP06	BG1SBP07	BG1SBP08	BG1SBP09	BG3SBA01	BG3SBA03
Sample	BG1SBA0401	BG1SBP0401	BG1SBP0601	BG1SBP0701	BG1SBP0801	BG1SBP0901	BG3SBA0101	BG3SBA0301
Matrix	Surface Soil	Surface Soil	Surface Soil	Surface Soil	Surface Soil	Surface Soil	Surface Soil	Surface Soil
Depth Range	0 - 1	0 - 1	0 - 1	0 - 1	0 - 1	0 - 1	0 - 1	0 - 1
Risk	Basewide Background	Basewide Background	Basewide Background	Basewide Background	Basewide Background	Basewide Background	Basewide Background	Basewide Background
Soil Group	3	3	3	3	3	3	3	3
Sample Date	11/5/1999	11/6/1999	11/5/1999	11/5/1999	11/6/1999	11/6/1999	11/2/1999	11/3/1999
Heptachlor Epoxide	NA	NA	NA	NA	NA	NA	NA	NA
Methoxychlor	NA	NA	NA	NA	NA	NA	NA	NA
Toxaphene	NA	NA	NA	NA	NA	NA	NA	NA
Herbicides (ug/kg)								
2,4,5-T	NA	NA	NA	NA	NA	NA	NA	NA
2,4,5-TP (Silvex)	NA	NA	NA	NA	NA	NA	NA	NA
2,4-D	NA	NA	NA	NA	NA	NA	NA	NA
Dinoseb	NA	NA	NA	NA	NA	NA	NA	NA
Pentachlorophenol	NA	NA	NA	NA	NA	NA	NA	NA
Inorganics (mg/kg)								
Aluminum	6920 J	12200	14800 J	6770 J	17400	9300	8240 J	9600 J
Antimony	0 37 U	0 72 U	0 61 U	0 26 U	1 8 U	3 2 U	0 71 U	0 71 U
Arsenic	4	5 2 J	6 8 J	2.4 J	8 5 J	4 7 J	3 7	4 8
Barium	59 1 J	72 2 J	66 7 J	46 1 J	75 J	77 1 J	74 3 J	105 J
Beryllium	0 35 U	0 68 U	0 6 U	0 96 U	0 56 U	0 84 U	0 64 U	0 69 U
Cadmium	0 3 U	0 26 J	0 45 J	0 19 J	0 61	0 1 J	0 2 U	0 29 U
Calcium	896 J	255	405 J	115 J	418	278	334	957 J
Chromium	10 2 J	13 7 J	17 6 J	8 5 J	19 9 J	13 3 J	9 2 J	15 J
Cobalt	6	15 1	10 4	10 2	8 5	13 1	8 8	14 4
Copper	8 8	9 8	12 2	5 4	17 1	9 4	6 5	8 J
Iron	12100 J	15600 J	19700 J	12300 J	23400 J	15900 J	9340 J	16900 J
Lead	9 4 J	13 6 J	13 J	10 7 J	13 8 J	13 7 J	12 3 J	19 J
Magnesium	967 J	1430 J	1910 J	712 J	2250 J	988 J	876 J	1310 J
Manganese	417 J	577 J	389 J	606 J	268 J	1480 J	721 J	1560 J
Mercury	0 05 U	0 05 U	0 05 U	0 05	0 04	0 05 U	0 05 U	0 05
Nickel	10 3 J	13 1 J	14 6 J	13 2 J	15 9 J	15 2 J	8 8 J	13 2 J
Potassium	607 J	831	1110 J	418 J	1490	889	584	1060
Selenium	0 45 U	0 63	0 55	0 58	0 51	0 64	0 64 U	1 U
Silver	0 05 J	0 11 J	0 1 J	0 05 J	0 1 J	0 05 J	0 05 J	0 06 J
Sodium	2 5 U	16 1 J	22 6 U	2 41 U	18 1 J	14 2 J	2 5 U	2 9 U
Strontium	13 7 J	9 4 J	13 7 J	8 7 J	10 7 J	12 7 J	7 4 J	10 1 J
Thallium	0.1 J	0 21 J	0 25 J	0 14 J	0 25 J	0 2 J	0 15 J	0 17 J
Thorium	6 3 J	7 5 J	8 4 J	5.9 J	8 5 J	7 9 J	4 8 J	6 4 J
Thorium-Calc	NA	NA	NA	NA	NA	NA	NA	NA
Tin	0 53 U	0 67 U	0 61 U	0 51 U	0 8 U	0 6 U	0 66 U	0 82 U
Vanadium	17 5 J	28 4 J	34 6 J	17 1 J	40 J	20 4 J	16 9	23 5
Zinc	24 4 J	41 4 J	43 1 J	32 7 J	52 6 J	36 2 J	34 1 J	37 7 J
Miscellaneous Parameters								
1,4-Dithiane (ug/kg)	NA	NA	NA	NA	NA	NA	NA	NA
1,4-Oxathiane (ug/kg)	NA	NA	NA	NA	NA	NA	NA	NA
Bis(2-Chloroethyl)Sulfide (ug/kg)	NA	NA	NA	NA	NA	NA	NA	NA
Cation Exchange Capacity (meq/100g	NA	NA	NA	NA	NA	NA	NA	NA
pH (S U)	NA	NA	NA	NA	NA	NA	NA	NA
Total Organic Carbon (mg/kg)	NA	NA	NA	NA	NA	NA	NA	NA
Total Radiologicals (pCi/g)								
Actinium-228	NA	NA	NA	NA	NA	NA	NA	NA
Bismuth-212	NA	NA	NA	NA	NA	NA	NA	NA
Bismuth-214	NA	NA	NA	NA	NA	NA	NA	NA
Cesium-137	NA	NA	NA	NA	NA	NA	NA	NA
Cobalt-60	NA	NA	NA	NA	NA	NA	NA	NA
Europium-154	NA	NA	NA	NA	NA	NA	NA	NA

Calc = Calculated Value as descibed in Section 3.4 2 1
NA = Not Analyzed

TABLE E-1

SUMMARY OF ANALYTIC RESULTS - SURFACE SOIL
CRANE 158 - MUSTARD GAS BURIAL GROUND
NSWC CRANE
CRANE, INDIANA

Location	BG1SBA04	BG1SBP04	BG1SBP06	BG1SBP07	BG1SBP08	BG1SBP09	BG3SBA01	BG3SBA03
Sample	BG1SBA0401	BG1SBP0401	BG1SBP0601	BG1SBP0701	BG1SBP0801	BG1SBP0901	BG3SBA0101	BG3SBA0301
Matrix	Surface Soil	Surface Soil	Surface Soil	Surface Soil	Surface Soil	Surface Soil	Surface Soil	Surface Soil
Depth Range	0 - 1	0 - 1	0 - 1	0 - 1	0 - 1	0 - 1	0 - 1	0 - 1
Risk	Basewide Background	Basewide Background	Basewide Background	Basewide Background	Basewide Background	Basewide Background	Basewide Background	Basewide Background
Soil Group	3	3	3	3	3	3	3	3
Sample Date	11/5/1999	11/6/1999	11/5/1999	11/5/1999	11/6/1999	11/6/1999	11/2/1999	11/3/1999
Europium-155	NA	NA	NA	NA	NA	NA	NA	NA
Lead-210	NA	NA	NA	NA	NA	NA	NA	NA
Lead-212	NA	NA	NA	NA	NA	NA	NA	NA
Lead-214	NA	NA	NA	NA	NA	NA	NA	NA
Potassium-40	NA	NA	NA	NA	NA	NA	NA	NA
Protactinium-234	NA	NA	NA	NA	NA	NA	NA	NA
Radium-226	NA	NA	NA	NA	NA	NA	NA	NA
Thallium-208	NA	NA	NA	NA	NA	NA	NA	NA
Thorium-228	NA	NA	NA	NA	NA	NA	NA	NA
Thorium-230	NA	NA	NA	NA	NA	NA	NA	NA
Thorium-232	NA	NA	NA	NA	NA	NA	NA	NA
Thorium-234	NA	NA	NA	NA	NA	NA	NA	NA
Uranium-235	NA	NA	NA	NA	NA	NA	NA	NA

Calc = Calculated Value as descibed in Section 3 4 2 1
NA = Not A[illegible]d

TABLE E-1

SUMMARY OF ANALYTIC RESULTS - SURFACE SOIL
CRANE 158 - MUSTARD GAS BURIAL GROUND
NSWC CRANE
CRANE, INDIANA

Location	BG3SBA05	BG3SBM02	BG3SBM04	BG3SBM06	BG3SBM07	BG3SBM08
Sample	BG3SBA0501	BG3SBM0201	BG3SBM0401	BG3SBM0601	BG3SBM0701	BG3SBM0801
Matrix	Surface Soil	Surface Soil	Surface Soil	Surface Soil	Surface Soil	Surface Soil
Depth Range	0 - 1	0 - 1	0 - 1	0 - 1	0 - 1	0 - 1
Risk	Basewide Background	Basewide Background	Basewide Background	Basewide Background	Basewide Background	Basewide Background
Soil Group	3	3	3	3	3	3
Sample Date	11/4/1999	11/2/1999	11/3/1999	11/2/1999	11/3/1999	11/3/1999
Volatile Organics (ug/kg)						
1,1,1,2-Tetrachloroethane	NA	NA	NA	NA	NA	NA
1,1,1-Trichloroethane	NA	NA	NA	NA	NA	NA
1,1,2,2-Tetrachloroethane	NA	NA	NA	NA	NA	NA
1,1,2-Trichloroethane	NA	NA	NA	NA	NA	NA
1,1-Dichloroethane	NA	NA	NA	NA	NA	NA
1,1-Dichloroethene	NA	NA	NA	NA	NA	NA
1,2,3-Trichloropropane	NA	NA	NA	NA	NA	NA
1,2-Dibromo-3-Chloropropane	NA	NA	NA	NA	NA	NA
1,2-Dibromoethane	NA	NA	NA	NA	NA	NA
1,2-Dichloroethane	NA	NA	NA	NA	NA	NA
1,2-Dichloropropane	NA	NA	NA	NA	NA	NA
1,4-Dioxane	NA	NA	NA	NA	NA	NA
2-Butanone	NA	NA	NA	NA	NA	NA
2-Hexanone	NA	NA	NA	NA	NA	NA
3-Chloropropene	NA	NA	NA	NA	NA	NA
4-Methyl-2-Pentanone	NA	NA	NA	NA	NA	NA
Acetone	NA	NA	NA	NA	NA	NA
Acetonitrile	NA	NA	NA	NA	NA	NA
Acrolein	NA	NA	NA	NA	NA	NA
Acrylonitrile	NA	NA	NA	NA	NA	NA
Benzene	NA	NA	NA	NA	NA	NA
Bromodichloromethane	NA	NA	NA	NA	NA	NA
Bromoform	NA	NA	NA	NA	NA	NA
Bromomethane	NA	NA	NA	NA	NA	NA
Carbon Disulfide	NA	NA	NA	NA	NA	NA
Carbon Tetrachloride	NA	NA	NA	NA	NA	NA
Chlorobenzene	NA	NA	NA	NA	NA	NA
Chlorodibromomethane	NA	NA	NA	NA	NA	NA
Chloroethane	NA	NA	NA	NA	NA	NA
Chloroform	NA	NA	NA	NA	NA	NA
Chloromethane	NA	NA	NA	NA	NA	NA
Chloroprene	NA	NA	NA	NA	NA	NA
Cis-1,2-Dichloroethene	NA	NA	NA	NA	NA	NA
Cis-1,3-Dichloropropene	NA	NA	NA	NA	NA	NA
Dibromomethane	NA	NA	NA	NA	NA	NA
Dichlorodifluoromethane	NA	NA	NA	NA	NA	NA
Ethyl Methacrylate	NA	NA	NA	NA	NA	NA
Ethylbenzene	NA	NA	NA	NA	NA	NA
Isobutanol	NA	NA	NA	NA	NA	NA
Methacrylonitrile	NA	NA	NA	NA	NA	NA
Methyl Iodide	NA	NA	NA	NA	NA	NA
Methyl Methacrylate	NA	NA	NA	NA	NA	NA
Methylene Chloride	NA	NA	NA	NA	NA	NA
Pentachloroethane	NA	NA	NA	NA	NA	NA
Propionitrile	NA	NA	NA	NA	NA	NA
Styrene	NA	NA	NA	NA	NA	NA
Tetrachloroethene	NA	NA	NA	NA	NA	NA
Toluene	NA	NA	NA	NA	NA	NA
Total Xylenes	NA	NA	NA	NA	NA	NA
Trans-1,2-Dichloroethene	NA	NA	NA	NA	NA	NA

Calc = Calculated Value as descibed in Section 3 4 2.1
NA = Not Analyzed

TABLE E-1

SUMMARY OF ANALYTIC RESULTS - SURFACE SOIL
CRANE 158 - MUSTARD GAS BURIAL GROUND
NSWC CRANE
CRANE, INDIANA

Location	BG3SBA05	BG3SBM02	BG3SBM04	BG3SBM06	BG3SBM07	BG3SBM08
Sample	BG3SBA0501	BG3SBM0201	BG3SBM0401	BG3SBM0601	BG3SBM0701	BG3SBM0801
Matrix	Surface Soil	Surface Soil	Surface Soil	Surface Soil	Surface Soil	Surface Soil
Depth Range	0 - 1	0 - 1	0 - 1	0 - 1	0 - 1	0 - 1
Risk	Basewide Background	Basewide Background	Basewide Background	Basewide Background	Basewide Background	Basewide Background
Soil Group	3	3	3	3	3	3
Sample Date	11/4/1999	11/2/1999	11/3/1999	11/2/1999	11/3/1999	11/3/1999
Trans-1,3-Dichloropropene	NA	NA	NA	NA	NA	NA
Trans-1,4-Dichloro-2-Butene	NA	NA	NA	NA	NA	NA
Trichloroethene	NA	NA	NA	NA	NA	NA
Trichlorofluoromethane	NA	NA	NA	NA	NA	NA
Vinyl Acetate	NA	NA	NA	NA	NA	NA
Vinyl Chloride	NA	NA	NA	NA	NA	NA
Semivolatile Organics (ug/kg)						
1,2,4,5-Tetrachlorobenzene	NA	NA	NA	NA	NA	NA
1,2,4-Trichlorobenzene	NA	NA	NA	NA	NA	NA
1,2-Dichlorobenzene	NA	NA	NA	NA	NA	NA
1,3-Dichlorobenzene	NA	NA	NA	NA	NA	NA
1,4-Dichlorobenzene	NA	NA	NA	NA	NA	NA
1,4-Naphthoquinone	NA	NA	NA	NA	NA	NA
1,4-Phenylenediamine	NA	NA	NA	NA	NA	NA
1-Naphthylamine	NA	NA	NA	NA	NA	NA
2,2'-Oxybis(1-Chloropropane)	NA	NA	NA	NA	NA	NA
2,3,4,6-Tetrachlorophenol	NA	NA	NA	NA	NA	NA
2,4,5-Trichlorophenol	NA	NA	NA	NA	NA	NA
2,4,6-Trichlorophenol	NA	NA	NA	NA	NA	NA
2,4-Dichlorophenol	NA	NA	NA	NA	NA	NA
2,4-Dimethylphenol	NA	NA	NA	NA	NA	NA
2,4-Dinitrophenol	NA	NA	NA	NA	NA	NA
2,6-Dichlorophenol	NA	NA	NA	NA	NA	NA
2-Acetylaminofluorene	NA	NA	NA	NA	NA	NA
2-Chloronaphthalene	NA	NA	NA	NA	NA	NA
2-Chlorophenol	NA	NA	NA	NA	NA	NA
2-Methylnaphthalene	NA	NA	NA	NA	NA	NA
2-Methylphenol	NA	NA	NA	NA	NA	NA
2-Naphthylamine	NA	NA	NA	NA	NA	NA
2-Nitroaniline	NA	NA	NA	NA	NA	NA
2-Nitrophenol	NA	NA	NA	NA	NA	NA
2-Picoline	NA	NA	NA	NA	NA	NA
3,3'-Dichlorobenzidine	NA	NA	NA	NA	NA	NA
3,3'-Dimethylbenzidine	NA	NA	NA	NA	NA	NA
3-Methylcholanthrene	NA	NA	NA	NA	NA	NA
3-Methylphenol	NA	NA	NA	NA	NA	NA
3-Nitroaniline	NA	NA	NA	NA	NA	NA
4,6-Dinitro-2-Methylphenol	NA	NA	NA	NA	NA	NA
4-Aminobiphenyl	NA	NA	NA	NA	NA	NA
4-Bromophenyl Phenyl Ether	NA	NA	NA	NA	NA	NA
4-Chloro-3-Methylphenol	NA	NA	NA	NA	NA	NA
4-Chloroaniline	NA	NA	NA	NA	NA	NA
4-Chlorophenyl Phenyl Ether	NA	NA	NA	NA	NA	NA
4-Methylphenol	NA	NA	NA	NA	NA	NA
4-Nitroaniline	NA	NA	NA	NA	NA	NA
4-Nitrophenol	NA	NA	NA	NA	NA	NA
4-Nitroquinoline-1-Oxide	NA	NA	NA	NA	NA	NA
5-Nitro-O-Toluidine	NA	NA	NA	NA	NA	NA
7,12-Dimethylbenz(A)Anthracene	NA	NA	NA	NA	NA	NA
A,A-Dimethylphenethylamine	NA	NA	NA	NA	NA	NA
Acenaphthene	NA	NA	NA	NA	NA	NA

Calc = Calculated Value as descibed in Section 3 4 2 1
NA = Not A[illegible]d

TABLE E-1

SUMMARY OF ANALYTIC RESULTS - SURFACE SOIL
CRANE 158 - MUSTARD GAS BURIAL GROUND
NSWC CRANE
CRANE, INDIANA

Location	BG3SBA05	BG3SBM02	BG3SBM04	BG3SBM06	BG3SBM07	BG3SBM08
Sample	BG3SBA0501	BG3SBM0201	BG3SBM0401	BG3SBM0601	BG3SBM0701	BG3SBM0801
Matrix	Surface Soil	Surface Soil	Surface Soil	Surface Soil	Surface Soil	Surface Soil
Depth Range	0 - 1	0 - 1	0 - 1	0 - 1	0 - 1	0 - 1
Risk	Basewide Background	Basewide Background	Basewide Background	Basewide Background	Basewide Background	Basewide Background
Soil Group	3	3	3	3	3	3
Sample Date	11/4/1999	11/2/1999	11/3/1999	11/2/1999	11/3/1999	11/3/1999
Acenaphthylene	NA	NA	NA	NA	NA	NA
Acetophenone	NA	NA	NA	NA	NA	NA
Aniline	NA	NA	NA	NA	NA	NA
Anthracene	NA	NA	NA	NA	NA	NA
Aramite	NA	NA	NA	NA	NA	NA
Benzo(A)Anthracene	NA	NA	NA	NA	NA	NA
Benzo(A)Pyrene	NA	NA	NA	NA	NA	NA
Benzo(B)Fluoranthene	NA	NA	NA	NA	NA	NA
Benzo(G,H,I)Perylene	NA	NA	NA	NA	NA	NA
Benzo(K)Fluoranthene	NA	NA	NA	NA	NA	NA
Benzyl Alcohol	NA	NA	NA	NA	NA	NA
Bis(2-Chloroethoxy)Methane	NA	NA	NA	NA	NA	NA
Bis(2-Chloroethyl)Ether	NA	NA	NA	NA	NA	NA
Bis(2-Ethylhexyl)Phthalate	NA	NA	NA	NA	NA	NA
Butyl Benzyl Phthalate	NA	NA	NA	NA	NA	NA
Chlorobenzilate	NA	NA	NA	NA	NA	NA
Chrysene	NA	NA	NA	NA	NA	NA
Di-N-Butyl Phthalate	NA	NA	NA	NA	NA	NA
Di-N-Octyl Phthalate	NA	NA	NA	NA	NA	NA
Diallate	NA	NA	NA	NA	NA	NA
Dibenzo(A,H)Anthracene	NA	NA	NA	NA	NA	NA
Dibenzofuran	NA	NA	NA	NA	NA	NA
Diethyl Phthalate	NA	NA	NA	NA	NA	NA
Dimethyl Phthalate	NA	NA	NA	NA	NA	NA
Diphenylamine	NA	NA	NA	NA	NA	NA
Ethyl Methane Sulfonate	NA	NA	NA	NA	NA	NA
Fluoranthene	NA	NA	NA	NA	NA	NA
Fluorene	NA	NA	NA	NA	NA	NA
Hexachlorobenzene	NA	NA	NA	NA	NA	NA
Hexachlorobutadiene	NA	NA	NA	NA	NA	NA
Hexachlorocyclopentadiene	NA	NA	NA	NA	NA	NA
Hexachloroethane	NA	NA	NA	NA	NA	NA
Hexachlorophene	NA	NA	NA	NA	NA	NA
Hexachloropropene	NA	NA	NA	NA	NA	NA
Indeno(1,2,3-CD)Pyrene	NA	NA	NA	NA	NA	NA
Isodrin	NA	NA	NA	NA	NA	NA
Isophorone	NA	NA	NA	NA	NA	NA
Isosafrole	NA	NA	NA	NA	NA	NA
Kepone	NA	NA	NA	NA	NA	NA
Methapyrilene	NA	NA	NA	NA	NA	NA
Methyl Methane Sulfonate	NA	NA	NA	NA	NA	NA
N-Nitroso-Di-N-Butylamine	NA	NA	NA	NA	NA	NA
N-Nitroso-Di-N-Propylamine	NA	NA	NA	NA	NA	NA
N-Nitrosodiethylamine	NA	NA	NA	NA	NA	NA
N-Nitrosodimethylamine	NA	NA	NA	NA	NA	NA
N-Nitrosomethylethylamine	NA	NA	NA	NA	NA	NA
N-Nitrosomorpholine	NA	NA	NA	NA	NA	NA
N-Nitrosopiperidine	NA	NA	NA	NA	NA	NA
N-Nitrosopyrrolidine	NA	NA	NA	NA	NA	NA
Naphthalene	NA	NA	NA	NA	NA	NA
O,O,O-Triethyl Phosphorothioate	NA	NA	NA	NA	NA	NA

Calc = Calculated Value as described in Section 3 4.2.1.
NA = Not Analyzed

TABLE E-1

SUMMARY OF ANALYTIC RESULTS - SURFACE SOIL
CRANE 158 - MUSTARD GAS BURIAL GROUND
NSWC CRANE
CRANE, INDIANA

Location	BG3SBA05	BG3SBM02	BG3SBM04	BG3SBM06	BG3SBM07	BG3SBM08
Sample	BG3SBA0501	BG3SBM0201	BG3SBM0401	BG3SBM0601	BG3SBM0701	BG3SBM0801
Matrix	Surface Soil	Surface Soil	Surface Soil	Surface Soil	Surface Soil	Surface Soil
Depth Range	0 - 1	0 - 1	0 - 1	0 - 1	0 - 1	0 - 1
Risk	Basewide Background	Basewide Background	Basewide Background	Basewide Background	Basewide Background	Basewide Background
Soil Group	3	3	3	3	3	3
Sample Date	11/4/1999	11/2/1999	11/3/1999	11/2/1999	11/3/1999	11/3/1999
O-Toluidine	NA	NA	NA	NA	NA	NA
P-(Dimethylamino)Azobenzene	NA	NA	NA	NA	NA	NA
Pentachlorobenzene	NA	NA	NA	NA	NA	NA
Pentachloronitrobenzene	NA	NA	NA	NA	NA	NA
Phenacetin	NA	NA	NA	NA	NA	NA
Phenanthrene	NA	NA	NA	NA	NA	NA
Phenol	NA	NA	NA	NA	NA	NA
Pronamide	NA	NA	NA	NA	NA	NA
Pyrene	NA	NA	NA	NA	NA	NA
Pyridine	NA	NA	NA	NA	NA	NA
Safrole	NA	NA	NA	NA	NA	NA
Energetics (ug/kg)						
1,3,5-Trinitrobenzene	NA	NA	NA	NA	NA	NA
1,3-Dinitrobenzene	NA	NA	NA	NA	NA	NA
2,4,6-Trinitrotoluene	NA	NA	NA	NA	NA	NA
2,4-Dinitrotoluene	NA	NA	NA	NA	NA	NA
2,6-Dinitrotoluene	NA	NA	NA	NA	NA	NA
2-Amino-4,6-Dinitrotoluene	NA	NA	NA	NA	NA	NA
2-Nitrotoluene	NA	NA	NA	NA	NA	NA
3-Nitrotoluene	NA	NA	NA	NA	NA	NA
4-Amino-2,6-Dinitrotoluene	NA	NA	NA	NA	NA	NA
4-Nitrotoluene	NA	NA	NA	NA	NA	NA
Hmx	NA	NA	NA	NA	NA	NA
Nitrobenzene	NA	NA	NA	NA	NA	NA
Rdx	NA	NA	NA	NA	NA	NA
Tetryl	NA	NA	NA	NA	NA	NA
Pesticides/PCBs (ug/kg)						
4,4'-DDD	NA	NA	NA	NA	NA	NA
4,4'-DDE	NA	NA	NA	NA	NA	NA
4,4'-DDT	NA	NA	NA	NA	NA	NA
Aldrin	NA	NA	NA	NA	NA	NA
Alpha-BHC	NA	NA	NA	NA	NA	NA
Alpha-Chlordane	NA	NA	NA	NA	NA	NA
Aroclor-1016	NA	NA	NA	NA	NA	NA
Aroclor-1221	NA	NA	NA	NA	NA	NA
Aroclor-1232	NA	NA	NA	NA	NA	NA
Aroclor-1242	NA	NA	NA	NA	NA	NA
Aroclor-1248	NA	NA	NA	NA	NA	NA
Aroclor-1254	NA	NA	NA	NA	NA	NA
Aroclor-1260	NA	NA	NA	NA	NA	NA
Beta-BHC	NA	NA	NA	NA	NA	NA
Delta-BHC	NA	NA	NA	NA	NA	NA
Dieldrin	NA	NA	NA	NA	NA	NA
Endosulfan I	NA	NA	NA	NA	NA	NA
Endosulfan II	NA	NA	NA	NA	NA	NA
Endosulfan Sulfate	NA	NA	NA	NA	NA	NA
Endrin	NA	NA	NA	NA	NA	NA
Endrin Aldehyde	NA	NA	NA	NA	NA	NA
Gamma-BHC (Lindane)	NA	NA	NA	NA	NA	NA
Gamma-Chlordane	NA	NA	NA	NA	NA	NA
Heptachlor	NA	NA	NA	NA	NA	NA

Calc = Calculated Value as described in Section 3 4 2 1
NA = Not Applied

TABLE E-1

SUMMARY OF ANALYTIC RESULTS - SURFACE SOIL
CRANE 158 - MUSTARD GAS BURIAL GROUND
NSWC CRANE
CRANE, INDIANA

Location	BG3SBA05	BG3SBM02	BG3SBM04	BG3SBM06	BG3SBM07	BG3SBM08
Sample	BG3SBA0501	BG3SBM0201	BG3SBM0401	BG3SBM0601	BG3SBM0701	BG3SBM0801
Matrix	Surface Soil	Surface Soil	Surface Soil	Surface Soil	Surface Soil	Surface Soil
Depth Range	0 - 1	0 - 1	0 - 1	0 - 1	0 - 1	0 - 1
Risk	Basewide Background	Basewide Background	Basewide Background	Basewide Background	Basewide Background	Basewide Background
Soil Group	3	3	3	3	3	3
Sample Date	11/4/1999	11/2/1999	11/3/1999	11/2/1999	11/3/1999	11/3/1999
Heptachlor Epoxide	NA	NA	NA	NA	NA	NA
Methoxychlor	NA	NA	NA	NA	NA	NA
Toxaphene	NA	NA	NA	NA	NA	NA
Herbicides (ug/kg)						
2,4,5-T	NA	NA	NA	NA	NA	NA
2,4,5-TP (Silvex)	NA	NA	NA	NA	NA	NA
2,4-D	NA	NA	NA	NA	NA	NA
Dinoseb	NA	NA	NA	NA	NA	NA
Pentachlorophenol	NA	NA	NA	NA	NA	NA
Inorganics (mg/kg)						
Aluminum	9800 J	10400	9900	9320	12300	8450
Antimony	0 41 U	0 38 U	5 6 J	0 44 U	1 4 J	0 36 U
Arsenic	8	5 9 J	5 5 J	7 8 J	10 2 J	4 6 J
Barium	128 J	71 8 J	118 J	153 J	143 J	65 2 J
Beryllium	0 73 U	0 65 U	0 94 U	0 77 U	1.2 U	0 61 U
Cadmium	0 28 U	3 6 J	1 2 J	0 83 J	0 72 J	0 83 J
Calcium	595 J	303 J	424 J	35300 J	286 J	370 J
Chromium	11 1 J	17 8 J	12 2 J	13 1 J	16.4 J	17 6 J
Cobalt	8 7	15 2	13 5	13 7	27 1	8 4
Copper	7 5	7 6	8 1 J	7 6	7 1 J	7 9 J
Iron	10700 J	15700	12400	15000	20900	13200
Lead	12 3 J	16 6 J	14 2 J	17 8 J	20 6 J	14 3 J
Magnesium	1000 J	1210 J	1310 J	1330 J	1110 J	1040 J
Manganese	1430 J	851 J	1380 J	1690 J	3040 J	666 J
Mercury	0 05 U	0 05 U	0 05 U	0 05 U	0 05 U	0 05
Nickel	12 8 J	11 2 J	13 8 J	14 2 J	13 6 J	10 2 J
Potassium	821	688	801	1340	791	630
Selenium	0 73 U	0 98 U	0 94 U	1 U	1 3 U	0 72 U
Silver	0 06 J	0 05 J	0 06 J	0 06 J	0 06 J	0 06 J
Sodium	2 8 U	9 4 J	2 8 U	23 7 J	13 7 U	4 4 U
Strontium	9 9 J	8 6 J	13 3 J	63 2 J	11 1 J	7 4 J
Thallium	0 22 J	0 16 J	0 22 J	0 18 J	0 22 J	0 17 J
Thorium	5 3 J	7 1 J	7 3 J	5.9 J	7 8 J	5 8 J
Thorium-Calc	NA	NA	NA	NA	NA	NA
Tin	0 56 U	0 65 U	0 59 U	1 2 U	1 2 U	0 52 U
Vanadium	19 4 J	26 9	23 1	21 6	37 4	22 3
Zinc	30 2 U	35 1 J	37 2 J	40 2 J	60 2 J	28 1 J
Miscellaneous Parameters						
1,4-Dithiane (ug/kg)	NA	NA	NA	NA	NA	NA
1,4-Oxathiane (ug/kg)	NA	NA	NA	NA	NA	NA
Bis(2-Chloroethyl)Sulfide (ug/kg)	NA	NA	NA	NA	NA	NA
Cation Exchange Capacity (meq/100g	NA	NA	NA	NA	NA	NA
pH (S U)	NA	NA	NA	NA	NA	NA
Total Organic Carbon (mg/kg)	NA	NA	NA	NA	NA	NA
Total Radiologicals (pCi/g)						
Actinium-228	NA	NA	NA	NA	NA	NA
Bismuth-212	NA	NA	NA	NA	NA	NA
Bismuth-214	NA	NA	NA	NA	NA	NA
Cesium-137	NA	NA	NA	NA	NA	NA
Cobalt-60	NA	NA	NA	NA	NA	NA
Europium-154	NA	NA	NA	NA	NA	NA

Calc = Calculated Value as described in Section 3 4 2 1
NA = Not Analyzed

TABLE E-1

SUMMARY OF ANALYTIC RESULTS - SURFACE SOIL
CRANE 158 - MUSTARD GAS BURIAL GROUND
NSWC CRANE
CRANE, INDIANA

Location	BG3SBA05	BG3SBM02	BG3SBM04	BG3SBM06	BG3SBM07	BG3SBM08
Sample	BG3SBA0501	BG3SBM0201	BG3SBM0401	BG3SBM0601	BG3SBM0701	BG3SBM0801
Matrix	Surface Soil	Surface Soil	Surface Soil	Surface Soil	Surface Soil	Surface Soil
Depth Range	0 - 1	0 - 1	0 - 1	0 - 1	0 - 1	0 - 1
Risk	Basewide Background	Basewide Background	Basewide Background	Basewide Background	Basewide Background	Basewide Background
Soil Group	3	3	3	3	3	3
Sample Date	11/4/1999	11/2/1999	11/3/1999	11/2/1999	11/3/1999	11/3/1999
Europium-155	NA	NA	NA	NA	NA	NA
Lead-210	NA	NA	NA	NA	NA	NA
Lead-212	NA	NA	NA	NA	NA	NA
Lead-214	NA	NA	NA	NA	NA	NA
Potassium-40	NA	NA	NA	NA	NA	NA
Protactinium-234	NA	NA	NA	NA	NA	NA
Radium-226	NA	NA	NA	NA	NA	NA
Thallium-208	NA	NA	NA	NA	NA	NA
Thorium-228	NA	NA	NA	NA	NA	NA
Thorium-230	NA	NA	NA	NA	NA	NA
Thorium-232	NA	NA	NA	NA	NA	NA
Thorium-234	NA	NA	NA	NA	NA	NA
Uranium-235	NA	NA	NA	NA	NA	NA

Calc = Calculated Value as described in Section 3 4 2 1
NA = Not Applied

TABLE E-2

SUMMARY OF ANALYTIC RESULTS- SUBSURFACE SOIL
CRANE 158 - MUSTARD GAS BURIAL GROUND
NSWC CRANE
CRANE, INDIANA

Location	01SB01	01SB02	01SB02	01SB03	01SB04	01SB04	01SB05	01SB05	01SB06	01SB06
Sample	01SB010206	01SB020206	01SB020610	01SB030206	01SB040206	01SB040610	01SB050206	01SB050610	01SB060206	01SB060610
Matrix	Subsurface Soil	Subsurface Soil	Subsurface Soil	Subsurface Soil	Subsurface Soil	Subsurface Soil	Subsurface Soil	Subsurface Soil	Subsurface Soil	Subsurface Soil
Depth Range	2 - 6	2 - 6	6 - 9 5	2 - 6	2 - 6	6 - 10	2 - 6	6 - 8.5	2 - 6	6 - 10
Risk	Site	Site	Site	Site	Site	Site	Site	Site	Site	Site
Soil Group	8	8	8	8	8	8	8	8	8	8
Sample Date	8/26/2001	8/26/2001	8/26/2001	8/26/2001	8/26/2001	8/26/2001	8/26/2001	8/26/2001	8/27/2001	8/27/2001
Volatile Organics (ug/kg)										
1,1,1,2-Tetrachloroethane	3 U	3 U	3 U	3 U	2 U	3 U	3 U	3 U	3 U	3 U
1,1,1-Trichloroethane	3 U	3 U	3 U	3 U	2 U	3 U	3 U	3 U	3 U	3 U
1,1,2,2-Tetrachloroethane	3 UJ	3 UJ	3 UJ	3 U	2 UJ	3 UJ	3 U	3 UJ	3 U	3 U
1,1,2-Trichloroethane	6 U	5 U	5 U	5 U	4 U	5 U	5 U	5 U	5 U	5 U
1,1-Dichloroethane	3 UJ	3 U	3 U	3 UJ	2 U	3 U	3 UJ	3 UJ	3 U	3 U
1,1-Dichloroethene	6 U	5 U	5 U	5 U	4 U	5 U	5 U	5 U	5 U	5 U
1,2,3-Trichloropropane	3 UJ	3 UJ	3 UJ	3 UJ	2 UJ	3 UJ	3 UJ	3 UJ	3 U	3 U
1,2-Dibromo-3-Chloropropane	6 UJ	5 UJ	5 UJ	5 UJ	4 UJ	5 UJ	5 UJ	5 UJ	5 U	5 U
1,2-Dibromoethane	3 UJ	3 UJ	3 UJ	3 U	2 UJ	3 UJ	3 U	3 UJ	3 U	3 U
1,2-Dichloroethane	3 U	3 U	3 U	3 U	2 U	3 U	3 U	3 U	3 U	3 U
1,2-Dichloropropane	6 U	5 U	5 U	5 U	4 U	5 U	5 U	5 U	5 U	5 U
1,4-Dioxane	570 UR	510 UR	500 UR	530 UR	450 UR	460 UR	540 UR	490 UR	530 UR	500 UR
2-Butanone	6 UJ	5 UJ	5 UJ	5 UJ	4 UJ	5 UJ	5 UJ	5 UJ	5 U	5 U
2-Hexanone	6 UJ	5 UJ	5 UJ	5 UJ	4 UJ	5 UJ	5 UJ	5 UJ	5 U	5 U
3-Chloropropene	6 UJ	5 UJ	5 UJ	5 UJ	4 UJ	5 UJ	5 UJ	5 UJ	5 U	5 U
4-Methyl-2-Pentanone	3 UJ	3 UJ	3 UJ	3 UJ	2 UJ	3 UJ	3 UJ	3 UJ	3 UJ	3 UJ
Acetone	6 UJ	5 UJ	5 UJ	5 UJ	4 UJ	5 UJ	5 UJ	5 UJ	32 J	9 J
Acetonitrile	230 UJ	200 UJ	200 UJ	210 UJ	180 UJ	180 UJ	220 UJ	200 UJ	210 UJ	200 UJ
Acrolein	57 UR	51 UR	50 UR	53 UR	45 UR	46 UR	54 UR	49 UR	53 UR	50 UR
Acrylonitrile	57 UJ	51 UJ	50 UJ	53 UJ	45 UJ	46 UJ	54 UJ	49 UJ	53 U	50 U
Benzene	3 U	3 U	3 U	3 U	2 U	3 U	3 U	3 U	3 U	3 U
Bromodichloromethane	3 U	3 U	3 U	3 U	2 U	3 U	3 U	3 U	3 U	3 U
Bromofor	3 UJ	3 UJ	3 UJ	3 U	2 U	3 U	3 U	3 UJ	3 U	3 U
Bromomethane	6 UJ	5 U	5 U	5 U	4 U	5 U	5 U	5 UJ	5 U	5 U
Carbon Disulfide	3 U	3 U	3 U	3 U	2 U	3 U	3 U	3 U	3 U	3 U
Carbon Tetrachloride	3 UJ	3 UJ	3 UJ	3 UJ	2 UJ	3 UJ	3 UJ	3 UJ	3 UJ	3 UJ
Chlorobenzene	3 U	3 U	3 U	3 U	2 U	3 U	3 U	3 U	3 U	3 U
Chlorodibromomethane	3 U	3 U	3 U	3 U	2 U	3 U	3 U	3 U	3 U	3 U
Chloroethane	6 U	5 U	5 U	5 U	4 U	5 U	5 U	5 U	5 U	5 U
Chlorofor	3 U	3 U	3 U	3 U	2 U	3 U	3 U	3 U	3 U	3 U
Chloromethane	6 U	5 U	5 U	5 U	4 U	5 U	5 U	5 U	5 U	5 U
Chloroprene	6 UJ	5 UJ	5 UJ	5 UJ	4 UJ	5 UJ	5 UJ	5 UJ	5 UJ	5 UJ
Cis-1,2-Dichloroethene	6 U	5 U	5 U	5 U	4 U	5 U	5 U	5 U	5 U	5 U
Cis-1,3-Dichloropropene	3 U	3 U	3 U	3 U	2 U	3 U	3 U	3 U	3 U	3 U
Dibromomethane	6 U	5 U	5 U	5 U	4 U	5 U	5 U	5 U	5 U	5 U
Dichlorodifluoromethane	3 U	3 U	3 U	3 U	2 U	3 U	3 U	3 U	3 U	3 U
Ethyl Methacrylate	6 UJ	5 UJ	5 UJ	5 U	4 UJ	5 UJ	5 U	5 UJ	5 U	5 U
Ethylbenzene	3 U	3 U	3 U	3 U	2 U	3 U	3 U	3 U	3 U	3 U
Isobutanol	230 UR	200 UR	200 UR	210 UR	180 UR	180 UR	220 UR	200 UR	210 UR	200 UR
Methacrylonitrile	110 UJ	100 UJ	100 UJ	110 UJ	90 UJ	91 UJ	110 UJ	99 UJ	110 UJ	100 UJ
Methyl Iodide	6 UJ	5 U	5 U	5 U	4 UJ	5 UJ	5 U	5 UJ	5 UJ	5 UJ
Methyl Methacrylate	6 UJ	5 UJ	5 UJ	5 UJ	4 U	5 U	5 UJ	5 UJ	5 U	5 U
Methylene Chloride	40 BU	20 U	6 U	9 U	3 J	5 U	54 U	48 BU	58 J	46 J
Pentachloroethane	6 UJ	5 UJ	5 UJ	5 UJ	4 UJ	5 UJ	5 UJ	5 UJ	5 U	5 U
Propionitrile	110 UR	100 UR	100 UR	110 UR	90 UR	91 UR	110 UR	99 UR	110 UR	100 UR
Styrene	3 U	3 U	3 U	3 U	2 U	3 U	3 U	3 U	3 U	3 U
Tetrachloroethene	3 UJ	3 UJ	3 UJ	3 U	2 UJ	3 UJ	3 U	3 UJ	3 U	3 U
Toluene	3 U	3 U	3 U	3 U	2 U	3 U	3 U	3 U	3 U	3 U
Total Xylenes	3 U	3 U	3 U	3 U	2 U	3 U	3 U	3 U	3 U	3 U

Calc = Calculated Value as descibed in Section 3 4 2.1
NA = Not Analyzed

TABLE E-2

SUMMARY OF ANALYTIC RESULTS- SUBSURFACE SOIL
CRANE 158 - MUSTARD GAS BURIAL GROUND
NSWC CRANE
CRANE, INDIANA

Location	01SB01	01SB02	01SB02	01SB03	01SB04	01SB04	01SB05	01SB05	01SB06	01SB06
Sample	01SB010206	01SB020206	01SB020610	01SB030206	01SB040206	01SB040610	01SB050206	01SB050610	01SB060206	01SB060610
Matrix	Subsurface Soil	Subsurface Soil	Subsurface Soil	Subsurface Soil	Subsurface Soil	Subsurface Soil	Subsurface Soil	Subsurface Soil	Subsurface Soil	Subsurface Soil
Depth Range	2 - 6	2 - 6	6 - 9.5	2 - 6	2 - 6	6 - 10	2 - 6	6 - 8.5	2 - 6	6 - 10
Risk	Site	Site	Site	Site	Site	Site	Site	Site	Site	Site
Soil Group	8	8	8	8	8	8	8	8	8	8
Sample Date	8/26/2001	8/26/2001	8/26/2001	8/26/2001	8/26/2001	8/26/2001	8/26/2001	8/26/2001	8/27/2001	8/27/2001
Trans-1,2-Dichloroethene	6 U	5 U	5 U	5 U	4 U	5 U	5 U	5 U	5 U	5 U
Trans-1,3-Dichloropropene	3 U	3 U	3 U	3 U	2 U	3 U	3 U	3 U	3 U	3 U
Trans-1,4-Dichloro-2-Butene	6 U	5 U	5 U	5 U	4 UJ	5 UJ	5 U	5 U	5 U	5 U
Trichloroethene	3 U	3 U	3 U	3 U	2 U	3 U	3 U	3 U	3 U	3 U
Trichlorofluoromethane	6 U	5 U	5 U	5 U	4 U	5 U	5 U	5 U	5 UJ	5 UJ
Vinyl Acetate	3 U	3 U	3 U	3 U	2 U	3 U	3 U	3 U	3 U	3 U
Vinyl Chloride	6 U	5 U	5 U	5 U	4 U	5 U	5 U	5 U	5 U	5 U
Semivolatile Organics (ug/kg)										
1,2,4,5-Tetrachlorobenzene	400 U	400 U	360 U	410 U	370 U	370 U	360 U	370 U	400 U	400 U
1,2,4-Trichlorobenzene	400 U	400 U	360 U	410 U	370 U	370 U	360 U	370 U	400 U	400 U
1,2-Dichlorobenzene	200 U	200 U	180 U	210 U	190 U	190 U	180 U	190 U	200 U	200 U
1,3-Dichlorobenzene	200 U	200 U	180 U	210 U	190 U	190 U	180 U	190 U	200 U	200 U
1,4-Dichlorobenzene	200 U	200 U	180 U	210 U	190 U	190 U	180 U	190 U	200 U	200 U
1,4-Naphthoquinone	400 U	400 U	360 U	410 U	370 U	370 U	360 U	370 U	400 U	400 U
1,4-Phenylenediamine	990 UJ	1000 UJ	910 UJ	1000 UJ	920 U	920 U	890 UJ	940 UJ	990 UJ	1000 UJ
1-Naphthylamine	400 U	400 U	360 U	410 U	370 U	370 U	360 U	370 U	400 U	400 U
2,2'-Oxybis(1-Chloropropane)	200 U	200 U	180 U	210 U	190 U	190 U	180 U	190 U	200 U	200 U
2,3,4,6-Tetrachlorophenol	400 U	400 U	360 U	410 U	370 U	370 U	360 U	370 U	400 U	400 U
2,4,5-Trichlorophenol	990 U	1000 U	910 U	1000 U	920 U	920 U	890 U	940 U	990 U	1000 U
2,4,6-Trichlorophenol	400 U	400 U	360 U	410 U	370 U	370 U	360 U	370 U	400 U	400 U
2,4-Dichlorophenol	400 U	400 U	360 U	410 U	370 U	370 U	360 U	370 U	400 U	400 U
2,4-Dimethylphenol	400 U	400 U	360 U	410 U	370 U	370 U	360 U	370 U	400 U	400 U
2,4-Dinitrophenol	990 U	1000 U	910 U	1000 U	920 U	920 U	890 U	940 U	990 U	1000 U
2,6-Dichlorophenol	400 U	400 U	360 U	410 U	370 U	370 U	360 U	370 U	400 U	400 U
2-Acetylaminofluorene	200 U	200 U	180 U	210 U	190 U	190 U	180 U	190 U	200 U	200 U
2-Chloronaphthalene	200 U	200 U	180 U	210 U	190 U	190 U	180 U	190 U	200 U	200 U
2-Chlorophenol	200 U	200 U	180 U	210 U	190 U	190 U	180 U	190 U	200 U	200 U
2-Methylnaphthalene	200 U	200 U	180 U	210 U	190 U	190 U	180 U	190 U	200 U	200 U
2-Methylphenol	200 U	200 U	180 U	210 U	190 U	190 U	180 U	190 U	200 U	200 U
2-Naphthylamine	200 U	200 U	190 U	210 U	190 U	190 U	190 U	190 U	200 U	200 U
2-Nitroaniline	500 U	500 U	460 U	500 U	460 U	460 U	450 U	470 U	500 U	500 U
2-Nitrophenol	400 U	400 U	360 U	410 U	370 U	370 U	360 U	370 U	400 U	400 U
2-Picoline	300 U	300 U	270 U	310 U	280 U	280 U	270 U	280 U	300 U	300 U
3,3'-Dichlorobenzidine	400 U	400 U	360 U	410 U	370 U	370 U	360 U	370 U	400 U	400 U
3,3'-Dimethylbenzidine	400 U	400 U	360 U	410 U	370 U	370 U	360 U	370 U	400 U	400 U
3-Methylcholanthrene	440 U	450 U	410 U	470 U	410 U	410 U	400 U	420 U	450 U	450 U
3-Methylphenol	200 U	200 U	180 U	210 U	190 U	190 U	180 U	190 U	200 U	200 U
3-Nitroaniline	990 U	1000 U	910 U	1000 U	920 U	920 U	890 U	940 U	990 U	1000 U
4,6-Dinitro-2-Methylphenol	990 U	1000 U	910 U	1000 U	920 U	920 U	890 U	940 U	990 U	1000 U
4-Aminobiphenyl	200 U	200 U	180 U	210 U	190 U	190 U	180 U	190 U	200 U	200 U
4-Bromophenyl Phenyl Ether	400 U	400 U	360 U	410 U	370 U	370 U	360 U	370 U	400 U	400 U
4-Chloro-3-Methylphenol	400 U	400 U	360 U	410 U	370 U	370 U	360 U	370 U	400 U	400 U
4-Chloroaniline	400 U	400 U	360 U	410 U	370 U	370 U	360 U	370 U	400 U	400 U
4-Chlorophenyl Phenyl Ether	200 U	200 U	180 U	210 U	190 U	190 U	180 U	190 U	200 U	200 U
4-Methylphenol	200 U	200 U	180 U	210 U	190 U	190 U	180 U	190 U	200 U	200 U
4-Nitroaniline	990 U	1000 U	910 U	1000 U	920 U	920 U	890 U	940 U	990 U	1000 U
4-Nitrophenol	990 U	1000 U	910 U	1000 U	920 U	920 U	890 U	940 U	990 U	1000 U
4-Nitroquinoline-1-Oxide	990 UR	1000 UR	910 UR	1000 UR	920 UR	920 UR	890 UR	940 UR	990 UR	1000 UR
5-Nitro-O-Toluidine	400 U	400 U	360 U	410 U	370 U	370 U	360 U	370 U	400 U	400 U
7,12-Dimethylbenz(A)Anthracene	300 U	300 U	270 U	310 U	280 U	280 U	270 U	280 U	300 U	300 U

Calc = Calculated Value as descibed in Section 3 4.2 1
NA = Not Analyzed

TABLE E-2

SUMMARY OF ANALYTIC RESULTS- SUBSURFACE SOIL
CRANE 158 - MUSTARD GAS BURIAL GROUND
NSWC CRANE
CRANE, INDIANA

Location	01SB01	01SB02	01SB02	01SB03	01SB04	01SB04	01SB05	01SB05	01SB06	01SB06
Sample	01SB010206	01SB020206	01SB020610	01SB030206	01SB040206	01SB040610	01SB050206	01SB050610	01SB060206	01SB060610
Matrix	Subsurface Soil	Subsurface Soil	Subsurface Soil	Subsurface Soil	Subsurface Soil	Subsurface Soil	Subsurface Soil	Subsurface Soil	Subsurface Soil	Subsurface Soil
Depth Range	2 - 6	2 - 6	6 - 9.5	2 - 6	2 - 6	6 - 10	2 - 6	6 - 8.5	2 - 6	6 - 10
Risk	Site	Site	Site	Site	Site	Site	Site	Site	Site	Site
Soil Group	8	8	8	8	8	8	8	8	8	8
Sample Date	8/26/2001	8/26/2001	8/26/2001	8/26/2001	8/26/2001	8/26/2001	8/26/2001	8/26/2001	8/27/2001	8/27/2001
A,A-Dimethylphenethylamine	990 U	1000 U	910 U	1000 U	920 U	920 U	890 U	940 U	990 U	1000 U
Acenaphthene	11.7 U	12.1 U	10.9 U	12.3 U	11 U	11 U	10.7 U	11.2 U	30.3	4.34 J
Acenaphthylene	11.7 U	12.1 U	10.9 U	12.3 U	11 U	11 U	10.7 U	11.2 U	12 U	12 U
Acetophenone	200 U	200 U	180 U	210 U	190 U	190 U	180 U	190 U	200 U	200 U
Aniline	200 U	200 U	180 U	210 U	190 U	190 U	180 U	190 U	200 U	200 U
Anthracene	11.7 U	12.1 U	10.9 U	12.3 U	11 U	11 U	10.7 U	11.2 U	12 U	12 U
Aramite	990 U	1000 U	910 U	1000 U	920 U	920 U	890 U	940 U	990 U	1000 U
Benzo(A)Anthracene	11.7 U	12.1 U	10.9 U	12.3 U	11 U	11 U	10.7 U	11.2 U	12 U	12 U
Benzo(A)Pyrene	11.7 U	12.1 U	10.9 U	12.3 U	11 U	11 U	10.7 U	11.2 U	12 U	12 U
Benzo(B)Fluoranthene	11.7 U	12.1 U	10.9 U	12.3 U	11 U	11 U	10.7 U	11.2 U	12 U	12 U
Benzo(G,H,I)Perylene	11.7 U	12.1 U	10.9 U	12.3 U	11 U	11 U	10.7 U	11.2 U	12 U	12 U
Benzo(K)Fluoranthene	11.7 U	12.1 U	10.9 U	12.3 U	11 U	11 U	10.7 U	11.2 U	12 U	12 U
Benzyl Alcohol	270 U	270 U	270 U	270 U	270 U	270 U	270 U	270 U	270 U	270 U
Bis(2-Chloroethoxy)Methane	400 U	400 U	360 U	410 U	370 U	370 U	360 U	370 U	400 U	400 U
Bis(2-Chloroethyl)Ether	200 U	200 U	180 U	210 U	190 U	190 U	180 U	190 U	200 U	200 U
Bis(2-Ethylhexyl)Phthalate	200 U	200 U	180 U	210 U	190 U	190 U	180 U	110 J	200 U	200 U
Butyl Benzyl Phthalate	200 U	200 U	180 U	210 U	190 U	190 U	180 U	190 U	200 U	200 U
Chlorobenzilate	400 U	400 U	360 U	410 U	370 U	370 U	360 U	370 U	400 U	400 U
Chrysene	11.7 U	12.1 U	10.9 U	12.3 U	11 U	11 U	10.7 U	11.2 U	12 U	12 U
Di-N-Butyl Phthalate	200 U	200 U	180 U	210 U	190 UJ	190 U	180 U	190 U	200 UJ	200 UJ
Di-N-Octyl Phthalate	200 U	200 U	190 U	210 U	190 U	190 U	190 U	190 U	200 U	200 U
Diallate	400 U	400 U	360 U	410 U	370 U	370 U	360 U	370 U	400 U	400 U
Dibenzo(A,H)Anthracene	11.7 U	12.1 U	10.9 U	12.3 U	11 U	11 U	10.7 U	11.2 U	12 U	12 U
Dibenzofuran	200 U	200 U	180 U	210 U	190 U	190 U	180 U	190 U	200 U	200 U
Diethyl Phthalate	200 U	200 U	180 U	210 U	190 U	190 U	180 U	190 U	200 U	200 U
Dimethyl Phthalate	200 U	200 U	180 U	210 U	190 U	190 U	180 U	190 U	200 U	200 U
Diphenylamine	200 U	200 U	180 U	210 U	190 U	190 U	180 U	190 U	200 U	200 U
Ethyl Methane Sulfonate	200 U	200 U	180 U	210 U	190 U	190 U	180 U	190 U	200 U	200 U
Fluoranthene	11.7 U	12.1 U	10.9 U	12.3 U	11 U	11 U	10.7 U	11.2 U	12 U	12 U
Fluorene	11.7 U	12.1 U	10.9 U	12.3 U	11 U	11 U	10.7 U	11.2 U	12 U	12 U
Hexachlorobenzene	400 U	400 U	360 U	410 U	370 U	370 U	360 U	370 U	400 U	400 U
Hexachlorobutadiene	400 U	400 U	360 U	410 U	370 U	370 U	360 U	370 U	400 U	400 U
Hexachlorocyclopentadiene	400 U	400 U	360 U	410 U	370 U	370 U	360 U	370 U	400 U	400 U
Hexachloroethane	200 U	200 U	180 U	210 U	190 U	190 U	180 U	190 U	200 U	200 U
Hexachlorophene	16000 UJ	16000 UJ	14000 UJ	17000 UJ	15000 U	15000 U	14000 UJ	15000 UJ	16000 UJ	16000 UJ
Hexachloropropene	400 U	400 U	360 U	410 U	370 U	370 U	360 U	370 U	400 U	400 U
Indeno(1,2,3-CD)Pyrene	11.7 U	12.1 U	10.9 U	12.3 U	11 U	11 U	10.7 U	11.2 U	12 U	12 U
Isodrin	400 U	400 U	360 U	410 U	370 U	370 U	360 U	370 U	400 U	400 U
Isophorone	200 U	200 U	180 U	210 U	190 U	190 U	180 U	190 U	200 U	200 U
Isosafrole	400 U	400 U	360 U	410 U	370 U	370 U	360 U	370 U	400 U	400 U
Kepone	990 U	1000 U	910 U	1000 U	920 U	920 U	890 U	940 U	990 U	1000 U
Methapyrilene	990 UR	1000 UR	910 UR	1000 UR	920 U	920 U	890 UR	940 UR	990 UR	1000 UR
Methyl Methane Sulfonate	500 U	500 U	460 U	500 U	460 U	460 U	450 U	470 U	500 U	500 U
N-Nitroso-Di-N-Butylamine	400 U	400 U	360 U	410 U	370 U	370 U	360 U	370 U	400 U	400 U
N-Nitroso-Di-N-Propylamine	200 U	200 U	180 U	210 U	190 U	190 U	180 U	190 U	200 U	200 U
N-Nitrosodiethylamine	200 U	200 U	180 U	210 U	190 U	190 U	180 U	190 U	200 U	200 U
N-Nitrosodimethylamine	200 U	200 U	180 U	210 U	190 U	190 U	180 U	190 U	200 U	200 U
N-Nitrosomethylethylamine	200 U	200 U	180 U	210 U	190 U	190 U	180 U	190 U	200 U	200 U
N-Nitrosomorpholine	200 U	200 U	180 U	210 U	190 U	190 U	180 U	190 U	200 U	200 U
N-Nitrosopiperidine	400 U	400 U	360 U	410 U	370 U	370 U	360 U	370 U	400 U	400 U

Calc = Calculated Value as described in Section 3 4 2 1
NA = Not Analyzed

TABLE E-2

SUMMARY OF ANALYTIC RESULTS- SUBSURFACE SOIL
CRANE 158 - MUSTARD GAS BURIAL GROUND
NSWC CRANE
CRANE, INDIANA

Location	01SB01	01SB02	01SB02	01SB03	01SB04	01SB04	01SB05	01SB05	01SB06	01SB06
Sample	01SB010206	01SB020206	01SB020610	01SB030206	01SB040206	01SB040610	01SB050206	01SB050610	01SB060206	01SB060610
Matrix	Subsurface Soil	Subsurface Soil	Subsurface Soil	Subsurface Soil	Subsurface Soil	Subsurface Soil	Subsurface Soil	Subsurface Soil	Subsurface Soil	Subsurface Soil
Depth Range	2 - 6	2 - 6	6 - 9.5	2 - 6	2 - 6	6 - 10	2 - 6	6 - 8.5	2 - 6	6 - 10
Risk	Site	Site	Site	Site	Site	Site	Site	Site	Site	Site
Soil Group	8	8	8	8	8	8	8	8	8	8
Sample Date	8/26/2001	8/26/2001	8/26/2001	8/26/2001	8/26/2001	8/26/2001	8/26/2001	8/26/2001	8/27/2001	8/27/2001
N-Nitrosopyrrolidine	200 U	200 U	180 U	210 U	190 U	190 U	180 U	190 U	200 U	200 U
Naphthalene	11 7 U	8 85 J	10 9 U	8 52 J	11 U	11 U	10 7 U	11 2 U	12 U	12 U
O,O,O-Triethyl Phosphorothioate	400 U	400 U	360 U	410 U	370 U	370 U	360 U	370 U	400 U	400 U
O-Toluidine	200 U	200 U	180 U	210 U	190 U	190 U	180 U	190 U	200 U	200 U
P-(Dimethylamino)Azobenzene	400 U	400 U	360 U	410 U	370 U	370 U	360 U	370 U	400 U	400 U
Pentachlorobenzene	400 U	400 U	360 U	410 U	370 U	370 U	360 U	370 U	400 U	400 U
Pentachloronitrobenzene	990 U	1000 U	910 U	1000 U	920 U	920 U	890 U	940 U	990 U	1000 U
Phenacetin	400 U	400 U	360 U	410 U	370 U	370 U	360 U	370 U	400 U	400 U
Phenanthrene	11 7 U	12 1 U	10 9 U	12 3 U	11 U	11 U	10 7 U	11 2 U	12 U	12 U
Phenol	200 U	200 U	180 U	210 U	190 U	190 U	180 U	190 U	200 U	200 U
Pronamide	400 UR	400 UR	360 UR	410 UR	370 U	370 U	360 UR	370 UR	400 UR	400 UR
Pyrene	11 7 U	12 1 U	10.9 U	12 3 U	11 U	11 U	10 7 U	11 2 U	12 U	12 U
Pyridine	220 U	220 U	220 U	220 U	220 U	220 U	220 U	220 U	220 U	220 U
Safrole	400 U	400 U	360 U	410 U	370 U	370 U	360 U	370 U	400 U	400 U
Energetics (ug/kg)										
1,3,5-Trinitrobenzene	476 U	500 U	476 U	476 U	476 U	476 U	454 U	476 U	454 U	476 U
1,3-Dinitrobenzene	476 U	500 U	476 U	476 U	476 U	476 U	454 U	476 U	454 U	476 U
2,4,6-Trinitrotoluene	476 U	500 U	476 U	476 U	476 U	476 U	454 U	476 U	454 U	476 U
2,4-Dinitrotoluene	476 U	500 U	476 U	476 U	476 U	476 U	454 U	476 U	454 U	476 U
2,6-Dinitrotoluene	476 U	500 U	476 U	476 U	476 U	476 U	454 U	476 U	454 U	476 U
2-Amino-4,6-Dinitrotoluene	476 U	500 U	476 U	476 U	476 U	476 U	454 U	476 U	454 U	476 U
2-Nitrotoluene	476 U	500 U	476 U	476 U	476 U	476 U	454 U	476 U	454 U	476 U
3-Nitrotoluene	476 U	500 U	476 U	476 U	476 U	476 U	454 U	476 U	454 U	476 U
4-Amino-2,6-Dinitrotoluene	476 U	500 U	476 U	476 U	476 U	476 U	454 U	476 U	454 U	476 U
4-Nitrotoluene	476 U	500 U	476 U	476 U	476 U	476 U	454 U	476 U	454 U	476 U
HMX	476 U	500 U	476 U	476 U	476 U	476 U	454 U	476 U	454 U	476 U
Nitrobenzene	476 U	500 U	476 U	476 U	476 U	476 U	454 U	476 U	454 U	476 U
RDX	476 U	500 U	476 U	476 U	476 U	476 U	454 U	476 U	454 U	476 U
Tetryl	476 U	500 U	476 U	476 U	476 U	476 U	454 U	476 U	454 U	476 U
Pesticides/PCBs (ug/kg)										
4,4'-DDD	3 U	3 U	NA	3 1 U	2 8 U	NA	2 7 U	NA	3 U	NA
4,4'-DDE	3 U	3 U	NA	3 1 U	2 8 U	NA	2 7 U	NA	3 U	NA
4,4'-DDT	3 UJ	3 UJ	NA	3 1 UJ	2 8 U	NA	2 7 UJ	NA	3 U	NA
Aldrin	1 5 U	1 6 U	NA	1 6 U	1 4 U	NA	1 4 U	NA	1 5 U	NA
Alpha-BHC	1 5 U	1 6 U	NA	1 6 U	1 4 U	NA	1 4 U	NA	1 5 U	NA
Alpha-Chlordane	1 5 U	1 6 U	NA	1 6 U	1 4 U	NA	1 4 U	NA	1 5 U	NA
Aroclor-1016	39 U	40 U	NA	41 U	36 U	NA	35 U	NA	39 U	NA
Aroclor-1221	39 U	40 U	NA	41 U	36 U	NA	35 U	NA	39 U	NA
Aroclor-1232	39 U	40 U	NA	41 U	36 U	NA	35 U	NA	39 U	NA
Aroclor-1242	39 U	40 U	NA	41 U	36 U	NA	35 U	NA	39 U	NA
Aroclor-1248	39 U	40 U	NA	41 U	36 U	NA	35 U	NA	39 U	NA
Aroclor-1254	39 U	40 U	NA	41 U	36 U	NA	35 U	NA	39 U	NA
Aroclor-1260	39 U	40 U	NA	41 U	36 U	NA	35 U	NA	39 U	NA
Beta-BHC	1 5 U	1 6 U	NA	1 6 U	1 4 U	NA	1 4 U	NA	1 5 U	NA
Delta-BHC	1 5 U	1 6 U	NA	1 6 U	1 4 U	NA	1 4 U	NA	1 5 U	NA
Dieldrin	3 U	3 U	NA	3 1 U	2 8 U	NA	2 7 U	NA	3 U	NA
Endosulfan I	1 5 U	1 6 U	NA	1 6 U	1 4 U	NA	1 4 U	NA	1.5 U	NA
Endosulfan II	3 UJ	3 UJ	NA	3 1 UJ	2 8 U	NA	2 7 U	NA	3 U	NA
Endosulfan Sulfate	3 U	3 U	NA	3 1 U	2 8 U	NA	2 7 U	NA	3 U	NA
Endrin	3 U	3 U	NA	3 1 U	2 8 U	NA	2 7 U	NA	3 U	NA

Calc = Calculated Value as described in Section 3 4 2 1
NA = Not Analyzed

TABLE-2

SUMMARY OF ANALYTIC RESULTS- SUBSURFACE SOIL
CRANE 158 - MUSTARD GAS BURIAL GROUND
NSWC CRANE
CRANE, INDIANA

Location	01SB01	01SB02	01SB02	01SB03	01SB04	01SB04	01SB05	01SB05	01SB06	01SB06
Sample	01SB010206	01SB020206	01SB020610	01SB030206	01SB040206	01SB040610	01SB050206	01SB050610	01SB060206	01SB060610
Matrix	Subsurface Soil	Subsurface Soil	Subsurface Soil	Subsurface Soil	Subsurface Soil	Subsurface Soil	Subsurface Soil	Subsurface Soil	Subsurface Soil	Subsurface Soil
Depth Range	2 - 6	2 - 6	6 - 9.5	2 - 6	2 - 6	6 - 10	2 - 6	6 - 8.5	2 - 6	6 - 10
Risk	Site	Site	Site	Site	Site	Site	Site	Site	Site	Site
Soil Group	8	8	8	8	8	8	8	8	8	8
Sample Date	8/26/2001	8/26/2001	8/26/2001	8/26/2001	8/26/2001	8/26/2001	8/26/2001	8/26/2001	8/27/2001	8/27/2001
Endrin Aldehyde	3 U	3 U	NA	3 1 U	2 8 U	NA	2 7 U	NA	3 UJ	NA
Gamma-BHC (Lindane)	1 5 U	1 6 U	NA	1 6 U	1 4 U	NA	1 4 U	NA	1 5 U	NA
Gamma-Chlordane	1 5 U	1 6 U	NA	1 6 U	1 4 U	NA	1 4 U	NA	1 5 U	NA
Heptachlor	1 4 J	1 2 J	NA	1 2 J	1 2 BU	NA	0 96 J	NA	1 J	NA
Heptachlor Epoxide	1 5 U	1 6 U	NA	1 6 U	1 4 U	NA	1 4 U	NA	1 5 U	NA
Methoxychlor	15 U	16 U	NA	16 U	14 U	NA	14 U	NA	15 U	NA
Toxaphene	99 U	100 U	NA	100 U	92 U	NA	89 U	NA	99 U	NA
Herbicides (ug/kg)										
2,4,5-T	12 U	12 U	NA	12 U	11 U	NA	11 U	NA	12 U	NA
2,4,5-TP (Silvex)	12 U	12 U	NA	12 U	11 U	NA	11 U	NA	12 U	NA
2,4-D	83 U	85 U	NA	87 U	77 U	NA	75 U	NA	84 U	NA
Dinoseb	24 U	24 U	NA	25 U	22 U	NA	21 U	NA	24 U	NA
Pentachlorophenol	12 U	12 U	NA	12 U	11 U	NA	11 U	NA	12 U	NA
Inorganics (mg/kg)										
Aluminum	8350 J	7610 J	3180 J	9130 J	8280 J	4100 J	4890 J	3730 J	18100	7010
Antimony	0 23 U	0 19 UJ	0 54 U	0 65 U	0 36 U	0 43 U	0 46 U	0 25 U	1 3 U	0 52 U
Arsenic	3 2 J	2 9 J	0 36 U	4 8 J	4 7 J	0 88 U	5 1 J	2 3 U	7 7 J	2 0 J
Barium	64 9 J	35 5 J	58 2 J	38 1 J	30 9	52 0	15 7 J	14 9 J	52 8	28 3
Beryllium	0 37 J	0 38 J	1 2 J	0 45 J	0 38 J	1 1 J	0 34 J	0 42 J	0 38	1 5
Cadmium	0 04 J	0 76	0 03 UJ	1 1	0 21 J	0 35 J	0 03 UJ	0 03 UJ	0 05 U	0 05 U
Calcium	43200 J	485 J	487 J	553 J	461 J	540 J	121 J	69 6 J	629 J	673 J
Chromium	12 2	11 5	8 7	14 6	12 7 J	10 7 J	9 0	7 7	24 0	21 3
Cobalt	2 6	3 4	25 8	3 5	2 9 J	14 6 J	5 5	4 3	8 0	22 3
Copper	10 6 J	10 2 J	12 8 J	11 3 J	9 5 J	13 1 J	6 8 J	7 6 J	14 2	17 5
Iron	12400	13900	30800	18300	15000	24800 J	18000	13200	27700	22400
Lead	8 3	18 6	15 4	36 9	9 9	10 6	6 2	7 9	16 0	12 6
Magnesium	4670 J	1320 J	1030 J	1480 J	1390 J	1130 J	395 J	311 J	1830 J	1530 J
Manganese	69 6 J	70 1 J	379 J	107 J	86 4 J	270 J	133 J	100 J	251	408
Mercury	0 02 UJ	0 02 UJ	0 02 UJ	0 02 UJ	0 02 U	0.02 U	0 02 J	0 02 J	0 07 J	0 03 J
Nickel	6 5	8 3	32 7	7 2	7 5 J	26 6 J	11 2	9 2	11 5	39 3
Potassium	358 J	420 J	488 J	371 J	393 J	752 J	305 J	427 J	792 J	1190 J
Selenium	0 12 J	0 21 J	0 85 J	0 45 J	0 45 U	0 90 U	0 32 J	0 28 J	1 7	0 71
Silver	0 36 U	0 37 U	0 32 U	0 37 U	0 33 U	0 33 U	0 31 U	0 34 U	0 15 U	0 16 U
Sodium	365 J	392 J	357 J	411 J	332 J	347 J	240 J	251 J	657	755
Strontium	46 0 J	5 7 J	4 0 J	6 9 J	5 6 J	4 8 J	2 0 J	1 3 J	11 6 J	12 5 J
Thallium	0 84	1 0	2.7	1 5	1.7 J	2 7	1 7	1 1	0 55 U	0 58 U
Thorium-Calc	3 79	3 6	5 18	3 82	6 43	5 05	2 20	3 07	4 80	6 94
Tin	22 5 U	23 1 U	20 1 U	23 5 U	21 1 U	21 0 U	19 9 U	21 4 U	2 4	2 3 U
Vanadium	18 7	18 7	9 2	27 7	21 6	9 4	13 8	8 9	42 6	14 7
Zinc	31 3 J	23 9 J	70 9 J	22 1 J	23 1 J	62 0 J	49 8 J	29 4 J	43 6	72 1
Miscellaneous Parameters										
1,4-Dithiane (ug/kg)	237 U	244 U	218 U	249 U	222 U	221 U	216 U	225 U	241 U	242 U
1,4-Oxathiane (ug/kg)	237 U	244 U	218 U	249 U	222 U	221 U	216 U	225 U	241 U	242 U
Bis(2-Chloroethyl)Sulfide (ug/kg)	237 U	244 U	218 U	249 U	222 U	221 U	216 U	225 U	241 U	242 U
Cation Exchange Capacity (meq/100g)	12 9	NA	NA	18 2	NA	NA	20 1	18 7	NA	NA
pH (S U.)	7 1 J	NA	NA	5 1 J	NA	NA	4 4 J	5 1 J	NA	NA
Total Organic Carbon (mg/kg)	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Total Radiologicals (pCi/g)										
Actinium-228	1 11	1 27	NA	1 07	1 01	NA	NA	NA	NA	NA
Bismuth-212	1 30	1 07	NA	1 13	0 98	NA	NA	NA	NA	NA

Calc = Calculated Value as described in Section 3 4 2 1.
NA = Not Analyzed

TABLE E-2

SUMMARY OF ANALYTIC RESULTS- SUBSURFACE SOIL
CRANE 158 - MUSTARD GAS BURIAL GROUND
NSWC CRANE
CRANE, INDIANA

Location	01SB01	01SB02	01SB02	01SB03	01SB04	01SB04	01SB05	01SB05	01SB06	01SB06
Sample	01SB010206	01SB020206	01SB020610	01SB030206	01SB040206	01SB040610	01SB050206	01SB050610	01SB060206	01SB060610
Matrix	Subsurface Soil	Subsurface Soil	Subsurface Soil	Subsurface Soil	Subsurface Soil	Subsurface Soil	Subsurface Soil	Subsurface Soil	Subsurface Soil	Subsurface Soil
Depth Range	2 - 6	2 - 6	6 - 9.5	2 - 6	2 - 6	6 - 10	2 - 6	6 - 8.5	2 - 6	6 - 10
Risk	Site	Site	Site	Site	Site	Site	Site	Site	Site	Site
Soil Group	8	8	8	8	8	8	8	8	8	8
Sample Date	8/26/2001	8/26/2001	8/26/2001	8/26/2001	8/26/2001	8/26/2001	8/26/2001	8/26/2001	8/27/2001	8/27/2001
Bismuth-214	0 87	0 85	NA	0 73	0 73	NA	NA	NA	NA	NA
Cesium-137	0 00857 U	0 0104 U	NA	0 00668 U	0 0086 U	NA	NA	NA	NA	NA
Cobalt-60	0 0148 U	0 0284 U	NA	0 0139 U	0.0124 U	NA	NA	NA	NA	NA
Europium-154	0 029 U	0 0469 U	NA	0 0218 U	0 0363 U	NA	NA	NA	NA	NA
Europium-155	0 242 U	0 09	NA	0 244 U	0 08	NA	NA	NA	NA	NA
Lead-210	0 45	0 57	NA	0 65	0 36	NA	NA	NA	NA	NA
Lead-212	1 00	1 13	NA	1 00	0 95	NA	NA	NA	NA	NA
Lead-214	0 87	0 83	NA	0 72	0 75	NA	NA	NA	NA	NA
Potassium-40	5 98	9 23	NA	9 05	8 48	NA	NA	NA	NA	NA
Protactinium-234	2 58 U	3 21 U	NA	2.75 U	3 17 U	NA	NA	NA	NA	NA
Radium-226	1.79	1 90	NA	1 68	1 66	NA	NA	NA	NA	NA
Thallium-208	0 91	1 04	NA	0 94	0 91	NA	NA	NA	NA	NA
Thorium-228	0 359	0 393	0 477	0 343	0 781	0 494	0 207	0 332	0 512	0 654
Thorium-230	0 0522 U	0 0646 U	0 0661 J	0 113 J	0 485 J	0 520 J	0 0386 J	0 0332 J	0 0536 U	0 140
Thorium-232	0 475	0 400	0 663	0 497	0 633	0 618	0 276	0 343	0 543	0 872
Thorium-234	1 10	1 14	NA	1 88	1 00	NA	NA	NA	NA	NA
Uranium-235	0 144 U	0 191 U	NA	0 102 U	0 207 U	NA	NA	NA	NA	NA

Calc = Calculated Value as described in Section 3 4 2 1
NA = Not A[illegible]ed

TABLE E-2

SUMMARY OF ANALYTIC RESULTS- SUBSURFACE SOIL
CRANE 158 - MUSTARD GAS BURIAL GROUND
NSWC CRANE
CRANE, INDIANA

Location	01SB07	01SB08	01SB08	01SB09	01SB10	01SB11	01SB11	01SB12	01SB12	01SB13
Sample	01SB070206	01SB080206	01SB080610	01SB090206	01SB100206	01SB110206	01SB110610	01SB120206	01SB120610	01SB130206
Matrix	Subsurface Soil	Subsurface Soil	Subsurface Soil	Subsurface Soil	Subsurface Soil	Subsurface Soil	Subsurface Soil	Subsurface Soil	Subsurface Soil	Subsurface Soil
Depth Range	2 - 5	2 - 6	6 - 10	2 - 6	2 - 6	2 - 6	6 - 10	2 - 6	6 - 10	2 - 6
Risk	Site	Site	Site	Site	Site	Site	Site	Site	Site	Site
Soil Group	8	8	9	8	8	8	8	8	9	8
Sample Date	8/27/2001	8/21/2001	8/21/2001	8/27/2001	8/27/2001	8/22/2001	8/22/2001	8/25/2001	8/25/2001	8/24/2001
Volatile Organics (ug/kg)										
1,1,1,2-Tetrachloroethane	3 U	3 U	3 U	3 U	3 U	3 U	3 U	3 U	3 U	3 U
1,1,1-Trichloroethane	3 U	3 U	3 U	3 U	3 U	3 U	3 U	3 U	3 U	3 U
1,1,2,2-Tetrachloroethane	3 U	3 U	3 U	2 J	3 UJ	3 U	3 U	3 U	3 U	3 U
1,1,2-Trichloroethane	6 U	5 U	5 U	5 U	5 U	6 U	5 U	5 U	5 U	6 U
1,1-Dichloroethane	3 U	3 U	3 U	3 UJ	3 U	3 U	3 U	3 U	3 U	3 U
1,1-Dichloroethene	6 U	5 U	5 U	5 U	5 U	6 U	5 U	5 U	5 U	6 U
1,2,3-Trichloropropane	3 U	3 U	3 U	3 UJ	3 UJ	3 U	3 U	3 U	3 U	3 U
1,2-Dibromo-3-Chloropropane	6 U	5 U	5 U	5 UJ	5 UJ	6 U	5 U	5 U	5 U	6 U
1,2-Dibromoethane	3 U	3 U	3 U	3 U	3 UJ	3 U	3 U	3 U	3 U	3 U
1,2-Dichloroethane	3 U	3 U	3 U	3 U	3 U	3 U	3 U	3 U	3 U	3 U
1,2-Dichloropropane	6 U	5 U	5 U	5 U	5 U	6 U	5 U	5 U	5 U	6 U
1,4-Dioxane	600 UR	530 UR	540 UR	480 UR	470 UR	580 UR	510 UR	450 UR	480 UR	570 UR
2-Butanone	6 U	5 U	5 U	5 UJ	5 UJ	6 U	5 U	5 UJ	5 UJ	6 UJ
2-Hexanone	6 U	5 UJ	5 UJ	5 UJ	5 UJ	6 UJ	5 UJ	5 U	5 U	6 U
3-Chloropropene	6 U	5 UJ	5 UJ	5 UJ	5 UJ	6 UJ	5 UJ	5 UJ	5 UJ	6 UJ
4-Methyl-2-Pentanone	3 UJ	3 U	3 U	3 UJ	3 UJ	3 U	3 U	3 U	3 U	3 U
Acetone	29 J	5 UJ	5 UJ	5 UJ	5 UJ	6 UJ	5 UJ	6	5 U	36
Acetonitrile	240 UJ	210 UJ	220 UJ	190 UJ	190 UJ	230 UJ	210 UJ	180 UJ	190 UJ	230 UJ
Acrolein	60 UR	53 UR	54 UR	48 UR	47 UR	58 UR	51 UR	45 UR	48 UR	57 UR
Acrylonitrile	60 U	53 U	54 U	48 UJ	47 UJ	58 U	51 U	45 U	48 U	57 U
Benzene	3 U	3 U	3 U	3 U	3 U	3 U	3 U	3 U	3 U	3 U
Bromodichloromethane	3 U	3 U	3 U	3 U	3 U	3 U	3 U	3 U	3 U	3 U
Bromofor	3 U	3 U	3 U	3 U	3 UJ	3 U	3 U	3 U	3 U	3 U
Bromomethane	6 U	5 U	5 U	5 U	5 U	6 U	5 U	5 U	5 U	6 U
Carbon Disulfide	3 U	3 U	3 U	3 U	3 U	3 U	3 U	3 U	3 U	3 U
Carbon Tetrachloride	3 UJ	3 UJ	3 UJ	3 UJ	3 UJ	3 UJ	3 UJ	3 UJ	3 UJ	3 UJ
Chlorobenzene	3 U	3 U	3 U	3 U	3 U	3 U	3 U	3 U	3 U	3 U
Chlorodibromomethane	3 U	3 U	3 U	3 U	3 U	3 U	3 U	3 U	3 U	3 U
Chloroethane	6 U	5 U	5 U	5 U	5 U	6 U	5 U	5 U	5 U	6 U
Chlorofor	3 U	3 U	3 U	4 J	3 U	3 U	3 U	3 U	3 U	3 U
Chloromethane	6 U	5 UJ	5 UJ	5 U	5 U	6 UJ	5 UJ	5 U	5 U	6 U
Chloroprene	6 UJ	5 UJ	5 UJ	5 UJ	5 UJ	6 UJ	5 UJ	5 UJ	5 UJ	6 UJ
Cis-1,2-Dichloroethene	6 U	5 U	5 U	5 U	5 U	6 U	5 U	5 U	5 U	6 U
Cis-1,3-Dichloropropene	3 U	3 U	3 U	3 U	3 U	3 U	3 U	3 U	3 U	3 U
Dibromomethane	6 U	5 U	5 U	5 U	5 U	6 U	5 U	5 U	5 U	6 U
Dichlorodifluoromethane	3 U	3 U	3 U	3 U	3 U	3 U	3 U	3 U	3 U	3 U
Ethyl Methacrylate	6 U	5 U	5 U	5 U	5 UJ	6 U	5 U	5 U	5 U	6 UJ
Ethylbenzene	3 U	3 U	3 U	3 U	3 U	3 U	3 U	3 U	3 U	3 U
Isobutanol	240 UR	210 UR	220 UR	190 UR	190 UR	230 UR	210 UR	180 UR	190 UR	230 UR
Methacrylonitrile	120 UJ	110 U	110 U	95 UJ	94 UJ	120 U	100 U	91 UJ	96 UJ	110 UJ
Methyl Iodide	6 UJ	5 UJ	5 UJ	5 U	5 U	6 UJ	5 UJ	5 UJ	5 UJ	6 UJ
Methyl Methacrylate	6 U	5 U	5 U	5 UJ	5 UJ	6 U	5 U	5 U	5 U	6 U
Methylene Chloride	86 J	21 J	16 J	45 U	50 J	26 J	15 J	15 J	13 J	10
Pentachloroethane	6 U	5 UJ	5 UJ	5 UJ	5 UJ	6 UJ	5 UJ	5 UJ	5 UJ	6 UJ
Propionitrile	120 UR	110 UR	110 UR	95 UR	94 UR	120 UR	100 UR	91 UR	96 UR	110 UR
Styrene	3 U	3 U	3 U	3 U	3 U	3 U	3 U	3 U	3 U	3 U
Tetrachloroethene	3 U	3 U	3 U	3 U	3 U	3 U	3 U	3 U	3 U	3 U
Toluene	3 U	3 U	3 U	3 U	3 UJ	3 U	3 U	3 U	3 U	3 U
Total Xylenes	3 U	3 U	3 U	3 U	3 U	3 U	3 U	3 U	3 U	3 U

Calc = Calculated Value as described in Section 3 4 2 1
NA = Not Analyzed

TABLE E-2

SUMMARY OF ANALYTIC RESULTS- SUBSURFACE SOIL
CRANE 158 - MUSTARD GAS BURIAL GROUND
NSWC CRANE
CRANE, INDIANA

Location	01SB07	01SB08	01SB08	01SB09	01SB10	01SB11	01SB11	01SB12	01SB12	01SB13
Sample	01SB070206	01SB080206	01SB080610	01SB090206	01SB100206	01SB110206	01SB110610	01SB120206	01SB120610	01SB130206
Matrix	Subsurface Soil	Subsurface Soil	Subsurface Soil	Subsurface Soil	Subsurface Soil	Subsurface Soil	Subsurface Soil	Subsurface Soil	Subsurface Soil	Subsurface Soil
Depth Range	2 - 5	2 - 6	6 - 10	2 - 6	2 - 6	2 - 6	6 - 10	2 - 6	6 - 10	2 - 6
Risk	Site	Site	Site	Site	Site	Site	Site	Site	Site	Site
Soil Group	8	8	9	8	8	8	8	8	9	8
Sample Date	8/27/2001	8/21/2001	8/21/2001	8/27/2001	8/27/2001	8/22/2001	8/22/2001	8/25/2001	8/25/2001	8/24/2001
Trans-1,2-Dichloroethene	6 U	5 U	5 U	5 U	5 U	6 U	5 U	5 U	5 U	6 U
Trans-1,3-Dichloropropene	3 U	3 U	3 U	3 U	3 U	3 U	3 U	3 U	3 U	3 U
Trans-1,4-Dichloro-2-Butene	6 U	5 U	5 U	5 U	5 UJ	6 U	5 U	5 U	5 U	6 U
Trichloroethene	3 U	3 U	3 U	3 U	3 U	3 U	3 U	3 U	3 U	3 U
Trichlorofluoromethane	6 UJ	5 U	5 U	5 U	5 UJ	6 U	5 U	5 U	5 U	6 U
Vinyl Acetate	3 U	3 U	3 U	3 U	3 U	3 U	3 U	3 U	3 U	3 U
Vinyl Chloride	6 U	5 U	5 U	5 U	5 U	6 U	5 U	5 U	5 U	6 U
Semivolatile Organics (ug/kg)										
1,2,4,5-Tetrachlorobenzene	460 U	390 U	380 U	390 U	390 U	390 U	380 U	370 U	370 U	420 U
1,2,4-Trichlorobenzene	460 U	390 U	380 U	390 U	390 U	390 U	380 U	370 U	370 U	420 U
1,2-Dichlorobenzene	230 U	200 U	190 U	200 U	200 U	200 U	190 U	190 U	190 U	210 U
1,3-Dichlorobenzene	230 U	200 U	190 U	200 U	200 U	200 U	190 U	190 U	190 U	210 U
1,4-Dichlorobenzene	230 U	200 U	190 U	200 U	200 U	200 U	190 U	190 U	190 U	210 U
1,4-Naphthoquinone	460 U	390 U	380 U	390 U	390 U	390 U	380 U	370 U	370 U	420 U
1,4-Phenylenediamine	1100 UJ	970 UJ	960 UJ	970 UJ	970 UJ	960 UJ	950 UJ	930 U	920 U	1100 U
1-Naphthylamine	460 U	390 U	380 U	390 U	390 U	390 U	380 U	370 U	370 U	420 U
2,2'-Oxybis(1-Chloropropane)	230 U	200 U	190 U	200 U	200 U	200 U	190 U	190 U	190 U	210 U
2,3,4,6-Tetrachlorophenol	460 U	390 U	380 U	390 U	390 U	390 U	380 U	370 U	370 U	420 U
2,4,5-Trichlorophenol	1100 U	970 U	960 U	970 U	970 U	960 U	950 U	930 U	920 U	1100 U
2,4,6-Trichlorophenol	460 U	390 U	380 U	390 U	390 U	390 U	380 U	370 U	370 U	420 U
2,4-Dichlorophenol	460 U	390 U	380 U	390 U	390 U	390 U	380 U	370 U	370 U	420 U
2,4-Dimethylphenol	460 U	390 U	380 U	390 U	390 U	390 U	380 U	370 U	370 U	420 U
2,4-Dinitrophenol	1100 U	970 U	960 U	970 U	970 U	960 U	950 U	930 U	920 U	1100 U
2,6-Dichlorophenol	460 U	390 U	380 U	390 U	390 U	390 U	380 U	370 U	370 U	420 U
2-Acetylaminofluorene	230 U	200 U	190 U	200 U	200 U	200 U	190 U	190 U	190 U	210 U
2-Chloronaphthalene	230 U	200 U	190 U	200 U	200 U	200 U	190 U	190 U	190 U	210 U
2-Chlorophenol	230 U	200 U	190 U	200 U	200 U	200 U	190 U	190 U	190 U	210 U
2-Methylnaphthalene	230 U	200 U	190 U	200 U	200 U	200 U	190 U	190 U	190 U	210 U
2-Methylphenol	230 U	200 U	190 U	200 U	200 U	200 U	190 U	190 U	190 U	210 U
2-Naphthylamine	230 U	200 U	190 U	200 U	200 U	200 U	190 U	190 U	190 U	210 U
2-Nitroaniline	550 U	490 U	480 U	490 U	490 U	480 U	480 U	470 U	460 U	550 U
2-Nitrophenol	460 U	390 U	380 U	390 U	390 U	390 U	380 U	370 U	370 U	420 U
2-Picoline	340 U	290 U	290 U	290 U	290 U	300 U	290 U	280 U	280 U	320 U
3,3'-Dichlorobenzidine	460 U	390 U	380 U	390 U	390 U	390 U	380 U	370 U	370 U	420 U
3,3'-Dimethylbenzidine	460 U	390 U	380 U	390 U	390 U	390 U	380 U	370 U	370 U	420 U
3-Methylcholanthrene	510 U	430 U	430 U	430 U	430 U	430 U	430 U	420 U	410 U	480 U
3-Methylphenol	230 U	200 U	190 U	200 U	200 U	200 U	190 U	190 U	190 U	210 U
3-Nitroaniline	1100 U	970 U	960 U	970 U	970 U	960 U	950 U	930 U	920 U	1100 U
4,6-Dinitro-2-Methylphenol	1100 U	970 U	960 U	970 U	970 U	960 U	950 U	930 U	920 U	1100 U
4-Aminobiphenyl	230 U	200 U	190 U	200 U	200 U	200 U	190 U	190 U	190 U	210 U
4-Bromophenyl Phenyl Ether	460 U	390 U	380 U	390 U	390 U	390 U	380 U	370 U	370 U	420 U
4-Chloro-3-Methylphenol	460 U	390 U	380 U	390 U	390 U	390 U	380 U	370 U	370 U	420 U
4-Chloroaniline	460 U	390 U	380 U	390 U	390 U	390 U	380 U	370 U	370 U	420 U
4-Chlorophenyl Phenyl Ether	230 U	200 U	190 U	200 U	200 U	200 U	190 U	190 U	190 U	210 U
4-Methylphenol	230 U	200 U	190 U	200 U	200 U	200 U	190 U	190 U	190 U	210 U
4-Nitroaniline	1100 U	970 U	960 U	970 U	970 U	960 U	950 U	930 U	920 U	1100 U
4-Nitrophenol	1100 U	970 U	960 U	970 U	970 U	960 U	950 U	930 U	920 U	1100 U
4-Nitroquinoline-1-Oxide	1100 UR	970 UR	960 UR	970 UR	970 UR	960 UR	950 UR	930 UR	920 UR	1100 UR
5-Nitro-O-Toluidine	460 U	390 U	380 U	390 U	390 U	390 U	380 U	370 U	370 U	420 U
7,12-Dimethylbenz(A)Anthracene	340 U	290 U	290 U	290 U	290 U	300 U	290 U	280 U	280 U	320 U

Calc = Calculated Value as descibed in Section 3 4 2 1
NA = Not A[illegible]d

TABLE E-2

SUMMARY OF ANALYTIC RESULTS- SUBSURFACE SOIL
CRANE 158 - MUSTARD GAS BURIAL GROUND
NSWC CRANE
CRANE, INDIANA

Location	01SB07	01SB08	01SB08	01SB09	01SB10	01SB11	01SB11	01SB12	01SB12	01SB13
Sample	01SB070206	01SB080206	01SB080610	01SB090206	01SB100206	01SB110206	01SB110610	01SB120206	01SB120610	01SB130206
Matrix	Subsurface Soil	Subsurface Soil	Subsurface Soil	Subsurface Soil	Subsurface Soil	Subsurface Soil	Subsurface Soil	Subsurface Soil	Subsurface Soil	Subsurface Soil
Depth Range	2 - 5	2 - 6	6 - 10	2 - 6	2 - 6	2 - 6	6 - 10	2 - 6	6 - 10	2 - 6
Risk	Site	Site	Site	Site	Site	Site	Site	Site	Site	Site
Soil Group	8	8	9	8	8	8	8	8	9	8
Sample Date	8/27/2001	8/21/2001	8/21/2001	8/27/2001	8/27/2001	8/22/2001	8/22/2001	8/25/2001	8/25/2001	8/24/2001
A,A-Dimethylphenethylamine	1100 U	970 UJ	960 UJ	970 U	970 U	960 UJ	950 U	930 U	920 U	1100 U
Acenaphthene	13.5 U	11.6 U	11.3 U	11.6 U	11.6 U	11.8 U	11.3 U	11.1 U	11 U	12.7 UJ
Acenaphthylene	13.5 U	11.6 UJ	11.3 UJ	11.6 U	11.6 U	11.8 UJ	11.3 UJ	11.1 U	11 U	12.7 UJ
Acetophenone	230 U	200 U	190 U	200 U	200 U	200 U	190 U	190 U	190 U	210 U
Aniline	230 U	200 U	190 U	200 U	200 U	200 U	190 U	190 U	190 U	210 U
Anthracene	13.5 U	11.6 UJ	11.3 UJ	11.6 U	11.6 U	11.8 UJ	11.3 UJ	11.1 U	11 U	12.7 UJ
Aramite	1100 U	970 U	960 U	970 U	970 U	960 U	950 U	930 U	920 U	1100 U
Benzo(A)Anthracene	13.5 U	11.6 U	11.3 U	11.6 U	11.6 U	11.8 U	11.3 U	11.1 U	11 U	12.7 UJ
Benzo(A)Pyrene	13.5 U	11.6 U	11.3 U	11.6 U	11.6 U	11.8 U	11.3 U	11.1 U	11 U	12.7 UJ
Benzo(B)Fluoranthene	13.5 U	11.6 U	11.3 U	11.6 U	11.6 U	11.8 U	11.3 U	11.1 U	11 U	12.7 UJ
Benzo(G,H,I)Perylene	13.5 U	11.6 U	11.3 U	11.6 U	11.6 U	11.8 U	11.3 U	11.1 U	11 U	12.7 UJ
Benzo(K)Fluoranthene	13.5 U	11.6 U	11.3 U	11.6 U	11.6 U	11.8 U	11.3 U	11.1 U	11 U	12.7 UJ
Benzyl Alcohol	270 U	270 U	270 U	270 U	270 U	270 U	270 U	270 U	270 U	270 U
Bis(2-Chloroethoxy)Methane	460 U	390 U	380 U	390 U	390 U	390 U	380 U	370 U	370 U	420 U
Bis(2-Chloroethyl)Ether	230 U	200 U	190 U	200 U	200 U	200 U	190 U	190 U	190 U	210 U
Bis(2-Ethylhexyl)Phthalate	230 U	200 U	190 U	5600	200 U	200 U	190 U	190 U	190 U	210 U
Butyl Benzyl Phthalate	230 U	200 U	190 U	200 U	200 U	200 U	190 U	190 U	190 U	210 U
Chlorobenzilate	460 U	390 U	380 U	390 U	390 U	390 U	380 U	370 U	370 U	420 U
Chrysene	13.5 U	11.6 U	11.3 U	11.6 U	11.6 U	11.8 U	11.3 U	11.1 U	11 U	12.7 UJ
Di-N-Butyl Phthalate	230 UJ	200 U	190 U	200 U	200 UJ	200 U	190 U	190 UJ	190 UJ	210 UJ
Di-N-Octyl Phthalate	230 U	200 U	190 U	200 U	200 U	200 U	190 U	190 U	190 U	210 U
Diallate	460 U	390 U	380 U	390 U	390 U	390 U	380 U	370 U	370 U	420 U
Dibenzo(A,H)Anthracene	13.5 U	11.6 UJ	11.3 UJ	11.6 U	11.6 U	11.8 UJ	11.3 UJ	11.1 U	11 U	12.7 UJ
Dibenzofuran	230 U	200 U	190 U	200 U	200 U	200 U	190 U	190 U	190 U	210 U
Diethyl Phthalate	230 U	200 U	190 U	200 U	200 U	200 U	190 U	190 U	190 U	210 U
Dimethyl Phthalate	230 U	200 U	190 U	200 U	200 U	200 U	190 U	190 U	190 U	210 U
Diphenylamine	230 U	200 U	190 U	200 U	200 U	200 U	190 U	190 U	190 U	210 U
Ethyl Methane Sulfonate	230 U	200 U	190 U	200 U	200 U	200 U	190 U	190 U	190 U	210 U
Fluoranthene	13.5 U	11.6 U	11.3 U	11.6 U	11.6 U	11.8 U	11.3 U	11.1 U	11 U	12.7 UJ
Fluorene	13.5 U	11.6 U	11.3 U	11.6 U	11.6 U	11.8 U	11.3 U	11.1 U	11 U	12.7 UJ
Hexachlorobenzene	460 U	390 U	380 U	390 U	390 U	390 U	380 U	370 U	370 U	420 U
Hexachlorobutadiene	460 U	390 U	380 U	390 U	390 U	390 U	380 U	370 U	370 U	420 U
Hexachlorocyclopentadiene	460 U	390 U	380 U	390 U	390 U	390 U	380 U	370 U	370 U	420 U
Hexachloroethane	230 U	200 U	190 U	200 U	200 U	200 U	190 U	190 U	190 U	210 U
Hexachlorophene	18000 UJ	15000 UJ	15000 UJ	15000 UJ	15000 UJ	15000 UJ	15000 UJ	15000 U	15000 U	17000 U
Hexachloropropene	460 U	390 U	380 U	390 U	390 U	390 U	380 U	370 U	370 U	420 U
Indeno(1,2,3-CD)Pyrene	13.5 U	11.6 U	11.3 U	11.6 U	11.6 U	11.8 U	11.3 U	11.1 U	11 U	12.7 UJ
Isodrin	460 U	390 U	380 U	390 U	390 U	390 U	380 U	370 U	370 U	420 U
Isophorone	230 U	200 U	190 U	200 U	200 U	200 U	190 U	190 U	190 U	210 U
Isosafrole	460 U	390 U	380 U	390 U	390 U	390 U	380 U	370 U	370 U	420 U
Kepone	1100 U	970 U	960 U	970 U	970 U	960 U	950 U	930 U	920 U	1100 U
Methapyrilene	1100 UR	970 U	960 U	970 UR	970 UR	960 U	950 U	930 U	920 U	1100 U
Methyl Methane Sulfonate	550 U	490 U	480 U	490 U	490 U	480 U	480 U	470 U	460 U	550 U
N-Nitroso-Di-N-Butylamine	460 U	390 U	380 U	390 U	390 U	390 U	380 U	370 U	370 U	420 U
N-Nitroso-Di-N-Propylamine	230 U	200 U	190 U	200 U	200 U	200 U	190 U	190 U	190 U	210 U
N-Nitrosodiethylamine	230 U	200 U	190 U	200 U	200 U	200 U	190 U	190 U	190 U	210 U
N-Nitrosodimethylamine	230 U	200 U	190 U	200 U	200 U	200 U	190 U	190 U	190 U	210 U
N-Nitrosomethylethylamine	230 U	200 U	190 U	200 U	200 U	200 U	190 U	190 U	190 U	210 U
N-Nitrosomorpholine	230 U	200 U	190 U	200 U	200 U	200 U	190 U	190 U	190 U	210 U
N-Nitrosopiperidine	460 U	390 U	380 U	390 U	390 U	390 U	380 U	370 U	370 U	420 U

Calc = Calculated Value as descibed in Section 3 4 2 1.
NA = Not Analyzed

TABLE E-2

SUMMARY OF ANALYTIC RESULTS- SUBSURFACE SOIL
CRANE 158 - MUSTARD GAS BURIAL GROUND
NSWC CRANE
CRANE, INDIANA

Location	01SB07	01SB08	01SB08	01SB09	01SB10	01SB11	01SB11	01SB12	01SB12	01SB13
Sample	01SB070206	01SB080206	01SB080610	01SB090206	01SB100206	01SB110206	01SB110610	01SB120206	01SB120610	01SB130206
Matrix	Subsurface Soil	Subsurface Soil	Subsurface Soil	Subsurface Soil	Subsurface Soil	Subsurface Soil	Subsurface Soil	Subsurface Soil	Subsurface Soil	Subsurface Soil
Depth Range	2 - 5	2 - 6	6 - 10	2 - 6	2 - 6	2 - 6	6 - 10	2 - 6	6 - 10	2 - 6
Risk	Site	Site	Site	Site	Site	Site	Site	Site	Site	Site
Soil Group	8	8	9	8	8	8	8	8	9	8
Sample Date	8/27/2001	8/21/2001	8/21/2001	8/27/2001	8/27/2001	8/22/2001	8/22/2001	8/25/2001	8/25/2001	8/24/2001
N-Nitrosopyrrolidine	230 U	200 U	190 U	200 U	200 U	200 U	190 U	190 U	190 U	210 U
Naphthalene	13 5 U	11 6 UR	11 3 UR	10 2 J	11 6 U	11 8 UR	11 3 UR	11 1 U	11 U	12 7 UJ
O,O,O-Triethyl Phosphorothioate	460 U	390 U	380 U	390 U	390 U	390 U	380 U	370 U	370 U	420 U
O-Toluidine	230 U	200 U	190 U	200 U	200 U	200 U	190 U	190 U	190 U	210 U
P-(Dimethylamino)Azobenzene	460 U	390 U	380 U	390 U	390 U	390 U	380 U	370 U	370 U	420 U
Pentachlorobenzene	460 U	390 U	380 U	390 U	390 U	390 U	380 U	370 U	370 U	420 U
Pentachloronitrobenzene	1100 U	970 U	960 U	970 U	970 U	960 U	950 U	930 U	920 U	1100 U
Phenacetin	460 U	390 U	380 U	390 U	390 U	390 U	380 U	370 U	370 U	420 U
Phenanthrene	13 5 U	11 6 U	11 3 U	11 6 U	11 6 U	11 8 U	11.3 U	11 1 U	11 U	12 7 UJ
Phenol	230 U	200 U	190 U	200 U	200 U	200 U	190 U	190 U	190 U	210 U
Pronamide	460 UR	390 UR	380 UR	390 UR	390 UR	390 UR	380 UR	370 U	370 U	420 U
Pyrene	13 5 U	11.6 U	11 3 U	11 6 U	11 6 U	11 8 U	11 3 U	11 1 U	11 U	12 7 UJ
Pyridine	230 U	220 U	220 U	220 U	220 U	220 U	220 U	220 U	220 U	220 U
Safrole	460 U	390 U	380 U	390 U	390 U	390 U	380 U	370 U	370 U	420 U
Energertics (ug/kg)										
1,3,5-Trinitrobenzene	476 U	500 U	476 U	476 U	476 U	500 U	500 U	500 U	476 U	476 U
1,3-Dinitrobenzene	476 U	500 U	476 U	476 U	476 U	500 U	500 U	500 U	476 U	476 U
2,4,6-Trinitrotoluene	476 U	500 U	476 U	476 U	476 U	500 U	500 U	500 U	476 U	476 U
2,4-Dinitrotoluene	476 U	500 U	476 U	476 U	476 U	500 U	500 U	500 U	476 U	476 U
2,6-Dinitrotoluene	476 U	500 U	476 U	476 U	476 U	500 U	500 U	500 U	476 U	476 U
2-Amino-4,6-Dinitrotoluene	476 U	500 U	476 U	476 U	476 U	500 U	500 U	500 U	476 U	476 U
2-Nitrotoluene	476 U	500 U	476 U	476 U	476 U	500 U	500 U	500 U	476 U	476 U
3-Nitrotoluene	476 U	500 U	476 U	476 U	476 U	500 U	500 U	500 U	476 U	476 U
4-Amino-2,6-Dinitrotoluene	476 U	500 U	476 U	476 U	476 U	500 U	500 U	500 U	476 U	476 U
4-Nitrotoluene	476 U	500 U	476 U	476 U	476 U	500 U	500 U	500 U	476 U	476 U
HMX	476 U	70 6 J	476 U	476 U	476 U	500 U	500 U	500 U	476 U	476 U
Nitrobenzene	476 U	500 U	476 U	476 U	476 U	500 U	500 U	500 U	476 U	476 U
RDX	476 U	500 U	476 U	476 U	476 U	500 U	500 U	500 U	476 U	476 U
Tetryl	476 U	500 U	476 U	476 U	476 U	500 U	500 U	500 U	476 U	476 U
Pesticides/PCBs (ug/kg)										
4,4'-DDD	3 4 U	2 9 U	NA	2 9 U	2 9 U	2 9 U	NA	2 8 U	NA	3 2 U
4,4'-DDE	3 4 U	2 9 U	NA	2 9 U	2 9 U	2 9 U	NA	2 8 U	NA	3 2 U
4,4'-DDT	3 4 U	2.9 U	NA	2 9 UJ	2 9 U	2 9 U	NA	2 8 U	NA	3 2 U
Aldrin	1 8 U	1 5 U	NA	1 5 U	1 5 U	1 5 U	NA	1 5 U	NA	1.7 U
Alpha-BHC	1.8 U	1 5 U	NA	1 5 U	1 5 U	1.5 U	NA	1 5 U	NA	1 7 U
Alpha-Chlordane	1 8 U	1 5 U	NA	1 5 U	1 5 U	1 5 U	NA	1 5 U	NA	1.7 U
Aroclor-1016	45 U	38 U	NA	38 U	38 U	39 U	NA	37 U	NA	42 U
Aroclor-1221	45 U	38 U	NA	38 U	38 U	39 U	NA	37 U	NA	42 U
Aroclor-1232	45 U	38 U	NA	38 U	38 U	39 U	NA	37 U	NA	42 U
Aroclor-1242	45 U	38 U	NA	38 U	38 U	39 U	NA	37 U	NA	42 U
Aroclor-1248	45 U	38 U	NA	38 U	38 U	39 U	NA	37 U	NA	42 U
Aroclor-1254	45 U	38 U	NA	38 U	38 U	39 U	NA	37 U	NA	42 U
Aroclor-1260	45 U	38 U	NA	38 U	38 U	39 U	NA	37 U	NA	42 U
Beta-BHC	1 8 U	1 5 U	NA	1 5 U	1 5 U	1 5 U	NA	1.5 U	NA	1 7 U
Delta-BHC	1 8 U	1 5 U	NA	1 5 U	1 5 U	1 5 U	NA	1.5 U	NA	1 7 U
Dieldrin	3 4 U	2 9 U	NA	2 9 U	2 9 U	2 9 U	NA	2 8 U	NA	3 2 U
Endosulfan I	1 8 U	1 5 U	NA	1 5 U	1 5 U	1 5 U	NA	1 5 U	NA	1 7 U
Endosulfan II	3 4 U	2 9 U	NA	2 9 U	2.9 U	2 9 U	NA	2 8 U	NA	3 2 U
Endosulfan Sulfate	3 4 U	2 9 U	NA	2 9 U	2 9 U	2 9 U	NA	2.8 U	NA	3 2 U
Endrin	3 4 U	2 9 U	NA	2 9 U	2 9 U	2 9 U	NA	2 8 U	NA	3.2 U

Calc = Calculated Value as described in Section 3 4 2.1
NA = Not A[illegible]d

TABLE E-2

SUMMARY OF ANALYTIC RESULTS- SUBSURFACE SOIL
CRANE 158 - MUSTARD GAS BURIAL GROUND
NSWC CRANE
CRANE, INDIANA

Location	01SB07	01SB08	01SB08	01SB09	01SB10	01SB11	01SB11	01SB12	01SB12	01SB13
Sample	01SB070206	01SB080206	01SB080610	01SB090206	01SB100206	01SB110206	01SB110610	01SB120206	01SB120610	01SB130206
Matrix	Subsurface Soil	Subsurface Soil	Subsurface Soil	Subsurface Soil	Subsurface Soil	Subsurface Soil	Subsurface Soil	Subsurface Soil	Subsurface Soil	Subsurface Soil
Depth Range	2 - 5	2 - 6	6 - 10	2 - 6	2 - 6	2 - 6	6 - 10	2 - 6	6 - 10	2 - 6
Risk	Site	Site	Site	Site	Site	Site	Site	Site	Site	Site
Soil Group	8	8	9	8	8	8	8	8	9	8
Sample Date	8/27/2001	8/21/2001	8/21/2001	8/27/2001	8/27/2001	8/22/2001	8/22/2001	8/25/2001	8/25/2001	8/24/2001
Endrin Aldehyde	3 4 UJ	2 9 U	NA	2 9 U	2 9 UJ	2 9 U	NA	2 8 U	NA	3 2 U
Gamma-BHC (Lindane)	1 8 U	1 5 U	NA	1 5 U	1 5 U	1 5 U	NA	1 5 U	NA	1 7 U
Gamma-Chlordane	1 8 U	1 5 U	NA	1 5 U	1 5 U	1 5 U	NA	0 82 J	NA	2 6 J
Heptachlor	1 5 J	1 6 J	NA	1 2 J	0 94 J	1 5 J	NA	1 BU	NA	1 5 BU
Heptachlor Epoxide	1 8 U	1 5 U	NA	1 5 U	1 5 U	1 5 U	NA	1 5 U	NA	1 7 U
Methoxychlor	18 U	15 U	NA	15 U	15 U	15 U	NA	15 U	NA	17 U
Toxaphene	110 U	96 U	NA	96 U	96 U	97 U	NA	93 U	NA	110 U
Herbicides (ug/kg)										
2,4,5-T	14 U	12 U	NA	12 U	12 U	12 U	NA	11 U	NA	13 U
2,4,5-TP (Silvex)	14 U	12 UJ	NA	12 U	12 U	12 UJ	NA	11 U	NA	13 U
2,4-D	96 U	81 U	NA	81 U	81 U	82 U	NA	78 U	NA	90 U
Dinoseb	27 U	23 U	NA	23 U	23 U	23 U	NA	22 U	NA	26 U
Pentachlorophenol	14 U	12 U	NA	12 U	12 U	12 U	NA	11 U	NA	13 U
Inorganics (mg/kg)										
Aluminum	12700	7030 J	4290 J	10100 J	14200	11900 J	4530 J	8210 J	4330 J	9510 J
Antimony	1 3 U	0 48 U	1 6 U	0 41 U	0 95 U	0 44 U	0 55 U	0 40 U	0 18 U	0 29 U
Arsenic	6 7 J	4 2	0 48 J	4 1 J	2 7 J	8 1	3 1	3 4 J	1 7 U	5 3 J
Barium	55 4	26 3	23 6	34 8 J	51.2	44 0	28 1	27 9	52 2	39 7
Beryllium	0 24	0 31 U	1 6 J	0 55 J	0 24	0 42 U	0 32 U	0 33 J	0 47 J	0 35 J
Cadmium	0 05 U	0 01 U	0 01 U	0 03 UJ	0 04 U	0 01 U	0 01 U	0 16 J	0 16	0 04 J
Calcium	549 J	262 J	362 J	901 J	10000 J	332 J	557 J	305 J	485 J	263 J
Chromium	18 7	10 4	15 0	14 9	17 6	15 9	10 3	11 3 J	8 5 J	12 7 J
Cobalt	5 5	2 0 J	16 8 J	2 6	4 0	4 0 J	1 3 J	3 0 J	3 9 J	3 4 J
Copper	14 4	9 4 J	25 3 J	10 7 J	11 4	12 7 J	9 1 J	7 4 J	7 8 J	10 8 J
Iron	24400	12600	71500	15800	15700	23600	16200	12800	8750	17800
Lead	12 2	8 0 J	7 6 J	10 3	10 5	11 9 J	9 6 J	10 5	9 8	9 2
Magnesium	2350 J	826 J	395 J	1210 J	1840 J	1750 J	512 J	1120 J	663 J	1630 J
Manganese	250	45 4 J	329 J	20 3 J	137	180 J	21 7 J	157 J	20 9 J	131 J
Mercury	0 02 J	0 04	0 03	0 02 J	0 02 J	0.06	0 03	0 03 J	0 02 U	0 03 U
Nickel	11 5	4 5	24 9	6 7	8 8	8 1	3 2	5 6 J	8 2 J	8 2 J
Potassium	617 J	441 J	754 J	353 J	615 J	553 J	207 J	381 J	449 J	504 J
Selenium	1 4	0 31 J	1 3 J	0 36 J	1 1	0 41 J	0 34 J	0 48 U	0 18 U	0 55 U
Silver	0 17 U	0 05 U	0 06 U	0 34 U	0 14 U	0 08 U	0 05 U	0 32 U	0 33 U	0 38 U
Sodium	567	359 J	379 J	342 J	706	336 J	343 J	329 J	379 J	391 J
Strontium	10 2 J	5 0 J	4 4 J	9 9 J	17 5 J	6 1 J	4 1 J	5 2 J	4 9 J	5 4 J
Thallium	0 63 U	1 1 J	5 3 J	1 5	0 53 U	2 1	1 4 J	1 1 J	1 0	1 8 J
Thorium-Calc	4 22	3 44	2 93	3 98	5 22	3.34	4 84	4 74	4 48	3 41
Tin	2 5 U	3 6	4 0	21 8 U	2 8	3 3	2 3	20 4 U	21 1 U	24.0 U
Vanadium	32 9	18 3 J	15 9 J	26,8	28 1	29 4 J	20 5 J	20 9	10 2	22.2
Zinc	46 9	18 1	129	16 2 J	43 3	34 2	15 0	17 6 J	26.1 J	31 7 J
Miscellaneous Parameters										
1,4-Dithiane (ug/kg)	274 U	232 U	231 U	232 U	233 U	236 U	230 U	224 U	222 U	255 U
1,4-Oxathiane (ug/kg)	274 U	232 U	231 U	232 U	233 U	236 U	230 U	224 U	222 U	255 U
Bis(2-Chloroethyl)Sulfide (ug/kg)	274 U	232 U	231 U	232 U	233 U	236 U	230 U	224 U	222 U	255 U
Cation Exchange Capacity (meq/100g)	19 2 J	NA	NA	NA	NA	NA	NA	NA	NA	14 8 J
pH (S U)	5	NA	NA	NA	NA	NA	NA	NA	NA	4 8
Total Organic Carbon (mg/kg)	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Total Radiologicals (pCi/g)										
Actinium-228	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Bismuth-212	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA

Calc = Calculated Value as descibed in Section 3 4 2 1.
NA = Not Analyzed

TABLE E-2

SUMMARY OF ANALYTIC RESULTS- SUBSURFACE SOIL
CRANE 158 - MUSTARD GAS BURIAL GROUND
NSWC CRANE
CRANE, INDIANA

Location	01SB07	01SB08	01SB08	01SB09	01SB10	01SB11	01SB11	01SB12	01SB12	01SB13
Sample	01SB070206	01SB080206	01SB080610	01SB090206	01SB100206	01SB110206	01SB110610	01SB120206	01SB120610	01SB130206
Matrix	Subsurface Soil	Subsurface Soil	Subsurface Soil	Subsurface Soil	Subsurface Soil	Subsurface Soil	Subsurface Soil	Subsurface Soil	Subsurface Soil	Subsurface Soil
Depth Range	2 - 5	2 - 6	6 - 10	2 - 6	2 - 6	2 - 6	6 - 10	2 - 6	6 - 10	2 - 6
Risk	Site	Site	Site	Site	Site	Site	Site	Site	Site	Site
Soil Group	8	8	9	8	8	8	8	8	9	8
Sample Date	8/27/2001	8/21/2001	8/21/2001	8/27/2001	8/27/2001	8/22/2001	8/22/2001	8/25/2001	8/25/2001	8/24/2001
Bismuth-214	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Cesium-137	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Cobalt-60	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Europium-154	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Europium-155	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Lead-210	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Lead-212	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Lead-214	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Potassium-40	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Protactinium-234	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Radium-226	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Thallium-208	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Thorium-228	0 355	0 242	0 400	0 400	0 537	0.319	0 502	0 504	0 507	0 291
Thorium-230	0 164	0 334 J	0 385 J	0 0427 U	0 111	0 434 J	0 637 J	0 394 U	0 360 U	0 421 J
Thorium-232	0 574	0 514	0 245	0 475	0 612	0 416	0 562	0 538	0 479	0 459
Thorium-234	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Uranium-235	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA

Calc = Calculated Value as descibed in Section 3 4.2 1.
NA = Not A[illegible]d

TABLE E-2

SUMMARY OF ANALYTIC RESULTS- SUBSURFACE SOIL
CRANE 158 - MUSTARD GAS BURIAL GROUND
NSWC CRANE
CRANE, INDIANA

Location	01SB13	01SB14	01SB14	01SB15	01SB15	01SB16	01SB16	01SB17	01SB17	01SB18
Sample	01SB130610	01SB140206	01SB140610	01SB150206	01SB150610	01SB160206	01SB160610	01SB170206	01SB170610	01SB180206
Matrix	Subsurface Soil	Subsurface Soil	Subsurface Soil	Subsurface Soil	Subsurface Soil	Subsurface Soil	Subsurface Soil	Subsurface Soil	Subsurface Soil	Subsurface Soil
Depth Range	6 - 10	2 - 6	6 - 8	2 - 6	6 - 10	2 - 6	6 - 10	2 - 6	6 - 9.7	2 - 6
Risk	Site	Site	Site	Site	Site	Site	Site	Site	Site	Site
Soil Group	8	8	8	8	8	8	9	8	8	8
Sample Date	8/24/2001	8/24/2001	8/24/2001	8/22/2001	8/22/2001	8/21/2001	8/21/2001	8/24/2001	8/24/2001	8/24/2001
Volatile Organics (ug/kg)										
1,1,1,2-Tetrachloroethane	3 U	3 U	3 U	3 U	3 U	3 U	3 U	3 U	3 U	3 U
1,1,1-Trichloroethane	3 U	3 U	3 U	3 U	3 U	3 U	3 U	3 U	3 U	3 U
1,1,2,2-Tetrachloroethane	3 U	3 UJ	3 U	3 U	3 U	3 U	3 U	3 U	3 U	3 U
1,1,2-Trichloroethane	6 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	6 U
1,1-Dichloroethane	3 U	3 U	3 U	3 U	3 U	3 U	3 U	3 U	3 U	3 U
1,1-Dichloroethene	6 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	6 U
1,2,3-Trichloropropane	3 U	3 UJ	3 U	3 U	3 U	3 U	3 U	3 U	3 U	3 U
1,2-Dibromo-3-Chloropropane	6 U	5 UJ	5 U	5 U	5 U	5 U	5 U	5 U	5 U	6 U
1,2-Dibromoethane	3 U	3 UJ	3 U	3 U	3 U	3 U	3 U	3 U	3 U	3 U
1,2-Dichloroethane	3 U	3 U	3 U	3 U	3 U	3 U	3 U	3 U	3 U	3 U
1,2-Dichloropropane	6 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	6 U
1,4-Dioxane	550 UR	540 UR	500 UR	530 UR	510 UR	500 UR	530 UR	500 UR	500 UR	580 UR
2-Butanone	6 UJ	5 UJ	5 UJ	5 U	5 U	5 U	5 UJ	5 UJ	5 UJ	6 UJ
2-Hexanone	6 U	5 UJ	5 U	5 UJ	5 UJ	5 U	5 U	5 U	5 U	6 U
3-Chloropropene	6 UJ	5 UJ	5 UJ	5 UJ	5 UJ	5 UJ	5 UJ	5 UJ	5 UJ	6 UJ
4-Methyl-2-Pentanone	3 U	3 UJ	3 U	3 U	3 U	3 U	3 U	3 U	3 U	3 U
Acetone	17	5 UJ	5 U	5 UJ	5 UJ	5 UJ	5 UJ	11	14	26
Acetonitrile	220 UJ	220 UJ	200 UJ	210 UJ	200 UJ	200 UJ	210 UJ	200 UJ	200 UJ	230 UJ
Acrolein	55 UR	54 UR	50 UR	53 UR	51 UR	50 UR	53 UR	50 UR	50 UR	58 UR
Acrylonitrile	55 U	54 UJ	50 U	53 U	51 U	50 U	53 U	50 U	50 U	58 U
Benzene	3 U	3 U	3 U	3 U	3 U	3 U	3 U	3 U	3 U	3 U
Bromodichloromethane	3 U	3 U	3 U	3 U	3 U	3 U	3 U	3 U	3 U	3 U
Bromofor	3 U	3 U	3 U	3 U	3 U	3 U	3 U	3 U	3 U	3 U
Bromomethane	6 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	6 U
Carbon Disulfide	3 U	3 U	3 U	3 U	3 U	3 U	3 U	3 U	3 UJ	3 U
Carbon Tetrachloride	3 UJ	3 UJ	3 UJ	3 UJ	3 UJ	3 UJ	3 UJ	3 UJ	3 UJ	3 UJ
Chlorobenzene	3 U	3 U	3 U	3 U	3 U	3 U	3 U	3 U	3 U	3 U
Chlorodibromomethane	3 U	3 U	3 U	3 U	3 U	3 U	3 U	3 U	3 U	3 U
Chloroethane	6 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	6 U
Chlorofor	3 U	3 U	3 U	3 U	3 U	3 U	3 U	3 U	3 U	3 U
Chloromethane	6 U	5 U	5 U	5 UJ	5 UJ	5 UJ	5 U	5 U	5 U	6 U
Chloroprene	6 UJ	5 UJ	5 UJ	5 UJ	5 UJ	5 UJ	5 UJ	5 UJ	5 UJ	6 UJ
Cis-1,2-Dichloroethene	6 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	6 U
Cis-1,3-Dichloropropene	3 U	3 U	3 U	3 U	3 U	3 U	3 U	3 U	3 U	3 U
Dibromomethane	6 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	6 U
Dichlorodifluoromethane	3 U	3 U	3 U	3 U	3 U	3 U	3 U	3 U	3 U	3 U
Ethyl Methacrylate	6 UJ	5 UJ	5 UJ	5 U	5 U	5 U	5 UJ	5 U	5 U	6 U
Ethylbenzene	3 U	3 U	3 U	3 U	3 U	3 U	3 U	3 U	3 U	3 U
Isobutanol	220 UR	220 UR	200 UR	210 UR	200 UR	200 UR	210 UR	200 UR	200 UR	230 UR
Methacrylonitrile	110 UJ	110 UJ	99 UJ	110 U	100 U	100 U	110 UJ	100 UJ	100 UJ	120 UJ
Methyl Iodide	6 UJ	5 UJ	5 UJ	5 UJ	5 UJ	5 UJ	5 UJ	5 UJ	5 UJ	6 UJ
Methyl Methacrylate	6 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	6 U
Methylene Chloride	5 J	5 J	47	14 J	16 J	13 J	11 J	7 J	4 J	7 J
Pentachloroethane	6 UJ	5 UJ	5 UJ	5 UJ	5 UJ	5 UJ	5 UJ	5 UJ	5 UJ	6 UJ
Propionitrile	110 UR	110 UR	99 UR	110 UR	100 UR	100 UR	110 UR	100 UR	100 UR	120 UR
Styrene	3 U	3 U	3 U	3 U	3 U	3 U	3 U	3 U	3 U	3 U
Tetrachloroethene	3 U	3 UJ	3 U	3 U	3 U	3 U	3 U	3 U	3 U	3 U
Toluene	3 U	3 U	3 U	3 U	3 U	3 U	3 U	3 U	3 U	3 U
Total Xylenes	3 U	3 U	3 U	3 U	3 U	3 U	3 U	3 U	3 U	3 U

Calc = Calculated Value as descibed in Section 3 4 2 1.
NA = Not Analyzed

TABLE E-2

SUMMARY OF ANALYTIC RESULTS- SUBSURFACE SOIL
CRANE 158 - MUSTARD GAS BURIAL GROUND
NSWC CRANE
CRANE, INDIANA

Location	01SB13	01SB14	01SB14	01SB15	01SB15	01SB16	01SB16	01SB17	01SB17	01SB18
Sample	01SB130610	01SB140206	01SB140610	01SB150206	01SB150610	01SB160206	01SB160610	01SB170206	01SB170610	01SB180206
Matrix	Subsurface Soil	Subsurface Soil	Subsurface Soil	Subsurface Soil	Subsurface Soil	Subsurface Soil	Subsurface Soil	Subsurface Soil	Subsurface Soil	Subsurface Soil
Depth Range	6 - 10	2 - 6	6 - 8	2 - 6	6 - 10	2 - 6	6 - 10	2 - 6	6 - 9.7	2 - 6
Risk	Site	Site	Site	Site	Site	Site	Site	Site	Site	Site
Soil Group	8	8	8	8	8	8	9	8	8	8
Sample Date	8/24/2001	8/24/2001	8/24/2001	8/22/2001	8/22/2001	8/21/2001	8/21/2001	8/24/2001	8/24/2001	8/24/2001
Trans-1,2-Dichloroethene	6 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	6 U
Trans-1,3-Dichloropropene	3 U	3 U	3 U	3 U	3 U	3 U	3 U	3 U	3 U	3 U
Trans-1,4-Dichloro-2-Butene	6 U	5 UJ	5 U	5 U	5 U	5 U	5 U	5 U	5 U	6 U
Trichloroethene	3 U	3 U	3 U	3 U	3 U	3 U	3 U	3 U	3 U	3 U
Trichlorofluoromethane	6 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	6 U
Vinyl Acetate	3 U	3 U	3 U	3 U	3 U	3 U	3 U	3 U	3 U	3 U
Vinyl Chloride	6 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	6 U
Semivolatile Organics (ug/kg)										
1,2,4,5-Tetrachlorobenzene	400 U	390 U	380 U	400 U	400 U	400 U	390 U	360 U	380 U	410 U
1,2,4-Trichlorobenzene	400 U	390 U	380 U	400 U	400 U	400 U	390 U	360 U	380 U	410 U
1,2-Dichlorobenzene	200 U	200 U	190 U	200 U	200 U	200 U	200 U	180 U	190 U	210 U
1,3-Dichlorobenzene	200 U	200 U	190 U	200 U	200 U	200 U	200 U	180 U	190 U	210 U
1,4-Dichlorobenzene	200 U	200 U	190 U	200 U	200 U	200 U	200 U	180 U	190 U	210 U
1,4-Naphthoquinone	400 U	390 U	380 U	400 U	400 U	400 U	390 U	360 U	380 U	410 U
1,4-Phenylenediamine	1000 U	960 U	950 U	990 UJ	990 UJ	1000 U	980 UJ	890 U	960 U	1000 U
1-Naphthylamine	400 U	390 U	380 U	400 U	400 U	400 U	390 U	360 U	380 U	410 U
2,2'-Oxybis(1-Chloropropane)	200 U	200 U	190 U	200 U	200 U	200 U	200 U	180 U	190 U	210 U
2,3,4,6-Tetrachlorophenol	400 U	390 U	380 U	400 U	400 U	400 U	390 U	360 U	380 U	410 U
2,4,5-Trichlorophenol	1000 U	960 U	950 U	990 U	990 U	1000 U	980 U	890 U	960 U	1000 U
2,4,6-Trichlorophenol	400 U	390 U	380 U	400 U	400 U	400 U	390 U	360 U	380 U	410 U
2,4-Dichlorophenol	400 U	390 U	380 U	400 U	400 U	400 U	390 U	360 U	380 U	410 U
2,4-Dimethylphenol	400 U	390 U	380 U	400 U	400 U	400 U	390 U	360 U	380 U	410 U
2,4-Dinitrophenol	1000 U	960 U	950 U	990 U	990 U	1000 U	980 U	890 U	960 U	1000 U
2,6-Dichlorophenol	400 U	390 U	380 U	400 U	400 U	400 U	390 U	360 U	380 U	410 U
2-Acetylaminofluorene	200 U	200 U	190 U	200 U	200 U	200 U	200 U	180 U	190 U	210 U
2-Chloronaphthalene	200 U	200 U	190 U	200 U	200 U	200 U	200 U	180 U	190 U	210 U
2-Chlorophenol	200 U	200 U	190 U	200 U	200 U	200 U	200 U	180 U	190 U	210 U
2-Methylnaphthalene	200 U	200 U	190 U	200 U	200 U	200 U	200 U	180 U	190 U	210 U
2-Methylphenol	200 U	200 U	190 U	200 U	200 U	200 U	200 U	180 U	190 U	210 U
2-Naphthylamine	200 U	200 U	190 U	200 U	200 U	200 U	200 U	190 U	190 U	210 U
2-Nitroaniline	500 U	480 U	480 U	500 U	500 U	500 U	490 U	450 U	480 U	500 U
2-Nitrophenol	400 U	390 U	380 U	400 U	400 U	400 U	390 U	360 U	380 U	410 U
2-Picoline	300 U	290 U	290 U	300 U	300 U	300 U	300 U	320 U	290 U	300 U
3,3'-Dichlorobenzidine	400 U	390 U	380 U	400 U	400 U	400 U	390 U	360 U	380 U	410 U
3,3'-Dimethylbenzidine	400 U	390 U	380 U	400 U	400 U	400 U	390 U	360 U	380 U	410 U
3-Methylcholanthrene	450 U	430 U	430 U	450 U	440 U	450 U	440 U	400 U	430 U	460 U
3-Methylphenol	200 U	200 U	190 U	200 U	200 U	200 U	200 U	180 U	190 U	210 U
3-Nitroaniline	1000 U	960 U	950 U	990 U	990 U	1000 U	980 U	890 U	960 U	1000 U
4,6-Dinitro-2-Methylphenol	1000 U	960 U	950 U	990 U	990 U	1000 U	980 U	890 U	960 U	1000 U
4-Aminobiphenyl	200 U	200 U	190 U	200 U	200 U	200 U	200 U	180 U	190 U	210 U
4-Bromophenyl Phenyl Ether	400 U	390 U	380 U	400 U	400 U	400 U	390 U	360 U	380 U	410 U
4-Chloro-3-Methylphenol	400 U	390 U	380 U	400 U	400 U	400 U	390 U	360 U	380 U	410 U
4-Chloroaniline	400 U	390 U	380 U	400 U	400 U	400 U	390 U	360 U	380 U	410 U
4-Chlorophenyl Phenyl Ether	200 U	200 U	190 U	200 U	200 U	200 U	200 U	180 U	190 U	210 U
4-Methylphenol	200 U	200 U	190 U	200 U	200 U	200 U	200 U	180 U	190 U	210 U
4-Nitroaniline	1000 U	960 U	950 U	990 U	990 U	1000 U	980 U	890 U	960 U	1000 U
4-Nitrophenol	1000 U	960 U	950 U	990 U	990 U	1000 U	980 U	890 U	960 U	1000 U
4-Nitroquinoline-1-Oxide	1000 UR	960 UR	950 UR	990 UR	990 UR	1000 UR	980 UR	890 U	960 UR	1000 UR
5-Nitro-O-Toluidine	400 U	390 U	380 U	400 U	400 U	400 U	390 U	360 U	380 U	410 U
7,12-Dimethylbenz(A)Anthracene	300 U	290 U	290 U	300 U	300 U	300 U	300 U	320 U	290 U	300 U

Calc = Calculated Value as descibed in Section 3 4.2 1
NA = Not A[illegible]d

TABLE-2

SUMMARY OF ANALYTIC RESULTS- SUBSURFACE SOIL
CRANE 158 - MUSTARD GAS BURIAL GROUND
NSWC CRANE
CRANE, INDIANA

Location	01SB13	01SB14	01SB14	01SB15	01SB15	01SB16	01SB16	01SB17	01SB17	01SB18
Sample	01SB130610	01SB140206	01SB140610	01SB150206	01SB150610	01SB160206	01SB160610	01SB170206	01SB170610	01SB180206
Matrix	Subsurface Soil	Subsurface Soil	Subsurface Soil	Subsurface Soil	Subsurface Soil	Subsurface Soil	Subsurface Soil	Subsurface Soil	Subsurface Soil	Subsurface Soil
Depth Range	6 - 10	2 - 6	6 - 8	2 - 6	6 - 10	2 - 6	6 - 10	2 - 6	6 - 9.7	2 - 6
Risk	Site	Site	Site	Site	Site	Site	Site	Site	Site	Site
Soil Group	8	8	8	8	8	8	9	8	8	8
Sample Date	8/24/2001	8/24/2001	8/24/2001	8/22/2001	8/22/2001	8/21/2001	8/21/2001	8/24/2001	8/24/2001	8/24/2001
A,A-Dimethylphenethylamine	1000 U	960 U	950 U	990 UJ	990 U	1000 U	980 U	890 U	960 U	1000 U
Acenaphthene	11.9 U	14.2	11.4 U	11.9 U	12 U	12 U	11.8 U	12.7 U	11.4 UR	12 U
Acenaphthylene	11.9 U	11.6 U	11.4 U	11.9 UJ	12 UJ	12 U	11.8 U	12.7 U	11.4 UR	12 U
Acetophenone	200 U	200 U	190 U	200 U	200 U	200 U	200 U	180 U	190 U	210 U
Aniline	200 U	200 U	190 U	200 U	200 U	200 U	200 U	180 U	190 U	210 U
Anthracene	11.9 U	11.6 U	11.4 U	11.9 UJ	12 UJ	12 U	11.8 U	12.7 U	11.4 UR	12 U
Aramite	1000 U	960 U	950 U	990 U	990 U	1000 U	980 U	890 U	960 U	1000 U
Benzo(A)Anthracene	11.9 U	11.6 U	11.4 U	11.9 U	12 U	12 U	11.8 U	12.7 U	11.4 UR	12 U
Benzo(A)Pyrene	11.9 U	11.6 U	11.4 U	11.9 U	12 U	12 U	11.8 U	12.7 U	11.4 UR	12 U
Benzo(B)Fluoranthene	11.9 U	11.6 U	11.4 U	11.9 U	12 U	12 U	11.8 U	12.7 U	11.4 UR	12 U
Benzo(G,H,I)Perylene	11.9 U	11.6 U	11.4 U	11.9 U	12 U	12 U	11.8 U	12.7 U	11.4 UR	12 U
Benzo(K)Fluoranthene	11.9 U	11.6 U	11.4 U	11.9 U	12 U	12 U	11.8 U	12.7 U	11.4 UR	12 U
Benzyl Alcohol	270 U	270 U	270 U	270 U	270 U	270 U	270 U	270 U	270 U	270 U
Bis(2-Chloroethoxy)Methane	400 U	390 U	380 U	400 U	400 U	400 U	390 U	360 U	380 U	410 U
Bis(2-Chloroethyl)Ether	200 U	200 U	190 U	200 U	200 U	200 U	200 U	180 U	190 U	210 U
Bis(2-Ethylhexyl)Phthalate	200 U	200 U	190 U	200 U	200 U	200 U	97 J	180 U	190 U	210 U
Butyl Benzyl Phthalate	200 U	200 U	190 U	200 U	200 U	200 U	200 U	180 U	190 U	210 U
Chlorobenzilate	400 U	390 U	380 U	400 U	400 U	400 U	390 U	360 U	380 U	410 U
Chrysene	11.9 U	11.6 U	11.4 U	11.9 U	12 U	12 U	11.8 U	12.7 U	11.4 UR	12 U
Di-N-Butyl Phthalate	200 UJ	200 UJ	190 UJ	200 U	200 U	200 U	200 U	180 UJ	190 U	210 UJ
Di-N-Octyl Phthalate	200 U	200 U	190 U	200 U	200 U	200 U	200 U	190 U	190 U	210 U
Diallate	400 U	390 U	380 U	400 U	400 U	400 U	390 U	360 U	380 U	410 U
Dibenzo(A,H)Anthracene	11.9 U	11.6 U	11.4 U	11.9 UJ	12 UJ	12 U	11.8 U	12.7 U	11.4 UR	12 U
Dibenzofuran	200 U	200 U	190 U	200 U	200 U	200 U	200 U	180 U	190 U	210 U
Diethyl Phthalate	200 U	200 U	190 U	200 U	200 U	200 U	200 U	180 U	190 U	210 U
Dimethyl Phthalate	200 U	200 U	190 U	200 U	200 U	200 U	200 U	180 U	190 U	210 U
Diphenylamine	200 U	200 U	190 U	200 U	200 U	200 U	200 U	180 U	190 U	210 U
Ethyl Methane Sulfonate	200 U	200 U	190 U	200 U	200 U	200 U	200 U	180 U	190 U	210 U
Fluoranthene	11.9 U	11.6 U	11.4 U	11.9 U	12 U	12 U	11.8 U	12.7 U	11.4 UR	12 U
Fluorene	11.9 U	11.6 U	11.4 U	11.9 U	12 U	12 U	11.8 U	12.7 U	11.4 UR	12 U
Hexachlorobenzene	400 U	390 U	380 U	400 U	400 U	400 U	390 U	360 U	380 U	410 U
Hexachlorobutadiene	400 U	390 U	380 U	400 U	400 U	400 U	390 U	360 U	380 U	410 U
Hexachlorocyclopentadiene	400 U	390 U	380 U	400 U	400 U	400 U	390 U	360 U	380 U	410 U
Hexachloroethane	200 U	200 U	190 U	200 U	200 U	200 U	200 U	180 U	190 U	210 U
Hexachlorophene	16000 U	15000 U	15000 U	16000 UJ	16000 UJ	16000 UJ	16000 UJ	14000 U	15000 U	16000 U
Hexachloropropene	400 U	390 U	380 U	400 U	400 U	400 U	390 U	360 U	380 U	410 U
Indeno(1,2,3-CD)Pyrene	11.9 U	11.6 U	11.4 U	11.9 U	12 U	12 U	11.8 U	12.7 U	11.4 UR	12 U
Isodrin	400 U	390 U	380 U	400 U	400 U	400 U	390 U	360 U	380 U	410 U
Isophorone	200 U	200 U	190 U	200 U	200 U	200 U	200 U	180 U	190 U	210 U
Isosafrole	400 U	390 U	380 U	400 U	400 U	400 U	390 U	360 U	380 U	410 U
Kepone	1000 U	960 U	950 U	990 U	990 U	1000 U	980 U	890 U	960 U	1000 U
Methapyrilene	1000 U	960 U	950 U	990 U	990 U	1000 U	980 U	890 U	960 U	1000 U
Methyl Methane Sulfonate	500 U	480 U	480 U	500 U	500 U	500 U	490 U	450 U	480 U	500 U
N-Nitroso-Di-N-Butylamine	400 U	390 U	380 U	400 U	400 U	400 U	390 U	360 U	380 U	410 U
N-Nitroso-Di-N-Propylamine	200 U	200 U	190 U	200 U	200 U	200 U	200 U	180 U	190 U	210 U
N-Nitrosodiethylamine	200 U	200 U	190 U	200 U	200 U	200 U	200 U	180 U	190 U	210 U
N-Nitrosodimethylamine	200 U	200 U	190 U	200 U	200 U	200 U	200 U	180 U	190 U	210 U
N-Nitrosomethylethylamine	200 U	200 U	190 U	200 U	200 U	200 U	200 U	180 U	190 U	210 U
N-Nitrosomorpholine	200 U	200 U	190 U	200 U	200 U	200 U	200 U	180 U	190 U	210 U
N-Nitrosopiperidine	400 U	390 U	380 U	400 U	400 U	400 U	390 U	360 U	380 U	410 U

Calc = Calculated Value as described in Section 3 4 2.1
NA = Not Analyzed

TABLE E-2

SUMMARY OF ANALYTIC RESULTS- SUBSURFACE SOIL
CRANE 158 - MUSTARD GAS BURIAL GROUND
NSWC CRANE
CRANE, INDIANA

Location	01SB13	01SB14	01SB14	01SB15	01SB15	01SB16	01SB16	01SB17	01SB17	01SB18
Sample	01SB130610	01SB140206	01SB140610	01SB150206	01SB150610	01SB160206	01SB160610	01SB170206	01SB170610	01SB180206
Matrix	Subsurface Soil	Subsurface Soil	Subsurface Soil	Subsurface Soil	Subsurface Soil	Subsurface Soil	Subsurface Soil	Subsurface Soil	Subsurface Soil	Subsurface Soil
Depth Range	6 - 10	2 - 6	6 - 8	2 - 6	6 - 10	2 - 6	6 - 10	2 - 6	6 - 9.7	2 - 6
Risk	Site	Site	Site	Site	Site	Site	Site	Site	Site	Site
Soil Group	8	8	8	8	8	8	9	8	8	8
Sample Date	8/24/2001	8/24/2001	8/24/2001	8/22/2001	8/22/2001	8/21/2001	8/21/2001	8/24/2001	8/24/2001	8/24/2001
N-Nitrosopyrrolidine	200 U	200 U	190 U	200 U	200 U	200 U	200 U	180 U	190 U	210 U
Naphthalene	11.9 U	11 6 U	11 4 U	11 9 UR	12 UR	12 UR	11 8 UR	12 7 U	11.4 UR	12 U
O,O,O-Triethyl Phosphorothioate	400 U	390 U	380 U	400 U	400 U	400 U	390 U	360 U	380 U	410 U
O-Toluidine	200 U	200 U	190 U	200 U	200 U	200 U	200 U	180 U	190 U	210 U
P-(Dimethylamino)Azobenzene	400 U	390 U	380 U	400 U	400 U	400 U	390 U	360 U	380 U	410 U
Pentachlorobenzene	400 U	390 U	380 U	400 U	400 U	400 U	390 U	360 U	380 U	410 U
Pentachloronitrobenzene	1000 U	960 U	950 U	990 U	990 U	1000 U	980 U	890 U	960 U	1000 U
Phenacetin	400 U	390 U	380 U	400 U	400 U	400 U	390 U	360 U	380 U	410 U
Phenanthrene	11 9 U	11 6 U	11 4 U	11 9 U	12 U	12 U	11 8 U	12 7 U	11 4 UR	12 U
Phenol	200 U	200 U	190 U	200 U	200 U	200 U	200 U	180 U	190 U	210 U
Pronamide	400 U	390 U	380 U	400 UR	400 UR	400 UR	390 UR	360 U	380 U	410 U
Pyrene	11 9 U	11 6 U	11 4 U	11 9 U	12 U	12 U	11 8 U	12 7 U	11 4 UR	12 U
Pyridine	220 U	220 U	220 U	220 U	220 U	220 U	220 U	220 U	220 U	220 U
Safrole	400 U	390 U	380 U	400 U	400 U	400 U	390 U	360 U	380 U	410 U
Energertics (ug/kg)										
1,3,5-Trinitrobenzene	454 U	476 U	476 U	476 U	476 U	476 U	454 U	454 U	476 U	476 U
1,3-Dinitrobenzene	454 U	476 U	476 U	476 U	476 U	476 U	454 U	454 U	476 U	476 U
2,4,6-Trinitrotoluene	454 U	476 U	476 U	476 U	476 U	476 U	454 U	454 U	476 U	476 U
2,4-Dinitrotoluene	454 U	476 U	476 U	476 U	476 U	476 U	454 U	454 U	476 U	476 U
2,6-Dinitrotoluene	454 U	476 U	476 U	476 U	476 U	476 U	454 U	454 U	476 U	476 U
2-Amino-4,6-Dinitrotoluene	454 U	476 U	476 U	476 U	476 U	476 U	454 U	454 U	476 U	476 U
2-Nitrotoluene	454 U	476 U	476 U	476 U	476 U	476 U	454 U	454 U	476 U	476 U
3-Nitrotoluene	454 U	476 U	476 U	476 U	476 U	476 U	454 U	454 U	476 U	476 U
4-Amino-2,6-Dinitrotoluene	454 U	476 U	476 U	476 U	476 U	476 U	454 U	454 U	476 U	476 U
4-Nitrotoluene	454 U	476 U	476 U	476 U	476 U	476 U	454 U	454 U	476 U	476 U
HMX	454 U	476 U	476 U	476 U	476 U	476 U	454 U	454 U	476 U	476 U
Nitrobenzene	454 U	476 U	476 U	476 U	476 U	476 U	454 U	454 U	476 U	476 U
RDX	454 U	476 U	476 U	476 U	476 U	476 U	454 U	454 U	476 U	476 U
Tetryl	454 U	476 U	476 U	476 U	476 U	476 U	454 U	454 U	476 U	476 U
Pesticides/PCBs (ug/kg)										
4,4'-DDD	NA	2 9 U	NA	3 U	NA	3 U	NA	3 2 U	NA	3 U
4,4'-DDE	NA	2 9 U	NA	3 U	NA	3 U	NA	3 2 U	NA	3 U
4,4'-DDT	NA	2 9 U	NA	3 U	NA	3 U	NA	3 2 U	NA	3 U
Aldrin	NA	1 5 U	NA	1 6 U	NA	1 6 U	NA	1 7 U	NA	1 6 U
Alpha-BHC	NA	1 5 U	NA	1 6 U	NA	1 6 U	NA	1 7 U	NA	1 6 U
Alpha-Chlordane	NA	1 5 U	NA	1 6 U	NA	1 6 U	NA	1 7 U	NA	1 6 U
Aroclor-1016	NA	38 U	NA	40 U	NA	40 U	NA	42 U	NA	40 U
Aroclor-1221	NA	38 U	NA	40 U	NA	40 U	NA	42 U	NA	40 U
Aroclor-1232	NA	38 U	NA	40 U	NA	40 U	NA	42 U	NA	40 U
Aroclor-1242	NA	38 U	NA	40 U	NA	40 U	NA	42 U	NA	40 U
Aroclor-1248	NA	38 U	NA	40 U	NA	40 U	NA	42 U	NA	40 U
Aroclor-1254	NA	38 U	NA	40 U	NA	40 U	NA	42 U	NA	40 U
Aroclor-1260	NA	38 U	NA	40 U	NA	40 U	NA	42 U	NA	40 U
Beta-BHC	NA	1 5 U	NA	1 6 U	NA	1 6 U	NA	1 7 U	NA	1 6 U
Delta-BHC	NA	1 5 U	NA	1 6 U	NA	1 6 U	NA	1 7 U	NA	1 6 U
Dieldrin	NA	2 9 U	NA	3 U	NA	3 U	NA	3 2 U	NA	3 U
Endosulfan I	NA	1 5 U	NA	1.6 U	NA	1 6 U	NA	1 7 U	NA	1 6 U
Endosulfan II	NA	2 9 U	NA	3 U	NA	3 U	NA	3 2 U	NA	3 U
Endosulfan Sulfate	NA	2.9 U	NA	3 U	NA	3 U	NA	3 2 U	NA	3 U
Endrin	NA	2 9 U	NA	3 U	NA	3 U	NA	3 2 U	NA	3 U

Calc = Calculated Value as described in Section 3 4 2 1.
NA = Not A[illegible]ed

TABLE E-2

SUMMARY OF ANALYTIC RESULTS- SUBSURFACE SOIL
CRANE 158 - MUSTARD GAS BURIAL GROUND
NSWC CRANE
CRANE, INDIANA

Location	01SB13	01SB14	01SB14	01SB15	01SB15	01SB16	01SB16	01SB17	01SB17	01SB18
Sample	01SB130610	01SB140206	01SB140610	01SB150206	01SB150610	01SB160206	01SB160610	01SB170206	01SB170610	01SB180206
Matrix	Subsurface Soil	Subsurface Soil	Subsurface Soil	Subsurface Soil	Subsurface Soil	Subsurface Soil	Subsurface Soil	Subsurface Soil	Subsurface Soil	Subsurface Soil
Depth Range	6 - 10	2 - 6	6 - 8	2 - 6	6 - 10	2 - 6	6 - 10	2 - 6	6 - 9.7	2 - 6
Risk	Site	Site	Site	Site	Site	Site	Site	Site	Site	Site
Soil Group	8	8	8	8	8	8	9	8	8	8
Sample Date	8/24/2001	8/24/2001	8/24/2001	8/22/2001	8/22/2001	8/21/2001	8/21/2001	8/24/2001	8/24/2001	8/24/2001
Endrin Aldehyde	NA	2 9 U	NA	3 U	NA	3 U	NA	3 2 U	NA	3 U
Gamma-BHC (Lindane)	NA	1 5 U	NA	1 6 U	NA	1 6 U	NA	1 7 U	NA	1 6 U
Gamma-Chlordane	NA	0 64 J	NA	1 6 U	NA	3 J	NA	0 65 J	NA	0 98 J
Heptachlor	NA	1 4 BU	NA	2 J	NA	1 9	NA	2 1 BU	NA	1 BU
Heptachlor Epoxide	NA	1 5 U	NA	1 6 U	NA	1 6 U	NA	1 7 U	NA	1 6 U
Methoxychlor	NA	15 U	NA	16 U	NA	16 U	NA	17 U	NA	16 U
Toxaphene	NA	96 U	NA	99 U	NA	99 U	NA	110 U	NA	100 U
Herbicides (ug/kg)										
2,4,5-T	NA	12 U	NA	12 U	NA	12 U	NA	13 U	NA	12 U
2,4,5-TP (Silvex)	NA	12 U	NA	12 UJ	NA	12 U	NA	13 U	NA	12 U
2,4-D	NA	81 U	NA	84 U	NA	85 U	NA	90 U	NA	85 U
Dinoseb	NA	23 U	NA	24 U	NA	24 U	NA	26 U	NA	24 U
Pentachlorophenol	NA	12 U	NA	12 U	NA	12 U	NA	13 U	NA	12 U
Inorganics (mg/kg)										
Aluminum	4090 J	7630 J	3270 J	8610 J	4280 J	9900	5760	10600 J	6800 J	4700 J
Antimony	0 19 UJ	0 29 U	0 25 U	0 23 U	0 23 U	0 51 U	0 51 U	0 61 U	0 18 UJ	0 25 U
Arsenic	2 0 U	2 8 J	1 7 U	4 7	0 85	4 4	7 8	7 2 J	1.2 U	1.8 U
Barium	34 3	30 8	21 4	36 3	41 7	32 7	34 1	43 7	300	31 4
Beryllium	0 36 J	0 34 J	0 22 U	0 38 U	0 69 J	0 27 U	0 33 U	0 38 J	0.58 J	0 34 J
Cadmium	0 04	0 04 J	0 05	0 01 U	0 01 U	0 05 UJ	0 59 J	0 20 J	0 04	0 04 U
Calcium	475 J	314 J	251 J	350 J	1080 J	3250	834	393 J	912 J	223 J
Chromium	7 5 J	12 1 J	6 9 J	15 5	6.4 J	12 7	9 8	12 7 J	8 7 J	8 0 J
Cobalt	2 2 J	2 4 J	1 7 J	3 4 J	8 1 J	2 7 J	1 4 J	4 5 J	4 3 J	2 6 J
Copper	7 5 J	6 7 J	4 3 J	9 6 J	9 5 J	9 8 J	7 6 J	12 8 J	6 8 J	9 4 J
Iron	8200	11700	6540	19500	9730 J	17400	12000	18800	4940	8540
Lead	8 8	12 0	6 1	12 0 J	5 8 J	10 3	18 0	12 8	9 8	8 4
Magnesium	640 J	945 J	477 J	1430 J	1150 J	1760	617	1900 J	1300 J	683 J
Manganese	12 8 J	114 J	23 3 J	155 J	32 2 J	66 4	12 3	177 J	12 9 J	15 6 J
Mercury	0 02 U	0 02 U	0 02 U	0 04	0 03	0 05 U	0 03 U	0 02 U	0 02 U	0 02 U
Nickel	6 0 J	4 9 J	4 0 J	6 8	12 1	6 0	3 4	9 1 J	10 5 J	6 8 J
Potassium	531 J	329 J	359 J	356 J	488 J	417 J	254 J	574 J	550 J	570 J
Selenium	0 52 U	0 52 U	0 28 U	0 28 UJ	0 28 U	0 38 U	0 38 U	0 65 U	0 22 U	0 35 U
Silver	0 36 U	0 35 U	0 34 U	0 02 U	0 02 U	0 15 U	0 15 U	0 38 U	0 34 U	0 35 U
Sodium	349 J	318 J	329 J	360 J	351 J	356	355	379 J	441 J	385 J
Strontium	4 1 J	5 1 J	3 2 J	4 7 J	5 3 J	7 8 J	5 2 J	6 4 J	11 3 J	3 5 J
Thallium	0 86	1 3 J	1 1	1 4 J	1 0	2 2	1 4	1 8 J	0 75	1.1
Thorium-Calc	3 12	3 59	3 38	3 08	4 84	3 50	4 59	3 51	4 11	4 7
Tin	22 6 U	22 1 U	21.4 U	3 4	3.6	2 7	2 3 U	23 9 U	21 8 U	22.3 U
Vanadium	10 4	21 7	7 4	25 2 J	7 2 J	22 4	16 1	26 4	7 1	10 1
Zinc	20 6 J	15 7 J	18 0 J	26 8	31 8	22 8	11 2	36.8 J	29 0 J	25 6 J
Miscellaneous Parameters										
1,4-Dithiane (ug/kg)	240 U	233 U	230 U	240 U	242 U	243 U	238 U	256 U	229 U	244 U
1,4-Oxathiane (ug/kg)	240 U	233 U	230 U	240 U	242 U	243 U	238 U	256 U	229 U	244 U
Bis(2-Chloroethyl)Sulfide (ug/kg)	240 U	233 U	230 U	240 U	242 U	243 U	238 U	256 U	229 U	244 U
Cation Exchange Capacity (meq/100g)	11 J	NA	NA	NA	NA	NA	NA	NA	NA	NA
pH (S U)	5 7	NA	NA	NA	NA	NA	NA	NA	NA	NA
Total Organic Carbon (mg/kg)	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Total Radiologicals (pCi/g)										
Actinium-228	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Bismuth-212	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA

Calc = Calculated Value as descibed in Section 3 4 2 1
NA = Not Analyzed

TABLE E-2

SUMMARY OF ANALYTIC RESULTS- SUBSURFACE SOIL
CRANE 158 - MUSTARD GAS BURIAL GROUND
NSWC CRANE
CRANE, INDIANA

Location	01SB13	01SB14	01SB14	01SB15	01SB15	01SB16	01SB16	01SB17	01SB17	01SB18
Sample	01SB130610	01SB140206	01SB140610	01SB150206	01SB150610	01SB160206	01SB160610	01SB170206	01SB170610	01SB180206
Matrix	Subsurface Soil	Subsurface Soil	Subsurface Soil	Subsurface Soil	Subsurface Soil	Subsurface Soil	Subsurface Soil	Subsurface Soil	Subsurface Soil	Subsurface Soil
Depth Range	6 - 10	2 - 6	6 - 8	2 - 6	6 - 10	2 - 6	6 - 10	2 - 6	6 - 9.7	2 - 6
Risk	Site	Site	Site	Site	Site	Site	Site	Site	Site	Site
Soil Group	8	8	8	8	8	8	9	8	8	8
Sample Date	8/24/2001	8/24/2001	8/24/2001	8/22/2001	8/22/2001	8/21/2001	8/21/2001	8/24/2001	8/24/2001	8/24/2001
Bismuth-214	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Cesium-137	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Cobalt-60	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Europium-154	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Europium-155	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Lead-210	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Lead-212	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Lead-214	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Potassium-40	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Protactinium-234	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Radium-226	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Thallium-208	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Thorium-228	0 298	0 331	0 378	0 308	0 627	0 266	0 535	0 360	0 480	0 452
Thorium-230	0 284 J	0 0540 U	0 257 J	0 539 J	0 474 J	0 438	0 349	0 0428 U	0 0683 U	0 265 J
Thorium-232	0 388	0 458	0 365	0 369	0 438	0 503	0 474	0 413	0 424	0 583
Thorium-234	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Uranium-235	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA

Calc = Calculated Value as described in Section 3 4 2 1
NA = Not Analyzed

TABLE-2

SUMMARY OF ANALYTIC RESULTS- SUBSURFACE SOIL
CRANE 158 - MUSTARD GAS BURIAL GROUND
NSWC CRANE
CRANE, INDIANA

Location	01SB18	01SB19	01SB19	01SB20	01SB20	01SB21	01SB21	BG1SBP01	BG1SBP02
Sample	01SB180610	01SB190206	01SB190610	01SB200206	01SB200610	01SB210206	01SB210610	BG1SBP0103	BG1SBP0204
Matrix	Subsurface Soil	Subsurface Soil	Subsurface Soil	Subsurface Soil	Subsurface Soil	Subsurface Soil	Subsurface Soil	Subsurface Soil	Subsurface Soil
Depth Range	6 - 8	2 - 6	6 - 8	2 - 6	6 - 8	0 - 2	6 - 10	2 - 3	3 - 4
Risk	Site	Site	Site	Site	Site	Site Background	Site Background	Basewide Background	Basewide Background
Soil Group	8	8	9	8	8	8	9	8	8
Sample Date	8/24/2001	8/24/2001	8/24/2001	8/21/2001	8/21/2001	8/21/2001	8/21/2001	11/6/1999	11/6/1999
Volatile Organics (ug/kg)									
1,1,1,2-Tetrachloroethane	3 U	4 U	3 U	3 U	3 U	NA	NA	NA	NA
1,1,1-Trichloroethane	3 U	4 U	3 U	3 U	3 U	NA	NA	NA	NA
1,1,2,2-Tetrachloroethane	3 U	4 U	3 U	3 U	3 U	NA	NA	NA	NA
1,1,2-Trichloroethane	6 U	7 U	6 U	5 U	5 U	NA	NA	NA	NA
1,1-Dichloroethane	3 U	4 U	3 U	3 U	3 U	NA	NA	NA	NA
1,1-Dichloroethene	6 U	7 U	6 U	5 U	5 U	NA	NA	NA	NA
1,2,3-Trichloropropane	3 U	4 U	3 U	3 U	3 U	NA	NA	NA	NA
1,2-Dibromo-3-Chloropropane	6 U	7 U	6 U	5 U	5 U	NA	NA	NA	NA
1,2-Dibromoethane	3 U	4 U	3 U	3 U	3 U	NA	NA	NA	NA
1,2-Dichloroethane	3 U	4 U	3 U	3 U	3 U	NA	NA	NA	NA
1,2-Dichloropropane	6 U	7 U	6 U	5 U	5 U	NA	NA	NA	NA
1,4-Dioxane	590 UR	730 UR	620 UR	500 UR	530 UR	NA	NA	NA	NA
2-Butanone	6 UJ	7 UJ	6 UJ	5 U	5 U	NA	NA	NA	NA
2-Hexanone	6 U	7 U	6 U	5 U	5 U	NA	NA	NA	NA
3-Chloropropene	6 UJ	7 UJ	6 UJ	5 UJ	5 UJ	NA	NA	NA	NA
4-Methyl-2-Pentanone	3 U	4 U	3 U	3 U	3 U	NA	NA	NA	NA
Acetone	42	20	31	5 UJ	5 UJ	NA	NA	NA	NA
Acetonitrile	230 UJ	290 UJ	250 UJ	200 UJ	210 UJ	NA	NA	NA	NA
Acrolein	59 UR	73 UR	62 UR	50 UR	53 UR	NA	NA	NA	NA
Acrylonitrile	59 U	73 U	62 U	50 U	53 U	NA	NA	NA	NA
Benzene	3 U	4 U	3 U	3 U	3 U	NA	NA	NA	NA
Bromodichloromethane	3 U	4 U	3 U	3 U	3 U	NA	NA	NA	NA
Bromofor	3 U	4 U	3 U	3 U	3 U	NA	NA	NA	NA
Bromomethane	6 U	7 U	6 U	5 U	5 U	NA	NA	NA	NA
Carbon Disulfide	3 U	4 U	3 U	3 U	3 U	NA	NA	NA	NA
Carbon Tetrachloride	3 UJ	4 UJ	3 UJ	3 UJ	3 UJ	NA	NA	NA	NA
Chlorobenzene	3 U	4 U	3 U	3 U	3 U	NA	NA	NA	NA
Chlorodibromomethane	3 U	4 U	3 U	3 U	3 U	NA	NA	NA	NA
Chloroethane	6 U	7 U	6 U	5 U	5 U	NA	NA	NA	NA
Chlorofor	3 U	4 U	3 U	3 U	3 U	NA	NA	NA	NA
Chloromethane	6 U	7 U	6 U	5 UJ	5 UJ	NA	NA	NA	NA
Chloroprene	6 UJ	7 UJ	6 UJ	5 UJ	5 UJ	NA	NA	NA	NA
Cis-1,2-Dichloroethene	6 U	7 U	6 U	5 U	5 U	NA	NA	NA	NA
Cis-1,3-Dichloropropene	3 U	4 U	3 U	3 U	3 U	NA	NA	NA	NA
Dibromomethane	6 U	7 U	6 U	5 U	5 U	NA	NA	NA	NA
Dichlorodifluoromethane	3 U	4 U	3 U	3 U	3 U	NA	NA	NA	NA
Ethyl Methacrylate	6 U	7 U	6 U	5 U	5 U	NA	NA	NA	NA
Ethylbenzene	3 U	4 U	3 U	3 U	3 U	NA	NA	NA	NA
Isobutanol	230 UR	290 UR	250 UR	200 UR	210 UR	NA	NA	NA	NA
Methacrylonitrile	120 UJ	150 UJ	120 UJ	100 U	110 U	NA	NA	NA	NA
Methyl Iodide	6 UJ	7 UJ	6 UJ	5 UJ	5 UJ	NA	NA	NA	NA
Methyl Methacrylate	6 U	7 U	6 U	5 U	5 U	NA	NA	NA	NA
Methylene Chloride	6 J	7 J	5 J	12 J	9 J	NA	NA	NA	NA
Pentachloroethane	6 UJ	7 UJ	6 UJ	5 UJ	5 UJ	NA	NA	NA	NA
Propionitrile	120 UR	150 UR	120 UR	100 UR	110 UR	NA	NA	NA	NA
Styrene	3 U	4 U	3 U	3 U	3 U	NA	NA	NA	NA
Tetrachloroethene	3 U	4 U	3 U	3 U	3 U	NA	NA	NA	NA
Toluene	3 U	4 U	3 U	3 U	3 U	NA	NA	NA	NA
Total Xylenes	3 U	4 U	3 U	3 U	3 U	NA	NA	NA	NA

Calc = Calculated Value as described in Section 3 4 2 1
NA = Not Analyzed

TABLE E-2

SUMMARY OF ANALYTIC RESULTS- SUBSURFACE SOIL
CRANE 158 - MUSTARD GAS BURIAL GROUND
NSWC CRANE
CRANE, INDIANA

Location	01SB18	01SB19	01SB19	01SB20	01SB20	01SB21	01SB21	BG1SBP01	BG1SBP02
Sample	01SB180610	01SB190206	01SB190610	01SB200206	01SB200610	01SB210206	01SB210610	BG1SBP0103	BG1SBP0204
Matrix	Subsurface Soil	Subsurface Soil	Subsurface Soil	Subsurface Soil	Subsurface Soil	Subsurface Soil	Subsurface Soil	Subsurface Soil	Subsurface Soil
Depth Range	6 - 8	2 - 6	6 - 8	2 - 6	6 - 8	0 - 2	6 - 10	2 - 3	3 - 4
Risk	Site	Site	Site	Site	Site	Site Background	Site Background	Basewide Background	Basewide Background
Soil Group	8	8	9	8	8	8	9	8	8
Sample Date	8/24/2001	8/24/2001	8/24/2001	8/21/2001	8/21/2001	8/21/2001	8/21/2001	11/6/1999	11/6/1999
Trans-1,2-Dichloroethene	6 U	7 U	6 U	5 U	5 U	NA	NA	NA	NA
Trans-1,3-Dichloropropene	3 U	4 U	3 U	3 U	3 U	NA	NA	NA	NA
Trans-1,4-Dichloro-2-Butene	6 U	7 U	6 U	5 U	5 U	NA	NA	NA	NA
Trichloroethene	3 U	4 U	3 U	3 U	3 U	NA	NA	NA	NA
Trichlorofluoromethane	6 U	7 U	6 U	5 U	5 U	NA	NA	NA	NA
Vinyl Acetate	3 U	4 U	3 U	3 U	3 U	NA	NA	NA	NA
Vinyl Chloride	6 U	7 U	6 U	5 U	5 U	NA	NA	NA	NA
Semivolatile Organics (ug/kg)									
1,2,4,5-Tetrachlorobenzene	420 U	490 U	390 U	400 U	410 U	NA	NA	NA	NA
1,2,4-Trichlorobenzene	420 U	490 U	390 U	400 U	410 U	NA	NA	NA	NA
1,2-Dichlorobenzene	210 U	250 U	200 U	200 U	210 U	NA	NA	NA	NA
1,3-Dichlorobenzene	210 U	250 U	200 U	200 U	210 U	NA	NA	NA	NA
1,4-Dichlorobenzene	210 U	250 U	200 U	200 U	210 U	NA	NA	NA	NA
1,4-Naphthoquinone	420 U	490 U	390 U	400 U	410 U	NA	NA	NA	NA
1,4-Phenylenediamine	1000 U	1200 U	970 U	1000 U	1000 U	NA	NA	NA	NA
1-Naphthylamine	420 U	490 U	390 U	400 U	410 U	NA	NA	NA	NA
2,2'-Oxybis(1-Chloropropane)	210 U	250 U	200 U	200 U	210 U	NA	NA	NA	NA
2,3,4,6-Tetrachlorophenol	420 U	490 U	390 U	400 U	410 U	NA	NA	NA	NA
2,4,5-Trichlorophenol	1000 U	1200 U	970 U	1000 U	1000 U	NA	NA	NA	NA
2,4,6-Trichlorophenol	420 U	490 U	390 U	400 U	410 U	NA	NA	NA	NA
2,4-Dichlorophenol	420 U	490 U	390 U	400 U	410 U	NA	NA	NA	NA
2,4-Dimethylphenol	420 U	490 U	390 U	400 U	410 U	NA	NA	NA	NA
2,4-Dinitrophenol	1000 U	1200 U	970 U	1000 U	1000 U	NA	NA	NA	NA
2,6-Dichlorophenol	420 U	490 U	390 U	400 U	410 U	NA	NA	NA	NA
2-Acetylaminofluorene	210 U	250 U	200 U	200 U	210 U	NA	NA	NA	NA
2-Chloronaphthalene	210 U	250 U	200 U	200 U	210 U	NA	NA	NA	NA
2-Chlorophenol	210 U	250 U	200 U	200 U	210 U	NA	NA	NA	NA
2-Methylnaphthalene	210 U	250 U	200 U	200 U	210 U	NA	NA	NA	NA
2-Methylphenol	210 U	250 U	200 U	200 U	210 U	NA	NA	NA	NA
2-Naphthylamine	210 U	250 U	200 U	200 U	210 U	NA	NA	NA	NA
2-Nitroaniline	500 U	600 U	490 U	500 U	500 U	NA	NA	NA	NA
2-Nitrophenol	420 U	490 U	390 U	400 U	410 U	NA	NA	NA	NA
2-Picoline	310 U	370 U	300 U	300 U	310 U	NA	NA	NA	NA
3,3'-Dichlorobenzidine	420 U	490 U	390 U	400 U	410 U	NA	NA	NA	NA
3,3'-Dimethylbenzidine	420 U	490 U	390 U	400 U	410 U	NA	NA	NA	NA
3-Methylcholanthrene	470 U	550 U	440 U	450 U	460 U	NA	NA	NA	NA
3-Methylphenol	210 U	250 U	200 U	200 U	210 U	NA	NA	NA	NA
3-Nitroaniline	1000 U	1200 U	970 U	1000 U	1000 U	NA	NA	NA	NA
4,6-Dinitro-2-Methylphenol	1000 U	1200 U	970 U	1000 U	1000 U	NA	NA	NA	NA
4-Aminobiphenyl	210 U	250 U	200 U	200 U	210 U	NA	NA	NA	NA
4-Bromophenyl Phenyl Ether	420 U	490 U	390 U	400 U	410 U	NA	NA	NA	NA
4-Chloro-3-Methylphenol	420 U	490 U	390 U	400 U	410 U	NA	NA	NA	NA
4-Chloroaniline	420 U	490 U	390 U	400 U	410 U	NA	NA	NA	NA
4-Chlorophenyl Phenyl Ether	210 U	250 U	200 U	200 U	210 U	NA	NA	NA	NA
4-Methylphenol	210 U	250 U	200 U	200 U	210 U	NA	NA	NA	NA
4-Nitroaniline	1000 U	1200 U	970 U	1000 U	1000 U	NA	NA	NA	NA
4-Nitrophenol	1000 U	1200 U	970 U	1000 U	1000 U	NA	NA	NA	NA
4-Nitroquinoline-1-Oxide	1000 UR	1200 UR	970 U	1000 UR	1000 UR	NA	NA	NA	NA
5-Nitro-O-Toluidine	420 U	490 U	390 U	400 U	410 U	NA	NA	NA	NA
7,12-Dimethylbenz(A)Anthracene	310 U	370 U	300 U	300 U	310 U	NA	NA	NA	NA

Calc = Calculated Value as described in Section 3 4 2 1
NA = Not A[illegible]d

TABLE E-2

SUMMARY OF ANALYTIC RESULTS- SUBSURFACE SOIL
CRANE 158 - MUSTARD GAS BURIAL GROUND
NSWC CRANE
CRANE, INDIANA

Location	01SB18	01SB19	01SB19	01SB20	01SB20	01SB21	01SB21	BG1SBP01	BG1SBP02
Sample	01SB180610	01SB190206	01SB190610	01SB200206	01SB200610	01SB210206	01SB210610	BG1SBP0103	BG1SBP0204
Matrix	Subsurface Soil	Subsurface Soil	Subsurface Soil	Subsurface Soil	Subsurface Soil	Subsurface Soil	Subsurface Soil	Subsurface Soil	Subsurface Soil
Depth Range	6 - 8	2 - 6	6 - 8	2 - 6	6 - 8	0 - 2	6 - 10	2 - 3	3 - 4
Risk	Site	Site	Site	Site	Site	Site Background	Site Background	Basewide Background	Basewide Background
Soil Group	8	8	9	8	8	8	9	8	8
Sample Date	8/24/2001	8/24/2001	8/24/2001	8/21/2001	8/21/2001	8/21/2001	8/21/2001	11/6/1999	11/6/1999
A,A-Dimethylphenethylamine	1000 U	1200 U	970 U	1000 U	1000 U	NA	NA	NA	NA
Acenaphthene	12 3 U	14 8 U	11 8 U	11 7 U	12 1 U	NA	NA	NA	NA
Acenaphthylene	12 3 U	14 8 U	11 8 U	11 7 U	12 1 U	NA	NA	NA	NA
Acetophenone	210 U	250 U	200 U	200 U	210 U	NA	NA	NA	NA
Aniline	210 U	250 U	200 U	200 U	210 U	NA	NA	NA	NA
Anthracene	12 3 U	14 8 U	11 8 U	11 7 U	41.5	NA	NA	NA	NA
Aramite	1000 U	1200 U	970 U	1000 U	1000 U	NA	NA	NA	NA
Benzo(A)Anthracene	12 3 U	14 8 U	11 8 U	11 7 U	153 J	NA	NA	NA	NA
Benzo(A)Pyrene	12 3 U	14 8 U	11 8 U	11 7 U	181 J	NA	NA	NA	NA
Benzo(B)Fluoranthene	12 3 U	14.8 U	11 8 U	11 7 U	318 J	NA	NA	NA	NA
Benzo(G,H,I)Perylene	12 3 U	14 8 U	11 8 U	11 7 U	160 J	NA	NA	NA	NA
Benzo(K)Fluoranthene	12 3 U	14 8 U	11 8 U	11 7 U	12 1 U	NA	NA	NA	NA
Benzyl Alcohol	270 U	270 U	270 U	270 U	270 U	NA	NA	NA	NA
Bis(2-Chloroethoxy)Methane	420 U	490 U	390 U	400 U	410 U	NA	NA	NA	NA
Bis(2-Chloroethyl)Ether	210 U	250 U	200 U	200 U	210 U	NA	NA	NA	NA
Bis(2-Ethylhexyl)Phthalate	210 U	250 U	200 U	200 U	210 U	NA	NA	NA	NA
Butyl Benzyl Phthalate	210 U	250 U	200 U	200 U	210 U	NA	NA	NA	NA
Chlorobenzilate	420 U	490 U	390 U	400 U	410 U	NA	NA	NA	NA
Chrysene	12 3 U	14 8 U	11 8 U	11 7 U	108 J	NA	NA	NA	NA
Di-N-Butyl Phthalate	210 UJ	250 UJ	200 UJ	200 U	210 U	NA	NA	NA	NA
Di-N-Octyl Phthalate	210 U	250 U	200 U	200 U	210 U	NA	NA	NA	NA
Diallate	420 U	490 U	390 U	400 U	410 U	NA	NA	NA	NA
Dibenzo(A,H)Anthracene	12 3 U	14 8 U	11 8 U	11 7 U	12 1 U	NA	NA	NA	NA
Dibenzofuran	210 U	250 U	200 U	200 U	210 U	NA	NA	NA	NA
Diethyl Phthalate	210 U	250 U	200 U	200 U	210 U	NA	NA	NA	NA
Dimethyl Phthalate	210 U	250 U	200 U	200 U	210 U	NA	NA	NA	NA
Diphenylamine	210 U	250 U	200 U	200 U	210 U	NA	NA	NA	NA
Ethyl Methane Sulfonate	210 U	250 U	200 U	200 U	210 U	NA	NA	NA	NA
Fluoranthene	12 3 U	14 8 U	11 8 U	11 7 U	540 J	NA	NA	NA	NA
Fluorene	12 3 U	14 8 U	11 8 U	11 7 U	22 3	NA	NA	NA	NA
Hexachlorobenzene	420 U	490 U	390 U	400 U	410 U	NA	NA	NA	NA
Hexachlorobutadiene	420 U	490 U	390 U	400 U	410 U	NA	NA	NA	NA
Hexachlorocyclopentadiene	420 U	490 U	390 U	400 U	410 U	NA	NA	NA	NA
Hexachloroethane	210 U	250 U	200 U	200 U	210 U	NA	NA	NA	NA
Hexachlorophene	17000 U	20000 U	16000 U	16000 UJ	16000 UJ	NA	NA	NA	NA
Hexachloropropene	420 U	490 U	390 U	400 U	410 U	NA	NA	NA	NA
Indeno(1,2,3-CD)Pyrene	12 3 U	14 8 U	11 8 U	11 7 U	68 1	NA	NA	NA	NA
Isodrin	420 U	490 U	390 U	400 U	410 U	NA	NA	NA	NA
Isophorone	210 U	250 U	200 U	200 U	210 U	NA	NA	NA	NA
Isosafrole	420 U	490 U	390 U	400 U	410 U	NA	NA	NA	NA
Kepone	1000 U	1200 U	970 U	1000 U	1000 U	NA	NA	NA	NA
Methapyrilene	1000 U	1200 U	970 U	1000 U	1000 U	NA	NA	NA	NA
Methyl Methane Sulfonate	500 U	600 U	490 U	500 U	500 U	NA	NA	NA	NA
N-Nitroso-Di-N-Butylamine	420 U	490 U	390 U	400 U	410 U	NA	NA	NA	NA
N-Nitroso-Di-N-Propylamine	210 U	250 U	200 U	200 U	210 U	NA	NA	NA	NA
N-Nitrosodiethylamine	210 U	250 U	200 U	200 U	210 U	NA	NA	NA	NA
N-Nitrosodimethylamine	210 U	250 U	200 U	200 U	210 U	NA	NA	NA	NA
N-Nitrosomethylethylamine	210 U	250 U	200 U	200 U	210 U	NA	NA	NA	NA
N-Nitrosomorpholine	210 U	250 U	200 U	200 U	210 U	NA	NA	NA	NA
N-Nitrosopiperidine	420 U	490 U	390 U	400 U	410 U	NA	NA	NA	NA

Calc = Calculated Value as described in Section 3 4 2 1
NA = Not Analyzed

TABLE E-2

SUMMARY OF ANALYTIC RESULTS- SUBSURFACE SOIL
CRANE 158 - MUSTARD GAS BURIAL GROUND
NSWC CRANE
CRANE, INDIANA

Location	01SB18	01SB19	01SB19	01SB20	01SB20	01SB21	01SB21	BG1SBP01	BG1SBP02
Sample	01SB180610	01SB190206	01SB190610	01SB200206	01SB200610	01SB210206	01SB210610	BG1SBP0103	BG1SBP0204
Matrix	Subsurface Soil	Subsurface Soil	Subsurface Soil	Subsurface Soil	Subsurface Soil	Subsurface Soil	Subsurface Soil	Subsurface Soil	Subsurface Soil
Depth Range	6 - 8	2 - 6	6 - 8	2 - 6	6 - 8	0 - 2	6 - 10	2 - 3	3 - 4
Risk	Site	Site	Site	Site	Site	Site Background	Site Background	Basewide Background	Basewide Background
Soil Group	8	8	9	8	8	8	9	8	8
Sample Date	8/24/2001	8/24/2001	8/24/2001	8/21/2001	8/21/2001	8/21/2001	8/21/2001	11/6/1999	11/6/1999
N-Nitrosopyrrolidine	210 U	250 U	200 U	200 U	210 U	NA	NA	NA	NA
Naphthalene	12 3 U	14 8 U	11 8 U	11 7 UR	12 1 UR	NA	NA	NA	NA
O,O,O-Triethyl Phosphorothioate	420 U	490 U	390 U	400 U	410 U	NA	NA	NA	NA
O-Toluidine	210 U	250 U	200 U	200 U	210 U	NA	NA	NA	NA
P-(Dimethylamino)Azobenzene	420 U	490 U	390 U	400 U	410 U	NA	NA	NA	NA
Pentachlorobenzene	420 U	490 U	390 U	400 U	410 U	NA	NA	NA	NA
Pentachloronitrobenzene	1000 U	1200 U	970 U	1000 U	1000 U	NA	NA	NA	NA
Phenacetin	420 U	490 U	390 U	400 U	410 U	NA	NA	NA	NA
Phenanthrene	12 3 U	14 8 U	11 8 U	11 7 U	278 J	NA	NA	NA	NA
Phenol	210 U	250 U	200 U	200 U	210 U	NA	NA	NA	NA
Pronamide	420 U	490 U	390 U	400 UR	410 UR	NA	NA	NA	NA
Pyrene	12 3 U	14 8 U	11 8 U	11 7 U	306 J	NA	NA	NA	NA
Pyridine	220 U	250 U	220 U	220 U	220 U	NA	NA	NA	NA
Safrole	420 U	490 U	390 U	400 U	410 U	NA	NA	NA	NA
Energetics (ug/kg)									
1,3,5-Trinitrobenzene	454 U	476 U	476 U	500 U	500 U	NA	NA	NA	NA
1,3-Dinitrobenzene	454 U	476 U	476 U	500 U	500 U	NA	NA	NA	NA
2,4,6-Trinitrotoluene	454 U	476 U	476 U	500 U	500 U	NA	NA	NA	NA
2,4-Dinitrotoluene	454 U	476 U	476 U	500 U	500 U	NA	NA	NA	NA
2,6-Dinitrotoluene	454 U	476 U	476 U	500 U	500 U	NA	NA	NA	NA
2-Amino-4,6-Dinitrotoluene	454 U	476 U	476 U	500 U	500 U	NA	NA	NA	NA
2-Nitrotoluene	454 U	476 U	476 U	500 U	500 U	NA	NA	NA	NA
3-Nitrotoluene	454 U	476 U	476 U	500 U	500 U	NA	NA	NA	NA
4-Amino-2,6-Dinitrotoluene	454 U	476 U	476 U	500 U	500 U	NA	NA	NA	NA
4-Nitrotoluene	454 U	476 U	476 U	500 U	500 U	NA	NA	NA	NA
HMX	454 U	476 U	476 U	500 U	500 U	NA	NA	NA	NA
Nitrobenzene	454 U	476 U	476 U	500 U	500 U	NA	NA	NA	NA
RDX	454 U	476 U	476 U	500 U	500 U	NA	NA	NA	NA
Tetryl	454 U	476 U	476 U	500 U	500 U	NA	NA	NA	NA
Pesticides/PCBs (ug/kg)									
4,4'-DDD	NA	3 7 U	NA	3 U	NA	NA	NA	NA	NA
4,4'-DDE	NA	3 7 U	NA	3 U	NA	NA	NA	NA	NA
4,4'-DDT	NA	3 7 U	NA	3 U	NA	NA	NA	NA	NA
Aldrin	NA	1 9 U	NA	1 6 U	NA	NA	NA	NA	NA
Alpha-BHC	NA	1 9 U	NA	1 6 U	NA	NA	NA	NA	NA
Alpha-Chlordane	NA	1 9 U	NA	1 6 U	NA	NA	NA	NA	NA
Aroclor-1016	NA	49 U	NA	39 U	NA	NA	NA	NA	NA
Aroclor-1221	NA	49 U	NA	39 U	NA	NA	NA	NA	NA
Aroclor-1232	NA	49 U	NA	39 U	NA	NA	NA	NA	NA
Aroclor-1242	NA	49 U	NA	39 U	NA	NA	NA	NA	NA
Aroclor-1248	NA	49 U	NA	39 U	NA	NA	NA	NA	NA
Aroclor-1254	NA	49 U	NA	39 U	NA	NA	NA	NA	NA
Aroclor-1260	NA	49 U	NA	39 U	NA	NA	NA	NA	NA
Beta-BHC	NA	1 9 U	NA	1 6 U	NA	NA	NA	NA	NA
Delta-BHC	NA	1 9 U	NA	1.6 U	NA	NA	NA	NA	NA
Dieldrin	NA	3 7 U	NA	3 U	NA	NA	NA	NA	NA
Endosulfan I	NA	1 9 U	NA	1 6 U	NA	NA	NA	NA	NA
Endosulfan II	NA	3 7 U	NA	3 U	NA	NA	NA	NA	NA
Endosulfan Sulfate	NA	3 7 U	NA	3 U	NA	NA	NA	NA	NA
Endrin	NA	3 7 U	NA	3 U	NA	NA	NA	NA	NA

Calc = Calculated Value as described in Section 3 4 2.1
NA = Not A[illegible]d

TABLE E-2

SUMMARY OF ANALYTIC RESULTS- SUBSURFACE SOIL
CRANE 158 - MUSTARD GAS BURIAL GROUND
NSWC CRANE
CRANE, INDIANA

Location	01SB18	01SB19	01SB19	01SB20	01SB20	01SB21	01SB21	BG1SBP01	BG1SBP02
Sample	01SB180610	01SB190206	01SB190610	01SB200206	01SB200610	01SB210206	01SB210610	BG1SBP0103	BG1SBP0204
Matrix	Subsurface Soil	Subsurface Soil	Subsurface Soil	Subsurface Soil	Subsurface Soil	Subsurface Soil	Subsurface Soil	Subsurface Soil	Subsurface Soil
Depth Range	6 - 8	2 - 6	6 - 8	2 - 6	6 - 8	0 - 2	6 - 10	2 - 3	3 - 4
Risk	Site	Site	Site	Site	Site	Site Background	Site Background	Basewide Background	Basewide Background
Soil Group	8	8	9	8	8	8	9	8	8
Sample Date	8/24/2001	8/24/2001	8/24/2001	8/21/2001	8/21/2001	8/21/2001	8/21/2001	11/6/1999	11/6/1999
Endrin Aldehyde	NA	3 7 U	NA	3 U	NA	NA	NA	NA	NA
Gamma-BHC (Lindane)	NA	1 9 U	NA	1 6 U	NA	NA	NA	NA	NA
Gamma-Chlordane	NA	1 9 U	NA	1 6 U	NA	NA	NA	NA	NA
Heptachlor	NA	1 3 BU	NA	1 4 J	NA	NA	NA	NA	NA
Heptachlor Epoxide	NA	1 9 U	NA	1 6 U	NA	NA	NA	NA	NA
Methoxychlor	NA	19 U	NA	16 U	NA	NA	NA	NA	NA
Toxaphene	NA	120 U	NA	99 U	NA	NA	NA	NA	NA
Herbicides (ug/kg)									
2,4,5-T	NA	15 U	NA	12 U	NA	NA	NA	NA	NA
2,4,5-TP (Silvex)	NA	15 U	NA	12 U	NA	NA	NA	NA	NA
2,4-D	NA	100 U	NA	84 U	NA	NA	NA	NA	NA
Dinoseb	NA	30 U	NA	24 U	NA	NA	NA	NA	NA
Pentachlorophenol	NA	15 U	NA	12 U	NA	NA	NA	NA	NA
Inorganics (mg/kg)									
Aluminum	4490 J	12500 J	1420 J	11700	10100	NA	NA	15700	15300
Antimony	0 20 UJ	0 65 U	0 25 U	0 49 U	0 51 U	NA	NA	0 97 U	0 77 U
Arsenic	2 3 U	3 5 J	20 2 J	5 0 J	1 5 J	NA	NA	8 J	8 5 J
Barium	40 1	85 1	11.3	35 3	47 6	NA	NA	55 4 J	79 5 J
Beryllium	0 43 J	0 52 J	0 22 U	0 48 U	0 76 J	NA	NA	0 52 U	0 56 U
Cadmium	0 05	0 07 J	0 20	0 05 UJ	0 05 UJ	NA	NA	0 29 J	0 36 J
Calcium	385 J	510 J	222 J	271	427	NA	NA	199	543
Chromium	11 0 J	15 3 J	6 8 J	18 6	14 6	NA	NA	21 3 J	21 6 J
Cobalt	8 2 J	2 3 J	0 60 U	4 3	5 5	NA	NA	9 1	6 8
Copper	8 9 J	9 1 J	6 5 J	11 3 J	13 4 J	NA	NA	18	20 4
Iron	7420	19100	7360	26100	25400	NA	NA	24500 J	24600 J
Lead	10 5	12 1	8 4	14 7	11 6	NA	NA	13 7 J	11 1 J
Magnesium	909 J	1240 J	193 J	1380	1050	NA	NA	2390 J	2870 J
Manganese	109 J	48 1 J	8 6 J	172	36 8	NA	NA	301 J	222 J
Mercury	0 02 U	0 02 U	0 02 U	0 03 U	0 03 U	NA	NA	0 14	0 05 U
Nickel	12 1 J	5 8 J	1 6 J	7 5	10 4	NA	NA	14 6 J	13 4 J
Potassium	594 J	382 J	233 J	488 J	460 J	NA	NA	1170	1290
Selenium	0 33 U	0 55 U	0 31 U	0 37 U	0 40	NA	NA	0 43 J	0 56
Silver	0 38 U	0 43 U	0 36 U	0 15 U	0 15 U	NA	NA	0 05 J	0 05 J
Sodium	426 J	446 J	321 J	399	456	NA	NA	10 J	76.8
Strontium	4 3 J	6 7 J	2 1 J	5 3 J	7 1 J	NA	NA	10 3 J	19 2 J
Thallium	0 99	1 7 J	0 94	2 1	2 6	NA	NA	0 24 J	0.25 J
Thorium-Calc	3 85	2 44	3 92	1 87	4 28	3 53	4 11	NA	NA
Tin	23 9 U	27 0 U	22 5 U	3 3	3 2	NA	NA	0 74 U	0 82 U
Vanadium	8 2	28 1	10 3	32 1	21 3	NA	NA	37 8 J	38 2 J
Zinc	37 0 J	20 4 J	9 3 J	26 7	42 6	NA	NA	45 2 J	47 8 J
Miscellaneous Parameters									
1,4-Dithiane (ug/kg)	252 U	299 U	237 U	240 U	248 U	NA	NA	NA	NA
1,4-Oxathiane (ug/kg)	252 U	299 U	237 U	240 U	248 U	NA	NA	NA	NA
Bis(2-Chloroethyl)Sulfide (ug/kg)	252 U	299 U	237 U	240 U	248 U	NA	NA	NA	NA
Cation Exchange Capacity (meq/100g)	NA	NA	NA	11 5	20 1	NA	NA	NA	NA
pH (S U)	NA	NA	NA	5 0 J	5 1 J	NA	NA	NA	NA
Total Organic Carbon (mg/kg)	NA	NA	NA	NA	NA	608 U	589 U	NA	NA
Total Radiologicals (pCi/g)									
Actinium-228	NA	NA	NA	NA	NA	NA	NA	1 41 J	1 46 J
Bismuth-212	NA	NA	NA	NA	NA	NA	NA	1 98 J	1 58 J

Calc = Calculated Value as described in Section 3 4 2 1
NA = Not Analyzed

TABLE E-2

SUMMARY OF ANALYTIC RESULTS- SUBSURFACE SOIL
CRANE 158 - MUSTARD GAS BURIAL GROUND
NSWC CRANE
CRANE, INDIANA

Location	01SB18	01SB19	01SB19	01SB20	01SB20	01SB21	01SB21	BG1SBP01	BG1SBP02
Sample	01SB180610	01SB190206	01SB190610	01SB200206	01SB200610	01SB210206	01SB210610	BG1SBP0103	BG1SBP0204
Matrix	Subsurface Soil	Subsurface Soil	Subsurface Soil	Subsurface Soil	Subsurface Soil	Subsurface Soil	Subsurface Soil	Subsurface Soil	Subsurface Soil
Depth Range	6 - 8	2 - 6	6 - 8	2 - 6	6 - 8	0 - 2	6 - 10	2 - 3	3 - 4
Risk	Site	Site	Site	Site	Site	Site Background	Site Background	Basewide Background	Basewide Background
Soil Group	8	8	9	8	8	8	9	8	8
Sample Date	8/24/2001	8/24/2001	8/24/2001	8/21/2001	8/21/2001	8/21/2001	8/21/2001	11/6/1999	11/6/1999
Bismuth-214	NA	NA	NA	NA	NA	NA	NA	1 2 J	1 32 J
Cesium-137	NA	NA	NA	NA	NA	NA	NA	0 06 UJ	0 0591 UJ
Cobalt-60	NA	NA	NA	NA	NA	NA	NA	0 04 UJ	0 0397 UJ
Europium-154	NA	NA	NA	NA	NA	NA	NA	0 04 UJ	0 0225 UJ
Europium-155	NA	NA	NA	NA	NA	NA	NA	0 07 J	0 08 J
Lead-210	NA	NA	NA	NA	NA	NA	NA	0 74 J	0 9 J
Lead-212	NA	NA	NA	NA	NA	NA	NA	1 38 J	1 40 J
Lead-214	NA	NA	NA	NA	NA	NA	NA	1 13 J	1 29 J
Potassium-40	NA	NA	NA	NA	NA	NA	NA	18 1 J	20 3 J
Protactinium-234	NA	NA	NA	NA	NA	NA	NA	6.26 UJ	7 54 UJ
Radium-226	NA	NA	NA	NA	NA	NA	NA	2 09 J	2 04 J
Thallium-208	NA	NA	NA	NA	NA	NA	NA	1 13 J	1 22 J
Thorium-228	0 467	0 226	0 485	0 167	0 392	0 387	0 450	NA	NA
Thorium-230	0 0747 U	0 0148 U	0 126 U	0 0418	0 136	0 289	0 254	NA	NA
Thorium-232	0 380	0 310	0 378	0 245	0 549	0 389	0 455	NA	NA
Thorium-234	NA	NA	NA	NA	NA	NA	NA	1 2 J	2 1 J
Uranium-235	NA	NA	NA	NA	NA	NA	NA	0 198 UJ	0.348 UJ

Calc = Calculated Value as descibed in Section 3 4.2 1
NA = Not A[illegible]d

TABLE E-2

SUMMARY OF ANALYTIC RESULTS- SUBSURFACE SOIL
CRANE 158 - MUSTARD GAS BURIAL GROUND
NSWC CRANE
CRANE, INDIANA

Location	BG1SBP02	BG1SBP03	BG1SBP04	BG1SBP05	BG1SBP06	BG1SBP08	BG1SBP10	BG1SBP08
Sample	BG1SBP0206	BG1SBP0305	BG1SBP0406	BG1SBP0505	BG1SBP0603	BG1SBP0804	BG1SBP1004	BG1SBP0806
Matrix	Subsurface Soil	Subsurface Soil	Subsurface Soil	Subsurface Soil	Subsurface Soil	Subsurface Soil	Subsurface Soil	Subsurface Soil
Depth Range	5 - 6	4 - 5	5 - 6	4 - 5	2 - 3	3 - 4	3 - 4	5 - 6
Risk	Basewide Background	Basewide Background	Basewide Background	Basewide Background	Basewide Background	Basewide Background	Basewide Background	Basewide Background
Soil Group	8	8	8	8	8	8	8	9
Sample Date	11/6/1999	11/6/1999	11/6/1999	11/5/1999	11/5/1999	11/6/1999	11/5/1999	11/6/1999
Volatile Organics (ug/kg)								
1,1,1,2-Tetrachloroethane	NA	NA	NA	NA	NA	NA	NA	NA
1,1,1-Trichloroethane	NA	NA	NA	NA	NA	NA	NA	NA
1,1,2,2-Tetrachloroethane	NA	NA	NA	NA	NA	NA	NA	NA
1,1,2-Trichloroethane	NA	NA	NA	NA	NA	NA	NA	NA
1,1-Dichloroethane	NA	NA	NA	NA	NA	NA	NA	NA
1,1-Dichloroethene	NA	NA	NA	NA	NA	NA	NA	NA
1,2,3-Trichloropropane	NA	NA	NA	NA	NA	NA	NA	NA
1,2-Dibromo-3-Chloropropane	NA	NA	NA	NA	NA	NA	NA	NA
1,2-Dibromoethane	NA	NA	NA	NA	NA	NA	NA	NA
1,2-Dichloroethane	NA	NA	NA	NA	NA	NA	NA	NA
1,2-Dichloropropane	NA	NA	NA	NA	NA	NA	NA	NA
1,4-Dioxane	NA	NA	NA	NA	NA	NA	NA	NA
2-Butanone	NA	NA	NA	NA	NA	NA	NA	NA
2-Hexanone	NA	NA	NA	NA	NA	NA	NA	NA
3-Chloropropene	NA	NA	NA	NA	NA	NA	NA	NA
4-Methyl-2-Pentanone	NA	NA	NA	NA	NA	NA	NA	NA
Acetone	NA	NA	NA	NA	NA	NA	NA	NA
Acetonitrile	NA	NA	NA	NA	NA	NA	NA	NA
Acrolein	NA	NA	NA	NA	NA	NA	NA	NA
Acrylonitrile	NA	NA	NA	NA	NA	NA	NA	NA
Benzene	NA	NA	NA	NA	NA	NA	NA	NA
Bromodichloromethane	NA	NA	NA	NA	NA	NA	NA	NA
Bromofor	NA	NA	NA	NA	NA	NA	NA	NA
Bromomethane	NA	NA	NA	NA	NA	NA	NA	NA
Carbon Disulfide	NA	NA	NA	NA	NA	NA	NA	NA
Carbon Tetrachloride	NA	NA	NA	NA	NA	NA	NA	NA
Chlorobenzene	NA	NA	NA	NA	NA	NA	NA	NA
Chlorodibromomethane	NA	NA	NA	NA	NA	NA	NA	NA
Chloroethane	NA	NA	NA	NA	NA	NA	NA	NA
Chlorofor	NA	NA	NA	NA	NA	NA	NA	NA
Chloromethane	NA	NA	NA	NA	NA	NA	NA	NA
Chloroprene	NA	NA	NA	NA	NA	NA	NA	NA
Cis-1,2-Dichloroethene	NA	NA	NA	NA	NA	NA	NA	NA
Cis-1,3-Dichloropropene	NA	NA	NA	NA	NA	NA	NA	NA
Dibromomethane	NA	NA	NA	NA	NA	NA	NA	NA
Dichlorodifluoromethane	NA	NA	NA	NA	NA	NA	NA	NA
Ethyl Methacrylate	NA	NA	NA	NA	NA	NA	NA	NA
Ethylbenzene	NA	NA	NA	NA	NA	NA	NA	NA
Isobutanol	NA	NA	NA	NA	NA	NA	NA	NA
Methacrylonitrile	NA	NA	NA	NA	NA	NA	NA	NA
Methyl Iodide	NA	NA	NA	NA	NA	NA	NA	NA
Methyl Methacrylate	NA	NA	NA	NA	NA	NA	NA	NA
Methylene Chloride	NA	NA	NA	NA	NA	NA	NA	NA
Pentachloroethane	NA	NA	NA	NA	NA	NA	NA	NA
Propionitrile	NA	NA	NA	NA	NA	NA	NA	NA
Styrene	NA	NA	NA	NA	NA	NA	NA	NA
Tetrachloroethene	NA	NA	NA	NA	NA	NA	NA	NA
Toluene	NA	NA	NA	NA	NA	NA	NA	NA
Total Xylenes	NA	NA	NA	NA	NA	NA	NA	NA

Calc = Calculated Value as descibed in Section 3 4.2 1
NA = Not Analyzed

TABLE E-2

SUMMARY OF ANALYTIC RESULTS- SUBSURFACE SOIL
CRANE 158 - MUSTARD GAS BURIAL GROUND
NSWC CRANE
CRANE, INDIANA

Location	BG1SBP02	BG1SBP03	BG1SBP04	BG1SBP05	BG1SBP06	BG1SBP08	BG1SBP10	BG1SBP08
Sample	BG1SBP0206	BG1SBP0305	BG1SBP0406	BG1SBP0505	BG1SBP0603	BG1SBP0804	BG1SBP1004	BG1SBP0806
Matrix	Subsurface Soil	Subsurface Soil	Subsurface Soil	Subsurface Soil	Subsurface Soil	Subsurface Soil	Subsurface Soil	Subsurface Soil
Depth Range	5 - 6	4 - 5	5 - 6	4 - 5	2 - 3	3 - 4	3 - 4	5 - 6
Risk	Basewide Background	Basewide Background	Basewide Background	Basewide Background	Basewide Background	Basewide Background	Basewide Background	Basewide Background
Soil Group	8	8	8	8	8	8	8	9
Sample Date	11/6/1999	11/6/1999	11/6/1999	11/5/1999	11/5/1999	11/6/1999	11/5/1999	11/6/1999
Trans-1,2-Dichloroethene	NA	NA	NA	NA	NA	NA	NA	NA
Trans-1,3-Dichloropropene	NA	NA	NA	NA	NA	NA	NA	NA
Trans-1,4-Dichloro-2-Butene	NA	NA	NA	NA	NA	NA	NA	NA
Trichloroethene	NA	NA	NA	NA	NA	NA	NA	NA
Trichlorofluoromethane	NA	NA	NA	NA	NA	NA	NA	NA
Vinyl Acetate	NA	NA	NA	NA	NA	NA	NA	NA
Vinyl Chloride	NA	NA	NA	NA	NA	NA	NA	NA
Semivolatile Organics (ug/kg)								
1,2,4,5-Tetrachlorobenzene	NA	NA	NA	NA	NA	NA	NA	NA
1,2,4-Trichlorobenzene	NA	NA	NA	NA	NA	NA	NA	NA
1,2-Dichlorobenzene	NA	NA	NA	NA	NA	NA	NA	NA
1,3-Dichlorobenzene	NA	NA	NA	NA	NA	NA	NA	NA
1,4-Dichlorobenzene	NA	NA	NA	NA	NA	NA	NA	NA
1,4-Naphthoquinone	NA	NA	NA	NA	NA	NA	NA	NA
1,4-Phenylenediamine	NA	NA	NA	NA	NA	NA	NA	NA
1-Naphthylamine	NA	NA	NA	NA	NA	NA	NA	NA
2,2'-Oxybis(1-Chloropropane)	NA	NA	NA	NA	NA	NA	NA	NA
2,3,4,6-Tetrachlorophenol	NA	NA	NA	NA	NA	NA	NA	NA
2,4,5-Trichlorophenol	NA	NA	NA	NA	NA	NA	NA	NA
2,4,6-Trichlorophenol	NA	NA	NA	NA	NA	NA	NA	NA
2,4-Dichlorophenol	NA	NA	NA	NA	NA	NA	NA	NA
2,4-Dimethylphenol	NA	NA	NA	NA	NA	NA	NA	NA
2,4-Dinitrophenol	NA	NA	NA	NA	NA	NA	NA	NA
2,6-Dichlorophenol	NA	NA	NA	NA	NA	NA	NA	NA
2-Acetylaminofluorene	NA	NA	NA	NA	NA	NA	NA	NA
2-Chloronaphthalene	NA	NA	NA	NA	NA	NA	NA	NA
2-Chlorophenol	NA	NA	NA	NA	NA	NA	NA	NA
2-Methylnaphthalene	NA	NA	NA	NA	NA	NA	NA	NA
2-Methylphenol	NA	NA	NA	NA	NA	NA	NA	NA
2-Naphthylamine	NA	NA	NA	NA	NA	NA	NA	NA
2-Nitroaniline	NA	NA	NA	NA	NA	NA	NA	NA
2-Nitrophenol	NA	NA	NA	NA	NA	NA	NA	NA
2-Picoline	NA	NA	NA	NA	NA	NA	NA	NA
3,3'-Dichlorobenzidine	NA	NA	NA	NA	NA	NA	NA	NA
3,3'-Dimethylbenzidine	NA	NA	NA	NA	NA	NA	NA	NA
3-Methylcholanthrene	NA	NA	NA	NA	NA	NA	NA	NA
3-Methylphenol	NA	NA	NA	NA	NA	NA	NA	NA
3-Nitroaniline	NA	NA	NA	NA	NA	NA	NA	NA
4,6-Dinitro-2-Methylphenol	NA	NA	NA	NA	NA	NA	NA	NA
4-Aminobiphenyl	NA	NA	NA	NA	NA	NA	NA	NA
4-Bromophenyl Phenyl Ether	NA	NA	NA	NA	NA	NA	NA	NA
4-Chloro-3-Methylphenol	NA	NA	NA	NA	NA	NA	NA	NA
4-Chloroaniline	NA	NA	NA	NA	NA	NA	NA	NA
4-Chlorophenyl Phenyl Ether	NA	NA	NA	NA	NA	NA	NA	NA
4-Methylphenol	NA	NA	NA	NA	NA	NA	NA	NA
4-Nitroaniline	NA	NA	NA	NA	NA	NA	NA	NA
4-Nitrophenol	NA	NA	NA	NA	NA	NA	NA	NA
4-Nitroquinoline-1-Oxide	NA	NA	NA	NA	NA	NA	NA	NA
5-Nitro-O-Toluidine	NA	NA	NA	NA	NA	NA	NA	NA
7,12-Dimethylbenz(A)Anthracene	NA	NA	NA	NA	NA	NA	NA	NA

Calc = Calculated Value as described in Section 3 4.2 1
NA = Not Applied

TABLE E-2

SUMMARY OF ANALYTIC RESULTS- SUBSURFACE SOIL
CRANE 158 - MUSTARD GAS BURIAL GROUND
NSWC CRANE
CRANE, INDIANA

Location	BG1SBP02	BG1SBP03	BG1SBP04	BG1SBP05	BG1SBP06	BG1SBP08	BG1SBP10	BG1SBP08
Sample	BG1SBP0206	BG1SBP0305	BG1SBP0406	BG1SBP0505	BG1SBP0603	BG1SBP0804	BG1SBP1004	BG1SBP0806
Matrix	Subsurface Soil	Subsurface Soil	Subsurface Soil	Subsurface Soil	Subsurface Soil	Subsurface Soil	Subsurface Soil	Subsurface Soil
Depth Range	5 - 6	4 - 5	5 - 6	4 - 5	2 - 3	3 - 4	3 - 4	5 - 6
Risk	Basewide Background	Basewide Background	Basewide Background	Basewide Background	Basewide Background	Basewide Background	Basewide Background	Basewide Background
Soil Group	8	8	8	8	8	8	8	9
Sample Date	11/6/1999	11/6/1999	11/6/1999	11/5/1999	11/5/1999	11/6/1999	11/5/1999	11/6/1999
A,A-Dimethylphenethylamine	NA	NA	NA	NA	NA	NA	NA	NA
Acenaphthene	NA	NA	NA	NA	NA	NA	NA	NA
Acenaphthylene	NA	NA	NA	NA	NA	NA	NA	NA
Acetophenone	NA	NA	NA	NA	NA	NA	NA	NA
Aniline	NA	NA	NA	NA	NA	NA	NA	NA
Anthracene	NA	NA	NA	NA	NA	NA	NA	NA
Aramite	NA	NA	NA	NA	NA	NA	NA	NA
Benzo(A)Anthracene	NA	NA	NA	NA	NA	NA	NA	NA
Benzo(A)Pyrene	NA	NA	NA	NA	NA	NA	NA	NA
Benzo(B)Fluoranthene	NA	NA	NA	NA	NA	NA	NA	NA
Benzo(G,H,I)Perylene	NA	NA	NA	NA	NA	NA	NA	NA
Benzo(K)Fluoranthene	NA	NA	NA	NA	NA	NA	NA	NA
Benzyl Alcohol	NA	NA	NA	NA	NA	NA	NA	NA
Bis(2-Chloroethoxy)Methane	NA	NA	NA	NA	NA	NA	NA	NA
Bis(2-Chloroethyl)Ether	NA	NA	NA	NA	NA	NA	NA	NA
Bis(2-Ethylhexyl)Phthalate	NA	NA	NA	NA	NA	NA	NA	NA
Butyl Benzyl Phthalate	NA	NA	NA	NA	NA	NA	NA	NA
Chlorobenzilate	NA	NA	NA	NA	NA	NA	NA	NA
Chrysene	NA	NA	NA	NA	NA	NA	NA	NA
Di-N-Butyl Phthalate	NA	NA	NA	NA	NA	NA	NA	NA
Di-N-Octyl Phthalate	NA	NA	NA	NA	NA	NA	NA	NA
Diallate	NA	NA	NA	NA	NA	NA	NA	NA
Dibenzo(A,H)Anthracene	NA	NA	NA	NA	NA	NA	NA	NA
Dibenzofuran	NA	NA	NA	NA	NA	NA	NA	NA
Diethyl Phthalate	NA	NA	NA	NA	NA	NA	NA	NA
Dimethyl Phthalate	NA	NA	NA	NA	NA	NA	NA	NA
Diphenylamine	NA	NA	NA	NA	NA	NA	NA	NA
Ethyl Methane Sulfonate	NA	NA	NA	NA	NA	NA	NA	NA
Fluoranthene	NA	NA	NA	NA	NA	NA	NA	NA
Fluorene	NA	NA	NA	NA	NA	NA	NA	NA
Hexachlorobenzene	NA	NA	NA	NA	NA	NA	NA	NA
Hexachlorobutadiene	NA	NA	NA	NA	NA	NA	NA	NA
Hexachlorocyclopentadiene	NA	NA	NA	NA	NA	NA	NA	NA
Hexachloroethane	NA	NA	NA	NA	NA	NA	NA	NA
Hexachlorophene	NA	NA	NA	NA	NA	NA	NA	NA
Hexachloropropene	NA	NA	NA	NA	NA	NA	NA	NA
Indeno(1,2,3-CD)Pyrene	NA	NA	NA	NA	NA	NA	NA	NA
Isodrin	NA	NA	NA	NA	NA	NA	NA	NA
Isophorone	NA	NA	NA	NA	NA	NA	NA	NA
Isosafrole	NA	NA	NA	NA	NA	NA	NA	NA
Kepone	NA	NA	NA	NA	NA	NA	NA	NA
Methapyrilene	NA	NA	NA	NA	NA	NA	NA	NA
Methyl Methane Sulfonate	NA	NA	NA	NA	NA	NA	NA	NA
N-Nitroso-Di-N-Butylamine	NA	NA	NA	NA	NA	NA	NA	NA
N-Nitroso-Di-N-Propylamine	NA	NA	NA	NA	NA	NA	NA	NA
N-Nitrosodiethylamine	NA	NA	NA	NA	NA	NA	NA	NA
N-Nitrosodimethylamine	NA	NA	NA	NA	NA	NA	NA	NA
N-Nitrosomethylethylamine	NA	NA	NA	NA	NA	NA	NA	NA
N-Nitrosomorpholine	NA	NA	NA	NA	NA	NA	NA	NA
N-Nitrosopiperidine	NA	NA	NA	NA	NA	NA	NA	NA

Calc = Calculated Value as descibed in Section 3 4 2.1
NA = Not Analyzed

TABLE E-2

SUMMARY OF ANALYTIC RESULTS- SUBSURFACE SOIL
CRANE 158 - MUSTARD GAS BURIAL GROUND
NSWC CRANE
CRANE, INDIANA

Location	BG1SBP02	BG1SBP03	BG1SBP04	BG1SBP05	BG1SBP06	BG1SBP08	BG1SBP10	BG1SBP08
Sample	BG1SBP0206	BG1SBP0305	BG1SBP0406	BG1SBP0505	BG1SBP0603	BG1SBP0804	BG1SBP1004	BG1SBP0806
Matrix	Subsurface Soil	Subsurface Soil	Subsurface Soil	Subsurface Soil	Subsurface Soil	Subsurface Soil	Subsurface Soil	Subsurface Soil
Depth Range	5 - 6	4 - 5	5 - 6	4 - 5	2 - 3	3 - 4	3 - 4	5 - 6
Risk	Basewide Background	Basewide Background	Basewide Background	Basewide Background	Basewide Background	Basewide Background	Basewide Background	Basewide Background
Soil Group	8	8	8	8	8	8	8	9
Sample Date	11/6/1999	11/6/1999	11/6/1999	11/5/1999	11/5/1999	11/6/1999	11/5/1999	11/6/1999
N-Nitrosopyrrolidine	NA	NA	NA	NA	NA	NA	NA	NA
Naphthalene	NA	NA	NA	NA	NA	NA	NA	NA
O,O,O-Triethyl Phosphorothioate	NA	NA	NA	NA	NA	NA	NA	NA
O-Toluidine	NA	NA	NA	NA	NA	NA	NA	NA
P-(Dimethylamino)Azobenzene	NA	NA	NA	NA	NA	NA	NA	NA
Pentachlorobenzene	NA	NA	NA	NA	NA	NA	NA	NA
Pentachloronitrobenzene	NA	NA	NA	NA	NA	NA	NA	NA
Phenacetin	NA	NA	NA	NA	NA	NA	NA	NA
Phenanthrene	NA	NA	NA	NA	NA	NA	NA	NA
Phenol	NA	NA	NA	NA	NA	NA	NA	NA
Pronamide	NA	NA	NA	NA	NA	NA	NA	NA
Pyrene	NA	NA	NA	NA	NA	NA	NA	NA
Pyridine	NA	NA	NA	NA	NA	NA	NA	NA
Safrole	NA	NA	NA	NA	NA	NA	NA	NA
Energetics (ug/kg)								
1,3,5-Trinitrobenzene	NA	NA	NA	NA	NA	NA	NA	NA
1,3-Dinitrobenzene	NA	NA	NA	NA	NA	NA	NA	NA
2,4,6-Trinitrotoluene	NA	NA	NA	NA	NA	NA	NA	NA
2,4-Dinitrotoluene	NA	NA	NA	NA	NA	NA	NA	NA
2,6-Dinitrotoluene	NA	NA	NA	NA	NA	NA	NA	NA
2-Amino-4,6-Dinitrotoluene	NA	NA	NA	NA	NA	NA	NA	NA
2-Nitrotoluene	NA	NA	NA	NA	NA	NA	NA	NA
3-Nitrotoluene	NA	NA	NA	NA	NA	NA	NA	NA
4-Amino-2,6-Dinitrotoluene	NA	NA	NA	NA	NA	NA	NA	NA
4-Nitrotoluene	NA	NA	NA	NA	NA	NA	NA	NA
HMX	NA	NA	NA	NA	NA	NA	NA	NA
Nitrobenzene	NA	NA	NA	NA	NA	NA	NA	NA
RDX	NA	NA	NA	NA	NA	NA	NA	NA
Tetryl	NA	NA	NA	NA	NA	NA	NA	NA
Pesticides/PCBs (ug/kg)								
4,4'-DDD	NA	NA	NA	NA	NA	NA	NA	NA
4,4'-DDE	NA	NA	NA	NA	NA	NA	NA	NA
4,4'-DDT	NA	NA	NA	NA	NA	NA	NA	NA
Aldrin	NA	NA	NA	NA	NA	NA	NA	NA
Alpha-BHC	NA	NA	NA	NA	NA	NA	NA	NA
Alpha-Chlordane	NA	NA	NA	NA	NA	NA	NA	NA
Aroclor-1016	NA	NA	NA	NA	NA	NA	NA	NA
Aroclor-1221	NA	NA	NA	NA	NA	NA	NA	NA
Aroclor-1232	NA	NA	NA	NA	NA	NA	NA	NA
Aroclor-1242	NA	NA	NA	NA	NA	NA	NA	NA
Aroclor-1248	NA	NA	NA	NA	NA	NA	NA	NA
Aroclor-1254	NA	NA	NA	NA	NA	NA	NA	NA
Aroclor-1260	NA	NA	NA	NA	NA	NA	NA	NA
Beta-BHC	NA	NA	NA	NA	NA	NA	NA	NA
Delta-BHC	NA	NA	NA	NA	NA	NA	NA	NA
Dieldrin	NA	NA	NA	NA	NA	NA	NA	NA
Endosulfan I	NA	NA	NA	NA	NA	NA	NA	NA
Endosulfan II	NA	NA	NA	NA	NA	NA	NA	NA
Endosulfan Sulfate	NA	NA	NA	NA	NA	NA	NA	NA
Endrin	NA	NA	NA	NA	NA	NA	NA	NA

Calc = Calculated Value as described in Section 3 4 2 1
NA = Not A[illegible]d

TABLE-2

SUMMARY OF ANALYTIC RESULTS- SUBSURFACE SOIL
CRANE 158 - MUSTARD GAS BURIAL GROUND
NSWC CRANE
CRANE, INDIANA

Location	BG1SBP02	BG1SBP03	BG1SBP04	BG1SBP05	BG1SBP06	BG1SBP08	BG1SBP10	BG1SBP08
Sample	BG1SBP0206	BG1SBP0305	BG1SBP0406	BG1SBP0505	BG1SBP0603	BG1SBP0804	BG1SBP1004	BG1SBP0806
Matrix	Subsurface Soil	Subsurface Soil	Subsurface Soil	Subsurface Soil	Subsurface Soil	Subsurface Soil	Subsurface Soil	Subsurface Soil
Depth Range	5 - 6	4 - 5	5 - 6	4 - 5	2 - 3	3 - 4	3 - 4	5 - 6
Risk	Basewide Background	Basewide Background	Basewide Background	Basewide Background	Basewide Background	Basewide Background	Basewide Background	Basewide Background
Soil Group	8	8	8	8	8	8	8	9
Sample Date	11/6/1999	11/6/1999	11/6/1999	11/5/1999	11/5/1999	11/6/1999	11/5/1999	11/6/1999
Endrin Aldehyde	NA	NA	NA	NA	NA	NA	NA	NA
Gamma-BHC (Lindane)	NA	NA	NA	NA	NA	NA	NA	NA
Gamma-Chlordane	NA	NA	NA	NA	NA	NA	NA	NA
Heptachlor	NA	NA	NA	NA	NA	NA	NA	NA
Heptachlor Epoxide	NA	NA	NA	NA	NA	NA	NA	NA
Methoxychlor	NA	NA	NA	NA	NA	NA	NA	NA
Toxaphene	NA	NA	NA	NA	NA	NA	NA	NA
Herbicides (ug/kg)								
2,4,5-T	NA	NA	NA	NA	NA	NA	NA	NA
2,4,5-TP (Silvex)	NA	NA	NA	NA	NA	NA	NA	NA
2,4-D	NA	NA	NA	NA	NA	NA	NA	NA
Dinoseb	NA	NA	NA	NA	NA	NA	NA	NA
Pentachlorophenol	NA	NA	NA	NA	NA	NA	NA	NA
Inorganics (mg/kg)								
Aluminum	16200	9070	10500	13800 J	13200 J	12500	10900 J	5430
Antimony	0 68 U	0 4 U	0 48 U	11 3 J	0 42 U	1 2 U	0 31 U	0 76 U
Arsenic	6 J	5 6 J	1 4 J	2 5 J	5 9 J	6 4 J	5 3 J	2 9 J
Barium	73 6 J	25 1 J	52 6 J	83 4 J	36 9 J	56 1 J	49 1 J	24 8 J
Beryllium	1 2 U	1 U	0 93 U	0 7 U	0 49 U	0 55 U	0 42 U	0 28 U
Cadmium	0 64	0 1 J	0 05 U	0 05 J	0 2 J	0 35 J	0 28 J	0 14 J
Calcium	650	85 2 J	835	970 J	340 J	144	333 J	53 6 J
Chromium	27 1 J	19 6 J	14 7 J	19 1 J	24 7 J	14 2 J	17 J	7 7 J
Cobalt	12 5	12 1	5 9	6	6 7	10 3	5 2	8 8
Copper	14 2	23 8	10 1	11	13 6	11 9	13	5 6
Iron	31500 J	40800 J	14800 J	19500 J	27200 J	18300 J	18600 J	11300 J
Lead	14 6 J	13 9 J	8 2 J	9 3 J	15 2 J	11.3 J	8.9 J	11 7 J
Magnesium	2010 J	1100 J	1660 J	1800 J	1810 J	1960 J	1900 J	654 J
Manganese	444 J	323 J	29 J	71 8 J	274 J	457 J	249 J	327 J
Mercury	0 05 U	0 04 U	0 04 U	0 05 U	0 05 U	0 05 U	0 05 U	0 04 U
Nickel	15 7 J	23 7 J	9 6 J	10 3 J	11 3 J	12 5 J	11 3 J	4 6 J
Potassium	988	1290	697	718 J	900 J	866	744 J	353
Selenium	0 88	0 56	0 42 J	0 28 U	0 39 J	0 45 J	0 37 J	0 28 J
Silver	0 1 J	0 05 J	0 05 U	0 05 J	0 05 J	0 05 J	0 05 J	0 05 J
Sodium	145	25 9 J	191	125 U	30 6 U	11 7 J	46 7 U	2 3 U
Strontium	10 4 J	11 8 J	20 3 J	17 2 J	13 0 J	10 0 J	11 6 J	5 4 J
Thallium	0 25 J	0 15 J	0 14 J	0 19 J	0 2 J	0 2 J	0 14 J	0 09 J
Thorium-Calc	NA	NA	NA	NA	NA	NA	NA	NA
Tin	0 5 U	0 65 U	0 65 U	0 91 U	0 6 U	0.6 U	0 61 U	0 43 U
Vanadium	48 5 J	26.6 J	20 9 J	30 J	38 5 J	30 J	28 3 J	14 1 J
Zinc	31 4 J	58 2 J	25 8 J	24 3 J	29 4 J	35.5 J	32 J	11 4 J
Miscellaneous Parameters								
1,4-Dithiane (ug/kg)	NA	NA	NA	NA	NA	NA	NA	NA
1,4-Oxathiane (ug/kg)	NA	NA	NA	NA	NA	NA	NA	NA
Bis(2-Chloroethyl)Sulfide (ug/kg)	NA	NA	NA	NA	NA	NA	NA	NA
Cation Exchange Capacity (meq/100g)	NA	NA	NA	NA	NA	NA	NA	NA
pH (S U)	NA	NA	NA	NA	NA	NA	NA	NA
Total Organic Carbon (mg/kg)	NA	NA	NA	NA	NA	NA	NA	NA
Total Radiologicals (pCi/g)								
Actinium-228	1 17 J	2 11 J	1 65 J	1 64 J	1 46 J	1 36 J	1 23 J	0 77 J
Bismuth-212	1 35 J	2 36 J	1 63 J	2 18 J	1 7 J	1 67 J	1 53 J	1 18 J

Calc = Calculated Value as descibed in Section 3 4 2 1
NA = Not Analyzed

TABLE E-2

SUMMARY OF ANALYTIC RESULTS- SUBSURFACE SOIL
CRANE 158 - MUSTARD GAS BURIAL GROUND
NSWC CRANE
CRANE, INDIANA

Location	BG1SBP02	BG1SBP03	BG1SBP04	BG1SBP05	BG1SBP06	BG1SBP08	BG1SBP10	BG1SBP08
Sample	BG1SBP0206	BG1SBP0305	BG1SBP0406	BG1SBP0505	BG1SBP0603	BG1SBP0804	BG1SBP1004	BG1SBP0806
Matrix	Subsurface Soil	Subsurface Soil	Subsurface Soil	Subsurface Soil	Subsurface Soil	Subsurface Soil	Subsurface Soil	Subsurface Soil
Depth Range	5 - 6	4 - 5	5 - 6	4 - 5	2 - 3	3 - 4	3 - 4	5 - 6
Risk	Basewide Background	Basewide Background	Basewide Background	Basewide Background	Basewide Background	Basewide Background	Basewide Background	Basewide Background
Soil Group	8	8	8	8	8	8	8	9
Sample Date	11/6/1999	11/6/1999	11/6/1999	11/5/1999	11/5/1999	11/6/1999	11/5/1999	11/6/1999
Bismuth-214	1 05 J	1 54 J	1 10 J	1 35 J	1 29 J	1 29 J	1.01 J	0 70 J
Cesium-137	0 038 UJ	0 0657 UJ	0 0594 UJ	0 0585 UJ	0 025 UJ	0 0673 UJ	0 0412 UJ	0 0456 UJ
Cobalt-60	0 0474 UJ	0 0541 UJ	0 0279 UJ	0 0602 UJ	0 0323 UJ	0 0306 UJ	0 0507 UJ	0 03 UJ
Europium-154	0 0589 UJ	0 077 UJ	0 0798 UJ	0 0438 UJ	0 0497 UJ	0 09 UJ	0 0494 UJ	0 0567 UJ
Europium-155	0 09 J	0 103 UJ	0 31 J	0 13 J	0 08 J	0 09 J	0 37 J	0 0831 UJ
Lead-210	0 95 J	1 37 J	1 11 J	0 77 J	0 89 J	0 56 J	0 82 J	0 53 J
Lead-212	1 18 J	2 15 J	1 64 J	1 51 J	1 45 J	1 41 J	1 16 J	0 86 J
Lead-214	1 03 J	1 49 J	1 14 J	1 28 J	1 21 J	1 25 J	1.08 J	0 70 J
Potassium-40	13 7 J	27 40 J	13.90 J	13 80 J	18 1 J	22 20 J	18 00 J	11 70 J
Protactinium-234	6 2 UJ	8 52 UJ	4 06 UJ	5 37 UJ	8 13 UJ	6 05 UJ	6.98 J	3 14 UJ
Radium-226	1 56 J	3 68 J	2 04 J	2 40 J	2 37 J	2 59 J	1 64 J	1 36 J
Thallium-208	0 98 J	1 81 J	1 33 J	1 35 J	1 34 J	1 08 J	0 97 J	0 78 J
Thorium-228	NA	NA	NA	NA	NA	NA	NA	NA
Thorium-230	NA	NA	NA	NA	NA	NA	NA	NA
Thorium-232	NA	NA	NA	NA	NA	NA	NA	NA
Thorium-234	1 22 J	1 87 J	1 41 J	1 35 J	1 8 J	1 32 J	1 98 J	0 83 J
Uranium-235	0 213 UJ	0 345 UJ	0 376 UJ	0 386 UJ	0 269 UJ	0 359 UJ	0 20 J	0 33 UJ

Calc = Calculated Value as descibed in Section 3 4 2 1
NA = Not A[illegible]d

TABLE E-3-1

SUMMARY OF ANALYTIC RESULTS - ROUND 1 GROUND WATER
CRANE 158 - MUSTARD GAS BURIAL GROUND
NSWC CRANE
CRANE, INDIANA

Location	01-01	01-02	01-03	01-04	01-05	01-06	01-07	01-08	01-09	01-10	01-11	01-12
Sample	01GW0101	01GW0201	01GW0301	01GW0401	01GW0501	01GW0601	01GW0701	01GW0801	01GW0901	01GW1001	01GW1101	01GW1201
Matrix	Ground Water	Ground Water	Ground Water	Ground Water	Ground Water	Ground Water	Ground Water	Ground Water	Ground Water	Ground Water	Ground Water	Ground Water
Risk	Site	Site	Site	Site	Site	Site	Site	Site	Site	Site	Site	Site
Sample Date	9/6/2001	9/8/2001	9/7/2001	8/28/2001	9/19/2001	9/4/2001	9/18/2001	9/18/2001	9/7/2001	9/8/2001	8/22/2001	9/5/2001
Volatile Organic Compounds (ug/L)												
1,1,1 2-Tetrachloroethane	0 5 U	500 U	0 5 U	0 5 U	0 5 U	0 5 U	0 5 U	0 5 UJ	0 5 U	0 5 U	3	7 U
1,1,1-Trichloroethane	0 5 U	500 U	0 5 U	0 5 U	0 5 U	0 5 U	0 5 U	0 5 UJ	0 5 U	0 5 U	0 5 U	7 U
1,1,2 2-Tetrachloroethane	0 5 U	38000	0 5 U	0 5 U	9 J	0 5 U	0 5 U	0 5 UJ	0 5 U	0 5 U	170	230
1,1,2-Trichloroethane	1 UJ	1000 U	1 U	1 U	9 J	1 U	1 U	0 6 J	1 U	1 U	5	13 U
1,1 Dichloroethane	0 5 U	500 U	0 5 U	0 5 U	0 5 U	0 5 U	0 5 U	0 5 UJ	0 5 U	0 5 U	0 5 U	7 U
1,1-Dichloroethene	1 U	1000 U	1 U	1 U	0 2 J	1 U	1 U	1 UJ	1 U	1 U	0 7 J	13 U
1,2,3-Trichloropropane	0 5 U	500 U	0 5 U	0 5 U	0 5 U	0 5 UJ	0 5 U	0 5 UJ	0 5 U	0 5 U	0 5 U	7 U
1 2-Dibromo-3-Chloropropane	1 UJ	1000 UJ	1 UJ	1 UJ	1 U	1 UJ	1 U	1 UJ	1 UJ	1 UJ	1 U	13 UJ
1,2-Dibromoethane	0 6 U	600 U	0 6 U	0 6 U	0 6 U	0 6 U	0 6 U	0 6 UJ	0 6 U	0 6 U	0 6 U	8 U
1,2-Dichloroethane	0 5 U	500 U	0 5 U	0 5 U	0 5 U	0 5 U	0 5 U	0 5 UJ	0 5 U	0 5 U	4	7 U
1 2-Dichloropropane	1 U	1000 U	1 U	1 U	1 U	1 U	1 U	1 UJ	1 U	1 U	1 U	13 U
1,4-Dioxane	100 UR	100000 UR	100 UR	100 UR	100 UR	100 UR	100 UR	100 UR	100 UR	100 UR	100 UR	1300 UR
2-Butanone	5 UR	5000 UR	5 UR	5 UR	5 UJ	5 UR	5 U	5 UJ	5 UR	5 UR	5 UR	63 UR
2-Hexanone	5 UJ	5000 UJ	5 UJ	5 UJ	5 UJ	5 UJ	5 UJ	5 UJ	5 UJ	5 UJ	5 U	63 UJ
3-Chloropropene	5 U	5000 U	5 U	5 U	5 U	5 U	5 U	5 UJ	5 U	5 U	5 U	63 U
4-Methyl-2-Pentanone	3 UJ	2500 UJ	3 UJ	3 U	3 U	3 UJ	3 U	3 UJ	3 UJ	3 U	3 U	32 UJ
Acetone	5 UR	5000 UR	5 UR	5 UR	5 UR	5 UR	5 UR	5 UR	5 UR	5 UR	5 UR	63 UR
Acetonitrile	40 U	40000 U	40 U	40 U	40 U	40 U	40 U	40 UJ	40 U	40 U	40 U	500 U
Acrolein	10 UR	10000 UR	10 UR	10 UR	10 UR	10 UR	10 UR	10 UR	10 UR	10 UR	10 UR	130 UR
Acrylonitrile	10 UR	10000 UR	10 UR	10 UR	10 UR	10 UR	10 UR	10 UR	10 UR	10 UR	10 UR	130 UR
Benzene	0 5 U	500 U	0 5 U	0 5 U	0 5 U	0 5 U	0 5 U	0 5 UJ	0 5 U	0 5 U	0 5 U	7 U
Bromodichloromethane	0 5 U	500 U	0 5 U	0 5 U	0 5 U	0 5 U	0 5 U	0 5 UJ	0 5 U	0 5 U	0 5 U	7 U
Bromoform	0 5 UJ	500 UJ	0 5 UJ	0 5 U	0 5 U	0 5 U	0 5 U	0 5 UJ	0 5 UJ	0 5 U	0 5 U	7 UJ
Bromomethane	1 U	1000 U	1 U	1 U	1 U	1 U	1 U	1 UJ	1 U	1 U	1 U	13 U
Carbon Disulfide	1 U	1000 U	1 U	1 UJ	1 U	1 U	1 U	1 UJ	1 U	1 U	1 UJ	13 U
Carbon Tetrachloride	0 5 U	500 U	0 5 U	0 5 U	0 5 UJ	0 5 U	0 5 UJ	0 5 UJ	0 5 U	0 5 U	0 5 U	7 U
Chlorobenzene	0 5 U	500 U	0 5 U	0 5 U	0 5 U	0 5 U	0 5 U	0 5 UJ	0 5 U	0 5 U	0 5 U	7 U
Chlorodibromomethane	0 5 U	500 U	0 5 U	0 5 U	0 5 U	0 5 U	0 5 U	0 5 UJ	0 5 U	0 5 U	0 5 U	7 U
Chloroethane	1 U	1000 U	1 U	1 U	1 U	1 U	1 U	1 UJ	1 U	1 U	1 U	13 U
Chloroform	0 5 U	840 J	0 5 U	0 5 U	0 2 BU	0 5 U	0 5 U	0 5 UJ	0 5 U	0 5 U	15	9 BJ
Chloromethane	1 U	1000 U	1 U	1 U	1 U	1 U	1 U	1 UJ	1 U	1 U	1 U	13 U
Chloroprene	1 UJ	1000 UJ	1 UJ	1 UJ	1 U	1 U	1 U	1 UJ	1 UJ	1 UJ	1 U	13 UJ
Cis-1,2-Dichloroethene	1 UJ	1000 U	1 U	1 U	2 J	1 U	1 U	1 UJ	1 U	1 U	5	13 U
Cis-1,3-Dichloropropene	3 UJ	2500 U	3 U	3 U	3 U	3 U	3 U	3 UJ	3 U	3 U	3 U	32 U
Dibromomethane	1 U	1000 U	1 U	1 U	1 U	1 U	1 U	1 UJ	1 U	1 U	1 U	13 U
Dichlorodifluoromethane	0 7 UJ	700 UJ	0 7 UJ	0 7 U	0 7 U	0 7 U	0 7 U	0 7 UJ	0 7 UJ	0 7 UJ	0 7 U	9 UJ
Ethyl Methacrylate	1 U	1000 U	1 U	1 UJ	1 U	1 U	1 U	1 UJ	1 U	1 U	1 U	13 U
Ethylbenzene	0 5 U	500 U	0 5 U	0 5 U	0 5 U	0 5 U	0 5 U	0 5 UJ	0 5 U	0 5 U	0 5 U	7 U
Isobutanol	40 UR	40000 UR	40 UR	40 UR	40 UR	40 UR	40 UR	40 UR	40 UR	40 UR	40 UR	500 UR
Methacrylonitrile	20 UR	20000 UR	20 UR	20 UR	20 UR	20 UR	20 UR	20 UR	20 UR	20 UR	20 UR	250 UR
Methyl Iodide	1 U	1000 U	1 U	1 U	1 U	1 UJ	1 U	1 UJ	1 U	1 U	1 U	13 U
Methyl Methacrylate	1 U	1000 U	1 U	1 UJ	1 U	1 UJ	1 U	1 UJ	1 U	1 U	1 UJ	13 UJ
Methylene Chloride	1 BU	1000 U	0 3 BU	5 BU	1 U	3 BU	1 U	1 UJ	0 8 BU	0 5 U	6 BU	5 BU
Pentachloroethane	5 U	5000 U	5 U	5 UJ	5 U	5 U	5 U	5 UJ	5 U	5 U	5 U	63 U
Propionitrile	20 UR	20000 UR	20 UR	20 UR	20 UR	20 UR	20 UR	20 UR	20 UR	20 UR	20 UR	250 UR
Styrene	0 5 U	500 U	0 5 U	0 5 U	0 5 U	0 5 U	0 5 U	0 5 UJ	0 5 U	0 5 U	0 5 U	7 U
Tetrachloroethene	0 5 U	370 J	0 5 U	0 5 U	2 J	0 5 U	0 5 U	0 5 UJ	0 5 U	0 5 U	6	7 U
Toluene	0 5 U	500 U	0 5 U	0 5 U	0 5 U	0 5 U	1	0 5 UJ	0 5 U	0 5 U	0 5 U	7 U
Total Xylenes	3 UJ	2500 U	3 U	3 U	3 U	3 U	3 U	3 UJ	3 U	3 U	3 U	32 U
Trans-1,2-Dichloroethene	1 U	1000 U	1 U	1 U	0 3 J	1 U	1 U	1 UJ	1 U	1 U	2	13 U
Trans-1,3-Dichloropropene	3 UJ	2800 UJ	3 UJ	3 U	3 U	3 U	3 U	3 UJ	3 UJ	3 U	3 U	35 UJ
Trans-1,4-Dichloro-2-Butene	1 UJ	1000 UJ	1 UJ	1 U	1 UJ	1 UJ	1 U	1 UJ	1 UJ	1 UJ	1 U	13 UJ
Trichloroethene	0 5 U	16000	0 5 U	0 5 U	550 J	0 5 U	0 5 U	4 J	0 5 U	0 4 J	180 J	190
Trichlorofluoromethane	1 U	1000 U	1 U	1 U	1 U	1 U	1 U	1 UJ	1 U	1 U	1 U	13 U

(1) Reanalyzed on February 22, 2002 for gross beta
NA = Not Analyzed

TABLE E-3-1

SUMMARY OF ANALYTIC RESULTS - ROUND 1 GROUND WATER
CRANE 158 - MUSTARD GAS BURIAL GROUND
NSWC CRANE
CRANE, INDIANA

Location Sample Matrix	01-01 01GW0101 Ground Water	01-02 01GW0201 Ground Water	01-03 01GW0301 Ground Water	01-04 01GW0401 Ground Water	01-05 01GW0501 Ground Water	01-06 01GW0601 Ground Water	01-07 01GW0701 Ground Water	01-08 01GW0801 Ground Water	01-09 01GW0901 Ground Water	01-10 01GW1001 Ground Water	01-11 01GW1101 Ground Water	01-12 01GW1201 Ground Water
Vinyl Acetate	3 UJ	2500 UJ	3 UJ	3 UJ	3 U	3 UJ	3 U	3 UJ	3 UJ	3 UJ	3 U	32 UJ
Vinyl Chloride	1 U	1000 U	1 U	1 U	1 U	1 U	1 U	1 UJ	1 U	1 U	1 U	13 U
Semivolatile Organic Compounds (ug/L)												
1,2,4,5-Tetrachlorobenzene	10 U	10 U	10 U	10 U	10 U	10 U	NA	NA	NA	NA	10 U	NA
1,2,4-Trichlorobenzene	10 U	10 U	10 U	10 U	10 U	10 U	NA	NA	NA	NA	10 U	NA
1,2-Dichlorobenzene	5 U	5 U	5 U	5 U	5 U	5 U	NA	NA	NA	NA	5 U	NA
1,3-Dichlorobenzene	5 U	5 U	5 U	5 U	5 U	5 U	NA	NA	NA	NA	5 U	NA
1 4-Dichlorobenzene	5 U	5 U	5 U	5 U	5 U	5 U	NA	NA	NA	NA	5 U	NA
1,4-Naphthoquinone	10 U	10 U	10 U	10 U	10 U	10 U	NA	NA	NA	NA	10 U	NA
1,4-Phenylenediamine	25 U	25 U	25 U	25 U	25 U	25 U	NA	NA	NA	NA	25 UJ	NA
1-Naphthylamine	10 U	10 U	10 U	10 U	10 U	10 U	NA	NA	NA	NA	10 U	NA
2,2'-Oxybis(1-Chloropropane)	5 U	5 U	5 U	5 U	5 U	5 U	NA	NA	NA	NA	5 U	NA
2,3,4,6-Tetrachlorophenol	10 U	10 U	10 U	10 U	10 U	10 U	NA	NA	NA	NA	10 U	NA
2 4,5-Trichlorophenol	25 U	25 U	25 U	25 U	25 U	25 U	NA	NA	NA	NA	25 U	NA
2,4 6-Trichlorophenol	10 U	10 U	10 U	10 U	10 U	10 U	NA	NA	NA	NA	10 U	NA
2,4-Dichlorophenol	10 U	10 U	10 U	10 U	10 U	10 U	NA	NA	NA	NA	10 U	NA
2,4-Dimethylphenol	10 U	10 U	10 U	10 U	10 U	10 U	NA	NA	NA	NA	10 U	NA
2,4-Dinitrophenol	25 U	25 U	25 U	25 U	25 U	25 U	NA	NA	NA	NA	25 U	NA
2,6-Dichlorophenol	10 U	10 U	10 U	10 U	10 U	10 U	NA	NA	NA	NA	10 U	NA
2-Acetylaminofluorene	5 U	5 U	5 U	5 U	5 U	5 U	NA	NA	NA	NA	5 U	NA
2 Chloronaphthalene	5 U	5 U	5 U	5 U	5 U	5 U	NA	NA	NA	NA	5 U	NA
2-Chlorophenol	5 U	5 U	5 U	5 U	5 U	5 U	NA	NA	NA	NA	5 U	NA
2-Methylnaphthalene	5 U	5 U	5 U	5 U	5 U	5 U	NA	NA	NA	NA	5 U	NA
2-Methylphenol	6 U	6 U	6 U	6 U	6 U	6 U	NA	NA	NA	NA	6 U	NA
2-Naphthylamine	5 U	5 U	5 U	5 U	5 U	5 U	NA	NA	NA	NA	5 U	NA
2 Nitroaniline	13 U	13 U	13 U	13 U	13 U	13 U	NA	NA	NA	NA	13 U	NA
2 Nitrophenol	10 U	10 U	10 U	10 U	10 U	10 U	NA	NA	NA	NA	10 U	NA
2 Picoline	5 U	5 U	5 U	5 U	5 U	5 U	NA	NA	NA	NA	5 U	NA
3 3' Dichlorobenzidine	10 U	10 U	10 U	10 U	10 U	10 U	NA	NA	NA	NA	10 U	NA
3 3 Dimethylbenzidine	10 U	10 U	10 U	10 U	10 U	10 U	NA	NA	NA	NA	10 U	NA
3-Methylcholanthrene	5 U	5 U	5 U	5 U	5 U	5 U	NA	NA	NA	NA	5 U	NA
3 Methylphenol	5 U	5 U	5 U	5 U	5 U	5 U	NA	NA	NA	NA	5 U	NA
3-Nitroaniline	25 U	25 U	25 U	25 U	25 U	25 U	NA	NA	NA	NA	25 U	NA
4,6 Dinitro-2 Methylphenol	25 U	25 U	25 U	25 U	25 U	25 U	NA	NA	NA	NA	25 U	NA
4 Aminobiphenyl	5 U	5 U	5 U	5 U	5 U	5 U	NA	NA	NA	NA	5 U	NA
4 Bromophenyl Phenyl Ether	10 U	10 U	10 U	10 U	10 U	10 U	NA	NA	NA	NA	10 U	NA
4-Chloro-3-Methylphenol	10 U	10 U	10 U	10 U	10 U	10 U	NA	NA	NA	NA	10 U	NA
4-Chloroaniline	10 U	10 U	10 U	10 U	10 U	10 U	NA	NA	NA	NA	10 U	NA
4-Chlorophenyl Phenyl Ether	5 U	5 U	5 U	5 U	5 U	5 U	NA	NA	NA	NA	5 U	NA
4-Methylphenol	5 U	5 U	5 U	5 U	5 U	5 U	NA	NA	NA	NA	5 U	NA
4-Nitroaniline	25 U	25 U	25 U	25 U	25 U	25 U	NA	NA	NA	NA	25 U	NA
4-Nitrophenol	25 U	25 U	25 U	25 U	15 J	25 U	NA	NA	NA	NA	25 U	NA
4-Nitroquinoline-1-Oxide	25 UR	25 UR	25 UR	25 UR	25 UR	25 UR	NA	NA	NA	NA	25 UR	NA
5-Nitro-O-Toluidine	10 U	10 U	10 U	10 U	10 U	10 U	NA	NA	NA	NA	10 U	NA
7,12-Dimethylbenz(A)Anthracene	5 U	5 U	5 U	5 U	5 U	5 U	NA	NA	NA	NA	5 U	NA
A,A-Dimethylphenethylamine	25 U	25 U	25 U	25 U	25 U	25 U	NA	NA	NA	NA	25 U	NA
Acenaphthene	0 2 UJ	0 2 U	0 2 U	0 0793 J	0 2 U	0 2 U	NA	NA	NA	NA	0 0896 J	NA
Acenaphthylene	0 2 U	0 763	0 2 U	0 2 U	0 2 U	0 2 U	NA	NA	NA	NA	0 2 U	NA
Acetophenone	5 U	5 U	5 U	5 U	5 U	5 U	NA	NA	NA	NA	5 U	NA
Aniline	10 U	10 U	10 U	10 U	10 U	10 U	NA	NA	NA	NA	10 U	NA
Anthracene	0 2 U	0 2 U	0 2 U	0 2 U	0 2 U	0 2 U	NA	NA	NA	NA	0 2 U	NA
Aramite	25 U	25 U	25 U	25 U	25 U	25 U	NA	NA	NA	NA	25 U	NA
Benzo(A)Anthracene	0 2 U	0 2 U	0 2 U	0 2 U	0 2 U	0 2 U	NA	NA	NA	NA	0 2 U	NA
Benzo(A)Pyrene	0 2 U	0 2 U	0 2 U	0 2 U	0 2 U	0 2 U	NA	NA	NA	NA	0 2 U	NA
Benzo(B)Fluoranthene	0 2 U	0 2 U	0 2 U	0 2 U	0 2 U	0 2 U	NA	NA	NA	NA	0 2 U	NA
Benzo(G,H,I)Perylene	0 2 UJ	0 2 U	0 2 U	0 2 U	0 2 U	0 2 UJ	NA	NA	NA	NA	0 2 U	NA
Benzo(K)Fluoranthene	0 2 UJ	0 2 U	0 2 U	0 2 U	0 2 U	0 2 U	NA	NA	NA	NA	0 2 U	NA

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NA = Not Analyzed

TABLE E-3-1

SUMMARY OF ANALYTIC RESULTS - ROUND 1 GROUND WATER
CRANE 158 - MUSTARD GAS BURIAL GROUND
NSWC CRANE
CRANE, INDIANA

Location	01-01	01-02	01-03	01-04	01-05	01-06	01-07	01-08	01-09	01-10	01-11	01-12
Sample	01GW0101	01GW0201	01GW0301	01GW0401	01GW0501	01GW0601	01GW0701	01GW0801	01GW0901	01GW1001	01GW1101	01GW1201
Matrix	Ground Water	Ground Water	Ground Water	Ground Water	Ground Water	Ground Water	Ground Water	Ground Water	Ground Water	Ground Water	Ground Water	Ground Water
Benzyl Alcohol	7 U	7 U	7 U	7 U	7 U	7 U	NA	NA	NA	NA	7 U	NA
Bis(2-Chloroethoxy)Methane	10 UJ	10 U	10 U	10 U	10 U	10 U	NA	NA	NA	NA	10 U	NA
Bis(2-Chloroethyl)Ether	5 U	5 U	5 U	5 U	5 U	5 U	NA	NA	NA	NA	5 U	NA
Bis(2-Ethylhexyl)Phthalate	7 J	5 U	5 U	5 U	5 U	5 U	NA	NA	NA	NA	15 J	NA
Butyl Benzyl Phthalate	5 U	5 U	5 U	5 U	5 U	5 U	NA	NA	NA	NA	9 J	NA
Chlorobenzilate	10 U	10 U	10 U	10 U	10 U	10 U	NA	NA	NA	NA	10 U	NA
Chrysene	0 2 UJ	0 2 U	0 2 U	0 2 U	0 2 U	0 2 U	NA	NA	NA	NA	0 2 U	NA
Diallate	5 U	5 UJ	5 UJ	5 U	5 U	5 U	NA	NA	NA	NA	5 U	NA
Dibenzo(A,H)Anthracene	5 U	5 U	5 U	5 U	5 U	5 U	NA	NA	NA	NA	5 U	NA
Dibenzofuran	10 U	10 U	10 U	10 U	10 U	10 U	NA	NA	NA	NA	10 U	NA
Diethyl Phthalate	0 2 U	0 2 U	0 2 U	0 2 U	0 2 U	0 2 U	NA	NA	NA	NA	0 2 U	NA
Dimethyl Phthalate	5 U	5 U	5 U	5 U	5 U	5 U	NA	NA	NA	NA	5 U	NA
Di-N-Butyl Phthalate	5 U	5 U	5 U	5 U	5 U	5 U	NA	NA	NA	NA	5 U	NA
Di-N-Octyl Phthalate	6 U	6 U	6 U	6 U	6 U	6 U	NA	NA	NA	NA	6 U	NA
Diphenylamine	5 U	5 U	5 U	5 U	5 U	5 U	NA	NA	NA	NA	5 U	NA
Ethyl Methane Sulfonate	5 U	5 U	5 U	5 U	5 U	5 U	NA	NA	NA	NA	5 U	NA
Fluoranthene	0 2 U	0 2 U	0 2 U	0 2 U	0 2 U	0 2 U	NA	NA	NA	NA	0 2 U	NA
Fluorene	0 2 U	0 0593 J	0 2 U	0 2 U	0 2 U	0 2 U	NA	NA	NA	NA	0 2 U	NA
Hexachlorobenzene	10 U	10 U	10 U	10 U	10 U	10 U	NA	NA	NA	NA	10 U	NA
Hexachlorobutadiene	10 U	10 U	10 U	10 U	10 U	10 U	NA	NA	NA	NA	10 U	NA
Hexachlorocyclopentadiene	10 UR	10 U	10 U	10 U	10 U	10 U	NA	NA	NA	NA	10 U	NA
Hexachloroethane	5 U	5 J	5 U	5 U	5 U	5 U	NA	NA	NA	NA	5 U	NA
Hexachlorophene	400 UJ	400 UJ	400 UJ	400 UJ	400 UJ	400 UJ	NA	NA	NA	NA	400 UJ	NA
Hexachloropropene	10 U	10 U	10 U	10 U	10 U	10 U	NA	NA	NA	NA	10 UJ	NA
Indeno(1,2,3-CD)Pyrene	0 2 U	0 2 U	0 2 U	0 2 U	0 2 U	0 2 U	NA	NA	NA	NA	0 2 U	NA
Isodrin	10 U	10 U	10 U	10 U	10 U	10 U	NA	NA	NA	NA	10 U	NA
Isophorone	5 U	5 U	5 U	5 U	5 U	5 U	NA	NA	NA	NA	5 U	NA
Isosafrole	10 U	10 U	10 U	10 U	10 U	10 U	NA	NA	NA	NA	10 U	NA
Kepone	25 U	25 U	25 U	25 U	25 U	25 U	NA	NA	NA	NA	25 U	NA
Methapyrilene	25 UR	25 UR	25 UR	25 U	25 UR	25 U	NA	NA	NA	NA	25 U	NA
Methyl Methane Sulfonate	13 U	13 U	13 U	13 U	13 U	13 U	NA	NA	NA	NA	13 U	NA
Naphthalene	10 U	10 U	10 U	10 U	10 U	10 U	NA	NA	NA	NA	10 U	NA
N-Nitrosodiethylamine	6 U	6 U	6 U	6 U	6 U	6 U	NA	NA	NA	NA	6 UJ	NA
N-Nitrosodimethylamine	5 U	5 U	5 U	5 U	5 U	5 U	NA	NA	NA	NA	5 U	NA
N-Nitroso-Di-N-Butylamine	5 U	5 U	5 U	5 U	5 U	5 U	NA	NA	NA	NA	5 U	NA
N-Nitroso-Di-N-Propylamine	7 U	7 U	7 U	7 U	7 U	7 U	NA	NA	NA	NA	7 U	NA
N-Nitrosomethylethylamine	5 U	5 U	5 U	5 U	5 U	5 U	NA	NA	NA	NA	5 U	NA
N-Nitrosomorpholine	10 U	10 U	10 U	10 U	10 U	10 U	NA	NA	NA	NA	10 U	NA
N-Nitrosopiperidine	5 U	5 U	5 U	5 U	5 U	5 U	NA	NA	NA	NA	5 UJ	NA
N-Nitrosopyrrolidine	0 2 U	0 579	0 2 U	0 2 U	0 2 U	0 0796 J	NA	NA	NA	NA	0 103 J	NA
O O,O-Triethyl Phosphorothioate	10 U	10 U	10 U	10 U	10 U	10 U	NA	NA	NA	NA	10 U	NA
O-Toluidine	5 U	5 U	5 U	5 U	5 U	5 U	NA	NA	NA	NA	5 U	NA
P-(Dimethylamino)Azobenzene	10 U	10 U	10 U	10 U	10 U	10 U	NA	NA	NA	NA	10 U	NA
Pentachlorobenzene	10 U	10 U	10 U	10 U	10 U	10 U	NA	NA	NA	NA	10 U	NA
Pentachloronitrobenzene	25 U	25 U	25 U	25 U	25 U	25 U	NA	NA	NA	NA	25 U	NA
Phenacetin	10 U	10 U	10 U	10 U	10 UJ	10 U	NA	NA	NA	NA	10 U	NA
Phenanthrene	0 2 U	0 2 U	0 2 U	0 2 U	0 2 U	0 2 U	NA	NA	NA	NA	0 2 U	NA
Phenol	10 U	10 U	10 U	10 U	10 U	10 U	NA	NA	NA	NA	10 U	NA
Pronamide	10 UR	10 UR	10 UR	10 UR	10 UR	10 UR	NA	NA	NA	NA	10 UR	NA
Pyrene	0 2 U	0 2 U	0 2 U	0 2 U	0 2 U	0 2 U	NA	NA	NA	NA	0 2 U	NA
Pyridine	10 U	10 U	10 U	10 U	10 U	10 U	NA	NA	NA	NA	10 U	NA
Safrole	10 U	10 U	10 U	10 U	10 U	10 U	NA	NA	NA	NA	10 U	NA
Energertics (ug/L)												
1,3,5-Trinitrobenzene	0 65 U	0 65 U	0 65 U	0 65 U	0 65 U	0 65 U	NA	NA	NA	NA	0 65 U	NA
1,3-Dinitrobenzene	0 65 U	0 65 U	0 65 U	0 65 U	0 65 U	0 65 U	NA	NA	NA	NA	0 65 U	NA
2,4,6-Trinitrotoluene	0 65 U	0 65 U	0 65 U	0 65 U	0 65 U	0 65 U	NA	NA	NA	NA	0 65 U	NA
2,4-Dinitrotoluene	0 65 U	0 65 U	0 65 U	0 65 U	0 65 U	0 65 U	NA	NA	NA	NA	0 65 U	NA

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NA = Not Analyzed

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SUMMARY OF ANALYTIC RESULTS - ROUND 1 GROUND WATER
CRANE 158 - MUSTARD GAS BURIAL GROUND
NSWC CRANE
CRANE, INDIANA

Location	01-01	01-02	01-03	01-04	01-05	01-06	01-07	01-08	01-09	01-10	01-11	01-12
Sample	01GW0101	01GW0201	01GW0301	01GW0401	01GW0501	01GW0601	01GW0701	01GW0801	01GW0901	01GW1001	01GW1101	01GW1201
Matrix	Ground Water	Ground Water	Ground Water	Ground Water	Ground Water	Ground Water	Ground Water	Ground Water	Ground Water	Ground Water	Ground Water	Ground Water
2,6-Dinitrotoluene	0 65 U	0 65 U	0 65 U	0 65 U	0 65 U	0 65 U	NA	NA	NA	NA	0 65 U	NA
2-Amino-4,6-Dinitrotoluene	0 65 U	0 65 U	0 65 U	0 65 U	0 65 U	0 65 U	NA	NA	NA	NA	0 65 U	NA
2-Nitrotoluene	0 65 U	0 202 J	0 65 U	0 65 U	0 65 U	0 65 U	NA	NA	NA	NA	0 65 U	NA
3-Nitrotoluene	0 65 U	0 65 U	0 65 U	0 65 U	0 65 U	0 65 U	NA	NA	NA	NA	0 65 U	NA
4-Amino-2,6-Dinitrotoluene	0 65 U	0 65 U	0 65 U	0 65 U	0 263 J	0 65 U	NA	NA	NA	NA	0 65 U	NA
4-Nitrotoluene	0 65 U	0 65 U	0 65 U	0 65 U	0 65 U	0 65 U	NA	NA	NA	NA	0 65 U	NA
HMX	0 201 J	0 65 U	0 65 U	0 65 U	0 65 U	0 171 R	NA	NA	NA	NA	0 65 U	NA
Nitrobenzene	0 65 U	0 65 U	0 65 U	0 65 U	0 65 U	0 65 U	NA	NA	NA	NA	0 65 U	NA
RDX	0 65 U	0 855 R	0 0858 R	0 65 U	0 65 U	0 65 U	NA	NA	NA	NA	0 65 U	NA
Tetryl	0 65 U	0 65 U	0 65 U	0 65 U	0 65 U	0 65 U	NA	NA	NA	NA	0 65 U	NA
Pesticides/PCBs (ug/L)												
4,4'-DDD	0 08 U	0 08 U	0 08 U	0 08 UJ	0 08 U	0 08 U	NA	NA	NA	NA	0 08 U	NA
4,4'-DDE	0 08 U	0 08 U	0 08 U	0 08 U	0 08 U	0 08 U	NA	NA	NA	NA	0 08 U	NA
4,4'-DDT	0 08 U	0 08 U	0 08 U	0 08 U	0 08 U	0 08 U	NA	NA	NA	NA	0 08 U	NA
Aldrin	0 04 U	0 04 U	0 04 U	0 04 U	0 04 U	0 04 U	NA	NA	NA	NA	0 04 U	NA
Alpha-BHC	0 04 U	0 04 U	0 04 U	0 04 U	0 04 U	0 04 U	NA	NA	NA	NA	0 04 UJ	NA
Alpha-Chlordane	0 04 U	0 04 U	0 04 U	0 04 U	0 04 U	0 04 U	NA	NA	NA	NA	0 04 U	NA
Aroclor-1016	1 U	1 U	1 U	1 U	1 U	1 U	NA	NA	NA	NA	1 U	NA
Aroclor-1221	1 U	1 U	1 U	1 U	1 U	1 U	NA	NA	NA	NA	1 U	NA
Aroclor-1232	1 U	1 U	1 U	1 U	1 U	1 U	NA	NA	NA	NA	1 U	NA
Aroclor-1242	1 U	1 U	1 U	1 U	1 U	1 U	NA	NA	NA	NA	1 U	NA
Aroclor-1248	1 U	1 U	1 U	1 U	1 U	1 U	NA	NA	NA	NA	1 U	NA
Aroclor-1254	1 U	1 U	1 U	1 U	1 U	1 U	NA	NA	NA	NA	1 U	NA
Aroclor-1260	1 U	1 U	1 U	1 U	1 U	1 U	NA	NA	NA	NA	1 U	NA
Beta-BHC	0 04 U	0 04 U	0 04 U	0 04 U	0 04 U	0 04 U	NA	NA	NA	NA	0 04 U	NA
Delta-BHC	0 04 U	0 04 U	0 04 U	0 04 U	0 04 U	0 04 U	NA	NA	NA	NA	0 04 U	NA
Dieldrin	0 08 U	0 08 U	0 08 U	0 08 U	0 08 U	0 08 U	NA	NA	NA	NA	0 08 U	NA
Endosulfan I	0 04 U	0 04 U	0 04 U	0 04 U	0 04 U	0 04 U	NA	NA	NA	NA	0 04 U	NA
Endosulfan II	0 08 U	0 25 R	0 08 U	0 08 U	0 08 U	0 08 U	NA	NA	NA	NA	0 08 U	NA
Endosulfan Sulfate	0 08 U	0 08 U	0 08 U	0 08 UJ	0 08 U	0 08 U	NA	NA	NA	NA	0 08 U	NA
Endrin	0 08 U	0 08 U	0 08 U	0 08 U	0 08 U	0 08 U	NA	NA	NA	NA	0 08 U	NA
Endrin Aldehyde	0 08 U	0 08 U	0 08 U	0 08 U	0 08 U	0 08 U	NA	NA	NA	NA	0 08 U	NA
Gamma-BHC (Lindane)	0 04 U	0 04 U	0 04 U	0 04 U	0 04 U	0 04 U	NA	NA	NA	NA	0 04 U	NA
Gamma-Chlordane	0 025 J	0 04 U	0 075 J	0 04 U	0 04 U	0 04 U	NA	NA	NA	NA	0 04 U	NA
Heptachlor	0 042 BU	0 04 U	0 059 U	0 013 BU	0 05 BU	0 049 BU	NA	NA	NA	NA	0 023 J	NA
Heptachlor Epoxide	0 04 U	0 04 U	0 04 U	0 04 U	0 04 U	0 04 U	NA	NA	NA	NA	0 04 U	NA
Methoxychlor	0 38 U	0 38 U	0 38 U	0 38 U	0 38 U	0 38 U	NA	NA	NA	NA	0 38 U	NA
Toxaphene	2 5 U	2 5 U	2 5 U	2 5 U	2 5 U	2 5 U	NA	NA	NA	NA	2 5 U	NA
Herbicides (ug/L)												
2 4,5-T	0 8 UJ	0 8 U	0 8 U	0 8 U	0 8 U	0 8 U	NA	NA	NA	NA	0 8 U	NA
2,4,5-TP (Silvex)	0 5 UJ	0 5 U	0 5 U	0 5 U	0 5 U	0 5 U	NA	NA	NA	NA	0 5 U	NA
2,4-D	2 5 U	2 5 U	2 5 U	2 5 U	2 5 U	2 5 U	NA	NA	NA	NA	2 5 U	NA
Dinoseb	1 UR	1 U	1 U	1 U	1 U	1 UJ	NA	NA	NA	NA	1 UJ	NA
Pentachlorophenol	0 5 U	0 5 U	0 5 U	0 5 U	0 5 U	0 5 U	NA	NA	NA	NA	0 5 U	NA
Total Metals (ug/L)												
Aluminum	68 8	40 2 U	5700	40 2 U	40 3 U	40 2 U	1330	40 3 U	162	40 2 U	1370 J	447
Antimony	1 6 U	1 6 U	1 6 U	1 9	3 0	1 6 U	1 6 U	1 6 U	1 6 U	2 1 U	4 7 U	1 6 U
Arsenic	1 5 U	1 5 U	7 9	2 5 U	1 5 U	3 2 U	2 7	1 5 U	1 5 U	1 5 U	3 6	1 5 U
Barium	29 1	134	258	17 1	25 0	21 3	156	19 4	16 0	41 7	45 4	15 0
Beryllium	0 40 U	0 40 U	0 59	0 40 U	0 40 U	0 40 U	0 40 U	0 40 U	0 40 U	0 40 U	0 70 U	0 40 U
Cadmium	0 30 U	0 74	0 94	0 30 U	0 30 U	0 30 U	0 30 U	0 30 U	0 30 U	0 30 U	0 41 U	0 30 U
Calcium	105000 J	121000 J	60200 J	89100	196000	170000	77100	66100	39800 J	113000 J	95100	86000
Chromium	0 60 U	0 61 U	7 1 J	0 60 U	0 70 U	0 60 U	1 5	0 70 U	0 98 U	0 60 U	3 6 U	1 7 U
Cobalt	11 1	3 1	14 1	1 0 U	3 0	1 0 U	6 4	2 7	1 2	2 7	17 8	1 9
Copper	0 90 U	0 90 U	14 5 J	0 90 U	0 90 U	0 90 U	2 9	0 90 U	0 90 U	0 90 U	2 6 U	0 90 U
Iron	1410	22 1	8670	24 9	319	398	1410	6370	624	673	1160 J	487
Lead	1 6 U	1 6 U	8 2 J	1 6 U	1 6 U	1 6 U	1 6 U	1 6 U	1 6 U	1 6 U	0 70 U	1 6 U

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CRANE 158 - MUSTARD GAS BURIAL GROUND
NSWC CRANE
CRANE, INDIANA

Location	01-01	01-02	01-03	01-04	01-05	01-06	01-07	01-08	01-09	01-10	01-11	01-12
Sample	01GW0101	01GW0201	01GW0301	01GW0401	01GW0501	01GW0601	01GW0701	01GW0801	01GW0901	01GW1001	01GW1101	01GW1201
Matrix	Ground Water	Ground Water	Ground Water	Ground Water	Ground Water	Ground Water	Ground Water	Ground Water	Ground Water	Ground Water	Ground Water	Ground Water
Magnesium	72400 J	72100 J	18000 J	59800	151000	156000	22000	23400	10400 J	20400 J	5780 J	25000
Manganese	2450 J	434 J	2670 J	1 5	590	37 9	1500	886	144 J	987 J	303 J	401
Mercury	0 10 U	0 10 U	0 10 U	0 10 U	0 15	0 10 U	0 24	0 13	0 10 U	0 10 U	0 13 U	0 10 U
Nickel	10 2 J	41 4 J	31 9 J	0 70 U	6 9	2 6	17 6	4 1	11 5 J	8 5 J	10 5	64 7
Potassium	3010	1530	4300	1310	2800 J	2790	10400 J	2370 J	1170	2070	1350 J	1340
Selenium	0 80 U	0 80 U	0 80 U	0 80 U	0 80 U	0 80 U	0 80 U	0 80 U	0 80 U	2 2 U	2 3 U	0 80 U
Silver	3 0 U	3 0 U	3 0 U	3 0 U	0 70 U	3 0 U	1 1	0 71	3 0 U	3 0 U	0 65 J	3 0 U
Sodium	48500 J	102000 J	10700 J	80800	117000	17200	12500	6100	3070 J	7900 J	5830 J	14800
Strontium	265 J	257 J	158 J	148 J	347 J	958 J	576 J	211 J	76 5 J	214 J	98 8 J	132 J
Thallium	5 0 UJ	5 0 UJ	5 0 UJ	5 0 U	4 1	5 0 U	4 6	3 6	5 0 UJ	5 0 UJ	3 9 U	5 0 U
Thorium - Calc	0 605 U	1 45 U	0 363 U	0 585 U	0 810	0 329	NA	NA	NA	NA	0 228	NA
Tin	190 U	190 U	190 U	190 U	17 3 U	190 U	17 3 U	17 3 U	190 U	190 U	17 3 U	190 U
Vanadium	3 0 U	3 0 U	11 8	3 0 U	0 50 U	3 0 U	1 1	0 50 U	3 0 U	3 0 U	3 3 U	3 0 U
Zinc	11 3 U	61 9 J	43 8 U	1 1 U	1 7 U	1 1 U	8 6	8 2	9 4 U	3 6 U	27 4	23 2
Dissolved Metals (ug/L)												
Aluminum	NA	NA	40 2 U	NA	NA	NA	NA	NA	NA	40 2 U	87 0 U	NA
Antimony	NA	NA	1 6 U	NA	NA	NA	NA	NA	NA	3 1 U	2 1 U	NA
Arsenic	NA	NA	2 3	NA	NA	NA	NA	NA	NA	1 5 U	3 0 U	NA
Barium	NA	NA	215	NA	NA	NA	NA	NA	NA	41 0	36 2	NA
Beryllium	NA	NA	0 40 U	NA	NA	NA	NA	NA	NA	0 40 U	0 70 U	NA
Cadmium	NA	NA	0 30 U	NA	NA	NA	NA	NA	NA	0 30 U	0 49 U	NA
Calcium	NA	NA	60500 J	NA	NA	NA	NA	NA	NA	115000 J	93100	NA
Chromium	NA	NA	0 60 U	NA	NA	NA	NA	NA	NA	0 60 U	1 0 U	NA
Cobalt	NA	NA	8 3	NA	NA	NA	NA	NA	NA	2 4	1 0 U	NA
Copper	NA	NA	0 90 U	NA	NA	NA	NA	NA	NA	0 90 U	1 3 U	NA
Iron	NA	NA	288	NA	NA	NA	NA	NA	NA	414	51 7 J	NA
Lead	NA	NA	1 6 U	NA	NA	NA	NA	NA	NA	1 6 U	0 70 U	NA
Magnesium	NA	NA	16600 J	NA	NA	NA	NA	NA	NA	20400 J	5430 J	NA
Manganese	NA	NA	2740 J	NA	NA	NA	NA	NA	NA	1010 J	22 4 J	NA
Mercury	NA	NA	0 10 U	NA	NA	NA	NA	NA	NA	0 10 U	0 14 U	NA
Nickel	NA	NA	17 7 J	NA	NA	NA	NA	NA	NA	8 7 J	4 9 U	NA
Potassium	NA	NA	3630	NA	NA	NA	NA	NA	NA	1990	1100 J	NA
Selenium	NA	NA	0 80 U	NA	NA	NA	NA	NA	NA	0 80 U	2 3 U	NA
Silver	NA	NA	3 0 U	NA	NA	NA	NA	NA	NA	3 0 U	0 20 U	NA
Sodium	NA	NA	7100 J	NA	NA	NA	NA	NA	NA	7640 J	5000 J	NA
Strontium	NA	NA	153 J	NA	NA	NA	NA	NA	NA	212 J	96 5 J	NA
Thallium	NA	NA	5 0 UJ	NA	NA	NA	NA	NA	NA	5 0 UJ	3 9 U	NA
Thorium - Calc	NA	NA	0 404 U	NA	NA	NA	NA	NA	NA	NA	0 377 U	NA
Tin	NA	NA	190 U	NA	NA	NA	NA	NA	NA	190 U	17 3 U	NA
Vanadium	NA	NA	3 0 U	NA	NA	NA	NA	NA	NA	3 0 U	0 30 U	NA
Zinc	NA	NA	6 2 U	NA	NA	NA	NA	NA	NA	7 0 U	9 4 U	NA
Miscellaneous Parameters (mg/L)												
1,4-Dithiane	200 U	200 U	200 U	200 U	200 U	200 U	NA	NA	NA	NA	200 U	NA
1,4-Oxathiane	200 U	200 U	200 U	200 U	200 U	200 U	NA	NA	NA	NA	200 U	NA
Bis(2-Chloroethyl)Sulfide	200 U	200 U	200 U	200 U	200 U	200 U	NA	NA	NA	NA	200 U	NA
Total Organic Carbon	4 5 J	7 8 J	35 3 J	3 7	4 78	6 21	NA	NA	NA	NA	NA	NA
Total Radiologicals (pCi/L)												
Gross Alpha	4 82 J	3 00 UJ	1 50 J	2 05 J	3 35 U	5 26 J	1 08 U	1 49 J	1 87 J	2 46 J	4 76 J	2 04 J
Gross Beta	11 8 J	3 18	6 79	4 86 U	4 46 U	5 16 U	14 2	2 58	2 32 U	3 53	8 28 J	3 81 U
Thorium-228	0 0875 U	0 166 U	0 0399 U	0 108 U	0 0863 U	0 0408	NA	NA	NA	NA	0 0329	NA
Thorium-230	0 230 U	0 106 U	0 119 U	0 130 U	0 135 U	0 122 U	NA	NA	NA	NA	0 146 U	NA
Thorium-232	0 0457 U	0 154 U	0 0399 U	0 0207 U	0 135	0 0631 U	NA	NA	NA	NA	0 0346 U	NA
Dissolved Radiologicals (pCi/L)												
Gross Alpha	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Gross Beta	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Thorium-228	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	0 0493 U	NA
Thorium-230	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	0 124 U	NA

(1) Reanalyzed on February 22, 2002 for gross beta
NA = Not Analyzed

TABLE E-3-1

SUMMARY OF ANALYTIC RESULTS - ROUND 1 GROUND WATER
CRANE 158 - MUSTARD GAS BURIAL GROUND
NSWC CRANE
CRANE, INDIANA

Location	01-01	01-02	01-03	01-04	01-05	01-06	01-07	01-08	01-09	01-10	01-11	01-12
Sample	01GW0101	01GW0201	01GW0301	01GW0401	01GW0501	01GW0601	01GW0701	01GW0801	01GW0901	01GW1001	01GW1101	01GW1201
Matrix	Ground Water	Ground Water	Ground Water	Ground Water	Ground Water	Ground Water	Ground Water	Ground Water	Ground Water	Ground Water	Ground Water	Ground Water
Thorium-232	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	0 0337 U	NA
Field Parameters												
Dissolved Oxygen (mg/L)	0 95	1 6	0 84	0 63	2 37	0 69	0 38	0 39	0 71	0 72	1 01	1 56
Oxidation Reduction Potential (mV)	393	480	-152	490	490 4	109	221 5	39 6	618 1	71	444 8	466
pH (S U)	6 00	6 17	6 26	6 7	6	5 25	6 9	6 28	4 41	6 33	5 74	5 89
Specific Conductance (mS/cm)	1 007	1 659	0 486	0 922	2 37	1 67	0 518	0 546	0 272	0 699	0 444	0 643
Temperature (C)	15 38	17 5	17 4	18 7	15 46	14 62	13 86	14 39	15 4	21 89	17 15	18 3
Turbidity (NTU)	4 7	3 3	14	1 5	2 6	2 6	4 9	5	4 8	8 9	27	4 1

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NA = Not Analyzed

TABLE E-3-1

SUMMARY OF ANALYTIC RESULTS - ROUND 1 GROUND WATER
CRANE 158 - MUSTARD GAS BURIAL GROUND
NSWC CRANE
CRANE, INDIANA

Location	01-13	01-14	01-15	01-17	01-18	01-19	01-20	01-21	01-22	01-23	01-23 [1]	01-24
Sample	01GW1301	01GW1401	01GW1501	01GW1701	01GW1801	01GW1901	01GW2001	01GW2101	01GW2201	01GW2301	01GW2301-RE	01GW2401
Matrix	Ground Water	Ground Water	Ground Water	Ground Water	Ground Water	Ground Water	Ground Water	Ground Water	Ground Water	Ground Water	Ground Water	Ground Water
Risk	Site	Site	Site	Site	Site	Site	Site	Site	Site	Site	Site	Site
Sample Date	9/5/2001	8/24/2001	9/5/2001	9/19/2001	9/20/2001	9/18/2001	9/20/2001	9/5/2001	9/19/2001	9/7/2001	9/7/2001	9/20/2001
Volatile Organic Compounds (ug/L												
1,1,1,2-Tetrachloroethane	0 5 U	0 5 U	13 U	0 3 J	0 5 U	5 J	0 5 U	0 5 U	2 J	0 5 U	NA	0 5 U
1,1,1-Trichloroethane	0 5 U	0 5 U	13 U	0 5 U	0 5 U	0 5 U	0 5 U	0 5 U	0 5 U	0 5 U	NA	0 5 U
1,1,2,2-Tetrachloroethane	9 J	8	250	10 J	0 3 J	270	30 J	0 5 U	150 J	0 5 U	NA	0 5 U
1,1,2-Trichloroethane	1 U	0 4 J	14 J	0 8 J	1 U	9 J	0 6 J	1 U	4 J	1 U	NA	1 U
1,1-Dichloroethane	0 5 U	0 5 U	13 U	0 5 U	0 5 U	0 5 U	0 5 U	0 5 U	0 5 U	0 5 U	NA	0 5 U
1,1-Dichloroethene	1 U	1 U	25 U	0 4 J	1 U	2 J	1 U	1 U	0 8 J	1 U	NA	1 U
1,2,3-Trichloropropane	0 5 U	0 5 U	13 UJ	0 5 U	0 5 U	0 5 U	0 5 U	0 5 U	0 5 U	0 5 U	NA	0 5 U
1,2-Dibromo-3-Chloropropane	1 UJ	1 U	25 UJ	1 U	1 U	1 U	1 U	1 UJ	1 U	1 UJ	NA	1 U
1,2-Dibromoethane	0 6 U	0 8 U	15 U	0 6 U	0 6 U	0 6 U	0 6 U	0 6 U	0 6 U	0 6 U	NA	0 6 U
1,2-Dichloroethane	0 5 U	0 3 J	13 U	1 J	0 5 U	10 J	0 5 U	0 5 U	0 5 U	0 5 U	NA	0 5 U
1,2-Dichloropropane	1 U	1 U	25 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	NA	1 U
1,4-Dioxane	100 UR	100 UR	2500 UR	100 UR	100 UR	100 UR	100 UR	100 UR	100 UR	100 UR	NA	100 UR
2 Butanone	5 UR	5 UR	130 UR	5 UJ	5 UJ	5 U	5 UJ	5 UR	5 UJ	5 UR	NA	5 UJ
2-Hexanone	5 UJ	5 UJ	130 UJ	5 UJ	5 UJ	5 UJ	5 UJ	5 UJ	5 UJ	5 UJ	NA	5 UJ
3-Chloropropene	5 U	5 U	130 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	NA	5 U
4-Methyl-2-Pentanone	3 UJ	3 UJ	65 UJ	3 U	3 U	3 U	3 U	3 UJ	3 U	3 U	NA	3 U
Acetone	5 UR	5 UJ	130 UR	5 UR	5 UR	5 UR	5 UR	5 UR	5 UR	5 UR	NA	5 UR
Acetonitrile	40 U	40 U	1000 U	40 U	40 U	40 U	40 U	40 U	40 U	40 U	NA	40 U
Acrolein	10 UR	10 UR	250 UR	10 UR	10 UR	10 UR	10 UR	10 UR	10 UR	10 UR	NA	10 UR
Acrylonitrile	10 UR	10 UR	250 UR	10 UR	10 UR	10 UR	10 UR	10 UR	10 UR	10 UR	NA	10 UR
Benzene	0 5 U	0 5 U	13 U	0 5 U	0 5 U	0 5 U	0 5 U	0 5 U	0 5 U	0 5 U	NA	0 5 U
Bromodichloromethane	0 5 U	0 5 U	13 U	0 5 U	0 5 U	0 5 U	0 5 U	0 5 U	0 5 U	0 5 U	NA	0 5 U
Bromoform	0 5 UJ	0 5 U	13 U	0 5 U	0 5 U	0 5 U	0 5 U	0 5 UJ	0 5 U	0 5 U	NA	0 5 U
Bromomethane	1 U	1 U	25 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	NA	1 U
Carbon Disulfide	1 U	1 UJ	25 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	NA	1 U
Carbon Tetrachloride	0 5 U	0 5 U	13 U	0 5 UJ	0 5 UJ	0 5 UJ	0 5 UJ	0 5 U	0 5 UJ	0 5 U	NA	0 5 UJ
Chlorobenzene	0 5 U	0 5 U	13 U	0 5 U	0 5 U	0 5 U	0 5 U	0 5 U	0 5 U	0 5 U	NA	0 5 U
Chlorodibromomethane	0 5 U	0 5 U	13 U	0 5 U	0 5 U	0 5 U	0 5 U	0 5 U	0 5 U	0 5 U	NA	0 5 U
Chloroethane	1 U	1 U	25 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	NA	1 U
Chloroform	0 5 BU	0 1 J	18 U	4 J	0 5 U	27 J	0 5 BU	0 5 U	15 J	0 5 U	NA	0 5 U
Chloromethane	1 U	1 U	25 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	NA	1 U
Chloroprene	1 UJ	1 U	25 U	1 U	1 U	1 U	1 U	1 UJ	1 U	1 UJ	NA	1 U
Cis 1 2-Dichloroethene	1 U	0 9 J	25 U	1 J	1 U	8 J	1 U	1 U	4 J	1 U	NA	1 U
Cis 1,3-Dichloropropene	3 U	3 U	65 U	3 U	3 U	3 U	3 U	3 U	3 U	3 U	NA	3 U
Dibromomethane	1 U	1 U	25 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	NA	1 U
Dichlorodifluoromethane	0 7 UJ	0 7 U	18 U	0 7 U	0 7 U	0 7 U	0 7 U	0 7 UJ	0 7 U	0 7 UJ	NA	0 7 U
Ethyl Methacrylate	1 U	1 UJ	25 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	NA	1 U
Ethylbenzene	0 5 U	0 5 U	13 U	0 5 U	0 5 U	0 5 U	0 5 U	0 5 U	0 5 U	0 5 U	NA	0 5 U
Isobutanol	40 UR	40 UR	1000 UR	40 UR	40 UR	40 UR	40 UR	40 UR	40 UR	40 UR	NA	40 UR
Methacrylonitrile	20 UR	20 UR	500 UR	20 UR	20 UR	20 UR	20 UR	20 UR	20 UR	20 UR	NA	20 UR
Methyl Iodide	1 U	1 U	25 UJ	1 U	1 U	1 U	1 U	1 U	1 U	1 U	NA	1 U
Methyl Methacrylate	1 UJ	1 UJ	25 UJ	1 U	1 U	1 U	1 U	1 UJ	1 U	1 U	NA	1 U
Methylene Chloride	0 5 BU	2 BU	53 BU	1 U	0 2 J	0 4 J	0 3 J	0 5 BU	0 3 J	0 2 U	NA	1 U
Pentachloroethane	5 U	5 U	130 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	NA	5 U
Propionitrile	20 UR	20 UR	500 UR	20 UR	20 UR	20 UR	20 UR	20 UR	20 UR	20 UR	NA	20 UR
Styrene	0 5 U	0 5 U	13 U	0 5 U	0 5 U	0 5 U	0 5 U	0 5 U	0 5 U	0 5 U	NA	0 5 U
Tetrachloroethene	0 5 U	0 5 U	13 U	1 J	0 5 U	6 J	0 5 U	0 5 U	3 J	0 5 U	NA	0 5 U
Toluene	0 5 U	0 5 U	13 U	0 5 U	0 5 U	0 5 U	0 5 U	0 5 U	0 5 U	0 5 U	NA	0 5 U
Total Xylenes	3 U	3 U	65 U	3 U	3 U	3 U	3 U	3 U	3 U	3 U	NA	3 U
Trans-1,2-Dichloroethene	1 U	0 3 J	25 U	0 7 J	1 U	3 J	1 U	1 U	2 J	1 U	NA	1 U
Trans-1,3-Dichloropropene	3 UJ	3 U	70 U	3 U	3 U	3 U	3 U	3 UJ	3 U	3 U	NA	3 U
Trans-1,4-Dichloro-2-Butene	1 UJ	1 U	25 UJ	1 UJ	1 UJ	1 U	1 UJ	1 UJ	1 UJ	1 UJ	NA	1 UJ
Trichloroethene	8 J	20	310	45 J	5 J	300	30 J	0 5 U	120 J	0 5 U	NA	0 4 J
Trichlorofluoromethane	1 U	1 U	25 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	NA	1 U

[1] Reanalyzed on February 22, 2002 for gross beta
NA = Not Analyzed

TABLE E-3-1

SUMMARY OF ANALYTIC RESULTS - ROUND 1 GROUND WATER
CRANE 158 - MUSTARD GAS BURIAL GROUND
NSWC CRANE
CRANE, INDIANA

Location	01-13	01-14	01-15	01-17	01-18	01-19	01-20	01-21	01-22	01-23	01-23 [1]	01-24
Sample	01GW1301	01GW1401	01GW1501	01GW1701	01GW1801	01GW1901	01GW2001	01GW2101	01GW2201	01GW2301	01GW2301-RE	01GW2401
Matrix	Ground Water	Ground Water	Ground Water	Ground Water	Ground Water	Ground Water	Ground Water	Ground Water	Ground Water	Ground Water	Ground Water	Ground Water
Vinyl Acetate	3 UJ	3 UJ	65 UJ	3 U	3 U	3 U	3 U	3 UJ	3 U	3 UJ	NA	3 U
Vinyl Chloride	1 U	1 U	25 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	NA	1 U
Semivolatile Organic Compounds (												
1,2,4,5-Tetrachlorobenzene	NA	NA	NA	10 U	10 U	NA	NA	NA	NA	NA	NA	NA
1,2,4-Trichlorobenzene	NA	NA	NA	10 U	10 U	NA	NA	NA	NA	NA	NA	NA
1,2-Dichlorobenzene	NA	NA	NA	5 U	5 U	NA	NA	NA	NA	NA	NA	NA
1,3 Dichlorobenzene	NA	NA	NA	5 U	5 U	NA	NA	NA	NA	NA	NA	NA
1,4-Dichlorobenzene	NA	NA	NA	5 U	5 U	NA	NA	NA	NA	NA	NA	NA
1 4-Naphthoquinone	NA	NA	NA	10 U	10 U	NA	NA	NA	NA	NA	NA	NA
1,4-Phenylenediamine	NA	NA	NA	25 U	25 U	NA	NA	NA	NA	NA	NA	NA
1-Naphthylamine	NA	NA	NA	10 U	10 U	NA	NA	NA	NA	NA	NA	NA
2,2'-Oxybis(1-Chloropropane)	NA	NA	NA	5 U	5 U	NA	NA	NA	NA	NA	NA	NA
2,3,4,6-Tetrachlorophenol	NA	NA	NA	10 U	10 U	NA	NA	NA	NA	NA	NA	NA
2,4,5-Trichlorophenol	NA	NA	NA	25 U	25 U	NA	NA	NA	NA	NA	NA	NA
2 4,6-Trichlorophenol	NA	NA	NA	10 U	10 U	NA	NA	NA	NA	NA	NA	NA
2,4-Dichlorophenol	NA	NA	NA	10 U	10 U	NA	NA	NA	NA	NA	NA	NA
2,4-Dimethylphenol	NA	NA	NA	10 U	10 U	NA	NA	NA	NA	NA	NA	NA
2,4-Dinitrophenol	NA	NA	NA	25 U	25 U	NA	NA	NA	NA	NA	NA	NA
2,6-Dichlorophenol	NA	NA	NA	10 U	10 U	NA	NA	NA	NA	NA	NA	NA
2-Acetylaminofluorene	NA	NA	NA	5 U	5 U	NA	NA	NA	NA	NA	NA	NA
2-Chloronaphthalene	NA	NA	NA	5 U	5 U	NA	NA	NA	NA	NA	NA	NA
2-Chlorophenol	NA	NA	NA	5 U	5 U	NA	NA	NA	NA	NA	NA	NA
2-Methylnaphthalene	NA	NA	NA	5 U	5 U	NA	NA	NA	NA	NA	NA	NA
2-Methylphenol	NA	NA	NA	6 U	6 U	NA	NA	NA	NA	NA	NA	NA
2 Naphthylamine	NA	NA	NA	5 U	5 U	NA	NA	NA	NA	NA	NA	NA
2 Nitroaniline	NA	NA	NA	13 U	13 U	NA	NA	NA	NA	NA	NA	NA
2-Nitrophenol	NA	NA	NA	10 U	10 U	NA	NA	NA	NA	NA	NA	NA
2 Picoline	NA	NA	NA	5 U	5 U	NA	NA	NA	NA	NA	NA	NA
3 3' Dichlorobenzidine	NA	NA	NA	10 U	10 U	NA	NA	NA	NA	NA	NA	NA
3,3 Dimethylbenzidine	NA	NA	NA	10 U	10 U	NA	NA	NA	NA	NA	NA	NA
3 Methylcholanthrene	NA	NA	NA	5 U	5 U	NA	NA	NA	NA	NA	NA	NA
3 Methylphenol	NA	NA	NA	5 U	5 U	NA	NA	NA	NA	NA	NA	NA
3 Nitroaniline	NA	NA	NA	25 U	25 U	NA	NA	NA	NA	NA	NA	NA
4 6-Dinitro-2 Methylphenol	NA	NA	NA	25 U	25 U	NA	NA	NA	NA	NA	NA	NA
4-Aminobiphenyl	NA	NA	NA	5 U	5 U	NA	NA	NA	NA	NA	NA	NA
4 Bromophenyl Phenyl Ether	NA	NA	NA	10 U	10 U	NA	NA	NA	NA	NA	NA	NA
4 Chloro-3-Methylphenol	NA	NA	NA	10 U	10 U	NA	NA	NA	NA	NA	NA	NA
4-Chloroaniline	NA	NA	NA	10 U	10 U	NA	NA	NA	NA	NA	NA	NA
4-Chlorophenyl Phenyl Ether	NA	NA	NA	5 U	5 U	NA	NA	NA	NA	NA	NA	NA
4-Methylphenol	NA	NA	NA	5 U	5 U	NA	NA	NA	NA	NA	NA	NA
4-Nitroaniline	NA	NA	NA	25 U	25 U	NA	NA	NA	NA	NA	NA	NA
4-Nitrophenol	NA	NA	NA	25 U	25 U	NA	NA	NA	NA	NA	NA	NA
4-Nitroquinoline 1-Oxide	NA	NA	NA	25 UR	25 UR	NA	NA	NA	NA	NA	NA	NA
5 Nitro-O-Toluidine	NA	NA	NA	10 U	10 U	NA	NA	NA	NA	NA	NA	NA
7,12-Dimethylbenz(A)Anthracene	NA	NA	NA	5 U	5 U	NA	NA	NA	NA	NA	NA	NA
A A-Dimethylphenethylamine	NA	NA	NA	25 U	25 U	NA	NA	NA	NA	NA	NA	NA
Acenaphthene	NA	NA	NA	0 2 U	0 2 U	NA	NA	NA	NA	NA	NA	NA
Acenaphthylene	NA	NA	NA	0 2 U	0 2 U	NA	NA	NA	NA	NA	NA	NA
Acetophenone	NA	NA	NA	5 U	5 U	NA	NA	NA	NA	NA	NA	NA
Aniline	NA	NA	NA	10 U	10 U	NA	NA	NA	NA	NA	NA	NA
Anthracene	NA	NA	NA	0 2 U	0 2 U	NA	NA	NA	NA	NA	NA	NA
Aramite	NA	NA	NA	25 U	25 U	NA	NA	NA	NA	NA	NA	NA
Benzo(A)Anthracene	NA	NA	NA	0 2 U	0 2 U	NA	NA	NA	NA	NA	NA	NA
Benzo(A)Pyrene	NA	NA	NA	0 2 U	0 2 U	NA	NA	NA	NA	NA	NA	NA
Benzo(B)Fluoranthene	NA	NA	NA	0 2 U	0 2 U	NA	NA	NA	NA	NA	NA	NA
Benzo(G,H,I)Perylene	NA	NA	NA	0 2 U	0 2 U	NA	NA	NA	NA	NA	NA	NA
Benzo(K)Fluoranthene	NA	NA	NA	0 2 U	0 2 U	NA	NA	NA	NA	NA	NA	NA

[1] Reanalyzed on February 22, 2002 for gross beta
NA = Not A[illegible]d

TABLE E-3-1

SUMMARY OF ANALYTIC RESULTS - ROUND 1 GROUND WATER
CRANE 158 - MUSTARD GAS BURIAL GROUND
NSWC CRANE
CRANE, INDIANA

Location	01-13	01-14	01-15	01-17	01-18	01-19	01-20	01-21	01-22	01-23	01-23 [1]	01-24
Sample	01GW1301	01GW1401	01GW1501	01GW1701	01GW1801	01GW1901	01GW2001	01GW2101	01GW2201	01GW2301	01GW2301-RE	01GW2401
Matrix	Ground Water	Ground Water	Ground Water	Ground Water	Ground Water	Ground Water	Ground Water	Ground Water	Ground Water	Ground Water	Ground Water	Ground Water
Benzyl Alcohol	NA	NA	NA	7 U	7 U	NA	NA	NA	NA	NA	NA	NA
Bis(2-Chloroethoxy)Methane	NA	NA	NA	10 U	10 U	NA	NA	NA	NA	NA	NA	NA
Bis(2 Chloroethyl)Ether	NA	NA	NA	5 U	5 U	NA	NA	NA	NA	NA	NA	NA
Bis(2-Ethylhexyl)Phthalate	NA	NA	NA	5 J	5 U	NA	NA	NA	NA	NA	NA	NA
Butyl Benzyl Phthalate	NA	NA	NA	5 U	5 U	NA	NA	NA	NA	NA	NA	NA
Chlorobenzilate	NA	NA	NA	10 U	10 U	NA	NA	NA	NA	NA	NA	NA
Chrysene	NA	NA	NA	0 2 U	0 2 U	NA	NA	NA	NA	NA	NA	NA
Diallate	NA	NA	NA	5 U	5 U	NA	NA	NA	NA	NA	NA	NA
Dibenzo(A,H)Anthracene	NA	NA	NA	5 U	5 U	NA	NA	NA	NA	NA	NA	NA
Dibenzofuran	NA	NA	NA	10 U	10 U	NA	NA	NA	NA	NA	NA	NA
Diethyl Phthalate	NA	NA	NA	0 2 U	0 2 U	NA	NA	NA	NA	NA	NA	NA
Dimethyl Phthalate	NA	NA	NA	5 U	5 U	NA	NA	NA	NA	NA	NA	NA
Di-N-Butyl Phthalate	NA	NA	NA	5 U	5 U	NA	NA	NA	NA	NA	NA	NA
Di-N-Octyl Phthalate	NA	NA	NA	6 U	6 U	NA	NA	NA	NA	NA	NA	NA
Diphenylamine	NA	NA	NA	5 U	5 U	NA	NA	NA	NA	NA	NA	NA
Ethyl Methane Sulfonate	NA	NA	NA	5 U	5 U	NA	NA	NA	NA	NA	NA	NA
Fluoranthene	NA	NA	NA	0 2 U	0 2 U	NA	NA	NA	NA	NA	NA	NA
Fluorene	NA	NA	NA	0 2 U	0 2 U	NA	NA	NA	NA	NA	NA	NA
Hexachlorobenzene	NA	NA	NA	10 U	10 U	NA	NA	NA	NA	NA	NA	NA
Hexachlorobutadiene	NA	NA	NA	10 U	10 U	NA	NA	NA	NA	NA	NA	NA
Hexachlorocyclopentadiene	NA	NA	NA	10 U	10 U	NA	NA	NA	NA	NA	NA	NA
Hexachloroethane	NA	NA	NA	5 U	5 U	NA	NA	NA	NA	NA	NA	NA
Hexachlorophene	NA	NA	NA	400 UJ	400 UJ	NA	NA	NA	NA	NA	NA	NA
Hexachloropropene	NA	NA	NA	10 U	10 U	NA	NA	NA	NA	NA	NA	NA
Indeno(1,2,3-CD)Pyrene	NA	NA	NA	0 2 U	0 2 U	NA	NA	NA	NA	NA	NA	NA
Isodrin	NA	NA	NA	10 U	10 U	NA	NA	NA	NA	NA	NA	NA
Isophorone	NA	NA	NA	5 U	5 U	NA	NA	NA	NA	NA	NA	NA
Isosafrole	NA	NA	NA	10 U	10 U	NA	NA	NA	NA	NA	NA	NA
Kepone	NA	NA	NA	25 U	25 U	NA	NA	NA	NA	NA	NA	NA
Methapyrilene	NA	NA	NA	25 UR	25 UR	NA	NA	NA	NA	NA	NA	NA
Methyl Methane Sulfonate	NA	NA	NA	13 U	13 U	NA	NA	NA	NA	NA	NA	NA
Naphthalene	NA	NA	NA	10 U	10 U	NA	NA	NA	NA	NA	NA	NA
N-Nitrosodiethylamine	NA	NA	NA	6 U	6 U	NA	NA	NA	NA	NA	NA	NA
N Nitrosodimethylamine	NA	NA	NA	5 U	5 U	NA	NA	NA	NA	NA	NA	NA
N-Nitroso-Di-N-Butylamine	NA	NA	NA	5 U	5 U	NA	NA	NA	NA	NA	NA	NA
N-Nitroso-Di-N-Propylamine	NA	NA	NA	7 U	7 U	NA	NA	NA	NA	NA	NA	NA
N Nitrosomethylethylamine	NA	NA	NA	5 U	5 U	NA	NA	NA	NA	NA	NA	NA
N-Nitrosomorpholine	NA	NA	NA	10 U	10 U	NA	NA	NA	NA	NA	NA	NA
N-Nitrosopiperidine	NA	NA	NA	5 U	5 U	NA	NA	NA	NA	NA	NA	NA
N-Nitrosopyrrolidine	NA	NA	NA	0 2 U	0 2 U	NA	NA	NA	NA	NA	NA	NA
O,O,O-Triethyl Phosphorothioate	NA	NA	NA	10 U	10 U	NA	NA	NA	NA	NA	NA	NA
O Toluidine	NA	NA	NA	5 U	5 U	NA	NA	NA	NA	NA	NA	NA
P-(Dimethylamino)Azobenzene	NA	NA	NA	10 U	10 U	NA	NA	NA	NA	NA	NA	NA
Pentachlorobenzene	NA	NA	NA	10 U	10 U	NA	NA	NA	NA	NA	NA	NA
Pentachloronitrobenzene	NA	NA	NA	25 U	25 U	NA	NA	NA	NA	NA	NA	NA
Phenacetin	NA	NA	NA	10 UJ	10 UJ	NA	NA	NA	NA	NA	NA	NA
Phenanthrene	NA	NA	NA	0 2 U	0 2 U	NA	NA	NA	NA	NA	NA	NA
Phenol	NA	NA	NA	10 U	10 U	NA	NA	NA	NA	NA	NA	NA
Pronamide	NA	NA	NA	10 UR	10 UR	NA	NA	NA	NA	NA	NA	NA
Pyrene	NA	NA	NA	0 2 U	0 2 U	NA	NA	NA	NA	NA	NA	NA
Pyridine	NA	NA	NA	10 U	10 U	NA	NA	NA	NA	NA	NA	NA
Safrole	NA	NA	NA	10 U	10 U	NA	NA	NA	NA	NA	NA	NA
Energertics (ug/L)												
1,3,5-Trinitrobenzene	NA	NA	NA	0 65 U	0 65 U	NA	NA	NA	NA	NA	NA	NA
1,3-Dinitrobenzene	NA	NA	NA	0 65 U	0 65 U	NA	NA	NA	NA	NA	NA	NA
2,4,6-Trinitrotoluene	NA	NA	NA	0 127 J	0 65 U	NA	NA	NA	NA	NA	NA	NA
2,4-Dinitrotoluene	NA	NA	NA	0 65 U	0 65 U	NA	NA	NA	NA	NA	NA	NA

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NA = Not Analyzed

TABLE E-3-1

SUMMARY OF ANALYTIC RESULTS - ROUND 1 GROUND WATER
CRANE 158 - MUSTARD GAS BURIAL GROUND
NSWC CRANE
CRANE, INDIANA

Location	01-13	01-14	01-15	01-17	01-18	01-19	01-20	01-21	01-22	01-23	01-23 [1]	01-24
Sample	01GW1301	01GW1401	01GW1501	01GW1701	01GW1801	01GW1901	01GW2001	01GW2101	01GW2201	01GW2301	01GW2301-RE	01GW2401
Matrix	Ground Water	Ground Water	Ground Water	Ground Water	Ground Water	Ground Water	Ground Water	Ground Water	Ground Water	Ground Water	Ground Water	Ground Water
2,6-Dinitrotoluene	NA	NA	NA	0 65 U	0 65 U	NA	NA	NA	NA	NA	NA	NA
2-Amino-4,6-Dinitrotoluene	NA	NA	NA	0 65 U	0 65 U	NA	NA	NA	NA	NA	NA	NA
2-Nitrotoluene	NA	NA	NA	0 65 U	0 65 U	NA	NA	NA	NA	NA	NA	NA
3-Nitrotoluene	NA	NA	NA	0 65 U	0 65 U	NA	NA	NA	NA	NA	NA	NA
4-Amino-2,6-Dinitrotoluene	NA	NA	NA	0 65 U	0 65 U	NA	NA	NA	NA	NA	NA	NA
4-Nitrotoluene	NA	NA	NA	0 65 U	0 65 U	NA	NA	NA	NA	NA	NA	NA
HMX	NA	NA	NA	0 65 U	0 65 U	NA	NA	NA	NA	NA	NA	NA
Nitrobenzene	NA	NA	NA	0 65 U	0 65 U	NA	NA	NA	NA	NA	NA	NA
RDX	NA	NA	NA	0 65 U	0 65 U	NA	NA	NA	NA	NA	NA	NA
Tetryl	NA	NA	NA	0 65 U	0 65 U	NA	NA	NA	NA	NA	NA	NA
Pesticides/PCBs (ug/L)												
4,4' DDD	NA	NA	NA	0 08 U	0 08 U	NA	NA	NA	NA	NA	NA	NA
4,4'-DDE	NA	NA	NA	0 08 U	0 08 U	NA	NA	NA	NA	NA	NA	NA
4,4 -DDT	NA	NA	NA	0 08 U	0 08 U	NA	NA	NA	NA	NA	NA	NA
Aldrin	NA	NA	NA	0 04 U	0 04 U	NA	NA	NA	NA	NA	NA	NA
Alpha-BHC	NA	NA	NA	0 04 U	0 04 U	NA	NA	NA	NA	NA	NA	NA
Alpha-Chlordane	NA	NA	NA	0 04 U	0 04 U	NA	NA	NA	NA	NA	NA	NA
Aroclor-1016	NA	NA	NA	1 U	1 U	NA	NA	NA	NA	NA	NA	NA
Aroclor-1221	NA	NA	NA	1 U	1 U	NA	NA	NA	NA	NA	NA	NA
Aroclor-1232	NA	NA	NA	1 U	1 U	NA	NA	NA	NA	NA	NA	NA
Aroclor-1242	NA	NA	NA	1 U	1 U	NA	NA	NA	NA	NA	NA	NA
Aroclor-1248	NA	NA	NA	1 U	1 U	NA	NA	NA	NA	NA	NA	NA
Aroclor-1254	NA	NA	NA	1 U	1 U	NA	NA	NA	NA	NA	NA	NA
Aroclor-1260	NA	NA	NA	1 U	1 U	NA	NA	NA	NA	NA	NA	NA
Beta-BHC	NA	NA	NA	0 04 U	0 04 U	NA	NA	NA	NA	NA	NA	NA
Delta-BHC	NA	NA	NA	0 04 U	0 04 U	NA	NA	NA	NA	NA	NA	NA
Dieldrin	NA	NA	NA	0 08 U	0 08 U	NA	NA	NA	NA	NA	NA	NA
Endosulfan I	NA	NA	NA	0 04 U	0 04 U	NA	NA	NA	NA	NA	NA	NA
Endosulfan II	NA	NA	NA	0 08 U	0 08 U	NA	NA	NA	NA	NA	NA	NA
Endosulfan Sulfate	NA	NA	NA	0 08 U	0 08 U	NA	NA	NA	NA	NA	NA	NA
Endrin	NA	NA	NA	0 08 U	0 08 U	NA	NA	NA	NA	NA	NA	NA
Endrin Aldehyde	NA	NA	NA	0 08 U	0 08 U	NA	NA	NA	NA	NA	NA	NA
Gamma BHC (Lindane)	NA	NA	NA	0 04 U	0 04 U	NA	NA	NA	NA	NA	NA	NA
Gamma-Chlordane	NA	NA	NA	0 04 U	0 04 U	NA	NA	NA	NA	NA	NA	NA
Heptachlor	NA	NA	NA	0 041 BU	0 032 BU	NA	NA	NA	NA	NA	NA	NA
Heptachlor Epoxide	NA	NA	NA	0 04 U	0 04 U	NA	NA	NA	NA	NA	NA	NA
Methoxychlor	NA	NA	NA	0 38 U	0 38 U	NA	NA	NA	NA	NA	NA	NA
Toxaphene	NA	NA	NA	2 5 U	2 5 U	NA	NA	NA	NA	NA	NA	NA
Herbicides (ug/L)												
2,4,5-T	NA	NA	NA	0 8 U	0 8 U	NA	NA	NA	NA	NA	NA	NA
2,4,5-TP (Silvex)	NA	NA	NA	0 5 U	0 5 U	NA	NA	NA	NA	NA	NA	NA
2,4-D	NA	NA	NA	2 5 U	2 5 U	NA	NA	NA	NA	NA	NA	NA
Dinoseb	NA	NA	NA	1 U	1 U	NA	NA	NA	NA	NA	NA	NA
Pentachlorophenol	NA	NA	NA	0 5 U	0 5 U	NA	NA	NA	NA	NA	NA	NA
Total Metals (ug/L)												
Aluminum	40 2 U	40 2 U	46 3	40 3 U	249	62 6	40 3 U	40 2 U	40 3 U	40 2 U	NA	107
Antimony	1 6 U	4 1 U	3 1	1 6 U	2 0	1 6 U	1 6 U	1 6 U	1 6 U	1 6 U	NA	1 6 U
Arsenic	1 5 U	1 5 U	1 5 U	1 5 U	1 5 U	1 5 U	1 5 U	1 5 U	1 5 U	1 5 U	NA	1 5 U
Barium	24 9	15 1	24 3	9 7	26 5	9 5	13 4	30 3	9 9	5 4 J	NA	88 1
Beryllium	0 40 U	0 40 U	0 40 U	0 40 U	0 40 U	0 40 U	0 40 U	0 40 U	0 40 U	0 40 U	NA	0 40 U
Cadmium	0 30 U	0 30 U	0 30 U	0 30 U	0 30 U	0 30 U	0 30 U	0 30 U	0 30 U	0 30 U	NA	0 30 U
Calcium	107000	154000 J	145000	46000	93800	110000	244000	128000	112000	282000 J	NA	75800
Chromium	0 60 U	0 60 UJ	0 60 U	0 83	0 79	1 6	1 2	0 60 U	0 70	0 60 U	NA	0 70 U
Cobalt	4 6	27 8 J	10 8	1 9	4 3	1 0 U	1 6	1 0 U	1 0 U	1 0 U	NA	6 6
Copper	0 90 U	0 90 U	0 90 U	0 90 U	0 90 U	0 90 U	0 90 U	0 90 U	0 90 U	0 90 UJ	NA	0 94
Iron	488	44600	16700	89 6	4090	134	158	15300	20 3 U	1050	NA	4460
Lead	1 6 U	1 6 U	1 6 U	1 6 U	1 6 U	1 6 U	1 6 U	1 6 U	1 6 U	1 6 U	NA	1 6 U

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NA = Not Analyzed

TABLE E-3-1

SUMMARY OF ANALYTIC RESULTS - ROUND 1 GROUND WATER
CRANE 158 - MUSTARD GAS BURIAL GROUND
NSWC CRANE
CRANE, INDIANA

Location	01-13	01-14	01-15	01-17	01-18	01-19	01-20	01-21	01-22	01-23	01-23 [1]	01-24
Sample	01GW1301	01GW1401	01GW1501	01GW1701	01GW1801	01GW1901	01GW2001	01GW2101	01GW2201	01GW2301	01GW2301-RE	01GW2401
Matrix	Ground Water	Ground Water	Ground Water	Ground Water	Ground Water	Ground Water	Ground Water	Ground Water	Ground Water	Ground Water	Ground Water	Ground Water
Magnesium	17800	59200 J	48600	36500	16300	45700	148000	64300	50000	139000 J	NA	27300
Manganese	647	6050 J	3860	4 7	736	6 0	44 5	977	2 9	446 J	NA	949
Mercury	0 10 U	0 10 U	0 10 U	0 12	0 10 U	0 12	0 10 U	0 10 U	0 12	0 10 U	NA	0 10
Nickel	19 5	52 2	12 7	0 70 U	4 3	2 5	27 3	1 4	2 3	3 5 U	NA	13 6
Potassium	1330	2560 J	1980	1200 J	1720 J	1370 J	5440 J	6060	1320 J	6150	NA	2370 J
Selenium	0 80 U	4 2 U	0 80 U	0 80 U	0 80 U	0 80 U	0 80 U	0 80 U	2 0 U	0 80 UJ	NA	0 80 U
Silver	3 0 U	3 0 U	3 0 U	0 90	0 88	0 87	0 70 U	3 0 U	0 70 U	3 0 U	NA	0 70
Sodium	7290	54700 J	35200	61700	27000	71600	22000	14800	81900	29300 J	NA	10400
Strontium	132 J	277 J	253 J	124 J	109 J	137 J	333 J	948 J	185 J	823 J	NA	325 J
Thallium	5 0 U	5 0 U	5 0 U	5 1	2 5	3 9	5 1	5 0 U	3 0	5 0 UJ	NA	4 4
Thorium - Calc	NA	NA	NA	0 579 U	0 683 U	NA	NA	NA	NA	NA	NA	NA
Tin	190 U	190 U	190 U	17 3 U	17 3 U	17 3 U	17 3 U	190 U	17 3 U	190 U	NA	17 3 U
Vanadium	3 0 U	3 0 U	3 0 U	0 50 U	0 75	0 53	0 53	3 0 U	0 50 U	3 0 U	NA	0 58
Zinc	17 9	24 0 U	1 1 U	1 7 U	4 3	7 0	5 0	1 1 U	3 9	1 1 UJ	NA	3 9
Dissolved Metals (ug/L)												
Aluminum	40 2 U	NA	NA	NA	40 3 U	NA	40 3 U	NA	NA	40 2 U	NA	NA
Antimony	1 6 U	NA	NA	NA	1 6 U	NA	2 1 J	NA	NA	2 3 U	NA	NA
Arsenic	2 1 U	NA	NA	NA	1 5 U	NA	1 5 UJ	NA	NA	1 7 J	NA	NA
Barium	23 5	NA	NA	NA	24 8	NA	12 9	NA	NA	5 4 J	NA	NA
Beryllium	0 40 U	NA	NA	NA	0 40 U	NA	0 40 U	NA	NA	0 40 U	NA	NA
Cadmium	0 30 U	NA	NA	NA	0 30 U	NA	0 30 UJ	NA	NA	0 30 U	NA	NA
Calcium	102000	NA	NA	NA	96600	NA	275000	NA	NA	279000 J	NA	NA
Chromium	0 60 U	NA	NA	NA	0 70 U	NA	1 1	NA	NA	0 60 U	NA	NA
Cobalt	3 0	NA	NA	NA	3 2	NA	1 0 U	NA	NA	1 0 U	NA	NA
Copper	0 90 U	NA	NA	NA	0 90 U	NA	0 90 U	NA	NA	1 2 U	NA	NA
Iron	252	NA	NA	NA	748	NA	20 3 U	NA	NA	150	NA	NA
Lead	1 6 U	NA	NA	NA	1 6 U	NA	1 6 U	NA	NA	1 6 U	NA	NA
Magnesium	17100	NA	NA	NA	16700	NA	173000	NA	NA	138000 J	NA	NA
Manganese	538	NA	NA	NA	765	NA	13 7	NA	NA	386 J	NA	NA
Mercury	0 10 U	NA	NA	NA	0 10 U	NA	0 10	NA	NA	0 10 U	NA	NA
Nickel	16 1	NA	NA	NA	4 6	NA	27 2	NA	NA	1 4 U	NA	NA
Potassium	1270	NA	NA	NA	1770 J	NA	5480 J	NA	NA	5940	NA	NA
Selenium	0 80 U	NA	NA	NA	0 80 U	NA	1 5 U	NA	NA	0 80 UJ	NA	NA
Silver	3 0 U	NA	NA	NA	0 70 U	NA	0 70 U	NA	NA	3 0 U	NA	NA
Sodium	7130	NA	NA	NA	27500	NA	23600	NA	NA	28800 J	NA	NA
Strontium	128 J	NA	NA	NA	109 J	NA	366 J	NA	NA	807 J	NA	NA
Thallium	5 0 U	NA	NA	NA	5 4	NA	7 7 J	NA	NA	5 0 UJ	NA	NA
Thorium - Calc	NA	NA	NA	NA	1 10 U	NA	NA	NA	NA	NA	NA	NA
Tin	190 U	NA	NA	NA	17 3 U	NA	17 3 U	NA	NA	190 U	NA	NA
Vanadium	3 0 U	NA	NA	NA	0 50 U	NA	0 77	NA	NA	3 0 U	NA	NA
Zinc	13 5	NA	NA	NA	7 1	NA	7 6	NA	NA	1 1 UJ	NA	NA
Miscellaneous Parameters (mg/L)												
1,4-Dithiane	NA	NA	NA	200 U	200 U	NA	NA	NA	NA	NA	NA	NA
1,4-Oxathiane	NA	NA	NA	200 U	200 U	NA	NA	NA	NA	NA	NA	NA
Bis(2-Chloroethyl)Sulfide	NA	NA	NA	200 U	200 U	NA	NA	NA	NA	NA	NA	NA
Total Organic Carbon	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Total Radiologicals (pCi/L)												
Gross Alpha	1 68 J	5 57	3 92 J	1 24 U	2 30 J	2 01 U	4 73 U	2 60 J	2 06 U	8 53 J	NA	1 36 J
Gross Beta	3 28 U	6 38	9 25 J	1 58 U	2 78	2 52 U	9 81	7 78 J	2 40 U	50 2 J	8 35	1 99
Thorium-228	NA	NA	NA	0 0710 U	0 0893 U	NA	NA	NA	NA	NA	NA	NA
Thorium-230	NA	NA	NA	0 0764 U	0 0746 U	NA	NA	NA	NA	NA	NA	NA
Thorium-232	NA	NA	NA	0 0563 U	0 0610 U	NA	NA	NA	NA	NA	NA	NA
Dissolved Radiologicals (pCi/L)												
Gross Alpha	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Gross Beta	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Thorium-228	NA	NA	NA	NA	0 149 U	NA	NA	NA	NA	NA	NA	NA
Thorium-230	NA	NA	NA	NA	0 158 U	NA	NA	NA	NA	NA	NA	NA

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TABLE E-3-1

SUMMARY OF ANALYTIC RESULTS - ROUND 1 GROUND WATER
CRANE 158 - MUSTARD GAS BURIAL GROUND
NSWC CRANE
CRANE, INDIANA

Location Sample Matrix	01-13 01GW1301 Ground Water	01-14 01GW1401 Ground Water	01-15 01GW1501 Ground Water	01-17 01GW1701 Ground Water	01-18 01GW1801 Ground Water	01-19 01GW1901 Ground Water	01-20 01GW2001 Ground Water	01-21 01GW2101 Ground Water	01-22 01GW2201 Ground Water	01-23 01GW2301 Ground Water	01-23 [1] 01GW2301-RE Ground Water	01-24 01GW2401 Ground Water
Thorium-232	NA	NA	NA	NA	0 0919 U	NA	NA	NA	NA	NA	NA	NA
Field Parameters												
Dissolved Oxygen (mg/L)	0 38	0 08	0 702	2 82	0 86	2 07	2 67	1 19	1 55	1 58	NA	0 54
Oxidation Reduction Potential (mV)	206	-156	75 2	474	93 8	434	327	28 1	511	433 2	NA	78 5
pH (S U)	6 44	6 50	6 59	5 54	6 94	6 43	7 14	5 61	6 41	4 99	NA	6 69
Specific Conductance (mS/cm)	0 608	1 47	1 352	0 824	0 768	1 162	1 567	1 1	1 281	2 161	NA	0 679
Temperature (C)	16 34	16 5	14 74	16 5	16 77	16 8	15	14 73	16 46	17 79	NA	15 02
Turbidity (NTU)	6	4	3 9	3 7	31	3 4	11	4 2	1 7	30	NA	2

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TABLE E-3-1

SUMMARY OF ANALYTIC RESULTS - ROUND 1 GROUND WATER
CRANE 158 - MUSTARD GAS BURIAL GROUND
NSWC CRANE
CRANE, INDIANA

Location	01-25	01-26	01-27	01C01	01T02	01T02
Sample	01GW2501	01GW2601	01GW2701	01GWC0101	01GWT0201	01GWT0202
Matrix	Ground Water	Ground Water	Ground Water	Ground Water	Background	Background
Risk	Site	Site	Site	Site	Site	Site
Sample Date	9/8/2001	9/6/2001	9/8/2001	8/25/2001	9/19/2001	9/22/2001
Volatile Organic Compounds (ug/L						
1,1,1,2-Tetrachloroethane	2 J	0 5 U	0 5 U	0 5 U	0 5 U	0 5 U
1,1 1-Trichloroethane	3 U	0 5 U	0 5 U	0 5 U	0 5 U	0 5 U
1,1,2 2-Tetrachloroethane	32	0 5 U	0 5 U	0 5 U	0 5 U	0 5 U
1,1,2-Trichloroethane	5 U	1 U	1 U	1 U	1 U	1 U
1,1-Dichloroethane	3 U	0 5 U	0 5 U	0 5 U	0 5 U	0 5 U
1,1-Dichloroethene	5 U	1 U	1 U	1 U	1 U	1 U
1,2,3-Trichloropropane	3 U	0 5 U	0 5 U	0 5 U	0 5 U	0 5 U
1,2-Dibromo-3-Chloropropane	5 UJ	1 UJ	1 UJ	1 UJ	1 U	1 U
1,2-Dibromoethane	3 U	0 6 U	0 6 U	0 8 U	0 6 U	0 6 U
1,2-Dichloroethane	3 U	0 5 U	0 5 U	0 5 U	0 5 U	0 5 U
1,2-Dichloropropane	5 U	1 U	1 U	1 U	1 U	1 U
1,4-Dioxane	500 UR	100 UR	100 UR	100 UR	100 UR	100 UR
2-Butanone	25 UR	5 UR	5 UR	5 UR	5 UJ	5 UJ
2-Hexanone	25 UJ	5 UJ	5 UJ	5 UJ	5 UJ	5 UJ
3-Chloropropene	25 U	5 U	5 U	5 U	5 U	5 U
4-Methyl-2 Pentanone	13 U	3 U	3 UJ	3 UJ	3 U	3 U
Acetone	25 UR	5 UR	5 UR	5 UR	5 UR	5 UR
Acetonitrile	200 U	40 U	40 U	40 U	40 U	40 U
Acrolein	50 UR	10 UR	10 UR	10 UR	10 UR	10 UR
Acrylonitrile	50 UR	10 UR	10 UR	10 U	10 UR	10 UR
Benzene	3 U	0 5 U	0 5 U	0 5 UR	0 5 U	0 5 U
Bromodichloromethane	3 U	0 5 U	0 5 U	0 5 U	0 5 U	0 5 U
Bromoform	3 U	0 5 U	0 5 UJ	0 5 U	0 5 U	0 5 U
Bromomethane	5 UJ	1 U	1 U	1 U	1 U	1 U
Carbon Disulfide	5 U	1 U	1 U	1 UJ	1 U	1 U
Carbon Tetrachloride	3 U	0 5 U	0 5 U	0 5 U	0 5 UJ	0 5 UJ
Chlorobenzene	3 U	0 5 U	0 5 U	0 5 U	0 5 U	0 5 U
Chlorodibromomethane	3 U	0 5 U	0 5 U	0 5 U	0 5 U	0 5 U
Chloroethane	5 U	1 U	1 U	1 U	1 U	1 U
Chloroform	7 J	0 5 U	0 5 U	0 5 U	0 3 BU	0 2 BU
Chloromethane	5 U	1 U	1 U	1 U	1 U	1 U
Chloroprene	5 UJ	1 UJ	1 UJ	1 U	1 U	1 U
Cis-1,2-Dichloroethene	5 U	1 U	1 U	1 U	1 U	1 U
Cis-1,3-Dichloropropene	13 U	3 U	3 U	3 U	3 U	3 U
Dibromomethane	5 U	1 U	1 U	1 U	1 U	1 U
Dichlorodifluoromethane	4 UJ	0 7 UJ	0 7 UJ	0 7 U	0 7 U	0 7 U
Ethyl Methacrylate	5 U	1 U	1 U	1 UJ	1 U	1 U
Ethylbenzene	3 U	0 5 U	0 5 U	0 5 U	0 5 U	0 5 U
Isobutanol	200 UR	40 UR	40 UR	40 UR	40 UR	40 UR
Methacrylonitrile	100 UR	20 UR	20 UR	20 UR	20 UR	20 UR
Methyl Iodide	5 U	1 U	1 U	1 U	1 U	1 U
Methyl Methacrylate	5 U	1 U	1 U	1 UJ	1 U	1 U
Methylene Chloride	1 U	1 U	0 3 BU	1 BU	0 2 J	1 U
Pentachloroethane	25 U	5 U	5 U	5 UJ	5 U	5 U
Propionitrile	100 UR	20 UR	20 UR	20 UR	20 UR	20 UR
Styrene	3 U	0 5 U	0 5 U	0 5 U	0 5 U	0 5 U
Tetrachloroethene	3 U	0 5 U	0 5 U	0 5 U	0 5 U	0 5 U
Toluene	3 U	0 5 U	0 5 U	0 5 U	0 6 J	0 3 J
Total Xylenes	13 U	3 U	3 U	3 U	3 U	3 U
Trans-1,2-Dichloroethene	5 U	1 U	1 U	1 U	1 U	1 U
Trans-1,3-Dichloropropene	14 U	3 U	3 UJ	3 U	3 U	3 U
Trans-1,4-Dichloro-2-Butene	5 UJ	1 UJ	1 UJ	1 U	1 UJ	1 UJ
Trichloroethene	65 J	0 5 U	0 5 U	0 5 U	0 2 J	0 2 J
Trichlorofluoromethane	5 U	1 U	1 U	1 U	1 U	1 U

(1) Reanalyzed on February 22, 2002 for gross beta
NA = Not Analyzed

TABLE E-3-1

SUMMARY OF ANALYTIC RESULTS - ROUND 1 GROUND WATER
CRANE 158 - MUSTARD GAS BURIAL GROUND
NSWC CRANE
CRANE, INDIANA

Location Sample Matrix	01-25 01GW2501 Ground Water	01-26 01GW2601 Ground Water	01-27 01GW2701 Ground Water	01C01 01GWC0101 Ground Water	01T02 01GWT0201 Background	01T02 01GWT0202 Background
Vinyl Acetate	13 UJ	3 UJ	3 UJ	3 UJ	3 U	3 U
Vinyl Chloride	5 U	1 U	1 U	1 U	1 U	1 U
Semivolatile Organic Compounds (						
1,2,4,5-Tetrachlorobenzene	10 U	NA	NA	10 U	10 U	10 U
1,2,4-Trichlorobenzene	10 U	NA	NA	10 U	10 U	10 U
1,2-Dichlorobenzene	5 U	NA	NA	5 U	5 U	5 U
1,3-Dichlorobenzene	5 U	NA	NA	5 U	5 U	5 U
1,4-Dichlorobenzene	5 U	NA	NA	5 U	5 U	5 U
1 4-Naphthoquinone	10 U	NA	NA	10 U	10 U	10 U
1,4-Phenylenediamine	25 U	NA	NA	25 UJ	25 U	25 U
1-Naphthylamine	10 U	NA	NA	10 U	10 U	10 U
2,2'-Oxybis(1-Chloropropane)	5 U	NA	NA	5 U	5 U	5 U
2,3 4,6-Tetrachlorophenol	10 U	NA	NA	10 U	10 U	10 U
2,4,5-Trichlorophenol	25 U	NA	NA	25 U	25 U	25 U
2,4,6-Trichlorophenol	10 U	NA	NA	10 U	10 U	10 U
2,4-Dichlorophenol	10 U	NA	NA	10 U	10 U	10 U
2,4 Dimethylphenol	10 U	NA	NA	10 U	10 U	10 U
2,4-Dinitrophenol	25 U	NA	NA	25 U	25 U	25 U
2,6 Dichlorophenol	10 U	NA	NA	10 U	10 U	10 U
2 Acetylaminofluorene	5 U	NA	NA	5 U	5 U	5 U
2-Chloronaphthalene	5 U	NA	NA	5 U	5 U	5 U
2-Chlorophenol	5 U	NA	NA	5 U	5 U	5 U
2-Methylnaphthalene	5 U	NA	NA	5 U	5 U	5 U
2-Methylphenol	6 U	NA	NA	6 U	6 U	6 U
2-Naphthylamine	5 U	NA	NA	5 U	5 U	5 U
2 Nitroaniline	13 U	NA	NA	13 U	13 U	13 U
2 Nitrophenol	10 U	NA	NA	10 U	10 U	10 U
2-Picoline	5 U	NA	NA	5 U	5 U	5 U
3 3' Dichlorobenzidine	10 U	NA	NA	10 U	10 U	10 U
3 3'-Dimethylbenzidine	10 U	NA	NA	10 U	10 U	10 UJ
3-Methylcholanthrene	5 U	NA	NA	5 U	5 U	5 U
3-Methylphenol	5 U	NA	NA	5 U	5 U	5 U
3-Nitroaniline	25 U	NA	NA	25 U	25 U	25 U
4,6 Dinitro-2 Methylphenol	25 U	NA	NA	25 U	25 U	25 U
4-Aminobiphenyl	5 U	NA	NA	5 U	5 U	5 U
4-Bromophenyl Phenyl Ether	10 U	NA	NA	10 U	10 U	10 U
4-Chloro-3-Methylphenol	10 U	NA	NA	10 U	10 U	10 U
4-Chloroaniline	10 U	NA	NA	10 U	10 U	10 U
4-Chlorophenyl Phenyl Ether	5 U	NA	NA	5 U	5 U	5 U
4-Methylphenol	5 U	NA	NA	5 U	5 U	5 U
4-Nitroaniline	25 U	NA	NA	25 U	25 U	25 U
4-Nitrophenol	25 U	NA	NA	25 U	25 U	25 U
4-Nitroquinoline-1-Oxide	25 UR	NA	NA	25 UR	25 UR	25 UR
5-Nitro-O-Toluidine	10 U	NA	NA	10 U	10 U	10 U
7,12 Dimethylbenz(A)Anthracene	5 U	NA	NA	5 U	5 U	5 UJ
A,A-Dimethylphenethylamine	25 U	NA	NA	25 U	25 U	25 U
Acenaphthene	0 2 U	NA	NA	0 108 J	0 2 U	0 2 U
Acenaphthylene	0 2 U	NA	NA	0 2 U	0 2 U	0 2 U
Acetophenone	5 U	NA	NA	5 U	5 U	5 U
Aniline	10 U	NA	NA	10 U	10 U	10 U
Anthracene	0 2 U	NA	NA	0 2 U	0 2 U	0 2 U
Aramite	25 U	NA	NA	25 U	25 U	25 U
Benzo(A)Anthracene	0 2 U	NA	NA	0 2 U	0 2 U	0 2 U
Benzo(A)Pyrene	0 2 U	NA	NA	0 2 U	0 2 U	0 2 U
Benzo(B)Fluoranthene	0 2 U	NA	NA	0 2 U	0 2 U	0 2 U
Benzo(G,H I)Perylene	0 2 U	NA	NA	0 2 U	0 2 U	0 2 U
Benzo(K)Fluoranthene	0 2 U	NA	NA	0 2 U	0 2 U	0 2 U

(1) Reanalyzed on February 22, 2002 for gross beta
NA = Not Analyzed

TABLE E-3-1

SUMMARY OF ANALYTIC RESULTS - ROUND 1 GROUND WATER
CRANE 158 - MUSTARD GAS BURIAL GROUND
NSWC CRANE
CRANE, INDIANA

Location	01-25	01-26	01-27	01C01	01T02	01T02
Sample	01GW2501	01GW2601	01GW2701	01GWC0101	01GWT0201	01GWT0202
Matrix	Ground Water	Ground Water	Ground Water	Ground Water	Background	Background
Benzyl Alcohol	7 U	NA	NA	7 U	7 U	7 U
Bis(2-Chloroethoxy)Methane	10 U	NA	NA	10 U	10 U	10 U
Bis(2 Chloroethyl)Ether	5 U	NA	NA	5 U	5 U	5 U
Bis(2 Ethylhexyl)Phthalate	5 U	NA	NA	5 U	5 U	5 U
Butyl Benzyl Phthalate	5 U	NA	NA	5 U	5 U	5 U
Chlorobenzilate	10 U	NA	NA	10 U	10 U	10 U
Chrysene	0 2 U	NA	NA	0 2 U	0 2 U	0 2 U
Diallate	5 UJ	NA	NA	5 U	5 U	5 U
Dibenzo(A,H)Anthracene	5 U	NA	NA	5 U	5 U	5 U
Dibenzofuran	10 U	NA	NA	10 U	10 U	10 U
Diethyl Phthalate	0 2 U	NA	NA	0 2 U	0 2 U	0 2 U
Dimethyl Phthalate	5 U	NA	NA	5 U	5 U	5 U
Di-N-Butyl Phthalate	5 U	NA	NA	5 U	5 U	5 U
Di-N Octyl Phthalate	6 U	NA	NA	6 U	6 U	6 U
Diphenylamine	5 U	NA	NA	5 U	5 U	5 U
Ethyl Methane Sulfonate	5 U	NA	NA	5 U	5 U	5 U
Fluoranthene	0 2 U	NA	NA	0 2 U	0 2 U	0 2 U
Fluorene	0 2 U	NA	NA	0 2 U	0 2 U	0 2 U
Hexachlorobenzene	10 U	NA	NA	10 U	10 U	10 U
Hexachlorobutadiene	10 U	NA	NA	10 U	10 U	10 U
Hexachlorocyclopentadiene	10 U	NA	NA	10 U	10 U	10 U
Hexachloroethane	5 U	NA	NA	5 U	5 U	5 U
Hexachlorophene	400 UJ	NA	NA	400 UJ	400 UJ	400 UR
Hexachloropropene	10 U	NA	NA	10 U	10 U	10 U
Indeno(1,2,3 CD)Pyrene	0 2 U	NA	NA	0 2 U	0 2 U	0 2 U
Isodrin	10 U	NA	NA	10 U	10 U	10 U
Isophorone	5 U	NA	NA	5 U	5 U	5 U
Isosafrole	10 U	NA	NA	10 U	10 U	10 U
Kepone	25 U	NA	NA	25 U	25 U	25 U
Methapyrilene	25 UR	NA	NA	25 U	25 UR	25 UR
Methyl Methane Sulfonate	13 U	NA	NA	13 U	13 U	13 U
Naphthalene	10 U	NA	NA	10 U	10 U	10 U
N-Nitrosodiethylamine	6 U	NA	NA	6 U	6 U	6 U
N-Nitrosodimethylamine	5 U	NA	NA	5 U	5 U	5 U
N-Nitroso-Di N-Butylamine	5 U	NA	NA	5 U	5 U	5 U
N-Nitroso-Di N-Propylamine	7 U	NA	NA	7 U	7 U	7 U
N-Nitrosomethylethylamine	5 U	NA	NA	5 U	5 U	5 U
N-Nitrosomorpholine	10 U	NA	NA	10 U	10 U	10 U
N-Nitrosopiperidine	5 U	NA	NA	5 U	5 U	5 U
N-Nitrosopyrrolidine	0 2 U	NA	NA	0 2 U	0 2 U	0 2 U
O,O,O-Triethyl Phosphorothioate	10 U	NA	NA	10 U	10 U	10 U
O-Toluidine	5 U	NA	NA	5 U	5 U	5 U
P-(Dimethylamino)Azobenzene	10 U	NA	NA	10 U	10 U	10 U
Pentachlorobenzene	10 U	NA	NA	10 U	10 U	10 U
Pentachloronitrobenzene	25 U	NA	NA	25 U	25 U	25 U
Phenacetin	10 U	NA	NA	10 U	10 UJ	10 UJ
Phenanthrene	0 2 U	NA	NA	0 2 U	0 2 U	0 2 U
Phenol	10 U	NA	NA	10 U	10 U	10 U
Pronamide	10 UR	NA	NA	10 UR	10 UR	10 UR
Pyrene	0 2 U	NA	NA	0 2 U	0 2 U	0 2 U
Pyridine	10 U	NA	NA	10 U	10 U	10 U
Safrole	10 U	NA	NA	10 U	10 U	10 U
Energetics (ug/L)						
1,3,5-Trinitrobenzene	0 65 U	NA	NA	0 65 U	0 65 U	0 65 U
1,3 Dinitrobenzene	0 65 U	NA	NA	0 65 U	0 0771 J	0 65 U
2,4,6-Trinitrotoluene	0 65 U	NA	NA	0 65 U	0 65 U	0 65 U
2,4-Dinitrotoluene	0 65 U	NA	NA	0 65 U	0 65 U	0 65 U

(1) Reanalyzed on February 22, 2002 for gross beta
NA = Not Analyzed

TABLE E-3-1

SUMMARY OF ANALYTIC RESULTS - ROUND 1 GROUND WATER
CRANE 158 - MUSTARD GAS BURIAL GROUND
NSWC CRANE
CRANE, INDIANA

Location Sample Matrix	01-25 01GW2501 Ground Water	01-26 01GW2601 Ground Water	01-27 01GW2701 Ground Water	01C01 01GWC0101 Ground Water	01T02 01GWT0201 Background	01T02 01GWT0202 Background
2,6 Dinitrotoluene	0 65 U	NA	NA	0 65 U	0 65 U	0 65 U
2-Amino-4,6-Dinitrotoluene	0 65 U	NA	NA	0 65 U	0 65 U	0 65 U
2-Nitrotoluene	0 65 U	NA	NA	0 65 U	0 65 U	0 65 U
3-Nitrotoluene	0 65 U	NA	NA	0 65 U	0 65 U	0 65 U
4-Amino-2,6 Dinitrotoluene	0 65 U	NA	NA	0 65 U	0 275 J	0 65 U
4-Nitrotoluene	0 65 U	NA	NA	0 65 U	0 65 U	0 65 U
HMX	0 65 U	NA	NA	0 65 U	0 65 U	0 65 U
Nitrobenzene	0 65 U	NA	NA	0 65 U	0 65 U	0 65 U
RDX	0 65 U	NA	NA	0 65 U	0 65 U	0 65 U
Tetryl	0 65 U	NA	NA	0 65 U	0 65 U	0 65 U
Pesticides/PCBs (ug/L)						
4,4' DDD	0 08 U	NA	NA	0 08 U	0 08 U	0 08 U
4,4' DDE	0 08 U	NA	NA	0 08 U	0 08 U	0 08 U
4,4'-DDT	0 08 U	NA	NA	0 08 U	0 08 U	0 08 U
Aldrin	0 04 U	NA	NA	0 04 U	0 04 U	0 04 U
Alpha-BHC	0 04 U	NA	NA	0 04 U	0 04 U	0 04 U
Alpha-Chlordane	0 04 U	NA	NA	0 04 U	0 04 U	0 04 U
Aroclor-1016	1 U	NA	NA	1 U	1 U	1 U
Aroclor-1221	1 U	NA	NA	1 U	1 U	1 U
Aroclor-1232	1 U	NA	NA	1 U	1 U	1 U
Aroclor-1242	1 U	NA	NA	1 U	1 U	1 U
Aroclor-1248	1 U	NA	NA	1 U	1 U	1 U
Aroclor-1254	1 U	NA	NA	1 U	1 U	1 U
Aroclor-1260	1 U	NA	NA	1 U	1 U	1 U
Beta-BHC	0 04 U	NA	NA	0 04 U	0 04 U	0 04 U
Delta-BHC	0 04 U	NA	NA	0 04 U	0 04 U	0 04 U
Dieldrin	0 08 U	NA	NA	0 08 U	0 08 U	0 08 U
Endosulfan I	0 04 U	NA	NA	0 04 U	0 04 U	0 04 U
Endosulfan II	0 08 U	NA	NA	0 08 U	0 08 U	0 08 U
Endosulfan Sulfate	0 08 U	NA	NA	0 08 U	0 08 U	0 08 U
Endrin	0 08 U	NA	NA	0 08 U	0 08 U	0 08 U
Endrin Aldehyde	0 08 U	NA	NA	0 08 U	0 08 U	0 08 U
Gamma-BHC (Lindane)	0 04 U	NA	NA	0 04 U	0 04 U	0 04 U
Gamma-Chlordane	0 04 U	NA	NA	0 04 U	0 04 U	0 04 U
Heptachlor	0 02 U	NA	NA	0 017 J	0 051 BU	0 034 U
Heptachlor Epoxide	0 04 U	NA	NA	0 04 U	0 04 U	0 04 U
Methoxychlor	0 38 U	NA	NA	0 38 U	0 38 U	0 38 U
Toxaphene	2 5 U	NA	NA	2 5 U	2 5 U	2 5 U
Herbicides (ug/L)						
2 4 5 T	0 8 U	NA	NA	0 8 U	0 8 U	0 8 U
2,4,5-TP (Silvex)	0 5 U	NA	NA	0 5 U	0 5 U	0 5 U
2,4-D	2 5 U	NA	NA	2 5 U	2 5 U	2 5 U
Dinoseb	1 U	NA	NA	1 U	1 U	1 U
Pentachlorophenol	0 5 U	NA	NA	0 5 U	0 5 U	0 5 U
Total Metals (ug/L)						
Aluminum	40 2 U	170	163	40 2 U	1580	40 3 U
Antimony	1 6 U	1 7 U	2 6 U	1 6 U	1 6 U	1 6 U
Arsenic	1 5 U	1 5 U	1 5 U	1 6 U	2 2 J	1 5 UJ
Barium	10 3	21 2	54 9	39 2	59 0	17 8
Beryllium	0 40 U	0 40 U	0 40 U	0 40 U	0 70 J	0 40 U
Cadmium	0 30 U	0 30 U	0 30 U	0 30 U	0 30 UJ	0 30 UJ
Calcium	120000 J	149000 J	138000 J	72800 J	304000	330000
Chromium	0 60 U	0 60 U	0 62 U	0 80	5 4	0 70 U
Cobalt	1 0 U	4 0	2 6	1 0 U	55 8	66 3
Copper	0 90 U	0 90 U	0 98 U	0 90 U	4 9	0 90 U
Iron	20 2 U	3560	941	37 8	19500	10600
Lead	1 6 U	1 6 U	1 6 U	1 6 U	4 3	1 6 U

(1) Reanalyzed on February 22, 2002 for gross beta
NA = Not A[illegible]d

TABLE E-3-1

SUMMARY OF ANALYTIC RESULTS - ROUND 1 GROUND WATER
CRANE 158 - MUSTARD GAS BURIAL GROUND
NSWC CRANE
CRANE, INDIANA

Location	01-25	01-26	01-27	01C01	01T02	01T02
Sample	01GW2501	01GW2601	01GW2701	01GWC0101	01GWT0201	01GWT0202
Matrix	Ground Water	Ground Water	Ground Water	Ground Water	Background	Background
Magnesium	52800 J	71900 J	62000 J	26500	218000	242000
Manganese	43 3 J	3410 J	1150 J	24 8 J	8040	9170
Mercury	0 10 U	0 10 U	0 10 U	0 10 U	0 12	0 11
Nickel	2 0 U	5 7 U	4 0 U	1 5	115	124
Potassium	1860	3650	2300	1300 J	14300 J	15500 J
Selenium	0 80 U	0 80 U	0 80 U	0 80 U	0 80 U	0 95 U
Silver	3 0 U	3 0 U	3 0 U	3 0 U	0 70 U	0 70 U
Sodium	87000 J	64400 J	57300 J	5710 J	81500	84000
Strontium	209 J	375 J	266 J	228 J	3820 J	3990 J
Thallium	5 0 UJ	5 0 UJ	5 0 UJ	5 0 U	2 4 UJ	2 4 UJ
Thorium - Calc	0 845 U	NA	NA	0 672 U	1 50	0 156
Tin	190 U	190 U	190 U	190 U	17 3 U	17 3 U
Vanadium	3 0 U	3 0 U	3 0 U	3 0 U	1 4	0 50 U
Zinc	1 1 U	5 3 U	1 6 U	4 5 U	32 1	16 4
Dissolved Metals (ug/L)						
Aluminum	NA	146	40 2 U	NA	NA	NA
Antimony	NA	1 6 U	1 6 U	NA	NA	NA
Arsenic	NA	1 5 U	1 5 U	NA	NA	NA
Barium	NA	21 6	50 4	NA	NA	NA
Beryllium	NA	0 40 U	0 40 U	NA	NA	NA
Cadmium	NA	0 30 U	0 30 U	NA	NA	NA
Calcium	NA	158000 J	136000 J	NA	NA	NA
Chromium	NA	0 60 U	0 60 U	NA	NA	NA
Cobalt	NA	4 0	1 7	NA	NA	NA
Copper	NA	0 90 U	0 99 U	NA	NA	NA
Iron	NA	3270	416	NA	NA	NA
Lead	NA	1 6 U	1 6 U	NA	NA	NA
Magnesium	NA	76500 J	60000 J	NA	NA	NA
Manganese	NA	3610 J	1070 J	NA	NA	NA
Mercury	NA	0 10 U	0 10 U	NA	NA	NA
Nickel	NA	5 3 U	3 1 U	NA	NA	NA
Potassium	NA	3860	2190	NA	NA	NA
Selenium	NA	0 80 U	0 80 U	NA	NA	NA
Silver	NA	3 0 U	3 0 U	NA	NA	NA
Sodium	NA	66900 J	54100 J	NA	NA	NA
Strontium	NA	395 J	259 J	NA	NA	NA
Thallium	NA	5 0 UJ	5 0 UJ	NA	NA	NA
Thorium - Calc	NA	NA	NA	NA	NA	NA
Tin	NA	190 U	190 U	NA	NA	NA
Vanadium	NA	3 0 U	3 0 U	NA	NA	NA
Zinc	NA	1 1 U	1 1 U	NA	NA	NA
Miscellaneous Parameters (mg/L)						
1 4-Dithiane	200 U	NA	NA	200 U	200 U	200 U
1,4-Oxathiane	200 U	NA	NA	200 U	200 U	200 U
Bis(2-Chloroethyl)Sulfide	200 U	NA	NA	200 U	200 U	200 U
Total Organic Carbon	NA	NA	NA	2 9	1 73	2 38
Total Radiologicals (pCi/L)						
Gross Alpha	2 59 UJ	4 28 J	2 32 UJ	3 26 J	10 5 J	6 06 U
Gross Beta	2 50 U	7 97 J	2 70	4 03 U	20 8	19 3
Thorium-228	0 119 U	NA	NA	0 0933 U	0 172	0 0216 U
Thorium-230	0 145 U	NA	NA	0 0941 U	0 329 U	0 047 U
Thorium-232	0 0669 U	NA	NA	0 0546 U	0 157	0 0235
Dissolved Radiologicals (pCi/L)						
Gross Alpha	NA	NA	NA	NA	NA	NA
Gross Beta	NA	NA	NA	NA	NA	NA
Thorium-228	NA	NA	NA	NA	NA	NA
Thorium-230	NA	NA	NA	NA	NA	NA

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NA = Not Analyzed

TABLE E-3-1

SUMMARY OF ANALYTIC RESULTS - ROUND 1 GROUND WATER
CRANE 158 - MUSTARD GAS BURIAL GROUND
NSWC CRANE
CRANE, INDIANA

Location Sample Matrix	01-25 01GW2501 Ground Water	01-26 01GW2601 Ground Water	01-27 01GW2701 Ground Water	01C01 01GWC0101 Ground Water	01T02 01GWT0201 Background	01T02 01GWT0202 Background
Thorium-232	NA	NA	NA	NA	NA	NA
Field Parameters						
Dissolved Oxygen (mg/L)	0 74	0 75	2 89	0 12	7 67	6 7
Oxidation Reduction Potential (mV)	433	543 9	396 1	365 7	346	343
pH (S U)	6 4	7	6 06	6 97	5 4	5 42
Specific Conductance (mS/cm)	1 289	1 428	1 297	0 522	2 948	2 929
Temperature (C)	20 58	17 1	17 01	16 34	14 4	15 9
Turbidity (NTU)	5	24	16	1 7	3 6	2 6

(1) Reanalyzed on February 22, 2002 for gross beta
NA = Not Analyzed

TABLE E-3-2

SUMMARY OF ANALYTIC RESULTS - ROUND 2 GROUND WATER
CRANE 158 - MUSTARD GAS BURIAL GROUND
NSWC CRANE
CRANE, INDIANA

Location	01-01	01-02	01-03	01-04	01-05	01-06	01-08	01-09	01-10	01-11	01-14
Nsample	01GW0102	01GW0202	01GW0302	01GW0402	01GW0502	01GW0602	01GW0802	01GW0902	01GW1002	01GW1102	01GW1402
Sample	01GW0102	01GW0202	01GW0302	01GW0402	01GW0502	01GW0602	01GW0802	01GW0902	01GW1002	01GW1102	01GW1402
Matrix	Ground Water	Ground Water	Ground Water	Ground Water	Ground Water	Ground Water	Ground Water	Ground Water	Ground Water	Ground Water	Ground Water
Risk	Site	Site	Site	Site	Site	Site	Site	Site	Site	Site	Site
Sample Date	6/2/2002	6/17/2002	6/1/2002	6/1/2002	6/15/2002	6/2/2002	6/3/2002	6/3/2002	6/11/2002	6/14/2002	6/5/2002
Volatile Organic Compounds (ug/L)											
1,1,1,2-Tetrachloroethane	0 5 U	0 5 U	0 5 U	0 5 U	0 5 U	0 5 U	0 5 U	0 5 U	0 5 U	0 5 U	0 5 U
1,1,1-Trichloroethane	0 5 U	0 5 U	0 5 U	0 5 U	0 5 U	0 5 U	0 5 U	0 5 U	0 5 U	0 5 U	0 5 U
1,1,2,2-Tetrachloroethane	0 5 U	30	0 5 U	0 5 U	8	0 5 U	3	0 5 U	0 5 U	1	0 5 U
1,1,2-Trichloroethane	1 U	0 6 J	1 U	1 U	11	1 U	3	1 U	1 U	1 U	1 U
1,1-Dichloroethane	0 5 U	0 5 U	0 5 U	0 5 U	0 5 U	0 5 U	0 5 U	0 5 U	0 5 U	0 5 U	0 5 U
1,1-Dichloroethene	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U
1,2,3-Trichloropropane	0 5 U	0 5 U	0 5 U	0 5 U	0 5 U	0 5 U	0 5 U	0 5 U	0 5 U	0 5 U	0 5 U
1,2-Dibromo-3-Chloropropane	1 UJ	1 U	1 UJ	1 UJ	1 U	1 UJ	1 UJ	1 UJ	1 U	1 U	1 U
1,2-Dibromoethane	0 6 U	0 6 U	0 6 U	0 6 U	0 6 U	0 6 U	0 6 U	0 6 U	0 6 U	0 6 U	0 6 U
1,2-Dichloroethane	0 5 U	0 5 U	0 5 U	0 5 U	0 5 U	0 5 U	0 5 U	0 5 U	0 5 U	0 5 U	0 5 U
1,2-Dichloropropane	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U
1,4-Dioxane	100 UR	100 UR	100 UR	100 UR	100 UR	100 UR	100 UR	100 UR	100 UR	100 UR	100 UR
2-Butanone	5 UR	5 UR	5 UR	5 UR	5 UR	5 UR	5 UR	5 UR	5 UR	5 UR	5 U
2-Hexanone	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U
3-Chloropropene	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U
4-Methyl-2-Pentanone	3 U	3 U	3 U	3 U	3 U	3 U	3 U	3 U	3 U	3 U	3 UJ
Acetone	5 UR	5 UR	5 UR	5 UR	5 UR	5 UR	5 UR	5 UR	5 UR	5 UR	5 UR
Acetonitrile	40 UR	40 UR	40 UR	40 UR	40 UR	40 UR	40 UR	40 UR	40 UR	40 UR	40 U
Acrolein	10 UR	10 UR	10 UR	10 UR	10 UR	10 UR	10 UR	10 UR	10 UR	10 UR	10 UR
Acrylonitrile	10 UR	10 UR	10 UR	10 UR	10 UR	10 UR	10 UR	10 UR	10 UR	10 UR	10 UR
Benzene	0 5 U	0 5 U	0 5 U	0 5 U	0 5 U	0 5 U	0 5 U	0 5 U	0 5 U	0 5 U	0 5 U
Bromodichloromethane	0 5 U	0 5 U	0 5 U	0 5 U	0 5 U	0 5 U	0 5 U	0 5 U	0 5 U	0 5 U	0 5 U
Bromoform	0 5 UJ	0 5 U	0 5 UJ	0 5 UJ	0 5 U	0 5 UJ	0 5 UJ	0 5 UJ	0 5 U	0 5 U	0 5 U
Bromomethane	1 UJ	1 UJ	1 UJ	1 UJ	1 UJ	1 UJ	1 UJ	1 UJ	1 UJ	1 UJ	1 U
Carbon Disulfide	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U
Carbon Tetrachloride	0 5 U	0 5 U	0 5 U	0 5 U	0 5 U	0 5 U	0 5 U	0 5 U	0 5 U	0 5 U	0 5 U
Chlorobenzene	0 5 U	0 5 U	0 5 U	0 5 U	0 5 U	0 5 U	0 5 U	0 5 U	0 5 U	0 5 U	0 5 U
Chlorodibromomethane	0 5 U	0 5 U	0 5 U	0 5 U	0 5 U	0 5 U	0 5 U	0 5 U	0 5 U	0 5 U	0 5 U
Chloroethane	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 UJ
Chloroform	0 5 U	1	0 5 U	0 5 U	0 5 U	0 5 U	0 5 U	0 5 U	0 5 U	0 7 J	0 5 U
Chloromethane	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U
Chloroprene	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U
Cis-1,2-Dichloroethene	1 U	1 U	1 U	1 U	2	1 U	1 U	1 U	1 U	1 U	1
Cis-1,3-Dichloropropene	3 U	3 U	3 U	3 U	3 U	3 U	3 U	3 U	3 U	3 U	3 U
Dibromomethane	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U
Dichlorodifluoromethane	0 7 U	0 7 UJ	0 7 U	0 7 U	0 7 UJ	0 7 U	0 7 U	0 7 U	0 7 U	0 7 U	0 7 U
Ethane	NA	1 U	NA	NA	NA	NA	NA	NA	NA	1 U	NA
Ethene	NA	1 U	NA	NA	NA	NA	NA	NA	NA	1 U	NA
Ethyl Methacrylate	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U
Ethylbenzene	0 5 U	0 5 U	0 5 U	0 5 U	0 5 U	0 5 U	0 5 U	0 5 U	0 5 U	0 5 U	0 5 U
Isobutanol	40 UR	40 UR	40 UR	40 UR	40 UR	40 UR	40 UR	40 UR	40 UR	40 UR	40 UR
Methacrylonitrile	20 UR	20 UR	20 UR	20 UR	20 UR	20 UR	20 UR	20 UR	20 UR	20 UR	20 UR
Methane	NA	1 UJ	NA	NA	NA	NA	NA	NA	NA	1 UJ	NA
Methyl Iodide	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U
Methyl Methacrylate	1 UJ	1 U	1 UJ	1 UJ	1 U	1 UJ	1 UJ	1 UJ	1 U	1 U	1 U
Methylene Chloride	1 UJ	1 UJ	1 UJ	1 UJ	1 UJ	1 UJ	1 UJ	1 UJ	1 UJ	1 J	1 UJ
Pentachloroethane	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U
Propionitrile	20 UR	20 UR	20 UR	20 UR	20 UR	20 UR	20 UR	20 UR	20 UR	20 UR	20 UR
Styrene	0 5 U	0 5 U	0 5 U	0 5 U	0 5 U	0 5 U	0 5 U	0 5 U	0 5 U	0 5 U	0 5 U
Tetrachloroethene	0 5 U	1	0 5 U	0 5 U	2	0 5 U	0 5 U	0 5 U	0 5 U	2	0 5 U

NA = Not Analyzed

TABLE E-3-2

SUMMARY OF ANALYTIC RESULTS - ROUND 2 GROUND WATER
CRANE 158 - MUSTARD GAS BURIAL GROUND
NSWC CRANE
CRANE, INDIANA

Location	01-01	01-02	01-03	01-04	01-05	01-06	01-08	01-09	01-10	01-11	01-14
Nsample	01GW0102	01GW0202	01GW0302	01GW0402	01GW0502	01GW0602	01GW0802	01GW0902	01GW1002	01GW1102	01GW1402
Sample	01GW0102	01GW0202	01GW0302	01GW0402	01GW0502	01GW0602	01GW0802	01GW0902	01GW1002	01GW1102	01GW1402
Matrix	Ground Water	Ground Water	Ground Water	Ground Water	Ground Water	Ground Water	Ground Water	Ground Water	Ground Water	Ground Water	Ground Water
Risk	Site	Site	Site	Site	Site	Site	Site	Site	Site	Site	Site
Sample Date	6/2/2002	6/17/2002	6/1/2002	6/1/2002	6/15/2002	6/2/2002	6/3/2002	6/3/2002	6/11/2002	6/14/2002	6/5/2002
Toluene	0 5 U	0 5 U	0 5 U	0 5 U	0 5 U	0 5 U	0 5 U	0 5 U	0 5 U	0 7 J	0 5 U
Total Xylenes	3 U	3 U	3 U	3 U	3 U	3 U	3 U	3 U	3 U	3 U	3 U
Trans-1,2-Dichloroethene	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	0 4 J
Trans-1,3-Dichloropropene	3 U	3 U	3 U	3 U	3 U	3 U	3 U	3 U	3 U	3 U	3 U
Trans-1,4-Dichloro-2-Butene	1 UJ	1 U	1 UJ	1 UJ	1 U	1 UJ	1 UJ	1 UJ	1 U	1 U	1 UJ
Trichloroethene	0 5 U	20	0 5 U	0 5 U	840	0 5 U	7	0 5 U	0 5 U	15	26
Trichlorofluoromethane	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 UJ
Vinyl Acetate	3 U	3 U	3 U	3 U	3 U	3 U	3 U	3 U	3 U	3 U	3 U
Vinyl Chloride	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U
Total Metals (ug/L)											
Aluminum	NA	21 2 U	NA	NA	NA	NA	NA	NA	NA	180 J	NA
Antimony	NA	5 1 U	NA	NA	NA	NA	NA	NA	NA	5 1 U	NA
Arsenic	NA	2 2 U	NA	NA	NA	NA	NA	NA	NA	2 2 U	NA
Barium	NA	32 4 J	NA	NA	NA	NA	NA	NA	NA	21 8 J	NA
Beryllium	NA	0 30 U	NA	NA	NA	NA	NA	NA	NA	0 30 U	NA
Cadmium	NA	0 60 U	NA	NA	NA	NA	NA	NA	NA	0 60 U	NA
Calcium	NA	21800	NA	NA	NA	NA	NA	NA	NA	7640	NA
Chromium	NA	0 80 U	NA	NA	NA	NA	NA	NA	NA	0 80 U	NA
Cobalt	NA	1 1 U	NA	NA	NA	NA	NA	NA	NA	1 1 U	NA
Copper	NA	3 2 U	NA	NA	NA	NA	NA	NA	NA	3 2 U	NA
Iron	NA	27 0 U	NA	NA	NA	NA	NA	NA	NA	151	NA
Lead	NA	2 8 U	NA	NA	NA	NA	NA	NA	NA	2 8 U	NA
Magnesium	NA	8970	NA	NA	NA	NA	NA	NA	NA	2720	NA
Manganese	NA	22 0	NA	NA	NA	NA	NA	NA	NA	14 9	NA
Mercury	NA	0 10 U	NA	NA	NA	NA	NA	NA	NA	0 10 U	NA
Nickel	NA	3 0	NA	NA	NA	NA	NA	NA	NA	2 7 U	NA
Potassium	NA	446	NA	NA	NA	NA	NA	NA	NA	797	NA
Selenium	NA	2 7 U	NA	NA	NA	NA	NA	NA	NA	2 6 U	NA
Silver	NA	1 8 U	NA	NA	NA	NA	NA	NA	NA	1 8 U	NA
Sodium	NA	5550	NA	NA	NA	NA	NA	NA	NA	1510	NA
Strontium	NA	75 2 J	NA	NA	NA	NA	NA	NA	NA	33 1 J	NA
Thallium	NA	0 60 U	NA	NA	NA	NA	NA	NA	NA	1 3 U	NA
Tin	NA	17 0 U	NA	NA	NA	NA	NA	NA	NA	17 0 U	NA
Vanadium	NA	0 80 U	NA	NA	NA	NA	NA	NA	NA	0 80 U	NA
Zinc	NA	8 3 U	NA	NA	NA	NA	NA	NA	NA	8 3 U	NA
Dissolved Metals (ug/L)											
Aluminum	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Antimony	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Arsenic	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Barium	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Beryllium	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Cadmium	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Calcium	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Chromium	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Cobalt	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Copper	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Iron	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Lead	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Magnesium	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Manganese	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Mercury	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA

NA = Not A[illegible]d

TABLE E-3-2

SUMMARY OF ANALYTIC RESULTS - ROUND 2 GROUND WATER
CRANE 158 - MUSTARD GAS BURIAL GROUND
NSWC CRANE
CRANE, INDIANA

Location	01-01	01-02	01-03	01-04	01-05	01-06	01-08	01-09	01-10	01-11	01-14
Nsample	01GW0102	01GW0202	01GW0302	01GW0402	01GW0502	01GW0602	01GW0802	01GW0902	01GW1002	01GW1102	01GW1402
Sample	01GW0102	01GW0202	01GW0302	01GW0402	01GW0502	01GW0602	01GW0802	01GW0902	01GW1002	01GW1102	01GW1402
Matrix	Ground Water	Ground Water	Ground Water	Ground Water	Ground Water	Ground Water	Ground Water	Ground Water	Ground Water	Ground Water	Ground Water
Risk	Site	Site	Site	Site	Site	Site	Site	Site	Site	Site	Site
Sample Date	6/2/2002	6/17/2002	6/1/2002	6/1/2002	6/15/2002	6/2/2002	6/3/2002	6/3/2002	6/11/2002	6/14/2002	6/5/2002
Nickel	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Potassium	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Selenium	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Silver	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Sodium	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Strontium	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Thallium	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Tin	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Vanadium	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Zinc	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Total Radiologicals (pCi/L)											
Gross Alpha	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Gross Beta	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Miscellaneous Parameters (mg/L)											
Chloride	NA	4 1	NA	NA	NA	NA	NA	NA	NA	0 60	NA
Hardness	NA	91 4	NA	NA	NA	NA	NA	NA	NA	30 3	NA
Hardness, Filtered	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Total Organic Carbon	NA	3 6 J	NA	NA	NA	NA	NA	NA	NA	2 9 J	NA
Field Parameters (mg/L)											
Alkalinity	NA	50	NA	NA	NA	NA	NA	NA	NA	15	NA
Carbon Dioxide	NA	75	NA	NA	NA	NA	NA	NA	NA	60	NA
Dissolved Oxygen	NA	4 5	NA	NA	NA	NA	NA	NA	NA	2	NA
Dissolved Oxygen - Meter	1 28	7 57	6 77	5 61	9 06	2 56	0 73	1 55	1 76	3 55	2 41
Ferrous Iron	NA	0 01	NA	NA	NA	NA	NA	NA	NA	0 01	NA
Hydrogen Sulfide	NA	0	NA	NA	NA	NA	NA	NA	NA	0	NA
Manganese(+2)	NA	0 4	NA	NA	NA	NA	NA	NA	NA	0 7	NA
Nitrate	NA	0 08	NA	NA	NA	NA	NA	NA	NA	0 29	NA
Nitrite	NA	0 008	NA	NA	NA	NA	NA	NA	NA	0	NA
Sulfate	NA	25	NA	NA	NA	NA	NA	NA	NA	12	NA
Sulfide	NA	0 01	NA	NA	NA	NA	NA	NA	NA	0 01	NA
Field Parameters											
Oxidation Reduction Potential (MV)	168	488	-6	575	50	142	-51	433	-16	562	-57
pH (S U)	5 77	5 89	6 58	6	6 86	6 61	6 75	5 26	6 87	5 32	6 34
Specific Conductance (MS/CM)	0 873	0 209	0 207	1 466	2 112	1 466	0 404	0 088	0 812	0 065	1 083
Temperature (C)	14 8	15 1	12 77	16 62	12 93	14 98	13 29	14 47	15 1	16 17	14 24
Turbidity (Ntu)	4 3	2	21	0 1	4 2	1 3	4 2	8 3	2 4	4 4	16

NA = Not Analyzed

TABLE E-3-2

SUMMARY OF ANALYTIC RESULTS - ROUND 2 GROUND WATER
CRANE 158 - MUSTARD GAS BURIAL GROUND
NSWC CRANE
CRANE, INDIANA

Location	01-15	01-23	01-25	01-25	01-26	01C01	01T02	01T02	01T03	01T04	01T05
Nsample	01GW1502	01GW2302	01GW2502	01GW2502-F	01GW2602	01GWC0102	01GWT0203	01GWT0203-F	01GWT0301	01GWT0401	01GWT0501
Sample	01GW1502	01GW2302	01GW2502	01GW2502-F	01GW2602	01GWC0102	01GWT0203	01GWT0203-F	01GWT0301	01GWT0401	01GWT0501
Matrix	Ground Water	Ground Water	Ground Water	Ground Water	Ground Water	Ground Water	Ground Water	Ground Water	Ground Water	Ground Water	Ground Water
Risk	Site	Site	Site	Site	Site	Site	Site	Site	Site	Site	Site
Sample Date	6/15/2002	6/4/2002	6/14/2002	6/14/2002	6/4/2002	6/11/2002	6/12/2002	6/12/2002	6/17/2002	6/15/2002	6/15/2002
Volatile Organic Compounds (ug/L)											
1,1,1,2-Tetrachloroethane	1	0 5 U	1	NA	0 5 U	0 5 U	0 5 U	NA	0 5 U	0 5 U	0 5 U
1,1,1-Trichloroethane	0 5 U	0 5 U	0 5 U	NA	0 5 U	0 5 U	0 5 U	NA	0 5 U	0 5 U	0 5 U
1,1,2,2-Tetrachloroethane	230	0 5 U	24	NA	0 5 U	0 5 U	0 5 U	NA	0 5 U	0 5 U	2
1,1,2-Trichloroethane	16	1 U	2	NA	1 U	1 U	1 U	NA	1 U	1 U	1 U
1,1-Dichloroethane	0 5 U	0 5 U	0 5 U	NA	0 5 U	0 5 U	0 5 U	NA	0 5 U	0 5 U	0 5 U
1,1-Dichloroethene	1	1 U	1 U	NA	1 U	1 U	1 U	NA	1 U	1 U	1 U
1,2,3-Trichloropropane	0 5 U	0 5 U	0 5 U	NA	0 5 U	0 5 U	0 5 U	NA	0 5 U	0 5 U	0 5 U
1,2-Dibromo-3-Chloropropane	1 U	1 U	1 U	NA	1 U	1 U	1 U	NA	1 U	1 U	1 U
1,2-Dibromoethane	0 6 U	0 6 U	0 6 U	NA	0 6 U	0 6 U	0 6 U	NA	0 6 U	0 6 U	0 6 U
1,2-Dichloroethane	9	0 5 U	2	NA	0 5 U	0 5 U	0 5 U	NA	0 5 U	0 5 U	0 5 U
1,2-Dichloropropane	1 U	1 U	1 U	NA	1 U	1 U	1 U	NA	1 U	1 U	1 U
1,4-Dioxane	100 UR	100 UR	100 UR	NA	100 UR	100 UR	100 UR	NA	100 UR	100 UR	100 UR
2-Butanone	5 UR	5 U	5 UR	NA	5 U	5 UR	5 UR	NA	5 UR	5 UR	5 UR
2-Hexanone	5 U	5 U	5 U	NA	5 U	5 U	5 U	NA	5 U	5 U	5 U
3-Chloropropene	5 U	5 U	5 U	NA	5 U	5 U	5 U	NA	5 U	5 U	5 U
4-Methyl-2-Pentanone	3 U	3 UJ	3 U	NA	3 UJ	3 U	3 U	NA	3 U	3 U	3 U
Acetone	5 UR	5 UR	5 UR	NA	5 UR	5 UR	5 UR	NA	5 UR	5 UR	5 UR
Acetonitrile	40 UR	40 U	40 UR	NA	40 U	40 UR	40 UR	NA	40 UR	40 UR	40 UR
Acrolein	10 UR	10 UR	10 UR	NA	10 UR	10 UR	10 UR	NA	10 UR	10 UR	10 UR
Acrylonitrile	10 UR	10 UR	10 UR	NA	10 UR	10 UR	10 UR	NA	10 UR	10 UR	10 UR
Benzene	0 5 U	0 5 U	0 5 U	NA	0 5 U	0 5 U	0 5 U	NA	0 5 U	0 5 U	0 5 U
Bromodichloromethane	0 5 U	0 5 U	0 5 U	NA	0 5 U	0 5 U	0 5 U	NA	0 5 U	0 5 U	0 5 U
Bromoform	0 5 U	0 5 U	0 5 U	NA	0 5 U	0 5 U	0 5 U	NA	0 5 U	0 5 U	0 5 U
Bromomethane	1 UJ	1 U	1 UJ	NA	1 U	1 UJ	1 UJ	NA	1 UJ	1 UJ	1 UJ
Carbon Disulfide	1 U	1 U	1 U	NA	1 U	1 U	1 U	NA	1 U	1 U	1 U
Carbon Tetrachloride	0 5 U	0 5 U	0 5 U	NA	0 5 U	0 5 U	0 5 U	NA	0 5 U	0 5 U	0 5 U
Chlorobenzene	0 5 U	0 5 U	0 5 U	NA	0 5 U	0 5 U	0 5 U	NA	0 5 U	0 5 U	0 5 U
Chlorodibromomethane	0 5 U	0 5 U	0 5 U	NA	0 5 U	0 5 U	0 5 U	NA	0 5 U	0 5 U	0 5 U
Chloroethane	1 U	1 UJ	1 U	NA	1 UJ	1 U	1 U	NA	1 U	1 U	1 U
Chloroform	6	0 5 U	6	NA	0 5 U	0 5 U	0 5 U	NA	0 5 U	0 5 U	1
Chloromethane	1 U	1 U	1 U	NA	1 U	1 U	1 U	NA	1 U	1 U	1 U
Chloroprene	1 U	1 U	1 U	NA	1 U	1 U	1 U	NA	1 U	1 U	1 U
Cis-1,2-Dichloroethene	9	1 U	2	NA	1 U	1 U	1 U	NA	1 U	1 U	1 U
Cis-1,3-Dichloropropene	3 U	3 U	3 U	NA	3 U	3 U	3 U	NA	3 U	3 U	3 U
Dibromomethane	1 U	1 U	1 U	NA	1 U	1 U	1 U	NA	1 U	1 U	1 U
Dichlorodifluoromethane	0 7 UJ	0 7 U	0 7 U	NA	0 7 U	0 7 U	0 7 U	NA	0 7 UJ	0 7 U	0 7 UJ
Ethane	1 U	NA	1 U	NA	NA	NA	1 UJ	NA	1 U	1 U	1 U
Ethene	1 U	NA	1 U	NA	NA	NA	2 J	NA	1 U	1 U	1 U
Ethyl Methacrylate	1 U	1 U	1 U	NA	1 U	1 U	1 U	NA	1 U	1 U	1 U
Ethylbenzene	0 5 U	0 5 U	0 5 U	NA	0 5 U	0 5 U	0 5 U	NA	0 5 U	0 5 U	0 5 U
Isobutanol	40 UR	40 UR	40 UR	NA	40 UR	40 UR	40 UR	NA	40 UR	40 UR	40 UR
Methacrylonitrile	20 UR	20 UR	20 UR	NA	20 UR	20 UR	20 UR	NA	20 UR	20 UR	20 UR
Methane	24 J	NA	1 UJ	NA	NA	NA	0 9 J	NA	1 UJ	1 UJ	1 UJ
Methyl Iodide	1 U	1 U	1 U	NA	1 U	1 U	1 U	NA	1 U	1 U	1 U
Methyl Methacrylate	1 U	1 U	1 U	NA	1 U	1 U	1 U	NA	1 U	1 U	1 U
Methylene Chloride	1 UJ	1 UJ	1 J	NA	1 UJ	1 UJ	1 UJ	NA	1 UJ	1 UJ	1 UJ
Pentachloroethane	5 U	5 U	5 U	NA	5 U	5 U	5 U	NA	5 U	5 U	5 U
Propionitrile	20 UR	20 UR	20 UR	NA	20 UR	20 UR	20 UR	NA	20 UR	20 UR	20 UR
Styrene	0 5 U	0 5 U	0 5 U	NA	0 5 U	0 5 U	0 5 U	NA	0 5 U	0 5 U	0 5 U
Tetrachloroethene	5	0 5 U	1	NA	0 5 U	0 5 U	0 5 U	NA	0 5 U	0 5 U	0 5 U

NA = Not Applied

TABLE E-3-2

SUMMARY OF ANALYTIC RESULTS - ROUND 2 GROUND WATER
CRANE 158 - MUSTARD GAS BURIAL GROUND
NSWC CRANE
CRANE, INDIANA

Location	01-15	01-23	01-25	01-25	01-26	01C01	01T02	01T02	01T03	01T04	01T05
Nsample	01GW1502	01GW2302	01GW2502	01GW2502-F	01GW2602	01GWC0102	01GWT0203	01GWT0203-F	01GWT0301	01GWT0401	01GWT0501
Sample	01GW1502	01GW2302	01GW2502	01GW2502-F	01GW2602	01GWC0102	01GWT0203	01GWT0203-F	01GWT0301	01GWT0401	01GWT0501
Matrix	Ground Water	Ground Water	Ground Water	Ground Water	Ground Water	Ground Water	Ground Water	Ground Water	Ground Water	Ground Water	Ground Water
Risk	Site	Site	Site	Site	Site	Site	Site	Site	Site	Site	Site
Sample Date	6/15/2002	6/4/2002	6/14/2002	6/14/2002	6/4/2002	6/11/2002	6/12/2002	6/12/2002	6/17/2002	6/15/2002	6/15/2002
Toluene	0 5 U	0 5 U	0 7 J	NA	0 5 U	0 5 U	0 5 J	NA	0 5 U	0 5 U	0 5 U
Total Xylenes	3 U	3 U	3 U	NA	3 U	3 U	3 U	NA	3 U	3 U	3 U
Trans-1,2-Dichloroethene	3	1 U	0 8 J	NA	1 U	1 U	1 U	NA	1 U	1 U	1 U
Trans-1,3-Dichloropropene	3 U	3 U	3 U	NA	3 U	3 U	3 U	NA	3 U	3 U	3 U
Trans-1,4-Dichloro-2-Butene	1 U	1 UJ	1 U	NA	1 UJ	1 U	1 U	NA	1 U	1 U	1 U
Trichloroethene	360	0 5 U	74	NA	0 5 U	0 5 U	0 5 U	NA	1	0 5 U	2
Trichlorofluoromethane	1 U	1 UJ	1 U	NA	1 UJ	1 U	1 U	NA	1 U	1 U	1 U
Vinyl Acetate	3 U	3 U	3 U	NA	3 U	3 U	3 U	NA	3 U	3 U	3 U
Vinyl Chloride	1 U	1 U	1 U	NA	1 U	1 U	1 U	NA	1 U	1 U	1 U
Total Metals (ug/L)											
Aluminum	21 2 U	NA	21 2 U	NA	NA	NA	57 8 U	NA	21 2 U	21 2 U	21 2 U
Antimony	5 1 U	NA	5 1 U	NA	NA	NA	5 1 U	NA	5 1 U	5 1 U	5 1 U
Arsenic	2 2 U	NA	2 2 U	NA	NA	NA	2 2 U	NA	2 2 U	2 2 U	2 2 U
Barium	29 9 J	NA	10 J	NA	NA	NA	16 6 J	NA	40 1 J	33 1 J	22 8 J
Beryllium	0 30 U	NA	0 30 U	NA	NA	NA	0 30 U	NA	0 30 U	0 30 U	0 30 U
Cadmium	0 60 U	NA	0 60 U	NA	NA	NA	0 60 U	NA	0 60 U	0 60 U	0 60 U
Calcium	162000	NA	131000	NA	NA	NA	344000	NA	87700	70400	147000
Chromium	0 80 U	NA	0 80 U	NA	NA	NA	0 80 UJ	NA	0 80 U	0 80 U	0 80 U
Cobalt	4 3 U	NA	1 1 U	NA	NA	NA	126 J	NA	1 2 U	1 1 U	11 2 J
Copper	3 2 U	NA	3 2 U	NA	NA	NA	3 2 U	NA	3 2 U	3 2 U	3 2 U
Iron	11600	NA	27 0 U	NA	NA	NA	14800	NA	27 0 U	27 0 U	31 0
Lead	2 8 U	NA	2 8 U	NA	NA	NA	2 8 UJ	NA	2 8 U	2 8 U	2 8 U
Magnesium	52300	NA	56000	NA	NA	NA	250000	NA	59900	21500	233000
Manganese	1970	NA	4 0	NA	NA	NA	9600	NA	45 2	5 9	5420
Mercury	0 10 U	NA	0 10 U	NA	NA	NA	0 10 U	NA	0 10 U	0 10 U	0 10 U
Nickel	5 1	NA	2 7 U	NA	NA	NA	273	NA	9 3	2 7 U	75 1
Potassium	2450	NA	1760	NA	NA	NA	15300	NA	4830	1720	4130
Selenium	5 6 U	NA	2 6 U	NA	NA	NA	4 2 U	NA	2 6 U	2 6 U	2 6 U
Silver	1 8 U	NA	1 8 U	NA	NA	NA	1 8 UJ	NA	1 8 U	1 8 U	1 8 U
Sodium	49900	NA	73400	NA	NA	NA	69700	NA	4300	4050	110000
Strontium	310 J	NA	229 J	NA	NA	NA	3910 J	NA	329 J	172 J	468 J
Thallium	0 60 U	NA	0 60 U	NA	NA	NA	2 1 U	NA	0 60 U	0 60 U	0 6 U
Tin	17 0 U	NA	17 0 U	NA	NA	NA	17 0 U	NA	17 0 U	17 0 U	17 0 U
Vanadium	0 80 U	NA	0 80 U	NA	NA	NA	0 80 U	NA	0 80 U	0 80 U	0 80 U
Zinc	8 3 U	NA	8 3 U	NA	NA	NA	103	NA	8 3 U	8 3 U	12 1
Dissolved Metals (ug/L)											
Aluminum	NA	NA	NA	80 5 U	NA	NA	NA	21 2 U	NA	NA	NA
Antimony	NA	NA	NA	5 1 U	NA	NA	NA	5 1 U	NA	NA	NA
Arsenic	NA	NA	NA	2 2 U	NA	NA	NA	2 2 U	NA	NA	NA
Barium	NA	NA	NA	9 9 J	NA	NA	NA	13 8 J	NA	NA	NA
Beryllium	NA	NA	NA	0 30 U	NA	NA	NA	0 30 U	NA	NA	NA
Cadmium	NA	NA	NA	0 60 U	NA	NA	NA	0 60 U	NA	NA	NA
Calcium	NA	NA	NA	123000	NA	NA	NA	349000	NA	NA	NA
Chromium	NA	NA	NA	0 80 U	NA	NA	NA	0 80 UJ	NA	NA	NA
Cobalt	NA	NA	NA	1 1 U	NA	NA	NA	96 8 J	NA	NA	NA
Copper	NA	NA	NA	3 2 U	NA	NA	NA	3 2 U	NA	NA	NA
Iron	NA	NA	NA	123	NA	NA	NA	20300	NA	NA	NA
Lead	NA	NA	NA	2 8 U	NA	NA	NA	2 8 UJ	NA	NA	NA
Magnesium	NA	NA	NA	52700	NA	NA	NA	254000	NA	NA	NA
Manganese	NA	NA	NA	10 4	NA	NA	NA	9650	NA	NA	NA
Mercury	NA	NA	NA	0 10 U	NA	NA	NA	0 10 U	NA	NA	NA

NA = Not Analyzed

TABLE E-3-2

SUMMARY OF ANALYTIC RESULTS - ROUND 2 GROUND WATER
CRANE 158 - MUSTARD GAS BURIAL GROUND
NSWC CRANE
CRANE, INDIANA

Location	01-15	01-23	01-25	01-25	01-26	01C01	01T02	01T02	01T03	01T04	01T05
Nsample	01GW1502	01GW2302	01GW2502	01GW2502-F	01GW2602	01GWC0102	01GWT0203	01GWT0203-F	01GWT0301	01GWT0401	01GWT0501
Sample	01GW1502	01GW2302	01GW2502	01GW2502-F	01GW2602	01GWC0102	01GWT0203	01GWT0203-F	01GWT0301	01GWT0401	01GWT0501
Matrix	Ground Water	Ground Water	Ground Water	Ground Water	Ground Water	Ground Water	Ground Water	Ground Water	Ground Water	Ground Water	Ground Water
Risk	Site	Site	Site	Site	Site	Site	Site	Site	Site	Site	Site
Sample Date	6/15/2002	6/4/2002	6/14/2002	6/14/2002	6/4/2002	6/11/2002	6/12/2002	6/12/2002	6/17/2002	6/15/2002	6/15/2002
Nickel	NA	NA	NA	2 7 U	NA	NA	NA	208	NA	NA	NA
Potassium	NA	NA	NA	1690	NA	NA	NA	15200	NA	NA	NA
Selenium	NA	NA	NA	2 6 U	NA	NA	NA	2 8 U	NA	NA	NA
Silver	NA	NA	NA	1 8 U	NA	NA	NA	1 8 UJ	NA	NA	NA
Sodium	NA	NA	NA	70200	NA	NA	NA	70700	NA	NA	NA
Strontium	NA	NA	NA	192 J	NA	NA	NA	4040 J	NA	NA	NA
Thallium	NA	NA	NA	0 60 U	NA	NA	NA	2 1 U	NA	NA	NA
Tin	NA	NA	NA	17 0 U	NA	NA	NA	17 0 U	NA	NA	NA
Vanadium	NA	NA	NA	0 80 U	NA	NA	NA	0 80 U	NA	NA	NA
Zinc	NA	NA	NA	8 3 U	NA	NA	NA	65 6	NA	NA	NA
Total Radiologicals (pCi/L)											
Gross Alpha	NA	4 89	NA	NA	NA	NA	8 22	NA	2 60 U	0 906 U	4 83 U
Gross Beta	NA	12 3	NA	NA	NA	NA	18 8	NA	3 75	1 69	5 21
Miscellaneous Parameters (mg/L)											
Chloride	56 8	NA	42 8	NA	NA	NA	94 4	NA	2 1	1 6	127
Hardness	619 9	NA	557 7	NA	NA	NA	1888 5	NA	465 7	264 3	1326 6
Hardness, Filtered	NA	NA	NA	524 1	NA	NA	NA	1917 4	NA	NA	NA
Total Organic Carbon	4 4 J	NA	4 7 J	NA	NA	NA	9 2 J	NA	3 7 J	2 6 J	5 1 J
Field Parameters (mg/L)											
Alkalinity	250	NA	250	NA	NA	NA	120	NA	275	150	70
Carbon Dioxide	58	NA	25	NA	NA	NA	350	NA	18	12	225
Dissolved Oxygen	0 3	NA	0 4	NA	NA	NA	1 5	NA	0 7	2	3
Dissolved Oxygen - Meter	8 35	3 01	0 63	NA	2 66	2 28	10 17	NA	7 72	2 63	3 92
Ferrous Iron	8 8	NA	0	NA	NA	NA	8 5	NA	0 01	0 01	0 07
Hydrogen Sulfide	0	NA	0	NA	NA	NA	0	NA	0	0	0
Manganese(+2)	1 7	NA	0 3	NA	NA	NA	22 >	NA	0 3	0	6 2
Nitrate	0	NA	0 21	NA	NA	NA	0 04	NA	0 32	1 28	0 38
Nitrite	0	NA	0	NA	NA	NA	0	NA	0 008	0	0 006
Sulfate	80 >	NA	80 >	NA	NA	NA	80 >	NA	80 >	54	80 >
Sulfide	0	NA	0 02	NA	NA	NA	0 04	NA	0	0	0
Field Parameters											
Oxidation Reduction Potential (MV)	-71	3	232	NA	7	565	98	NA	404	272	228
pH (S U)	6 42	6 28	7 02	NA	6 34	6 9	5 68	NA	7 23	7 45	5 77
Specific Conductance (MS/CM)	1 396	1 648	1 363	NA	1 129	0 394	2 686	NA	0 739	0 482	2 61
Temperature (C)	16 92	15 91	14 5	NA	15 42	16 42	14 99	NA	13 9	13 4	13 8
Turbidity (Ntu)	2	9 1	14	NA	16	0 6	18	NA	2 7	0 7	2 3

NA = Not Analyzed

TABLE E-4-1

SUMMARY OF ANALYTIC RESULTS - ROUND 1 SEDIMENT
CRANE 158 - MUSTARD GAS BURIAL GROUND
NSWC CRANE
CRANE, INDIANA

Location	01SD01	01SD02	01SD03	01SD04	01SD05	01SD06	01SD07	01SD08
Sample	01SD01	01SD02	01SD03	01SD04	01SD05	01SD06	01SD07	01SD08
Matrix	Sediment	Sediment	Sediment	Sediment	Sediment	Sediment	Sediment	Sediment
Depth Range	0 - 0.5	0 - 0.5	0 - 0.5	0 - 0.5	0 - 0.5	0 - 0.5	0 - 0.5	0 - 0.5
Risk	Background	Site	Site	Site	Site	Site	Site	Site
Sample Date	8/14/2001	8/14/2001	8/14/2001	8/14/2001	8/14/2001	8/14/2001	8/14/2001	8/14/2001
Volatile Organics (ug/kg)								
1,1,1,2-Tetrachloroethane	3 U	3 U	3 U	4 U	3 U	4 U	3 U	4 U
1,1,1-Trichloroethane	3 U	3 U	3 U	4 U	3 U	4 U	3 U	4 U
1,1,2,2-Tetrachloroethane	3 U	3 U	7	4 U	3 UJ	4 U	3 U	4 U
1,1,2-Trichloroethane	5 U	5 U	6 U	7 U	5 U	8 U	5 U	7 U
1,1-Dichloroethane	3 U	3 U	3 U	4 U	3 U	4 U	3 U	4 U
1,1-Dichloroethene	5 U	5 U	6 U	7 U	5 U	8 U	5 U	7 U
1,2,3-Trichloropropane	3 U	3 U	3 U	4 U	3 UJ	4 U	3 U	4 U
1,2-Dibromo-3-Chloropropane	5 U	5 U	6 U	7 U	5 UJ	8 U	5 U	7 U
1,2-Dibromoethane	3 U	3 U	3 U	4 U	3 U	4 U	3 U	4 U
1,2-Dichloroethane	3 U	3 U	3 U	4 U	3 U	4 U	3 U	4 U
1,2-Dichloropropane	5 U	5 U	6 U	7 U	5 U	8 U	5 U	7 U
1,4-Dioxane	470 UR	500 UR	560 UR	680 UR	540 UR	780 UR	540 UR	720 UR
2-Butanone	5 U	5 U	6 U	7 U	5 U	8 U	5 U	7 U
2-Hexanone	5 U	5 U	6 U	7 U	5 U	8 U	5 U	7 U
3-Chloropropene	5 UJ	5 UJ	6 UJ	7 UJ	5 UJ	8 UJ	5 UJ	7 UJ
4-Methyl-2-Pentanone	3 U	3 U	3 U	4 U	3 U	4 U	3 U	4 U
Acetone	5 UJ	5 UJ	6 UJ	7 UJ	5 UJ	12 J	5 UJ	7 UJ
Acetonitrile	190 UJ	200 UJ	220 UJ	270 UJ	220 UJ	310 UJ	220 UJ	290 UJ
Acrolein	47 UR	50 UR	56 UR	68 UR	54 UR	78 UR	54 UR	72 UR
Acrylonitrile	47 U	50 U	56 U	68 U	54 U	78 U	54 U	72 U
Benzene	3 U	3 U	3 U	4 U	3 U	4 U	3 U	4 U
Bromodichloromethane	3 U	3 U	3 U	4 U	3 U	4 U	3 U	4 U
Bromoform	3 U	3 U	3 U	4 U	3 U	4 U	3 U	4 U
Bromomethane	5 U	5 U	6 U	7 U	5 U	8 U	5 U	7 U
Carbon Disulfide	3 U	3 U	3 U	4 U	3 U	4 U	3 U	4 U
Carbon Tetrachloride	3 UJ	3 UJ	3 UJ	4 UJ	3 UJ	4 UJ	3 UJ	4 UJ
Chlorobenzene	3 U	3 U	3 U	4 U	3 U	4 U	3 U	4 U
Chlorodibromomethane	3 U	3 U	3 U	4 U	3 U	4 U	3 U	4 U
Chloroethane	5 U	5 U	6 U	7 U	5 U	8 U	5 U	7 U
Chloroform	3 U	3 U	3 U	4 U	3 U	4 U	3 U	4 U
Chloromethane	5 U	5 U	6 U	7 U	5 U	8 U	5 U	7 U
Chloroprene	5 UJ	5 UJ	6 UJ	7 UJ	5 UJ	8 UJ	5 UJ	7 UJ
Cis-1,2-Dichloroethene	5 U	5 U	6 U	7 U	5 U	8 U	5 U	7 U
Cis-1,3-Dichloropropene	3 U	3 U	3 U	4 U	3 U	4 U	3 U	4 U
Dibromomethane	5 U	5 U	6 U	7 U	5 U	8 U	5 U	7 U
Dichlorodifluoromethane	3 UJ	3 J	1 J	4 UJ	3 UJ	4 UJ	3 UJ	2 J
Ethyl Methacrylate	5 U	5 U	6 U	7 U	5 U	8 U	5 U	7 U
Ethylbenzene	3 U	3 U	3 U	4 U	3 U	4 U	3 U	4 U
Isobutanol	190 UR	200 UR	220 UR	270 UR	220 UR	310 UR	220 UR	290 UR
Methacrylonitrile	95 U	100 U	110 U	140 U	110 U	160 U	110 U	140 U
Methyl Iodide	5 UJ	5 UJ	6 UJ	7 UJ	5 UJ	8 UJ	5 UJ	7 UJ
Methyl Methacrylate	5 U	5 U	6 U	7 U	5 U	8 U	5 U	7 U
Methylene Chloride	5 UJ	5 UJ	6 UJ	7 UJ	5 UJ	8 UJ	5 UJ	7 UJ
Pentachloroethane	5 U	5 U	6 U	7 U	5 UJ	8 U	5 U	7 U
Propionitrile	95 UR	100 UR	110 UR	140 UR	110 UR	160 UR	110 UR	140 UR
Styrene	3 U	3 U	3 U	4 U	3 U	4 U	3 U	4 U
Tetrachloroethene	3 U	3 U	3 U	4 U	3 U	4 U	3 U	4 U
Toluene	3 U	3 U	3 U	4 U	3 U	4 U	3 U	4 U
Total Xylenes	3 U	3 U	3 U	4 U	3 U	4 U	3 U	4 U
Trans-1,2-Dichloroethene	5 U	5 U	6 U	7 U	5 U	8 U	5 U	7 U
Trans-1,3-Dichloropropene	3 U	3 U	3 U	4 U	3 U	4 U	3 U	4 U
Trans-1,4-Dichloro-2-Butene	5 U	5 U	6 U	7 U	5 U	8 U	5 U	7 U

Calc = Calculated Value as descibed on Page X

TABLE E-4-1

SUMMARY OF ANALYTIC RESULTS - ROUND 1 SEDIMENT
CRANE 158 - MUSTARD GAS BURIAL GROUND
NSWC CRANE
CRANE, INDIANA

Location	01SD01	01SD02	01SD03	01SD04	01SD05	01SD06	01SD07	01SD08
Sample	01SD01	01SD02	01SD03	01SD04	01SD05	01SD06	01SD07	01SD08
Matrix	Sediment	Sediment	Sediment	Sediment	Sediment	Sediment	Sediment	Sediment
Depth Range	0 - 0 5	0 - 0 5	0 - 0 5	0 - 0 5	0 - 0 5	0 - 0 5	0 - 0 5	0 - 0 5
Risk	Background	Site	Site	Site	Site	Site	Site	Site
Sample Date	8/14/2001	8/14/2001	8/14/2001	8/14/2001	8/14/2001	8/14/2001	8/14/2001	8/14/2001
Trichloroethene	3 U	3 U	3 U	4 U	3 U	4 U	3 U	4 U
Trichlorofluoromethane	5 U	5 U	6 U	7 U	5 U	8 U	5 U	7 U
Vinyl Acetate	3 U	3 U	3 U	4 U	3 U	4 U	3 U	4 U
Vinyl Chloride	5 U	5 U	6 U	7 U	5 U	8 U	5 U	7 U
Semivolatile Organics (ug/kg)								
1,2,4,5-Tetrachlorobenzene	390 U	380 U	450 U	450 U	380 U	370 U	380 U	460 U
1,2,4-Trichlorobenzene	390 U	380 U	450 U	450 U	380 U	370 U	380 U	460 U
1,2-Dichlorobenzene	200 U	190 U	230 U	230 U	190 U	190 U	190 U	230 U
1,3-Dichlorobenzene	200 U	190 U	230 U	230 U	190 U	190 U	190 U	230 U
1,4-Dichlorobenzene	200 U	190 U	230 U	230 U	190 U	190 U	190 U	230 U
1,4-Naphthoquinone	390 U	380 U	450 U	450 U	380 U	370 U	380 U	460 U
1,4-Phenylenediamine	970 UJ	940 UJ	1100 UJ	1100 UJ	960 UJ	930 UJ	940 UJ	1200 UJ
1-Naphthylamine	390 U	380 U	450 U	450 U	380 U	370 U	380 U	460 U
2,2'-Oxybis(1-Chloropropane)	200 U	190 U	230 U	230 U	190 U	190 U	190 U	230 U
2,3,4,6-Tetrachlorophenol	390 U	380 U	450 U	450 U	380 U	370 U	380 U	460 U
2,4,5-Trichlorophenol	970 U	940 U	1100 U	1100 U	960 U	930 U	940 U	1200 U
2,4,6-Trichlorophenol	390 U	380 U	450 U	450 U	380 U	370 U	380 U	460 U
2,4-Dichlorophenol	390 U	380 U	450 U	450 U	380 U	370 U	380 U	460 U
2,4-Dimethylphenol	390 U	380 U	450 U	450 U	380 U	370 U	380 U	460 U
2,4-Dinitrophenol	970 U	940 U	1100 U	1100 U	960 U	930 U	940 U	1200 U
2,6-Dichlorophenol	390 U	380 U	450 U	450 U	380 U	370 U	380 U	460 U
2 Acetylaminofluorene	200 U	190 U	230 U	230 U	190 U	190 U	190 U	230 U
2-Chloronaphthalene	200 U	190 U	230 U	230 U	190 U	190 U	190 U	230 U
2-Chlorophenol	200 U	190 U	230 U	230 U	190 U	190 U	190 U	230 U
2-Methylnaphthalene	200 U	190 U	230 U	230 U	190 U	190 U	190 U	230 U
2-Methylphenol	200 U	190 U	230 U	230 U	190 U	190 U	190 U	230 U
2-Naphthylamine	200 U	190 U	230 U	230 U	190 U	190 U	190 U	230 U
2-Nitroaniline	490 U	470 U	550 U	550 U	480 U	470 U	470 U	600 U
2-Nitrophenol	390 U	380 U	450 U	450 U	380 U	370 U	380 U	460 U
2-Picoline	300 U	290 U	350 U	340 U	290 U	280 U	290 U	350 U
3,3'-Dichlorobenzidine	390 U	380 U	450 U	450 U	380 U	370 U	380 UJ	460 U
3,3'-Dimethylbenzidine	390 U	380 U	450 U	450 U	380 U	370 U	380 U	460 U
3-Methylcholanthrene	440 U	420 U	510 U	500 U	430 UJ	420 U	420 U	520 UJ
3-Methylphenol	200 U	190 U	230 U	230 U	190 U	190 U	190 U	230 U
3-Nitroaniline	970 U	940 U	1100 U	1100 U	960 U	930 U	940 U	1200 U
4,6-Dinitro-2-Methylphenol	970 U	940 U	1100 U	1100 U	960 U	930 U	940 U	1200 U
4-Aminobiphenyl	200 U	190 U	230 U	230 U	190 U	190 U	190 U	230 U
4-Bromophenyl Phenyl Ether	390 U	380 U	450 U	450 U	380 U	370 U	380 U	460 U
4-Chloro-3-Methylphenol	390 U	380 U	450 U	450 U	380 U	370 U	380 U	460 U
4-Chloroaniline	390 U	380 U	450 U	450 U	380 U	370 U	380 U	460 U
4-Chlorophenyl Phenyl Ether	200 U	190 U	230 U	230 U	190 U	190 U	190 U	230 U
4-Methylphenol	200 U	190 U	230 U	230 U	190 U	190 U	190 U	230 U
4-Nitroaniline	970 U	940 U	1100 U	1100 U	960 U	930 U	940 U	1200 U
4-Nitrophenol	970 U	940 U	1100 U	1100 U	960 U	930 U	940 U	1200 U
4-Nitroquinoline-1-Oxide	970 UR	940 UR	1100 UR	1100 UR	960 UR	930 UR	940 UR	1200 UR
5-Nitro-O-Toluidine	390 U	380 U	450 U	450 U	380 U	370 U	380 U	460 U
7,12-Dimethylbenz(A)Anthracene	300 U	290 U	350 U	340 U	290 UJ	280 U	290 U	350 UJ
A,A-Dimethylphenethylamine	970 U	940 U	1100 U	1100 U	960 U	930 U	940 U	1200 U
Acenaphthene	11 8 U	11 6 U	13 9 U	13 7 U	11 7 U	11 2 U	139 J	13 8 U
Acenaphthylene	11 8 U	11 6 U	13 9 U	13 7 U	11 7 U	11 2 U	11 5 UJ	13 8 U
Acetophenone	200 U	190 U	230 U	230 U	190 U	190 U	190 U	230 U
Aniline	200 U	190 U	230 U	230 U	190 U	190 U	190 U	230 U
Anthracene	11 8 U	11 6 U	13 9 U	13 7 U	11 7 U	11 2 U	11 5 U	13 8 U

Calc = Calc[illegible] Value as descibed on Page X

TABLE E-4-1

SUMMARY OF ANALYTIC RESULTS - ROUND 1 SEDIMENT
CRANE 158 - MUSTARD GAS BURIAL GROUND
NSWC CRANE
CRANE, INDIANA

Location	01SD01	01SD02	01SD03	01SD04	01SD05	01SD06	01SD07	01SD08
Sample	01SD01	01SD02	01SD03	01SD04	01SD05	01SD06	01SD07	01SD08
Matrix	Sediment	Sediment	Sediment	Sediment	Sediment	Sediment	Sediment	Sediment
Depth Range	0 - 0 5	0 - 0 5	0 - 0 5	0 - 0 5	0 - 0 5	0 - 0 5	0 - 0 5	0 - 0 5
Risk	Background	Site	Site	Site	Site	Site	Site	Site
Sample Date	8/14/2001	8/14/2001	8/14/2001	8/14/2001	8/14/2001	8/14/2001	8/14/2001	8/14/2001
Aramite	970 U	940 U	1100 U	1100 U	960 U	930 U	940 U	1200 U
Benzo(A)Anthracene	11 8 U	11 6 U	13 9 U	13 7 U	11 7 U	11 2 U	14 4	13 8 U
Benzo(A)Pyrene	11 8 U	11 6 U	13 9 U	13 7 U	7 05 J	4 97 J	27 5 J	6 73 J
Benzo(B)Fluoranthene	11 8 U	11 6 U	9 95 J	13 7 U	11 7 U	7 7 J	120 J	22 5 J
Benzo(G,H,I)Perylene	11 8 U	11 6 U	13 9 U	13 7 U	11 7 U	11 2 U	21 8 J	13 8 U
Benzo(K)Fluoranthene	11 8 U	11 6 U	13 9 U	13 7 U	8 96 J	11 2 U	14 6 J	6 26 J
Benzyl Alcohol	270 U	270 U	270 U	270 U	270 U	270 U	270 U	270 U
Bis(2-Chloroethoxy)Methane	390 U	380 U	450 U	450 U	380 U	370 U	380 U	460 U
Bis(2-Chloroethyl)Ether	200 U	190 U	230 U	230 U	190 U	190 U	190 U	230 U
Bis(2-Ethylhexyl)Phthalate	200 U	190 U	230 U	230 U	190 U	190 U	190 UJ	98 J
Butyl Benzyl Phthalate	200 U	190 U	230 U	230 U	190 U	190 U	190 U	230 U
Chlorobenzilate	390 U	380 U	450 U	450 U	380 U	370 U	380 U	460 U
Chrysene	11 8 U	11 6 U	13 9 U	13 7 U	11 7 U	11 2 U	17 3 J	13 8 U
Di-N-Butyl Phthalate	200 U	190 U	230 U	230 U	190 U	190 U	190 U	230 U
Di-N-Octyl Phthalate	200 U	190 U	230 U	230 U	190 UJ	190 U	190 UJ	230 UJ
Diallate	390 U	380 U	450 U	450 U	380 U	370 U	380 U	460 U
Dibenzo(A,H)Anthracene	11 8 U	11 6 U	13 9 U	13 7 U	11 7 U	11 2 U	11 5 UJ	13 8 U
Dibenzofuran	200 U	190 U	230 U	230 U	190 U	190 U	190 U	230 U
Diethyl Phthalate	200 U	190 U	230 U	230 U	190 U	190 U	190 U	230 U
Dimethyl Phthalate	200 U	190 U	230 U	230 U	190 U	190 U	190 U	230 U
Diphenylamine	200 U	190 U	230 U	230 U	190 U	190 U	190 U	230 U
Ethyl Methane Sulfonate	200 U	190 U	230 U	230 U	190 U	190 U	190 U	230 U
Fluoranthene	11 8 U	11 6 U	13 9 U	13 7 U	4 93 J	5 39 J	18 4 J	7 83 J
Fluorene	11 8 U	11 6 U	13 9 U	13 7 U	11 7 U	11 2 U	11 5 U	13 8 U
Hexachlorobenzene	390 U	380 U	450 U	450 U	380 U	370 U	380 U	460 U
Hexachlorobutadiene	390 U	380 U	450 U	450 U	380 U	370 U	380 U	460 U
Hexachlorocyclopentadiene	390 U	380 U	450 U	450 U	380 U	370 U	380 UJ	460 U
Hexachloroethane	200 U	190 U	230 U	230 U	190 U	190 U	190 U	230 U
Hexachlorophene	16000 UJ	15000 UJ	18000 UJ	18000 UJ	15000 UJ	15000 UJ	15000 UJ	19000 UJ
Hexachloropropene	390 U	380 U	450 U	450 UJ	380 U	370 U	380 U	460 U
Indeno(1,2,3-CD)Pyrene	11 8 U	11 6 U	13 9 U	13 7 U	11 7 U	11 2 U	12 8	13 8 U
Isodrin	390 U	380 U	450 U	450 U	380 U	370 U	380 U	460 U
Isophorone	200 U	190 U	230 U	230 U	190 U	190 U	190 U	230 U
Isosafrole	390 U	380 U	450 U	450 U	380 U	7600	380 U	460 U
Kepone	970 U	940 U	1100 U	1100 U	960 U	930 U	940 U	1200 U
Methapyrilene	970 U	940 U	1100 U	1100 U	960 U	930 U	940 U	1200 U
Methyl Methane Sulfonate	490 U	470 U	550 U	550 U	480 U	470 U	470 U	600 U
N-Nitroso-Di-N-Butylamine	390 U	380 U	450 U	450 U	380 U	370 U	380 U	460 U
N-Nitroso-Di-N-Propylamine	200 U	190 U	230 U	230 UJ	190 U	190 U	190 U	230 U
N-Nitrosodiethylamine	200 U	190 U	230 U	230 U	190 U	190 U	190 U	230 U
N-Nitrosodimethylamine	200 U	190 U	230 U	230 U	190 U	190 U	190 U	230 U
N-Nitrosomethylethylamine	200 U	190 U	230 U	230 U	190 U	190 U	190 U	230 U
N-Nitrosomorpholine	200 U	190 U	230 U	230 U	190 U	190 U	190 U	230 U
N-Nitrosopiperidine	390 U	380 U	450 U	450 U	380 U	370 U	380 U	460 U
N-Nitrosopyrrolidine	200 U	190 U	230 U	230 UJ	190 U	190 U	190 U	230 U
Naphthalene	11 8 U	11 6 U	13 9 U	13 7 U	11 7 U	11 2 UR	11 5 UJ	13 8 U
O,O,O-Triethyl Phosphorothioate	390 U	380 U	450 U	450 U	380 U	370 U	380 U	460 U
O-Toluidine	200 U	190 U	230 U	230 U	190 U	190 U	190 U	230 U
P-(Dimethylamino)Azobenzene	390 U	380 U	450 U	450 U	380 U	370 U	380 U	460 U
Pentachlorobenzene	390 U	380 U	450 U	450 U	380 U	370 U	380 U	460 U
Pentachloronitrobenzene	970 U	940 U	1100 U	1100 U	960 U	930 U	940 U	1200 U
Phenacetin	390 U	380 U	450 U	450 U	380 U	370 U	380 U	460 U
Phenanthrene	11 8 U	11 6 U	13 9 U	13 7 U	11 7 U	11 2 U	11 5 U	13 8 U

Calc = Calculated Value as descibed on Page X

TABLE E-4-1

SUMMARY OF ANALYTIC RESULTS - ROUND 1 SEDIMENT
CRANE 158 - MUSTARD GAS BURIAL GROUND
NSWC CRANE
CRANE, INDIANA

Location	01SD01	01SD02	01SD03	01SD04	01SD05	01SD06	01SD07	01SD08
Sample	01SD01	01SD02	01SD03	01SD04	01SD05	01SD06	01SD07	01SD08
Matrix	Sediment	Sediment	Sediment	Sediment	Sediment	Sediment	Sediment	Sediment
Depth Range	0 - 0 5	0 - 0 5	0 - 0 5	0 - 0 5	0 - 0 5	0 - 0 5	0 - 0 5	0 - 0 5
Risk	Background	Site	Site	Site	Site	Site	Site	Site
Sample Date	8/14/2001	8/14/2001	8/14/2001	8/14/2001	8/14/2001	8/14/2001	8/14/2001	8/14/2001
Phenol	200 U	190 U	230 U	230 U	190 U	190 U	190 U	230 U
Pronamide	390 UR	380 UR	450 UR	450 UR	380 UR	370 UR	380 UR	460 UR
Pyrene	11 8 U	11 6 U	13 9 U	13 7 U	11 7 U	11 2 U	24 J	5 31 J
Pyridine	220 U	220 U	230 U	230 U	220 U	220 U	220 U	230 U
Safrole	390 U	380 U	450 U	450 U	380 U	370 U	380 U	460 U
Energertics (ug/kg)								
1,3,5-Trinitrobenzene	476 U	476 U	476 U	476 U	500 U	500 U	476 U	500 U
1,3-Dinitrobenzene	476 U	476 U	476 U	476 U	500 U	500 U	476 U	500 U
2,4,6-Trinitrotoluene	476 U	476 U	476 U	476 U	500 U	500 U	476 U	500 U
2,4-Dinitrotoluene	476 U	476 U	476 U	476 U	500 U	500 U	476 U	500 U
2,6-Dinitrotoluene	476 U	476 U	476 U	476 U	500 U	500 U	476 U	500 U
2-Amino-4,6-Dinitrotoluene	476 U	476 U	476 U	476 U	500 U	500 U	476 U	500 U
2-Nitrotoluene	476 U	476 U	476 U	476 U	500 U	500 U	476 U	500 U
3-Nitrotoluene	476 U	476 U	476 U	476 U	500 U	500 U	476 U	500 U
4-Amino-2,6-Dinitrotoluene	476 U	476 U	476 U	476 U	500 U	500 U	476 U	500 U
4-Nitrotoluene	476 U	476 U	476 U	476 U	500 U	500 U	476 U	500 U
HMX	476 U	54 2 J	422 J	86 7 J	134 J	500 U	476 U	500 U
Nitrobenzene	476 U	476 U	476 U	476 U	500 U	500 U	476 U	500 U
RDX	476 U	476 U	476 U	476 U	500 U	500 U	476 U	500 U
Tetryl	476 U	476 U	476 U	476 U	500 U	500 U	476 U	500 U
Pesticides/PCBs (ug/kg)								
4,4'-DDD	2 9 U	2 8 U	3 4 U	3 4 U	2 9 U	2 8 U	2 8 U	3 5 U
4,4'-DDE	2 9 U	2 8 U	3 4 U	3 4 U	2 9 U	2 8 U	2 8 U	3 5 U
4,4'-DDT	2 9 UJ	2 8 UJ	3 4 UJ	3 4 UJ	2 9 UJ	2 8 UJ	2 8 UJ	3 5 UJ
Aldrin	1 5 U	1 5 U	1 8 U	1 8 U	1 5 U	1 4 U	1 5 U	1 8 U
Alpha-BHC	1 5 U	1 5 U	1 8 U	1 8 U	1 5 U	1 4 U	1 5 U	1 8 U
Alpha-Chlordane	1 5 U	1 5 U	1 8 U	1 8 U	1 5 U	1 4 U	1 5 U	1 8 U
Aroclor-1016	38 U	38 U	46 U	45 U	38 U	37 U	37 U	45 U
Aroclor-1221	38 U	38 U	46 U	45 U	38 U	37 U	37 U	45 U
Aroclor-1232	38 U	38 U	46 U	45 U	38 U	37 U	37 U	45 U
Aroclor-1242	38 U	38 U	46 U	45 U	38 U	37 U	37 U	45 U
Aroclor-1248	38 U	38 U	46 U	45 U	38 U	37 U	37 U	45 U
Aroclor-1254	38 U	38 U	46 U	45 U	38 U	37 U	37 U	45 U
Aroclor-1260	38 U	38 U	46 U	45 U	38 U	37 U	19 J	45 U
Beta-BHC	1 5 U	1 5 U	1 8 U	1 8 U	1 5 U	1 4 U	1 5 U	1 8 U
Delta-BHC	1 5 U	1 5 U	1 8 U	1 8 U	1 5 U	1 4 U	1 5 U	1 8 U
Dieldrin	2 9 U	2 8 U	3 4 U	3 4 U	2 9 U	2 8 U	2 8 U	3 5 U
Endosulfan I	1 5 U	1 5 U	1 8 U	1 8 U	1 5 U	1 4 U	1 5 U	1 8 U
Endosulfan II	2 9 U	2 8 U	3 4 U	3 4 U	2 9 U	2 8 U	2 8 U	3 5 U
Endosulfan Sulfate	2 9 U	2 8 U	3 4 U	3 4 U	2 9 U	2 8 U	2 8 U	3 5 U
Endrin	2 9 U	2 8 U	3 4 U	3 4 U	2 9 U	2 8 U	2 8 U	3 5 U
Endrin Aldehyde	2 9 U	2 8 U	3 4 U	3 4 U	2 9 U	2 8 U	2 8 UR	3 5 U
Gamma-Bhc (Lindane)	1 5 U	1 5 U	1 8 U	1 8 U	1 5 U	1 4 U	1 5 U	1 8 U
Gamma-Chlordane	1 5 U	1 5 U	1 8 U	1 8 U	1 5 U	1 4 U	1 5 U	1 8 U
Heptachlor	0 95 J	1 7	1 8 U	1 4 J	1 2 J	2 5	1 1 J	1 8 U
Heptachlor Epoxide	1 5 U	1 5 U	1 8 U	1 8 U	1 5 U	1 4 U	1 5 U	1 8 U*
Methoxychlor	15 U	15 U	18 U	18 U	15 U	14 U	15 U	18 U
Toxaphene	96 U	95 U	110 U	110 U	96 U	92 U	94 U	120 U
Herbicides (ug/kg)								
2,4,5-T	12 U	12 U	14 U	8 6 J	12 U	11 U	11 U	14 U
2,4,5-TP (Silvex)	16	12	14 U	14 U	12 U	11 J	3 1 J	14 U
2,4-D	82 U	81 U	99 U	96 U	82 U	79 U	80 UJ	98 U
Dinoseb	23 UJ	23 UJ	28 UJ	27 UJ	23 UJ	22 UJ	23 U	28 U

Calc = Cal[illegible] Value as descibed on Page X

TABLE E-4-1

SUMMARY OF ANALYTIC RESULTS - ROUND 1 SEDIMENT
CRANE 158 - MUSTARD GAS BURIAL GROUND
NSWC CRANE
CRANE, INDIANA

Location	01SD01	01SD02	01SD03	01SD04	01SD05	01SD06	01SD07	01SD08
Sample	01SD01	01SD02	01SD03	01SD04	01SD05	01SD06	01SD07	01SD08
Matrix	Sediment	Sediment	Sediment	Sediment	Sediment	Sediment	Sediment	Sediment
Depth Range	0 - 0 5	0 - 0 5	0 - 0 5	0 - 0 5	0 - 0 5	0 - 0 5	0 - 0 5	0 - 0 5
Risk	Background	Site	Site	Site	Site	Site	Site	Site
Sample Date	8/14/2001	8/14/2001	8/14/2001	8/14/2001	8/14/2001	8/14/2001	8/14/2001	8/14/2001
Pentachlorophenol	12 U	12 U	14 U	14 U	12 U	11 U	11 U	14 U
Inorganics (mg/kg)								
Aluminum	9670	8790	6770	7470	9270	8190	11700	13700
Antimony	1 2 J	2 0 J	0 59 UJ	0 58 UJ	0 51 UJ	0 48 UJ	0 50 UJ	0 61 UJ
Arsenic	31 9	31 1	27 9	6 5	4 4	5 5	8 1	6 7
Barium	105	92 4	47 4	105	120	120	94 6	80 7
Beryllium	1 4 J	1 7 J	0 65 J	0 84 J	0 80 J	0 78 J	0 57 J	0 62 U
Cadmium	0 05 UJ	0 05 UJ	0 05 UJ	0 05 UJ	0 23 U	0 39 J	0 05 UJ	0 06 UJ
Calcium	1000	769	941	1690	2630	1960	3020	5520
Chromium	30 5	45 1	15 0	13 5	9 4	10 2	13 7	17 4
Cobalt	25 0	28 8	6 9	17 8	15 3	17 5	12 2	7 4
Copper	17 6 J	19 4 J	16 9 J	11 0 J	10 1 J	9 5 J	16 1 J	14 6 J
Iron	45700	76900	28600	20000	12500	12300	19900	21700
Lead	24 8	32 0	22 2	19 1	16 1	26 7	16 5	28 2
Magnesium	1520	1060	1050	1030	1200	1090	1820	1940
Manganese	1490	1640	278	1230	1250	1330	607	341
Mercury	0 06 U	0 05 U	0 09 U	0 06 U	0 05 U	0 07 U	0 06 U	0 08 U
Nickel	37 1	35 9	12 1	15 6	13 7	11 3	11 9	13 7
Potassium	875 J	703 J	1100 J	604 J	623 J	497 J	583 J	915 J
Selenium	0 66	1 2	0 92	0 66	0 38 U	0 45	0 59	1 0
Silver	0 15 U	0 15 U	0 18 U	0 18 U	0 15 U	0 14 U	0 15 U	0 18 U
Sodium	265	345 J	416	334	335	298	311	402
Strontium	10 2 J	8 1 J	10 6 J	9 6 J	11 2 J	8 2 J	8 7 J	14 5 J
Thallium	4 3	7 1	2 2	1 2	0 56 U	0 57	2 0	1 5
Thorium-Calc	9 3	9 4	12 5	7 75	7 54	6 47	6 53	7 31
Tin	3 6	3 4	3 6	3 4	3 1	3 2	3 0	3 7
Vanadium	32 5	45 8	20 4	20 5	18 9	19 6	27 0	31 5
Zinc	79 2	78 0	35 6	42 5	41 2	47 8	46 1	70 2
Miscellaneous Parameters								
1,4-Dithiane (ug/kg)	237 U	234 U	282 U	275 U	235 U	225 U	231 U	282 U
1,4-Oxathiane (ug/kg)	237 U	234 U	282 U	275 U	235 U	225 U	231 U	282 U
Bis(2-Chloroethyl)Sulfide (ug/kg)	237 U	234 U	282 U	275 U	235 U	225 U	231 U	282 U
Cation Exchange Capacity (meq/100g)	11 1	17 9	22 0	22 9	45 5	26 9	22 6	58 6
pH (S U)	5 8 J	5 6 J	5 5 J	6 1 J	7 0 J	6 2 J	7 3 J	7 1 J
Total Organic Carbon (mg/kg)	5950	5580	17600	21600	34900	24500	14300	49600
Total Radiologicals (pCi/g)								
Thorium-228	0 937	1 15	1 49	1 08	0 868	0 705	0 694	0 781
Thorium-230	1 20 J	1 14 J	1 26 J	0 832 J	0 791 J	1 08 J	0 937 J	1 05 J
Thorium-232	1 11	0 917	1 25	0 624	0 791	0 718	0 742	0 828

Calc = Calculated Value as descibed on Page X

TABLE E-4-2

SUMMARY OF ANALYTIC RESULTS - ROUND 2 SEDIMENT
CRANE 158 - MUSTARD GAS BURIAL GROUND
NSWC CRANE
CRANE, INDIANA

Location	01SD01	01SD03	01SD09	01SD10	01SD11	01SD12
Nsample	01SD0102	01SD0302	01SD0902	01SD1002	01SD1102	01SD1202
Sample	01SD0102	01SD0302	01SD0902	01SD1002	01SD1102	01SD1202
Matrix	Sediment	Sediment	Sediment	Sediment	Sediment	Sediment
Depth Range	0 - 0.5	0 - 0.5	0 - 0 5	0 - 0.5	0 - 0.5	0 - 0 5
Risk	Background	Site	Site	Site	Site	Site
Sample Date	6/17/2002	6/17/2002	6/17/2002	6/17/2002	6/17/2002	6/17/2002
Volatile Organics (ug/kg)						
1,1,1,2-Tetrachloroethane	3 U	4 U	4 U	3 UJ	3 UJ	4 UJ
1,1,1-Trichloroethane	3 U	4 U	4 U	3 UJ	3 UJ	4 UJ
1,1,2,2-Tetrachloroethane	3 UJ	9	4 U	3 UJ	3 UJ	4 UJ
1,1,2-Trichloroethane	6 U	8 U	7 U	6 UJ	6 UJ	7 UJ
1,1-Dichloroethane	3 U	4 U	4 U	3 UJ	3 UJ	4 UJ
1,1-Dichloroethene	6 UJ	8 U	7 U	6 UJ	6 UJ	7 UJ
1,2,3-Trichloropropane	3 U	4 U	4 U	3 UJ	3 UJ	4 UJ
1,2-Dibromo-3-Chloropropane	6 U	8 U	7 U	6 UJ	6 UJ	7 UJ
1,2-Dibromoethane	3 U	4 U	4 U	3 UJ	3 UJ	4 UJ
1,2-Dichloroethane	3 U	4 U	4 U	3 UJ	3 UJ	4 UJ
1,2-Dichloropropane	6 U	8 U	7 U	6 UJ	6 UJ	7 UJ
1,4-Dioxane	580 UR	750 UR	670 UR	610 UR	570 UR	720 UR
2-Butanone	6 U	8 U	7 U	6 UJ	6 UJ	7 UJ
2-Hexanone	6 UJ	8 UJ	7 UJ	6 UJ	6 UJ	7 UJ
3-Chloropropene	6 U	8 U	7 UJ	6 UJ	6 UJ	7 UJ
4-Methyl-2-Pentanone	3 U	4 U	4 U	3 UJ	3 UJ	4 UJ
Acetone	290 J	510 J	190 J	230 J	540 J	630 J
Acetonitrile	230 UR	300 UR	270 UR	250 UR	230 UR	290 UR
Acrolein	58 UR	75 UR	67 UR	61 UR	57 UR	72 UR
Acrylonitrile	58 UR	75 UR	67 U	61 UJ	57 UR	72 UR
Benzene	3 U	4 U	4 U	3 UJ	3 UJ	4 UJ
Bromodichloromethane	3 U	4 U	4 U	3 UJ	3 UJ	4 UJ
Bromoform	3 U	4 U	4 U	3 UJ	3 UJ	4 UJ
Bromomethane	6 UJ	8 UJ	7 UJ	6 UJ	6 UJ	7 UJ
Carbon Disulfide	2 J	2 J	4 U	3 UJ	2 J	4 UJ
Carbon Tetrachloride	3 U	4 U	4 U	3 UJ	3 UJ	4 UJ
Chlorobenzene	3 U	4 U	4 U	3 UJ	3 UJ	4 UJ
Chlorodibromomethane	3 U	4 U	4 U	3 UJ	3 UJ	4 UJ
Chloroethane	6 U	8 U	7 U	6 UJ	6 UJ	7 UJ
Chloroform	3 U	4 U	4 U	3 UJ	3 UJ	4 UJ
Chloromethane	6 U	8 U	7 U	6 UJ	6 UJ	7 UJ
Chloroprene	6 U	8 U	7 U	6 UJ	6 UJ	7 UJ
Cis-1,2-Dichloroethene	6 U	8 U	7 U	6 UJ	6 UJ	7 UJ
Cis-1,3-Dichloropropene	3 U	4 U	4 U	3 UJ	3 UJ	4 UJ
Dibromomethane	6 U	8 U	7 U	6 UJ	6 UJ	7 UJ
Dichlorodifluoromethane	3 U	4 U	4 U	8 J	3 UJ	4 UJ
Ethyl Methacrylate	6 U	8 U	7 U	6 UJ	6 UJ	7 UJ
Ethylbenzene	3 U	4 U	4 U	3 UJ	3 UJ	4 UJ
Isobutanol	230 UR	300 UR	270 UR	250 UR	230 UR	290 UR
Methacrylonitrile	120 U	150 U	130 U	120 UJ	110 UJ	140 UJ
Methyl Iodide	6 UJ	8 UJ	7 UJ	6 UJ	6 UJ	7 UJ
Methyl Methacrylate	6 U	8 U	7 U	6 UJ	6 UJ	7 UJ
Methylene Chloride	6 UJ	8 UJ	7 UJ	6 UJ	6 UJ	7 UJ
Pentachloroethane	6 U	8 U	7 U	6 UJ	6 UJ	7 UJ
Propionitrile	120 UR	150 UR	130 UR	120 UR	110 UR	140 UR
Styrene	3 U	4 U	4 U	3 UJ	3 UJ	4 UJ

Calc = Calculated Value as described on Page X
NA = Not Analyzed

TABLE E-4-2

SUMMARY OF ANALYTIC RESULTS - ROUND 2 SEDIMENT
CRANE 158 - MUSTARD GAS BURIAL GROUND
NSWC CRANE
CRANE, INDIANA

Location	01SD01	01SD03	01SD09	01SD10	01SD11	01SD12
Nsample	01SD0102	01SD0302	01SD0902	01SD1002	01SD1102	01SD1202
Sample	01SD0102	01SD0302	01SD0902	01SD1002	01SD1102	01SD1202
Matrix	Sediment	Sediment	Sediment	Sediment	Sediment	Sediment
Depth Range	0 - 0.5	0 - 0 5	0 - 0.5	0 - 0 5	0 - 0.5	0 - 0 5
Risk	Background	Site	Site	Site	Site	Site
Sample Date	6/17/2002	6/17/2002	6/17/2002	6/17/2002	6/17/2002	6/17/2002
Tetrachloroethene	3 U	4 U	4 U	3 UJ	3 UJ	4 UJ
Toluene	3 U	2 J	1 J	3 UJ	1 J	4 UJ
Total Xylenes	3 U	4 U	4 U	3 UJ	3 UJ	4 UJ
Trans-1,2-Dichloroethene	6 UJ	8 U	7 U	6 UJ	6 UJ	7 UJ
Trans-1,3-Dichloropropene	3 U	4 U	4 U	3 UJ	3 UJ	4 UJ
Trans-1,4-Dichloro-2-Butene	6 U	8 U	7 U	6 UJ	6 UJ	7 UJ
Trichloroethene	3 U	4 U	4 U	3 UJ	3 UJ	4 UJ
Trichlorofluoromethane	6 U	8 U	7 U	6 UJ	6 UJ	7 UJ
Vinyl Acetate	3 U	4 U	4 U	3 UJ	3 UJ	4 UJ
Vinyl Chloride	6 U	8 U	7 U	6 UJ	6 UJ	7 UJ
Inorganics (mg/kg)						
Aluminum	7360	NA	NA	NA	NA	NA
Antimony	1 6 J	NA	NA	NA	NA	NA
Arsenic	28 4 J	NA	NA	NA	NA	NA
Barium	93 1	NA	NA	NA	NA	NA
Beryllium	1 7	NA	NA	NA	NA	NA
Cadmium	0 06 U	NA	NA	NA	NA	NA
Calcium	894 J	NA	NA	NA	NA	NA
Chromium	40 8 J	NA	NA	NA	NA	NA
Cobalt	27 4	NA	NA	NA	NA	NA
Copper	14 7 J	NA	NA	NA	NA	NA
Iron	76500 J	NA	NA	NA	NA	NA
Lead	26 3	NA	NA	NA	NA	NA
Magnesium	1190	NA	NA	NA	NA	NA
Manganese	1890	NA	NA	NA	NA	NA
Mercury	0 04	NA	NA	NA	NA	NA
Nickel	38 7	NA	NA	NA	NA	NA
Potassium	6 6 J	NA	NA	NA	NA	NA
Selenium	2 1	NA	NA	NA	NA	NA
Silver	0 14 U	NA	NA	NA	NA	NA
Sodium	308	NA	NA	NA	NA	NA
Strontium	8 8	NA	NA	NA	NA	NA
Thallium	0 57 U	NA	NA	NA	NA	NA
Tin	1 9 J	NA	NA	NA	NA	NA
Vanadium	43 6 J	NA	NA	NA	NA	NA
Zinc	71 7 J	NA	NA	NA	NA	NA
Total Radiologicals (pCi/g)						
Thorium-228	1 09	NA	NA	NA	NA	NA
Thorium-230	0 908	NA	NA	NA	NA	NA
Thorium-232	1 13	NA	NA	NA	NA	NA

Calc = Calculated Value as described on Page X
NA = Not Analyzed

TABLE E-5

SUMMARY OF ANALYTIC RESULTS - SURFACE WATER
CRANE 158 - MUSTARD GAS BURIAL GROUND
NSWC CRANE
CRANE, INDIANA

Location	01SW01	01SW02	01SW04	01SW05
Nsample	01SW0102	01SW0202	01SW0402	01SW0502
Sample	01SW0102	01SW0202	01SW0402	01SW0502
Matrix	Surface Water	Surface Water	Surface Water	Surface Water
Risk	Back	Site	Back	Site
Sample Date	6/17/2002	6/17/2002	6/18/2002	6/17/2002
Volatile Organics (ug/L)				
1,1,1,2-Tetrachloroethane	0 5 U	0 5 U	0 5 U	0 5 U
1,1,1-Trichloroethane	0 5 U	0 5 U	0 5 U	0 5 U
1,1,2,2-Tetrachloroethane	0 5 U	0 5 U	0 5 U	0 5 UJ
1,1,2-Trichloroethane	1 U	1 U	1 U	1 U
1,1-Dichloroethane	0 5 U	0 5 U	0 5 U	0 5 U
1,1-Dichloroethene	1 U	1 U	1 U	1 U
1,2,3-Trichloropropane	0 5 U	0 5 U	0 5 U	0 5 U
1,2-Dibromo-3-Chloropropane	1 UJ	1 UJ	1 UJ	1 UJ
1,2-Dibromoethane	0 6 U	0 6 U	0 6 U	0 6 U
1,2-Dichloroethane	0 5 U	0 5 U	0 5 U	0 5 U
1,2-Dichloropropane	1 U	1 U	1 U	1 U
1,4-Dioxane	100 UR	100 UR	100 UR	100 UR
2-Butanone	5 UR	5 UR	5 UR	5 UR
2-Hexanone	5 U	5 U	5 U	5 U
3-Chloropropene	5 U	5 U	5 U	5 U
4-Methyl-2-Pentanone	3 U	3 U	3 U	3 U
Acetone	5 UR	5 UR	5 UR	5 UR
Acetonitrile	40 UR	40 UR	40 UR	40 UR
Acrolein	10 UR	10 UR	10 UR	10 UR
Acrylonitrile	10 UR	10 UR	10 UR	10 UR
Benzene	0 5 U	0 5 U	0 5 U	0 5 U
Bromodichloromethane	0 5 U	0 5 U	0 5 U	0 5 U
Bromoform	0 5 U	0 5 U	0 5 U	0 5 U
Bromomethane	1 UJ	1 UJ	1 UJ	1 UJ
Carbon Disulfide	1 U	1 U	1 U	1 U
Carbon Tetrachloride	0 5 U	0 5 U	0 5 U	0 5 U
Chlorobenzene	0 5 U	0 5 U	0 5 U	0 5 U
Chlorodibromomethane	0 5 U	0 5 U	0 5 U	0 5 U
Chloroethane	1 U	1 U	1 U	1 U
Chloroform	0 5 U	0 5 U	0 5 U	0 5 U
Chloromethane	1 U	1 U	1 U	1 U
Chloroprene	1 U	1 U	1 U	1 U
Cis-1,2-Dichloroethene	1 U	1 U	1 U	1 U
Cis-1,3-Dichloropropene	3 U	3 U	3 U	3 U
Dibromomethane	1 U	1 U	1 U	1 U
Dichlorodifluoromethane	0 7 UJ	0 7 UJ	0 7 UJ	0 7 UJ
Ethyl Methacrylate	1 U	1 U	1 U	1 U
Ethylbenzene	0 5 U	0 5 U	0 5 U	0 5 U
Isobutanol	40 UR	40 UR	40 UR	40 UR
Methacrylonitrile	20 UR	20 UR	20 UR	20 UR
Methyl Iodide	1 U	1 U	1 U	1 U
Methyl Methacrylate	1 U	1 U	1 U	1 U
Methylene Chloride	1 UJ	1 UJ	1 UJ	1 UJ
Pentachloroethane	5 U	5 U	5 U	5 U
Propionitrile	20 UR	20 UR	20 UR	20 UR
Styrene	0 5 U	0 5 U	0 5 U	0 5 U

TABLE E-5

SUMMARY OF ANALYTIC RESULTS - SURFACE WATER
CRANE 158 - MUSTARD GAS BURIAL GROUND
NSWC CRANE
CRANE, INDIANA

Location	01SW01	01SW02	01SW04	01SW05
Nsample	01SW0102	01SW0202	01SW0402	01SW0502
Sample	01SW0102	01SW0202	01SW0402	01SW0502
Matrix	Surface Water	Surface Water	Surface Water	Surface Water
Risk	Back	Site	Back	Site
Sample Date	6/17/2002	6/17/2002	6/18/2002	6/17/2002
Tetrachloroethene	0 5 U	0 5 U	0 5 U	0 5 UJ
Toluene	0 5 U	0 5 U	0 5 U	0 5 U
Total Xylenes	3 U	3 U	3 U	3 U
Trans-1,2-Dichloroethene	1 U	1 U	1 U	1 U
Trans-1,3-Dichloropropene	3 U	3 U	3 U	3 U
Trans-1,4-Dichloro-2-Butene	1 U	1 U	1 U	1 U
Trichloroethene	0 5 U	0 5 U	0 5 U	0 5 UJ
Trichlorofluoromethane	1 U	1 U	1 U	1 U
Vinyl Acetate	3 U	3 U	3 U	3 U
Vinyl Chloride	1 U	1 U	1 U	1 U
Field Parameters				
Dissolved Oxygen - Meter (mg/L)	6 63	2 94	7 59	7 96
Oxidation Reduction Potential (MV)	335 9	278 4	274	291
pH (S U)	6 6	6 41	7 08	6 37
Specific Conductance (MS/CM)	0 114	0 121	0 114	0 058
Temperature (C)	17 08	17 53	16 4	16 79
Turbidity (NTU)	5 1	5 4	3 8	1 2

Appendix F

Statistical Methodology and Results of Statistical Analyses

F.1 Basis for Statistical Methodology

The foundation for the procedures used to analyze this data was the "Procedural Guidance for Statistically Analyzing Environmental Background Data" (SWDIV & EFA WEST, 1998) and the accompanying "Handbook for Statistical Analysis of Environmental Background Data" (SWDIV & EFA WEST, 1998).

F.2 Parametric and Non-parametric Analysis of Variance (ANOVA)

ANOVA is widely used in the examination of environmental data sets. A one-way classification ANOVA is used to determine whether or not the difference between average concentrations of a parameter detected on site and in representative background is statistically significant. Because only two means are compared, an ANOVA test will give the same result as the t-test for independent samples. The assumptions that the data are drawn from an underlying normal (or lognormal) distribution and that the data have homogeneous variances must be examined prior to employing a parametric ANOVA.

F.3 The Shapiro-Wilk "W-test" of Normality ($n \leq 50$)

As stated above, the data must be analyzed to determine whether they were drawn from an underlying normal or lognormal distribution. A number of statistical evaluations may be used to determine which, if either, of the distributions is exhibited by a given data set. As recommended by the EPA, the Shapiro-Wilk "W-test" (for sample sets < 50) and the Shapiro-Francia "W-test" (for sample sets > 50) are used to determine whether the data are normally or lognormally distributed (EPA, 1992). If the test is inconclusive, lognormality is assumed.

The Shapiro-Wilk W-test (Gilbert, 1987) is an effective method for determining whether a data set has been drawn from an underlying normal (or lognormal) distribution. By conducting the Shapiro-Wilk W-test on the log-transformed data, the test may be used to determine whether the data have been drawn from an underlying lognormal distribution. The null hypothesis (H_0) that is tested is:

> H_O - The population has a normal (or lognormal when the data is log-transformed) distribution.

The alternate hypothesis (H_A) is:

> H_A . The population does not have a normal (or lognormal when the data is log-transformed) distribution.

A 'W' statistic (W_{calc}) is computed and compared to a test statistic (W_{test}) for both the normal and log transformed data set. If both the normal and lognormal W_{calc} are greater than or equal to the W_{test}, then the underlying distribution is considered to be the one producing the greatest W_{calc} value. If only one W_{calc} value exceeds the W_{test} value the underlying distribution is the one represented by the value that exceeds the W_{test} value. If neither 'W' statistic is greater than or equal to the test statistic or if W_{calc} is equal for normal and lognormal. the underlying distribution is defaulted to lognormal. This is because "EPA's experience with environmental concentration data ... suggests that the Lognormal distribution is generally more appropriate as a default statistical model than the Normal distribution... " (EPA, 1992).

The following equations present a step-by-step procedure for conducting the W-test on the residuals.

- Step 1. Group all of the data from each of the individual (k) locations.

- Step 2. Order the n results from smallest to largest:

$$x_1 \leq x_2 \leq x_3 \leq \ldots \leq x_n$$

- Step 3. Compute the standard deviation by:

$$S_x = \sqrt{\sum_{i=1}^{n} \frac{\left(X_i - \overline{X}\right)^2}{(n-1)}}$$

- Step 4. Determine the coefficients a_1, a_2, a_3 ,.., a_k for the sample size n using Table F-1, where:

$$k = \frac{n}{2} \; if \; n \; is \; even \text{; and}$$

$$k = \frac{n-1}{2} \; if \; n \; is \; odd$$

- Step 5. Determine b by the formula:

$$b = \sum_{i=1}^{k} a_i \left(X_{[n-i+1]} - X_i\right) = \sum_{i=1}^{k} b_i$$

- Step 6. Calculate W_{calc} using b from above, where:

$$W_{calc} = \left[\frac{b}{S_x\sqrt{n-1}}\right]^2 \text{ x}$$

- Step 7. Determine W_{test} at the 5% significance level from Table F-2.

- Step 8. Reject H_O at the 5% significance level if W_{calc} is less than W_{test}.

To test the null hypothesis for a data set drawn from an underlying lognormal distribution, transform the data to $y_{1j}, y_{2j}, y_{3j}, \ldots, y_{km}$ where $y_{ij} = ln\ X_{ij}$. Repeat steps 1 through 8 as described in the preceding paragraphs.

F.4 Homogeneity of Variance

An important assumption in analysis of variance (ANOVA) is that the variances in the different groups are equal (homogeneous). A powerful and commonly used test of this assumption is the Levene test. This test has practically replaced the older and less robust Bartlett's test and Chi-square test.

Levene's test (homogeneity of variances): For each dependent variable, an analysis of variance is performed on the absolute deviations of values from the respective group means. If the Levene test is statistically significant, then the hypothesis of homogeneous variances should be rejected.

To conduct Levene's test first compute the absolute value of the residuals:

$$Zij = \left| Xij - \overline{Xi} \right|$$

where Xij represents the ith value from the jth location. Then run a standard one-way parametric analysis of variation (ANOVA) on the variable Zij (see below) If the F test is significant, reject the hypothesis of equal group variances. Otherwise, proceed with the analysis as planned.

F.5 Parametric ANOVA

Assume that a site has k locations and that n_i data points (analyte concentrations) are available for the ith location. The following presents a step-by-step procedure for conducting the parametric ANOVA.

- Step 1. Compute the sums and means of each well (*i*) using the following equations as follows:

$$X_i = \sum_{j=1}^{n_i} X_{ij}, \Sigma \text{ of all } n_i \text{ observations at location } i$$

$$\overline{X_i} = \frac{X_i}{n_i}, \text{average of all } n_i \text{ observations at location } i$$

$$X = \sum_{i=1}^{k} \sum_{j=1}^{n_i} X_{ij}, \text{grand total of all } n_i \text{ observations}$$

$$N = \sum_{i=1}^{k} n_i, \text{total number of observations}$$

$$\overline{X} = \frac{X}{N}, \text{ grand mean of all observations}$$

- Step 2. Compute the sum of squares of differences between the individual location means and the grand mean by the formula:

$$SS_{location} = \sum_{i=1}^{k} n_i \left(\overline{X_i} - \overline{X}\right)^2 = \sum_{i=1}^{k} \left[\frac{X_i^{\,2}}{n_i}\right] - \frac{X^2}{N}$$

This sum of squares has (*k-1*) degrees of freedom associated with it and is a measure of the variability between locations.

- Step 3. Compute the corrected total sum of squares by the formula:

$$SS_{total} = \sum_{i=1}^{k}\sum_{j=1}^{n_i}\left(X_{ij} - \overline{X}\right)^2 = \sum_{i=1}^{k}\sum_{j=1}^{n_i}\left[\left(X_{ij}\right)^2\right] - \frac{X^2}{N}$$

This sum of squares has (*N-1*) degrees of freedom associated with it and is a measure of variability in the whole data set.

- Step 4. Compute the sum of squares of differences of observations within locations from the location means. This value is the sum of squares due to error and is obtained by simple subtraction:

$$SS_{Error} = SS_{Total} - SS_{Well}$$

The sum of squares due to error has associated with it (*N-k*) degrees of freedom and is a measure of the variability within locations.

- Step 5. Set up an ANOVA table as shown below. The sums of squares and their degree of freedom were obtained from Steps 2 through 4. The mean square quantities are simply obtained by dividing each sum of squares by its corresponding degrees of freedom.

ONE-WAY PARAMETRIC ANOVA TABLE

Source of Variation	Sums of Squares	Degrees of Freedom	Mean Squares	F
Between Locations	$SS_{Location}$	k-1	$MS_{Location}=SS_{Location}/(k-1)$	$F=MS_{Location}/MS_{Error}$
Error (within Locations)	SS_{Error}	N-k	$MS_{Error}=SS_{Error}/(N-k)$	
Total	SS_{Total}	N-1		

- Step 6. To test the hypothesis of equal means for all *k* locations, compute $F = MS_{Location}/MS_{Error}$ (last column in above table). Compare this statistic to the

tabulated F statistic with (k-1) and (N-k) degrees of freedom (F-3) at the 5% significance level. If the calculated F value does not exceeds the tabulated value, conclude that there is no significant difference between the concentrations of the k locations. If the calculated F value exceeds the tabulated value, reject the hypothesis of equal location means. Check the site mean concentration relative to the background mean concentration. If the site mean is lower than the background mean, there is no evidence of contamination. If the background mean is lower than the site mean, the site concentration is statistically higher than the background concentration at a 95% confidence level.

F.5 Non-parametric ANOVA

The parametric ANOVA technique is the preferred approach for comparing environmental measurements site locations to representative background data. However, parametric ANOVA methods make two key assumptions: 1) the data are both normally (or both lognormally) distributed, and 2) the group variances are homogenous. If this assumption is violated, non-parametric tests (i.e. Kruskal-Wallis or Wilcoxon Rank-Sum tests) may be used to determine whether constituent concentrations present in the site areas significantly exceed those present background.

The Kruskal-Wallis (EPA, 1989) test should be employed when comparing three or more data sets. However, it is not amenable to two data set comparisons. In these situations, the Wilcoxon Rank-Sum test (EPA, 1992) (also known as the Mann-Whitney U test) should be employed.

Non-parametric tests are conducted using the ranks of the analytical results rather than the analytical results themselves. Therefore, the data sets are inspected for extremely high values that may be underestimated as a result of the ranking process.

F.6 The Wilcoxon Rank-Sum Test

The Wilcoxon Rank-Sum test is described in the following paragraphs.

- Step 1. Combine the background and site data and rank the ordered values from 1 to N. Assume there are n site samples and m background samples so that $N = m + n$.

- Step 2. Compute the Wilcoxon statistic W:

$$W = \sum_{i=1}^{n} E_i - \frac{1}{2}n(n+1)$$

where E_i are the ranks of the site samples. Large values of the statistic W give evidence of contamination in site locations.

- Step 3. Compute an approximate *Z-score*. To find the critical value of W, a normal approximation to its distribution is used. The expected value and standard deviation of W under the null hypothesis (i.e., no contamination exists) are given by the formulas

$$E(W) = \frac{1}{2}mn; \qquad SD(W) = \sqrt{\frac{1}{12}mn(N+1)}$$

An approximate *Z-score* for the Wilcoxon Rank-Sum test may be calculated by the following equations:

$$Z = \frac{W - E(W) - \frac{1}{2}}{SD(W)}$$

The factor of 1/2 in the numerator serves as a continuity correction because the discrete distribution of the statistic W is being approximated by the continuous normal distribution. If $n,m > 10$ and ties are present, an adjustment to the approximate *Z-score* must be made as follows:

$$Z_{RS} = \frac{W - E(W) - \frac{1}{2}}{SD'(W)}$$

where: $$SD'(W) = \left(\frac{mn}{12} \left[N + 1 - \frac{\sum_{j=1}^{g} t_j (t_j^2 - 1)}{N(N-1)} \right] \right)^{\frac{1}{2}}$$

g = the number of tied groups and t_j is the number of tied data in the jth group.

- Step 4. For a one-tailed 0.05 significance level test for H_0 versus H_A (i.e. the measurements from population 1 tend to exceed those from population 2), reject H_0 and accept H_A if

  $Z_{RS} > Z_{0.95} = +1.645$.

F.7 Two-Sample Test of Proportions

When more than 50% of the data for a constituent are non-detects, it is difficult to conduct a valid statistical test of whether the average site concentration is significantly greater than the average background concentration. The Two-Sample Test of Proportions is suitable for this situation.

The null and alternative hypotheses are:

$$H_0 : P_s \leq P_b$$
$$H_A : P_s > P_b$$

Where P_s and are P_b the true proportion of the site and background distributions of potential measurement that exceed a specified concentration C. The value of the concentration C should be just slightly greater than the greatest background non-detect value.

- Step 1. Let K_s and K_b be the number of site and background measurements that exceed C.

- Step 2. Compute $P_s = K_s / n$ and $P_b = K_b / m$ where there are n site samples and m background samples so that $N = m + n$..

- Step 3. Compute $P = (K_s + K_b) / N$.

- Step 4. Compute the Test Statistic: $Z_p = (P_s - P_b) / [P(1-P)(1/n+1/m)]^{1/2}$

- Step 5. At 95% confidence, reject H_0 and accept H_A if $Z_p > Z_{0\,95} = +1.645$.

F.8 Statistical Comparison of PBA and MGBG Populations

Samples from the Mustard Gas Burial Ground (MGBG) included samples from the 5 locations in the Primary Burial Area (PBA) and 15 other locations in what we will refer to as the Secondary Burial Area (SBA). Descriptive statistics (frequency of detection, minimum, maximum, mean) were calculated for surface soil and subsurface soil samples from both of these areas and are presented in Table F-3. Inspection of these values established that the organic constituents had similar concentrations in the PBA and the SBA. Differences in surface and subsurface concentrations were discovered, but these differences were consistent across both in the PBA and the SBA.

Wilcoxon Rank-Sum Non-Parametric ANOVA comparisons at 95% confidence were made for each of the 26 inorganic constituents. Surface soil results from the PBA were compared to surface soil results from the SBA and subsurface soil results from the PBA were compared to subsurface soil results from the SBA. Results of these comparisons showed only sodium to have statistically different concentrations in the surface soil (higher in the secondary burial area) and mercury and beryllium to have statistically different concentrations in the subsurface soil (mercury greater in the secondary burial area and beryllium greater in the primary burial area). The results are displayed in Tables F-4 and F-5.

One would expect to find one of the 26 constituents to be greater in one of the areas more than 72% of the time and two of the 26 constituents to be greater in one of the areas more than 35% of the time, even if the true concentrations in the two areas were statistically similar. There is no statistical evidence to indicate that the PBA and the SBA are different populations and no need to treat them differently during risk assessment.

F.9 NSWC Crane Basewide Background Soil Investigation Data Summary Statistics

While the data comparisons such as the WRS test described above require that all values in a complete data set be compared to values in another data set, it is helpful to summarize the data sets. Summary data are provided in Section 4 of the RFI report for the MGBG site data. Summary data for background Soil Groups 3, 8, and 9, corresponding to MGBG soils, are provided in Tables F-6 through F-8 of this appendix.

Table F-1
COEFFICIENTS A_i FOR W TEST OF NORMALITY FOR N=2 to 50

i/n	2	3	4	5	6	7	8	9	10
1	0 7071	0 7071	0 6872	0 6646	0 6431	0 6233	0 6052	0 5888	0 5739
2			0 1677	0 2413	0 2806	0 3031	0 3164	0 3244	0 3291
3					0 0875	0 1401	0 1743	0 1976	0 2141
4							0 0561	0 0947	0 1224
5									0 0399

i/n	11	12	13	14	15	16	17	18	19	20
1	0 5601	0 5475	0 5359	0 5251	0 5150	0 5056	0 4968	0 4886	0 4808	0 4734
2	0 3315	0 3325	0 3325	0 3318	0 3306	0 3290	0 3273	0 3253	0 3232	0 3211
3	0 2260	0 2347	0 2412	0 2460	0 2495	0 2521	0 2540	0 2553	0 2561	0 2565
4	0 1429	0 1586	0 1707	0 1802	0 1878	0 1939	0 1988	0 2027	0 2059	0 2085
5	0 0695	0 0922	0 1099	0 1240	0 1353	0 1447	0 1524	0 1587	0 1641	0 1686
6		0 0303	0 0539	0 0727	0 0880	0 1005	0 1109	0 1197	0 1271	0 1334
7				0 0240	0 0433	0 0593	0 0725	0 0837	0 0932	0 1013
8						0 0196	0 0359	0 0496	0 0612	0 0711
9								0 0163	0 0303	0 0422
10										0 0140

i/n	21	22	23	24	25	26	27	28	29	30
1	0 4643	0 4590	0 4542	0 4493	0 4450	0 4407	0 4366	0 4328	0 4291	0 4254
2	0 3185	0 3156	0 3126	0 3098	0 3069	0 3043	0 3018	0 2992	0 2968	0 2944
3	0 2578	0 2571	0 2563	0 2554	0 2543	0 2533	0 2522	0 2510	0 2499	0 2487
4	0 2119	0 2131	0 2139	0 2145	0 2148	0 2151	0 2152	0 2151	0 2150	0 2148
5	0 1736	0 1764	0 1787	0 1807	0 1822	0 1836	0 1848	0 1857	0 1864	0 1870
6	0 1399	0 1443	0 1480	0 1512	0 1539	0 1563	0 1584	0 1601	0 1616	0 1630
7	0 1092	0 1150	0 1201	0 1245	0 1283	0 1316	0 1346	0 1372	0 1395	0 1415
8	0 0804	0 0878	0 0941	0 0997	0 1046	0 1089	0 1128	0 1162	0 1192	0 1219
9	0 0530	0 0618	0 0696	0 0764	0 0823	0 0876	0 0923	0 0965	0 1002	0 1036
10	0 0263	0 0368	0 0459	0 0539	0 0610	0 0672	0 0728	0 0778	0 0822	0 0862
11		0 0122	0 0228	0 0321	0 0403	0 0476	0 0540	0 0598	0 0650	0 0697
12				0 0107	0 0200	0 0284	0 0358	0 0424	0 0483	0 0537
13						0 0094	0 0178	0 0253	0 0320	0 0381
14								0 0084	0 0159	0 0227
15										0 0076

i/n	31	32	33	34	35	36	37	38	39	40
1	0 4220	0 4188	0 4156	0 4127	0 4096	0 4068	0 4040	0 4015	0 9689	0 3964
2	0 2921	0 2898	0 2876	0 2854	0 2834	0 2813	0 2794	0 2774	0 2755	0 2737
3	0 2475	0 2463	0 2451	0 2439	0 2427	0 2415	0 2403	0 2391	0 2380	0 2368
4	0 2145	0 2141	0 2137	0 2132	0 2127	0 2121	0 2116	0 2110	0 2104	0 2098
5	0 1874	0 1878	0 1880	0 1882	0 1883	0 1883	0 1883	0 1881	0 1880	0 1878
6	0 1641	0 1651	0 1660	0 1667	0 1673	0 1678	0 1683	0 1686	0 1689	0 1691
7	0 1433	0 1449	0 1463	0 1475	0 1487	0 1496	0 1503	0 1513	0 1520	0 1526
8	0 1243	0 1265	0 1284	0 1301	0 1317	0 1331	0 1344	0 1356	0 1366	0 1376
9	0 1066	0 1093	0 1118	0 1140	0 1160	0 1179	0 1196	0 1211	0 1225	0 1237
10	0 0899	0 0931	0 0961	0 0988	0 1013	0 1036	0 1056	0 1075	0 1092	0 1108
11	0 0739	0 0777	0 0821	0 0844	0 0873	0 0900	0 0924	0 0947	0 0967	0 0986
12	0 0585	0 0629	0 0669	0 0706	0 0739	0 0770	0 0798	0 0824	0 0848	0 0870
13	0 0435	0 0485	0 0530	0 0572	0 0610	0 0645	0 0677	0 0706	0 0733	0 0759
14	0 0289	0 0344	0 0395	0 0441	0 0484	0 0523	0 0559	0 0592	0 0622	0 0651
15	0 0144	0 0206	0 0262	0 0314	0 0361	0 0404	0 0444	0 0481	0 0515	0 0546
16		0 0068	0 0131	0 0187	0 0239	0 0287	0 0331	0 0372	0 0409	0 0444
17				0 0062	0 0119	0 0172	0 0220	0 0264	0 0305	0 0343
18						0 0057	0 0110	0 0158	0 0203	0 0244
19								0 0053	0 0101	0 0146
20										0 0049

i/n	41	42	43	44	45	46	47	48	49	50
1	0 3940	0 3917	0 3894	0 3872	0 3850	0 3830	0 3808	0 3789	0 3770	0 3751
2	0 2719	0 2701	0 2684	0 2667	0 2651	0 2635	0 2620	0 2604	0 2589	0 2574
3	0 2357	0 2345	0 2334	0 2323	0 2313	0 2302	0 2291	0 2281	0 2271	0 2260
4	0 2091	0 2085	0 2078	0 2072	0 2065	0 2058	0 2052	0 2045	0 2038	0 2032
5	0 1876	0 1874	0 1871	0 1868	0 1865	0 1862	0 1859	0 1855	0 1851	0 1847
6	0 1693	0 1694	0 1695	0 1695	0 1695	0 1695	0 1695	0 1693	0 1692	0 1691
7	0 1531	0 1535	0 1539	0 1542	0 1545	0 1548	0 1550	0 1551	0 1553	0 1554
8	0 1384	0 1392	0 1398	0 1405	0 1410	0 1415	0 1420	0 1423	0 1427	0 1430
9	0 1249	0 1259	0 1269	0 1278	0 1286	0 1293	0 1300	0 1306	0 1312	0 1317
10	0 1123	0 1136	0 1149	0 1160	0 1170	0 1180	0 1189	0 1197	0 1205	0 1212
11	0 1004	0 1020	0 1035	0 1049	0 1062	0 1073	0 1085	0 1095	0 1105	0 1113
12	0 0891	0 0909	0 0927	0 0943	0 0959	0 0972	0 0986	0 0998	0 1010	0 1020
13	0 0782	0 0804	0 0824	0 0842	0 0860	0 0876	0 0892	0 0906	0 0919	0 0932
14	0 0677	0 0701	0 0724	0 0745	0 0775	0 0785	0 0801	0 0817	0 0832	0 0846
15	0 0575	0 0602	0 0628	0 0651	0 0673	0 0694	0 0713	0 0731	0 0748	0 0764
16	0 0476	0 0506	0 0534	0 0560	0 0584	0 0607	0 0628	0 0648	0 0667	0 0685
17	0 0379	0 0411	0 0442	0 0471	0 0497	0 0522	0 0546	0 0568	0 0588	0 0608
18	0 0283	0 0318	0 0352	0 0383	0 0412	0 0439	0 0465	0 0489	0 0511	0 0532
19	0 0188	0 0227	0 0263	0 0296	0 0328	0 0357	0 0385	0 0411	0 0436	0 0459
20	0 0094	0 0136	0 0175	0 0211	0 0245	0 0277	0 0307	0 0335	0 0361	0 0386
21		0 0045	0 0087	0 0126	0 0163	0 0197	0 0229	0 0259	0 0288	0 0314
22				0 0042	0 0081	0 0188	0 0153	0 0185	0 0215	0 0244
23						0 0039	0 0076	0 0111	0 0143	0 0174
24								0 0037	0 0071	0 0104
25										0 0350

Table F-2
PERCENTAGE POINTS OF THE W TEST FOR N=3 to 50

n	0.01	0.05
3	0.753	0.767
4	0.687	0.748
5	0.686	0.762
6	0.713	0.788
7	0.730	0.803
8	0.749	0.818
9	0.764	0.829
10	0.781	0.842
11	0.792	0.850
12	0.805	0.859
13	0.814	0.866
14	0.825	0.874
15	0.835	0.881
16	0.844	0.887
17	0.851	0.892
18	0.858	0.897
19	0.863	0.901
20	0.868	0.905
21	0.873	0.908
22	0.878	0.911
23	0.881	0.914
24	0.884	0.916
25	0.888	0.918
26	0.891	0.920
27	0.894	0.923
28	0.896	0.924
29	0.898	0.926
30	0.900	0.927

n	0.01	0.05
31	0.902	0.929
32	0.904	0.930
33	0.906	0.931
34	0.908	0.933
35	0.910	0.934
36	0.912	0.935
37	0.914	0.936
38	0.916	0.938
39	0.917	0.939
40	0.919	0.940
41	0.920	0.941
42	0.922	0.942
43	0.923	0.943
44	0.924	0.944
45	0.926	0.945
46	0.927	0.945
47	0.928	0.946
48	0.929	0.947
49	0.929	0.947
50	0.930	0.947

TABLE F-3

Descriptive Statistics of Mustard Gas Burial Ground
PBA Surface and Subsurface vs. PBA Complement Surface and Subsurface

	PBA Surface Soil				SBA Surface Soil				PBA Subsurface Soil				SBA Subsurface Soil			
parameter	frequency	min	max	avg_all	frequency	min	max	avg_all	frequency	min	max	avg_all	frequency	min	max	avg_all
Volatile Organics (ug/kg)																
1,1,1,2-TETRACHLOROETHANE	0/5	0	0	1 50	0/15	0	0	1 67	0/7	0	0	1 43	0/28	0	0	110 71
1,1,1-TRICHLOROETHANE	0/5	0	0	1 50	0/15	0	0	1 67	0/7	0	0	1 43	0/28	0	0	198 21
1,1,2,2-TETRACHLOROETHANE	0/5	0	0	1 50	0/15	0	0	1 67	1/7	2	2	1 50	0/28	0	0	1 52
1,1,2-TRICHLOROETHANE	0/5	0	0	2 80	0/15	0	0	3 17	0/7	0	0	2 50	0/28	0	0	1 52
1,1-DICHLOROETHANE	0/5	0	0	1 50	0/15	0	0	1 67	0/7	0	0	1 43	0/28	0	0	1 52
1,1-DICHLOROETHENE	0/5	0	0	2 80	0/15	0	0	3 17	0/7	0	0	2 50	0/28	0	0	2 66
1,2,3-TRICHLOROPROPANE	0/5	0	0	1 50	0/15	0	0	1 67	0/7	0	0	1 43	0/28	0	0	1 52
1,2-DIBROMO-3-CHLOROPROPANE	0/5	0	0	2 80	0/15	0	0	3 17	0/7	0	0	2 50	0/28	0	0	2 66
1,2-DIBROMOETHANE	0/5	0	0	1 50	0/15	0	0	1 67	0/7	0	0	1 43	0/28	0	0	1 52
1,2-DICHLOROETHANE	0/5	0	0	1 50	0/15	0	0	1 67	0/7	0	0	1 43	0/28	0	0	2 66
1,2-DICHLOROPROPANE	0/5	0	0	2 80	0/15	0	0	3 17	0/7	0	0	2 50	0/28	0	0	1.52
2-BUTANONE	0/5	0	0	2 80	2/15	38	71	10 00	0/7	0	0	2 50	0/28	0	0	1 52
2-HEXANONE	0/5	0	0	2 80	0/15	0	0	3 17	0/7	0	0	2 50	0/28	0	0	2 66
3-CHLOROPROPENE	0/5	0	0	2 80	0/15	0	0	3 17	0/7	0	0	2 50	0/28	0	0	2 66
4-METHYL-2-PENTANONE	0/5	0	0	1 50	0/15	0	0	1 67	0/7	0	0	1 43	0/28	0	0	2 66
ACETONE	0/5	0	0	2 80	4/15	21	180	98 90	0/7	0	0	2 50	0/28	0	0	2 66
ACETONITRILE	0/5	0	0	113 00	0/15	0	0	125 67	0/7	0	0	99 29	0/28	0	0	1 52
ACRYLONITRILE	0/5	0	0	28 10	0/15	0	0	31 67	0/7	0	0	25 00	12/28	6	42	11 20
BENZENE	0/5	0	0	1 50	0/15	0	0	1 67	0/7	0	0	1 43	0/28	0	0	107 14
BROMODICHLOROMETHANE	0/5	0	0	1 50	0/15	0	0	1 67	0/7	0	0	1 43	0/28	0	0	26 79
BROMOFORM	0/5	0	0	1 50	0/15	0	0	1 67	0/7	0	0	1 43	0/28	0	0	1 52
BROMOMETHANE	0/5	0	0	2 80	0/15	0	0	3 17	0/7	0	0	2 50	0/28	0	0	1 52
CARBON DISULFIDE	0/5	0	0	1 50	1/15	6	6	1 90	0/7	0	0	1 43	0/28	0	0	1 52
CARBON TETRACHLORIDE	0/5	0	0	1 50	0/15	0	0	1 67	0/7	0	0	1 43	0/28	0	0	2 66
CHLOROBENZENE	0/5	0	0	1 50	0/15	0	0	1 67	0/7	0	0	1 43	0/28	0	0	1.52
CHLORODIBROMOMETHANE	0/5	0	0	1 50	0/15	0	0	1 67	0/7	0	0	1 43	0/28	0	0	1 52
CHLOROETHANE	0/5	0	0	2 80	0/15	0	0	3 17	0/7	0	0	2 50	0/28	0	0	1 52
CHLOROFORM	0/5	0	0	1 50	0/15	0	0	1 67	1/7	4	4	1 79	0/28	0	0	1 52
CHLOROMETHANE	0/5	0	0	2 80	0/15	0	0	3 17	0/7	0	0	2 50	0/28	0	0	2 66
CHLOROPRENE	0/5	0	0	2 80	0/15	0	0	3 17	0/7	0	0	2.50	0/28	0	0	1 52
CIS-1,2-DICHLOROETHENE	0/5	0	0	2 80	0/15	0	0	3 17	0/7	0	0	2 50	0/28	0	0	2 66
CIS-1,3-DICHLOROPROPENE	0/5	0	0	1 50	0/15	0	0	1 67	0/7	0	0	1 43	0/28	0	0	2 66
DIBROMOMETHANE	0/5	0	0	2 80	0/15	0	0	3 17	0/7	0	0	2.50	0/28	0	0	2 66
DICHLORODIFLUOROMETHANE	0/5	0	0	1 50	0/15	0	0	1 67	0/7	0	0	1 43	0/28	0	0	1 52
ETHYL METHACRYLATE	0/5	0	0	2 80	0/15	0	0	3 17	0/7	0	0	2 50	0/28	0	0	2 66
ETHYLBENZENE	0/5	0	0	1 50	0/15	0	0	1 67	0/7	0	0	1 43	0/28	0	0	1 52
METHACRYLONITRILE	0/5	0	0	56 00	0/15	0	0	64 00	0/7	0	0	49 71	0/28	0	0	2 66
METHYL IODIDE	0/5	0	0	2 80	0/15	0	0	3 17	0/7	0	0	2 50	0/28	0	0	1 52
METHYL METHACRYLATE	0/5	0	0	2 80	0/15	0	0	3 17	0/7	0	0	2 50	0/28	0	0	54 09
METHYLENE CHLORIDE	0/5	0	0	4 70	10/15	2	61	16 90	1/7	3	3	9 36	0/28	0	0	2 66
PENTACHLOROETHANE	0/5	0	0	2 80	0/15	0	0	3 17	0/7	0	0	2 50	0/28	0	0	2 66
STYRENE	0/5	0	0	1 50	0/15	0	0	1 67	0/7	0	0	1 43	26/28	4	86	20 54
TETRACHLOROETHENE	0/5	0	0	1 50	0/15	0	0	1 67	0/7	0	0	1 43	0/28	0	0	2 66
TOLUENE	0/5	0	0	1 50	1/15	2	2	1 67	0/7	0	0	1 43	0/28	0	0	1 52
TOTAL XYLENES	0/5	0	0	1 50	0/15	0	0	1 67	0/7	0	0	1 43	0/28	0	0	1 52
TRANS-1,2-DICHLOROETHENE	0/5	0	0	2 80	0/15	0	0	3 17	0/7	0	0	2 50	0/28	0	0	1 52
TRANS-1,3-DICHLOROPROPENE	0/5	0	0	1 50	0/15	0	0	1 67	0/7	0	0	1 43	0/28	0	0	1.52
TRANS-1,4-DICHLORO-2-BUTENE	0/5	0	0	2 80	0/15	0	0	3 17	0/7	0	0	2 50	0/28	0	0	2 66

TABLE F-3

Descriptive Statistics of Mustard Gas Burial Ground
PBA Surface and Subsurface vs. PBA Complement Surface and Subsurface

	PBA Surface Soil				SBA Surface Soil				PBA Subsurface Soil				SBA Subsurface Soil			
parameter	frequency	min	max	avg_all	frequency	min	max	avg_all	frequency	min	max	avg_all	frequency	min	max	avg_all
TRICHLOROETHENE	0/5	0	0	1 50	0/15	0	0	1 67	0/7	0	0	1 43	0/28	0	0	1 52
TRICHLOROFLUOROMETHANE	0/5	0	0	2 80	0/15	0	0	3 17	0/7	0	0	2.50	0/28	0	0	2 66
VINYL ACETATE	0/5	0	0	1 50	0/15	0	0	1 67	0/7	0	0	1 43	0/28	0	0	1 52
VINYL CHLORIDE	0/5	0	0	2 80	0/15	0	0	3 17	0/7	0	0	2 50	0/28	0	0	2 66
Semivolatile Organics (ug/kg)																
1,2,4,5-TETRACHLOROBENZENE	0/5	0	0	208 00	0/15	0	0	208 67	0/7	0	0	192 86	0/28	0	0	198 21
1,2,4-TRICHLOROBENZENE	0/5	0	0	208 00	0/15	0	0	208 67	0/7	0	0	192 86	0/28	0	0	198 21
1,2-DICHLOROBENZENE	0/5	0	0	106 00	0/15	0	0	105 00	0/7	0	0	97 86	0/28	0	0	100 18
1,3-DICHLOROBENZENE	0/5	0	0	106 00	0/15	0	0	105 00	0/7	0	0	97 86	0/28	0	0	100 18
1,4-DICHLOROBENZENE	0/5	0	0	106 00	0/15	0	0	105 00	0/7	0	0	97 86	0/28	0	0	100 18
1,4-NAPHTHOQUINONE	0/5	0	0	208 00	0/15	0	0	208 67	0/7	0	0	192 86	0/28	0	0	198 21
1,4-PHENYLENEDIAMINE	0/5	0	0	510 00	0/15	0	0	517 67	0/7	0	0	479 29	0/28	0	0	492 32
1-NAPHTHYLAMINE	0/5	0	0	208 00	0/15	0	0	208 67	0/7	0	0	192 86	0/28	0	0	198 21
2,2'-OXYBIS(1-CHLOROPROPANE)	0/5	0	0	106 00	0/15	0	0	105 00	0/7	0	0	97 86	0/28	0	0	100 18
2,3,4,6-TETRACHLOROPHENOL	0/5	0	0	208 00	0/15	0	0	208 67	0/7	0	0	192 86	0/28	0	0	198 21
2,4,5-TRICHLOROPHENOL	0/5	0	0	510 00	0/15	0	0	517 67	0/7	0	0	479 29	0/28	0	0	492 32
2,4,6-TRICHLOROPHENOL	0/5	0	0	208 00	0/15	0	0	208 67	0/7	0	0	192 86	0/28	0	0	198 21
2,4-DICHLOROPHENOL	0/5	0	0	208 00	0/15	0	0	208 67	0/7	0	0	192 86	0/28	0	0	198 21
2,4-DIMETHYLPHENOL	0/5	0	0	208 00	0/15	0	0	208 67	0/7	0	0	192 86	0/28	0	0	198 21
2,4-DINITROPHENOL	0/5	0	0	510 00	0/15	0	0	517 67	0/7	0	0	479 29	0/28	0	0	492.32
2,6-DICHLOROPHENOL	0/5	0	0	208 00	0/15	0	0	208 67	0/7	0	0	192 86	0/28	0	0	198 21
2-ACETYLAMINOFLUORENE	0/5	0	0	106 00	0/15	0	0	105 00	0/7	0	0	97 86	0/28	0	0	100 18
2-CHLORONAPHTHALENE	0/5	0	0	106 00	0/15	0	0	105 00	0/7	0	0	97 86	0/28	0	0	100 18
2-CHLOROPHENOL	0/5	0	0	106 00	0/15	0	0	105 00	0/7	0	0	97 86	0/28	0	0	100 18
2-METHYLNAPHTHALENE	0/5	0	0	106 00	0/15	0	0	105 00	0/7	0	0	97 86	0/28	0	0	100 18
2-METHYLPHENOL	0/5	0	0	106 00	0/15	0	0	105 00	0/7	0	0	97 86	0/28	0	0	100 18
2-NAPHTHYLAMINE	0/5	0	0	106 00	0/15	0	0	105 00	0/7	0	0	98 57	0/28	0	0	100 54
2-NITROANILINE	0/5	0	0	255 00	0/15	0	0	259 33	0/7	0	0	240 71	0/28	0	0	247.14
2-NITROPHENOL	0/5	0	0	208 00	0/15	0	0	208 67	0/7	0	0	192 86	0/28	0	0	198 21
2-PICOLINE	0/5	0	0	156 00	0/15	0	0	152 33	0/7	0	0	145 00	0/28	0	0	150 18
3,3'-DICHLOROBENZIDINE	0/5	0	0	208 00	0/15	0	0	208 67	0/7	0	0	192 86	0/28	0	0	198 21
3,3'-DIMETHYLBENZIDINE	0/5	0	0	208 00	0/15	0	0	208 67	0/7	0	0	192 86	0/28	0	0	198 21
3-METHYLCHOLANTHRENE	0/5	0	0	236 00	0/15	0	0	234 00	0/7	0	0	215 71	0/28	0	0	222 14
3-METHYLPHENOL	0/5	0	0	106 00	0/15	0	0	105 00	0/7	0	0	97 86	0/28	0	0	100 18
3-NITROANILINE	0/5	0	0	510 00	0/15	0	0	517 67	0/7	0	0	479 29	0/28	0	0	492 32
4,6-DINITRO-2-METHYLPHENOL	0/5	0	0	510 00	0/15	0	0	517 67	0/7	0	0	479 29	0/28	0	0	492 32
4-AMINOBIPHENYL	0/5	0	0	106 00	0/15	0	0	105 00	0/7	0	0	97 86	0/28	0	0	100 18
4-BROMOPHENYL PHENYL ETHER	0/5	0	0	208 00	0/15	0	0	208 67	0/7	0	0	192 86	0/28	0	0	198 21
4-CHLORO-3-METHYLPHENOL	0/5	0	0	208 00	0/15	0	0	208 67	0/7	0	0	192 86	0/28	0	0	198 21
4-CHLOROANILINE	0/5	0	0	208 00	0/15	0	0	208 67	0/7	0	0	192 86	0/28	0	0	198 21
4-CHLOROPHENYL PHENYL ETHER	0/5	0	0	106 00	0/15	0	0	105 00	0/7	0	0	97 86	0/28	0	0	100 18
4-METHYLPHENOL	0/5	0	0	106 00	0/15	0	0	105 00	0/7	0	0	97 86	0/28	0	0	100 18
4-NITROANILINE	0/5	0	0	510 00	0/15	0	0	517 67	0/7	0	0	479 29	0/28	0	0	492 32
4-NITROPHENOL	0/5	0	0	510 00	0/15	0	0	517 67	0/7	0	0	479 29	0/28	0	0	492 32
5-NITRO-O-TOLUIDINE	0/5	0	0	208 00	0/15	0	0	208 67	0/7	0	0	192 86				
7,12-DIMETHYLBENZ(A)ANTHRACENE	0/5	0	0	156 00	1/15	260	260	161 00	0/7	0	0	145 00	0/2	0	0	465 00
A,A-DIMETHYLPHENETHYLAMINE	0/5	0	0	510 00	0/15	0	0	517 67	0/7	0	0	479 29	0/28	0	0	198 21
ACENAPHTHENE	0/5	0	0	6 25	2/15	15 8	70 8	11 18	0/7	0	0	5 76	0/28	0	0	150 18
ACENAPHTHYLENE	0/4	0	0	6 26	0/15	0	0	6 23	0/7	0	0	5 76	0/28	0	0	492 32

TABLE F-3

Descriptive Statistics of Mustard Gas Burial Ground
PBA Surface and Subsurface vs. PBA Complement Surface and Subsurface

	PBA Surface Soil				SBA Surface Soil				PBA Subsurface Soil				SBA Subsurface Soil			
parameter	frequency	min	max	avg_all	frequency	min	max	avg_all	frequency	min	max	avg_all	frequency	min	max	avg_all
ACETOPHENONE	0/5	0	0	106 00	0/15	0	0	105 00	0/7	0	0	97 86	3/27	4 34	30 3	7 11
ANILINE	0/5	0	0	106 00	0/15	0	0	105 00	0/7	0	0	97 86	0/27	0	0	5 96
ANTHRACENE	0/5	0	0	6 25	0/15	0	0	6 23	0/7	0	0	5 76	0/28	0	0	100.18
ARAMITE	0/5	0	0	510 00	0/15	0	0	517 67	0/7	0	0	479 29	0/28	0	0	100 18
BENZO(A)ANTHRACENE	0/5	0	0	6 25	0/15	0	0	6 23	0/7	0	0	5.76	1/27	41 5	41 5	7 27
BENZO(A)PYRENE	1/5	11 9	11 9	7 40	0/15	0	0	6 23	0/7	0	0	5 76	0/28	0	0	492 32
BENZO(B)FLUORANTHENE	0/5	0	0	6 25	0/15	0	0	6 23	0/7	0	0	5 76	1/27	153	153	11 40
BENZO(G,H,I)PERYLENE	1/5	11 8	11 8	7 38	0/15	0	0	6 23	0/7	0	0	5 76	1/27	181	181	12 44
BENZO(K)FLUORANTHENE	0/5	0	0	6 25	0/15	0	0	6 23	0/7	0	0	5 76	1/27	318	318	17.51
BENZYL ALCOHOL	0/5	0	0	135 00	0/15	0	0	135 00	0/7	0	0	135 00	1/27	160	160	11 66
BIS(2-CHLOROETHOXY)METHANE	0/5	0	0	208 00	0/15	0	0	208 67	0/7	0	0	192 86	0/27	0	0	5 96
BIS(2-CHLOROETHYL)ETHER	0/5	0	0	106 00	0/15	0	0	105 00	0/7	0	0	97 86	0/28	0	0	135 00
BIS(2-ETHYLHEXYL)PHTHALATE	1/5	420	420	169 00	2/15	83	89	103 47	1/7	5600	5600	883 57	0/28	0	0	198 21
BUTYL BENZYL PHTHALATE	0/5	0	0	106 00	0/15	0	0	105 00	0/7	0	0	97 86	0/28	0	0	100 18
CHLOROBENZILATE	0/5	0	0	208 00	0/15	0	0	208 67	0/7	0	0	192 86	2/28	97	110	100 61
CHRYSENE	0/5	0	0	6 25	0/15	0	0	6 23	0/7	0	0	5 76	0/28	0	0	100 18
DIALLATE	0/5	0	0	208 00	0/15	0	0	208 67	0/7	0	0	192 86	0/28	0	0	198 21
DIBENZO(A,H)ANTHRACENE	0/5	0	0	6 25	0/15	0	0	6 23	0/7	0	0	5 76	1/27	108	108	9 74
DIBENZOFURAN	0/5	0	0	106 00	0/15	0	0	105 00	0/7	0	0	97 86	0/28	0	0	198.21
DIETHYL PHTHALATE	0/5	0	0	106 00	0/15	0	0	105 00	0/7	0	0	97 86	0/27	0	0	5 96
DIMETHYL PHTHALATE	0/5	0	0	106 00	0/15	0	0	105 00	0/7	0	0	97 86	0/28	0	0	100 18
DI-N-BUTYL PHTHALATE	0/5	0	0	106 00	0/15	0	0	105 00	0/7	0	0	97 86	0/28	0	0	100 18
DI-N-OCTYL PHTHALATE	0/5	0	0	106 00	0/15	0	0	105 00	0/7	0	0	98 57	0/28	0	0	100 18
DIPHENYLAMINE	0/5	0	0	106 00	0/15	0	0	105 00	0/7	0	0	97 86	0/28	0	0	100 18
ETHYL METHANE SULFONATE	0/5	0	0	106 00	0/15	0	0	105 00	0/7	0	0	97 86	0/28	0	0	100 54
FLUORANTHENE	1/5	3 98	3 98	5 82	0/15	0	0	6 23	0/7	0	0	5 76	0/28	0	0	100 18
FLUORENE	0/5	0	0	6 25	0/15	0	0	6 23	0/7	0	0	5 76	0/28	0	0	100 18
HEXACHLOROBENZENE	0/5	0	0	208 00	0/15	0	0	208 67	0/7	0	0	192 86	1/27	540	540	25 74
HEXACHLOROBUTADIENE	0/5	0	0	208 00	0/15	0	0	208 67	0/7	0	0	192 86	1/27	22 3	22 3	6 56
HEXACHLOROCYCLOPENTADIENE	0/5	0	0	208 00	0/15	0	0	208 67	0/7	0	0	192 86	0/28	0	0	198 21
HEXACHLOROETHANE	0/5	0	0	106 00	0/15	0	0	105 00	0/7	0	0	97.86	0/28	0	0	198 21
HEXACHLOROPHENE	0/5	0	0	8,500 00	0/15	0	0	8,366 67	0/7	0	0	7,714 29	0/28	0	0	198 21
HEXACHLOROPROPENE	0/5	0	0	208 00	0/15	0	0	208 67	0/7	0	0	192 86	0/28	0	0	100 18
INDENO(1,2,3-CD)PYRENE	1/5	4 55	4 55	5 93	0/15	0	0	6 23	0/7	0	0	5 76	0/28	0	0	7,875.00
ISODRIN	0/5	0	0	208 00	0/15	0	0	208 67	0/7	0	0	192 86	0/28	0	0	198 21
ISOPHORONE	0/5	0	0	106 00	0/15	0	0	105 00	0/7	0	0	97 86	1/27	68 1	68 1	8 26
ISOSAFROLE	0/5	0	0	208 00	5/15	400	46000	3,655 67	0/7	0	0	192 86	0/28	0	0	198 21
KEPONE	0/5	0	0	510 00	0/15	0	0	517 67	0/7	0	0	479 29	0/28	0	0	100 18
METHAPYRILENE	0/1	0	0	500 00	0/6	0	0	501 67	0/2	0	0	460 00	0/28	0	0	198 21
METHYL METHANE SULFONATE	0/5	0	0	255 00	0/15	0	0	259 33	0/7	0	0	240 71	0/28	0	0	492.32
NAPHTHALENE	0/4	0	0	6 26	0/12	0	0	6 32	3/7	8 52	10 2	7 12	0/22	0	0	492.73
N-NITROSODIETHYLAMINE	0/5	0	0	106 00	0/15	0	0	105 00	0/7	0	0	97 86	0/28	0	0	247 14
N-NITROSODIMETHYLAMINE	0/5	0	0	106 00	0/15	0	0	105 00	0/7	0	0	97 86	0/17	0	0	6.01
N-NITROSO-DI-N-BUTYLAMINE	0/5	0	0	208 00	0/15	0	0	208.67	0/7	0	0	192 86	0/28	0	0	100 18
N-NITROSO-DI-N-PROPYLAMINE	0/5	0	0	106 00	0/15	0	0	105 00	0/7	0	0	97 86	0/28	0	0	100 18
N-NITROSOMETHYLETHYLAMINE	0/5	0	0	106 00	0/15	0	0	105 00	0/7	0	0	97 86	0/28	0	0	198 21
N-NITROSOMORPHOLINE	0/5	0	0	106 00	0/15	0	0	105 00	0/7	0	0	97 86	0/28	0	0	100 18
N-NITROSOPIPERIDINE	0/5	0	0	208 00	0/15	0	0	208 67	0/7	0	0	192 86	0/28	0	0	100 18
N-NITROSOPYRROLIDINE	0/5	0	0	106 00	0/15	0	0	105 00	0/7	0	0	97 86	0/28	0	0	100 18

TABLE F-3

Descriptive Statistics of Mustard Gas Burial Ground
PBA Surface and Subsurface vs. PBA Complement Surface and Subsurface

	PBA Surface Soil				SBA Surface Soil				PBA Subsurface Soil				SBA Subsurface Soil			
parameter	frequency	min	max	avg_all	frequency	min	max	avg_all	frequency	min	max	avg_all	frequency	min	max	avg_all
O,O,O-TRIETHYL PHOSPHOROTHIOATE	0/5	0	0	208 00	0/15	0	0	208 67	0/7	0	0	192 86	0/28	0	0	198 21
O-TOLUIDINE	0/5	0	0	106 00	0/15	0	0	105 00	0/7	0	0	97 86	0/28	0	0	100 18
P-(DIMETHYLAMINO)AZOBENZENE	0/5	0	0	208 00	0/15	0	0	208 67	0/7	0	0	192 86	0/28	0	0	198 21
PENTACHLOROBENZENE	0/5	0	0	208 00	0/15	0	0	208 67	0/7	0	0	192 86	0/28	0	0	100 18
PENTACHLORONITROBENZENE	0/5	0	0	510 00	0/15	0	0	517 67	0/7	0	0	479 29	0/28	0	0	198 21
PHENACETIN	0/5	0	0	208 00	0/15	0	0	208 67	0/7	0	0	192 86	0/28	0	0	198 21
PHENANTHRENE	0/5	0	0	6 25	0/14	0	0	6 23	0/7	0	0	5 76	0/28	0	0	492 32
PHENOL	0/5	0	0	106 00	0/15	0	0	105 00	0/7	0	0	97 86	0/28	0	0	198 21
PRONAMIDE	0/1	0	0	205 00	0/4	0	0	220 00	0/2	0	0	185 00	1/27	278	278	16 03
PYRENE	1/5	14 6	14 6	7 93	0/15	0	0	6 23	0/7	0	0	5 76	0/28	0	0	100 18
PYRIDINE	0/5	0	0	110 00	0/15	0	0	112 33	0/7	0	0	110 00	0/12	0	0	199 17
SAFROLE	0/5	0	0	208 00	0/15	0	0	208 67	0/7	0	0	192 86	1/27	306	306	17 07
Energetics (ug/kg)																
1,3,5-TRINITROBENZENE	0/5	0	0	240 40	0/15	0	0	242 07	0/7	0	0	239 71	0/28	0	0	238 21
1,3-DINITROBENZENE	0/5	0	0	240 40	0/15	0	0	242 07	0/7	0	0	239 71	0/28	0	0	238 21
2,4,6-TRINITROTOLUENE	0/5	0	0	240 40	0/15	0	0	242 07	0/7	0	0	239 71	0/28	0	0	238 21
2,4-DINITROTOLUENE	0/5	0	0	240 40	0/15	0	0	242 07	0/7	0	0	239 71	0/28	0	0	238 21
2,6-DINITROTOLUENE	0/5	0	0	240 40	0/15	0	0	242 07	0/7	0	0	239 71	0/28	0	0	238 21
2-AMINO-4,6-DINITROTOLUENE	0/5	0	0	240 40	0/15	0	0	242 07	0/7	0	0	239 71	0/28	0	0	238 21
2-NITROTOLUENE	0/5	0	0	240 40	0/15	0	0	242 07	0/7	0	0	239 71	0/28	0	0	238 21
3-NITROTOLUENE	0/5	0	0	240 40	0/15	0	0	242 07	0/7	0	0	239 71	0/28	0	0	238 21
4-AMINO-2,6-DINITROTOLUENE	0/5	0	0	240 40	0/15	0	0	242 07	0/7	0	0	239 71	0/28	0	0	238 21
4-NITROTOLUENE	0/5	0	0	240 40	0/15	0	0	242 07	0/7	0	0	239 71	0/28	0	0	238 21
HMX	0/5	0	0	240 40	0/15	0	0	242 07	0/7	0	0	239 71	1/28	70 6	70 6	231 81
NITROBENZENE	0/5	0	0	240 40	0/15	0	0	242 07	0/7	0	0	239 71	0/28	0	0	238 21
RDX	0/5	0	0	240 40	0/15	0	0	242 07	0/7	0	0	239 71	0/28	0	0	238 21
TETRYL	0/5	0	0	240 40	0/15	0	0	242 07	0/7	0	0	239 71	0/28	0	0	238 21
Pesticides/PCBs (ug/kg)																
4,4'-DDD	0/5	0	0	1 56	0/15	0	0	1 56	0/5	0	0	1 48	0/28	0	0	1 52
4,4'-DDE	0/5	0	0	1 56	0/15	0	0	1 56	0/5	0	0	1 48	0/28	0	0	2 66
4,4'-DDT	0/5	0	0	1 56	0/15	0	0	1 56	0/5	0	0	1 48	0/15	0	0	1 52
ALDRIN	0/5	0	0	0 81	0/15	0	0	0 81	0/5	0	0	0 76	0/15	0	0	1 52
ALPHA-BHC	0/5	0	0	0 81	0/15	0	0	0 81	0/5	0	0	0 76	0/15	0	0	1 52
ALPHA-CHLORDANE	0/5	0	0	0 81	0/15	0	0	0 81	0/5	0	0	0 76	0/15	0	0	0 80
AROCLOR-1016	0/5	0	0	20 70	0/15	0	0	20 63	0/5	0	0	19 40	0/15	0	0	0 80
AROCLOR-1221	0/5	0	0	20 70	0/15	0	0	20 63	0/5	0	0	19 40	0/15	0	0	0 80
AROCLOR-1232	0/5	0	0	20 70	0/15	0	0	20 63	0/5	0	0	19 40	0/15	0	0	20 03
AROCLOR-1242	0/5	0	0	20 70	0/15	0	0	20 63	0/5	0	0	19 40	0/15	0	0	20 03
AROCLOR-1248	0/5	0	0	20 70	0/15	0	0	20 63	0/5	0	0	19 40	0/15	0	0	20 03
AROCLOR-1254	0/5	0	0	20 70	0/15	0	0	20 63	0/5	0	0	19 40	0/15	0	0	20 03
AROCLOR-1260	0/5	0	0	20 70	0/15	0	0	20 63	0/5	0	0	19 40	0/15	0	0	20 03
BETA-BHC	0/5	0	0	0 81	0/15	0	0	0 81	0/5	0	0	0 76	0/15	0	0	20 03
DELTA-BHC	0/5	0	0	0 81	0/15	0	0	0 81	0/5	0	0	0 76	0/15	0	0	20 03
DIELDRIN	0/5	0	0	1 56	0/15	0	0	1 56	0/5	0	0	1 48	0/15	0	0	0 80
ENDOSULFAN I	0/5	0	0	0 81	0/15	0	0	0 81	0/5	0	0	0 76	0/15	0	0	0 80
ENDOSULFAN II	0/5	0	0	1 56	0/15	0	0	1 56	0/5	0	0	1 48	0/15	0	0	1 52
ENDOSULFAN SULFATE	0/5	0	0	1 56	0/15	0	0	1 56	0/5	0	0	1 48	0/15	0	0	0 80
ENDRIN	0/5	0	0	1 56	0/15	0	0	1 56	0/5	0	0	1.48	0/15	0	0	1 52
ENDRIN ALDEHYDE	0/5	0	0	1 56	0/15	0	0	1 56	0/5	0	0	1 48	0/15	0	0	1 52

TABLE F-3

Descriptive Statistics of Mustard Gas Burial Ground
PBA Surface and Subsurface vs. PBA Complement Surface and Subsurface

	PBA Surface Soil				SBA Surface Soil				PBA Subsurface Soil				SBA Subsurface Soil			
parameter	frequency	min	max	avg_all	frequency	min	max	avg_all	frequency	min	max	avg_all	frequency	min	max	avg_all
GAMMA-BHC (LINDANE)	0/5	0	0	0 81	0/15	0	0	0 81	0/5	0	0	0 76	0/15	0	0	1 52
GAMMA-CHLORDANE	1/4	0 55	0 55	0 74	6/13	0 62	1 1	0 81	0/5	0	0	0 76	0/15	0	0	1 52
HEPTACHLOR	4/5	1 2	1 4	1 20	7/14	1 3	2 4	1 24	4/5	1 2	1 4	1 12	0/15	0	0	0 80
HEPTACHLOR EPOXIDE	0/5	0	0	0 81	0/15	0	0	0 81	0/5	0	0	0 76	6/15	0 64	3	1 06
METHOXYCHLOR	0/5	0	0	8 10	0/15	0	0	8 13	0/5	0	0	7 60	9/15	0 94	2	1 13
TOXAPHENE	0/5	0	0	51 00	0/15	0	0	51 73	0/5	0	0	48 70	0/15	0	0	0 80
Herbicides (ug/kg)																
2,4,5-T	0/5	0	0	6 20	0/14	0	0	6 32	0/5	0	0	5 90	0/15	0	0	6 17
2,4,5-TP (SILVEX)	0/5	0	0	6 20	2/15	5 9	15	6 89	0/5	0	0	5 90	0/15	0	0	6 17
2,4-D	2/4	35	38	40 00	3/14	69	210	62 71	0/5	0	0	41 30	0/15	0	0	42 53
DINOSEB	0/5	0	0	12 60	0/14	0	0	12 43	0/5	0	0	11 80	0/15	0	0	12 13
PENTACHLOROPHENOL	0/5	0	0	6 20	0/15	0	0	6 30	0/5	0	0	5 90	0/15	0	0	6 17
Inorganics (mg/kg)																
ALUMINUM	5/5	9670	14900	12,214 00	15/15	9400	19400	14,086 67	7/7	3180	10100	7,250 00	28/28	1420	18100	7,724 29
ANTIMONY	1/5	1 7	1 7	0 61	0/15	0	0	0 33	0/7	0	0	0 20	0/28	0	0	0 25
ARSENIC	5/5	7	10 9	8 88	15/15	6	10 8	8 12	5/7	2 9	4 8	2 90	21/28	0 48	20 2	4 04
BARIUM	5/5	45 1	82 8	67 80	15/15	42 9	169	96 00	7/7	30 9	64 9	44 91	28/28	11 3	300	45 93
BERYLLIUM	5/5	0 4	0 63	0 50	14/15	0 21	1	0 65	7/7	0 37	1 2	0 63	19/28	0 24	1 6	0 42
CADMIUM	3/5	0 27	0 49	0 24	8/15	0 09	1 3	0 18	5/7	0 04	1.1	0 36	12/28	0 04	0 59	0 07
CALCIUM	5/5	510	24100	7,908 00	15/15	421	27900	2,968 00	7/7	461	43200	6,661 00	28/28	69 6	10000	875 16
CHROMIUM	5/5	13 4	17 8	16 06	15/15	12 1	24 3	16 28	7/7	8 7	14 9	12 19	28/28	6 4	24	12 46
COBALT	5/5	5 1	10 9	8 12	15/15	3 2	20 7	12 59	7/7	2.6	25 8	7 91	27/28	1 3	22 3	4 93
COPPER	5/5	12 1	16 5	14 44	15/15	8 1	18 5	12 63	7/7	9 5	13 1	11.17	28/28	4 3	25 3	10 27
IRON	5/5	16300	25500	21,560 00	15/15	15700	24700	20,446 67	7/7	12400	30800	18,714 29	28/28	4940	71500	17,406 43
LEAD	5/5	13 1	20 4	16 68	15/15	11	20	16 05	7/7	8 3	36 9	15 71	28/28	5 8	18	10 48
MAGNESIUM	5/5	1820	3790	2,660 00	15/15	1050	5260	2,084 67	7/7	1030	4670	1,747 14	28/28	193	2350	1,100 93
MANGANESE	5/5	232	588	412 40	15/15	114	2010	805 20	7/7	20 3	379	143 20	28/28	8 6	408	112.86
MERCURY	5/5	0 04	0 07	0 05	7/15	0 05	0 07	0 04	1/7	0 02	0 02	0 01	13/28	0 02	0 07	0 02
NICKEL	5/5	10 1	13 9	11 68	15/15	6 9	16	12 81	7/7	6 5	32 7	13 64	28/28	1.6	39 3	9 33
POTASSIUM	5/5	540	817	673 40	15/15	436	1310	757 67	7/7	353	752	447 86	28/28	207	1190	493 57
SELENIUM	4/5	0 58	1 2	0 80	8/15	0 49	1 3	0 61	5/7	0 12	0 85	0 38	11/28	0 28	1 7	0 41
SILVER	0/5	0	0	0 19	0/15	0	0	0 13	0/7	0	0	0 17	0/28	0	0	0 12
SODIUM	5/5	290	355	323 20	15/15	219	648	415 40	7/7	332	411	363 71	28/28	240	755	405 82
STRONTIUM	5/5	7	24 7	12 66	15/15	5	33 5	11 05	7/7	4	46	11 84	28/28	1 3	17.5	6 15
THALLIUM	5/5	0 85	2 8	1 77	13/15	0 87	2 7	1 52	7/7	0 84	2 7	1 71	24/28	0.75	5 3	1 39
THALLIUM-GF	1/1	0 13	0 13	0 13	1/1	0 07	0 07	0 07	1/1	0 07	0 07	0.07	1/2	0 16	0.16	0 10
THORIUM-CALC	5/5	2 53182	6 43636	4 31	15/15	1 89546	5 44091	3 93	7/7	3 60455	6 42727	4 55	28/28	1 87273	6 93636	3 87
TIN	0/5	0	0	11 74	7/15	2 5	3 9	7 32	0/7	0	0	10 94	11/28	2 3	4	6 98
VANADIUM	5/5	23 8	32 2	28 58	15/15	24 8	44 5	31 41	7/7	9 2	27 7	18 87	28/28	7 1	42 6	19.01
ZINC	5/5	41 4	50 6	46 56	15/15	25 1	67 8	46 83	7/7	16 2	70 9	35 64	28/28	9 3	129	33 25
Radionuclides (pCi/g)																
ACTINIUM-228									4/4	1 01	1 27	1 12	0/15	0	0	7 97
BISMUTH-212									4/4	0 98	1 3	1.12	0/15	0	0	50 43
BISMUTH-214									4/4	0 73	0 87	0 80				
BISMUTH-214									4/4	0 73	0 87	0 80				
CESIUM-137									0/4	0	0	0 00				
COBALT-60									0/4	0	0	0 01				
EUROPIUM-154									0/4	0	0	0 02				
EUROPIUM-155									2/4	0 08	0 09	0 10				

TABLE F-3

Descriptive Statistics of Mustard Gas Burial Ground
PBA Surface and Subsurface vs. PBA Complement Surface and Subsurface

	PBA Surface Soil				SBA Surface Soil				PBA Subsurface Soil				SBA Subsurface Soil			
parameter	frequency	min	max	avg_all	frequency	min	max	avg_all	frequency	min	max	avg_all	frequency	min	max	avg_all
LEAD-210									4/4	0 36	0.65	0.51				
LEAD-212									4/4	0 95	1.13	1 02				
LEAD-214									4/4	0.72	0 87	0 79				
POTASSIUM-40									4/4	5 98	9 23	8 19				
PROTACTINIUM-234									0/4	0	0	1 46				
RADIUM-226									4/4	1 66	1 9	1 76				
THALLIUM-208									4/4	0 91	1.04	0 95				
THALLIUM-208									4/4	0 91	1 04	0 95				
THORIUM-228	5/5	0 257	0 73	0 46	15/15	0 227	0 623	0 41	7/7	0.343	0 781	0 46				
THORIUM-230	4/5	0 0178	0 621	0 15	9/15	0 0414	0 578	0 22	4/7	0 0661	0 52	0 18				
THORIUM-232	5/5	0 3	0 686	0 49	15/15	0 19	0 574	0 45	7/7	0 4	0 663	0 54	28/28	0 167	0 654	0 40
THORIUM-234									4/4	1	1 88	1 28	19/28	0 0332	0 637	0 22
URANIUM-235									0/4	0	0	0.08	28/28	0.245	0 872	0 45
Miscellaneous																
1,4-DITHIANE	0/5	0	0	125.90	0/15	0	0	126 07	0/7	0	0	115.93	0/28	0	0	120 21
1,4-OXATHIANE	0/5	0	0	125 90	0/15	0	0	126 07	0/7	0	0	115.93	0/28	0	0	120.21
BIS(2-CHLOROETHYL)SULFIDE	0/5	0	0	125.90	0/15	0	0	126 07	0/7	0	0	115.93	0/28	0	0	120 21
CATION EXCHANGE CAPACITY	2/2	12.8	13.9	13.35	4/4	11.2	24.4	17.80	2/2	12 9	18 2	15 55	7/7	11	20.1	16.49
PH	2/2	5.4	7.8	6 60	4/4	5	5 8	5 25	2/2	5.1	7 1	6.10	7/7	4 4	5.7	5 01

TABLE F-4

Wilcoxon Rank-Sum Comparison of Subsurface Soil Results from Primary Burial Ground and Secondary Burial Ground

Parameter	SBG Rank Sum	PBG Rank Sum	U	Z	p-level	adjusted Z	p-level	SBG Valid N	PBG Valid N
ALUMINUM	509.5	120.5	92.5	0.227	0.821	0.227	0.821	28	7
ARSENIC	521.5	108.5	80.5	0.722	0.470	0.722	0.470	28	7
BARIUM	472	158	66	-1.320	0.187	-1.320	0.187	28	7
BERYLLIUM	**453**	**177**	**47**	**-2.103**	**0.035**	**-2.106**	**0.035**	**28**	**7**
CADMIUM	460	170	54	-1.815	0.070	-1.828	0.068	28	7
CALCIUM	459.5	170.5	53.5	-1.835	0.066	-1.835	0.066	28	7
CHROMIUM	499.5	130.5	93.5	-0.186	0.853	-0.186	0.853	28	7
COBALT	496	134	90	-0.330	0.741	-0.330	0.741	28	7
COPPER	467.5	162.5	61.5	-1.505	0.132	-1.506	0.132	28	7
IRON	483	147	77	-0.866	0.386	-0.866	0.386	28	7
LEAD	461	169	55	-1.773	0.076	-1.774	0.076	28	7
MAGNESIUM	473	157	67	-1.278	0.201	-1.279	0.201	28	7
MANGANESE	491	139	85	-0.536	0.592	-0.536	0.592	28	7
MERCURY	**556**	**74**	**46**	**2.144**	**0.032**	**2.263**	**0.024**	**28**	**7**
NICKEL	487.5	142.5	81.5	-0.680	0.496	-0.681	0.496	28	7
POTASSIUM	525	105	77	0.866	0.386	0.866	0.386	28	7
SELENIUM	487	143	81	-0.701	0.483	-0.701	0.483	28	7
SODIUM	516	114	86	0.495	0.621	0.495	0.621	28	7
STRONTIUM	479	151	73	-1.031	0.303	-1.031	0.302	28	7
THALLIUM	476	154	70	-1.155	0.248	-1.158	0.247	28	7
THALLIUM-GF	--	--	0	0.000	1.000	0.000	1.000	2	1
THORIUM-230	522	108	80	-0.7423	0.4579	-0.7423	0.4579	28	7
THORIUM-CALC	465	165	59	-1.608	0.108	-1.608	0.108	28	7
TIN	464.5	165.5	58.5	-1.629	0.103	-1.630	0.103	28	7
VANADIUM	503	127	97	-0.041	0.967	-0.041	0.967	28	7
ZINC	501	129	95	-0.124	0.902	-0.124	0.902	28	7

Adjusted Z score > +1.96 indicates that SBG greater than PBG.

Adjusted Z score < -1.96 indicates that PBG greater than SBG.

BLE F-5

Wilcoxon Rank-Sum Comparison of Surface Soil Results from Primary Burial Ground and Secondary Burial Ground

Parameter	SBG Rank Sum	PBG Rank Sum	U	Z	p-level	adjusted Z	p-level	SBG Valid N	PBG Valid N
ALUMINUM	171	39	24	1.178	0.239	1.179	0.238	15	5
ANTIMONY	144	66	24	-1.178	0.239	-1.178	0.239	15	5
ARSENIC	149	61	29	-0.742	0.458	-0.742	0.458	15	5
BARIUM	173	37	22	1.353	0.176	1.353	0.176	15	5
BERYLLIUM	166.5	43.5	28.5	0.786	0.432	0.786	0.432	15	5
CADMIUM	148	62	28	-0.829	0.407	-0.834	0.404	15	5
CALCIUM	140	70	20	-1.528	0.127	-1.528	0.127	15	5
CHROMIUM	153.5	56.5	33.5	-0.349	0.727	-0.349	0.727	15	5
COBALT	175	35	20	1.528	0.127	1.528	0.127	15	5
COPPER	141.5	68.5	21.5	-1.397	0.163	-1.399	0.162	15	5
IRON	150	60	30	-0.655	0.513	-0.655	0.512	15	5
LEAD	153.5	56.5	33.5	-0.349	0.727	-0.350	0.726	15	5
MAGNESIUM	137	73	17	-1.789	0.074	-1.790	0.073	15	5
MANGANESE	173	37	22	1.353	0.176	1.353	0.176	15	5
MERCURY	142.5	67.5	22.5	-1.309	0.190	-1.343	0.179	15	5
NICKEL	170.5	39.5	24.5	1.135	0.256	1.136	0.256	15	5
POTASSIUM	172.5	37.5	22.5	1.309	0.190	1.310	0.190	15	5
SELENIUM	138.5	71.5	18.5	-1.658	0.097	-1.660	0.097	15	5
SODIUM	**181**	**29**	**14**	**2.051**	**0.040**	**2.051**	**0.040**	**15**	**5**
STRONTIUM	150	60	30	-0.655	0.513	-0.656	0.512	15	5
THALLIUM	151.5	58.5	31.5	-0.524	0.600	-0.525	0.600	15	5
THALLIUM-GF	--	--	0	0.000	1.000	0.000	1.000	1	1
THORIUM-230	167	43	28	-0.8292	0.4070	-0.8295	0.4068	15	5
THORIUM-CALC	152	58	32	-0.480	0.631	-0.480	0.631	15	5
TIN	139.5	70.5	19.5	-1.571	0.116	-1.572	0.116	15	5
VANADIUM	166	44	29	0.742	0.458	0.742	0.458	15	5
ZINC	163	47	32	0.480	0.631	0.480	0.631	15	5

Adjusted Z score > +1.96 indicates that SBG greater than PBG.

TABLE F-6
STATISTICAL SUMMARY OF ANALYTICAL RESULTS
SOIL GROUP 3 - ALLUVIAL, MISSISSIPPIAN, AND PENNSYLVANIAN SURFACE SOIL
BASEWIDE BACKGROUND INVESTIGATION REPORT
NAVAL SURFACE WARFARE CENTER
CRANE, INDIANA

Metal (mg/kg)	Frequency of Detection	Frequency of Exceedance (2)	Minimum Detection	Maximum Detection	Average of All Results	Average of Positive Detections	Location of Maximum	Distribution of Data	95% Upper Tolerance Limit	Soil Risk Based Target Level (1)
ALUMINUM	15/15	0/15	6,770	17,400	10,238	10,238	BG1SBP0801	LOGNORMAL	19,900	75,000
ANTIMONY	2/15	2/15	1.4	5.6	0.83	3.50	BG3SBM0401	LOGNORMAL	6 9	0 1423
ARSENIC	15/15	15/15	2.4	10.2	6.11	6.11	BG3SBM0701	NORMAL	11 83	0 38
BARIUM	15/15	15/15	46.1	153	89.0	89.0	BG3SBM0601	LOGNORMAL	211	1 04
BERYLLIUM	1/15	1/15	0.49	0.49	0.40	0.49	BG3SBA0101-MAX	LOGNORMAL	0 93	0 10
CADMIUM	10/15	9/15	0 1	3.6	0.63	0.88	BG3SBM0201	LOGNORMAL	6 05	0.18095
CALCIUM	14/15	0/15	115	35,300	2,730	2,920	BG3SBM0601	LOGNORMAL	55,200	NA
CHROMIUM	15/15	15/15	8.5	21.7	14.6	14.6	BG1SBA0101	LOGNORMAL	28 7	0.4
COBALT	15/15	15/15	6	27.1	12.9	12.9	BG3SBM0701	LOGNORMAL	32.4	0 14033
COPPER	15/15	15/15	5.4	17.1	8.85	8.85	BG1SBP0801	LOGNORMAL	17 6	0 3132
IRON	15/15	2/15	10,700	36,200	16,800	16,800	BG1SBA0101	LOGNORMAL	37,400	22,000
LEAD	15/15	15/15	9.4	21.5	15.0	15.0	BG1SBA0101	LOGNORMAL	27.0	0.45053
LITHIUM	14/14	0/14	9 1	29.9	14.8	14.8	BG1SBP0901	LOGNORMAL	30.0	1,500
MAGNESIUM	15/15	0/15	620	2,250	1,200	1,200	BG1SBP0801	LOGNORMAL	2,800	NA
MANGANESE	15/15	0/15	268	3,040	1,140	1,140	BG3SBM0701	LOGNORMAL	5,700	3,100
MERCURY	7/15	7/15	0.04	0.07	0.037	0.051	BG1SBP0601-MAX	NORMAL	0 077	0.0079
NICKEL	15/15	15/15	9.2	20	13.4	13.4	BG1SBA0101	LOGNORMAL	22.1	7
POTASSIUM	15/15	0/15	418	1,490	847	847	BG1SBP0801	LOGNORMAL	1,970	NA
SELENIUM	5/15	5/15	0.51	0.64	0.48	0.58	BG1SBP0901	NORMAL	0.81	0.02765
SILVER	15/15	0/15	0 05	0.11	0.065	0.065	BG1SBP0401	LOGNORMAL	0.130	2
SODIUM	6/15	0/15	9 4	23 7	8.11	15 6	BG3SBM0601	NORMAL	28	NA
STRONTIUM	14/14	0/14	7.4	63 2	14.3	14 3	BG3SBM0601	LOGNORMAL	46 4	45,000
THALLIUM	15/15	15/15	0.1	0.27	0.19	0.19	BG1SBP0601-MAX	NORMAL	0 31	0.04
TIN	0/15	0/15	NA	NA	0.36 (3)	NA	NA	NA	NA	7 62
THORIUM	14/14	0/14	5 3	8.5	6 86	6 86	BG1SBP0801	LOGNORMAL	10 2	NA
VANADIUM	15/15	15/15	17.1	40	25.4	25.4	BG1SBP0801	LOGNORMAL	51.2	1 59
ZINC	14/15	14/15	24.4	60.2	37.0	38.6	BG3SBM0701	NORMAL	65.6	6 62

Notes:
NA - Not available
Concentrations which exceed soil risk-based target levels are bolded
1 - Value is based on human health and ecological risk-based criteria as presented in Appendix E, Table E-1 This risked-based criteria was current as of the QAPP (1999b). It is important to note that this information is updated by the appropriate regulatory agencies on a periodic basis.
2 - Exceedances are defined as detected values above the SRBTL.
3 - This value is the average of all detected and non-detected values. Non-detected values were represented by using one half the detection limit. This value was used for statistical analysis when no detections were encountered.

TABLE F-7

STATISTICAL SUMMARY OF ANALYTICAL RESULTS
SOIL GROUP 8 - PENNSYLVANIAN SUBSURFACE CLAY AND SILT
BASEWIDE BACKGROUND INVESTIGATION REPORT
NAVAL SURFACE WARFARE CENTER
CRANE, INDIANA

Metal (mg/kg)	Frequency of Detection	Frequency of Exceedance (2)	Minimum Detection	Maximum Detection	Average of All Results	Average of Positive Detections	Location of Maximum	Distribution of Data	95% Upper Tolerance Limit	Soil Risk Based Target Level (1)
ALUMINUM	9/9	0/9	9,070	16,200	13,019	13,019	BG1SBP0206	NORMAL	20,600	75,000
ANTIMONY	1/9	1/9	**11.3**	**11.3**	**1.83**	**11.30**	BG1SBP0505	LOGNORMAL	40 3	0.1423
ARSENIC	9/9	9/9	**1.4**	**8.5**	**5.51**	**5.51**	BG1SBP0204	NORMAL	12 5	0.38
BARIUM	9/9	9/9	**25.1**	**83.4**	**57.0**	**57.0**	BG1SBP0505	NORMAL	115	1 04
BERYLLIUM	0/9	0/9	NA	NA	**0.36 (3)**	NA	NA	NA	NA	0 10
CADMIUM	8/9	6/9	0 05	**0.64**	**0.26**	**0.28**	BG1SBP0206	NORMAL	0 8	0 18095
CALCIUM	9/9	0/9	85 2	970	470	470	BG1SBP0505	LOGNORMAL	4,640	NA
CHROMIUM	9/9	9/9	**14.2**	**27.1**	**19.9**	**19.9**	BG1SBP0206	NORMAL	33 0	0 4
COBALT	9/9	9/9	**5.2**	**12.5**	**8.32**	**8.32**	BG1SBP0206	LOGNORMAL	21 2	0 14033
COPPER	9/9	9/9	**11**	**23.8**	**15.3**	**15.3**	BG1SBP0305	LOGNORMAL	33 3	0 3132
IRON	9/9	5/9	14,800	**40,800**	**24,422**	**24,422**	BG1SBP0305	LOGNORMAL	60,200	22,000
LEAD	9/9	9/9	**8.6**	**15.2**	**11.8**	**11.8**	BG1SBP0603	NORMAL	19 6	0 45053
LITHIUM	9/9	0/9	13 7	46 6	23 2	23 2	BG1SBP0305	LOGNORMAL	80 0	1,500
MAGNESIUM	9/9	0/9	1,100	2,870	1,958	1,958	BG1SBP0204	NORMAL	3,410	NA
MANGANESE	9/9	0/9	29	457	263	263	BG1SBP0804	NORMAL	704	3,100
MERCURY	1/9	1/9	**0.14**	**0.14**	**0.037**	**0.140**	BG1SBP0103	LOGNORMAL	0 18	0 0079
NICKEL	9/9	9/9	**10**	**23.7**	**13.6**	**13.6**	BG1SBP0305	LOGNORMAL	29 6	7
POTASSIUM	9/9	0/9	718	1290	974	974	BG1SBP0204, BG1SBP0305	LOGNORMAL	1,890	NA
SELENIUM	8/9	8/9	**0.37**	**0.88**	**0.47**	**0.51**	BG1SBP0206	NORMAL	1 07	0 02765
SILVER	8/9	0/9	0 05	0 1	0 053	0 056	BG1SBP0206	LOGNORMAL	0 14	2
SODIUM	6/9	0/9	10	205	64 0	79 1	BG1SBP0406-MAX	LOGNORMAL	1,070	NA
STRONTIUM	9/9	0/9	10	20 3	13 8	13 8	BG1SBP0406-MAX	LOGNORMAL	30 9	45,000
THALLIUM	9/9	0/9	**0.14**	**0.25**	**0.20**	**0.20**	BG1SBP0204, BG1SBP0206	LOGNORMAL	0 33	0 04
TIN	0/9	0/9	NA	NA	0 35 (3)	NA	NA	NA	NA	7 62
THORIUM	9/9	9/9	7 1	11 7	9 02	9 02	BG1SBP0305	NORMAL	14 9	NA
VANADIUM	9/9	9/9	**20.9**	**48.5**	**33.2**	**33.2**	BG1SBP0206	LOGNORMAL	69 1	1 59
ZINC	9/9	9/9	**24.3**	**58.2**	**37.1**	**37.1**	BG1SBP0305	LOGNORMAL	83 3	6 62

Notes:
NA - Not available
Concentrations which exceed soil risk-based target levels are bolded
1 - Value is based on human health and ecological risk-based criteria as presented in Appendix E, Table E-1 This risked-based criteria was current as of the QAPP (1999b) It is important to note that this information is updated by the appropriate regulatory agencies on a periodic basis
2 - Exceedances are defined as detected values above the SRBTL
3 - This value is the average of all detected and non-detected values Non-detected values were represented by using one half the detection limit This value was used for statistical analysis when no detections were encountered

TABLE F-8
STATISTICAL SUMMARY OF ANALYTICAL RESULTS
SOIL GROUP 9 - PENNSYLVANIAN SUBSURFACE SAND
BASEWIDE BACKGROUND INVESTIGATION REPORT
NAVAL SURFACE WARFARE CENTER
CRANE, INDIANA

Metal (mg/kg)	Frequency of Detection	Frequency of Exceedance (2)	Minimum Detection	Maximum Detection	Average of All Results	Average of Positive Detections	Location of Maximum	Distribution of Data	95% Upper Tolerance Limit	Soil Risk Based Target Level (1)
ALUMINUM	1/1	0/1	5,430	5,430	5,430	5,430	BG1SBP0806	NA	NA	75,000
ANTIMONY	0/1	0/1	NA	NA	0.38 (3)	NA	NA	NA	NA	0.1423
ARSENIC	1/1	1/1	2.9	2.9	2.90	2.90	BG1SBP0806	NA	NA	0 38
BARIUM	1/1	1/1	24.8	24.8	24.8	24.8	BG1SBP0806	NA	NA	1 04
BERYLLIUM	0/1	0/1	NA	NA	0.14 (3)	NA	NA	NA	NA	0 10
CADMIUM	1/1	0/1	0.14	0 14	0 14	0 14	BG1SBP0806	NA	NA	0.18095
CALCIUM	1/1	0/1	53 6	53.6	54	54	BG1SBP0806	NA	NA	NA
CHROMIUM	1/1	1/1	7.7	7.7	7.7	7.7	BG1SBP0806	NA	NA	0.4
COBALT	1/1	1/1	8.8	8.8	8.80	8.80	BG1SBP0806	NA	NA	0.14033
COPPER	1/1	1/1	5.6	5.6	5.6	5.6	BG1SBP0806	NA	NA	0 3132
IRON	1/1	0/1	11,300	11,300	11,300	11,300	BG1SBP0806	NA	NA	22,000
LEAD	1/1	1/1	11.7	11.7	11.7	11.7	BG1SBP0806	NA	NA	0 45053
LITHIUM	1/1	0/1	8 6	8 6	8 6	8.6	BG1SBP0806	NA	NA	1,500
MAGNESIUM	1/1	0/1	654	654	654	654	BG1SBP0806	NA	NA	NA
MANGANESE	1/1	0/1	327	327	327	327	BG1SBP0806	NA	NA	3,100
MERCURY	0/1	0/1	NA	NA	0.02 (3)	NA	NA	NA	NA	0 0079
NICKEL	1/1	0/1	4.6	4 6	4 6	4 6	BG1SBP0806	NA	NA	7
POTASSIUM	1/1	0/1	353	353	353	353	BG1SBP0806	NA	NA	NA
SELENIUM	1/1	1/1	0.28	0.28	0.28	0.28	BG1SBP0806	NA	NA	0 02765
SILVER	1/1	0/1	0 05	0 05	0 050	0 050	BG1SBP0806	NA	NA	2
SODIUM	0/1	0/1	NA	NA	1.15 (3)	NA	NA	NA	NA	NA
STRONTIUM	1/1	0/1	5 4	5.4	5 4	5.4	BG1SBP0806	NA	NA	45,000
THALLIUM	1/1	1/1	0.09	0.09	0.09	0.09	BG1SBP0806	NA	NA	0.04
TIN	0/1	0/1	NA	NA	0.22	NA	NA	NA	NA	7.62
THORIUM	1/1	0/1	4.9	4 9	4 90	4 90	BG1SBP0806	NA	NA	NA
VANADIUM	1/1	1/1	14.1	14.1	14.1	14.1	BG1SBP0806	NA	NA	1.59
ZINC	1/1	1/1	11.4	11.4	11.4	11.4	BG1SBP0806	NA	NA	6.62

Notes
NA - Not available
Concentrations which exceed soil risk-based target levels are bolded
1 - Value is based on human health and ecological risk-based criteria as presented in Appendix E, Table E-1. This risked-based criteria was current as of the QAPP (1999b) It is important to note that this information is updated by the appropriate regulatory agencies on a periodic basis.
2 - Exceedances are defined as detected values above the SRBTL
3 - This value is the average of all detected and non-detected values. Non-detected values were represented by using one half the detection limit This value was used for statistical analysis when no detections were encountered

TABLE F-9

Wilcoxon Rank-Sum Comparison of Sediment Results from Site and Background Samples

Parameter	Site Rank	Background Rank	U	Z	p-level	Z-adjusted	p-level	Site N	Background N	Site Above Background
ALUMINUM	36.0	9.0	6	0.2928	0.7697	0.2928	0.7697	7	2	No
ANTIMONY	30.0	15.0	2	-1.4639	0.1432	-1.4639	0.1432	7	2	No
ARSENIC	29.0	16.0	1	-1.7566	0.0790	-1.7566	0.0790	7	2	No
BARIUM	34.5	10.5	7	-0.1464	0.8836	-0.1476	0.8826	7	2	No
BERYLLIUM	29.5	15.5	2	-1.6102	0.1074	-1.6170	0.1059	7	2	No
CADMIUM	35.5	9.5	7	0.1464	0.8836	0.1612	0.8720	7	2	No
CALCIUM	39.0	6.0	3	1.1711	0.2416	1.1711	0.2416	7	2	No
CHROMIUM	30.0	15.0	2	-1.4639	0.1432	-1.4639	0.1432	7	2	No
COBALT	30.0	15.0	2	-1.4639	0.1432	-1.4639	0.1432	7	2	No
COPPER	32.0	13.0	4	-0.8783	0.3798	-0.8783	0.3798	7	2	No
IRON	30.0	15.0	2	-1.4639	0.1432	-1.4639	0.1432	7	2	No
LEAD	34.0	11.0	6	-0.2928	0.7697	-0.2928	0.7697	7	2	No
MAGNESIUM	33.0	12.0	5	-0.5855	0.5582	-0.5855	0.5582	7	2	No
MANGANESE	29.0	16.0	1	-1.7566	0.0790	-1.7566	0.0790	7	2	No
MERCURY	33.5	11.5	6	-0.4392	0.6606	-0.4506	0.6523	7	2	No
NICKEL	28.0	17.0	0	-2.0494	0.0404	-2.0580	0.0396	7	2	No
POTASSIUM	37.0	8.0	5	0.5855	0.5582	0.5855	0.5582	7	2	No
SELENIUM	31.5	13.5	4	-1.0247	0.3055	-1.0290	0.3035	7	2	No
SILVER	39.0	6.0	3	1.1711	0.2416	1.2519	0.2106	7	2	No
SODIUM	**41.0**	**4.0**	**1**	**1.7566**	**0.0790**	**1.7566**	**0.0790**	**7**	**2**	**Yes**
STRONTIUM	35.0	10.0	7	0.0000	1.0000	0.0000	1.0000	7	2	No
THALLIUM	35.0	10.0	7	0.0000	1.0000	0.0000	1.0000	7	2	No
THALLIUM-GF	--	--	0	0.0000	1.0000	0.0000	1.0000	1	1	No
THORIUM-228	33.0	12.0	5	-0.5855	0.5582	-0.5855	0.5582	7	2	No
THORIUM-230	34.0	11.0	6	-0.2928	0.7697	-0.2928	0.7697	7	2	No
THORIUM-232	30.0	15.0	2	-1.4639	0.1432	-1.4639	0.1432	7	2	No
THORIUM-CALC	--	--	0	0.0000	1.0000	0.0000	1.0000	7	1	No
TIN	36.5	8.5	6	0.4392	0.6606	0.4429	0.6579	7	2	No
VANADIUM	30.0	15.0	2	-1.4639	0.1432	-1.4639	0.1432	7	2	No
ZINC	29.0	16.0	1	-1.7566	0.0790	-1.7566	0.0790	7	2	No

Adjusted Z score > +1.645 (one-tailed test) indicates that Site greater than Background.

TETRA TECH NUS, INC. **CALCULATION WORKSHEET** PAGE 1 OF ~~10~~

CLIENT NSWC CRANE	JOB NUMBER CTO ~~160~~ 158
SUBJECT SAMPLE CALCULATIONS OF STATISTICAL ANALYSIS	
BASED ON SS ARSENIC RESULTS -- OLD PISTOL RANGE	DRAWING NUMBER
BY TSK / CHECKED BY BEL	APPROVED BY / DATE 7/18/01

BEL 9/27/02

THE DATA USED FOR THE FOLLOWING SAMPLE CALCULATIONS ARE THE ARSENIC RESULTS COLLECTED FROM SURFACE SOIL AT THE OLD PISTOL RANGE

N SAMPLE	RESULT	QUAL	VALUE	TYPE
07SB290001-AVG	8.5	-	8.5	SITE
07SB300001	7.2	-	7.2	SITE
07SB310001	5.6	-	5.6	SITE
07SB320001	9.4	J	9.4	SITE
07SB330001	12.3	J	12.3	SITE
07SB340001	7.3	J	7.3	SITE
07CP350001	6.4	-	6.4	SITE
07CP360001	5.1	-	5.1	SITE
07CP370001	7.8	-	7.8	SITE
07CP380001-AVG	9.15	-	9.15	SITE
07CP390001	8.3	-	8.3	SITE
07CP410001	11	J	11	SITE
07CP410001	8	J	8	SITE
07CP420001	8	J	8	SITE
07CP430001	12.8	J	12.8	SITE
07CP440001-AVG	7.95	J	7.95	SITE
07CP450001	10.2	-	10.2	SITE
07CP460001	10.8	-	10.8	SITE

① CALCULATE THE ARITHMETIC MEAN ($\bar{x}$):

$$\bar{X} = \sum_{i=1}^{n} x_i / n$$

$$\sum_{i=1}^{18} x_i = 8.5 + 7.2 + 5.6 + 9.4 + 12.3 + 7.3 + 6.4 + 5.1 + 7.8 + 9.15 + 8.3 + 11 + 8 + 8 + 12.8 + 7.95 + 10.2 + 10.8$$

$$\sum_{i=1}^{18} x_i = 155.8 \qquad \bar{X} = \frac{\sum_{i=1}^{n} x_i}{n} = \frac{155.8}{18} = 8.6556$$

CLIENT NSWC CRANE		JOB NUMBER CTO ~~160~~ 158	BEL 9/27/01
SUBJECT SAMPLE CALCULATIONS OF STATISTICAL ANALYSIS			
BASED ON SS ARSENIC RESULTS -- OLD PISTOL RANGE		DRAWING NUMBER	
BY TSK	CHECKED BY BEL	APPROVED BY	DATE 7/18/01

② CALCULATE THE STANDARD DEVIATION (S_x):

$$S_x = \sqrt{\frac{\sum_{i=1}^{n} (x_i - \bar{x})^2}{n-1}}$$

$$\sum_{i=1}^{n}(x_i - \bar{x})^2 = (8.5-8.6556)^2 + (7.2-8.6556)^2 + (5.6-8.6556)^2 + (9.4-8.6556)^2$$
$$+ (82.3-8.6556)^2 + (7.3-8.6556)^2 + (6.4-8.6556)^2 + (5.1-8.6556)^2$$
$$+ (7.8-8.6556)^2 + (9.15-8.6556)^2 + (8.3-8.6556)^2 + (11-8.6556)^2$$
$$+ (8-8.6556)^2 + (8-8.6556)^2 + (12.8-8.6556)^2 + (7.95-8.6556)^2$$
$$+ (10.2-8.6556)^2 + (10.8-8.6556)^2$$

$$= (-.1556)^2 + (-1.4556)^2 + (-3.0556)^2 + (.7444)^2 + (3.6444)^2$$
$$+ (-1.3556)^2 + (-2.2556)^2 + (-3.5556)^2 + (-.8556)^2 + (.4944)^2$$
$$+ (-.3556)^2 + (2.3444)^2 + (.6556) + (-.6556) + (4.4444)^2$$
$$+ (-.7056)^2 + (1.5444)^2 + (2.1444)^2$$

$$= (0.2421136) + (2.11872136) + (9.33669) + (.554131) + (13.28165)$$
$$+ (1.83765) + (5.087731) + (12.64229) + (.73205) + (.24443)$$
$$+ (.12645) + (5.496211) + (.429811) + (.429811) + (17.17605)$$
$$+ (.49787) + (2.38517) + (4.59845)$$

$$\sum_{i=1}^{n}(x_i - \bar{x})^2 = 77.2173$$

$$S_x = \sqrt{\frac{\sum_{i=1}^{n}(x_i - \bar{x})^2}{n-1}} = \sqrt{\frac{77.2173}{17}} = \sqrt{4.5422} = 2.13$$

③ CALCULATE THE SHAPIRO-WILK W STATISTIC (W_{CALC}):

$$W_{CALC} = \left(\frac{b}{S_x\sqrt{n-1}}\right)^2$$

CLIENT NSWC CRANE	JOB NUMBER ~~CTO 160~~ CTO 158
SUBJECT SAMPLE CALCULATIONS OF STATISTICAL ANALYSIS	
BASED ON SS ARSENIC RESULTS -- OLD PISTOL RANGE	DRAWING NUMBER
BY TSK / CHECKED BY BEL	APPROVED BY / DATE 7/18/01

CALCULATE b BY CREATING THE FOLLOWING TABLE:

COLUMN 1: RESULTS ORDERED BY SMALLEST TO LARGEST (R_i)

COLUMN 2: RESULTS ORDERED BY LARGEST TO SMALLEST (R_{n-i+1})

COLUMN 3: COLUMN 2 - COLUMN 1 ($R_{n-i+1} - R_i$)

COLUMN 4: COEFFICIENT a_i FROM SAMPLE CALC TABLE 1

COLUMN 5: COLUMN 3 x COLUMN 4 = $b_i = a_i(R_{n-i+1} - R_i)$

$$b = \sum_{i=1}^{K} b_i = \sum_{i=1}^{9} b_i$$

* WHERE K IS THE GREATEST INTEGER LESS THAN OR EQUAL TO $n/2$

$$K \rightarrow n/2 = 18/2 = 9$$

R_i	R_{n-i+1}	$R_{n-i+1} - R_i$	a_i	b_i	i
5.1	12.8	7.7	0.4886	3.7622	1
5.6	12.3	6.7	0.3253	2.1795	2
6.4	11	4.6	0.2553	1.1744	3
7.2	10.8	3.6	0.2027	0.7297	4
7.3	10.2	2.9	0.1587	0.4602	5
7.8	9.4	1.6	0.1197	0.1915	6
7.95	9.15	1.2	0.0837	0.1004	7
8	8.5	0.5	0.0496	0.0248	8
8	8.3	0.3	0.0163	0.0049	9
8.3	8				10
8.5	8				11
9.15	7.95				12
9.4	7.8				13
10.2	7.5				14
10.8	7.2				15
11	6.4				16
12.3	5.6				17
12.8	5.1				18

$b = 8.6276$

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CLIENT NSWC CRANE	JOB NUMBER CTO ~~160~~ 158
SUBJECT SAMPLE CALCULATIONS OF STATISTICAL ANALYSIS	
BASED ON SS ARSENIC RESULTS -- OLD PISTOL RANGE	DRAWING NUMBER
BY JSK / CHECKED BY BEL	APPROVED BY / DATE 7/18/01

$$W_{CALC} = \left(\frac{b}{S_x\sqrt{n-1}}\right)^2 = \left(\frac{8.6276}{(2.12)\sqrt{17}}\right)^2 = \left(\frac{8.6276}{8.7822}\right)^2 = (.98239)^2$$

$$= 0.9651$$

DETERMINE W_{TEST} AT A 5% LEVEL OF SIGNIFICANCE FROM TABLE 2:

$$W_{TEST} = 0.897$$

COMPARE W_{CALC} TO W_{TEST}:

$$W_{CALC} = 0.9651 > 0.897 = W_{TEST}$$

SINCE $W_{CALC} > W_{TEST}$, WE ACCEPT THE NULL HYPOTHESIS THAT THE DATA SET HAS A NORMAL DISTRIBUTION.

CLIENT NSWC CRANE	JOB NUMBER CTO ~~160~~ 158
SUBJECT Sample Calculations of Statistical Analysis	
BASED ON SS Arsenic Results -- Old Pistol Range	DRAWING NUMBER
BY JSK / CHECKED BY BEL	APPROVED BY / DATE 7/18/01

The following data will be used for the Wilcoxon Test Sample Calculation. This data set is of background arsenic results:

NSample	Type	Result	Qual	Value
BG 1SBA0101	Background	7.9	–	7.9
BG 1SBA0401	Background	4	–	4
BG 1SBP0401	Background	5.2	J	5.2
BG 1SBP0601-MAX	Background	7.9	J	7.9
BG 1SBP0701	Background	2.4	J	2.4
BG 1SBP0801	Background	8.5	J	8.5
BG 1SBP0901	Background	4.7	J	4.7
BG 3SBA0101-MAX	Background	4.2	–	4.2
BG 3SBA0301	Background	4.8	–	4.8
BG 3SBA0501	Background	8	–	8
BG 3SBM0201	Background	5.9	J	5.9
BG 3SBM0401	Background	5.5	J	5.5
BG 3SBM0601	Background	7.8	J	7.8
BG 3SBM0701	Background	10.2	J	10.2
BG 3SBM0801	Background	4.6	J	4.6

(4) Perform the Wilcoxon Rank-Sum Non-Parametric ANOVA.

a) Rank Results from lowest to highest

* Rank adjusted for ties by using the median (middle) rank of the tied ranks for all tied values.

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CLIENT: NSWC CRANE	JOB NUMBER: CTO ~~160~~ 158
SUBJECT: SAMPLE CALCULATIONS OF STATISTICAL ANALYSIS	
BASED ON: SS ARSENIC RESULTS -- OLD PISTOL RANGE	DRAWING NUMBER:
BY: TSK / CHECKED BY: BKL	APPROVED BY: / DATE: 7/18/01

VALUE	TYPE	RANK	ADJUSTED RANK*
2.4	BK	1	1
4	BK	2	2
4.2	BK	3	3
4.6	BK	4	4
4.7	BK	5	5
4.8	BK	6	6
5.1	SITE	7	7
5.2	BK	8	8
5.5	BK	9	9
5.6	SITE	10	10
5.9	BK	11	11
6.4	SITE	12	12
7.2	SITE	13	13
7.3	SITE	14	14
7.8	BK	15	15.5
7.8	SITE	16	15.5
7.9	BK	17	17.5
7.9	BK	18	17.5
7.95	SITE	19	19
8	BK	20	21
8	SITE	21	21
8	SITE	22	21
8.3	SITE	23	23
8.5	BK	24	24.5
8.5	SITE	25	24.5
9.15	SITE	26	26
9.4	SITE	27	27
10.2	BK	28	28.5
10.2	SITE	29	28.5
10.8	SITE	30	30
11	SITE	31	31
12.3	SITE	32	32
12.8	SITE	33	33

3) SUM THE RANKS (ADJ) OF SITE AND BACKGROUND RESULTS:

$$WRS = \sum_{i=1}^{18} R_{(ADJ)\,SITE} = 7+10+12+13+14+15.5+19+21+21+23+24.5+26+27+28.5+30+31+32+33$$

$$WRS_{SITE} = 387.5$$

$$SUM_{BK} = \sum_{i=1}^{15} R_{(ADJ)\,BK} = 1+2+3+4+5+6+8+9+11+15.5+17.5+17.5+21+24.5+28.5$$

$$SUM_{BK} = 173.5$$

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CLIENT NSWC CRANE	JOB NUMBER CTO ~~160~~ 158
SUBJECT SAMPLE CALCULATIONS OF STATISTICAL ANALYSIS	
BASED ON SS ARSENIC RESULTS -- OLD PISTOL RANGE	DRAWING NUMBER
BY TSK / CHECKED BY BCL	APPROVED BY / DATE 7/18/01

✓ RANK SUMS $WRS_{SITE} + SUM_{BK} = \sum_{i=1}^{33} i = 33/2\,(33+1)$

$387.5 + 173.5 = 1+2+3 \cdots + 33 = 16.5\,(34)$

$561 = 561$

c) CALCULATE THE WRS_{SITE} Z-SCORE (Z_{RS}):

$$Z_{RS} = \frac{WRS_{SITE} - \frac{n_1(n+1)}{2}}{\sqrt{\frac{n_1(n_2)\,(n+1)}{12}}}$$

WHERE $n_1 = 18$ = # OF SITE RESULTS

$n_2 = 15$ = # OF BK RESULTS

$n = 33$ = # OF TOTAL RESULTS $= n_1 + n_2$

$$Z_{RS} = \frac{387.5 - \frac{18(34)}{2}}{\sqrt{\frac{18(15)(34)}{12}}}$$

$$= \frac{387.5 - 306}{\sqrt{\frac{9180}{12}}}$$

$$= \frac{81.5}{\sqrt{765}} = \frac{81.5}{27.659} = 2.947$$

$Z_{RS} = 2.947$

FROM SAMPLE CALC TABLE 4 A Z_{RS} SCORE OF 2.947 CORRESPONDS TO A P-LEVEL OF 0.00323

BECAUSE $0.00323 < 0.10$ WE FIND THAT WE REJECT OUR NULL HYPOTHESIS THAT OUR SITE ARSENIC CONCENTRATIONS ARE NOT STATISTICALLY HIGHER THAN OUR BACKGROUND ARSENIC CONCENTRATIONS AT A 95% CONFIDENCE LEVEL

CLIENT NSNC CRANE	JOB NUMBER CTO ~~160~~ 158
SUBJECT SAMPLE CALCULATIONS OF STATISTICAL ANALYSIS	
BASED ON SS ARSENIC RESULTS - OLD PISTOL RANGE	DRAWING NUMBER
BY TSK / CHECKED BY BEL	APPROVED BY / DATE 7/18/01

(5) PERFORM THE PARAMETRIC ANOVA

$$X = \sum_{i=1}^{2}\left[\sum_{j=1}^{2}\right] X_{ij} = 2.4+4+4.2+4.6+4.7+4.8+5.1+5.2+5.5+5.6+5.9+6.4+7.2+7.3+7.8+7.8+7.9+7.9+7.95+8+8+8+8.3+8.5+8.5+9.15+9.4+10.2+10.2+10.8+11+12.3+12.8$$

$$= 247.4$$

$N = n_1 + n_2 = 18 + 15 = 33$

$\bar{X} = X/N = 247.4/33 = 7.497$

NOW FIND $X_i = \sum_{j=1}^{n} X_{ij}$ AND $\bar{X}_i = X_i/n_i$

X_1 (SITE) $= 8.5+7.2+5.6+9.4+12.3+7.3+6.4+5.1+7.8+9.15+8.3+11+8+8+12.8+7.95+10.2+10.8$

$= 155.8$

$\bar{X}_1 = 155.8/18 = 8.6556$

X_2 (BK) $= 7.9+4+5.2+7.9+2.4+8.5+4.7+4.2+4.8+8+5.9+5.5+7.8+10.2+4.6$

$= 91.6$

$\bar{X}_2 = 91.6/15 = 6.1066$

i	$\bar{X}_i$	$\bar{X}$	n_i	$(\bar{X}_i - \bar{X})$	$(\bar{X}_i - \bar{X})^2$	$n_i(\bar{X}_i - \bar{X})^2$
1	8.6556	7.497	18	1.1586	1.34235	24.1605
2	6.1066	7.497	15	-1.3904	1.933212	+ 28.9954

$N = 33$ $SS_{sample} = 53.1559$

CLIENT NSWC Crane	JOB NUMBER CTO ~~160~~ 158
SUBJECT Sample Calculations of Statistical Analysis	
BASED ON SS Arsenic Results -- Old Piser Range	DRAWING NUMBER
BY TSK / CHECKED BY BEL	APPROVED BY / DATE 7/18/01

$$SS_{SAMPLE} = \sum_{i=1}^{K=2} n_i(\bar{X}_i - \bar{X})^2$$

where n_i = # of samples from group i
K = # of groups

$$SS_{TOTAL} = \sum_{i=1}^{K}\sum_{j=1}^{n_i}(X_{ij} - \bar{X})^2$$

$= (2.4-7.497)^2 + (4-7.497)^2 + (4.2-7.497)^2 + (4.6-7.497)^2 + (4.7-7.497)^2$
$+ (4.8-7.497)^2 + (5.1-7.497)^2 + (5.2-7.497)^2 + (5.5-7.497)^2 + (5.6-7.497)^2$
$+ (5.9-7.497)^2 + (6.4-7.497)^2 + (7.2-7.497)^2 + (7.3-7.497)^2 + (7.8-7.497)^2$
$+ (7.8-7.497)^2 + (7.9-7.497)^2 + (7.9-7.497)^2 + (7.95-7.497)^2 + (8-7.497)^2$
$+ (8-7.497)^2 + (8-7.497)^2 + (8.3-7.497)^2 + (8.5-7.497)^2 + (8.5-7.497)^2$
$+ (9.15-7.497)^2 + (9.4-7.497)^2 + (10.2-7.497)^2 + (10.2-7.497)^2 + (10.8-7.497)^2$
$+ (11-7.497)^2 + (12.3-7.497)^2 + (12.8-7.497)^2$

$= (-5.097)^2 + (-3.497)^2 + (-3.297)^2 + (-2.897)^2 + (-2.797)^2 + (-2.697)^2$
$+ (-2.397)^2 + (-2.297)^2 + (-1.997)^2 + (-1.897)^2 + (-1.597)^2 + (-1.097)^2$
$+ (-0.297)^2 + (-0.197)^2 + (.303)^2 + (.303)^2 + (.403)^2 + (.403)^2$
$+ (.453)^2 + (.503)^2 + (.503)^2 + (.503)^2 + (.803)^2 + (1.003)^2$
$+ (1.003)^2 + (1.653)^2 + (1.903)^2 + (2.703)^2 + (2.703)^2 + (3.303)^2$
$+ (3.503)^2 + (4.803)^2 + (5.303)^2$

$= 25.97141 + 12.22901 + 10.87021 + 8.392609 + 7.823209 + 7.273809$
$+ 5.745609 + 5.276209 + 3.988009 + 3.598609 + 2.550409 + 1.203409$
$+ 0.088209 + 0.038809 + 0.091809 + 0.091809 + 0.162409 + 0.162409$
$+ 0.205209 + 0.253009 + 0.253009 + 0.253009 + 0.644809 + 1.006009$
$+ 1.006009 + 2.732409 + 3.621409 + 7.306209 + 7.306209 + 10.90981$
$+ 12.27101 + 23.06881 + 28.1261$

$= 194.5247$

CLIENT NSWC CRANE	JOB NUMBER CTO 160 158
SUBJECT SAMPLE CALCULATIONS OF STATISTICAL ANALYSIS	
BASED ON SS ARSENIC RESULTS -- OHIO PISTOL RANGE	DRAWING NUMBER
BY TSK / CHECKED BY BCL	APPROVED BY / DATE 7/18/01

SOURCE OF VARIATION	SUMS OF SQUARES	DEGREES OF FREEDOM	MEAN SQUARES	F VALUE
EFFECT (BETWEEN NSAMPLES)	SS_{SAMPLE} = 53.1559	$V_1 = K-1$ = 2-1=1	MS_{EFFECT} = 531559	= 11.6475
ERROR (BETWEEN NSAMPLES)	SS_{ERROR} = 1411.3688	$V_2 = N-K$ = 31	MS_{ERROR} = 4.5603	
TOTAL	SS_{TOTAL} = 194.5247	N-1 = 32		

* WHERE $SS_{TOTAL} - SS_{SAMPLE} = SS_{ERROR}$

$$SS_{SAMPLE}/K-1 = MS_{EFFECT}$$

$$SS_{ERROR}/N-K = MS_{ERROR}$$

$$F = MS_{EFFECT}/MS_{ERROR}$$

FROM SAMPLE CALC TABLE 3, THE F-STATISTIC FOR $V_1 = 1$ AND $V_2 = 31$ IS 250.2

$$F_{VALUE} = 11.6475 < 250.2 = F_{STATISTIC}$$

SINCE $F_{VALUE} < F_{STATISTIC}$ WE ACCEPT THE NULL HYPOTHESIS OF EQUAL GROUP MEANS AND CONCLUDE THERE IS NO STATISTICALLY SIGNIFICANT DIFFERENCE BETWEEN THE ARSENIC SITE AND BACKGROUND DATA.

CLIENT CRANE	JOB NUMBER CTO 158
SUBJECT	
BASED ON	DRAWING NUMBER
BY BEL / CHECKED BY BEL	APPROVED BY / DATE 9/27/02

(6) PERFORM THE TWO-SAMPLE TEST OF PROPORTIONS:

[A] LET C = 5.0 mg/kg

[B] LET k_s & k_b BE THE NUMBER OF SITE AND BACKGROUND MEASUREMENTS THAT EXCEED C.

$k_s = 18$

$k_b = 9$

[C] Let n & m BE THE NUMBER OF SITE AND BACKGROUND SAMPLES

$k_s = 18$

$k_b = 15$

[D] Let p_s, p_b, AND p BE THE PROPORTION OF SITE, BACKGROUND, AND TOTAL SAMPLES THAT EXCEED C.

$$p_s = \frac{18}{18} = 1.000$$

$$p_b = \frac{9}{15} = 0.600$$

$$p = \frac{18+9}{18+15} = \frac{27}{33} = 0.818$$

[E] COMPUTE THE Z-SCORE:

$$Z_p = \frac{p_s - p_b}{\sqrt{p(1-p)\left(\frac{1}{n}+\frac{1}{m}\right)}} = \frac{1.000-0.600}{\sqrt{(0.818)(0.182)\left(\frac{1}{18}+\frac{1}{15}\right)}}$$

$$Z_p = \frac{0.400}{\sqrt{(0.149)(0.122)}} = \frac{0.400}{\sqrt{0.0182}} = \frac{0.400}{0.135} = +2.96$$

SINCE $Z_p = +2.96 > +1.645$, WE ACCEPT THE NULL HYPOTHESIS THAT SITE CONCENTRATIONS ARE ABOVE BACKGROUND

APPENDIX G

HUMAN HEALTH RISK ASSESSMENT SUPPORT

Appendix G-1 - CALCULATIONS OF RISK-BASED SCREENING CONCENTRATIONS AND SSLS FOR RADIONUCLIDES

Appendix G-2 - RAGS-PART D TABLES AND RISK ASSESSMENT CALCULATIONS

Appendix G-3 - EXAMPLE RISK ASSESSMENT CALCULATIONS

Appendix G4- - TOXICITY PROFILES

APPENDIX G-1

CALCULATIONS OF RISK-BASED SCREENING CONCENTRATIONS AND SSLS FOR RADIONUCLIDES

EPA United States Environmental Protection Agency **Superfund**

Topic for Key OSWER Radiation Guidances and Reports

Soil Screening Calculations for Radionuclides

These calculations are based on the U.S. Environmental Protection Agency's (EPA) Soil Screening Guidance for Radionuclides. The guidance must be read before attempting to calculate values. The guidance is available through:

Soil Screening Guidance for Radionuclides: User's Guide
EPA Document Number: EPA/540-R-00-007

Soil Screening Guidance for Radionuclides: Technical Background Document
EPA Document Number: EPA/540-R-00-006, October 2000

Highlight 1: Key Attributes of the Soil Screening Guidance for Radionuclides

- Standardized equations are presented to address human exposure pathways in a residential setting consistent with Superfund's concept of "Reasonable Maximum Exposure" (RME).
- Source size (area and depth) can be considered on a site-specific basis.
- Parameters are identified for which site-specific information is needed to develop site-specific SSLs.
- Default parameter values are provided to calculate generic SSLs where site-specific information is not available.
- SSLs are generally based on a 10^{-6} lifetime cancer risk. SSLs for

migration to ground water are based on maximum contaminant levels (MCLs), proposed MCLs (Uranium), or health based levels.

- Radiation risk coefficients used to calculate SSLs represent the average risk per unit exposure to members of a population exposed throughout life to a constant concentration of a radionuclide in a specific environmental medium. They assume no radioactive decay, however, radioactive decay is accounted for in this electronic version.

Usage and Limitations:

SSLs are not national cleanup standards.

Radionuclide SSLs are based on a target risk of one-in-a-million (10^{-6}), or, for the ground water migration pathway, a maximum contaminant level (MCL), where available.

Although the application of SSLs during site investigations is not mandatory at sites being addressed by CERCLA or RCRA, EPA recommends the use of SSLs as a tool to facilitate prompt identification of radionuclides and exposure areas of concern.

In addition, this guidance presents methodologies to address the leaching of radionuclides through soil to an underlying potable aquifer. This pathway should also be addressed in the development of PRGs.

The Soil Screening Guidance is a tool for screening at National Priorities List (NPL) sites.

Some NPL sites will not meet all the conditions necessary for use of this tool; consequently, EPA does not expect this tool to be applicable for all NPL sites.

The guidance is intended to be used to screen out areas of sites, exposure pathways, or chemicals of concern from further consideration, assuming certain conditions are present, or to determine that further study is warranted at a site.

Generally, areas of a site which fall below the screening levels may be eliminated from further assessment. Areas above the screening levels

generally warrant further evaluation.

The levels should not be interpreted to represent cleanup standards for a site, and concentrations in soil above screening levels do NOT automatically designate a site as dirty.

SSLs do not supersede existing federal or state ARARs and use of the guidance is not legally binding.

An ecological assessment should also be performed as part of the RI/FS to evaluate potential risks to ecological receptors.

Although SSLs are "risk-based," they do not eliminate the need to conduct a site-specific risk assessment for those areas identified as needing further investigation.

Exposure Pathways are as follows:

- **Direct ingestion of soil**
- **Inhalation of fugitive dusts**
- **External radiation exposure from photon-emitting radionuclides in soil**
- **Ingestion of homegrown produce that has been contaminated via plant uptake**
- **Ingestion of contaminated ground water caused by migration of radionuclides through soil to an underlying potable aquifer**

This guidance addresses the carcinogenic effects of radionuclides. For systemic toxicity of metals such as Uranium, please see the Soil Screening Calculations for chemicals.

The Soil Screening Guidance for Radionuclides should NOT be used for *chemical contaminants*. Please see Soil Screening Calculations for chemicals.

I accept the Usage and Limitations and am fully informed about using the Soil Screening

Guidance.
Begin Calculations for Radionuclides

[EPA Home | OSWER Home | Superfund Home]
[Search EPA | Search Superfund | What's New | Contact Us]
[Superfund Radiation Topics | Superfund Radiation Risk Assessment]

URL: http://risk.lsd.ornl.gov/rad_start.shtml
This page was last updated on: October 10, 2000
Site Maintained by: U.S. EPA, Office of Emergency and Remedial Response

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Residential Land Use

Introduction:

Under residential land use, residents are assumed to be exposed to contaminated media on a daily basis over a lifetime. Exposure routes considered are:

- ingestion of ground or surface water,
- inhalation of vapors from ground or surface water during water use in the home,
- dermal contact with ground or surface water while showering,
- incidental ingestion of soil or sediment,
- inhalation of particulates and/or vapors emitted from soil or sediment,
- dermal contact with contaminated soil or sediment, and
- external exposure to ionizing radiation emitted from contaminants in soil or sediment.

Highlights:

The exposure assumptions utilized for this land use scenario result in the smallest, or most conservative, chemical-specific risk-based PRGs.

For equations for consumption of farm products, please see agricultural land use.

For equations for consumption of fish, please see recreational land use.

Most radionuclides are not volatile; therefore, exposure to vapors emitted from ground or surface water is not considered for most radionuclides. Exceptions are tritium and radon. Tritium is considered because it may exist as either hydrogen gas in water or replace one of

the hydrogens found in the water molecule. Radon is considered because groundwater that is in contact with rock or soil containing radium will pick up radon-222 and release it to the atmosphere when the water is used. For example, with a contribution of 5 x 10^8 Ci of radon-222 per year, groundwater is considered the second largest source of environmental radon [15].

For the soil and sediment pathway, it is assumed that there is an unlimited potential for surface erosion and the production of particulates and vapor emissions.

Because the rate of incidental ingestion of soil and sediment in relation to body weight varies significantly between children and adults, the calculation of the PRG based on carcinogenic risk due to incidental ingestion of soil is calculated using an age-adjusted ingestion factor. For the same reason, the PRGs based on systemic toxicity (i.e., hazard) are calculated separately for the child and the adult. Additional information concerning these calculations can be found at the links listed below.

Equations:

Equations used to solve for the chemical-specific risk-based preliminary remediation goals (PRGs) for each of the exposure routes are presented at the following links. At each of these locations, equations used to calculate PRGs based on individual pathways and selected combinations are presented. There may be some combinations that are not included.

- Groundwater or Surface Water - nonradionuclide
- Groundwater or Surface Water - radionuclide
- Soil or Sediment - nonradionuclide
- Soil or Sediment - radionuclide

The equations used to develop some exposure parameters needed in the PRG equations are at the following link.

- Supporting Equations

Special cases that should be considered when utilizing the PRG equations and the chemical-

specific risk-based PRGs are presented here.

- Special Cases

Ground or Surface Water - nonradionuclide

- Ingestion alone
- Inhalation of Vapors (volatile analytes only) alone
- Dermal Contact alone
- Ingestion, Inhalation of Vapors, and Dermal Contact simultaneously

Ground or Surface Water - radionuclide

- Ingestion alone
- Inhalation of Vapors (tritium, radon-220, and radon-222 only) alone
- Ingestion and Inhalation of Vapors simultaneously

Soil or Sediment - nonradionuclide

- Incidental Ingestion alone
- Inhalation of Particulates and Vapors alone
- Dermal Contact alone
- Incidental Ingestion, Inhalation of Particulates and Vapors, and Dermal Contact simultaneously (Adults only)

Soil or Sediment - radionuclide

- Incidental Ingestion alone
- Inhalation of Particulates and Vapors alone
- External Exposure to Ionizing Radiation alone
- Incidental Ingestion, Inhalation of Particulates and Vapors, and External Exposure to Ionizing Radiation simultaneously (Adults only)

PRG Equations

Residential Land Use

Groundwater or Surface Water

Radionuclide

Total - Ingestion and inhalation (volatiles only)

$$C = \frac{TR}{EF \times ED \times [(SF_o \times IR) + (SF_i \times HR \times CF \times IEF)]}$$

where

Parameters	Definition (**units**)	Default Value
C	radionuclide PRG in water (**pCi/L**)	.
CF	units conversion factor (**day/hr**)	1/24
ED	exposure duration (**yr**)	30 [1]
EF	exposure frequency (**day/yr**)	350 [1]

IEF	inhalation exposure factor **(L-hr)/(m^3-day)**	0.2802 (tritium) [14] 7.6030 (radon) [14]
HR	inhalation rate **(m^3/day)**	20 [28]
IR	water ingestion rate **(L/day)**	2 [1]
SF_i	inhalation slope factor **(risk/pCi)**	radionuclide-specific [3]
SF_o	oral slope factor **(risk/pCi)**	radionuclide-specific [3]
TR	target excess individual lifetime cancer risk **(unitless)**	10^{-6} and 10^{-4}

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Toxicity Metadata | HH Risk Models | Eco Benchmarks | Glossary | Background

For information or technical assistance, please contact Fred Dolislager.

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Topic for Key OSWER Radiation Guidances and Reports

EPA Soil Screening Guidance for Radionuclides

Equation Values for Soil to Ground Water

Partitioning Equation Parameter	Value
Dilution factor (unitless)	1
Water-filled soil porosity (L_{water}/L_{soil})	0.3
Dry soil bulk density (kg/L)	1.5

Soil Screening Levels for Soil to Ground Water

Analyte	Ground Water Concentration (pCi/L)	Ground Water Concentration (mg/L)	Ground Water Concentration Source[1]	K_d (L/kg)	SSL (pCi/g)	SSL (mg/kg)
Th-234	6.5E+02	2.8E-11	RBL	20	4.1E+03	5.7E-10

[1]MCL = Maximum Contaminant Limit
PMCL = Proposed Maximum Contaminant Limit
RBL = Decay-corrected Risk Based Limit

EPA Soil Screening Guidance for Radionuclides

Equation Values for Soil to Ground Water

Partitioning Equation Parameter	Value
Dilution factor (unitless)	1
Water-filled soil porosity (L_{water}/L_{soil})	0.3
Dry soil bulk density (kg/L)	1.5

Soil Screening Levels for Soil to Ground Water

Analyte	Ground Water Concentration (pCi/L)	Ground Water Concentration (mg/L)	Ground Water Concentration Source[1]	K_d (L/kg)	SSL (pCi/g)	SSL (mg/kg)
Th-228+D decaychain	1.5E+01	1.8E-11	MCL	20	3.3E+00	3.6E-10

[1]MCL = Maximum Contaminant Limit
PMCL = Proposed Maximum Contaminant Limit
RBL = Decay-corrected Risk Based Limit

EPA Soil Screening Guidance for Radionuclides

Equation Values for Soil to Ground Water

Partitioning Equation Parameter	Value
Dilution factor (unitless)	1
Water-filled soil porosity (L_{water}/L_{soil})	0.3
Dry soil bulk density (kg/L)	1.5

Soil Screening Levels for Soil to Ground Water

Analyte	Ground Water Concentration (pCi/L)	Ground Water Concentration (mg/L)	Ground Water Concentration Source[1]	K_d (L/kg)	SSL (pCi/g)	SSL (mg/kg)
Th-232 decaychain	1.5E+01	1.4E-01	MCL	20	3.0E-01	2.8E+00

[1]MCL = Maximum Contaminant Limit
PMCL = Proposed Maximum Contaminant Limit
RBL = Decay-corrected Risk Based Limit

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Topic for Key OSWER Radiation Guidances and Reports

EPA Soil Screening Guidance for Radionuclides

Equation Values for Ingestion of Soil

Age-adjusted Parameter	Value	Adult-only Parameter	Value
Target Risk (unitless)	1.0E-6	Target Risk (unitless)	1.0E-6
Adult Exposure Duration (yr)	24	Exposure Duration (yr)	25
Child Exposure Duration (yr)	6		
Exposure Frequency (day/yr)	350	Exposure Frequency (day/yr)	250
Adult Intake Rate (mg/day)	100		
Child Intake Rate (mg/day)	200		
Age-adjusted Intake Rate (mg/day)	120	Intake Rate (mg/day)	50
Time of Exposure (yr)	30	Time of Exposure (yr)	25

Decay-Corrected Screening Levels for Ingestion of Soil

Analyte	Soil Ingestion Slope Factor (risk/pCi)	Decay Constant λ (yr^{-1})	Halflife (yr)	SSL (Age-adjusted) (pCi/g)	SSL (Adult) (pCi/g)	SSL (Age-adjusted) (mg/kg)	SSL (Adult) (mg/kg)
Th-232 decaychain	2.3E-10	4.9E-11	1.4E+10	3.4E+00	1.4E+01	3.1E+01	1.3E+02

Equation Values for Ingestion of Produce

Parameter	Value
Target Risk (unitless)	1.0E-6
Exposure Duration (yr)	30
Contaminated Plant Fraction from the site (unitless)	0.5
Vegetable and Fruit Ingestion Rate (kg/yr)	42.7
Leafy Vegetable Ingestion Rate (kg/yr)	4.66
Time of Exposure (yr)	30

Decay-Corrected Screening Levels for Ingestion of Produce

Analyte	Food Ingestion Slope Factor (risk/pCi)	Decay Constant λ (yr^{-1})	Halflife (yr)	Soil-to-plant Transfer Factor (pCi/g plant/pCi/g soil)	SSL (pCi/g)	SSL (mg/kg)
Th-232 decaychain	1.3E-10	4.9E-11	1.4E+10	1.0E-03	1.1E+01	9.7E+01

Equation Values for Inhalation of Fugitive Dust

Particulate Emission Factor Parameter	Value	Equation Parameter	Value
Surface Area (acres)	0.5	Target Risk (unitless)	1.0E-

			6
City (climate zone)	Minneapolis (V)	Exposure Duration (yr)	30
Q/C (g/m^2-s per kg/m^3)	90.8	Exposure Frequency (day/yr)	350
Fraction of vegetative cover (unitless)	0.5	Inhalation Rate (m^3/day)	20
Mean annual windspeed (m/s)	4.69	Outdoor Exposure Time Fraction (unitless)	0.073
Equivalent threshold value of windspeed at 7m (m/s)	11.32	Indoor Exposure Time Fraction (unitless)	0.683
Function dependent on U_m/U_t (unitless)	0.194	Indoor Dilution Factor (unitless)	0.4
		Time of Exposure (yr)	30

Decay-Corrected Screening Levels for Inhalation of Fugitive Dust

Analyte	Inhalation Slope Factor (risk/pCi)	Decay Constant λ (yr^{-1})	Halflife (yr)	Particulate Emission Factor (m^3/kg)	SSL (pCi/g)	SSL (mg/kg)
Th-232 decaychain	4.3E-08	4.9E-11	1.4E+10	1.3E+09	4.2E+02	3.8E+03

Equation Values for External Exposure

Parameter	Value
Target Risk (unitless)	1.0E-6
Exposure Duration (yr)	30
Exposure Frequency (day/yr)	350

Area Correction Factor (unitless)	0.9
Outdoor Exposure Time Fraction (unitless)	0.073
Indoor Exposure Time Fraction (unitless)	0.683
Gamma Shielding Factor (unitless)	0.4
Time of Exposure (yr)	30

Decay-Corrected Screening Levels for External Exposure

Analyte	External Exposure Slope Factor (risk/yr per pCi/g)	Decay Constant λ (yr^{-1})	Halflife (yr)	SSL (pCi/g)	SSL (mg/kg)
Th-232 decaychain	3.4E-10	4.9E-11	1.4E+10	3.3E+02	3.0E+03

Equation Values for Soil to Ground Water

Partitioning Equation Parameter	Value
Dilution factor (unitless)	20
Water-filled soil porosity (L_{water}/L_{soil})	0.3
Dry soil bulk density (kg/L)	1.5

Soil Screening Levels for Soil to Ground Water

Analyte	Ground Water Concentration (pCi/L)	Ground Water Concentration (mg/L)	Ground Water Concentration Source[1]	K_d (L/kg)	SSL (pCi/g)	SSL (mg/kg)

Th-232 decaychain	1.5E+01	1.4E-01	MCL	20	6.1E+00	5.7E+01

[1]MCL = Maximum Contaminant Limit
PMCL = Proposed Maximum Contaminant Limit
RBL = Decay-corrected Risk Based Limit

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Topic for Key OSWER Radiation Guidances and Reports

EPA Soil Screening Guidance for Radionuclides

Equation Values for Ingestion of Soil

Age-adjusted Parameter	Value	Adult-only Parameter	Value
Target Risk (unitless)	1.0E-6	Target Risk (unitless)	1.0E-6
Adult Exposure Duration (yr)	24	Exposure Duration (yr)	25
Child Exposure Duration (yr)	6		
Exposure Frequency (day/yr)	350	Exposure Frequency (day/yr)	250
Adult Intake Rate (mg/day)	100		
Child Intake Rate (mg/day)	200		
Age-adjusted Intake Rate (mg/day)	120	Intake Rate (mg/day)	50
Time of Exposure (yr)	30	Time of Exposure (yr)	25

Decay-Corrected Screening Levels for Ingestion of Soil

Analyte	Soil Ingestion Slope Factor (risk/pCi)	Decay Constant λ (yr^{-1})	Halflife (yr)	SSL (Age-adjusted) (pCi/g)	SSL (Adult) (pCi/g)	SSL (Age-adjusted) (mg/kg)	SSL (Adult) (mg/kg)
Th-230 decaychain	2.0E-10	9.0E-06	7.7E+04	3.9E+00	1.6E+01	1.9E-04	7.9E-04

Equation Values for Ingestion of Produce

Parameter	Value
Target Risk (unitless)	1.0E-6
Exposure Duration (yr)	30
Contaminated Plant Fraction from the site (unitless)	0.5
Vegetable and Fruit Ingestion Rate (kg/yr)	42.7
Leafy Vegetable Ingestion Rate (kg/yr)	4.66
Time of Exposure (yr)	30

Decay-Corrected Screening Levels for Ingestion of Produce

Analyte	Food Ingestion Slope Factor (risk/pCi)	Decay Constant λ (yr^{-1})	Halflife (yr)	Soil-to-plant Transfer Factor (pCi/g plant/pCi/g soil)	SSL (pCi/g)	SSL (mg/kg)
Th-230 decaychain	1.2E-10	9.0E-06	7.7E+04	1.0E-03	1.2E+01	5.9E-04

Equation Values for Inhalation of Fugitive Dust

Particulate Emission Factor Parameter	Value	Equation Parameter	Value
Surface Area (acres)	0.5	Target Risk (unitless)	1.0E-

			6
City (climate zone)	Minneapolis (V)	Exposure Duration (yr)	30
Q/C (g/m^2-s per kg/m^3)	90.8	Exposure Frequency (day/yr)	350
Fraction of vegetative cover (unitless)	0.5	Inhalation Rate (m^3/day)	20
Mean annual windspeed (m/s)	4.69	Outdoor Exposure Time Fraction (unitless)	0.073
Equivalent threshold value of windspeed at 7m (m/s)	11.32	Indoor Exposure Time Fraction (unitless)	0.683
Function dependent on U_m/U_t (unitless)	0.194	Indoor Dilution Factor (unitless)	0.4
		Time of Exposure (yr)	30

Decay-Corrected Screening Levels for Inhalation of Fugitive Dust

Analyte	Inhalation Slope Factor (risk/pCi)	Decay Constant λ (yr^{-1})	Halflife (yr)	Particulate Emission Factor (m^3/kg)	SSL (pCi/g)	SSL (mg/kg)
Th-230 decaychain	2.9E-08	9.0E-06	7.7E+04	1.3E+09	6.4E+02	3.2E-02

Equation Values for External Exposure

Parameter	Value
Target Risk (unitless)	1.0E-6
Exposure Duration (yr)	30
Exposure Frequency (day/yr)	350

Area Correction Factor (unitless)	0.9
Outdoor Exposure Time Fraction (unitless)	0.073
Indoor Exposure Time Fraction (unitless)	0.683
Gamma Shielding Factor (unitless)	0.4
Time of Exposure (yr)	30

Decay-Corrected Screening Levels for External Exposure

Analyte	External Exposure Slope Factor (risk/yr per pCi/g)	Decay Constant λ (yr^{-1})	Halflife (yr)	SSL (pCi/g)	SSL (mg/kg)
Th-230 decaychain	8.2E-10	9.0E-06	7.7E+04	1.4E+02	6.8E-03

Equation Values for Soil to Ground Water

Partitioning Equation Parameter	Value
Dilution factor (unitless)	20
Water-filled soil porosity (L_{water}/L_{soil})	0.3
Dry soil bulk density (kg/L)	1.5

Soil Screening Levels for Soil to Ground Water

Analyte	Ground Water Concentration (pCi/L)	Ground Water Concentration (mg/L)	Ground Water Concentration Source[1]	K_d (L/kg)	SSL (pCi/g)	SSL (mg/kg)

Th-230 decaychain	1.5E+01	7.4E-07	MCL	20	6.1E+00	3.0E-04

[1]MCL = Maximum Contaminant Limit
PMCL = Proposed Maximum Contaminant Limit
RBL = Decay-corrected Risk Based Limit

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Topic for Key OSWER Radiation Guidances and Reports

EPA Soil Screening Guidance for Radionuclides

Equation Values for Soil to Ground Water

Partitioning Equation Parameter	Value
Dilution factor (unitless)	1
Water-filled soil porosity (L_{water}/L_{soil})	0.3
Dry soil bulk density (kg/L)	1.5

Soil Screening Levels for Soil to Ground Water

Analyte	Ground Water Concentration (pCi/L)	Ground Water Concentration (mg/L)	Ground Water Concentration Source[1]	K_d (L/kg)	SSL (pCi/g)	SSL (mg/kg)
Th-230 decaychain	1.5E+01	7.4E-07	MCL	20	3.0E-01	1.5E-05

[1]MCL = Maximum Contaminant Limit
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Topic for Key OSWER Radiation Guidances and Reports

EPA Soil Screening Guidance for Radionuclides

Equation Values for Ingestion of Soil

Age-adjusted Parameter	Value	Adult-only Parameter	Value
Target Risk (unitless)	1.0E-6	Target Risk (unitless)	1.0E-6
Adult Exposure Duration (yr)	24	Exposure Duration (yr)	25
Child Exposure Duration (yr)	6		
Exposure Frequency (day/yr)	350	Exposure Frequency (day/yr)	250
Adult Intake Rate (mg/day)	100		
Child Intake Rate (mg/day)	200		
Age-adjusted Intake Rate (mg/day)	120	Intake Rate (mg/day)	50
Time of Exposure (yr)	30	Time of Exposure (yr)	25

Decay-Corrected Screening Levels for Ingestion of Soil

Analyte	Soil Ingestion Slope Factor (risk/pCi)	Decay Constant λ (yr^{-1})	Halflife (yr)	SSL (Age-adjusted) (pCi/g)	SSL (Adult) (pCi/g)	SSL (Age-adjusted) (mg/kg)	SSL (Adult) (mg/kg)
Th-228+D decaychain	8.1E-10	3.6E-01	1.9E+00	1.1E+01	3.6E+01	1.3E-08	4.4E-08

Equation Values for Ingestion of Produce

Parameter	Value
Target Risk (unitless)	1.0E-6
Exposure Duration (yr)	30
Contaminated Plant Fraction from the site (unitless)	0.5
Vegetable and Fruit Ingestion Rate (kg/yr)	42.7
Leafy Vegetable Ingestion Rate (kg/yr)	4.66
Time of Exposure (yr)	30

Decay-Corrected Screening Levels for Ingestion of Produce

Analyte	Food Ingestion Slope Factor (risk/pCi)	Decay Constant λ (yr^{-1})	Halflife (yr)	Soil-to-plant Transfer Factor (pCi/g plant/pCi/g soil)	SSL (pCi/g)	SSL (mg/kg)
Th-228+D decaychain	4.2E-10	3.6E-01	1.9E+00	1.0E-03	3.6E+01	4.4E-08

Equation Values for Inhalation of Fugitive Dust

Particulate Emission Factor Parameter	Value	Equation Parameter	Value
Surface Area (acres)	0.5	Target Risk (unitless)	1.0E-

			6
City (climate zone)	Minneapolis (V)	Exposure Duration (yr)	30
Q/C (g/m^2-s per kg/m^3)	90.8	Exposure Frequency (day/yr)	350
Fraction of vegetative cover (unitless)	0.5	Inhalation Rate (m^3/day)	20
Mean annual windspeed (m/s)	4.69	Outdoor Exposure Time Fraction (unitless)	0.073
Equivalent threshold value of windspeed at 7m (m/s)	11.32	Indoor Exposure Time Fraction (unitless)	0.683
Function dependent on U_m/U_t (unitless)	0.194	Indoor Dilution Factor (unitless)	0.4
		Time of Exposure (yr)	30

Decay-Corrected Screening Levels for Inhalation of Fugitive Dust

Analyte	Inhalation Slope Factor (risk/pCi)	Decay Constant λ (yr^{-1})	Halflife (yr)	Particulate Emission Factor (m^3/kg)	SSL (pCi/g)	SSL (mg/kg)
Th-228+D decaychain	1.4E-07	3.6E-01	1.9E+00	1.3E+09	1.4E+03	1.7E-06

Equation Values for External Exposure

Parameter	Value
Target Risk (unitless)	1.0E-6

Exposure Duration (yr)	30
Exposure Frequency (day/yr)	350
Area Correction Factor (unitless)	0.9
Outdoor Exposure Time Fraction (unitless)	0.073
Indoor Exposure Time Fraction (unitless)	0.683
Gamma Shielding Factor (unitless)	0.4
Time of Exposure (yr)	30

Decay-Corrected Screening Levels for External Exposure

Analyte	External Exposure Slope Factor (risk/yr per pCi/g)	Decay Constant λ (yr^{-1})	Halflife (yr)	SSL (pCi/g)	SSL (mg/kg)
Th-228+D decaychain	7.8E-06	3.6E-01	1.9E+00	1.6E-01	1.9E-10

Equation Values for Soil to Ground Water

Partitioning Equation Parameter	Value
Dilution factor (unitless)	20
Water-filled soil porosity (L_{water}/L_{soil})	0.3
Dry soil bulk density (kg/L)	1.5

Soil Screening Levels for Soil to Ground Water

Ground Water	Ground Water	Ground Water Concentration	K_d	SSL	SSL

Analyte	Concentration (pCi/L)	Concentration (mg/L)	Source[1]	(L/kg)	(pCi/g)	(mg/kg)
Th-228+D decaychain	1.5E+01	1.8E-11	MCL	20	6.6E+01	7.3E-09

[1]MCL = Maximum Contaminant Limit
PMCL = Proposed Maximum Contaminant Limit
RBL = Decay-corrected Risk Based Limit

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Topic for Key OSWER Radiation Guidances and Reports

EPA Soil Screening Guidance for Radionuclides

Equation Values for Ingestion of Soil

Age-adjusted Parameter	Value	Adult-only Parameter	Value
Target Risk (unitless)	1.0E-6	Target Risk (unitless)	1.0E-6
Adult Exposure Duration (yr)	24	Exposure Duration (yr)	25
Child Exposure Duration (yr)	6		
Exposure Frequency (day/yr)	350	Exposure Frequency (day/yr)	250
Adult Intake Rate (mg/day)	100		
Child Intake Rate (mg/day)	200		
Age-adjusted Intake Rate (mg/day)	120	Intake Rate (mg/day)	50
Time of Exposure (yr)	30	Time of Exposure (yr)	25

Decay-Corrected Screening Levels for Ingestion of Soil

Analyte	Soil Ingestion Slope Factor (risk/pCi)	Decay Constant λ (yr^{-1})	Halflife (yr)	SSL (Age-adjusted) (pCi/g)	SSL (Adult) (pCi/g)	SSL (Age-adjusted) (mg/kg)	SSL (Adult) (mg/kg)
U-235+D decaychain	1.6E-10	9.8E-10	7.0E+08	4.9E+00	2.0E+01	2.3E+00	9.1E+00

Equation Values for Ingestion of Produce

Parameter	Value
Target Risk (unitless)	1.0E-6
Exposure Duration (yr)	30
Contaminated Plant Fraction from the site (unitless)	0.5
Vegetable and Fruit Ingestion Rate (kg/yr)	42.7
Leafy Vegetable Ingestion Rate (kg/yr)	4.66
Time of Exposure (yr)	30

Decay-Corrected Screening Levels for Ingestion of Produce

Analyte	Food Ingestion Slope Factor (risk/pCi)	Decay Constant λ (yr^{-1})	Halflife (yr)	Soil-to-plant Transfer Factor (pCi/g plant/pCi/g soil)	SSL (pCi/g)	SSL (mg/kg)
U-235+D decaychain	9.8E-11	9.8E-10	7.0E+08	2.5E-03	5.8E+00	2.7E+00

Equation Values for Inhalation of Fugitive Dust

Particulate Emission Factor Parameter	Value	Equation Parameter	Value
Surface Area (acres)	0.5	Target Risk (unitless)	1.0E-

			6
City (climate zone)	Minneapolis (V)	Exposure Duration (yr)	30
Q/C (g/m^2-s per kg/m^3)	90.8	Exposure Frequency (day/yr)	350
Fraction of vegetative cover (unitless)	0.5	Inhalation Rate (m^3/day)	20
Mean annual windspeed (m/s)	4.69	Outdoor Exposure Time Fraction (unitless)	0.073
Equivalent threshold value of windspeed at 7m (m/s)	11.32	Indoor Exposure Time Fraction (unitless)	0.683
Function dependent on U_m/U_t (unitless)	0.194	Indoor Dilution Factor (unitless)	0.4
		Time of Exposure (yr)	30

Decay-Corrected Screening Levels for Inhalation of Fugitive Dust

Analyte	Inhalation Slope Factor (risk/pCi)	Decay Constant λ (yr^{-1})	Halflife (yr)	Particulate Emission Factor (m^3/kg)	SSL (pCi/g)	SSL (mg/kg)
U-235+D decaychain	1.0E-08	9.8E-10	7.0E+08	1.3E+09	1.8E+03	8.3E+02

Equation Values for External Exposure

Parameter	Value
Target Risk (unitless)	1.0E-6
Exposure Duration (yr)	30
Exposure Frequency (day/yr)	350

Area Correction Factor (unitless)	0.9
Outdoor Exposure Time Fraction (unitless)	0.073
Indoor Exposure Time Fraction (unitless)	0.683
Gamma Shielding Factor (unitless)	0.4
Time of Exposure (yr)	30

Decay-Corrected Screening Levels for External Exposure

Analyte	External Exposure Slope Factor (risk/yr per pCi/g)	Decay Constant λ (yr^{-1})	Halflife (yr)	SSL (pCi/g)	SSL (mg/kg)
U-235+D decaychain	5.4E-07	9.8E-10	7.0E+08	2.1E-01	9.5E-02

Equation Values for Soil to Ground Water

Partitioning Equation Parameter	Value
Dilution factor (unitless)	20
Water-filled soil porosity (L_{water}/L_{soil})	0.3
Dry soil bulk density (kg/L)	1.5

Soil Screening Levels for Soil to Ground Water

Analyte	Ground Water Concentration (pCi/L)	Ground Water Concentration (mg/L)	Ground Water Concentration Source[1]	K_d (L/kg)	SSL (pCi/g)	SSL (mg/kg)

U-235+D decaychain	6.5E+01	3.0E-02	MCL	0.4	7.8E-01	3.6E-01

[1]MCL = Maximum Contaminant Limit
PMCL = Proposed Maximum Contaminant Limit
RBL = Decay-corrected Risk Based Limit

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Topic for Key OSWER Radiation Guidances and Reports.

EPA Soil Screening Guidance for Radionuclides

Equation Values for Soil to Ground Water

Partitioning Equation Parameter	Value
Dilution factor (unitless)	1 ✓
Water-filled soil porosity (L_{water}/L_{soil})	0.3
Dry soil bulk density (kg/L)	1.5

Soil Screening Levels for Soil to Ground Water

Analyte	Ground Water Concentration (pCi/L)	Ground Water Concentration (mg/L)	Ground Water Concentration Source[1]	K_d (L/kg)	✓ SSL (pCi/g)	SSL (mg/kg)
U-235+D decaychain	6.5E+01	3.0E-02	MCL	0.4	3.9E-02	1.8E-02

[1]MCL = Maximum Contaminant Limit
PMCL = Proposed Maximum Contaminant Limit
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EPA Soil Screening Guidance for Radionuclides

Equation Values for Ingestion of Soil

Age-adjusted Parameter	Value	Adult-only Parameter	Value
Target Risk (unitless)	1.0E-6	Target Risk (unitless)	1.0E-6
Adult Exposure Duration (yr)	24	Exposure Duration (yr)	25
Child Exposure Duration (yr)	6		
Exposure Frequency (day/yr)	350	Exposure Frequency (day/yr)	250
Adult Intake Rate (mg/day)	100		
Child Intake Rate (mg/day)	200		
Age-adjusted Intake Rate (mg/day)	120	Intake Rate (mg/day)	50
Time of Exposure (yr)	30	Time of Exposure (yr)	25

Decay-Corrected Screening Levels for Ingestion of Soil

Analyte	Soil Ingestion Slope Factor (risk/pCi)	Decay Constant λ (yr^{-1})	Halflife (yr)	SSL (Age-adjusted) (pCi/g)	SSL (Adult) (pCi/g)	SSL (Age-adjusted) (mg/kg)	SSL (Adult) (mg/kg)
Ac-228	5.6E-12	9.9E+02	7.0E-04	4.2E+06	1.4E+07	1.9E-06	6.4E-06

Equation Values for Ingestion of Produce

Parameter	Value
Target Risk (unitless)	1.0E-6
Exposure Duration (yr)	30
Contaminated Plant Fraction from the site (unitless)	0.5
Vegetable and Fruit Ingestion Rate (kg/yr)	42.7
Leafy Vegetable Ingestion Rate (kg/yr)	4.66
Time of Exposure (yr)	30

Decay-Corrected Screening Levels for Ingestion of Produce

Analyte	Food Ingestion Slope Factor (risk/pCi)	Decay Constant λ (yr^{-1})	Halflife (yr)	Soil-to-plant Transfer Factor (pCi/g plant/pCi/g soil)	SSL (pCi/g)	SSL (mg/kg)
Ac-228	2.9E-12	9.9E+02	7.0E-04	2.5E-03	5.8E+06	2.6E-06

Equation Values for Inhalation of Fugitive Dust

Particulate Emission Factor Parameter	Value	Equation Parameter	Value
Surface Area (acres)	0.5	Target Risk (unitless)	1.0E-6
City (climate zone)	Minneapolis (V)	Exposure Duration (yr)	30

Q/C (g/m^2-s per kg/m^3)	90.8	Exposure Frequency (day/yr)	350
Fraction of vegetative cover (unitless)	0.5	Inhalation Rate (m^3/day)	20
Mean annual windspeed (m/s)	4.69	Outdoor Exposure Time Fraction (unitless)	0.073
Equivalent threshold value of windspeed at 7m (m/s)	11.32	Indoor Exposure Time Fraction (unitless)	0.683
Function dependent on U_m/U_t (unitless)	0.194	Indoor Dilution Factor (unitless)	0.4
		Time of Exposure (yr)	30

Decay-Corrected Screening Levels for Inhalation of Fugitive Dust

Analyte	Inhalation Slope Factor (risk/pCi)	Decay Constant λ (yr^{-1})	Halflife (yr)	Particulate Emission Factor (m^3/kg)	SSL (pCi/g)	SSL (mg/kg)
Ac-228	4.9E-11	9.9E+02	7.0E-04	1.3E+09	1.1E+10	4.9E-03

Equation Values for External Exposure

Parameter	Value
Target Risk (unitless)	1.0E-6
Exposure Duration (yr)	30
Exposure Frequency (day/yr)	350
Area Correction Factor (unitless)	0.9
Outdoor Exposure Time Fraction (unitless)	0.073
Indoor Exposure Time Fraction (unitless)	0.683

Gamma Shielding Factor (unitless)	0.4
Time of Exposure (yr)	30

Decay-Corrected Screening Levels for External Exposure

Analyte	External Exposure Slope Factor (risk/yr per pCi/g)	Decay Constant λ (yr^{-1})	Halflife (yr)	SSL (pCi/g)	SSL (mg/kg)
Ac-228	4.5E-06	9.9E+02	7.0E-04	7.3E+02	3.3E-10

Equation Values for Soil to Ground Water

Partitioning Equation Parameter	Value
Dilution factor (unitless)	20
Water-filled soil porosity (L_{water}/L_{soil})	0.3
Dry soil bulk density (kg/L)	1.5

Soil Screening Levels for Soil to Ground Water

Analyte	Ground Water Concentration (pCi/L)	Ground Water Concentration (mg/L)	Ground Water Concentration Source[1]	K_d (L/kg)	SSL (pCi/g)	SSL (mg/kg)
Ac-228	7.1E+05	3.2E-10	RBL			

[1]MCL = Maximum Contaminant Limit

PMCL = Proposed Maximum Contaminant Limit
RBL = Decay-corrected Risk Based Limit

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Topic for Key OSWER Radiation Guidances and Reports

EPA Soil Screening Guidance for Radionuclides

Equation Values for Ingestion of Soil

Age-adjusted Parameter	Value	Adult-only Parameter	Value
Target Risk (unitless)	1.0E-6	Target Risk (unitless)	1.0E-6
Adult Exposure Duration (yr)	24	Exposure Duration (yr)	25
Child Exposure Duration (yr)	6		
Exposure Frequency (day/yr)	350	Exposure Frequency (day/yr)	250
Adult Intake Rate (mg/day)	100		
Child Intake Rate (mg/day)	200		
Age-adjusted Intake Rate (mg/day)	120	Intake Rate (mg/day)	50
Time of Exposure (yr)	30	Time of Exposure (yr)	25

Decay-Corrected Screening Levels for Ingestion of Soil

Analyte	Soil Ingestion Slope Factor (risk/pCi)	Decay Constant λ (yr^{-1})	Halflife (yr)	SSL (Age-adjusted) (pCi/g)	SSL (Adult) (pCi/g)	SSL (Age-adjusted) (mg/kg)	SSL (Adult) (mg/kg)
Bi-212	1.8E-12	6.0E+03	1.2E-04	8.0E+07	2.7E+08	5.5E-06	1.8E-05

Equation Values for Ingestion of Produce

Parameter	Value
Target Risk (unitless)	1.0E-6
Exposure Duration (yr)	30
Contaminated Plant Fraction from the site (unitless)	0.5
Vegetable and Fruit Ingestion Rate (kg/yr)	42.7
Leafy Vegetable Ingestion Rate (kg/yr)	4.66
Time of Exposure (yr)	30

Decay-Corrected Screening Levels for Ingestion of Produce

Analyte	Food Ingestion Slope Factor (risk/pCi)	Decay Constant λ (yr^{-1})	Halflife (yr)	Soil-to-plant Transfer Factor (pCi/g plant/pCi/g soil)	SSL (pCi/g)	SSL (mg/kg)
Bi-212	1.0E-12	6.0E+03	1.2E-04	1.0E-01	2.5E+06	1.7E-07

Equation Values for Inhalation of Fugitive Dust

Particulate Emission Factor Parameter	Value	Equation Parameter	Value
Surface Area (acres)	0.5	Target Risk (unitless)	1.0E-6
City (climate zone)	Minneapolis (V)	Exposure Duration (yr)	30

Q/C (g/m^2-s per kg/m^3)	90.8	Exposure Frequency (day/yr)	350
Fraction of vegetative cover (unitless)	0.5	Inhalation Rate (m^3/day)	20
Mean annual windspeed (m/s)	4.69	Outdoor Exposure Time Fraction (unitless)	0.073
Equivalent threshold value of windspeed at 7m (m/s)	11.32	Indoor Exposure Time Fraction (unitless)	0.683
Function dependent on U_m/U_t (unitless)	0.194	Indoor Dilution Factor (unitless)	0.4
		Time of Exposure (yr)	30

Decay-Corrected Screening Levels for Inhalation of Fugitive Dust

Analyte	Inhalation Slope Factor (risk/pCi)	Decay Constant λ (yr^{-1})	Halflife (yr)	Particulate Emission Factor (m^3/kg)	SSL (pCi/g)	SSL (mg/kg)
Bi-212	7.8E-11	6.0E+03	1.2E-04	1.3E+09	4.2E+10	2.9E-03

Equation Values for External Exposure

Parameter	Value
Target Risk (unitless)	1.0E-6
Exposure Duration (yr)	30
Exposure Frequency (day/yr)	350
Area Correction Factor (unitless)	0.9
Outdoor Exposure Time Fraction (unitless)	0.073
Indoor Exposure Time Fraction (unitless)	0.683

Gamma Shielding Factor (unitless)	0.4
Time of Exposure (yr)	30

Decay-Corrected Screening Levels for External Exposure

Analyte	External Exposure Slope Factor (risk/yr per pCi/g)	Decay Constant λ (yr^{-1})	Halflife (yr)	SSL (pCi/g)	SSL (mg/kg)
Bi-212	8.9E-07	6.0E+03	1.2E-04	2.3E+04	1.6E-09

Equation Values for Soil to Ground Water

Partitioning Equation Parameter	Value
Dilution factor (unitless)	20
Water-filled soil porosity (L_{water}/L_{soil})	0.3
Dry soil bulk density (kg/L)	1.5

Soil Screening Levels for Soil to Ground Water

Analyte	Ground Water Concentration (pCi/L)	Ground Water Concentration (mg/L)	Ground Water Concentration Source[1]	K_d (L/kg)	SSL (pCi/g)	SSL (mg/kg)
Bi-212	1.2E+07	8.3E-10	RBL			

[1]MCL = Maximum Contaminant Limit

PMCL = Proposed Maximum Contaminant Limit
RBL = Decay-corrected Risk Based Limit

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Topic for Key OSWER Radiation Guidances and Reports

EPA Soil Screening Guidance for Radionuclides

Equation Values for Ingestion of Soil

Age-adjusted Parameter	Value	Adult-only Parameter	Value
Target Risk (unitless)	1.0E-6	Target Risk (unitless)	1.0E-6
Adult Exposure Duration (yr)	24	Exposure Duration (yr)	25
Child Exposure Duration (yr)	6		
Exposure Frequency (day/yr)	350	Exposure Frequency (day/yr)	250
Adult Intake Rate (mg/day)	100		
Child Intake Rate (mg/day)	200		
Age-adjusted Intake Rate (mg/day)	120	Intake Rate (mg/day)	50
Time of Exposure (yr)	30	Time of Exposure (yr)	25

Decay-Corrected Screening Levels for Ingestion of Soil

Analyte	Soil Ingestion Slope Factor (risk/pCi)	Decay Constant λ (yr^{-1})	Halflife (yr)	SSL (Age-adjusted) (pCi/g)	SSL (Adult) (pCi/g)	SSL (Age-adjusted) (mg/kg)	SSL (Adult) (mg/kg)
Bi-214	4.3E-13	1.8E+04	3.8E-05	1.0E+09	3.4E+09	2.3E-05	7.7E-05

Equation Values for Ingestion of Produce

Parameter	Value
Target Risk (unitless)	1.0E-6
Exposure Duration (yr)	30
Contaminated Plant Fraction from the site (unitless)	0.5
Vegetable and Fruit Ingestion Rate (kg/yr)	42.7
Leafy Vegetable Ingestion Rate (kg/yr)	4.66
Time of Exposure (yr)	30

Decay-Corrected Screening Levels for Ingestion of Produce

Analyte	Food Ingestion Slope Factor (risk/pCi)	Decay Constant λ (yr^{-1})	Halflife (yr)	Soil-to-plant Transfer Factor (pCi/g plant/pCi/g soil)	SSL (pCi/g)	SSL (mg/kg)
Bi-214	2.7E-13	1.8E+04	3.8E-05	1.0E-01	2.9E+07	6.6E-07

Equation Values for Inhalation of Fugitive Dust

Particulate Emission Factor Parameter	Value	Equation Parameter	Value
Surface Area (acres)	0.5	Target Risk (unitless)	1.0E-6
City (climate zone)	Minneapolis (V)	Exposure Duration (yr)	30

Q/C (g/m^2-s per kg/m^3)	90.8	Exposure Frequency (day/yr)	350
Fraction of vegetative cover (unitless)	0.5	Inhalation Rate (m^3/day)	20
Mean annual windspeed (m/s)	4.69	Outdoor Exposure Time Fraction (unitless)	0.073
Equivalent threshold value of windspeed at 7m (m/s)	11.32	Indoor Exposure Time Fraction (unitless)	0.683
Function dependent on U_m/U_t (unitless)	0.194	Indoor Dilution Factor (unitless)	0.4
		Time of Exposure (yr)	30

Decay-Corrected Screening Levels for Inhalation of Fugitive Dust

Analyte	Inhalation Slope Factor (risk/pCi)	Decay Constant λ (yr^{-1})	Halflife (yr)	Particulate Emission Factor (m^3/kg)	SSL (pCi/g)	SSL (mg/kg)
Bi-214	2.9E-11	1.8E+04	3.8E-05	1.3E+09	3.4E+11	7.8E-03

Equation Values for External Exposure

Parameter	Value
Target Risk (unitless)	1.0E-6
Exposure Duration (yr)	30
Exposure Frequency (day/yr)	350
Area Correction Factor (unitless)	0.9
Outdoor Exposure Time Fraction (unitless)	0.073
Indoor Exposure Time Fraction (unitless)	0.683

Gamma Shielding Factor (unitless)	0.4
Time of Exposure (yr)	30

Decay-Corrected Screening Levels for External Exposure

Analyte	External Exposure Slope Factor (risk/yr per pCi/g)	Decay Constant λ (yr^{-1})	Halflife (yr)	SSL (pCi/g)	SSL (mg/kg)
Bi-214	7.5E-06	1.8E+04	3.8E-05	8.2E+03	1.9E-10

Equation Values for Soil to Ground Water

Partitioning Equation Parameter	Value
Dilution factor (unitless)	20
Water-filled soil porosity (L_{water}/L_{soil})	0.3
Dry soil bulk density (kg/L)	1.5

Soil Screening Levels for Soil to Ground Water

Analyte	Ground Water Concentration (pCi/L)	Ground Water Concentration (mg/L)	Ground Water Concentration Source[1]	K_d (L/kg)	SSL (pCi/g)	SSL (mg/kg)
Bi-214	1.4E+08	3.1E-09	RBL			

[1]MCL = Maximum Contaminant Limit

PMCL = Proposed Maximum Contaminant Limit
RBL = Decay-corrected Risk Based Limit

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Topic for Reg OSWER Radiation Guidances and Reports

EPA Soil Screening Guidance for Radionuclides

Equation Values for Ingestion of Soil

Age-adjusted Parameter	Value	Adult-only Parameter	Value
Target Risk (unitless)	1.0E-6	Target Risk (unitless)	1.0E-6
Adult Exposure Duration (yr)	24	Exposure Duration (yr)	25
Child Exposure Duration (yr)	6		
Exposure Frequency (day/yr)	350	Exposure Frequency (day/yr)	250
Adult Intake Rate (mg/day)	100		
Child Intake Rate (mg/day)	200		
Age-adjusted Intake Rate (mg/day)	120	Intake Rate (mg/day)	50
Time of Exposure (yr)	30	Time of Exposure (yr)	25

Decay-Corrected Screening Levels for Ingestion of Soil

Analyte	Soil Ingestion Slope Factor (risk/pCi)	Decay Constant λ (yr^{-1})	Halflife (yr)	SSL (Age-adjusted) (pCi/g)	SSL (Adult) (pCi/g)	SSL (Age-adjusted) (mg/kg)	SSL (Adult) (mg/kg)
Cs-137+D decaychain	4.3E-11	2.3E-02	3.0E+01	2.5E+01	9.7E+01	2.9E-07	1.1E-06

Equation Values for Ingestion of Produce

Parameter	Value
Target Risk (unitless)	1.0E-6
Exposure Duration (yr)	30
Contaminated Plant Fraction from the site (unitless)	0.5
Vegetable and Fruit Ingestion Rate (kg/yr)	42.7
Leafy Vegetable Ingestion Rate (kg/yr)	4.66
Time of Exposure (yr)	30

Decay-Corrected Screening Levels for Ingestion of Produce

Analyte	Food Ingestion Slope Factor (risk/pCi)	Decay Constant λ (yr^{-1})	Halflife (yr)	Soil-to-plant Transfer Factor (pCi/g plant/pCi/g soil)	SSL (pCi/g)	SSL (mg/kg)
Cs-137+D decaychain	3.7E-11	2.3E-02	3.0E+01	4.0E-02	1.3E+00	1.5E-08

Equation Values for Inhalation of Fugitive Dust

Particulate Emission Factor Parameter	Value	Equation Parameter	Value
Surface Area (acres)	0.5	Target Risk (unitless)	1.0E-

			6
City (climate zone)	Minneapolis (V)	Exposure Duration (yr)	30
Q/C (g/m^2-s per kg/m^3)	90.8	Exposure Frequency (day/yr)	350
Fraction of vegetative cover (unitless)	0.5	Inhalation Rate (m^3/day)	20
Mean annual windspeed (m/s)	4.69	Outdoor Exposure Time Fraction (unitless)	0.073
Equivalent threshold value of windspeed at 7m (m/s)	11.32	Indoor Exposure Time Fraction (unitless)	0.683
Function dependent on U_m/U_t (unitless)	0.194	Indoor Dilution Factor (unitless)	0.4
		Time of Exposure (yr)	30

Decay-Corrected Screening Levels for Inhalation of Fugitive Dust

Analyte	Inhalation Slope Factor (risk/pCi)	Decay Constant λ (yr^{-1})	Halflife (yr)	Particulate Emission Factor (m^3/kg)	SSL (pCi/g)	SSL (mg/kg)
Cs-137+D decaychain	1.2E-11	2.3E-02	3.0E+01	1.3E+09	2.1E+06	2.4E-02

Equation Values for External Exposure

Parameter	Value
Target Risk (unitless)	1.0E-6

Exposure Duration (yr)	30
Exposure Frequency (day/yr)	350
Area Correction Factor (unitless)	0.9
Outdoor Exposure Time Fraction (unitless)	0.073
Indoor Exposure Time Fraction (unitless)	0.683
Gamma Shielding Factor (unitless)	0.4
Time of Exposure (yr)	30

Decay-Corrected Screening Levels for External Exposure

Analyte	External Exposure Slope Factor (risk/yr per pCi/g)	Decay Constant λ (yr^{-1})	Halflife (yr)	SSL (pCi/g)	SSL (mg/kg)
Cs-137+D decaychain	2.6E-06	2.3E-02	3.0E+01	6.1E-02	7.0E-10

Equation Values for Soil to Ground Water

Partitioning Equation Parameter	Value
Dilution factor (unitless)	20
Water-filled soil porosity (L_{water}/L_{soil})	0.3
Dry soil bulk density (kg/L)	1.5

Soil Screening Levels for Soil to Ground Water

Ground Water	Ground Water	Ground Water Concentration	K_d	SSL	SSL

Analyte	Concentration (pCi/L)	Concentration (mg/L)	Source[1]	(L/kg)	(pCi/g)	(mg/kg)
Cs-137+D decaychain	2.0E+02	2.3E-09	MCL	10	5.7E+01	4.7E-07

[1]MCL = Maximum Contaminant Limit
PMCL = Proposed Maximum Contaminant Limit
RBL = Decay-corrected Risk Based Limit

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Topic for Key OSWER Radiation Guidances and Reports

EPA Soil Screening Guidance for Radionuclides

Equation Values for Ingestion of Soil

Age-adjusted Parameter	Value	Adult-only Parameter	Value
Target Risk (unitless)	1.0E-6	Target Risk (unitless)	1.0E-6
Adult Exposure Duration (yr)	24	Exposure Duration (yr)	25
Child Exposure Duration (yr)	6		
Exposure Frequency (day/yr)	350	Exposure Frequency (day/yr)	250
Adult Intake Rate (mg/day)	100		
Child Intake Rate (mg/day)	200		
Age-adjusted Intake Rate (mg/day)	120	Intake Rate (mg/day)	50
Time of Exposure (yr)	30	Time of Exposure (yr)	25

Decay-Corrected Screening Levels for Ingestion of Soil

Analyte	Soil Ingestion Slope Factor (risk/pCi)	Decay Constant λ (yr^{-1})	Halflife (yr)	SSL (Age-adjusted) (pCi/g)	SSL (Adult) (pCi/g)	SSL (Age-adjusted) (mg/kg)	SSL (Adult) (mg/kg)
Eu-155 decaychain	5.4E-12	1.4E-01	5.0E+00	6.3E+02	2.1E+03	1.3E-06	4.6E-06

Equation Values for Ingestion of Produce

Parameter	Value
Target Risk (unitless)	1.0E-6
Exposure Duration (yr)	30
Contaminated Plant Fraction from the site (unitless)	0.5
Vegetable and Fruit Ingestion Rate (kg/yr)	42.7
Leafy Vegetable Ingestion Rate (kg/yr)	4.66
Time of Exposure (yr)	30

Decay-Corrected Screening Levels for Ingestion of Produce

Analyte	Food Ingestion Slope Factor (risk/pCi)	Decay Constant λ (yr^{-1})	Halflife (yr)	Soil-to-plant Transfer Factor (pCi/g plant/pCi/g soil)	SSL (pCi/g)	SSL (mg/kg)
Eu-155 decaychain	2.8E-12	1.4E-01	5.0E+00	2.5E-03	8.7E+02	1.9E-06

Equation Values for Inhalation of Fugitive Dust

Particulate Emission Factor Parameter	Value	Equation Parameter	Value
Surface Area (acres)	0.5	Target Risk (unitless)	1.0E-

			6
City (climate zone)	Minneapolis (V)	Exposure Duration (yr)	30
Q/C (g/m^2-s per kg/m^3)	90.8	Exposure Frequency (day/yr)	350
Fraction of vegetative cover (unitless)	0.5	Inhalation Rate (m^3/day)	20
Mean annual windspeed (m/s)	4.69	Outdoor Exposure Time Fraction (unitless)	0.073
Equivalent threshold value of windspeed at 7m (m/s)	11.32	Indoor Exposure Time Fraction (unitless)	0.683
Function dependent on U_m/U_t (unitless)	0.194	Indoor Dilution Factor (unitless)	0.4
		Time of Exposure (yr)	30

Decay-Corrected Screening Levels for Inhalation of Fugitive Dust

Analyte	Inhalation Slope Factor (risk/pCi)	Decay Constant λ (yr^{-1})	Halflife (yr)	Particulate Emission Factor (m^3/kg)	SSL (pCi/g)	SSL (mg/kg)
Eu-155 decaychain	1.5E-11	1.4E-01	5.0E+00	1.3E+09	5.2E+06	1.1E-02

Equation Values for External Exposure

Parameter	Value
Target Risk (unitless)	1.0E-6
Exposure Duration (yr)	30
Exposure Frequency (day/yr)	350

Area Correction Factor (unitless)	0.9
Outdoor Exposure Time Fraction (unitless)	0.073
Indoor Exposure Time Fraction (unitless)	0.683
Gamma Shielding Factor (unitless)	0.4
Time of Exposure (yr)	30

Decay-Corrected Screening Levels for External Exposure

Analyte	External Exposure Slope Factor (risk/yr per pCi/g)	Decay Constant λ (yr^{-1})	Halflife (yr)	SSL (pCi/g)	SSL (mg/kg)
Eu-155 decaychain	1.2E-07	1.4E-01	5.0E+00	3.8E+00	8.2E-09

Equation Values for Soil to Ground Water

Partitioning Equation Parameter	Value
Dilution factor (unitless)	20
Water-filled soil porosity (L_{water}/L_{soil})	0.3
Dry soil bulk density (kg/L)	1.5

Soil Screening Levels for Soil to Ground Water

Analyte	Ground Water Concentration (pCi/L)	Ground Water Concentration (mg/L)	Ground Water Concentration Source[1]	K_d (L/kg)	SSL (pCi/g)	SSL (mg/kg)

Eu-155 decaychain	6.0E+02	1.3E-09	MCL

[1]MCL = Maximum Contaminant Limit
PMCL = Proposed Maximum Contaminant Limit
RBL = Decay-corrected Risk Based Limit

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Topic for Key OSWER Radiation Guidances and Reports

EPA Soil Screening Guidance for Radionuclides

Equation Values for Ingestion of Soil

Age-adjusted Parameter	Value	Adult-only Parameter	Value
Target Risk (unitless)	1.0E-6	Target Risk (unitless)	1.0E-6
Adult Exposure Duration (yr)	24	Exposure Duration (yr)	25
Child Exposure Duration (yr)	6		
Exposure Frequency (day/yr)	350	Exposure Frequency (day/yr)	250
Adult Intake Rate (mg/day)	100		
Child Intake Rate (mg/day)	200		
Age-adjusted Intake Rate (mg/day)	120	Intake Rate (mg/day)	50
Time of Exposure (yr)	30	Time of Exposure (yr)	25

Decay-Corrected Screening Levels for Ingestion of Soil

Analyte	Soil Ingestion Slope Factor (risk/pCi)	Decay Constant λ (yr^{-1})	Halflife (yr)	SSL (Age-adjusted) (pCi/g)	SSL (Adult) (pCi/g)	SSL (Age-adjusted) (mg/kg)	SSL (Adult) (mg/kg)
Pb-210+D decaychain	2.7E-09	3.1E-02	2.2E+01	4.6E-01	1.7E+00	6.0E-09	2.3E-08

Equation Values for Ingestion of Produce

Parameter	Value
Target Risk (unitless)	1.0E-6
Exposure Duration (yr)	30
Contaminated Plant Fraction from the site (unitless)	0.5
Vegetable and Fruit Ingestion Rate (kg/yr)	42.7
Leafy Vegetable Ingestion Rate (kg/yr)	4.66
Time of Exposure (yr)	30

Decay-Corrected Screening Levels for Ingestion of Produce

Analyte	Food Ingestion Slope Factor (risk/pCi)	Decay Constant λ (yr^{-1})	Halflife (yr)	Soil-to-plant Transfer Factor (pCi/g plant/pCi/g soil)	SSL (pCi/g)	SSL (mg/kg)
Pb-210+D decaychain	3.4E-09	3.1E-02	2.2E+01	1.0E-02	6.3E-02	8.2E-10

Equation Values for Inhalation of Fugitive Dust

Particulate Emission Factor Parameter	Value	Equation Parameter	Value
Surface Area (acres)	0.5	Target Risk (unitless)	1.0E-

			6
City (climate zone)	Minneapolis (V)	Exposure Duration (yr)	30
Q/C (g/m^2-s per kg/m^3)	90.8	Exposure Frequency (day/yr)	350
Fraction of vegetative cover (unitless)	0.5	Inhalation Rate (m^3/day)	20
Mean annual windspeed (m/s)	4.69	Outdoor Exposure Time Fraction (unitless)	0.073
Equivalent threshold value of windspeed at 7m (m/s)	11.32	Indoor Exposure Time Fraction (unitless)	0.683
Function dependent on U_m/U_t (unitless)	0.194	Indoor Dilution Factor (unitless)	0.4
		Time of Exposure (yr)	30

Decay-Corrected Screening Levels for Inhalation of Fugitive Dust

Analyte	Inhalation Slope Factor (risk/pCi)	Decay Constant λ (yr^{-1})	Halflife (yr)	Particulate Emission Factor (m^3/kg)	SSL (pCi/g)	SSL (mg/kg)
Pb-210+D decaychain	1.4E-08	3.1E-02	2.2E+01	1.3E+09	2.0E+03	2.6E-05

Equation Values for External Exposure

Parameter	Value
Target Risk (unitless)	1.0E-6

Exposure Duration (yr)	30
Exposure Frequency (day/yr)	350
Area Correction Factor (unitless)	0.9
Outdoor Exposure Time Fraction (unitless)	0.073
Indoor Exposure Time Fraction (unitless)	0.683
Gamma Shielding Factor (unitless)	0.4
Time of Exposure (yr)	30

Decay-Corrected Screening Levels for External Exposure

Analyte	External Exposure Slope Factor (risk/yr per pCi/g)	Decay Constant λ (yr^{-1})	Halflife (yr)	SSL (pCi/g)	SSL (mg/kg)
Pb-210+D decaychain	4.2E-09	3.1E-02	2.2E+01	4.1E+01	5.3E-07

Equation Values for Soil to Ground Water

Partitioning Equation Parameter	Value
Dilution factor (unitless)	20
Water-filled soil porosity (L_{water}/L_{soil})	0.3
Dry soil bulk density (kg/L)	1.5

Soil Screening Levels for Soil to Ground Water

Ground Water	Ground Water	Ground Water Concentration	K_d	SSL	SSL

Analyte	Concentration (pCi/L)	Concentration (mg/L)	Source[1]	(L/kg)	(pCi/g)	(mg/kg)
Pb-210+D decaychain	5.8E-02	7.6E-13	RBL	6	1.1E-02	9.4E-11

[1]MCL = Maximum Contaminant Limit
PMCL = Proposed Maximum Contaminant Limit
RBL = Decay-corrected Risk Based Limit

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Topic for Key OSWER Radiation Guidances and Reports.

EPA Soil Screening Guidance for Radionuclides

Equation Values for Soil to Ground Water

Partitioning Equation Parameter	Value
Dilution factor (unitless)	1 ✓
Water-filled soil porosity (L_{water}/L_{soil})	0.3
Dry soil bulk density (kg/L)	1.5

Soil Screening Levels for Soil to Ground Water

Analyte	Ground Water Concentration (pCi/L)	Ground Water Concentration (mg/L)	Ground Water Concentration Source[1]	K_d (L/kg)	SSL (pCi/g)	SSL (mg/kg)
Pb-210+D decaychain	5.8E-02	7.6E-13	RBL	6	5.5E-04 ✓	4.7E-12

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RBL = Decay-corrected Risk Based Limit

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EPA Soil Screening Guidance for Radionuclides

Equation Values for Ingestion of Soil

Age-adjusted Parameter	Value	Adult-only Parameter	Value
Target Risk (unitless)	1.0E-6	Target Risk (unitless)	1.0E-6
Adult Exposure Duration (yr)	24	Exposure Duration (yr)	25
Child Exposure Duration (yr)	6		
Exposure Frequency (day/yr)	350	Exposure Frequency (day/yr)	250
Adult Intake Rate (mg/day)	100		
Child Intake Rate (mg/day)	200		
Age-adjusted Intake Rate (mg/day)	120	Intake Rate (mg/day)	50
Time of Exposure (yr)	30	Time of Exposure (yr)	25

Decay-Corrected Screening Levels for Ingestion of Soil

Analyte	Soil Ingestion Slope Factor (risk/pCi)	Decay Constant λ (yr^{-1})	Halflife (yr)	SSL (Age-adjusted) (pCi/g)	SSL (Adult) (pCi/g)	SSL (Age-adjusted) (mg/kg)	SSL (Adult) (mg/kg)
Pb-212	6.7E-11	5.7E+02	1.2E-03	2.0E+05	6.8E+05	1.5E-07	4.9E-07

Equation Values for Ingestion of Produce

Parameter	Value
Target Risk (unitless)	1.0E-6
Exposure Duration (yr)	30
Contaminated Plant Fraction from the site (unitless)	0.5
Vegetable and Fruit Ingestion Rate (kg/yr)	42.7
Leafy Vegetable Ingestion Rate (kg/yr)	4.66
Time of Exposure (yr)	30

Decay-Corrected Screening Levels for Ingestion of Produce

Analyte	Food Ingestion Slope Factor (risk/pCi)	Decay Constant λ (yr^{-1})	Halflife (yr)	Soil-to-plant Transfer Factor (pCi/g plant/pCi/g soil)	SSL (pCi/g)	SSL (mg/kg)
Pb-212	3.5E-11	5.7E+02	1.2E-03	1.0E-02	6.8E+04	4.9E-08

Equation Values for Inhalation of Fugitive Dust

Particulate Emission Factor Parameter	Value	Equation Parameter	Value
Surface Area (acres)	0.5	Target Risk (unitless)	1.0E-6
City (climate zone)	Minneapolis (V)	Exposure Duration (yr)	30

Q/C (g/m^2-s per kg/m^3)	90.8	Exposure Frequency (day/yr)	350
Fraction of vegetative cover (unitless)	0.5	Inhalation Rate (m^3/day)	20
Mean annual windspeed (m/s)	4.69	Outdoor Exposure Time Fraction (unitless)	0.073
Equivalent threshold value of windspeed at 7m (m/s)	11.32	Indoor Exposure Time Fraction (unitless)	0.683
Function dependent on U_m/U_t (unitless)	0.194	Indoor Dilution Factor (unitless)	0.4
		Time of Exposure (yr)	30

Decay-Corrected Screening Levels for Inhalation of Fugitive Dust

Analyte	Inhalation Slope Factor (risk/pCi)	Decay Constant λ (yr^{-1})	Halflife (yr)	Particulate Emission Factor (m^3/kg)	SSL (pCi/g)	SSL (mg/kg)
Pb-212	5.8E-10	5.7E+02	1.2E-03	1.3E+09	5.4E+08	3.9E-04

Equation Values for External Exposure

Parameter	Value
Target Risk (unitless)	1.0E-6
Exposure Duration (yr)	30
Exposure Frequency (day/yr)	350
Area Correction Factor (unitless)	0.9
Outdoor Exposure Time Fraction (unitless)	0.073
Indoor Exposure Time Fraction (unitless)	0.683

Gamma Shielding Factor (unitless)	0.4
Time of Exposure (yr)	30

Decay-Corrected Screening Levels for External Exposure

Analyte	External Exposure Slope Factor (risk/yr per pCi/g)	Decay Constant λ (yr^{-1})	Halflife (yr)	SSL (pCi/g)	SSL (mg/kg)
Pb-212	5.1E-07	5.7E+02	1.2E-03	3.8E+03	2.7E-09

Equation Values for Soil to Ground Water

Partitioning Equation Parameter	Value
Dilution factor (unitless)	20
Water-filled soil porosity (L_{water}/L_{soil})	0.3
Dry soil bulk density (kg/L)	1.5

Soil Screening Levels for Soil to Ground Water

Analyte	Ground Water Concentration (pCi/L)	Ground Water Concentration (mg/L)	Ground Water Concentration Source[1]	K_d (L/kg)	SSL (pCi/g)	SSL (mg/kg)
Pb-212	3.3E+04	2.4E-11	RBL	6	7.0E+07	2.9E-09

[1]MCL = Maximum Contaminant Limit

PMCL = Proposed Maximum Contaminant Limit
RBL = Decay-corrected Risk Based Limit

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Topic for Key OSWER Radiation Guidances and Reports

EPA Soil Screening Guidance for Radionuclides

Equation Values for Soil to Ground Water

Partitioning Equation Parameter	Value
Dilution factor (unitless)	1
Water-filled soil porosity (L_{water}/L_{soil})	0.3
Dry soil bulk density (kg/L)	1.5

Soil Screening Levels for Soil to Ground Water

Analyte	Ground Water Concentration (pCi/L)	Ground Water Concentration (mg/L)	Ground Water Concentration Source[1]	K_d (L/kg)	SSL (pCi/g)	SSL (mg/kg)
Pb-212	3.3E+04	2.4E-11	RBL	6	3.5E+06	1.5E-10

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Equation Values for Ingestion of Soil

Age-adjusted Parameter	Value	Adult-only Parameter	Value
Target Risk (unitless)	1.0E-6	Target Risk (unitless)	1.0E-6
Adult Exposure Duration (yr)	24	Exposure Duration (yr)	25
Child Exposure Duration (yr)	6		
Exposure Frequency (day/yr)	350	Exposure Frequency (day/yr)	250
Adult Intake Rate (mg/day)	100		
Child Intake Rate (mg/day)	200		
Age-adjusted Intake Rate (mg/day)	120	Intake Rate (mg/day)	50
Time of Exposure (yr)	30	Time of Exposure (yr)	25

Decay-Corrected Screening Levels for Ingestion of Soil

Analyte	Soil Ingestion Slope Factor (risk/pCi)	Decay Constant λ (yr^{-1})	Halflife (yr)	SSL (Age-adjusted) (pCi/g)	SSL (Adult) (pCi/g)	SSL (Age-adjusted) (mg/kg)	SSL (Adult) (mg/kg)
Pb-214	8.5E-13	1.4E+04	5.1E-05	3.8E+08	1.3E+09	1.2E-05	3.9E-05

Equation Values for Ingestion of Produce

Parameter	Value
Target Risk (unitless)	1.0E-6
Exposure Duration (yr)	30
Contaminated Plant Fraction from the site (unitless)	0.5
Vegetable and Fruit Ingestion Rate (kg/yr)	42.7
Leafy Vegetable Ingestion Rate (kg/yr)	4.66
Time of Exposure (yr)	30

Decay-Corrected Screening Levels for Ingestion of Produce

Analyte	Food Ingestion Slope Factor (risk/pCi)	Decay Constant λ (yr^{-1})	Halflife (yr)	Soil-to-plant Transfer Factor (pCi/g plant/pCi/g soil)	SSL (pCi/g)	SSL (mg/kg)
Pb-214	4.9E-13	1.4E+04	5.1E-05	1.0E-02	1.2E+08	3.6E-06

Equation Values for Inhalation of Fugitive Dust

Particulate Emission Factor Parameter	Value	Equation Parameter	Value
Surface Area (acres)	0.5	Target Risk (unitless)	1.0E-6
City (climate zone)	Minneapolis (V)	Exposure Duration (yr)	30

Q/C (g/m^2-s per kg/m^3)	90.8	Exposure Frequency (day/yr)	350
Fraction of vegetative cover (unitless)	0.5	Inhalation Rate (m^3/day)	20
Mean annual windspeed (m/s)	4.69	Outdoor Exposure Time Fraction (unitless)	0.073
Equivalent threshold value of windspeed at 7m (m/s)	11.32	Indoor Exposure Time Fraction (unitless)	0.683
Function dependent on U_m/U_t (unitless)	0.194	Indoor Dilution Factor (unitless)	0.4
		Time of Exposure (yr)	30

Decay-Corrected Screening Levels for Inhalation of Fugitive Dust

Analyte	Inhalation Slope Factor (risk/pCi)	Decay Constant λ (yr^{-1})	Halflife (yr)	Particulate Emission Factor (m^3/kg)	SSL (pCi/g)	SSL (mg/kg)
Pb-214	3.6E-11	1.4E+04	5.1E-05	1.3E+09	2.0E+11	6.2E-03

Equation Values for External Exposure

Parameter	Value
Target Risk (unitless)	1.0E-6
Exposure Duration (yr)	30
Exposure Frequency (day/yr)	350
Area Correction Factor (unitless)	0.9
Outdoor Exposure Time Fraction (unitless)	0.073
Indoor Exposure Time Fraction (unitless)	0.683

Gamma Shielding Factor (unitless)	0.4
Time of Exposure (yr)	30

Decay-Corrected Screening Levels for External Exposure

Analyte	External Exposure Slope Factor (risk/yr per pCi/g)	Decay Constant λ (yr^{-1})	Halflife (yr)	SSL (pCi/g)	SSL (mg/kg)
Pb-214	9.8E-07	1.4E+04	5.1E-05	4.6E+04	1.4E-09

Equation Values for Soil to Ground Water

Partitioning Equation Parameter	Value
Dilution factor (unitless)	20
Water-filled soil porosity (L_{water}/L_{soil})	0.3
Dry soil bulk density (kg/L)	1.5

Soil Screening Levels for Soil to Ground Water

Analyte	Ground Water Concentration (pCi/L)	Ground Water Concentration (mg/L)	Ground Water Concentration Source[1]	K_d (L/kg)	SSL (pCi/g)	SSL (mg/kg)
Pb-214	5.6E+07	1.7E-09	RBL	6	2.9E+12	2.1E-07

[1]MCL = Maximum Contaminant Limit

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EPA Soil Screening Guidance for Radionuclides

Equation Values for Soil to Ground Water

Partitioning Equation Parameter	Value
Dilution factor (unitless)	1 ✓
Water-filled soil porosity (L_{water}/L_{soil})	0.3
Dry soil bulk density (kg/L)	1.5

Soil Screening Levels for Soil to Ground Water

Analyte	Ground Water Concentration (pCi/L)	Ground Water Concentration (mg/L)	Ground Water Concentration Source[1]	K_d (L/kg)	SSL (pCi/g)	SSL (mg/kg)
Pb-214	5.6E+07	1.7E-09	RBL	6	1.4E+11 ✓	1.1E-08

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EPA Soil Screening Guidance for Radionuclides

Equation Values for Ingestion of Soil

Age-adjusted Parameter	Value	Adult-only Parameter	Value
Target Risk (unitless)	1.0E-6	Target Risk (unitless)	1.0E-6
Adult Exposure Duration (yr)	24	Exposure Duration (yr)	25
Child Exposure Duration (yr)	6		
Exposure Frequency (day/yr)	350	Exposure Frequency (day/yr)	250
Adult Intake Rate (mg/day)	100		
Child Intake Rate (mg/day)	200		
Age-adjusted Intake Rate (mg/day)	120	Intake Rate (mg/day)	50
Time of Exposure (yr)	30	Time of Exposure (yr)	25

Decay-Corrected Screening Levels for Ingestion of Soil

Analyte	Soil Ingestion Slope Factor (risk/pCi)	Decay Constant λ (yr^{-1})	Halflife (yr)	SSL (Age-adjusted) (pCi/g)	SSL (Adult) (pCi/g)	SSL (Age-adjusted) (mg/kg)	SSL (Adult) (mg/kg)
K-40 decaychain	6.2E-11	5.4E-10	1.3E+09	1.3E+01	5.2E+01	1.8E+00	7.4E+00

Equation Values for Ingestion of Produce

Parameter	Value
Target Risk (unitless)	1.0E-6
Exposure Duration (yr)	30
Contaminated Plant Fraction from the site (unitless)	0.5
Vegetable and Fruit Ingestion Rate (kg/yr)	42.7
Leafy Vegetable Ingestion Rate (kg/yr)	4.66
Time of Exposure (yr)	30

Decay-Corrected Screening Levels for Ingestion of Produce

Analyte	Food Ingestion Slope Factor (risk/pCi)	Decay Constant λ (yr^{-1})	Halflife (yr)	Soil-to-plant Transfer Factor (pCi/g plant/pCi/g soil)	SSL (pCi/g)	SSL (mg/kg)
K-40 decaychain	3.4E-11	5.4E-10	1.3E+09	3.0E-01	1.4E-01	2.0E-02

Equation Values for Inhalation of Fugitive Dust

Particulate Emission Factor Parameter	Value	Equation Parameter	Value
Surface Area (acres)	0.5	Target Risk (unitless)	1.0E-

			6
City (climate zone)	Minneapolis (V)	Exposure Duration (yr)	30
Q/C (g/m^2-s per kg/m^3)	90.8	Exposure Frequency (day/yr)	350
Fraction of vegetative cover (unitless)	0.5	Inhalation Rate (m^3/day)	20
Mean annual windspeed (m/s)	4.69	Outdoor Exposure Time Fraction (unitless)	0.073
Equivalent threshold value of windspeed at 7m (m/s)	11.32	Indoor Exposure Time Fraction (unitless)	0.683
Function dependent on U_m/U_t (unitless)	0.194	Indoor Dilution Factor (unitless)	0.4
		Time of Exposure (yr)	30

Decay-Corrected Screening Levels for Inhalation of Fugitive Dust

Analyte	Inhalation Slope Factor (risk/pCi)	Decay Constant λ (yr^{-1})	Halflife (yr)	Particulate Emission Factor (m^3/kg)	SSL (pCi/g)	SSL (mg/kg)
K-40 decaychain	1.0E-11	5.4E-10	1.3E+09	1.3E+09	1.8E+06	2.5E+05

Equation Values for External Exposure

Parameter	Value
Target Risk (unitless)	1.0E-6
Exposure Duration (yr)	30
Exposure Frequency (day/yr)	350

Area Correction Factor (unitless)	0.9
Outdoor Exposure Time Fraction (unitless)	0.073
Indoor Exposure Time Fraction (unitless)	0.683
Gamma Shielding Factor (unitless)	0.4
Time of Exposure (yr)	30

Decay-Corrected Screening Levels for External Exposure

Analyte	External Exposure Slope Factor (risk/yr per pCi/g)	Decay Constant λ (yr^{-1})	Halflife (yr)	SSL (pCi/g)	SSL (mg/kg)
K-40 decaychain	8.0E-07	5.4E-10	1.3E+09	1.4E-01	2.0E-02

Equation Values for Soil to Ground Water

Partitioning Equation Parameter	Value
Dilution factor (unitless)	20
Water-filled soil porosity (L_{water}/L_{soil})	0.3
Dry soil bulk density (kg/L)	1.5

Soil Screening Levels for Soil to Ground Water

Analyte	Ground Water Concentration (pCi/L)	Ground Water Concentration (mg/L)	Ground Water Concentration Source[1]	K_d (L/kg)	SSL (pCi/g)	SSL (mg/kg)

K-40 decaychain	1.9E+00	2.8E-04	RBL

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EPA Soil Screening Guidance for Radionuclides

Equation Values for Ingestion of Soil

Age-adjusted Parameter	Value	Adult-only Parameter	Value
Target Risk (unitless)	1.0E-6	Target Risk (unitless)	1.0E-6
Adult Exposure Duration (yr)	24	Exposure Duration (yr)	25
Child Exposure Duration (yr)	6		
Exposure Frequency (day/yr)	350	Exposure Frequency (day/yr)	250
Adult Intake Rate (mg/day)	100		
Child Intake Rate (mg/day)	200		
Age-adjusted Intake Rate (mg/day)	120	Intake Rate (mg/day)	50
Time of Exposure (yr)	30	Time of Exposure (yr)	25

Decay-Corrected Screening Levels for Ingestion of Soil

Analyte	Soil Ingestion Slope Factor (risk/pCi)	Decay Constant λ (yr^{-1})	Halflife (yr)	SSL (Age-adjusted) (pCi/g)	SSL (Adult) (pCi/g)	SSL (Age-adjusted) (mg/kg)	SSL (Adult) (mg/kg)
Ra-226+D decaychain	7.3E-10	4.3E-04	1.6E+03	1.1E+00	4.4E+00	1.1E-06	4.5E-06

Equation Values for Ingestion of Produce

Parameter	Value
Target Risk (unitless)	1.0E-6
Exposure Duration (yr)	30
Contaminated Plant Fraction from the site (unitless)	0.5
Vegetable and Fruit Ingestion Rate (kg/yr)	42.7
Leafy Vegetable Ingestion Rate (kg/yr)	4.66
Time of Exposure (yr)	30

Decay-Corrected Screening Levels for Ingestion of Produce

Analyte	Food Ingestion Slope Factor (risk/pCi)	Decay Constant λ (yr^{-1})	Halflife (yr)	Soil-to-plant Transfer Factor (pCi/g plant/pCi/g soil)	SSL (pCi/g)	SSL (mg/kg)
Ra-226+D decaychain	5.2E-10	4.3E-04	1.6E+03	4.0E-02	6.9E-02	7.0E-08

Equation Values for Inhalation of Fugitive Dust

Particulate Emission Factor Parameter	Value	Equation Parameter	Value
Surface Area (acres)	0.5	Target Risk (unitless)	1.0E-

			6
City (climate zone)	Minneapolis (V)	Exposure Duration (yr)	30
Q/C (g/m^2-s per kg/m^3)	90.8	Exposure Frequency (day/yr)	350
Fraction of vegetative cover (unitless)	0.5	Inhalation Rate (m^3/day)	20
Mean annual windspeed (m/s)	4.69	Outdoor Exposure Time Fraction (unitless)	0.073
Equivalent threshold value of windspeed at 7m (m/s)	11.32	Indoor Exposure Time Fraction (unitless)	0.683
Function dependent on U_m/U_t (unitless)	0.194	Indoor Dilution Factor (unitless)	0.4
		Time of Exposure (yr)	30

Decay-Corrected Screening Levels for Inhalation of Fugitive Dust

Analyte	Inhalation Slope Factor (risk/pCi)	Decay Constant λ (yr^{-1})	Halflife (yr)	Particulate Emission Factor (m^3/kg)	SSL (pCi/g)	SSL (mg/kg)
Ra-226+D decaychain	1.2E-08	4.3E-04	1.6E+03	1.3E+09	1.6E+03	1.6E-03

Equation Values for External Exposure

Parameter	Value
Target Risk (unitless)	1.0E-6

Exposure Duration (yr)	30
Exposure Frequency (day/yr)	350
Area Correction Factor (unitless)	0.9
Outdoor Exposure Time Fraction (unitless)	0.073
Indoor Exposure Time Fraction (unitless)	0.683
Gamma Shielding Factor (unitless)	0.4
Time of Exposure (yr)	30

Decay-Corrected Screening Levels for External Exposure

Analyte	External Exposure Slope Factor (risk/yr per pCi/g)	Decay Constant λ (yr^{-1})	Halflife (yr)	SSL (pCi/g)	SSL (mg/kg)
Ra-226+D decaychain	8.5E-06	4.3E-04	1.6E+03	1.3E-02	1.3E-08

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EPA Soil Screening Guidance for Radionuclides

Equation Values for Soil to Ground Water

Partitioning Equation Parameter	Value
Dilution factor (unitless)	1
Water-filled soil porosity (L_{water}/L_{soil})	0.3
Dry soil bulk density (kg/L)	1.5

Soil Screening Levels for Soil to Ground Water

Analyte	Ground Water Concentration (pCi/L)	Ground Water Concentration (mg/L)	Ground Water Concentration Source[1]	K_d (L/kg)	SSL (pCi/g)	SSL (mg/kg)
Ra-226+D decaychain	5.0E+00	5.1E-09	MCL	3	1.6E-02	1.6E-08

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RBL = Decay-corrected Risk Based Limit

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EPA United States Environmental Protection Agency **Superfund**

Topic for Reg OSWER Radiation Guidances and Reports.

EPA Soil Screening Guidance for Radionuclides

Equation Values for Soil to Ground Water

Partitioning Equation Parameter	Value
Dilution factor (unitless)	20
Water-filled soil porosity (L_{water}/L_{soil})	0.3
Dry soil bulk density (kg/L)	1.5

Soil Screening Levels for Soil to Ground Water

Analyte	Ground Water Concentration (pCi/L)	Ground Water Concentration (mg/L)	Ground Water Concentration Source[1]	K_d (L/kg)	SSL (pCi/g)	SSL (mg/kg)
Ra-226+D decaychain	5.0E+00	5.1E-09	MCL	3	3.2E-01	3.3E-07

[1]MCL = Maximum Contaminant Limit
PMCL = Proposed Maximum Contaminant Limit
RBL = Decay-corrected Risk Based Limit

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Topic for Key OSWER Radiation Guidances and Reports

EPA Soil Screening Guidance for Radionuclides

Equation Values for Ingestion of Soil

Age-adjusted Parameter	Value	Adult-only Parameter	Value
Target Risk (unitless)	1.0E-6	Target Risk (unitless)	1.0E-6
Adult Exposure Duration (yr)	24	Exposure Duration (yr)	25
Child Exposure Duration (yr)	6		
Exposure Frequency (day/yr)	350	Exposure Frequency (day/yr)	250
Adult Intake Rate (mg/day)	100		
Child Intake Rate (mg/day)	200		
Age-adjusted Intake Rate (mg/day)	120	Intake Rate (mg/day)	50
Time of Exposure (yr)	30	Time of Exposure (yr)	25

Decay-Corrected Screening Levels for Ingestion of Soil

Analyte	Soil Ingestion Slope Factor (risk/pCi)	Decay Constant λ (yr^{-1})	Halflife (yr)	SSL (Age-adjusted) (pCi/g)	SSL (Adult) (pCi/g)	SSL (Age-adjusted) (mg/kg)	SSL (Adult) (mg/kg)
Tl-208		1.2E+05	5.8E-06				

Equation Values for Ingestion of Produce

Parameter	Value
Target Risk (unitless)	1.0E-6
Exposure Duration (yr)	30
Contaminated Plant Fraction from the site (unitless)	0.5
Vegetable and Fruit Ingestion Rate (kg/yr)	42.7
Leafy Vegetable Ingestion Rate (kg/yr)	4.66
Time of Exposure (yr)	30

Decay-Corrected Screening Levels for Ingestion of Produce

Analyte	Food Ingestion Slope Factor (risk/pCi)	Decay Constant λ (yr^{-1})	Halflife (yr)	Soil-to-plant Transfer Factor (pCi/g plant/pCi/g soil)	SSL (pCi/g)	SSL (mg/kg)
Tl-208		1.2E+05	5.8E-06	2.0E-01		

Equation Values for Inhalation of Fugitive Dust

Particulate Emission Factor Parameter	Value	Equation Parameter	Value
Surface Area (acres)	0.5	Target Risk (unitless)	1.0E-6
City (climate zone)	Minneapolis (V)	Exposure Duration (yr)	30

Q/C (g/m^2-s per kg/m^3)	90.8	Exposure Frequency (day/yr)	350
Fraction of vegetative cover (unitless)	0.5	Inhalation Rate (m^3/day)	20
Mean annual windspeed (m/s)	4.69	Outdoor Exposure Time Fraction (unitless)	0.073
Equivalent threshold value of windspeed at 7m (m/s)	11.32	Indoor Exposure Time Fraction (unitless)	0.683
Function dependent on U_m/U_t (unitless)	0.194	Indoor Dilution Factor (unitless)	0.4
		Time of Exposure (yr)	30

Decay-Corrected Screening Levels for Inhalation of Fugitive Dust

Analyte	Inhalation Slope Factor (risk/pCi)	Decay Constant λ (yr^{-1})	Halflife (yr)	Particulate Emission Factor (m^3/kg)	SSL (pCi/g)	SSL (mg/kg)
Tl-208		1.2E+05	5.8E-06	1.3E+09		

Equation Values for External Exposure

Parameter	Value
Target Risk (unitless)	1.0E-6
Exposure Duration (yr)	30
Exposure Frequency (day/yr)	350
Area Correction Factor (unitless)	0.9
Outdoor Exposure Time Fraction (unitless)	0.073
Indoor Exposure Time Fraction (unitless)	0.683

Gamma Shielding Factor (unitless)	0.4
Time of Exposure (yr)	30

Decay-Corrected Screening Levels for External Exposure

Analyte	External Exposure Slope Factor (risk/yr per pCi/g)	Decay Constant λ (yr^{-1})	Halflife (yr)	SSL (pCi/g)	SSL (mg/kg)
Tl-208	1.8E-05	1.2E+05	5.8E-06	2.3E+04	7.7E-11

Equation Values for Soil to Ground Water

Partitioning Equation Parameter	Value
Dilution factor (unitless)	20
Water-filled soil porosity (L_{water}/L_{soil})	0.3
Dry soil bulk density (kg/L)	1.5

Soil Screening Levels for Soil to Ground Water

Analyte	Ground Water Concentration (pCi/L)	Ground Water Concentration (mg/L)	Ground Water Concentration Source[1]	K_d (L/kg)	SSL (pCi/g)	SSL (mg/kg)
Tl-208						

[1]MCL = Maximum Contaminant Limit

PMCL = Proposed Maximum Contaminant Limit
RBL = Decay-corrected Risk Based Limit

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Topic for Key OSWER Radiation Guidances and Reports

EPA Soil Screening Guidance for Radionuclides

Equation Values for Ingestion of Soil

Age-adjusted Parameter	Value	Adult-only Parameter	Value
Target Risk (unitless)	1.0E-6	Target Risk (unitless)	1.0E-6
Adult Exposure Duration (yr)	24	Exposure Duration (yr)	25
Child Exposure Duration (yr)	6		
Exposure Frequency (day/yr)	350	Exposure Frequency (day/yr)	250
Adult Intake Rate (mg/day)	100		
Child Intake Rate (mg/day)	200		
Age-adjusted Intake Rate (mg/day)	120	Intake Rate (mg/day)	50
Time of Exposure (yr)	30	Time of Exposure (yr)	25

Decay-Corrected Screening Levels for Ingestion of Soil

Analyte	Soil Ingestion Slope Factor (risk/pCi)	Decay Constant λ (yr^{-1})	Halflife (yr)	SSL (Age-adjusted) (pCi/g)	SSL (Adult) (pCi/g)	SSL (Age-adjusted) (mg/kg)	SSL (Adult) (mg/kg)
Th-234	6.7E-11	1.0E+01	6.6E-02	3.7E+03	1.3E+04	1.6E-07	5.4E-07

Equation Values for Ingestion of Produce

Parameter	Value
Target Risk (unitless)	1.0E-6
Exposure Duration (yr)	30
Contaminated Plant Fraction from the site (unitless)	0.5
Vegetable and Fruit Ingestion Rate (kg/yr)	42.7
Leafy Vegetable Ingestion Rate (kg/yr)	4.66
Time of Exposure (yr)	30

Decay-Corrected Screening Levels for Ingestion of Produce

Analyte	Food Ingestion Slope Factor (risk/pCi)	Decay Constant λ (yr^{-1})	Halflife (yr)	Soil-to-plant Transfer Factor (pCi/g plant/pCi/g soil)	SSL (pCi/g)	SSL (mg/kg)
Th-234	3.4E-11	1.0E+01	6.6E-02	1.0E-03	1.3E+04	5.6E-07

Equation Values for Inhalation of Fugitive Dust

Particulate Emission Factor Parameter	Value	Equation Parameter	Value
Surface Area (acres)	0.5	Target Risk (unitless)	1.0E-6
City (climate zone)	Minneapolis (V)	Exposure Duration (yr)	30

Q/C (g/m^2-s per kg/m^3)	90.8	Exposure Frequency (day/yr)	350
Fraction of vegetative cover (unitless)	0.5	Inhalation Rate (m^3/day)	20
Mean annual windspeed (m/s)	4.69	Outdoor Exposure Time Fraction (unitless)	0.073
Equivalent threshold value of windspeed at 7m (m/s)	11.32	Indoor Exposure Time Fraction (unitless)	0.683
Function dependent on U_m/U_t (unitless)	0.194	Indoor Dilution Factor (unitless)	0.4
		Time of Exposure (yr)	30

Decay-Corrected Screening Levels for Inhalation of Fugitive Dust

Analyte	Inhalation Slope Factor (risk/pCi)	Decay Constant λ (yr^{-1})	Halflife (yr)	Particulate Emission Factor (m^3/kg)	SSL (pCi/g)	SSL (mg/kg)
Th-234	3.1E-11	1.0E+01	6.6E-02	1.3E+09	1.9E+08	8.0E-03

Equation Values for External Exposure

Parameter	Value
Target Risk (unitless)	1.0E-6
Exposure Duration (yr)	30
Exposure Frequency (day/yr)	350
Area Correction Factor (unitless)	0.9
Outdoor Exposure Time Fraction (unitless)	0.073
Indoor Exposure Time Fraction (unitless)	0.683

Gamma Shielding Factor (unitless)	0.4
Time of Exposure (yr)	30

Decay-Corrected Screening Levels for External Exposure

Analyte	External Exposure Slope Factor (risk/yr per pCi/g)	Decay Constant λ (yr^{-1})	Halflife (yr)	SSL (pCi/g)	SSL (mg/kg)
Th-234	1.6E-08	1.0E+01	6.6E-02	2.2E+03	9.3E-08

Equation Values for Soil to Ground Water

Partitioning Equation Parameter	Value
Dilution factor (unitless)	20
Water-filled soil porosity (L_{water}/L_{soil})	0.3
Dry soil bulk density (kg/L)	1.5

Soil Screening Levels for Soil to Ground Water

Analyte	Ground Water Concentration (pCi/L)	Ground Water Concentration (mg/L)	Ground Water Concentration Source[1]	K_d (L/kg)	SSL (pCi/g)	SSL (mg/kg)
Th-234	6.5E+02	2.8E-11	RBL	20	8.3E+04	1.1E-08

[1]MCL = Maximum Contaminant Limit

PMCL = Proposed Maximum Contaminant Limit
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EPA Soil Screening Guidance for Radionuclides

Equation Values for Soil to Ground Water

Partitioning Equation Parameter	Value
Dilution factor (unitless)	1
Water-filled soil porosity (L_{water}/L_{soil})	0.3
Dry soil bulk density (kg/L)	1.5

Soil Screening Levels for Soil to Ground Water

Analyte	Ground Water Concentration (pCi/L)	Ground Water Concentration (mg/L)	Ground Water Concentration Source[1]	K_d (L/kg)	SSL (pCi/g)
Cs-137+D decaychain	2.0E+02	2.3E-09	MCL	10	2.8E+00

[1]MCL = Maximum Contaminant Limit
PMCL = Proposed Maximum Contaminant Limit
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Risk-Based PRGs

Risk-Based Preliminary Remediation Goals

The Special Cases is an important resource for using these risk-based preliminary remediation goals. The land uses of recreation, excavation, and agriculture, the dermal exposure pathway, and the radionuclides may not be applicable at all sites. In addition, the footnotes of **r** (EPA Region IV guidance), **u** (EPA Region IV guidance), **v** (provisional), **w** (withdrawn), and **x** (provisional) are provided for information purposes. Individuals intending to use these values should consult with risk assessment professionals, including those at regulatory agencies and at the Center for Risk Excellence.

Footnotes are associated with the applicable reference dose or slope factor.The Nonradionuclide Footnotes are usually chemical-specific and are noted where possible. Most Radionuclide Footnotes are not chemical-specific but may be of general interest. Footnotes are not provided in the tab and comma delimited formats.

NOTE: If this page is too wide to print, try selecting a smaller font or printing in landscape mode.

Dermal Pathway **Based on contaminated Water** **Residential Scenario** NonRad Equation	**Equation Parameters** Adult Surface Area= 1.94 (m^2/day) Average Lifetime= 70 (year) Body Weight= 70 (kg) Exposure Duration= 30 (year) Exposure Frequency= 350 (day/year) Exposure Time= 0.25 (hr/day)

Preliminary Remediation Goals

Analyte	CAS Number	Carcinogenic 1E-4	Carcinogenic 1E-6	Noncarcinogenic HQ=1	Noncarcinogenic HQ=0.1
Radionuclides [2] -- Units = pCi/L					
Th-228+D	14274829	No Slope Factor		N/A	
Th-232	7440291	No Slope Factor		N/A	

NOTE: The dermal pathway only applies to nonradionuclides and you selected one or more radionuclide.

Ingestion Pathway **Based on contaminated Water** **Residential Scenario** NonRad Equation Rad Equation	**Equation Parameters** Average Lifetime= 70 (year) Body Weight= 70 (kg) Exposure Duration= 30 (year) Exposure Frequency= 350 (day/year) Ingestion Rate = 2 (L/day)

Preliminary Remediation Goals

Analyte	CAS Number	Carcinogenic 1E-4	Carcinogenic 1E-6	Noncarcinogenic HQ=1	Noncarcinogenic HQ=0.1
Radionuclides [2] -- Units = pCi/L					
Th-228+D	14274829	1.6E+01	1.6E-01	N/A	
Th-232	7440291	4.7E+01	4.7E-01	N/A	

Inhalation Pathway **Based on contaminated Water** **Residential Scenario** NonRad Equation [1] Rad Equation	**Equation Parameters** Average Lifetime= 70 (year) Body Weight= 70 (kg) Exposure Duration= 30 (year) Exposure Frequency= 350 (day/year) Inhalation Rate= 20 (m^3/day)

Preliminary Remediation Goals

Analyte	CAS Number	Carcinogenic 1E-4	Carcinogenic 1E-6	Noncarcinogenic HQ=1	Noncarcinogenic HQ=0.1
Radionuclides [2] -- Units = pCi/L					
Th-228+D	14274829	N/A		N/A	
Th-232	7440291	N/A		N/A	

Total Pathway **Based on contaminated Water** **Residential Scenario** NonRad Equation Rad Equation	**Equation Parameters** Adult Surface Area= 1.94 (m^2/day) Average Lifetime= 70 (year) Body Weight= 70 (kg) Exposure Duration= 30 (year) Exposure Frequency= 350 (day/year) Exposure Time= 0.25 (hr/day) Ingestion Rate = 2 (L/day) Inhalation Rate= 20 (m^3/day)

Preliminary Remediation Goals

Analyte	CAS Number	Carcinogenic	Carcinogenic	Noncarcinogenic	Noncarcinogenic

		1E-4	1E-6	HQ=1	HQ=0.1
Radionuclides [2] -- Units = pCi/L					
Th-228+D	14274829	1.6E+01	1.6E-01	N/A	
Th-232	7440291	4.7E+01	4.7E-01	N/A	

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Toxicity Metadata | **HH Risk Models** | **Eco Benchmarks** | **Glossary** | **Background**

For information or technical assistance, please contact Fred Dolislager.

APPENDIX G-2

RAGS-PART D TABLES
AND
RISK ASSESSMENT CALCULATIONS

LIST OF RAGS-PART D TABLES

SEQUENCE OF TABLE NUMBERS: NOTE THE SEQUENCE OF TABLES IN THIS APPENDIX APPEARS TO BE OUT OF ORDER, i.e., THE ORDER IS 1,2,3,5,6,4,7,8,9. THE TABLES ARE ORDERED IN THIS MANNER TO AID THE READER IN FOLLOWING THE THE RISK ASSESSMENT CALCULATIONS.

RAGS PART D TABLE 1
SELECTION OF EXPOSURE PATHWAYS

RAGS PART D TABLE 2
OCCURRENCE, DISTRIBUTION AND SELECTION OF CHEMICALS OF POTENTIAL CONCERN

Table No.	
2.1	Direct Contact With Surface Soil
2.2	Migration From Surface Soil
2.3	Direct Contact With Subsurface Soil
2.4	Migration From Subsurface Soil
2.5	Direct Contact With Ground Water
2.6	Direct Contact With Deep Sediments

RAGS PART D TABLE 3
MEDIUM-SPECIFIC EXPOSURE POINT CONCENTRATION SUMMARY

Table No.	
3.1	Surface Soil
3.2	Surface/Subsurface Soil
3.3	Ground Water

RAGS PART D TABLES 5 AND 6
TOXICITY DATA FOR CHEMICALS OF CONCERN

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5.1	Non-Cancer Toxicity Data for Chemicals of Concern - Oral/Dermal
5.2	Non-Cancer Toxicity Data for Chemicals of Concern - Inhalation
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6.2	Cancer Toxicity Data for Chemicals of Concern - Inhalation

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4.1	Construction Workers Exposed to Surface/Subsurface Soil
4.2	Maintenance Workers Exposed to Surface Soil
4.3	Occupational Workers Exposed to Surface Soil
4.4	Adult Recreational Users Exposed to Surface Soil
4.5	Adolescent Trespassers Exposed to Surface Soil
4.6	Future Adult Resident Exposed to Surface Soil
4.7	Future Child Resident Exposed to Surface Soil
4.8	Construction Workers Exposed to Ground Water
4.9	Future Adult Resident Exposed to Ground Water
4.10	Future Child Resident Exposed to Ground Water
4.11	Future Adult Resident Exposed to Ground Water (Showering)
4.12	Future Child Resident Exposed to Ground Water (Showering)
4.13	Construction Workers Exposed to Air Emissions from Ground Water

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7.1a	Construction Workers Exposed to Surface/Subsurface Soil - Central Tendency Exposures
7.2	Maintenance Workers Exposed to Surface Soil - Reasonable Maximum Exposures
7.2a	Maintenance Workers Exposed to Surface Soil - Central Tendency Exposures
7.3	Occupational Workers Exposed to Surface Soil - Reasonable Maximum Exposures
7.3a	Occupational Workers Exposed to Surface Soil - Central Tendency Exposures
7.4	Adult Recreational Users Exposed to Surface Soil - Reasonable Maximum Exposures
7.4a	Adult Recreational Users Exposed to Surface Soil - Central Tendency Exposures
7.5	Adolescent Trespassers Exposed to Surface Soil - Reasonable Maximum Exposures
7.5a	Adolescent Trespassers Exposed to Surface Soil - Central Tendency Exposures
7.6	Future Adult Resident Exposed to Surface Soil - Reasonable Maximum Exposures
7.6a	Future Adult Resident Exposed to Surface Soil - Central Tendency Exposures
7.7	Future Child Resident Exposed to Surface Soil - Reasonable Maximum Exposures
7.7a	Future Child Resident Exposed to Surface Soil - Central Tendency Exposures
7.8	Construction Workers Exposed to Ground Water - Reasonable Maximum Exposures
7.8a	Construction Workers Exposed to Ground Water - Central Tendency Exposures
7.9	Future Adult Resident Exposed to Ground Water - Reasonable Maximum Exposures
7.9a	Future Adult Resident Exposed to Ground Water - Central Tendency Exposures
7.10	Future Child Resident Exposed to Ground Water - Reasonable Maximum Exposures
7.10a	Future Child Resident Exposed to Ground Water - Central Tendency Exposures
7.11	Future Adult Resident Exposed to Ground Water (Showering) - Reasonable Maximum Exposures
7.11a	Future Adult Resident Exposed to Ground Water (Showering) - Central Tendency Exposures
7.12	Future Child Resident Exposed to Ground Water (Showering) - Reasonable Maximum Exposures
7.12a	Future Child Resident Exposed to Ground Water (Showering) - Central Tendency Exposures
7.13	Construction Workers Exposed to Air Emissions from Ground Water - Reasonable Maximum Exposures
7.13a	Construction Workers Exposed to Air Emissions from Ground Water - Central Tendency Exposures

RAGS PART D TABLE 8
CALCULATION OF CANCER RISKS

Table No.	
8.1	Construction Workers Exposed to Surface/Subsurface Soil - Reasonable Maximum Exposures
8.1a	Construction Workers Exposed to Surface/Subsurface Soil - Central Tendency Exposures
8.2	Maintenance Workers Exposed to Surface Soil - Reasonable Maximum Exposures
8.2a	Maintenance Workers Exposed to Surface Soil - Central Tendency Exposures
8.3	Occupational Workers Exposed to Surface Soil - Reasonable Maximum Exposures
8.3a	Occupational Workers Exposed to Surface Soil - Central Tendency Exposures
8.4	Adult Recreational Users Exposed to Surface Soil - Reasonable Maximum Exposures
8.4a	Adult Recreational Users Exposed to Surface Soil - Central Tendency Exposures
8.5	Adolescent Trespassers Exposed to Surface Soil - Reasonable Maximum Exposures
8.5a	Adolescent Trespassers Exposed to Surface Soil - Central Tendency Exposures
8.6	Future Adult Resident Exposed to Surface Soil - Reasonable Maximum Exposures
8.6a	Future Adult Resident Exposed to Surface Soil - Central Tendency Exposures
8.7	Future Child Resident Exposed to Surface Soil - Reasonable Maximum Exposures
8.7a	Future Child Resident Exposed to Surface Soil - Central Tendency Exposures
8.8	Construction Workers Exposed to Ground Water - Reasonable Maximum Exposures
8.8a	Construction Workers Exposed to Ground Water - Central Tendency Exposures
8.9	Future Adult Resident Exposed to Ground Water - Reasonable Maximum Exposures
8.9a	Future Adult Resident Exposed to Ground Water - Central Tendency Exposures
8.10	Future Child Resident Exposed to Ground Water - Reasonable Maximum Exposures
8.10a	Future Child Resident Exposed to Ground Water - Central Tendency Exposures
8.11	Future Adult Resident Exposed to Ground Water (Showering) - Reasonable Maximum Exposures
8.11a	Future Adult Resident Exposed to Ground Water (Showering) - Central Tendency Exposures
8.12	Future Child Resident Exposed to Ground Water (Showering) - Reasonable Maximum Exposures
8.12a	Future Child Resident Exposed to Ground Water (Showering) - Central Tendency Exposures
8.13	Construction Workers Exposed to Air Emissions from Ground Water - Reasonable Maximum Exposures
8.13a	Construction Workers Exposed to Air Emissions from Ground Water - Central Tendency Exposures

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SUMMARY OF RECEPTOR RISKS AND HAZARDS FOR COPCs

Table No.	
9.1	Construction Workers - Reasonable Maximum Exposures
9.1a	Construction Workers - Central Tendency Exposures
9.2	Maintenance Workers - Reasonable Maximum Exposures
9.2a	Maintenance Workers - Central Tendency Exposures
9.3	Occupational Workers - Reasonable Maximum Exposures
9.3a	Occupational Workers - Central Tendency Exposures
9.4	Adult Recreational Users - Reasonable Maximum Exposures
9.4a	Adult Recreational Users - Central Tendency Exposures
9.5	Adolescent Trespassers - Reasonable Maximum Exposures
9.5a	Adolescent Trespassers - Central Tendency Exposures
9.6	Future Adult Resident - Reasonable Maximum Exposures
9.6a	Future Adult Resident - Central Tendency Exposures
9.7	Future Child Resident - Reasonable Maximum Exposures
9.7a	Future Child Resident - Central Tendency Exposures

TABLE 1
SELECTION OF EXPOSURE PATHWAYS
SWMU 1 - MUSTARD GAS BURIAL GROUND
NSWC CRANE, INDIANA

Scenario Timeframe	Medium	Exposure Medium	Exposure Point	Receptor Population	Receptor Age	Exposure Route	On-Site/ Off-Site	Type of Analysis	Rationale for Selection or Exclusion of Exposure Pathway
Current/Future	Surface Soil(1)	Surface Soil	Entire Site	Trespassers	Adolescent	Ingestion	On-site	Quant(2)	Although access to the base is controlled, once inside the base access to the study areas is not limited by any physical constraints.
						Dermal	On-site	Quant	
					Adult	Ingestion	On-site	None	Potential risks are assumed to be similar to adolescent trespassers. Risks for this receptor will be inferred using the calculated risks for the adolescent trespasser.
						Dermal	On-site	None	
		Air	Vapors and Particulates in Air - Entire Site	Trespassers	Adult and Adolescent	Inhalation	On-site	Qual(3)	Exposure is evaluated qualitatively by a comparison of site data to USEPA Generic SSLs(4) for transfers from soil to air.
	Groundwater	Groundwater/Air	Surficial Aquifer	Trespassers	Adult and Adolescent	Ingestion	On-site	None	Direct contact with groundwater does not occur under current land use. Shallow groundwater is not expected to be used as a domestic water supply.
						Dermal	On-site	None	
						Inhalation	On-site	None	
	Surface Water	Surface Water	On-site Intermittent Drainge Channels	Trespassers	Adolescent	Ingestion	On-site	Quant	Although access to the base is controlled, once inside the base access to the study areas is not limited by any physical constraints.
						Dermal	On-site	Quant	
					Adult	Ingestion	On-site	None	Potential risks are assumed to be similar to adolescent trespassers. Risks for this receptor will be inferred using the calculated risks for the adolescent trespasser.
						Dermal	On-site	None	
		Air	On-site Intermittent Drainge Channels	Trespassers	Adult and Adolescent	Inhalation	On-site	None	Minimal exposure to vapors emitted from surface water is anticipated (i.e., so low such that it is not worth quantifying).
	Sediment	Sediment	On-site Intermittent Drainge Channels	Trespassers	Adolescent	Ingestion	On-site	Quant	Although access to the base is controlled, once inside the base access to the study areas is not limited by any physical constraints.
						Dermal	On-site	Quant	
					Adult	Ingestion	On-site	None	Potential risks are assumed to be similar to adolescent trespassers. Risks for this receptor will be inferred using the calculated risks for the adolescent trespasser.
						Dermal	On-site	None	
		Air	Vapors and Particulates in Air - Entire Site	Trespassers	Adult and Adolescent	Inhalation	On-site	None	Minimal exposure is anticipated (i.e., so low such that it is not worth quantifying).
Future	Surface/ Subsurface Soil (5)	Surface/ Subsurface Soil	Entire Site	Excavation/Construction Workers	Adult	Ingestion	On-site	Quant	Excavation/construction activities may occur at the site in the future.
						Dermal	On-site	Quant	
		Air	Vapors and Particulates in Air - Entire Site	Excavation/Construction Workers	Adult	Inhalation	On-site	Qual	Exposure is evaluated qualitatively by a comparison of site data to USEPA Generic SSLs for transfers from soil to air.
	Surface Soil	Surface Soil	Entire Site	Maintenance Workers	Adult	Ingestion	On-site	Quant	Although maintenance activities are not currently performed on the site, activities, such as groundkeeping, may occur in the future.
						Dermal	On-site	Quant	
				Occupational Workers	Adult	Ingestion	On-site	Quant	Minimal exposure to ground water by workers is anticipated (i.e., so low such that it is not worth quantifying).
						Dermal	On-site	Quant	
				Recreational Users	Adult	Ingestion	On-site	Quant	This scenario is evaluated on the assumption that the Facility would close and be turned into a state park in the future.
						Dermal	On-site	Quant	
				Residents	Child and Adult	Ingestion	On-site	Quant	Although the scenario is unlikely, a residential scenario is included to aid in future risk management decisions.
						Dermal	On-site	Quant	
		Air	Vapors and Particulates in Air - Entire Site	Maintenance/Occupational Workers, Recreational Users, and Residents	Child and Adult	Inhalation	On-site	Qual	Exposure is evaluated qualitatively by a comparison of site data to USEPA Generic SSLs for transfers from soil to air.

TABLE 1
SELECTION OF EXPOSURE PATHWAYS
SWMU 1 - MUSTARD GAS BURIAL GROUND
NSWC CRANE, INDIANA

Scenario Timeframe	Medium	Exposure Medium	Exposure Point	Receptor Population	Receptor Age	Exposure Route	On-Site/ Off-Site	Type of Analysis	Rationale for Selection or Exclusion of Exposure Pathway
Future	Groundwater	Groundwater	Surficial Aquifer	Excavation/Construction and Maintenance Workers	Adult	Ingestion Dermal	On-site On-site	None Quant	Minimal exposure is anticipated (i.e., so low such that it is not worth quantifying). Excavation/construction activities may occur at the site and workers may be exposed by direct contact with groundwater.
				Occupational Workers	Adult	Ingestion Dermal	On-site On-site	None None	Minimal exposure to ground water is anticipated (i.e., so low such that it is not worth quantifying).
				Recreational Users	Adult	Ingestion Dermal	On-site On-site	None None	Direct contact with groundwater is not expected to occur for future recreational users.
				Residents	Child and Adult	Ingestion Dermal	On-site On-site	Quant Quant	Although it is unlikely that shallow groundwater at the site would be used as a domestic water supply. This scenario is included to aid in future risk management decisions.
		Air	Vapors	Maintenance/Occupational Workers and Recreational Users	Adult	Inhalation	On-site	None	Minimal exposure is anticipated (i.e., so low such that it is not worth quantifying).
				Excavation/Construction Workers	Adult	Inhalation	On-site	Quant	Construction workers may be exposed to COPCs that have volatilized from groundwater when excavation exposes the shallow water table.
				Residents	Child and Adult	Inhalation	On-site	Quant	Although it is unlikely that shallow groundwater at the site would be used as a domestic water supply. This scenario is included to aid in future risk management decisions.
	Surface Water	Surface Water	On-site Intermittent Drainge Channels	Excavation/Construction and Maintenance Workers Workers	Adult	Ingestion Dermal	On-site On-site	None None	Minimal exposure is anticipated (i.e., so low such that it is not worth quantifying).
				Occupational Workers	Adult	Ingestion Dermal	On-site On-site	None None	Minimal exposure to surface water is anticipated (i.e., so low such that it is not worth quantifying).
				Recreational Users	Adult	Ingestion Dermal	On-site On-site	Quant Quant	This scenario is evaluated on the assumption that the Facility would close and be turned into a state park in the future.
				Residents	Child and Adult	Ingestion Dermal	On-site On-site	Quant Quant	Although the scenario is unlikely, a residential scenario is included to aid in future risk management decisions.
		Air	On-site Intermittent Drainge Channels	Excavation/Constuction/ Maintenance/Occupational Workers, Recreational Users, and Residents	Child and Adult	Inhalation	On-site	None	Minimal exposure to vapors emitted from surface water is anticipated (i.e., so low such that it is not worth quantifying).

TABLE 1
SELECTION OF EXPOSURE PATHWAYS
SWMU 1 - MUSTARD GAS BURIAL GROUND
NSWC CRANE, INDIANA

Scenario Timeframe	Medium	Exposure Medium	Exposure Point	Receptor Population	Receptor Age	Exposure Route	On-Site/ Off-Site	Type of Analysis	Rationale for Selection or Exclusion of Exposure Pathway
Future	Sediment	*Sediment*	On-site Intermittent Drainge Channels	Excavation/Construction and Maintenance Workers	Adult	Ingestion Dermal	On-site On-site	None None	Minimal exposure is anticipated (i.e., so low such that it is not worth quantifying).
				Occupational Workers	Adult	Ingestion Dermal	On-site On-site	None None	Minimal exposure to sediment is anticipated (i.e., so low such that it is not worth quantifying).
				Recreational Users	Adult	Ingestion Dermal	On-site On-site	Quant Quant	This scenario is evaluated on the assumption that the Facility would close and be turned into a state park in the future.
				Residents	Adult and Child	Ingestion Dermal	On-site On-site	Quant Quant	Although the scenario is unlikely, a residential scenario is included to aid in future risk management decisions.
		Air	On-site Intermittent Drainge Channels	Excavation/Constuction/ Maintenance/Occupational Workers, Recreational Users, and Residents	Child and Adult	Inhalation	On-site	None	Minimal exposure to vapors emitted from surface water is anticipated (i.e., so low such that it is not worth quantifying).

Footnotes:
1 Surface soil is defined as soil collected from 0 to2 feet below ground surface (bgs).
2 Quantitative.
3 Qualitative.
4 Soil Screening Levels (USEPA, May 1996).
5 Surface/subsurface soil is defined as soil collected from 0 to 10 feet bgs; no exposure to soil at depths below 10 feet bgs is anticipated.

TABLE 2.1

OCCURRENCE, DISTRIBUTION, AND SELECTION OF CHEMICALS OF POTENTIAL CONCERN - DIRECT CONTACT WITH SURFACE SOIL, ROUND 1
SWMU 01 - MUSTARD GAS BURIAL GROUND
NSWC CRANE
CRANE, INDIANA

CAS Number	Chemical	Minimum Concentration (1)		Maximum Concentration (1)		Location of Maximum Concentration	Detection Frequency (1)	Range of Nondetects (2)	Concentration Used for Screening (3)	Site Above Background ?(4)	Risk-Based COPC Screening Level (5)		Potential ARAR/TBC Value	Potential ARAR/TBC Source	COPC	Rationale for Contaminant Deletion or Selection (6)
VOCs (mg/kg)																
78-93-3	2-Butanone	0.038	-	0.071	J	01SS130002	2/24	0.005 - 0.01	0.071	NA	730	N	20000	IDEM	No	BSL
67-64-1	Acetone	0.021	J	0.18	-	01SS180002	4/24	0.005 - 0.75	0.18	NA	160	N	3900	IDEM	No	BSL
75-15-0	Carbon Disulfide	0.006	-	0.006	-	01SS170002	1/24	0.003 - 0.004	0.006	NA	36	N	900	IDEM	No	BSL
75-09-2	Methylene Chloride	0.002	J	0.061	J	01SS060002	10/24	0.005 - 0.039	0.061	NA	8.9	C	120	IDEM	No	BSL
108-88-3	Toluene	0.002	J	0.002	J	01SS130002	1/24	0.003 - 0.005	0.002	NA	520	sat	1700	IDEM	No	BSL
SVCOs (mg/kg)																
57-97-6	7,12-Dimethylbenz(a)anthracene	0.26	J	0.26	J	01SS170002	1/24	0.28 - 1.5	0.26	NA	NA		NA	IDEM	No	NTX
83-32-9	Acenaphthene	0.0158	-	0.0708	-	01SS060002	2/24	0.0112 - 0.0158	0.0708	NA	370	N	9500	IDEM	No	BSL
50-32-8	Benzo(a)pyrene	0.00585	J	0.0119	J	01SS090002	2/24	0.0112 - 0.0158	0.0119	NA	0.062	C	0.5	IDEM	No	BSL
191-24-2	Benzo(g,h,i)perylene	0.0093	J	0.0118	J	01SS090002	2/24	0.0112 - 0.0158	0.0118	NA	230(7)	N	5500(7)	IDEM	No	BSL
207-08-9	Benzo(k)fluoranthene	0.0141	J	0.0141	J	01TPL01	1/24	0.0112 - 0.0158	0.0141	NA	6.2	C	50	IDEM	No	BSL
117-81-7	bis(2-Ethylhexyl) phthalate	0.083	J	0.42	-	01SS090002	3/24	0.19 - 1	0.42	NA	35	C	300	IDEM	No	BSL
53-70-3	Dibenzo(a,h)anthracene	0.00576	J	0.00576	J	01TPL01	1/24	0.0112 - 0.0158	0.00576	NA	0.062	C	0.5	IDEM	No	BSL
206-44-0	Fluoranthene	0.00398	J	0.00439	J	01TPL01	2/24	0.0112 - 0.0158	0.00439	NA	230	N	6300	IDEM	No	BSL
193-39-5	Indeno(1,2,3-cd)pyrene	0.00452	J	0.00455	J	01SS090002	2/24	0.0112 - 0.0158	0.00455	NA	0.62	C	5	IDEM	No	BSL
120-58-1	Isosafrole	0.15	J	46	-	01SS050002	6/24	0.38 - 2	46	NA	611	N	NA	IDEM	No	BSL
129-00-0	Pyrene	0.0041	J	0.0146	J	01SS040002	2/24	0.0112 - 0.0158	0.0146	NA	230	N	5500	IDEM	No	BSL
Pesticides/PCBs (mg/kg)																
5103-74-2	gamma-Chlordane	0.00055	J	0.0011	J	01SS170002	7/17	0.0015 - 0.0017	0.0011	NA	1.6	C	17	IDEM	No	BSL
76-44-8	Heptachlor	0.0012	J	0.0024	-	01SS200002	11/19	0.001 - 0.0024	0.0024	NA	0.11	C	0.54	IDEM	No	BSL
Herbicides (mg/kg)																
93-72-1	2,4,5-TP (Silvex)	0.0059	J	0.015	J	01SS110002	2/20	0.011 - 0.016	0.015	NA	49	N	NA	IDEM	No	BSL
94-75-7	2,4-D	0.035	J	0.21	-	01SS170002	5/18	0.081 - 0.09	0.21	NA	69	N	NA	IDEM	No	BSL
Inorganics (mg/kg)																
7429-90-5	Aluminum	9400	J	19400	-	01SS100002	24/24	---	19400	Yes	7600	N	NA	IDEM	Yes	ASL
7440-36-0	Antimony	1.7	J	1.7	J	01SS010002	1/24	0.2 - 1.4	1.7	No	3.1	N	140	IDEM	No	BSL,BKG
7440-38-2	Arsenic	6	J	10.9	J	01SS020002	24/24	---	10.9	No	0.39	C	3.9	IDEM	No	BKG(11)
7440-39-3	Barium	42.9	-	169	-	01SS170002	24/24	---	169	No	540	N	23000	IDEM	No	BSL,BKG
7440-41-7	Beryllium	0.21	-	1	J	01SS170002, 01SS120002	23/24	0.59	1	Yes	15	N	680	IDEM	No	BSL
7440-43-9	Cadmium	0.05	J	1.3	J	01SS170002	14/24	0.01 - 0.05	1.3	No	3.7	N	12	IDEM	No	BSL,BKG
7440-70-2	Calcium	421	J	27900	J	01SS100002	24/24	---	27900	Yes	NA	N	NA	IDEM	No	NUT
7440-47-3	Chromium	11.5	-	24.3	J	01SS170002	24/24	---	24.3	No	30(8)	C	430(8)	IDEM	No	BSL,BKG
7440-48-4	Cobalt	3.2	J	22.3	-	01TPL01	24/24	---	22.3	No	470	N	NA	IDEM	No	BSL,BKG
7440-50-8	Copper	7.4	J	18.5	-	01SS100002	24/24	---	18.5	Yes	290	N	13000	IDEM	No	BSL
7439-89-6	Iron	14600	-	25500	-	01SS030002	24/24	---	25500	Yes	2300	N	NA	IDEM	Yes	ASL
7439-92-1	Lead	11	-	21.6	-	01TPL01	24/24	---	21.6	No	400(9)	N	400(9)	IDEM	No	BSL,BKG
7439-95-4	Magnesium	1050	J	5260	J	01SS100002	24/24	---	5260	Yes	NA	N	NA	IDEM	No	NUT
7439-96-5	Manganese	114	J	2010	-	01SS060002	24/24	---	2010	No	180	N	NA	IDEM	No	BKG
7439-97-6	Mercury	0.03	J	0.07	J	01SS090002, 01SS150002, 01SS100002	16/24	0.03 - 0.1	0.07	No	2.3(10)	N	55(10)	IDEM	No	BSL,BKG
7440-02-0	Nickel	6.9	J	16	J	01SS170002, 01SS060002	24/24	---	16	No	160	N	6900	IDEM	No	BSL,BKG
7440-09-7	Potassium	436	J	1310	J	01SS100002	24/24	---	1310	No	NA	N	NA	IDEM	No	NUT, BKG
7782-49-2	Selenium	0.49	-	1.3	-	01SS070002	16/24	0.38 - 1.5	1.3	Yes	39	N	1700	IDEM	No	BSL
7440-23-5	Sodium	219	J	648	-	01SS100002	24/24	---	648	Yes	NA	N	NA	IDEM	No	NUT
7440-24-6	Strontium	5	J	33.5	J	01SS100002	24/24	---	33.5	No	4700	N	NA	IDEM	No	BSL,BKG
7440-28-0	Thallium	0.69	-	2.8	-	01SS030002	20/24	0.55 - 0.62	2.8	No	0.52	N	31	IDEM	No	BKG(11)
7440-28-0	Thallium - GF	0.07	J	0.13	J	01SS030002	2/2	---	0.13	No	0.52	N	31	IDEM	No	BSL,BKG(11)
7440-29-1	Thorium-Calc	1.90	-	6.44	-	01SS040002	25/25	---	6.44	No	NA	N	NA	IDEM	No	BKG, NTX
7440-31-5	Tin	2.5	-	3.9	-	01SS080002	7/24	2.5 - 29.2	3.9	Yes	4700	N	NA	IDEM	No	BSL
7440-62-2	Vanadium	22.8	-	44.5	-	01SS100002	24/24	---	44.5	Yes	55	N	NA	IDEM	No	BSL
7440-66-6	Zinc	25.1	J	67.8	-	01SS100002	24/24	---	67.8	Yes	2300	N	100000	IDEM	No	BSL

TABLE 2.1

OCCURRENCE, DISTRIBUTION, AND SELECTION OF CHEMICALS OF POTENTIAL CONCERN - DIRECT CONTACT WITH SURFACE SOIL, ROUND 1
SWMU 01 - MUSTARD GAS BURIAL GROUND
NSWC CRANE
CRANE, INDIANA
PAGE 2 OF 2

CAS Number	Chemical	Minimum Concentration (1)		Maximum Concentration (1)		Location of Maximum Concentration	Detection Frequency (1)	Range of Nondetects (2)	Concentration Used for Screening (3)	Site Above Background ?(4)	Risk-Based COPC Screening Level (5)		Potential ARAR/TBC Value	Potential ARAR/TBC Source	COPC	Rationale for Contaminant Deletion or Selection (6)
Total Radiologicals (pCi/g)																
14331-83-0	Actinium-228	0.92	-	0.97	-	01TPL03	2/2	---	0.97	No	730	C	NA	IDEM	No	BSL,BKG
14913-49-6	Bismuth-212	0.91	-	0.94	-	01TPL03	2/2	---	0.94	No	23000	C	NA	IDEM	No	BSL,BKG
14733-03-0	Bismuth-214	0.68	-	0.74	-	01TPL03	2/2	---	0.74	No	8200	C	NA	IDEM	No	BSL,BKG
10045-97-3	Cesium-137	0.09	-	0.09	-	01TPL03	1/2	0.0359	0.09	No	0.061	C	NA	IDEM	No	BKG
14255-04-0	Lead-210	0.47	-	0.52	-	01TPL03	2/2	---	0.52	No	0.063	C	NA	IDEM	No	BKG
15092-94-1	Lead-212	0.83	-	0.86	-	01TPL03	2/2	---	0.86	No	3800	C	NA	IDEM	No	BSL,BKG
15067-28-4	Lead-214	0.69	-	0.71	-	01TPL02	2/2	---	0.71	No	46000	C	NA	IDEM	No	BSL,BKG
13966-00-2	Potassium-40	9.76	-	9.94	-	01TPL02	2/2	---	9.94	No	0.14	C	NA	IDEM	No	BKG
13982-63-3	Radium-226	1.56	-	1.68	-	01TPL03	2/2	---	1.68	No	0.013	C	NA	IDEM	No	BKG
14913-50-9	Thallium-208	0.77	-	0.81	-	01TPL03	2/2	---	0.81	No	23000	C	NA	IDEM	No	BSL,BKG
14274-82-9	Thorium-228	0.227	-	0.73	-	01SS040002	25/25	---	0.73	No	0.16	C	NA	IDEM	No	BKG
14269-63-7	Thorium-230	0.0178	J	0.621	J	01SS040002	18/25	0.0342 - 0.0898	0.621	No	3.9	C	NA	IDEM	No	BSL,BKG(12)
7440-29-1	Thorium-232	0.19	-	0.686	-	01SS040002	25/25	---	0.686	No	3.4	C	NA	IDEM	No	BSL,BKG
15065-10-8	Thorium-234	1	-	1.73	-	01TPL03	2/2	---	1.73	No	2200	C	NA	IDEM	No	BSL,BKG
15117-96-1	Uranium-235	0.12	-	0.14	-	01TPL03	2/2	---	0.14	No	0.21	C	NA	IDEM	No	BSL,BKG

Shaded cells indicate that the specified criterion or background level has been exceeded or that the chemical has been selected as a COPC.

Footnotes:
1 Only the original of the duplicate sample pair was used for COPC selection. The duplicate was used for quality control purposes only.
2 Values presented are sample-specific detection limits.
3 The maximum detected concentration is used for screening purposes.
4 To determine whether metal concentrations were within background levels, soil concentrations were compared to base-wide background data presented in the Base-wide Background Soil Investigation Report (TtNUS, Inc., 2001a) by means of the Wilcoxon Rank Sum Test. If the Wilcoxon Test determined that a constituent concentration was not significanty different from background, that chemical was not selected as a COPC.
5 Risk-based soil COPC screening level for residential land use based on a target Hazard Quotient of 0.1 for noncarcinogens (denoted with a "N" flag) or an incremental cancer risk of 1E-6 for carcinogens (denoted with a "C" flag) (U.S. EPA, Region 9, 2000d and U.S. EPA, 2000c).
6 The chemical is selected as a COPC if the maximum detected concentration exceeds the risk-based COPC screening level and/or an ARAR/TBC(s) and background levels.
7 Pyrene is used as a surrogate for benzo(g,h,i)perylene.
8 Hexavalent chromium.
9 OSWER soil screening level for residential land use (U.S. EPA, 1994c)
10 Value is for mercuric chloride (U.S. EPA, Region 3, April 2002)
11 Reevaluation demonstrated that this chemical does not exceed background concentrations. See Section 3.4.4 (arsenic) and Section 3.4.5 (thallium).
12 The rationale for the elimination of Thorium-230 on the basis of background in presented in Section-3.4.7.

Definitions:
ARAR/TBC = Applicable or Relevant and Appropriate Requirement/To Be Considered.
C = Carcinogen.
CAS = Chemical abstract services.
COPC = Chemical of potential concern.
GF = Graphite furnace atomic absorption reanalysis.
IDEM = Indiana Department of Environmental Management, Risk Integrated System of Closure (RISC) residential levels for direct contact with soil (IDEM, July 2001).
J = Estimated value.
N = Noncarcinogen
NA = Not applicable/not available.
sat = Soil saturation concentration.

Rationale Codes:
For Selection as a COPC:
ASL = Above COPC screening level/ARAR/TBC.

For Elimination as a COPC:
BKG = Within background levels.
BSL = Below COPC screening level/ARAR/TBC.
NTX = No toxicity information.
NUT = Essential nutrient.

TABLE 2.2

OCCURRENCE, DISTRIBUTION, AND SELECTION OF CHEMICALS OF POTENTIAL CONCERN - MIGRATION FROM SURFACE SOIL, ROUND 1
SWMU 01 - MUSTARD GAS BURIAL GROUND
NWSC CRANE
CRANE, INDIANA

CAS Number	Chemical	Minimum Concentration (1)		Maximum Concentration (1)		Location of Maximum Concentration	Detection Frequency (1)	Range of Nondetects (2)	Concentration Used for Screening (3)	Site Above Background ?(4)	U.S. EPA Generic SSL for Migration to Ground Water (5)		U.S. EPA Generic SSL for Soil to Air (5)	IDEM SSL for Migration to Ground Water (6)	COPC	Rationale for Contaminant Deletion or Selection (7)
VOCs (mg/kg)																
78-93-3	2-Butanone	0.038	-	0.071	J	01SS130002	2/24	0.005 - 0.01	0.071	NA	NA	N	NA	11	No	BSL
67-64-1	Acetone	0.021	J	0.18	-	01SS180002	4/24	0.005 - 0.75	0.18	NA	0.8	N	100000	3.1	No	BSL
75-15-0	Carbon Disulfide	0.006	-	0.006	-	01SS170002	1/24	0.003 - 0.004	0.006	NA	2	N	720	10	No	BSL
75-09-2	Methylene Chloride	0.002	J	0.061	J	01SS060002	10/24	0.005 - 0.039	0.061	NA	0.001	C	13	0.023	Yes	ASL
108-88-3	Toluene	0.002	J	0.002	J	01SS130002	1/24	0.003 - 0.005	0.002	NA	0.6	N	650	12	No	BSL
SVOCs (mg/kg)																
57-97-6	7,12-Dimethylbenz(a)anthracene	0.26	J	0.26	J	01SS170002	1/24	0.28 - 1.5	0.26	NA	NA		NA	NA	No	BSL
83-32-9	Acenaphthene	0.0158	-	0.0708	-	01SS060002	2/24	0.0112 - 0.0158	0.0708	NA	29	N	NA	130	No	BSL
50-32-8	Benzo(a)pyrene	0.00585	J	0.0119	J	01SS090002	2/24	0.0112 - 0.0158	0.0119	NA	0.4	C	NA	8.2	No	BSL
191-24-2	Benzo(g,h,i)perylene	0.0093	J	0.0118	J	01SS090002	2/24	0.0112 - 0.0158	0.0118	NA	210(8)	N	NA	570(8)	No	BSL
207-08-9	Benzo(k)fluoranthene	0.0141	J	0.0141	J	01TPL01	1/24	0.0112 - 0.0158	0.0141	NA	2	C	NA	39	No	BSL
117-81-7	Bis(2-Ethylhexyl)phthalate	0.083	J	0.42	-	01SS090002	3/24	0.19 - 1	0.42	NA	180	C	31000	3600	No	BSL
53-70-3	Dibenzo(a,h)anthracene	0.00576	J	0.00576	J	01TPL01	1/24	0.0112 - 0.0158	0.00576	NA	0.08	C	NA	18	No	BSL
206-44-0	Fluoranthene	0.00398	J	0.00439	J	01TPL01	2/24	0.0112 - 0.0158	0.00439	NA	210	N	NA	880	No	BSL
193-39-5	Indeno(1,2,3-cd)pyrene	0.00452	J	0.00455	J	01SS090002	2/24	0.0112 - 0.0158	0.00455	NA	0.7	C	NA	3.1	No	BSL
120-58-1	Isosafrole	0.15	J	46	-	01SS050002	6/24	0.38 - 2	46	NA	NA		NA	NA	No	NTX
129-00-0	Pyrene	0.0041	J	0.0146	J	01SS040002	2/24	0.0112 - 0.0158	0.0146	NA	210	N	NA	570	No	BSL
Pesticides/PCBs (mg/kg)																
5103-74-2	gamma-Chlordane	0.00055	J	0.0011	J	01SS170002	7/17	0.0015 - 0.0017	0.0011	NA	0.5	C	20	9.6	No	BSL
76-44-8	Heptachlor	0.0012	J	0.0024	-	01SS200002	11/19	0.001 - 0.0024	0.0024	NA	1	C	4	23	No	BSL
Herbicides (mg/kg)																
93-72-1	2,4,5-TP (Silvex)	0.0059	J	0.015	J	01SS110002	2/20	0.011 - 0.016	0.015	NA	NA	N	NA	NA	No	BSL
94-75-7	2,4-D	0.035	J	0.21	-	01SS170002	5/18	0.081 - 0.09	0.21	NA	NA	N	NA	NA	No	BSL
Inorganics (mg/kg)																
7429-90-5	Aluminum	9400	J	19400	-	01SS100002	24/24	---	19400	Yes	NA	N	NA	NA	No	NS, BKG
7440-36-0	Antimony	1.7	J	1.7	J	01SS010002	1/24	0.2 - 1.4	1.7	No	0.3	N	NA	5.4	No	BKG
7440-38-2	Arsenic	6	J	10.9	J	01SS020002	24/24	---	10.9	Yes	1	C	750	29	No	BKG(9)
7440-39-3	Barium	42.9	-	169		01SS170002	24/24	---	169	No	82	N	690000	1600	No	BKG
7440-41-7	Beryllium	0.21	-	1	J	01SS170002, 01SS120002	23/24	0.59	1	Yes	3	N	1300	63	No	BSL
7440-43-9	Cadmium	0.05	J	1.3	J	01SS170002	14/24	0.01 - 0.05	1.3	No	0.4	N	1800	7.5	No	BKG
7440-70-2	Calcium	421	J	27900	J	01SS100002	24/24	---	27900	Yes	NA	N	NA	NA	No	NUT
7440-47-3	Chromium	11.5	-	24.3	J	01SS170002	24/24	---	24.3	No	2	N	270	38	No	BKG
7440-48-4	Cobalt	3.2	J	22.3	-	01TPL01	24/24	---	22.3	No	NA	N	NA	NA	No	NS, BKG
7440-50-8	Copper	7.4	J	18.5	-	01SS100002	24/24	---	18.5	Yes	NA	N	NA	580	No	BSL
7439-89-6	Iron	14600	-	25500	-	01SS030002	24/24	---	25500	Yes	NA	N	NA	NA	No	NTX
7439-92-1	Lead	11	-	21.6	-	01TPL01	24/24	---	21.6	No	NA	N	NA	81	No	BSL,BKG
7439-95-4	Magnesium	1050	J	5260	J	01SS100002	24/24	---	5260	Yes	NA	N	NA	NA	No	NUT
7439-96-5	Manganese	114	J	2010	-	01SS060002	24/24	---	2010	No	NA	N	NA	NA	No	NS, BKG
7439-97-6	Mercury	0.03	J	0.07	J	01SS090002, 01SS150002, 01SS100002	16/24	0.03 - 0.1	0.07	No	100	N	10	2.1	No	BSL,BKG
7440-02-0	Nickel	6.9	J	16	J	01SS170002, 01SS060002	24/24	---	16	No	7	N	13000	950	No	BKG
7440-09-7	Potassium	436	J	1310	J	01SS100002	24/24	---	1310	No	NA	N	NA	NA	No	NUT, BKG
7782-49-2	Selenium	0.49	-	1.3	-	01SS070002	16/24	0.38 - 1.5	1.3	Yes	0.3	N	NA	5.2	Yes	ASL
7440-23-5	Sodium	219	J	648	-	01SS100002	24/24	---	648	Yes	NA	N	NA	NA	No	NUT
7440-24-6	Strontium	5	J	33.5	J	01SS100002	24/24	---	33.5	No	NA	N	NA	NA	No	BSL,BKG
7440-28-0	Thallium	0.69	-	2.8	-	01SS030002	20/24	0.55 - 0.62	2.8	Yes	0.04	N	NA	2.8	No	BKG(9)
7440-28-0	Thallium - GF	0.07	J	0.13	J	01SS030002	2/2	---	0.13	No	0.04	N	NA	2.8	No	BKG(9)
7440-29-1	Thorium-Calc	1.90	-	6.44	-	01SS040002	25/25	---	6.44	No	NA	N	NA	NA	No	NTX, BKG

TABLE 2.2

OCCURRENCE, DISTRIBUTION, AND SELECTION OF CHEMICALS OF POTENTIAL CONCERN - MIGRATION FROM SURFACE SOIL, ROUND 1
SWMU 01 - MUSTARD GAS BURIAL GROUND
NWSC CRANE
CRANE, INDIANA

CAS Number	Chemical	Minimum Concentration (1)		Maximum Concentration (1)		Location of Maximum Concentration	Detection Frequency (1)	Range of Nondetects (2)	Concentration Used for Screening (3)	Site Above Background ?(4)	U.S. EPA Generic SSL for Migration to Ground Water (5)		U.S. EPA Generic SSL for Soil to Air (5)	IDEM SSL for Migration to Ground Water (6)	COPC	Rationale for Contaminant Deletion or Selection (7)
7440-31-5	Tin	2.5	-	3.9	-	01SS080002	7/24	2.5 - 29.2	3.9	Yes	NA	N	NA	NA	No	BSL
7440-62-2	Vanadium	22.8	-	44.5	-	01SS100002	24/24	---	44.5	Yes	300	N	NA	NA	No	BSL
7440-66-6	Zinc	25.1	J	67.8	-	01SS100002	24/24	---	67.8	Yes	620	N	NA	14000	No	BSL
Total Radiologicals (pCi/g)																
14331-83-0	Actinium-228	0.92	-	0.97	-	01TPL03	2/2	---	0.97	No	NA	C	1.10E+10	NA	No	BSL,BKG
14913-49-6	Bismuth-212	0.91	-	0.94	-	01TPL03	2/2	---	0.94	No	NA	C	4.20E+10	NA	No	BSL,BKG
14733-03-0	Bismuth-214	0.68	-	0.74	-	01TPL03	2/2	---	0.74	No	NA	C	3.40E+11	NA	No	BSL,BKG
10045-97-3	Cesium-137	0.09	-	0.09	-	01TPL03	1/2	0.0359	0.09	No	2.8	C	2.10E+06	NA	No	BSL,BKG
14255-04-0	Lead-210	0.47	-	0.52	-	01TPL03	2/2	---	0.52	No	5.50E-04	C	2000	NA	No	BKG
15092-94-1	Lead-212	0.83	-	0.86	-	01TPL03	2/2	---	0.86	No	3.50E+06	C	5.40E+08	NA	No	BSL,BKG
15067-28-4	Lead-214	0.69	-	0.71	-	01TPL02	2/2	---	0.71	No	1.40E+11	C	2.00E+11	NA	No	BSL,BKG
13966-00-2	Potassium-40	9.76	-	9.94	-	01TPL02	2/2	---	9.94	No	NA	C	1.80E+05	NA	No	BSL,BKG
13982-63-3	Radium-226	1.56	-	1.68	-	01TPL03	2/2	---	1.68	No	0.016	C	1600	NA	No	BKG
14913-50-9	Thallium-208	0.77	-	0.81	-	01TPL03	2/2	---	0.81	No	NA	C	NA	NA	No	BSL,BKG
14274-82-9	Thorium-228	0.227	-	0.73	-	01SS040002	25/25	---	0.73	No	3.3	C	1400	NA	No	BSL,BKG
14269-63-7	Thorium-230	0.0178	J	0.621	J	01SS040002	18/25	0.0342 - 0.0898	0.621	No	0.3	C	640	NA	No	BKG(10)
7440-29-1	Thorium-232	0.19	-	0.686	-	01SS040002	25/25	---	0.686	No	0.3	C	420	NA	No	BKG
15065-10-8	Thorium-234	1	-	1.73	-	01TPL03	2/2	---	1.73	No	4100	C	1.90E+08	NA	No	BSL,BKG
15117-96-1	Uranium-235	0.12	-	0.14	-	01TPL03	2/2	---	0.14	No	0.039	C	1800	NA	No	BKG

Shaded cells indicate that the specified criterion or background level hs been exceeded or that the chemical has been selected as a COPC.

Footnotes:
1 Only the original of the duplicate sample pair was used for COPC selection. The duplicate was used for quality control purposes only.
2 Values presented are sample-specific detection limits.
3 The maximum detected concentration is used for screening purposes.
4 To determine whether metal concentrations were within background levels, soil concentrations were compared to base-wide background data presented in the *Base-wide Background Soil Investigation Report* (TtNUS, Inc., 2001a) by means of the Wilcoxon Rank Sum Test. If the Wilcoxon Test determined that a constituent concentration was not significanty different from background, that chemical was not selected as a COPC.
5 Soil Screening Guidance: Technical Background Document. (U.S. EPA, 1996). The migration to groundwater value represents a dilution and attenuation factor (DAF) of 1.
6 Residential levels for migration from soil to groundwater (IDEM, 2001).
7 The chemical is selected as a COPC if the maximum detected concentration exceeds any screening level and background levels.
8 Pyrene is used as a surrogate for benzo(g,h,i)perylene.
9 Reevaluation demonstrated that this chemical does not exceed background concentrations. See Section 3.4.4 (arsenic) and Section 3.4.5 (thallium).
10 The rationale for the elimination of Thorium-230 on the basis of background in presented in Section 3.4.7.

Definitions:
ARAR/TBC = Applicable or Relevant and Appropriate Requirement/to be considered.
C = Carcinogen,
CAS = Chemical abstract services.
COPC = Chemical of potential concern.
GF = Graphite furnace atomic absorption reanalysis.
IDEM = Indiana Department of Environmental Management, Risk Integrated System of Closure (RISC) residential levels for migration from soil to ground water (IDEM, July 2001).
J = Estimated value.
N = Noncarcinogen.
NA = Not applicable/not available.
sat = Soil saturation concentration.

Rationale Codes:
For Selection as a COPC:
ASL = Above COPC screening level/ARAR/TBC.

For Elimination as a COPC:
BKG = Within background levels.
BSL = Below COPC screening level/ARAR/TBC.
NTX = No toxicity information.
NUT = Essential nutrient.
NS = Soil Screening Levels have not been determined for these constituents

TABLE 2.3

OCCURRENCE, DISTRIBUTION, AND SELECTION OF CHEMICALS OF POTENTIAL CONCERN - DIRECT CONTACT WITH SUBSURFACE SOIL, ROUND 1
SWMU 01 - MUSTARD GAS BURIAL GROUND
NSWC CRANE
CRANE, INDIANA
PAGE 1 OF 2

CAS Number	Chemical	Minimum Concentration [1]		Maximum Concentration [1]		Location of Maximum Concentration	Detection Frequency [1]	Range of Nondetects [2]	Concentration Used for Screening [3]	Site Above Background ? [4]	Risk-Based COPC Screening Level [5]		Potential ARAR/TBC Value	Potential ARAR/TBC Source	COPC	Rationale for Contaminant Deletion or Selection [6]
VOCs (mg/kg)																
79-34-5	1,1,2,2-Tetrachloroethane	0.002	J	0.002	J	01SB090206	1/35	0.002 - 0.004	0.002	NA	0.38	C	5	IDEM	No	BSL
67-64-1	Acetone	0.006	-	0.042	-	01SB180610	12/35	0.004 - 0.006	0.042	NA	160	N	3900	IDEM	No	BSL
67-66-3	Chloroform	0.004	J	0.004	J	01SB090206	1/35	0.002 - 0.004	0.004	NA	0.24	C	0.91	IDEM	No	BSL
75-09-2	Methylene Chloride	0.003	J	0.086	J	01SB070206	27/35	0.005 - 0.054	0.086	NA	8.9	C	120	IDEM	No	BSL
SVOCs (mg/kg)																
83-32-9	Acenaphthene	0.00434	J	0.0303	-	01SB060206	3/34	0.0107 - 0.0148	0.0303	NA	370	N	9500	IDEM	No	BSL
120-12-7	Anthracene	0.0415	-	0.0415	-	01SB200610	1/34	0.0107 - 0.0148	0.0415	NA	2200	N	47000	IDEM	No	BSL
56-55-3	Benzo(a)anthracene	0.153	J	0.153	J	01SB200610	1/34	0.0107 - 0.0148	0.153	NA	0.62	C	5	IDEM	No	BSL
50-32-8	Benzo(a)pyrene	0.181	J	0.181	J	01SB200610	1/34	0.0107 - 0.0148	0.181	NA	0.062	C	0.5	IDEM	Yes	ASL
205-99-2	Benzo(b)fluoranthene	0.318	J	0.318	J	01SB200610	1/34	0.0107 - 0.0148	0.318	NA	0.62	C	5	IDEM	No	BSL
191-24-2	Benzo(g,h,i)perylene	0.16	J	0.16	J	01SB200610	1/34	0.0107 - 0.0148	0.16	NA	230(7)	N	5500(7)	IDEM	No	BSL
117-81-7	bis(2-Ethylhexyl) phthalate	0.097	J	5.6	-	01SB090206	3/35	0.18 - 0.25	5.6	NA	35	C	300	IDEM	No	BSL
218-01-9	Chrysene	0.108	J	0.108	J	01SB200610	1/34	0.0107 - 0.0148	0.108	NA	62	C	500	IDEM	No	BSL
206-44-0	Fluoranthene	0.54	J	0.54	J	01SB200610	1/34	0.0107 - 0.0148	0.54	NA	230	N	6300	IDEM	No	BSL
86-73-7	Fluorene	0.0223	-	0.0223	-	01SB200610	1/34	0.0107 - 0.0148	0.0223	NA	260	N	6300	IDEM	No	BSL
193-39-5	Indeno(1,2,3-cd)pyrene	0.0681	-	0.0681	-	01SB200610	1/34	0.0107 - 0.0148	0.0681	NA	0.62	C	5	IDEM	No	BSL
91-20-3	Naphthalene	0.00852	J	0.0102	J	01SB090206	3/24	0.0107 - 0.0148	0.0102	NA	5.6	N	3200	IDEM	No	BSL
85-01-8	Phenanthrene	0.278	J	0.278	J	01SB200610	1/34	0.0107 - 0.0148	0.278	NA	230(7)	N	5500(7)	IDEM	No	BSL
129-00-0	Pyrene	0.306	J	0.306	J	01SB200610	1/34	0.0107 - 0.0148	0.306	NA	230	N	5500	IDEM	No	BSL
Energertics (mg/kg)																
2691-41-0	HMX	0.0706	J	0.0706	J	01SB080206	1/35	0.454 - 0.5	0.0706	NA	310	N	NA	IDEM	No	BSL
Pesticides/PCBs (mg/kg)																
5103-74-2	gamma-Chlordane	0.00064	J	0.003	J	01SB160206	6/20	0.0014 - 0.0019	0.003	NA	1.6	C	17	IDEM	No	BSL
76-44-8	Heptachlor	0.00094	J	0.002	J	01SB150206	13/20	0.001 - 0.0021	0.002	NA	0.11	C	0.54	IDEM	No	BSL
Inorganics (mg/kg)																
7429-90-5	Aluminum	1420	J	18100	-	01SB060206	35/35	---	18100	Yes	7600	N	NA	IDEM	Yes	ASL
7440-38-2	Arsenic	0.48	J	20.2	J	01SB190610	26/35	0.36 - 2.3	20.2	Yes	0.39	C	3.9	IDEM	No	BKG(11)
7440-39-3	Barium	11.3	-	300	-	01SB170610	35/35	---	300	Yes	540	N	23000	IDEM	No	BSL
7440-41-7	Beryllium	0.24	-	1.6	J	01SB080610	26/35	0.22 - 0.48	1.6	Yes	15	N	680	IDEM	No	BSL
7440-43-9	Cadmium	0.04	J	1.1	-	01SB030206	17/35	0.01 - 0.05	1.1	Yes	3.7	N	12	IDEM	No	BSL
7440-70-2	Calcium	69.6	J	43200	J	01SB010206	35/35	---	43200	Yes	NA	N	NA	IDEM	No	NUT
7440-47-3	Chromium	6.4	J	24	-	01SB060206	35/35	---	24	Yes	30(8)	C	430(8)	IDEM	No	BSL
7440-48-4	Cobalt	1.3	J	25.8	-	01SB020610	34/35	0.6	25.8	Yes	470	N	NA	IDEM	No	BSL
7440-50-8	Copper	4.3	J	25.3	J	01SB080610	35/35	---	25.3	Yes	290	N	13000	IDEM	No	BSL
7439-89-6	Iron	4940	-	71500	-	01SB080610	35/35	---	71500	Yes	2300	N	NA	IDEM	Yes	ASL
7439-92-1	Lead	5.8	J	36.9	-	01SB030206	35/35	---	36.9	Yes	400		400	IDEM	No	BSL
7439-95-4	Magnesium	193	J	4670	J	01SB010206	35/35	---	4670	Yes	NA	N	NA	IDEM	No	NUT
7439-96-5	Manganese	8.6	J	408	-	01SB060610	35/35	---	408	Yes	180	N	NA	IDEM	Yes	ASL
7439-97-6	Mercury	0.02	J	0.07	J	01SB060206	14/35	0.02 - 0.05	0.07	Yes	2.3(9)	N	55(9)	IDEM	No	BSL
7440-02-0	Nickel	1.6	J	39.3	-	01SB060610	35/35	---	39.3	Yes	160	N	6900	IDEM	No	BSL
7440-09-7	Potassium	207	J	1190	J	01SB060610	35/35	---	1190	Yes	NA	N	NA	IDEM	No	NUT
7782-49-2	Selenium	0.12	J	1.7	-	01SB060206	16/35	0.18 - 0.9	1.7	Yes	39	N	1700	IDEM	No	BSL
7440-23-5	Sodium	240	J	755	-	01SB060610	35/35	---	755	Yes	NA	N	NA	IDEM	No	NUT
7440-24-6	Strontium	1.3	J	46	J	01SB010206	35/35	---	46	No	4700	N	NA	IDEM	No	BSL,BKG
7440-28-0	Thallium	0.75	-	5.3	J	01SB080610	31/35	0.53 - 0.63	5.3	Yes	0.52	N	31	IDEM	No	BKG(11)
7440-28-0	Thallium - GF	0.07	J	0.16	J	01SB080610	2/3	0.53 - 0.63	0.16	No	0.52	N	31	IDEM	No	BSL
7440-29-1	Thorium-Calc	1.87	-	6.94	-	01SB060610	37/37	---	6.94	No	NA	N	NA	IDEM	No	NTX, BKG
7440-31-5	Tin	2.3	-	4	-	01SB080610	11/35	2.3 - 27	4	Yes	4700	N	NA	IDEM	No	BSL
7440-62-2	Vanadium	7.1	-	42.6	-	01SB060206	35/35	---	42.6	Yes	55	N	NA	IDEM	No	BSL
7440-66-6	Zinc	9.3	J	129	-	01SB080610	35/35	---	129	Yes	2300	N	100000	IDEM	No	BSL
Total Radiologicals (pCi/g)																
14331-83-0	Actinium-228	1.01	-	1.27	-	01SB020206	4/4	---	1.27	No	730	C	NA	IDEM	No	BSL,BKG
14913-49-6	Bismuth-212	0.98	-	1.3	-	01SB010206	4/4	---	1.3	No	23000	C	NA	IDEM	No	BSL,BKG

TABLE 2.3

OCCURRENCE, DISTRIBUTION, AND SELECTION OF CHEMICALS OF POTENTIAL CONCERN - DIRECT CONTACT WITH SUBSURFACE SOIL, ROUND 1
SWMU 01 - MUSTARD GAS BURIAL GROUND
NSWC CRANE
CRANE, INDIANA

CAS Number	Chemical	Minimum Concentration (1)		Maximum Concentration (1)		Location of Maximum Concentration	Detection Frequency (1)	Range of Nondetects (2)	Concentration Used for Screening (3)	Site Above Background ?(4)	Risk-Based COPC Screening Level (5)		Potential ARAR/TBC Value	Potential ARAR/TBC Source	COPC	Rationale for Contaminant Deletion or Selection (6)
14733-03-0	Bismuth-214	0.73	-	0.87	-	01SB010206	4/4	---	0.87	No	8200	C	NA	IDEM	No	BSL,BKG
14391-16-3	Europium-155	0.08	-	0.09	-	01SB020206	2/4	0.242 - 0.244	0.09	No	3.8	C	NA	IDEM	No	BSL,BKG
14255-04-0	Lead-210	0.36	-	0.65	-	01SB030206	4/4	---	0.65	No	0.053	C	NA	IDEM	No	BKG
15092-94-1	Lead-212	0.95	-	1.13	-	01SB020206	4/4	---	1.13	No	3800	C	NA	IDEM	No	BSL,BKG
15067-28-4	Lead-214	0.72	-	0.87	-	01SB010206	4/4	---	0.87	No	46000	C	NA	IDEM	No	BSL,BKG
13966-00-2	Potassium-40	5.98	-	9.23	-	01SB020206	4/4	---	9.23	No	0.14	C	NA	IDEM	No	BKG
13982-63-3	Radium-226	1.66	-	1.9	-	01SB020206	4/4	---	1.9	No	0.013	C	NA	IDEM	No	BKG
14913-50-9	Thallium-208	0.91	-	1.04	-	01SB020206	4/4	---	1.04	No	23000	C	NA	IDEM	No	BSL,BKG
14274-82-9	Thorium-228	0.167	-	0.781	-	01SB040206	37/37	---	0.781	No	0.16	C	NA	IDEM	No	BKG
14269-63-7	Thorium-230	0.0332	J	0.637	J	01SB110610	25/37	0.0148 - 0.394	0.637	No	3.9	C	NA	IDEM	No	BSL,BKG(12)
7440-29-1	Thorium-232	0.245	-	0.872	-	01SB060610	37/37	---	0.872	No	3.4	C	NA	IDEM	No	BSL,BKG
15065-10-8	Thorium-234	1	-	1.88	-	01SB030206	4/4	---	1.88	No	2200	C	NA	IDEM	No	BSL,BKG

Shaded cells indicate that the specified criterion or background level has been exceeded or that the chemical has been selected as a COPC.

Footnotes:
1 Only the original of the duplicate sample pair was used for COPC selection. The duplicate was used for quality control purposes only.
2 Values presented are sample-specific detection limits.
3 The maximum detected concentration is used for screening purposes.
4 To determine whether metal concentrations were within background levels, soil concentrations were compared to base-wide background data presented in the Basewide Background Soil Investigation Report (TtNUS, Inc., 2001a) by means of the Wilcoxon Rank Sum Test. If the Wilcoxon Test determined that a constituent concentration was not significantly different from background, that chemical was not selected as a COPC.
5 The risk-based soil COPC screening level for residential land use is presented. The value is based on a target Hazard Quotient of 0.1 for noncarcinogens (denoted with a "N" flag) or an incremental cancer risk of 1E-6 for carcinogens (denoted with a "C" flag) (U.S. EPA, Region 9, 2000d and U.S. EPA, 2000c).
6 The chemical is selected as a COPC if the maximum detected concentration exceeds the risk-based COPC screening level and/or an ARAR/TBC(s) and background levels.
7 Pyrene is used as a surrogate for benzo(g,h,i)perylene and phenanthrene.
8 Hexavalent chromium.
9 OSWER soil screening level for residential land use (U.S. EPA, 1994)
10 Value is for mercuric chloride (U.S. EPA, Region 3, April 2002)
11 Reevaluation demonstrated that this chemical does not exceed background concentrations. See Section 3.4.4 (arsenic) and Section 3.4.5 (thallium).
12 The rationale for the elimination of Thorium-230 on the basis of background in presented in Section 3.4.7.

Definitions:
ARAR/TBC = Applicable or Relevant and Appropriate Requirement/to be considered.
C = Carcinogen.
CAS = Chemical abstract services.
COPC = Chemical of potential concern.
GF = Graphite furnace atomic absorption reanalysis.
IDEM = Indiana Department of Environmental Management. Risk Integrated System of Closure (RISC) residential levels for direct contact with soil (IDEM, 2001).
J = Estimated value.
N = Noncarcinogen
NA = Not applicable/bot available.
sat = Soil saturation concentration.

Rationale Codes:
For Selection as a COPC:
ASL = Above COPC screening level/ARAR/TBC.

For Elimination as a COPC:
BKG = Within background levels.
BSL = Below COPC screening level/ARAR/TBC.
NTX = No toxicity information.
NUT = Essential nutrient.

TABLE 2.4

OCCURRENCE, DISTRIBUTION, AND SELECTION OF CHEMICALS OF POTENTIAL CONCERN - MIGRATION FROM SUBSURFACE SOIL, ROUND 1
SWMU 01 - MUSTARD GAS BURIAL GROUND
NWSC CRANE
CRANE, INDIANA

CAS Number	Chemical	Minimum Concentration (1)		Maximum Concentration (1)		Location of Maximum Concentration	Detection Frequency (1)	Range of Nondetects (2)	Concentration Used for Screening (3)	Site Above Background ? (4)	USEPA Generic SSL for Migration to Ground Water (5)		U.S. EPA Generic SSL for Soil to Air (5)	IDEM SSL for Migration to Ground Water (6)	COPC	Rationale for Contaminant Deletion or Selection (7)
VOCs (mg/kg)																
79-34-5	1,1,2,2-Tetrachloroethane	0.002	J	0.002	J	01SB090206	1/35	0.002 - 0.004	0.002	NA	0.0002	C	0.6	0.007	Yes	ASL
67-64-1	Acetone	0.006		0.042		01SB180610	12/35	0.004 - 0.006	0.042	NA	0.8	N	100000	3.1	No	BSL
67-66-3	Chloroform	0.004	J	0.004	J	01SB090206	1/35	0.002 - 0.004	0.004	NA	0.03	C	0.3	0.59	No	BSL
75-09-2	Methylene Chloride	0.003	J	0.086	J	01SB070206	27/35	0.005 - 0.054	0.086	NA	0.001	C	13	0.023	Yes	ASL
SVOCs (mg/kg)																
83-32-9	Acenaphthene	0.00434	J	0.0303		01SB060206	3/34	0.0107 - 0.0148	0.0303	NA	29	N	NA	130	No	BSL
120-12-7	Anthracene	0.0415		0.0415		01SB200610	1/34	0.0107 - 0.0148	0.0415	NA	590	N	NA	51	No	BSL
56-55-3	Benzo(a)anthracene	0.153	J	0.153	J	01SB200610	1/34	0.0107 - 0.0148	0.153	NA	0.08	C	NA	19	Yes	ASL
50-32-8	Benzo(a)pyrene	0.181	J	0.181	J	01SB200610	1/34	0.0107 - 0.0148	0.181	NA	0.4	C	NA	8.2	No	BSL
205-99-2	Benzo(b)fluoranthene	0.318	J	0.318	J	01SB200610	1/34	0.0107 - 0.0148	0.318	NA	0.2	C	NA	57	Yes	ASL
191-24-2	Benzo(g,h,i)perylene	0.16	J	0.16	J	01SB200610	1/34	0.0107 - 0.0148	0.16	NA	210(8)	N	NA	570(8)	No	BSL
117-81-7	bis(2-Ethylhexyl) phthalate	0.097	J	5.6		01SB090206	3/35	0.18 - 0.25	5.6	NA	180	C	31000	3600	No	BSL
218-01-9	Chrysene	0.108	J	0.108	J	01SB200610	1/34	0.0107 - 0.0148	0.108	NA	8	C	NA	25	No	BSL
206-44-0	Fluoranthene	0.54	J	0.54	J	01SB200610	1/34	0.0107 - 0.0148	0.54	NA	210	N	NA	880	No	BSL
86-73-7	Fluorene	0.0223		0.0223		01SB200610	1/34	0.0107 - 0.0148	0.0223	NA	28	N	NA	170	No	BSL
193-39-5	Indeno(1,2,3-cd)pyrene	0.0681		0.0681		01SB200610	1/34	0.0107 - 0.0148	0.0681	NA	0.7	C	NA	3.1	No	BSL
91-20-3	Naphthalene	0.00852	J	0.0102	J	01SB090206	3/24	0.0107 - 0.0148	0.0102	NA	4	N	NA	0.7	No	BSL
85-01-8	Phenanthrene	0.278	J	0.278	J	01SB200610	1/34	0.0107 - 0.0148	0.278	NA	210(8)	N	NA	570(8)	No	BSL
129-00-0	Pyrene	0.306	J	0.306	J	01SB200610	1/34	0.0107 - 0.0148	0.306	NA	210	N	NA	570	No	BSL
Energertics (mg/kg)																
2691-41-0	HMX	0.0706	J	0.0706	J	01SB080206	1/35	0.454 - 0.5	0.0706	NA	NA	N	NA	NA	No	NTX
Pesticides/PCBs (mg/kg)																
5103-74-2	gamma-Chlordane	0.00064	J	0.003	J	01SB160206	6/20	0.0014 - 0.0019	0.003	NA	0.5	C	20	9.6	No	BSL
76-44-8	Heptachlor	0.00094	J	0.002	J	01SB150206	13/20	0.001 - 0.0021	0.002	NA	1	C	4	23	No	BSL
Inorganics (mg/kg)																
7429-90-5	Aluminum	1420	J	18100		01SB060206	35/35	---	18100	Yes	NA	N	NA	NA	No	NTX
7440-38-2	Arsenic	0.48	J	20.2	J	01SB190610	26/35	0.36 - 2.3	20.2	No	1	C	750	29	No	BKG(9)
7440-39-3	Barium	11.3		300		01SB170610	35/35	---	300	Yes	82	N	690000	1600	Yes	ASL
7440-41-7	Beryllium	0.24		1.6	J	01SB080610	26/35	0.22 - 0.48	1.6	Yes	3	N	1300	63	No	BSL
7440-43-9	Cadmium	0.04	J	1.1		01SB030206	17/35	0.01 - 0.05	1.1	Yes	0.4	N	1800	7.5	Yes	ASL
7440-70-2	Calcium	69.6	J	43200	J	01SB010206	35/35	---	43200	Yes	NA	N	NA	NA	No	NUT
7440-47-3	Chromium	6.4	J	24		01SB060206	35/35	---	24	Yes	2	C	270	38	Yes	ASL
7440-48-4	Cobalt	1.3	J	25.8		01SB020610	34/35	0.6	25.8	Yes	NA	N	NA	NA	No	NTX
7440-50-8	Copper	4.3	J	25.3	J	01SB080610	35/35	---	25.3	Yes	NA	N	NA	580	No	BSL
7439-89-6	Iron	4940		71500		01SB080610	35/35	---	71500	Yes	NA	N	NA	NA	No	NTX
7439-92-1	Lead	5.8	J	36.9		01SB030206	35/35	---	36.9	Yes	NA		NA	81	No	BSL
7439-95-4	Magnesium	193	J	4670	J	01SB010206	35/35	---	4670	Yes	NA	N	NA	NA	No	NUT
7439-96-5	Manganese	8.6	J	408		01SB060610	35/35	---	408	Yes	NA	N	NA	NA	No	NTX
7439-97-6	Mercury	0.02	J	0.07	J	01SB060206	14/35	0.02 - 0.05	0.07	Yes	NA	N	NA	2.1	No	BSL
7440-02-0	Nickel	1.6	J	39.3		01SB060610	35/35	---	39.3	Yes	7	N	13000	950	Yes	ASL
7440-09-7	Potassium	207	J	1190	J	01SB060610	35/35	---	1190	Yes	NA	N	NA	NA	No	NUT
7782-49-2	Selenium	0.12	J	1.7		01SB060206	16/35	0.18 - 0.9	1.7	Yes	0.3	N	NA	5.2	Yes	ASL
7440-23-5	Sodium	240	J	755		01SB060610	35/35	---	755	Yes	NA	N	NA	NA	No	NUT
7440-24-6	Strontium	1.3	J	46	J	01SB010206	35/35	---	46	No	NA	N	NA	NA	No	NS, BKG
7440-28-0	Thallium	0.75		5.3	J	01SB080610	31/35	0.53 - 0.63	5.3	No	0.04	N	NA	2.8	No	BKG(9)
7440-28-0	Thallium - GF	0.07	J	0.16	J	01SB080610	2/3	0.53 - 0.63	0.16	No	0.04	N	NA	2.8	No	BKG(9)
7440-29-1	Thorium-Calc	1.87		6.94		01SB060610	37/37	---	6.94	No	NA	N	NA	NA	No	NTX, BKG
7440-31-5	Tin	2.30		4.00		01SB080610	11/35	2.3 - 27	4.00	Yes	NA	N	NA	NA	No	NTX
7440-62-2	Vanadium	7.1		42.6		01SB060206	35/35	---	42.6	Yes	300	N	NA	NA	No	BSL
7440-66-6	Zinc	9.3	J	129		01SB080610	35/35	---	129	Yes	620	N	NA	14000	No	BSL
Total Radiologicals (pCi/g)																
14331-83-0	Actinium-228	1.01		1.27		01SB020206	4/4	---	1.27	No	NA	C	1.10E+10	NA	No	BKG, NTX
14913-49-6	Bismuth-212	0.98		1.3		01SB010206	4/4	---	1.3	No	NA	C	4.20E+10	NA	No	BKG, NTX
14733-03-0	Bismuth-214	0.73		0.87		01SB010206	4/4	---	0.87	No	NA	C	3.40E+11	NA	No	BKG, NTX
14391-16-3	Europium-155	0.08		0.09		01SB020206	2/4	0.242 - 0.244	0.09	No	NA	C	5.20E 06	NA	No	BKG, NTX

TABLE 2.4

OCCURRENCE, DISTRIBUTION, AND SELECTION OF CHEMICALS OF POTENTIAL CONCERN - MIGRATION FROM SUBSURFACE SOIL, ROUND 1
SWMU 01 - MUSTARD GAS BURIAL GROUND
NWSC CRANE
CRANE, INDIANA
PAGE 2 OF 2

CAS Number	Chemical	Minimum Concentration (1)		Maximum Concentration (1)		Location of Maximum Concentration	Detection Frequency (1)	Range of Nondetects (2)	Concentration Used for Screening (3)	Site Above Background ? (4)	USEPA Generic SSL for Migration to Ground Water (5)		U.S. EPA Generic SSL for Soil to Air (5)	IDEM SSL for Migration to Ground Water (6)	COPC	Rationale for Contaminant Deletion or Selection (7)
14255-04-0	Lead-210	0.36		0.65		01SB030206	4/4	---	0.65	No	0.00055	C	2000	NA	No	BKG
15092-94-1	Lead-212	0.95		1.13		01SB020206	4/4	---	1.13	No	3500000	C	5.40E_08	NA	No	BSL,BKG
15067-28-4	Lead-214	0.72		0.87		01SB010206	4/4	---	0.87	No	1.4E+11	C	2.00E+11	NA	No	BSL,BKG
13966-00-2	Potassium-40	5.98		9.23		01SB020206	4/4	---	9.23	No	NA	C	1.80E+06	NA	No	BKG, NTX
13982-63-3	Radium-226	1.66		1.9		01SB020206	4/4	---	1.9	No	0.016	C	1600	NA	No	BKG
14913-50-9	Thallium-208	0.91		1.04		01SB020206	4/4	---	1.04	No	NA	C	NA	NA	No	BKG, NTX
14274-82-9	Thorium-228	0.167		0.781		01SB040206	37/37	---	0.781	No	3.3	C	1400	NA	No	BSL,BKG
14269-63-7	Thorium-230	0.0332	J	0.637	J	01SB110610	25/37	0.0148 - 0.394	0.637	No	0.3	C	640	NA	No	BKG(10)
7440-29-1	Thorium-232	0.245		0.872		01SB060610	37/37	---	0.872	No	0.3	C	420	NA	No	BKG
15065-10-8	Thorium-234	1		1.88		01SB030206	4/4	---	1.88	No	4100	C	1.90E+08	NA	No	BSL,BKG

Shaded cells indicate that the specified criterion or background level hs been exceeded or that the chemical has been selected as a COPC.

Footnotes:
1 Only the original of the duplicate sample pair was used for COPC selection. The duplicate was used for quality control purposes only.
2 Values presented are sample-specific detection limits.
3 The maximum detected concentration is used for screening purposes.
4 To determine whether metal concentrations were within background levels, soil concentrations were compared to base-wide background data presented in the Base-wide Background Soil Investigation Report (TtNUS, Inc., 2001a) by means of the Wilcoxon Rank Sum Test. If the Wilcoxon Test determined that a constituent concentration was not significanty different from background, that chemical was not selected as a COPC.
5 Soil Screening Guidance: Technical Background Document. (U.S. EPA, May 1996). The migration to groundwater value represents a dilution and attenuation factor (DAF) of 1.
6 Residential levels for migration from soil to groundwater (IDEM, 2001).
7 The chemical is selected as a COPC if the maximum detected concentration exceeds any screening level and background levels.
8 Pyrene is used as a surrogate for benzo(g,h,i)perylene and phenanthrene.
9 Reevaluation demonstrated that this chemical does not exceed background concentrations. See Section 3.4.4 (arsenic) and Section 3.4.5 (thallium).
10 The rationale for the elimination of Thorium-230 on the basis of background in presented in Section 3.4.7.

Definitions:
ARAR/TBC = Applicable or Relevant and Appropriate Requirement/to be considered.
C = Carcinogen.
CAS = Chemical abstract services.
COPC = Chemical of potential concern.
GF = Graphite furnace atomic absorption reanalysis.
IDEM = Indiana Department of Environmental Management, Risk Integrated System of Closure (RISC) residential levels for migration from soil to ground water (IDEM, 2001).
J = Estimated value.
N = Nocarcinogen.
NA = Not applicable/not available.
sat = Soil saturation concentration.

Rationale Codes:
For Selection as a COPC:
ASL = Above COPC screening level/ARAR/TBC.

For Elimination as a COPC:
BKG = Within background levels.
BSL = Below COPC screening level/ARAR/TBC.
NTX = No toxicity information.
NUT = Essential nutrient.
NS = Soil Screening Levels have not been determined for these constituents.

TABLE 2.5

OCCURRENCE, DISTRIBUTION, AND SELECTION OF CHEMICALS OF POTENTIAL CONCERN - GROUND WATER, ROUNDS 1 AND 2
SWMU 01 - MUSTARD GAS BURIAL GROUND
NSWC CRANE
CRANE, INDIANA

CAS Number	Chemical	Minimum Concentration (1)		Maximum Concentration (1)		Sample No. of Maximum Concentration	Detection Frequency (1)	Range of Nondetects(2)	Concentration Used for Screening(3)	Background Value(4)	Risk-Based COPC Screening Level(5)		Potential ARAR/TBC Value	Potential ARAR/TBC Source	COPC	Rationale for Contaminant Deletion or Selection(6)
VOCs (ug/L)																
630-20-6	1,1,1,2-Tetrachloroethane	0.3	J	5	J	01GW1901	7/49	0.5 - 500	5	NA	0.43	C	--- 6.9	FED-MCL IDEM	Yes	ASL
79-34-5	1,1,2,2-Tetrachloroethane	0.3	J	38000	-	01GW0201	20/49	0.5	38000	NA	0.055	C	--- 0.9	FED-MCL IDEM	Yes	ASL
79-00-5	1,1,2-Trichloroethane	0.4	J	16	-	01GW1502	14/49	1 - 1000	16	NA	0.2	C	5 5	FED-MCL IDEM	Yes	ASL
75-35-4	1,1-Dichloroethene	0.2	J	2	J	01GW1901	6/49	1 - 1000	2	NA	0.046	C	7 7	FED-MCL IDEM	Yes	ASL
107-06-2	1,2-Dichloroethane	0.3	J	10	J	01GW1901	6/49	0.5 - 500	10	NA	0.12	C	5 5	FED-MCL IDEM	Yes	ASL
67-66-3	Chloroform	0.1	J	840	J	01GW0201	13/49	0.2 - 18	840	NA	0.16	C	80 100	FED-MCL IDEM	Yes	ASL
156-59-2	cis-1,2-Dichloroethene	0.9	J	9	-	01GW1502	10/49	1 - 1000	9	NA	6.1	N	70 70	FED-MCL IDEM	Yes	ASL
75-09-2	Methylene Chloride	0.2	J	1	J	01GW1102	7/49	0.2 - 1000	1	NA	4.3	C	5 5	FED-MCL IDEM	No	BSL
127-18-4	Tetrachloroethene	1	-	370	J	01GW0201	11/49	0.5 - 13	370	NA	1.1	C	5 5	FED-MCL IDEM	Yes	ASL
108-88-3	Toluene	0.3	J	1	-	01GW0701	6/49	0.5 - 500	1	NA	72	N	1000 1000	FED-MCL IDEM	No	BSL
156-60-5	trans-1,2-Dichloroethene	0.3	J	3	-	01GW1502	9/49	1 - 1000	3	NA	12	N	100 100	FED-MCL IDEM	No	BSL
79-01-6	Trichloroethene	0.2	J	16000	-	01GW0201	27/49	0.5	16000	NA	1.6	C	5 5	FED-MCL IDEM	Yes	ASL
74-85-1	Ethene	2	J	2	J	01GWT0203	1/8	1	2	NA	NA		NA ---	FED-MCL IDEM	No	NTX
74-82-8	Methane	0.9	J	24	J	01GW1502	2/8	1	24	NA	NA		NA ---	FED-MCL IDEM	No	NTX
SVOCs (ug/L)																
100-02-7	4-Nitrophenol	15	J	15	J	01GW0501	1/13	25	15	NA	29	N	NA ---	FED-MCL IDEM	No	BSL
83-32-9	Acenaphthene	0.0793	J	0.108	J	01GWC0101	3/13	0.2	0.108	NA	37	N	NA 460	FED-MCL IDEM	No	BSL
208-96-8	Acenaphthylene	0.763	-	0.763	-	01GW0201	1/13	0.2	0.763	NA	37	N	NA 460	FED-MCL IDEM	No	BSL
117-81-7	bis(2-Ethylhexyl) phthalate	5	J	15	J	01GW1101	3/13	5	15	NA	4.8	C	6 6	FED-MCL IDEM	Yes	ASL
85-68-7	Butyl Benzyl Phthalate	9	J	9	J	01GW1101	1/13	5	9	NA	730	N	--- 2700	FED-MCL IDEM	No	BSL
86-73-7	Fluorene	0.0593	J	0.0593	J	01GW0201	1/13	0.2	0.0593	NA	24	N	--- 310	FED-MCL IDEM	No	BSL
67-72-1	Hexachloroethane	5	J	5	J	01GW0201	1/13	5	5	NA	4.8	C	--- 37	FED-MCL IDEM	Yes	ASL
91-20-3	Naphthalene	0.0796	J	0.579	-	01GW0201	3/13	0.2	0.579	NA	0.62	N	--- 8.3	FED-MCL IDEM	No	BSL
Energetics (ug/L)																
118-96-7	2,4,6-Trinitrotoluene	0.127	J	0.127	J	01GW1701	1/13	0.65	0.127	NA	2.2	C	NA ---	FED-MCL IDEM	No	BSL
88-72-2	2-Nitrotoluene	0.202	J	0.202	J	01GW0201	1/13	0.65	0.202	NA	6.1	N	NA ---	FED-MCL IDEM	No	BSL
19406-51-0	4-Amino-2,6-Dinitrotoluene	0.263	J	0.275	J	01GWT0201	2/13	0.65	0.275	NA	0.22(7)	N	NA ---	FED-MCL IDEM	Yes	ASL
2691-41-0	HMX	0.201	J	0.201	J	01GW0101	1/12	0.65	0.201	NA	180	N	NA ---	FED-MCL IDEM	No	BSL

TABLE 2.5

OCCURRENCE, DISTRIBUTION, AND SELECTION OF CHEMICALS OF POTENTIAL CONCERN - GROUND WATER, ROUNDS 1 AND 2
SWMU 01 - MUSTARD GAS BURIAL GROUND
NSWC CRANE
CRANE, INDIANA

CAS Number	Chemical	Minimum Concentration [1]		Maximum Concentration [1]		Sample No. of Maximum Concentration	Detection Frequency [1]	Range of Nondetects[2]	Concentration Used for Screening[3]	Background Value[4]	Risk-Based COPC Screening Level[5]		Potential ARAR/TBC Value	Potential ARAR/TBC Source	COPC	Rationale for Contaminant Deletion or Selection[6]
Pesticides/PCBs (ug/L)																
5103-74-2	gamma-Chlordane	0.025	J	0.075	J	01GW0301	2/13	0.04	0.075	NA	0.19	C	2 2	FED-MCL IDEM	No	BSL
76-44-8	Heptachlor	0.017	J	0.023	J	01GW1101	2/13	0.013 - 0.059	0.023	NA	0.015	C	0.4 0.4	FED-MCL IDEM	Yes	ASL
Total Metals (ug/L)																
7429-90-5	Aluminum	46.3	-	5700	-	01GW0301	14/37	21.2 - 57.8	5700	NA	3600	N	50(8) ---	FED-SMCL IDEM	Yes	ASL
7440-36-0	Antimony	1.9	-	3.1	-	01GW1501	4/37	1.6 - 5.1	3.1	NA	1.5	N	6 6	FED-MCL IDEM	Yes	ASL
7440-38-2	Arsenic	2.2	J	7.9	-	01GW0301	4/37	1.5 - 3.2	7.9	NA	0.045	C	10 10	FED-MCL IDEM	Yes	ASL
7440-39-3	Barium	5.4	J	258	-	01GW0301	37/37	---	258	NA	260	N	2000 2000	FED-MCL IDEM	No	BSL
7440-41-7	Beryllium	0.59	-	0.7	J	01GWT0201	2/37	0.3 - 0.7	0.7	NA	7.3	N	4 4	FED-AL IDEM	No	BSL
7440-43-9	Cadmium	0.74	-	0.94	-	01GW0301	2/37	0.3 - 0.6	0.94	NA	1.8	N	5 5	FED-MCL IDEM	No	BSL
7440-70-2	Calcium	7640	-	344000	-	01GWT0203	37/37	---	344000	NA	NA	N	--- ---	FED-MCL IDEM	No	NUT
7440-47-3	Chromium	0.7	-	7.1	J	01GW0301	9/37	0.6 - 3.6	7.1	NA	11(9)	N	100 100	FED-MCL IDEM	No	BSL
7440-48-4	Cobalt	1.2	-	126	J	01GWT0203	23/37	1 - 4.3	126	NA	220	N	--- ---	FED-MCL IDEM	No	BSL
7440-50-8	Copper	0.94	-	14.5	J	01GW0301	4/37	0.9 - 3.2	14.5	NA	140	N	1300 1300	FED-AL IDEM	No	BSL
7439-89-6	Iron	22.1	-	44600	-	01GW1401	31/37	20.2 - 27	44600	NA	1100	N	300(8) ---	FED-SMCL IDEM	Yes	ASL
7439-92-1	Lead	4.3	-	8.2	J	01GW0301	2/37	0.7 - 2.8	8.2	NA	NA	N	15 15	FED-AL IDEM	No	BSL
7439-95-4	Magnesium	2720	-	250000	-	01GWT0203	37/37	---	250000	NA	NA	N	NA ---	FED-MCL IDEM	No	NUT
7439-96-5	Manganese	1.5	-	9600	-	01GWT0203	37/37	---	9600	NA	88	N	50(8) ---	FED-SMCL IDEM	Yes	ASL
7439-97-6	Mercury	0.1	-	0.24	-	01GW0701	9/37	0.1 - 0.13	0.24	NA	1.1(10)	N	2 2	FED-MCL IDEM	No	BSL
7440-02-0	Nickel	1.4	-	273	-	01GWT0203	28/37	0.7 - 5.7	273	NA	73	N	--- 730	FED-MCL IDEM	Yes	ASL
7440-09-7	Potassium	446	-	15500	J	01GWT0202	37/37	---	15500	NA	NA	N	NA ---	FED-MCL IDEM	No	NUT
7440-22-4	Silver	0.65	J	1.1	-	01GW0701	7/37	0.7 - 3	1.1	NA	18	N	100 180	FED-SMCL IDEM	No	BSL
7440-23-5	Sodium	1510	-	117000	-	01GW0501	37/37	---	117000	NA	NA	N	NA ---	FED-MCL IDEM	No	NUT
7440-24-6	Strontium	33.1	J	3990	J	01GWT0202	37/37	---	3990	NA	2200	N	--- ---	FED-MCL IDEM	Yes	ASL
7440-28-0	Thallium	2.5	-	5.1	-	01GW1701	9/37	0.6 - 5	5.1	NA	0.24	N	2 2	FED-MCL IDEM	No	***
7440-28-0	Thallium - GF	0.6	UJ	3	UJ	01GW2001	0/4	0.6 - 3	3	NA	0.24	N	2 2	FED-MCL IDEM	No	BSL
CALC004	Thorium-Calc	0.16	-	1.50	-	01GWT0201	5/16	0.36 - 1.45	1.50	NA	NA	N	--- ---	FED-MCL IDEM	No	NTX
7440-62-2	Vanadium	0.53	-	11.8	-	01GW0301	7/37	0.5 - 3.3	11.8	NA	26	N	--- ---	FED-MCL IDEM	No	BSL

TABLE 2.5

OCCURRENCE, DISTRIBUTION, AND SELECTION OF CHEMICALS OF POTENTIAL CONCERN - GROUND WATER, ROUNDS 1 AND 2
SWMU 01 - MUSTARD GAS BURIAL GROUND
NSWC CRANE
CRANE, INDIANA
PAGE 3 OF 4

CAS Number	Chemical	Minimum Concentration [1]		Maximum Concentration [1]		Sample No. of Maximum Concentration	Detection Frequency [1]	Range of Nondetects[2]	Concentration Used for Screening[3]	Background Value[4]	Risk-Based COPC Screening Level[5]		Potential ARAR/TBC Value	Potential ARAR/TBC Source	COPC	Rationale for Contaminant Deletion or Selection[6]
7440-66-6	Zinc	3.9	-	103	-	01GWT0203	15/37	1.1 - 43.8	103	NA	1100	N	5000(8) 11000	FED-SMCL IDEM	No	BSL
Dissolved Metals (ug/L)																
7429-90-5	Aluminum	146	-	146	-	01GW2601-F	1/11	21.2 - 87	146	NA	3600	N	300(8) ---	FED-SMCL IDEM	Yes	ASL
7440-36-0	Antimony	2.1	J	2.1	J	01GW2001-F	1/11	1.6 - 5.1	2.1	NA	1.5	N	6 6	FED-MCL IDEM	Yes	ASL
7440-38-2	Arsenic	1.7	J	2.3	-	01GW0301-F	2/11	1.5 - 3	2.3	NA	0.045	C	5 50	FED-MCL IDEM	Yes	ASL
7440-39-3	Barium	5.4	J	215	-	01GW0301-F	11/11	---	215	NA	260	N	2000 2000	FED-MCL IDEM	No	BSL
7440-70-2	Calcium	60500	J	349000	-	01GWT0203-F	11/11	---	349000	NA	NA	N	--- ---	FED-MCL IDEM	No	NUT
7440-47-3	Chromium	1.1	-	1.1	-	01GW2001-F	1/11	0.6 - 1	1.1	NA	11(9)	N	100 100	FED-MCL IDEM	No	BSL
7440-48-4	Cobalt	1.7	-	96.8	J	01GWT0203-F	7/11	1 - 1.1	96.8	NA	220	N	--- ---	FED-MCL IDEM	No	BSL
7439-89-6	Iron	51.7	J	20300	-	01GWT0203-F	10/11	20.3	20300	NA	1100	N	300(8) ---	FED-SMCL IDEM	Yes	ASL
7439-95-4	Magnesium	5430	J	254000	-	01GWT0203-F	11/11	---	254000	NA	NA	N	NA ---	FED-MCL IDEM	No	NUT
7439-96-5	Manganese	10.4	-	9650	-	01GWT0203-F	11/11	---	9650	NA	88	N	300(8) ---	FED-SMCL IDEM	Yes	ASL
7439-97-6	Mercury	0.1	-	0.1	-	01GW2001-F	1/11	0.1 - 0.14	0.1	NA	1.1(10)	N	2 2	FED-AL IDEM	No	BSL
7440-02-0	Nickel	4.6	-	208	-	01GWT0203-F	6/11	1.4 - 5.3	208	NA	73	N	--- 730	FED-MCL IDEM	Yes	ASL
7440-09-7	Potassium	1100	J	15200	-	01GWT0203-F	11/11	---	15200	NA	NA	N	NA ---	FED-MCL IDEM	No	NUT
7440-23-5	Sodium	5000	J	70700	-	01GWT0203-F	11/11	---	70700	NA	NA	N	NA ---	FED-MCL IDEM	No	NUT
7440-24-6	Strontium	96.5	J	4040	J	01GWT0203-F	11/11	---	4040	NA	2200	N	--- ---	FED-MCL IDEM	Yes	ASL
7440-28-0	Thallium	5.4	-	7.7	J	01GW2001-F	2/11	0.6 - 5	7.7	NA	0.24	N	2 2	FED-MCL IDEM	No	**
7440-62-2	Vanadium	0.77	-	0.77	-	01GW2001-F	1/11	0.3 - 3	0.77	NA	26	N	--- ---	FED-MCL IDEM	No	BSL
7440-66-6	Zinc	7.1	-	65.6	-	01GWT0203-F	4/11	1.1 - 9.4	65.6	NA	1100	N	5000(8) 11000	FED-SMCL IDEM	No	BSL
Total Radionuclides (pCi/L)																
TTNUS006	Gross Alpha	1.36	J	10.5	J	01GWT0201	21/34	0.906 - 6.06	10.5	NA	NA		15 ---	FED-MCL IDEM	No	BSL
TTNUS007	Gross Beta	1.69	-	50.2	J	01GW2301	24/35	1.58 - 5.16	50.2	NA	NA		NA ---	FED-MCL IDEM	No	NTX
14274-82-9	Thorium-228	0.0329	-	0.172	-	01GWT0201	3/16	0.0216 - 0.166	0.172	NA	0.16		NA ---	FED-MCL IDEM	No	***
TTNUS097	Thorium-232	0.0235	-	0.157	-	01GWT0201	3/16	0.0207 - 0.154	0.157	NA	0.47		NA ---	FED-MCL IDEM	No	BSL
Field Parameters (mg/L)																
14797-55-8	Nitrate	---	-	1.28	-	01GWT0401	8/8	---	1.28	NA	10		10 ---	FED-SMCL IDEM	No	BSL
14797-65-0	Nitrite	---	-	0.008	-	01GWT0301.	8/8	---	0.008	NA	1		1 ---	FED-SMCL IDEM	No	BSL
14808-79-8	Sulfate	12	-	80	-	5 LOCATIONS	8/8	---	80	NA	NA		250 ---	FED-SMCL IDEM	No	BSL

Shaded cells indicate that the specified criterion or background level was exceeded and the chemical was selected as a COPC.

TABLE 2.5

OCCURRENCE, DISTRIBUTION, AND SELECTION OF CHEMICALS OF POTENTIAL CONCERN - GROUND WATER, ROUNDS 1 AND 2
SWMU 01 - MUSTARD GAS BURIAL GROUND
NSWC CRANE
CRANE, INDIANA

CAS Number	Chemical	Minimum Concentration [1]	Maximum Concentration [1]	Sample No. of Maximum Concentration	Detection Frequency [1]	Range of Nondetects[2]	Concentration Used for Screening[3]	Background Value[4]	Risk-Based COPC Screening Level[5]	Potential ARAR/TBC Value	Potential ARAR/TBC Source	COPC	Rationale for Contaminant Deletion or Selection[6]

Footnotes:

1 Sample and duplicate are counted as two separate samples when determining the minimum and maximum detected concentrations.
2 Values presented are sample-specific quantitation limits.
3 The maximum detected concentration is used for screening purposes.
4 Background data are not available for SWMU 1.
5 Risk-based COPC screening level for tap water use based on a target hazard quotient of 0.1 for noncarcinogens (denoted with a "N" flag) or an incremental cancer risk of 1E-6 for carcinogens (denoted with a "C" flag) (U.S. EPA, Region 9, 2000c).
6 The chemical is selected as a COPC if the maximum detected concentration exceeds the risk-based COPC screening level and/or an ARAR/TBC(s).
7 Value is for aminodinitrotoluenes (U.S. EPA, Region 3, April 2002)
8 Secondary MCL, based on aesthetic water quality (i.e., color, odor, taste, etc.).
9 Screening level is based on PRG for hexavalent chromium.
10 Value is for mercuric chloride (U.S. EPA, Region 3, April 2002)

Definitions:

ARAR/TBC = Applicable or Relevant and Appropriate Requirement/To Be Considered.
C = Carcinogen.
CAS = Chemical abstract services.
COPC = Chemical of Potential Concern.
GF = Graphite furnace atomic absorption reanalysis.
J = Estimated value.
N = Noncarcinogen.
NA = Not Analyzed / Not Applicable.
ND = Not Detected.
FED-AL = Federal Action Level (U.S. EPA, 2002).
FED-MCL = Federal Maximum Contaminant Level (U.S. EPA, 2002).
IDEM = Indiana Department of Environmental Management, Risk Inegrated System of Closure (RISC) residential closure levels for groundwater (IDEM, 2001).
UJ = Estimated detection limit.

Rationale Codes:

For Selection as a COPC:
ASL = Above COPC Screening Level/ARAR/TBC

For Elimination as a COPC:
BKG = Within Background Levels
BSL = Below COPC Screening Level/ARAR/TBC
NTX = No Toxicity Information
NUT = Essential Nutrient
** Reevaluation demonstrated that this chemical does not exceed background concentrations. See Section 3.4-5 .
*** See Section 4.2.4.

TABLE 2.6

OCCURRENCE, DISTRIBUTION, AND SELECTION OF CHEMICALS OF POTENTIAL CONCERN - DIRECT CONTACT WITH SEDIMENT, ROUNDS 1 AND 2
SWMU 01, MUSTARD GAS BURIAL GROUND
NSWC CRANE
CRANE, INDIANA

CAS Number	Chemical	Minimum Concentration (1)		Maximum Concentration (1)		Location of Maximum Concentration	Detection Frequency (1)	Range of Nondetects (2)	Concentration Used for Screening (3)	Site Above Background ? (4)	Risk-Based COPC Screening Level (5)		Potential ARAR/TBC Value	Potential ARAR/TBC Source	COPC	Rationale for Contaminant Deletion or Selection (6)
VOCs (mg/kg)																
79-34-5	1,1,2,2-Tetrachloroethane	0.007		0.009		01SD0302	2/12	0.003 -0.004	0.009	NA	0.38	C	5	IDEM	No	BSL
67-64-1	Acetone	0.012	J	0.63	J	01SD1202	6/12	0.005 -0.007	0.63	NA	160	N	3900	IDEM	No	BSL
75-15-0	Carbon Disulfide	0.002	J	0.002	J	01SD0302, 01SD1102	2/12	0.003 -0.004	0.002	NA	36	N	900	IDEM	No	BSL
75-71-8	Dichlorodifluoromethane	0.001	J	0.008	J	01SD1002	4/12	0.003 -0.004	0.008	NA	9.4	N	NA	IDEM	No	BSL
108-88-3	Toluene	0.001	J	0.002	J	01SD0302	3/12	0.003 -0.004	0.002	NA	520	sat	1700	IDEM	No	BSL
SVOCs (mg/kg)																
83-32-9	Acenaphthene	0.139	J	0.139	J	01SD0701	1/7	0.0112 - 0.139	0.139	NA	370	N	9500	IDEM	No	BSL
56-55-3	Benzo(a)anthracene	0.0144		0.0144		01SD0701	1/7	0.0112 - 0.139	0.0144	NA	0.62	C	5	IDEM	No	BSL
50-32-8	Benzo(a)pyrene	0.00497	J	0.0275	J	01SD0701	4/7	0.0116 - 0.139	0.0275	NA	0.062	C	0.5	IDEM	No	BSL
205-99-2	Benzo(b)fluoranthene	0.0077	J	0.12	J	01SD0701	4/7	0.0116 - 0.137	0.12	NA	0.62	C	5	IDEM	No	BSL
191-24-2	Benzo(g,h,i)perylene	0.0218	J	0.0218	J	01SD0701	1/7	0.0112 - 0.139	0.0218	NA	230	N	5500	IDEM	No	BSL
207-08-9	Benzo(k)fluoranthene	0.00626	J	0.0146	J	01SD0701	3/7	0.0112 - 0.139	0.0146	NA	6.2	C	50	IDEM	No	BSL
117-81-7	bis(2-ethylhexyl) phthalate	0.098	J	0.098	J	01SD0801	1/7	0.19 - 0.23	0.098	NA	35	C	300	IDEM	No	BSL
218-01-9	Chrysene	0.0173	J	0.0173	J	01SD0701	1/7	0.0112 - 0.139	0.0173	NA	62	C	500	IDEM	No	BSL
206-44-0	Fluoranthene	0.00493	J	0.0184	J	01SD0701	4/7	0.0116 - 0.139	0.0184	NA	230	N	6300	IDEM	No	BSL
193-39-5	Indeno(1,2,3-cd)pyrene	0.0128		0.0128		01SD0701	1/7	0.0112 - 0.139	0.0128	NA	0.62	C	5	IDEM	No	BSL
120-58-1	Isosafrole	7.6		7.6		01SD0601	1/7	0.38 - 0.46	7.6	NA	611	N	NA	IDEM	No	BSL
129-00-0	Pyrene	0.00531	J	0.024	J	01SD0701	2/7	0.0112 - 0.139	0.024	NA	230	N	5500	IDEM	No	BSL
Energetics (mg/kg)																
2691-41-0	HMX	0.0542	J	0.422	J	01SD0301	4/7	0.476 - 0.5	0.422	NA	310	N	NA	IDEM	No	BSL
Pesticides/PCBs (mg/kg)																
11096-82-5	Aroclor-1260	0.019	J	0.019	J	01SD0701	1/7	0.037 - 0.046	0.019	NA	0.22	C	NA	IDEM	No	BSL
76-44-8	Heptachlor	0.0011	J	0.0025		01SD0601	5/7	0.0018	0.0025	NA	0.11	C	0.54	IDEM	No	BSL
Herbicides (mg/kg)																
93-76-5	2,4,5-T	0.0086	J	0.0086	J	01SD0401	1/7	0.011 - 0.014	0.0086	NA	61	N	NA	IDEM	No	BSL
93-72-1	2,4,5-TP (Silvex)	0.0031	J	0.012		01SD0201	3/7	0.012 - 0.014	0.012	NA	49	N	NA	IDEM	No	BSL
Inorganics (mg/kg)																
7429-90-5	Aluminum	6770		13700		01SD0801	7/7	---	13700	No	7600	N	NA	IDEM	No	BKG
7440-36-0	Antimony	2	J	2	J	01SD0201	1/7	0.48 - 0.61	2	No	3.1	N	140	IDEM	No	BSL,BKG
7440-38-2	Arsenic	4.4		31.1		01SD0201	7/7	---	5.3	No	0.39	C	3.9	IDEM	No	BKG
7440-39-3	Barium	47.4		120		01SD0601, 01SD0501	7/7	---	120	No	540	N	23000	IDEM	No	BSL,BKG
7440-41-7	Beryllium	0.57	J	1.7	J	01SD0201	6/7	0.62	1.7	No	15	N	680	IDEM	No	BSL,BKG
7440-43-9	Cadmium	0.39	J	0.39	J	01SD0601	1/7	0.05 - 0.23	0.39	No	3.7	N	12	IDEM	No	BSL,BKG
7440-70-2	Calcium	769		5520		01SD0801	7/7	---	5520	No	NA		NA	IDEM	No	NUT, BKG
7440-47-3	Chromium	9.4		45.1		01SD0201	7/7	---	45.1	No	30(8)	C	430(8)	IDEM	No	BKG
7440-48-4	Cobalt	6.9		28.8		01SD0201	7/7	---	28.8	No	470	N	NA	IDEM	No	BSL,BKG
7440-50-8	Copper	9.5	J	19.4	J	01SD0201	7/7	---	19.4	No	290	N	13000	IDEM	No	BSL,BKG
7439-89-6	Iron	12300		76900		01SD0201	7/7	---	76900	No	2300	N	NA	IDEM	No	BKG
7439-92-1	Lead	16.1		32		01SD0201	7/7	---	32	No	400(9)		400(9)	IDEM	No	BSL,BKG
7439-95-4	Magnesium	1030		1940		01SD0801	7/7	---	1940	No	NA	N	NA	IDEM	No	NUT, BKG
7439-96-5	Manganese	278		1640		01SD0201	7/7	---	1640	No	180	N	NA	IDEM	No	BKG
7440-02-0	Nickel	11.3		35.9		01SD0201	7/7	---	35.9	No	160	N	6900	IDEM	No	BSL,BKG
7440-09-7	Potassium	497	J	1100	J	01SD0301	7/7	---	1100	No	NA		NA	IDEM	No	NUT, BKG
7782-49-2	Selenium	0.45		1.2		01SD0201	6/7	0.38	1.2	No	39	N	1700	IDEM	No	BSL,BKG
7440-23-5	Sodium	298		416		01SD0301	7/7	---	416	Yes	NA		NA	IDEM	No	NUT
7440-24-6	Strontium	8.1	J	14.5	J	01SD0801	7/7	---	14.5	No	4700	N	NA	IDEM	No	BSL,BKG
7440-28-0	Thallium	0.57		7.1		01SD0201	6/7	0.56	7.1	No	0.52	N	31	IDEM	No	BKG
TTNUS331	Thallium-GF	0.1	J	0.1	J	01SD0201	1/1	---	0.1	No	0.52	N	31	IDEM	No	BSL,BKG
CALC004	Thorium-Calc	6.47		12.45		01SD0301	7/7	---	12.45	No	NA		NA	IDEM	No	BKG, NTX
7440-31-5	Tin	3		3.7		01SD0801	7/7	---	3.7	No	4700	N	NA	IDEM	No	BSL,BKG
7440-62-2	Vanadium	18.9		45.8		01SD0201	7/7	---	45.8	No	55	N	NA	IDEM	No	BSL,BKG
7440-66-6	Zinc	35.6		78		01SD0201	7/7	---	78	No	2300	N	100000	IDEM	No	BSL,BKG

TABLE 2.6

OCCURRENCE, DISTRIBUTION, AND SELECTION OF CHEMICALS OF POTENTIAL CONCERN - DIRECT CONTACT WITH SEDIMENT, ROUNDS 1 AND 2
SWMU 01, MUSTARD GAS BURIAL GROUND
NSWC CRANE
CRANE, INDIANA

CAS Number	Chemical	Minimum Concentration [1]		Maximum Concentration [1]		Location of Maximum Concentration	Detection Frequency [1]	Range of Nondetects [2]	Concentration Used for Screening [3]	Site Above Background ? [4]	Risk-Based COPC Screening Level [5]		Potential ARAR/TBC Value	Potential ARAR/TBC Source	COPC	Rationale for Contaminant Deletion or Selection [6]
Total Radiologicals (pCi/g)																
14274-82-9	Thorium-228	0.694		1.49		01SD0301	7/7	---	1.49	No	0.16	C	NA	IDEM	No	BKG
14269-63-7	Thorium-230	0.791	J	1.26	J	01SD0301	7/7	---	1.26	No	3.9	C	NA	IDEM	No	BSL,BKG
TTNUS097	Thorium-232	0.624		1.25		01SD0301	7/7	---	1.25	No	3.4	C	NA	IDEM	No	BSL,BKG

Shaded cells indicate that the specified criterion or background level has been exceeded and the chemical has been selected as a COPC.

Footnotes:
1 Only the original of the duplicate sample pair was used for COPC selection. The duplicate was used for quality control purposes only.
2 Values presented are sample-specific detection limits.
3 The maximum detected concentration is used for screening purposes.
4 To determine whether metal concentrations were within background levels, sediment concentrations were compared to sediment background concentrations by means of the Wilcoxon Rank Sum Test. If the Wilcoxon Test determined that a constituent concentration was not significanty different from background, that chemical was not selected as a COPC.
5 The risk-based soil COPC screening level for residential land use is presented. The value is based on a target Hazard Quotient of 0.1 for noncarcinogens (denoted with a "N" flag) or an incremental cancer risk of 1E-6 for carcinogens (denoted with a "C" flag) (U.S. EPA, Region 9, 2000d and U.S. EPA, 2000c).
6 The chemical is selected as a COPC if the maximum detected concentration exceeds the risk-based COPC screening level and/or an ARAR/TBC(s) and background levels.
7 Pyrene is used as a surrogate for benzo(g,h,i)perylene.
8 Screening level is based on PRG for hexavalent chromium.
9 OSWER soil screening level for residential land use (U.S. EPA, 1994)

Definitions:
ARAR/TBC = Applicable or Relevant and Appropriate Requirement/to be considered.
C = Carcinogen.
CAS = Chemical abstract services.
COPC = Chemical of potential concern.
GF = Graphite furnace atomic absorption reanalysis.
IDEM = Indiana Department of Environmental Management, Risk Integrated System of Closure (RISC) residential levels for direct contact with soil (IDEM, 2001).
J = Estimated value.
N = Noncarcinogen
NA = Not applicable/not available.
sat = Soil saturation concentration.

Rationale Codes:
For Selection as a COPC:
ASL = Above COPC screening level/ARAR/TBC.

For Elimination as a COPC:
BKG = Within background levels.
BSL = Below COPC screening level/ARAR/TBC.
NTX = No toxicity information.
NUT = Essential nutrient.

TABLE 3.1

MEDIUM-SPECIFIC EXPOSURE POINT CONCENTRATION SUMMARY - SURFACE SOIL
SWMU 1 - MUSTARD GAS BURIAL GROUND
NSWC CRANE, INDIANA

Scenario Timeframe: Current/Future
Medium: Surface Soil
Exposure Medium: Surface Soil
Exposure Point: Entire Site

Chemical of Potential Concern	Units	Arithmetic Mean	95% UCL of Normal Data	Maximum Detected Concentration	Maximum Qualifier	EPC Units	Reasonable Maximum Exposure			Central Tendency Exposure		
							Medium EPC Value	Medium EPC Statistic	Medium EPC Rationale	Medium EPC Value	Medium EPC Statistic	Medium EPC Rationale
Methylene Chloride	mg/kg	1.24E-02	1.8E-02	6.10E-02	J	mg/kg	2.16E-02	95% UCL-T	W - Test (1)	2.16E-02	95% UCL-T	W - Test (1)
Aluminum	mg/kg	1.31E+04	1.4E+04	1.94E+04		mg/kg	1.41E+04	95% UCL-T	W - Test (2)	1.41E+04	95% UCL-T	W - Test (2)
Iron	mg/kg	1.99E+04	2.1E+04	2.55E+04		mg/kg	2.13E+04	95% UCL-T	W - Test (2)	2.13E+04	95% UCL-T	W - Test (2)
Selenium	mg/kg	6.71E-01	7.6E-01	1.30E+00		mg/kg	7.96E-01	95% UCL-T	W - Test (2)	7.96E-01	95% UCL-T	W - Test (2)

Statistics: Maximum Detected Value (Max); 95% UCL of Normal Data (95% UCL-N); 95% UCL of Log-transformed Data (95% UCL-T); Mean of Log-transformed Data (Mean-T); Mean of Normal Data (Mean-N).

(1) Shapiro-Wilk W Test indicates that the distrubution of the data is undefined. Best fit is a log-normal distribution.
(2) Shapiro-Wilk W Test indicates data are log-normally distributed.

TABLE 3.2

MEDIUM-SPECIFIC EXPOSURE POINT CONCENTRATION SUMMARY - SURFACE / SUBSURFACE SOIL
SWMU 1 - MUSTARD GAS BURIAL GROUND
NSWC CRANE, INDIANA

Scenario Timeframe: Current/Future
Medium: Surface / Subsurface Soil
Exposure Medium: Surface / Subsurface Soil
Exposure Point: Entire Site

Chemical of Potential Concern	Units	Arithmetic Mean	95% UCL of Normal Data	Maximum Detected Concentration	Maximum Qualifier	EPC Units	Reasonable Maximum Exposure			Central Tendency Exposure		
							Medium EPC Value	Medium EPC Statistic	Medium EPC Rationale	Medium EPC Value	Medium EPC Statistic	Medium EPC Rationale
1,1,2,2-Tetrachloroethene	mg/kg	1.55E-03	1.6E-03	2.00E-03	J	mg/kg	1.59E-03	95% UCL-T	W - Test (1)	1.59E-03	95% UCL-T	W - Test (1)
Methylene Chloride	mg/kg	1.59E-02	2.0E-02	8.60E-02	J	mg/kg	2.17E-02	95% UCL-T	W - Test (1)	2.17E-02	95% UCL-T	W - Test (1)
Benzo(a)anthracene	mg/kg	8.58E-03	1.3E-02	1.53E-01	J	mg/kg	7.76E-03	95% UCL-T	W - Test (1)	7.76E-03	95% UCL-T	W - Test (1)
Benzo(a)pyrene	mg/kg	9.15E-03	1.4E-02	1.81E-01	J	mg/kg	8.03E-03	95% UCL-T	W - Test (1)	8.03E-03	95% UCL-T	W - Test (1)
Benzo(b)fluoranthene	mg/kg	1.14E-02	2.0E-02	3.18E-01	J	mg/kg	8.45E-03	95% UCL-T	W - Test (1)	8.45E-03	95% UCL-T	W - Test (1)
Aluminum	mg/kg	9.85E+03	1.1E+04	1.94E+04		mg/kg	1.08E+04	95% UCL-N	W - Test (2)	1.08E+04	95% UCL-N	W - Test (2)
Barium	mg/kg	6.54E+01	7.6E+01	3.00E+02		mg/kg	7.71E+01	95% UCL-T	W - Test (3)	7.71E+01	95% UCL-T	W - Test (3)
Cadmium	mg/kg	1.47E-01	2.0E-01	1.30E+00	J	mg/kg	2.82E-01	95% UCL-T	W - Test (1)	2.82E-01	95% UCL-T	W - Test (1)
Chromium	mg/kg	1.37E+01	1.5E+01	2.43E+01	J	mg/kg	1.48E+01	95% UCL-T	W - Test (3)	1.48E+01	95% UCL-T	W - Test (3)
Iron	mg/kg	1.86E+04	2.1E+04	7.15E+04		mg/kg	2.07E+04	95% UCL-T	W - Test (1)	2.07E+04	95% UCL-T	W - Test (1)
Manganese	mg/kg	4.05E+02	5.1E+02	2.01E+03		mg/kg	8.71E+02	95% UCL-T	W - Test (1)	8.71E+02	95% UCL-T	W - Test (1)
Nickel	mg/kg	1.11E+01	1.3E+01	3.93E+01	J	mg/kg	1.28E+01	95% UCL-T	W - Test (1)	1.28E+01	95% UCL-T	W - Test (1)
Selenium	mg/kg	5.14E-01	5.9E-01	1.70E+00		mg/kg	6.34E-01	95% UCL-T	W - Test (3)	6.34E-01	95% UCL-T	W - Test (3)

Statistics: Maximum Detected Value (Max); 95% UCL of Normal Data (95% UCL-N); 95% UCL of Log-transformed Data (95% UCL-T); Mean of Log-transformed Data (Mean-T); Mean of Normal Data (Mean-N).

(1) Shapiro-Wilk W Test indicates that the distrubution of the data is undefined. Best fit is a log-normal distribution.
(2) Shapiro-Wilk W Test indicates data are normally distributed.
(3) Shapiro-Wilk W Test indicates data are log-normally distributed.

TABLE 3.3

MEDIUM-SPECIFIC EXPOSURE POINT CONCENTRATION SUMMARY - GROUNDWATER
SWMU 1 - MUSTARD GAS BURIAL GROUND
NSWC CRANE, INDIANA

Scenario Timeframe: Future
Medium: Groundwater
Exposure Medium: Groundwater
Exposure Point: Entire Site

Chemical of Potential Concern	Units	Arithmetic Mean	95% UCL of Normal Data	Maximum Detected Concentration	Maximum Qualifier	EPC Units	Reasonable Maximum Exposure			Central Tendency Exposure		
							Medium EPC Value	Medium EPC Statistic	Medium EPC Rationale	Medium EPC Value	Medium EPC Statistic	Medium EPC Rationale
1,1,1,2-Tetrachloroethane	mg/L	5.80E-03	NA	5.00E-03	J	mg/L	2.50E-01	1/2 DL	(1)	2.50E-01	1/2 DL	(1)
1,1,2,2-Tetrachloroethane	mg/L	8.06E-01	NA	3.80E+01		mg/L	3.80E+01	01GW02	(1)	3.80E+01	01GW02	(1)
1,1,2-Trichloroethane	mg/L	1.23E-02	NA	1.60E-02		mg/L	6.00E-04	01GW02	(1)	6.00E-04	01GW02	(1)
1,1-Dichloroethene	mg/L	1.11E-02	NA	2.00E-03	J	mg/L	5.00E-01	1/2 DL	(1)	5.00E-01	1/2 DL	(1)
1,2-Dichloroethane	mg/L	6.07E-03	NA	1.00E-02	J	mg/L	2.50E-01	1/2 DL	(1)	2.50E-01	1/2 DL	(1)
Chloroform	mg/L	1.94E-02	NA	8.40E-01	J	mg/L	8.40E-01	01GW02	(1)	8.40E-01	01GW02	(1)
cis-1,2-Dichloroethene	mg/L	1.17E-02	NA	9.00E-03		mg/L	5.00E-01	1/2 DL	(1)	5.00E-01	1/2 DL	(1)
Tetrachloroethene	mg/L	8.56E-03	NA	3.70E-01	J	mg/L	3.70E-01	01GW02	(1)	3.70E-01	01GW02	(1)
Trichloroethene	mg/L	3.91E-01	NA	1.60E+01		mg/L	1.60E+01	01GW02	(1)	1.60E+01	01GW02	(1)
Bis(2-Ethylhexyl)Phthalate	mg/L	4.00E-03	NA	1.50E-02	J	mg/L	2.50E-03	1/2 DL	(1)	2.50E-03	1/2 DL	(1)
Hexachloroethane	mg/L	2.69E-03	NA	5.00E-03	J	mg/L	5.00E-03	01GW02	(1)	5.00E-03	01GW02	(1)
4-Amino-2,6-Dinitrotoluene	mg/L	3.16E-04	NA	2.75E-04	J	mg/L	3.25E-04	1/2 DL	(1)	3.25E-04	1/2 DL	(1)
Heptachlor	mg/L	1.97E-05	NA	2.30E-05	J	mg/L	2.00E-05	1/2 DL	(1)	2.00E-05	1/2 DL	(1)
Aluminum	mg/L	3.26E-01	NA	5.70E+00		mg/L	2.01E-02	1/2 DL	(1)	2.01E-02	1/2 DL	(1)
Antimony	mg/L	1.46E-03	NA	3.10E-03		mg/L	2.55E-03	1/2 DL	(1)	2.55E-03	1/2 DL	(1)
Arsenic	mg/L	1.23E-03	NA	7.90E-03		mg/L	1.10E-03	1/2 DL	(1)	1.10E-03	1/2 DL	(1)
Iron	mg/L	4.59E+00	NA	4.46E+01		mg/L	2.21E-02	01GW02	(1)	2.21E-02	01GW02	(1)
Manganese	mg/L	1.70E+00	NA	9.60E+00		mg/L	4.34E-01	01GW02	(1)	4.34E-01	01GW02	(1)
Nickel	mg/L	2.61E-02	NA	2.73E-01		mg/L	4.14E-02	01GW02	(1)	4.14E-02	01GW02	(1)
Strontium	mg/L	5.81E-01	NA	3.99E+00	J	mg/L	2.57E-01	01GW02	(1)	2.57E-01	01GW02	(1)

(1) EPCs for groundwater are the concentrations in the most highly contaminated well (01GW02). If a consituent was selected as a COPC but was not detected in this sample, 1/2 the quantitation limit for the COPC in this sample was used as the EPC.

TABLE 5.1

CANCER TOXICITY DATA FOR CHEMICALS OF CONCERN - ORAL/DERMAL
SWMU 01 - MUSTARD GAS BURIAL GROUND
NSWC CRANE
CRANE, INDIANA

Chemical of Potential Concern	Chronic/ Subchronic	Oral RfD (mg/kg/day)	Oral to Dermal Adjustment Factor[1]	Adjusted Dermal RfD[2] (mg/kg/day)	Primary Target Organ	Combined Uncertainty/Modifying Factors	Sources of RfD: Target Organ	Dates of RfD: Target Organ[3]
1,1,1,2-Tetrachloroethane	chronic	3.0E-02	1	3.00E-02	Liver, Kidney	3,000	IRIS	09/05/02
1,1,2,2-Tetrachloroethane	chronic	6.0E-02	1	6.00E-02	Liver	NA	NCEA	04/02/02
1,1,2-Trichloroethane	chronic	4.0E-03	1	4.00E-03	Liver	1,000	IRIS	09/05/02
1,1-Dichloroethene	chronic	5.0E-02	1	5.00E-02	Liver	100	IRIS	09/05/02
1,2-Dichloroethane	chronic	3.0E-02	1	3.00E-02	NOAEL	NA	NCEA	04/02/02
Chloroform	chronic	1.0E-02	1	1.00E-02	Liver	1,000	IRIS	09/05/02
cis-1,2-Dichloroethene	chronic	1.0E-02	1	1.00E-02	Blood	NA	HEAST	07/97
Methylene Chloride	chronic	6.0E-02	1	6.00E-02	Liver	100	IRIS	09/05/02
Tetrachloroethene	chronic	1.0E-02	1	1.00E-02	Liver	1,000	IRIS	09/05/02
Trichloroethene	chronic	6.0E-03	1	6.00E-03	CNS	NA	NCEA	04/02/02
bis(2-Ethylhexyl) phthalate	chronic	2.0E-02	1	2.00E-02	Liver	1,000	IRIS	09/05/02
Hexachloroethane	chronic	1.0E-03	1	1.00E-03	Kidney	1,000	IRIS	09/05/02
Heptachlor	chronic	5.0E-04	1	5.00E-04	Liver	300	IRIS	09/05/02
4-Amino-2,6-dinitrotoluene	chronic	6.0E-05	1	6.00E-05	Liver	NA	IRIS	09/05/02
Aluminum	chronic	1.0E+00	1	1.00E+00	Immunological, Nails	300	NCEA	04/02/02
Antimony	chronic	4.0E-04	0.15	6.00E-05	Lifespan	1,000	IRIS	09/05/02
Arsenic	chronic	3.0E-04	1	3.00E-04	Skin, Vascular	3	IRIS	09/05/02
Barium	chronic	7.0E-02	0.07	4.90E-03	Blood	1,000	IRIS	09/05/02
Cadmium	chronic	5.0E-04	0.05	2.50E-05	Kidney	10	IRIS	09/05/02
Chromium	chronic	3.0E-03	0.025	7.50E-05	NOAEL	1,000	IRIS	09/05/02
Iron	chronic	3.0E-01	1	3.00E-01	Liver/Blood/GI Tract	NA	NCEA	04/02/02
Manganese (soil)	chronic	7.0E-02	0.04	2.80E-03	CNS	1	IRIS	09/05/02
Manganese (water)	chronic	2.4E-02	0.04	9.60E-04	CNS	1	IRIS	09/05/02
Nickel	chronic	2.0E-02	0.04	8.00E-04	Decreased body / organ weights	300	IRIS	09/05/02
Selenium	chronic	5.0E-03	1	5.00E-03	Blood/Skin/CNS	3	IRIS	09/05/02
Strontium	chronic	6.0E-01	0.04	2.40E-02	Bone	300	IRIS	09/05/02

1 - U.S. EPA, 2001.
2 - RfD dermal = RfD oral x (Oral to Dermal Adjustment Factor).
3 - Dates of IRIS, HEAST, or NCEA.

Notes: RfD = Reference dose.
CNS = Central nervous system.
IRIS = Integrated Risk Information System, on-line database search (U.S. EPA, September 2002).
HEAST = Health Effects Assessment Summary Tables (U.S. EPA, 1997b).
NCEA = U.S. EPA National Center for Environmental Assessment (U.S. EPA Region 3 RBC Table, April 2002).
NA = Not applicable/Not available.
NOAEL = No-observed-adverse-effect-level .

TABLE 5.2

NON-CANCER TOXICITY DATA FOR CHEMICALS OF CONCERN - INHALATION
SWMU 01 - MUSTARD GAS BURIAL GROUND
NSWC CRANE
CRANE, INDIANA

Chemical of Potential Concern	Chronic/ Subchronic	Value Inhalation RfC (mg/m^3)	Adjusted Inhalation RfD (mg/kg/day)	Primary Target Organ	Combined Uncertainty/Modifying Factors	Sources of RfC:RfD: Target Organ	Date[1]
1,1-Dichloroethene	Chronic	2.1E-01	5.7E-02	Liver	30	IRIS	9/5/2002
1,2-Dichloroethane	Chronic	4.9E-03	1.4E-03	NOAEL	NA	NCEA	4/2/2002
Chloroform	Chronic	3.0E-04	8.6E-05	Liver	NA	NCEA	4/2/2002
Tetrachloroethene	Chronic	4.9E-01	1.4E-01	Liver	NA	NCEA	4/2/2002
Trichloroethene	Chronic	3.5E-02	1.0E-02	CNS	NA	NCEA	4/2/2002

1 - Dates of IRIS and NCEA

Notes:

RfC = Reference concentration.
RfD = Reference dose.
IRIS = Integrated Risk Information System, on-line database search (U.S. EPA, 2002).
NCEA = U.S. EPA National Center for Environmental Assessment
(U.S. EPA Region III RBC Table, April 2002).
NA = Not applicable/not available.
NOAEL = No-observed-adverse-effect-level

TABLE 6.1

CANCER TOXICITY DATA FOR CHEMICALS OF CONCERN - - ORAL/DERMAL
SWMU 01 - MUSTARD GAS BURIAL GROUND
NSWC CRANE
CRANE, INDIANA

Chemical of Potential Concern	Oral CSF	Oral to Dermal Adjustment Factor[1]	Adjusted Dermal Cancer Slope Factor[2] $(mg/kg\text{-}day)^{-1}$	Weight of Evidence/ Cancer Guideline Description	Source	Date[3]
1,1,1,2-Tetrachloroethane	2.6E-02	1	2.60E-02	C	IRIS	09/05/02
1,1,2,2-Tetrachloroethane	2.0E-01	1	2.00E-01	C	IRIS	09/05/02
1,1,2-Trichloroethane	5.7E-02	1	5.70E-02	C	IRIS	09/05/02
1,1-Dichloroethene	NA	1	NA	NA	IRIS	09/05/02
1,2-Dichloroethane	9.1E-02	1	9.10E-02	B2	IRIS	09/05/02
Chloroform	6.1E-03	1	6.10E-03	B2	IRIS	09/05/02
Methylene Chloride	7.5E-03	1	7.50E-03	B2	IRIS	09/05/02
Tetrachloroethene	5.2E-02	1	5.20E-02	B2	NCEA	4/2/2002
Trichloroethene	4.0E-01	1	4.00E-01	B2	NCEA	4/2/2002
Benzo(a)anthracene	7.3E-01	1	7.30E-01	B2	IRIS	09/05/02
Benzo(a)pyrene	7.3E+00	1	7.30E+00	B2	IRIS	09/05/02
Benzo(b)fluoranthene	7.3E-01	1	7.30E-01	B2	IRIS	09/05/02
bis(2-Ethylhexyl) phthalate	1.4E-02	1	1.40E-02	B2	IRIS	09/05/02
Hexachloroethane	1.4E-02	1	1.20E-01	C	IRIS	09/05/02
Heptachlor	4.5E+00	1	4.50E+00	B2	IRIS	09/05/02
Arsenic	1.5E+00	1	1.50E+00	A	IRIS	09/05/02

1 - U.S. EPA, 2001.
2 - CSFdermal = CSForal/(Oral to Dermal Adjustment Factor).
3 - Dates of IRIS, HEAST, or NCEA.

Notes:
CSF = Cancer Slope Factor.
IRIS = Integrated Risk Information System, on-line database search (U.S. EPA, September 2002).
NCEA = U.S. EPA National Center for Environmental Assessment (U.S. EPA Region III RBC Table, April 2002).

EPA Group:
A - Human carcinogen.
B1 - Probable human carcinogen - indicates that limited humar data are available.
B2 - Probable human carcinogen - indicates sufficient evidence in animals and inadequate or no evidence in humans.
C - Possible human carcinogen.
D - Not classifiable as a human carcinogen.
E - Evidence of noncarcinogenicity.

TABLE 6.2

CANCER TOXICITY DATA FOR CHEMICALS OF CONCERN - - INHALATION
SWMU 01 - MUSTARD GAS BURIAL ROUND
NSWC CRANE
CRANE, INDIANA

Chemical of Potential Concern	Unit Risk	Units	Adjustment[1]	Inhalation Cancer Slope Factor $(mg/kg\text{-}day)^{-1}$	Weight of Evidence/ Cancer Guideline Description	Source	Date[2]
1,1,1,2-Tetrachloroethane	7.4E-03	$(mg/m^3)^{-1}$	3.5E+00	2.60E-02	C	IRIS	9/5/2002
1,1,2,2-Tetrachloroethane	5.8E-02	$(mg/m^3)^{-1}$	3.5E+00	2.00E-01	C	IRIS	9/5/2002
1,1,2-Trichloroethane	1.6E-02	$(mg/m^3)^{-1}$	3.5E+00	5.60E-02	C	IRIS	9/5/2002
1,1-Dichloroethene	NA	$(mg/m^3)^{-1}$	NA	NA	NA	IRIS	9/5/2002
1,2-Dichloroethane	2.6E-02	$(mg/m^3)^{-1}$	3.5E+00	9.10E-02	B2	IRIS	9/5/2002
Chloroform	2.3E-02	$(mg/m^3)^{-1}$	3.5E+00	8.10E-02	B2	IRIS	9/5/2002
Methylene Chloride	4.7E-04	$(mg/m^3)^{-1}$	3.5E+00	1.65E-03	B2	IRIS	9/5/2002
Tetrachloroethylene (PCE)	2.9E-03	$(mg/m^3)^{-1}$	3.5E+00	1.00E-02	B2	NCEA	4/2/2002
Trichloroethylene (TCE)	1.1E-01	$(mg/m^3)^{-1}$	3.5E+00	4.00E-01	B2	NCEA	4/2/2002

IRIS = Integrated Risk Information System (U.S.EPA, Spetember 2002).
HEAST= Health Effects Assessment Summary Tables.
NCEA = U.S. EPA National Center for Environmental Assessment (U.S. EPA Region III RBC Table, April 2002).

EPA Group:
B2 - Probable human carcinogen - indicates sufficient evidence in animals inadequate or no evidence in humans.
C - Possible human carcinogen.

1 - Unit risk is converted to an inhalation CSF by multiplying by 70 kg/20m^3/day.
2 - Dates of IRIS and NCEA.

TABLE 4.1

VALUES OF DAILY INTAKE CALCULATIONS FOR EXPOSURE OF CONSTRUCTION WORKERS TO SURFACE / SUBSURFACE SOIL SWMU 1 - MUSTARD GAS BURIAL GROUND NSWC CRANE, INDIANA

Scenario Timeframe: Future
Medium: Surface Soil/Subsurface Soil
Exposure Medium: Surface Soil/subsurface Soil
Exposure Point: Entire Site
Receptor Population: Construction Worker
Receptor Age: Adult

Exposure Route	Parameter Code	Parameter Definition	Units	RME Value	RME Rationale/ Reference	CTE Value	CTE Rationale/ Reference	Intake Equation/ Model Name
Ingestion	Csoil	Chemical Concentration in Soil	mg/kg	Max or 95% UCL	U.S. EPA, May 1992	Max or 95% UCL	U.S. EPA, May 1992	Ingestion CDI[1] (mg/kg/day) =
	IR	Ingestion Rate of Soil	mg/day	480	U.S. EPA, March 1991	240	1/2 RME value	Csoil x IR x Fi x EF x ED x CF
	Fi	Fraction ingested	--[3]	1.0	Professional Judgement	1.0	Professional Judgement	BW x AT
	EF	Exposure Frequency	days/year	150	Professional Judgement	150	Professional Judgement	USEPA, December 1989
	ED	Exposure Duration	years	1	Professional Judgement	1	Professional Judgement	
	CF	Conversion Factor	kg/mg	1.0E-06	U.S. EPA, December 1989	1.0E-06	U.S. EPA, December 1989	
	BW	Body Weight	kg	70	U.S. EPA, May 1993	70	U.S. EPA, May 1993	
	AT-C	Averaging Time (Cancer)	days	25,550	U.S. EPA, May 1993	25,550	U.S. EPA, May 1993	
	AT-N	Averaging Time (Non-Cancer)	days	365	U.S. EPA, December 1989	365	U.S. EPA, December 1989	
Dermal	Csoil	Chemical Concentration in Soil	mg/kg	Max or 95% UCL	U.S. EPA, May 1992	Max or 95% UCL	U.S. EPA, May 1992	Dermal CDI[1] (mg/kg/day) =
	CF	Conversion Factor	kg/mg	1.0E-06	U.S. EPA, December 1989	1.0E-06	U.S. EPA, December 1989	Csoil x CF x SA x AF x ABS x EF x ED
	SA	Skin Surface Area	cm^2/day	5,800	U.S. EPA, August 1997	5,000	U.S. EPA, August 1997	BW x AT
	AF	Soil to Skin Adherence Factor	mg/cm^2	0.3	U.S. EPA, September 2001	0.1	U.S. EPA, September 2001	USEPA, December 1989
	ABS	Dermal Absorption Factor (Solid)	unitless	chemical specific	U.S. EPA, September 2001	chemical specific	U.S. EPA, September 2001	
	EF	Exposure Frequency	days/year	150	Professional Judgement	150	Professional Judgement	
	ED	Exposure Duration	years	1	Professional Judgement	1	Professional Judgement	
	BW	Body Weight	kg	70	U.S. EPA, May 1993	70	U.S. EPA, May 1993	
	AT-C	Averaging Time (Cancer)	days	25,550	U.S. EPA, December 1989	25,550	U.S. EPA, December 1989	
	AT-N	Averaging Time (Non-Cancer)	days	365	U.S. EPA, December 1989	365	U.S. EPA, December 1989	

1 CDI = Chronic Daily Intake

Daily Intake Calculations

Ingestion Intake = (IR x Fi x EF x ED x CF) / (BW x AT)
Dermal Intake = (CF x SA x AF x ABS x EF x ED) / (BW x AT)

Cancer Ingestion Intake - RME = 4.03E-08
Noncancer Ingestion Intake - RME = 2.82E-06

Cancer Ingestion Intake - CTE = 2.01E-08
Noncancer Ingestion Intake - CTE = 1.41E-06

Cancer Dermal Intake - RME = 1.46E-07
Noncancer Dermal Intake - RME = 1.02E-05

Cancer Dermal Intake - CTE = 4.19E-08
Noncancer Dermal Intake - CTE = 2.94E-06

TABLE 7.1 - REASONABLE MAXIMUM EXPOSURE (RME)
CALCULATION OF NON-CANCER HAZARDS FROM EXPOSURE OF CONSTRUCTION WORKERS TO SURFACE/SUBSURFACE SOIL
SWMU 1 - MUSTARD GAS BURIAL GROUND
NSWC CRANE, INDIANA

Scenario Timeframe: Future
Medium: Surface Soil/Subsurface Soil
Exposure Medium: Surface Soil/subsurface Soil
Exposure Point: Entire Site
Receptor Population: Construction Worker
Receptor Age: Adult

Exposure Route	Chemical of Potential Concern	Medium EPC Value	Medium EPC Units	Route EPC Value	Route EPC Units	EPC Selected for Hazard Calculation (1)	Intake (Non-Cancer)	Intake (Non-Cancer) Units	Reference Dose	Reference Dose Units	Reference Concentration	Reference Concentration Units	Hazard Quotient
Ingestion	1,1,2,2-Tetrachloroethene	1.59E-03	mg/kg	1.59E-03	mg/kg	M	4.5E-09	mg/kg-day	6.00E-02	mg/kg-day	NA	NA	7.5E-08
	Methylene Chloride	2.17E-02	mg/kg	2.17E-02	mg/kg	M	6.1E-08	mg/kg-day	6.00E-02	mg/kg-day	NA	NA	1.0E-06
	Benzo(a)anthracene	7.76E-03	mg/kg	7.76E-03	mg/kg	M	2.2E-08	mg/kg-day		mg/kg-day	NA	NA	
	Benzo(a)pyrene	8.03E-03	mg/kg	8.03E-03	mg/kg	M	2.3E-08	mg/kg-day		mg/kg-day	NA	NA	
	Benzo(b)fluoranthene	8.45E-03	mg/kg	8.45E-03	mg/kg	M	2.4E-08	mg/kg-day		mg/kg-day	NA	NA	
	Aluminum	1.08E+04	mg/kg	1.08E+04	mg/kg	M	3.0E-02	mg/kg-day	1.00E+00	mg/kg-day	NA	NA	3.0E-02
	Barium	7.71E+01	mg/kg	7.71E+01	mg/kg	M	2.2E-04	mg/kg-day	7.00E-02	mg/kg-day	NA	NA	3.1E-03
	Cadmium	2.82E-01	mg/kg	2.82E-01	mg/kg	M	7.9E-07	mg/kg-day	5.00E-04	mg/kg-day	NA	NA	1.6E-03
	Chromium	1.48E+01	mg/kg	1.48E+01	mg/kg	M	4.2E-05	mg/kg-day	3.00E-03	mg/kg-day	NA	NA	1.4E-02
	Iron	2.07E+04	mg/kg	2.07E+04	mg/kg	M	5.8E-02	mg/kg-day	3.00E-01	mg/kg-day	NA	NA	1.9E-01
	Manganese	8.71E+02	mg/kg	8.71E+02	mg/kg	M	2.5E-03	mg/kg-day	7.00E-02	mg/kg-day	NA	NA	3.5E-02
	Nickel	1.28E+01	mg/kg	1.28E+01	mg/kg	M	3.6E-05	mg/kg-day	2.00E-02	mg/kg-day	NA	NA	1.8E-03
	Selenium	6.34E-01	mg/kg	6.34E-01	mg/kg	M	1.8E-06	mg/kg-day	5.00E-03	mg/kg-day	NA	NA	3.6E-04
	(total)												**2.8E-01**
Dermal	1,1,2,2-Tetrachloroethene	1.59E-03	mg/kg	1.59E-03	mg/kg	M		mg/kg-day	6.00E-02	mg/kg-day	NA	NA	
	Methylene Chloride	2.17E-02	mg/kg	2.17E-02	mg/kg	M		mg/kg-day	6.00E-02	mg/kg-day	NA	NA	
	Benzo(a)anthracene	7.76E-03	mg/kg	7.76E-03	mg/kg	M	1.0E-08	mg/kg-day		mg/kg-day	NA	NA	
	Benzo(a)pyrene	8.03E-03	mg/kg	8.03E-03	mg/kg	M	1.1E-08	mg/kg-day		mg/kg-day	NA	NA	
	Benzo(b)fluoranthene	8.45E-03	mg/kg	8.45E-03	mg/kg	M	1.1E-08	mg/kg-day		mg/kg-day	NA	NA	
	Aluminum	1.08E+04	mg/kg	1.08E+04	mg/kg	M		mg/kg-day	1.00E+00	mg/kg-day	NA	NA	
	Barium	7.71E+01	mg/kg	7.71E+01	mg/kg	M		mg/kg-day	4.90E-03	mg/kg-day	NA	NA	
	Cadmium	2.82E-01	mg/kg	2.82E-01	mg/kg	M	2.9E-09	mg/kg-day	2.50E-05	mg/kg-day	NA	NA	1.2E-04
	Chromium	1.48E+01	mg/kg	1.48E+01	mg/kg	M		mg/kg-day	7.50E-05	mg/kg-day	NA	NA	
	Iron	2.07E+04	mg/kg	2.07E+04	mg/kg	M		mg/kg-day	3.00E-01	mg/kg-day	NA	NA	
	Manganese	8.71E+02	mg/kg	8.71E+02	mg/kg	M		mg/kg-day	2.80E-03	mg/kg-day	NA	NA	
	Nickel	1.28E+01	mg/kg	1.28E+01	mg/kg	M		mg/kg-day	8.00E-04	mg/kg-day	NA	NA	
	Selenium	6.34E-01	mg/kg	6.34E-01	mg/kg	M		mg/kg-day	5.00E-03	mg/kg-day	NA	NA	
	(total)												**1.2E-04**
												Total Hazard Index Across All Exposure Routes/Pathways	**2.8E-01**

(1) Specify Medium-Specific (M) or Route-Specific (R) EPC selected for hazard calculation.

Dermal Absorption Fraction from Soil(ABS) (USEPA 2001):

Cadmium - 0.001 Volatiles - No ABS value provided

PAHs - 0.13 Other Metals - No ABS value provided

TABLE 8.1 - REASONABLE MAXIMUM EXPOSURE (RME)
CALCULATION OF CANCER RISKS FROM EXPOSURE OF CONSTRUCTION WORKERS TO SURFACE/SUBSURFACE SOIL
SWMU 1 - MUSTARD GAS BURIAL GROUND
NSWC CRANE, INDIANA

Scenario Timeframe: Future
Medium: Surface Soil/Subsurface Soil
Exposure Medium: Surface Soil/subsurface Soil
Exposure Point: Entire Site
Receptor Population: Construction Worker
Receptor Age: Adult

Exposure Route	Chemical of Potential Concern	Medium EPC Value	Medium EPC Units	Route EPC Value	Route EPC Units	EPC Selected for Risk Calculation (1)	Intake (Cancer)	Intake (Cancer) Units	Cancer Slope Factor	Cancer Slope Factor Units	Cancer Risk
Ingestion	1,1,2,2-Tetrachloroethene	1.59E-03	mg/kg	1.59E-03	mg/kg	M	6.4E-11	mg/kg-day	2.00E-01	(mg/kg-day)$^{-1}$	1.3E-11
	Methylene Chloride	2.17E-02	mg/kg	2.17E-02	mg/kg	M	8.7E-10	mg/kg-day	7.50E-03	(mg/kg-day)$^{-1}$	6.5E-12
	Benzo(a)anthracene	7.76E-03	mg/kg	7.76E-03	mg/kg	M	3.1E-10	mg/kg-day	7.30E-01	(mg/kg-day)$^{-1}$	2.3E-10
	Benzo(a)pyrene	8.03E-03	mg/kg	8.03E-03	mg/kg	M	3.2E-10	mg/kg-day	7.30E+00	(mg/kg-day)$^{-1}$	2.4E-09
	Benzo(b)fluoranthene	8.45E-03	mg/kg	8.45E-03	mg/kg	M	3.4E-10	mg/kg-day	7.30E-01	(mg/kg-day)$^{-1}$	2.5E-10
	Aluminum	1.08E+04	mg/kg	1.08E+04	mg/kg	M	4.3E-04	mg/kg-day		(mg/kg-day)$^{-1}$	
	Barium	7.71E+01	mg/kg	7.71E+01	mg/kg	M	3.1E-06	mg/kg-day		(mg/kg-day)$^{-1}$	
	Cadmium	2.82E-01	mg/kg	2.82E-01	mg/kg	M	1.1E-08	mg/kg-day		(mg/kg-day)$^{-1}$	
	Chromium	1.48E+01	mg/kg	1.48E+01	mg/kg	M	6.0E-07	mg/kg-day		(mg/kg-day)$^{-1}$	
	Iron	2.07E+04	mg/kg	2.07E+04	mg/kg	M	8.3E-04	mg/kg-day		(mg/kg-day)$^{-1}$	
	Manganese	8.71E+02	mg/kg	8.71E+02	mg/kg	M	3.5E-05	mg/kg-day		(mg/kg-day)$^{-1}$	
	Nickel	1.28E+01	mg/kg	1.28E+01	mg/kg	M	5.2E-07	mg/kg-day		(mg/kg-day)$^{-1}$	
	Selenium	6.34E-01	mg/kg	6.34E-01	mg/kg	M	2.6E-08	mg/kg-day		(mg/kg-day)$^{-1}$	
	(total)										**2.9E-09**
Dermal	1,1,2,2-Tetrachloroethene	1.59E-03	mg/kg	1.59E-03	mg/kg	M		mg/kg-day		(mg/kg-day)$^{-1}$	
	Methylene Chloride	2.17E-02	mg/kg	2.17E-02	mg/kg	M		mg/kg-day		(mg/kg-day)$^{-1}$	
	Benzo(a)anthracene	7.76E-03	mg/kg	7.76E-03	mg/kg	M	1.5E-10	mg/kg-day	7.30E-01	(mg/kg-day)$^{-1}$	1.1E-10
	Benzo(a)pyrene	8.03E-03	mg/kg	8.03E-03	mg/kg	M	1.5E-10	mg/kg-day	7.30E+00	(mg/kg-day)$^{-1}$	1.1E-09
	Benzo(b)fluoranthene	8.45E-03	mg/kg	8.45E-03	mg/kg	M	1.6E-10	mg/kg-day	7.30E-01	(mg/kg-day)$^{-1}$	1.2E-10
	Aluminum	1.08E+04	mg/kg	1.08E+04	mg/kg	M		mg/kg-day		(mg/kg-day)$^{-1}$	
	Barium	7.71E+01	mg/kg	7.71E+01	mg/kg	M		mg/kg-day		(mg/kg-day)$^{-1}$	
	Cadmium	2.82E-01	mg/kg	2.82E-01	mg/kg	M		mg/kg-day		(mg/kg-day)$^{-1}$	
	Chromium	1.48E+01	mg/kg	1.48E+01	mg/kg	M		mg/kg-day		(mg/kg-day)$^{-1}$	
	Iron	2.07E+04	mg/kg	2.07E+04	mg/kg	M		mg/kg-day		(mg/kg-day)$^{-1}$	
	Manganese	8.71E+02	mg/kg	8.71E+02	mg/kg	M		mg/kg-day		(mg/kg-day)$^{-1}$	
	Nickel	1.28E+01	mg/kg	1.28E+01	mg/kg	M		mg/kg-day		(mg/kg-day)$^{-1}$	
	Selenium	6.34E-01	mg/kg	6.34E-01	mg/kg	M		mg/kg-day		(mg/kg-day)$^{-1}$	
	(total)										**1.3E-09**
										Total Risk Across All Exposure Routes/Pathways	**4.2E-09**

(1) Specify Medium-Specific (M) or *Route-Specific (R) EPC selected for risk calculation.*

Dermal Absorption Fraction from Soil(ABS) (USEPA 2001):

Cadmium - 0.001 Volatiles - No ABS value provided
PAHs - 0.13 Other Metals - No ABS value provided

TABLE 7.1a - CENTRAL TENDENCY EXPOSURE (CTE)
CALCULATION OF NON-CANCER HAZARDS FROM EXPOSURE OF CONSTRUCTION WORKERS TO SURFACE/SUBSURFACE SOIL
SWMU 1 - MUSTARD GAS BURIAL GROUND
NSWC CRANE, INDIANA

Scenario Timeframe: Future
Medium: Surface Soil/Subsurface Soil
Exposure Medium: Surface Soil/subsurface Soil
Exposure Point: Entire Site
Receptor Population: Construction Worker
Receptor Age: Adult

Exposure Route	Chemical of Potential Concern	Medium EPC Value	Medium EPC Units	Route EPC Value	Route EPC Units	EPC Selected for Hazard Calculation (1)	Intake (Non-Cancer)	Intake (Non-Cancer) Units	Reference Dose	Reference Dose Units	Reference Concentration	Reference Concentration Units	Hazard Quotient
Ingestion	1,1,2,2-Tetrachloroethene	1.59E-03	mg/kg	1.59E-03	mg/kg	M	2.2E-09	mg/kg-day	6.00E-02	mg/kg-day	NA	NA	3.7E-08
	Methylene Chloride	2.17E-02	mg/kg	2.17E-02	mg/kg	M	3.1E-08	mg/kg-day	6.00E-02	mg/kg-day	NA	NA	5.1E-07
	Benzo(a)anthracene	7.76E-03	mg/kg	7.76E-03	mg/kg	M	1.1E-08	mg/kg-day		mg/kg-day	NA	NA	
	Benzo(a)pyrene	8.03E-03	mg/kg	8.03E-03	mg/kg	M	1.1E-08	mg/kg-day		mg/kg-day	NA	NA	
	Benzo(b)fluoranthene	8.45E-03	mg/kg	8.45E-03	mg/kg	M	1.2E-08	mg/kg-day		mg/kg-day	NA	NA	
	Aluminum	1.08E+04	mg/kg	1.08E+04	mg/kg	M	1.5E-02	mg/kg-day	1.00E+00	mg/kg-day	NA	NA	1.5E-02
	Barium	7.71E+01	mg/kg	7.71E+01	mg/kg	M	1.1E-04	mg/kg-day	7.00E-02	mg/kg-day	NA	NA	1.6E-03
	Cadmium	2.82E-01	mg/kg	2.82E-01	mg/kg	M	4.0E-07	mg/kg-day	5.00E-04	mg/kg-day	NA	NA	7.9E-04
	Chromium	1.48E+01	mg/kg	1.48E+01	mg/kg	M	2.1E-05	mg/kg-day	3.00E-03	mg/kg-day	NA	NA	7.0E-03
	Iron	2.07E+04	mg/kg	2.07E+04	mg/kg	M	2.9E-02	mg/kg-day	3.00E-01	mg/kg-day	NA	NA	9.7E-02
	Manganese	8.71E+02	mg/kg	8.71E+02	mg/kg	M	1.2E-03	mg/kg-day	7.00E-02	mg/kg-day	NA	NA	1.8E-02
	Nickel	1.28E+01	mg/kg	1.28E+01	mg/kg	M	1.8E-05	mg/kg-day	2.00E-02	mg/kg-day	NA	NA	9.0E-04
	Selenium	6.34E-01	mg/kg	6.34E-01	mg/kg	M	8.9E-07	mg/kg-day	5.00E-03	mg/kg-day	NA	NA	1.8E-04
	(total)												**1.4E-01**
Dermal	1,1,2,2-Tetrachloroethene	1.59E-03	mg/kg	1.59E-03	mg/kg	M		mg/kg-day	6.00E-02	mg/kg-day	NA	NA	
	Methylene Chloride	2.17E-02	mg/kg	2.17E-02	mg/kg	M		mg/kg-day	6.00E-02	mg/kg-day	NA	NA	
	Benzo(a)anthracene	7.76E-03	mg/kg	7.76E-03	mg/kg	M	3.0E-09	mg/kg-day		mg/kg-day	NA	NA	
	Benzo(a)pyrene	8.03E-03	mg/kg	8.03E-03	mg/kg	M	3.1E-09	mg/kg-day		mg/kg-day	NA	NA	
	Benzo(b)fluoranthene	8.45E-03	mg/kg	8.45E-03	mg/kg	M	3.2E-09	mg/kg-day		mg/kg-day	NA	NA	
	Aluminum	1.08E+04	mg/kg	1.08E+04	mg/kg	M		mg/kg-day	1.00E+00	mg/kg-day	NA	NA	
	Barium	7.71E+01	mg/kg	7.71E+01	mg/kg	M		mg/kg-day	4.90E-03	mg/kg-day	NA	NA	
	Cadmium	2.82E-01	mg/kg	2.82E-01	mg/kg	M	8.3E-10	mg/kg-day	2.50E-05	mg/kg-day	NA	NA	3.3E-05
	Chromium	1.48E+01	mg/kg	1.48E+01	mg/kg	M		mg/kg-day	7.50E-05	mg/kg-day	NA	NA	
	Iron	2.07E+04	mg/kg	2.07E+04	mg/kg	M		mg/kg-day	3.00E-01	mg/kg-day	NA	NA	
	Manganese	8.71E+02	mg/kg	8.71E+02	mg/kg	M		mg/kg-day	2.80E-03	mg/kg-day	NA	NA	
	Nickel	1.28E+01	mg/kg	1.28E+01	mg/kg	M		mg/kg-day	8.00E-04	mg/kg-day	NA	NA	
	Selenium	6.34E-01	mg/kg	6.34E-01	mg/kg	M		mg/kg-day	5.00E-03	mg/kg-day	NA	NA	
	Thallium	1.79E+00	mg/kg	1.79E+00	mg/kg	M		mg/kg-day	7.00E-05	mg/kg-day	NA	NA	
	(total)												**3.3E-05**
												Total Hazard Index Across All Exposure Routes/Pathways	**1.4E-01**

(1) Specify Medium-Specific (M) or Route-Specific (R) EPC selected for hazard calculation.

Dermal Absorption Fraction from Soil(ABS) (USEPA 2001):

Cadmium - 0.001 Volatiles - No ABS value provided

PAHs - 0.13 Other Metals - No ABS value provided

TABLE 8.1a - CENTRAL TENDENCY EXPOSURE (CTE)
CALCULATION OF CANCER RISKS FROM EXPOSURE OF CONSTRUCTION WORKERS TO SURFACE/SUBSURFACE SOIL
SWMU 1 - MUSTARD GAS BURIAL GROUND
NSWC CRANE, INDIANA

Scenario Timeframe: Future
Medium: Surface Soil/Subsurface Soil
Exposure Medium: Surface Soil/subsurface Soil
Exposure Point: Entire Site
Receptor Population: Construction Worker
Receptor Age: Adult

Exposure Route	Chemical of Potential Concern	Medium EPC Value	Medium EPC Units	Route EPC Value	Route EPC Units	EPC Selected for Risk Calculation (1)	Intake (Cancer)	Intake (Cancer) Units	Cancer Slope Factor	Cancer Slope Factor Units	Cancer Risk
Ingestion	1,1,2,2-Tetrachloroethene	1.59E-03	mg/kg	1.59E-03	mg/kg	M	3.2E-11	mg/kg-day	2.00E-01	(mg/kg-day)$^{-1}$	6.4E-12
	Methylene Chloride	2.17E-02	mg/kg	2.17E-02	mg/kg	M	4.4E-10	mg/kg-day	7.50E-03	(mg/kg-day)$^{-1}$	3.3E-12
	Benzo(a)anthracene	7.76E-03	mg/kg	7.76E-03	mg/kg	M	1.6E-10	mg/kg-day	7.30E-01	(mg/kg-day)$^{-1}$	1.1E-10
	Benzo(a)pyrene	8.03E-03	mg/kg	8.03E-03	mg/kg	M	1.6E-10	mg/kg-day	7.30E+00	(mg/kg-day)$^{-1}$	1.2E-09
	Benzo(b)fluoranthene	8.45E-03	mg/kg	8.45E-03	mg/kg	M	1.7E-10	mg/kg-day	7.30E-01	(mg/kg-day)$^{-1}$	1.2E-10
	Aluminum	1.08E+04	mg/kg	1.08E+04	mg/kg	M	2.2E-04	mg/kg-day		(mg/kg-day)$^{-1}$	
	Barium	7.71E+01	mg/kg	7.71E+01	mg/kg	M	1.6E-06	mg/kg-day		(mg/kg-day)$^{-1}$	
	Cadmium	2.82E-01	mg/kg	2.82E-01	mg/kg	M	5.7E-09	mg/kg-day		(mg/kg-day)$^{-1}$	
	Chromium	1.48E+01	mg/kg	1.48E+01	mg/kg	M	3.0E-07	mg/kg-day		(mg/kg-day)$^{-1}$	
	Iron	2.07E+04	mg/kg	2.07E+04	mg/kg	M	4.2E-04	mg/kg-day		(mg/kg-day)$^{-1}$	
	Manganese	8.71E+02	mg/kg	8.71E+02	mg/kg	M	1.8E-05	mg/kg-day		(mg/kg-day)$^{-1}$	
	Nickel	1.28E+01	mg/kg	1.28E+01	mg/kg	M	2.6E-07	mg/kg-day		(mg/kg-day)$^{-1}$	
	Selenium	6.34E-01	mg/kg	6.34E-01	mg/kg	M	1.3E-08	mg/kg-day		(mg/kg-day)$^{-1}$	
	(total)										**1.4E-09**
Dermal	1,1,2,2-Tetrachloroethene	1.59E-03	mg/kg	1.59E-03	mg/kg	M		mg/kg-day		(mg/kg-day)$^{-1}$	
	Methylene Chloride	2.17E-02	mg/kg	2.17E-02	mg/kg	M		mg/kg-day		(mg/kg-day)$^{-1}$	
	Benzo(a)anthracene	7.76E-03	mg/kg	7.76E-03	mg/kg	M	4.2E-11	mg/kg-day	7.30E-01	(mg/kg-day)$^{-1}$	3.1E-11
	Benzo(a)pyrene	8.03E-03	mg/kg	8.03E-03	mg/kg	M	4.4E-11	mg/kg-day	7.30E+00	(mg/kg-day)$^{-1}$	3.2E-10
	Benzo(b)fluoranthene	8.45E-03	mg/kg	8.45E-03	mg/kg	M	4.6E-11	mg/kg-day	7.30E-01	(mg/kg-day)$^{-1}$	3.4E-11
	Aluminum	1.08E+04	mg/kg	1.08E+04	mg/kg	M		mg/kg-day		(mg/kg-day)$^{-1}$	
	Barium	7.71E+01	mg/kg	7.71E+01	mg/kg	M		mg/kg-day		(mg/kg-day)$^{-1}$	
	Cadmium	2.82E-01	mg/kg	2.82E-01	mg/kg	M		mg/kg-day		(mg/kg-day)$^{-1}$	
	Chromium	1.48E+01	mg/kg	1.48E+01	mg/kg	M		mg/kg-day		(mg/kg-day)$^{-1}$	
	Iron	2.07E+04	mg/kg	2.07E+04	mg/kg	M		mg/kg-day		(mg/kg-day)$^{-1}$	
	Manganese	8.71E+02	mg/kg	8.71E+02	mg/kg	M		mg/kg-day		(mg/kg-day)$^{-1}$	
	Nickel	1.28E+01	mg/kg	1.28E+01	mg/kg	M		mg/kg-day		(mg/kg-day)$^{-1}$	
	Selenium	6.34E-01	mg/kg	6.34E-01	mg/kg	M		mg/kg-day		(mg/kg-day)$^{-1}$	
	(total)										**3.8E-10**
										Total Risk Across All Exposure Routes/Pathways	**1.8E-09**

(1) Specify Medium-Specific (M) or Route-Specific (R) EPC selected for risk calculation.

Dermal Absorption Fraction from Soil(ABS) (USEPA 2001):

Cadmium - 0.001 Volatiles - No ABS value provided
PAHs - 0.13 Other Metals - No ABS value provided

TABLE 4.2

VALUES OF DAILY INTAKE CALCULATIONS FOR EXPOSURE OF
MAINTENANCE WORKERS TO SURFACE SOIL
SWMU 1 - MUSTARD GAS BURIAL GROUND
NSWC CRANE, INDIANA

Scenario Timeframe: Future
Medium: Surface Soil
Exposure Medium: Surface Soil
Exposure Point: Entire Site
Receptor Population: Maintenance Workers
Receptor Age: Adult

Exposure Route	Parameter Code	Parameter Definition	Units	RME Value	RME Rationale/ Reference	CTE Value	CTE Rationale/ Reference	Intake Equation/ Model Name
Ingestion	Csoil	Chemical Concentration in Soil	mg/kg	Max or 95% UCL	U.S. EPA, May 1992	Max or 95% UCL	U.S. EPA, May 1992	Ingestion CDI (mg/kg/day) =
	IR	Ingestion Rate of Soil	mg/day	100	U.S. EPA, May 1993	50	U.S. EPA, May 1993	Csoil x IR x Fi x EF x ED x CF
	Fi	Fraction ingested	--(3)	1.0	U.S. EPA, May 1993	1.0	U.S. EPA, May 1993	BW x AT
	EF	Exposure Frequency	days/year	24	Professional Judgement	12	1/2 RME value	USEPA, December 1989
	ED	Exposure Duration	years	25	U.S. EPA, May 1993	9	U.S. EPA, May 1993	
	CF	Conversion Factor	kg/mg	1.0E-06	U.S. EPA, December 1989	1.0E-06	U.S. EPA, December 1989	
	BW	Body Weight	kg	70	U.S. EPA, May 1993	70	U.S. EPA, May 1993	
	AT-C	Averaging Time (Cancer)	days	25,550	U.S. EPA, December 1989	25,550	U.S. EPA, December 1989	
	AT-N	Averaging Time (Non-Cancer)	days	9,125	U.S. EPA, December 1989	3,285	U.S. EPA, December 1989	
Dermal	Csoil	Chemical Concentration in Soil	mg/kg	Max or 95% UCL	U.S. EPA, May 1992	Max or 95% UCL	U.S. EPA, May 1992	Dermal CDI (mg/kg/day) =
	CF	Conversion Factor	kg/mg	1.0E-06	U.S. EPA, December 1989	1.0E-06	U.S. EPA, December 1989	Csoil x CF x SA x AF x ABS x EF x ED
	SA	Skin Surface Area	cm^2/day	3,300	U.S. EPA, September 2001	3,300	U.S. EPA, September 2001	BW x AT
	AF	Soil to Skin Adherence Factor	mg/cm^2	0.2	U.S. EPA, September 2001	0.02	U.S. EPA, September 2001	USEPA, December 1989
	ABS	Dermal Absorption Factor (Solid)	unitless	chemical specific	U.S. EPA, September 2001	chemical specific	U.S. EPA, September 2001	
	EF	Exposure Frequency	days/year	24	Professional Judgement	12	1/2 RME value	
	ED	Exposure Duration	years	25	U.S. EPA, May 1993	9	U.S. EPA, May 1993	
	BW	Body Weight	kg	70	U.S. EPA, May 1993	70	U.S. EPA, May 1993	
	AT-C	Averaging Time (Cancer)	days	25,550	U.S. EPA, December 1989	25,550	U.S. EPA, December 1989	
	AT-N	Averaging Time (Non-Cancer)	days	9,125	U.S. EPA, December 1989	3,285	U.S. EPA, December 1989	

Surface soil is defined as soil collected from depths of 0 to 2 foot bgs.
CDI = Chronic Daily Intake

Daily Intake Calculations

Ingestion Intake = (IR x Fi x EF x ED x CF) / (BW x AT)
Dermal Intake = (CF x SA x AF x ABS x EF x ED) / (BW x AT)

Cancer Ingestion Intake - RME = 3.35E-08
Noncancer Ingestion Intake - RME = 9.39E-08

Cancer Ingestion Intake - CTE = 3.02E-09
Noncancer Ingestion Intake - CTE = 2.35E-08

Cancer Dermal Intake - RME = 2.21E-07
Noncancer Dermal Intake - RME = 6.20E-07

Cancer Dermal Intake - CTE = 3.99E-09
Noncancer Dermal Intake - CTE = 3.10E-08

TABLE 7.2 - REASONABLE MAXIMUM EXPOSURE (RME)
CALCULATION OF NON-CANCER HAZARDS FROM EXPOSURE OF MAINTENANCE WORKERS TO SURFACE SOIL
SWMU 1 - MUSTARD GAS BURIAL GROUND
NSWC CRANE, INDIANA

Scenario Timeframe: Future
Medium: Surface Soil
Exposure Medium: Surface Soil
Exposure Point: Entire Site
Receptor Population: Maintenance Workers
Receptor Age: Adult

Exposure Route	Chemical of Potential Concern	Medium EPC Value	Medium EPC Units	Route EPC Value	Route EPC Units	EPC Selected for Hazard Calculation (1)	Intake (Non-Cancer)	Intake (Non-Cancer) Units	Reference Dose	Reference Dose Units	Reference Concentration	Reference Concentration Units	Hazard Quotient
Ingestion	Methylene Chloride	2.16E-02	mg/kg	2.16E-02	mg/kg	M	2.0E-09	mg/kg-day	6.00E-02	mg/kg-day	NA	NA	3.4E-08
	Aluminum	1.41E+04	mg/kg	1.41E+04	mg/kg	M	1.3E-03	mg/kg-day	1.00E+00	mg/kg-day	NA	NA	1.3E-03
	Iron	2.13E+04	mg/kg	2.13E+04	mg/kg	M	2.0E-03	mg/kg-day	3.00E-01	mg/kg-day	NA	NA	6.7E-03
	Selenium	7.96E-01	mg/kg	7.96E-01	mg/kg	M	7.5E-08	mg/kg-day	5.00E-03	mg/kg-day	NA	NA	1.5E-05
	(total)												**8.0E-03**
Dermal	Methylene Chloride	2.16E-02	mg/kg	2.16E-02	mg/kg	M		mg/kg-day	6.00E-02	mg/kg-day	NA	NA	
	Aluminum	1.41E+04	mg/kg	1.41E+04	mg/kg	M		mg/kg-day	1.00E+00	mg/kg-day	NA	NA	
	Iron	2.13E+04	mg/kg	2.13E+04	mg/kg	M		mg/kg-day	3.00E-01	mg/kg-day	NA	NA	
	Selenium	7.96E-01	mg/kg	7.96E-01	mg/kg	M		mg/kg-day	5.00E-03	mg/kg-day	NA	NA	
	(total)												
												Total Hazard Index Across All Exposure Routes/Pathways	**8.0E-03**

(1) Specify Medium-Specific (M) or Route-Specific (R) EPC selected for hazard calculation.

Dermal Absorption Fraction from Soil(ABS) (USEPA 2001):

Volatiles - No ABS value provided
Other Metals - No ABS value provided

TABLE 8.2 - REASONABLE MAXIMUM EXPOSURE (RME)
CALCULATION OF CANCER RISKS FROM EXPOSURE OF MAINTENANCE WORKERS TO SURFACE SOIL
SWMU 1 - MUSTARD GAS BURIAL GROUND
NSWC CRANE, INDIANA

Scenario Timeframe: Future
Medium: Surface Soil
Exposure Medium: Surface Soil
Exposure Point: Entire Site
Receptor Population: Maintenance Workers
Receptor Age: Adult

Exposure Route	Chemical of Potential Concern	Medium EPC Value	Medium EPC Units	Route EPC Value	Route EPC Units	EPC Selected for Risk Calculation (1)	Intake (Cancer)	Intake (Cancer) Units	Cancer Slope Factor	Cancer Slope Factor Units	Cancer Risk
Ingestion	Methylene Chloride	2.16E-02	mg/kg	2.16E-02	mg/kg	M	7.3E-10	mg/kg-day	7.50E-03	$(mg/kg\text{-}day)^{-1}$	5.4E-12
	Aluminum	1.41E+04	mg/kg	1.41E+04	mg/kg	M	4.7E-04	mg/kg-day		$(mg/kg\text{-}day)^{-1}$	
	Iron	2.13E+04	mg/kg	2.13E+04	mg/kg	M	7.1E-04	mg/kg-day		$(mg/kg\text{-}day)^{-1}$	
	Selenium	7.96E-01	mg/kg	7.96E-01	mg/kg	M	2.7E-08	mg/kg-day		$(mg/kg\text{-}day)^{-1}$	
	(total)										**5.4E-12**
Dermal	Methylene Chloride	2.16E-02	mg/kg	2.16E-02	mg/kg	M		mg/kg-day	7.50E-03	$(mg/kg\text{-}day)^{-1}$	
	Aluminum	1.41E+04	mg/kg	1.41E+04	mg/kg	M		mg/kg-day		$(mg/kg\text{-}day)^{-1}$	
	Iron	2.13E+04	mg/kg	2.13E+04	mg/kg	M		mg/kg-day		$(mg/kg\text{-}day)^{-1}$	
	Selenium	7.96E-01	mg/kg	7.96E-01	mg/kg	M		mg/kg-day		$(mg/kg\text{-}day)^{-1}$	
	(total)										
										Total Risk Across All Exposure Routes/Pathways	**5.4E-12**

(1) Specify Medium-Specific (M) or Route-Specific (R) EPC selected for risk calculation.

Dermal Absorption Fraction from Soil(ABS) (USEPA 2001):

Volatiles - No ABS value provided

Other Metals - No ABS value provided

TABLE 7.2a - CENTRAL TENDENCY EXPOSURE (CTE)
CALCULATION OF NON-CANCER HAZARDS FROM EXPOSURE OF MAINTENANCE WORKERS TO SURFACE SOIL
SWMU 1 - MUSTARD GAS BURIAL GROUND
NSWC CRANE, INDIANA

Scenario Timeframe: Future
Medium: Surface Soil
Exposure Medium: Surface Soil
Exposure Point: Entire Site
Receptor Population: Maintenance Workers
Receptor Age: Adult

Exposure Route	Chemical of Potential Concern	Medium EPC Value	Medium EPC Units	Route EPC Value	Route EPC Units	EPC Selected for Hazard Calculation (1)	Intake (Non-Cancer)	Intake (Non-Cancer) Units	Reference Dose	Reference Dose Units	Reference Concentration	Reference Concentration Units	Hazard Quotient
Ingestion	Methylene Chloride	2.16E-02	mg/kg	2.16E-02	mg/kg	M	5.1E-10	mg/kg-day	6.00E-02	mg/kg-day	NA	NA	8.5E-09
	Aluminum	1.41E+04	mg/kg	1.41E+04	mg/kg	M	3.3E-04	mg/kg-day	1.00E+00	mg/kg-day	NA	NA	3.3E-04
	Iron	2.13E+04	mg/kg	2.13E+04	mg/kg	M	5.0E-04	mg/kg-day	3.00E-01	mg/kg-day	NA	NA	1.7E-03
	Selenium	7.96E-01	mg/kg	7.96E-01	mg/kg	M	1.9E-08	mg/kg-day	5.00E-03	mg/kg-day	NA	NA	3.7E-06
	(total)												**2.0E-03**
Dermal	Methylene Chloride	2.16E-02	mg/kg	2.16E-02	mg/kg	M		mg/kg-day	6.00E-02	mg/kg-day	NA	NA	
	Aluminum	1.41E+04	mg/kg	1.41E+04	mg/kg	M		mg/kg-day	1.00E+00	mg/kg-day	NA	NA	
	Iron	2.13E+04	mg/kg	2.13E+04	mg/kg	M		mg/kg-day	3.00E-01	mg/kg-day	NA	NA	
	Selenium	7.96E-01	mg/kg	7.96E-01	mg/kg	M		mg/kg-day	5.00E-03	mg/kg-day	NA	NA	
	(total)												
												Total Hazard Index Across All Exposure Routes/Pathways	**2.0E-03**

(1) Specify Medium-Specific (M) or Route-Specific (R) EPC selected for hazard calculation.

Dermal Absorption Fraction from Soil(ABS) (USEPA 2001):

Volatiles - No ABS value provided
Other Metals - No ABS value provided

TABLE 8.2a - CENTRAL TENDENCY EXPOSURE (CTE)
CALCULATION OF CANCER RISKS FROM EXPOSURE OF MAINTENANCE WORKERS TO SURFACE SOIL
SWMU 1 - MUSTARD GAS BURIAL GROUND
NSWC CRANE, INDIANA

Scenario Timeframe: Future
Medium: Surface Soil
Exposure Medium: Surface Soil
Exposure Point: Entire Site
Receptor Population: Maintenance Workers
Receptor Age: Adult

Exposure Route	Chemical of Potential Concern	Medium EPC Value	Medium EPC Units	Route EPC Value	Route EPC Units	EPC Selected for Risk Calculation (1)	Intake (Cancer)	Intake (Cancer) Units	Cancer Slope Factor	Cancer Slope Factor Units	Cancer Risk
Ingestion	Methylene Chloride	2.16E-02	mg/kg	2.16E-02	mg/kg	M	6.5E-11	mg/kg-day	7.50E-03	$(mg/kg\text{-}day)^{-1}$	4.9E-13
	Aluminum	1.41E+04	mg/kg	1.41E+04	mg/kg	M	4.3E-05	mg/kg-day		$(mg/kg\text{-}day)^{-1}$	
	Iron	2.13E+04	mg/kg	2.13E+04	mg/kg	M	6.4E-05	mg/kg-day		$(mg/kg\text{-}day)^{-1}$	
	Selenium	7.96E-01	mg/kg	7.96E-01	mg/kg	M	2.4E-09	mg/kg-day		$(mg/kg\text{-}day)^{-1}$	
	(total)										**4.9E-13**
Dermal	Methylene Chloride	2.16E-02	mg/kg	2.16E-02	mg/kg	M		mg/kg-day	7.50E-03	$(mg/kg\text{-}day)^{-1}$	
	Aluminum	1.41E+04	mg/kg	1.41E+04	mg/kg	M		mg/kg-day		$(mg/kg\text{-}day)^{-1}$	
	Iron	2.13E+04	mg/kg	2.13E+04	mg/kg	M		mg/kg-day		$(mg/kg\text{-}day)^{-1}$	
	Selenium	7.96E-01	mg/kg	7.96E-01	mg/kg	M		mg/kg-day		$(mg/kg\text{-}day)^{-1}$	
	(total)										
										Total Risk Across All Exposure Routes/Pathways	**4.9E-13**

(1) Specify Medium-Specific (M) or Route-Specific (R) EPC selected for risk calculation.

Dermal Absorption Fraction from Soil(ABS) (USEPA 2001):

Volatiles - No ABS value provided

Other Metals - No ABS value provided

TABLE 4.3

VALUES OF DAILY INTAKE CALCULATIONS FOR EXPOSURE OF
OCCUPATIONAL WORKERS TO SURFACE SOIL
SWMU 1 - MUSTARD GAS BURIAL GROUND
NSWC CRANE, INDIANA

Scenario Timeframe: Future
Medium: Surface Soil
Exposure Medium: Surface Soil
Exposure Point: Entire Site
Receptor Population: Occupational Workers
Receptor Age: Adult

Exposure Route	Parameter Code	Parameter Definition	Units	RME Value	RME Rationale/ Reference	CTE Value	CTE Rationale/ Reference	Intake Equation/ Model Name
Ingestion	Csoil	Chemical Concentration in Soil	mg/kg	Max or 95% UCL	U.S. EPA, May 1992	Max or 95% UCL	U.S. EPA, May 1992	Ingestion CDI (mg/kg/day) =
	IR	Ingestion Rate of Soil	mg/day	100	U.S. EPA, May 1993	50	U.S. EPA, May 1993	Csoil x IR x Fi x EF x ED x CF
	Fi	Fraction ingested	--(3)	1.0	U.S. EPA, May 1993	1.0	U.S. EPA, May 1993	BW x AT
	EF	Exposure Frequency	days/year	250	U.S. EPA, May 1993	219	U.S. EPA, May 1993	USEPA, December 1989
	ED	Exposure Duration	years	25	U.S. EPA, May 1993	9	U.S. EPA, May 1993	
	CF	Conversion Factor	kg/mg	1.0E-06	U.S. EPA, December 1989	1.0E-06	U.S. EPA, December 1989	
	BW	Body Weight	kg	70	U.S. EPA, May 1993	70	U.S. EPA, May 1993	
	AT-C	Averaging Time (Cancer)	days	25,550	U.S. EPA, December 1989	25,550	U.S. EPA, December 1989	
	AT-N	Averaging Time (Non-Cancer)	days	9,125	U.S. EPA, December 1989	3,285	U.S. EPA, December 1989	
Dermal	Csoil	Chemical Concentration in Soil	mg/kg	Max or 95% UCL	U.S. EPA, May 1992	Max or 95% UCL	U.S. EPA, May 1992	Dermal CDI (mg/kg/day) =
	CF	Conversion Factor	kg/mg	1.0E-06	U.S. EPA, December 1989	1.0E-06	U.S. EPA, December 1989	Csoil x CF x SA x AF x ABS x EF x ED
	SA	Skin Surface Area	cm^2/day	3,300	U.S. EPA, September 2001	3,300	U.S. EPA, September 2001	BW x AT
	AF	Soil to Skin Adherence Factor	mg/cm^2	0.2	U.S. EPA, September 2001	0.02	U.S. EPA, September 2001	USEPA, December 1989
	ABS	Dermal Absorption Factor (Solid)	unitless	chemical specific	U.S. EPA, September 2001	chemical specific	U.S. EPA, September 2001	
	EF	Exposure Frequency	days/year	250	U.S. EPA, May 1993	219	U.S. EPA, May 1993	
	ED	Exposure Duration	years	25	U.S. EPA, May 1993	9	U.S. EPA, May 1993	
	BW	Body Weight	kg	70	U.S. EPA, May 1993	70	U.S. EPA, May 1993	
	AT-C	Averaging Time (Cancer)	days	25,550	U.S. EPA, December 1989	25,550	U.S. EPA, December 1989	
	AT-N	Averaging Time (Non-Cancer)	days	9,125	U.S. EPA, December 1989	3,285	U.S. EPA, December 1989	

Surface soil is defined as soil collected from depths of 0 to 2 foot bgs.

CDI = Chronic Daily Intake

Daily Intake Calculations

Ingestion Intake = (IR x Fi x EF x ED x CF) / (BW x AT)
Dermal Intake = (CF x SA x AF x ABS x EF x ED) / (BW x AT)

Cancer Ingestion Intake - RME = 3.49E-07
Noncancer Ingestion Intake - RME = 9.78E-07

Cancer Ingestion Intake - CTE = 5.51E-08
Noncancer Ingestion Intake - CTE = 4.29E-07

Cancer Dermal Intake - RME = 2.31E-06
Noncancer Dermal Intake - RME = 6.46E-06

Cancer Dermal Intake - CTE = 7.27E-08
Noncancer Dermal Intake - CTE = 5.66E-07

TABLE 7.3 - REASONABLE MAXIMUM EXPOSURE (RME)
CALCULATION OF NON-CANCER HAZARDS FROM EXPOSURE OF OCCUPATIONAL WORKERS TO SURFACE SOIL
SWMU 1 - MUSTARD GAS BURIAL GROUND
NSWC CRANE, INDIANA

Scenario Timeframe: Future
Medium: Surface Soil
Exposure Medium: Surface Soil
Exposure Point: Entire Site
Receptor Population: Occupational Workers
Receptor Age: Adult

Exposure Route	Chemical of Potential Concern	Medium EPC Value	Medium EPC Units	Route EPC Value	Route EPC Units	EPC Selected for Hazard Calculation (1)	Intake (Non-Cancer)	Intake (Non-Cancer) Units	Reference Dose	Reference Dose Units	Reference Concentration	Reference Concentration Units	Hazard Quotient
Ingestion	Methylene Chloride	2.16E-02	mg/kg	2.16E-02	mg/kg	M	2.1E-08	mg/kg-day	6.00E-02	mg/kg-day	NA	NA	3.5E-07
	Aluminum	1.41E+04	mg/kg	1.41E+04	mg/kg	M	1.4E-02	mg/kg-day	1.00E+00	mg/kg-day	NA	NA	1.4E-02
	Iron	2.13E+04	mg/kg	2.13E+04	mg/kg	M	2.1E-02	mg/kg-day	3.00E-01	mg/kg-day	NA	NA	6.9E-02
	Selenium	7.96E-01	mg/kg	7.96E-01	mg/kg	M	7.8E-07	mg/kg-day	5.00E-03	mg/kg-day	NA	NA	1.6E-04
	(total)												**8.3E-02**
Dermal	Methylene Chloride	2.16E-02	mg/kg	2.16E-02	mg/kg	M		mg/kg-day	6.00E-02	mg/kg-day	NA	NA	
	Aluminum	1.41E+04	mg/kg	1.41E+04	mg/kg	M		mg/kg-day	1.00E+00	mg/kg-day	NA	NA	
	Iron	2.13E+04	mg/kg	2.13E+04	mg/kg	M		mg/kg-day	3.00E-01	mg/kg-day	NA	NA	
	Selenium	7.96E-01	mg/kg	7.96E-01	mg/kg	M		mg/kg-day	5.00E-03	mg/kg-day	NA	NA	
	(total)												
												Total Hazard Index Across All Exposure Routes/Pathways	**8.3E-02**

(1) Specify Medium-Specific (M) or Route-Specific (R) EPC selected for hazard calculation.

Dermal Absorption Fraction from Soil(ABS) (USEPA 2001):

Volatiles - No ABS value provided
Other Metals - No ABS value provided

TABLE 8.3 - REASONABLE MAXIMUM EXPOSURE (RME)
CALCULATION OF CANCER RISKS FROM EXPOSURE OF OCCUPATIONAL WORKERS TO SURFACE SOIL
SWMU 1 - MUSTARD GAS BURIAL GROUND
NSWC CRANE, INDIANA

Scenario Timeframe: Future
Medium: Surface Soil
Exposure Medium: Surface Soil
Exposure Point: Entire Site
Receptor Population: Occupational Workers
Receptor Age: Adult

Exposure Route	Chemical of Potential Concern	Medium EPC Value	Medium EPC Units	Route EPC Value	Route EPC Units	EPC Selected for Risk Calculation (1)	Intake (Cancer)	Intake (Cancer) Units	Cancer Slope Factor	Cancer Slope Factor Units	Cancer Risk
Ingestion	Methylene Chloride	2.16E-02	mg/kg	2.16E-02	mg/kg	M	7.6E-09	mg/kg-day	7.50E-03	$(mg/kg\text{-}day)^{-1}$	5.7E-11
	Aluminum	1.41E+04	mg/kg	1.41E+04	mg/kg	M	4.9E-03	mg/kg-day		$(mg/kg\text{-}day)^{-1}$	
	Iron	2.13E+04	mg/kg	2.13E+04	mg/kg	M	7.4E-03	mg/kg-day		$(mg/kg\text{-}day)^{-1}$	
	Selenium	7.96E-01	mg/kg	7.96E-01	mg/kg	M	2.8E-07	mg/kg-day		$(mg/kg\text{-}day)^{-1}$	
	(total)										**5.7E-11**
Dermal	Methylene Chloride	2.16E-02	mg/kg	2.16E-02	mg/kg	M		mg/kg-day	7.50E-03	$(mg/kg\text{-}day)^{-1}$	
	Aluminum	1.41E+04	mg/kg	1.41E+04	mg/kg	M		mg/kg-day		$(mg/kg\text{-}day)^{-1}$	
	Iron	2.13E+04	mg/kg	2.13E+04	mg/kg	M		mg/kg-day		$(mg/kg\text{-}day)^{-1}$	
	Selenium	7.96E-01	mg/kg	7.96E-01	mg/kg	M		mg/kg-day		$(mg/kg\text{-}day)^{-1}$	
	(total)										
										Total Risk Across All Exposure Routes/Pathways	**5.7E-11**

(1) Specify Medium-Specific (M) or Route-Specific (R) EPC selected for risk calculation.

Dermal Absorption Fraction from Soil(ABS) (USEPA 2001):

Volatiles - No ABS value provided

Other Metals - No ABS value provided

TABLE 7.3a - CENTRAL TENDENCY EXPOSURE (CTE)
CALCULATION OF NON-CANCER HAZARDS FROM EXPOSURE OF OCCUPATIONAL WORKERS TO SURFACE SOIL
SWMU 1 - MUSTARD GAS BURIAL GROUND
NSWC CRANE, INDIANA

Scenario Timeframe: Future
Medium: Surface Soil
Exposure Medium: Surface Soil
Exposure Point: Entire Site
Receptor Population: Occupational Workers
Receptor Age: Adult

Exposure Route	Chemical of Potential Concern	Medium EPC Value	Medium EPC Units	Route EPC Value	Route EPC Units	EPC Selected for Hazard Calculation (1)	Intake (Non-Cancer)	Intake (Non-Cancer) Units	Reference Dose	Reference Dose Units	Reference Concentration	Reference Concentration Units	Hazard Quotient
Ingestion	Methylene Chloride	2.16E-02	mg/kg	2.16E-02	mg/kg	M	9.3E-09	mg/kg-day	6.00E-02	mg/kg-day	NA	NA	1.5E-07
	Aluminum	1.41E+04	mg/kg	1.41E+04	mg/kg	M	6.0E-03	mg/kg-day	1.00E+00	mg/kg-day	NA	NA	6.0E-03
	Iron	2.13E+04	mg/kg	2.13E+04	mg/kg	M	9.1E-03	mg/kg-day	3.00E-01	mg/kg-day	NA	NA	3.0E-02
	Selenium	7.96E-01	mg/kg	7.96E-01	mg/kg	M	3.4E-07	mg/kg-day	5.00E-03	mg/kg-day	NA	NA	6.8E-05
	(total)												**3.6E-02**
Dermal	Methylene Chloride	2.16E-02	mg/kg	2.16E-02	mg/kg	M		mg/kg-day	6.00E-02	mg/kg-day	NA	NA	
	Aluminum	1.41E+04	mg/kg	1.41E+04	mg/kg	M		mg/kg-day	1.00E+00	mg/kg-day	NA	NA	
	Iron	2.13E+04	mg/kg	2.13E+04	mg/kg	M		mg/kg-day	3.00E-01	mg/kg-day	NA	NA	
	Selenium	7.96E-01	mg/kg	7.96E-01	mg/kg	M		mg/kg-day	5.00E-03	mg/kg-day	NA	NA	
	(total)												
												Total Hazard Index Across All Exposure Routes/Pathways	**3.6E-02**

(1) Specify Medium-Specific (M) or Route-Specific (R) EPC selected for hazard calculation.

Dermal Absorption Fraction from Soil(ABS) (USEPA 2001):

Volatiles - No ABS value provided
Other Metals - No ABS value provided

TABLE 8.3a - CENTRAL TENDENCY EXPOSURE (CTE)
CALCULATION OF CANCER RISKS FROM EXPOSURE OF OCCUPATIONAL WORKERS TO SURFACE SOIL
SWMU 1 - MUSTARD GAS BURIAL GROUND
NSWC CRANE, INDIANA

Scenario Timeframe: Future
Medium: Surface Soil
Exposure Medium: Surface Soil
Exposure Point: Entire Site
Receptor Population: Occupational Workers
Receptor Age: Adult

Exposure Route	Chemical of Potential Concern	Medium EPC Value	Medium EPC Units	Route EPC Value	Route EPC Units	EPC Selected for Risk Calculation (1)	Intake (Cancer)	Intake (Cancer) Units	Cancer Slope Factor	Cancer Slope Factor Units	Cancer Risk
Ingestion	Methylene Chloride	2.16E-02	mg/kg	2.16E-02	mg/kg	M	1.2E-09	mg/kg-day	7.50E-03	$(mg/kg\text{-}day)^{-1}$	8.9E-12
	Aluminum	1.41E+04	mg/kg	1.41E+04	mg/kg	M	7.8E-04	mg/kg-day		$(mg/kg\text{-}day)^{-1}$	
	Iron	2.13E+04	mg/kg	2.13E+04	mg/kg	M	1.2E-03	mg/kg-day		$(mg/kg\text{-}day)^{-1}$	
	Selenium	7.96E-01	mg/kg	7.96E-01	mg/kg	M	4.4E-08	mg/kg-day		$(mg/kg\text{-}day)^{-1}$	
	(total)										**8.9E-12**
Dermal	Methylene Chloride	2.16E-02	mg/kg	2.16E-02	mg/kg	M		mg/kg-day	7.50E-03	$(mg/kg\text{-}day)^{-1}$	
	Aluminum	1.41E+04	mg/kg	1.41E+04	mg/kg	M		mg/kg-day		$(mg/kg\text{-}day)^{-1}$	
	Iron	2.13E+04	mg/kg	2.13E+04	mg/kg	M		mg/kg-day		$(mg/kg\text{-}day)^{-1}$	
	Selenium	7.96E-01	mg/kg	7.96E-01	mg/kg	M		mg/kg-day		$(mg/kg\text{-}day)^{-1}$	
	(total)										
										Total Risk Across All Exposure Routes/Pathways	**8.9E-12**

(1) Specify Medium-Specific (M) or Route-Specific (R) EPC selected for risk calculation.

Dermal Absorption Fraction from Soil(ABS) (USEPA 2001):

Volatiles - No ABS value provided

Other Metals - No ABS value provided

TABLE 4.4

VALUES OF DAILY INTAKE CALCULATIONS FOR EXPOSURE OF ADULT RECREATIONAL USERS TO SURFACE SOIL SWMU 1 - MUSTARD GAS BURIAL GROUND NSWC CRANE, INDIANA

Scenario Timeframe: Future
Medium: Surface Soil
Exposure Medium: Surface Soil
Exposure Point: Entire Site
Receptor Population: Recreational Users
Receptor Age: Adult

Exposure Route	Parameter Code	Parameter Definition	Units	RME Value	RME Rationale/ Reference	CTE Value	CTE Rationale/ Reference	Intake Equation/ Model Name
Ingestion	Csoil	Chemical Concentration in Soil	mg/kg	Max or 95% UCL	U.S. EPA, May 1992	Max or 95% UCL	U.S. EPA, May 1992	Ingestion CDI (mg/kg/day) =
	IR	Ingestion Rate of Soil	mg/day	100	U.S. EPA, May 1993	50	U.S. EPA, May 1993	Csoil x IR x Fi x EF x ED x CF
	FI	Fraction Ingested	--(3)	1.0	U.S. EPA, May 1993	1.0	U.S. EPA, May 1993	BW x AT
	EF	Exposure Frequency	days/year	52	Professional Judgement	26	1/2 RME value	USEPA, December 1989
	ED	Exposure Duration	years	30	U.S. EPA, May 1993	9	U.S. EPA, May 1993	
	CF	Conversion Factor	kg/mg	1.0E-06	U.S. EPA, December 1989	1.0E-06	U.S. EPA, December 1989	
	BW	Body Weight	kg	70	U.S. EPA, May 1993	70	U.S. EPA, May 1993	
	AT-C	Averaging Time (Cancer)	days	25,550	U.S. EPA, December 1989	25,550	U.S. EPA, December 1989	
	AT-N	Averaging Time (Non-Cancer)	days	10,950	U.S. EPA, December 1989	3,285	U.S. EPA, December 1989	
Dermal	Csoil	Chemical Concentration in Soil	mg/kg	Max or 95% UCL	U.S. EPA, May 1992	Max or 95% UCL	U.S. EPA, May 1992	Dermal CDI (mg/kg/day) =
	CF	Conversion Factor	kg/mg	1.0E-06	U.S. EPA, December 1989	1.0E-06	U.S. EPA, December 1989	Csoil x CF x SA x AF x ABS x EF x ED
	SA	Skin Surface Area	cm^2/day	9,190	U.S. EPA, August 1997	7,770	U.S. EPA, August 1997	BW x AT
	AF	Soil to Skin Adherence Factor	mg/cm^2	0.07	U.S. EPA, September 2001	0.01	U.S. EPA, September 2001	USEPA, December 1989
	ABS	Dermal Absorption Factor (Solid)	unitless	chemical specific	U.S. EPA, September 2001	chemical specific	U.S. EPA, September 2001	
	EF	Exposure Frequency	days/year	52	Professional Judgement	26	1/2 RME value	
	ED	Exposure Duration	years	30	U.S. EPA, May 1993	9	U.S. EPA, May 1993	
	BW	Body Weight	kg	70	U.S. EPA, May 1993	70	U.S. EPA, May 1993	
	AT-C	Averaging Time (Cancer)	days	25,550	U.S. EPA, December 1989	25,550	U.S. EPA, December 1989	
	AT-N	Averaging Time (Non-Cancer)	days	10,950	U.S. EPA, December 1989	3,285	U.S. EPA, December 1989	

Surface soil is defined as soil collected from depths of 0 to 2 foot bgs.

CDI = Chronic Daily Intake

Daily Intake Calculations

Ingestion Intake = (IR x Fi x EF x ED x CF) / (BW x AT)
Dermal Intake = (CF x SA x AF x ABS x EF x ED) / (BW x AT)

Cancer Ingestion Intake - RME = 8.72E-08
Noncancer Ingestion Intake - RME = 2.04E-07

Cancer Ingestion Intake - CTE = 6.54E-09
Noncancer Ingestion Intake - CTE = 5.09E-08

Cancer Dermal Intake - RME = 5.61E-07
Noncancer Dermal Intake - RME = 1.31E-06

Cancer Dermal Intake - CTE = 1.02E-08
Noncancer Dermal Intake - CTE = 7.91E-08

TABLE 7.4 - REASONABLE MAXIMUM EXPOSURE (RME)
CALCULATION OF NON-CANCER HAZARDS FROM EXPOSURE OF ADULT RECREATIONAL USERS TO SURFACE SOIL
SWMU 1 - MUSTARD GAS BURIAL GROUND
NSWC CRANE, INDIANA

Scenario Timeframe: Future
Medium: Surface Soil
Exposure Medium: Surface Soil
Exposure Point: Entire Site
Receptor Population: Recreational Users
Receptor Age: Adult

Exposure Route	Chemical of Potential Concern	Medium EPC Value	Medium EPC Units	Route EPC Value	Route EPC Units	EPC Selected for Hazard Calculation (1)	Intake (Non-Cancer)	Intake (Non-Cancer) Units	Reference Dose	Reference Dose Units	Reference Concentration	Reference Concentration Units	Hazard Quotient
Ingestion	Methylene Chloride	2.16E-02	mg/kg	2.16E-02	mg/kg	M	4.4E-09	mg/kg-day	6.00E-02	mg/kg-day	NA	NA	7.3E-08
	Aluminum	1.41E+04	mg/kg	1.41E+04	mg/kg	M	2.9E-03	mg/kg-day	1.00E+00	mg/kg-day	NA	NA	2.9E-03
	Iron	2.13E+04	mg/kg	2.13E+04	mg/kg	M	4.3E-03	mg/kg-day	3.00E-01	mg/kg-day	NA	NA	1.4E-02
	Selenium	7.96E-01	mg/kg	7.96E-01	mg/kg	M	1.6E-07	mg/kg-day	5.00E-03	mg/kg-day	NA	NA	3.2E-05
	(total)												**1.7E-02**
Dermal	Methylene Chloride	2.16E-02	mg/kg	2.16E-02	mg/kg	M		mg/kg-day	6.00E-02	mg/kg-day	NA	NA	
	Aluminum	1.41E+04	mg/kg	1.41E+04	mg/kg	M		mg/kg-day	1.00E+00	mg/kg-day	NA	NA	
	Iron	2.13E+04	mg/kg	2.13E+04	mg/kg	M		mg/kg-day	3.00E-01	mg/kg-day	NA	NA	
	Selenium	7.96E-01	mg/kg	7.96E-01	mg/kg	M		mg/kg-day	5.00E-03	mg/kg-day	NA	NA	
	(total)												
												Total Hazard Index Across All Exposure Routes/Pathways	**1.7E-02**

(1) Specify Medium-Specific (M) or Route-Specific (R) EPC selected for hazard calculation.

Dermal Absorption Fraction from Soil(ABS) (USEPA 2001):

Volatiles - No ABS value provided
Other Metals - No ABS value provided

TABLE 8.4 - REASONABLE MAXIMUM EXPOSURE (RME)
CALCULATION OF CANCER RISKS FROM EXPOSURE OF ADULT RECREATIONAL USERS TO SURFACE SOIL
SWMU 1 - MUSTARD GAS BURIAL GROUND
NSWC CRANE, INDIANA

Scenario Timeframe: Future
Medium: Surface Soil
Exposure Medium: Surface Soil
Exposure Point: Entire Site
Receptor Population: Recreational Users
Receptor Age: Adult

Exposure Route	Chemical of Potential Concern	Medium EPC Value	Medium EPC Units	Route EPC Value	Route EPC Units	EPC Selected for Risk Calculation (1)	Intake (Cancer)	Intake (Cancer) Units	Cancer Slope Factor	Cancer Slope Factor Units	Cancer Risk
Ingestion	Methylene Chloride	2.16E-02	mg/kg	2.16E-02	mg/kg	M	1.9E-09	mg/kg-day	7.50E-03	$(mg/kg\text{-}day)^{-1}$	1.4E-11
	Aluminum	1.41E+04	mg/kg	1.41E+04	mg/kg	M	1.2E-03	mg/kg-day		$(mg/kg\text{-}day)^{-1}$	
	Iron	2.13E+04	mg/kg	2.13E+04	mg/kg	M	1.9E-03	mg/kg-day		$(mg/kg\text{-}day)^{-1}$	
	Selenium	7.96E-01	mg/kg	7.96E-01	mg/kg	M	6.9E-08	mg/kg-day		$(mg/kg\text{-}day)^{-1}$	
	(total)										**1.4E-11**
Dermal	Methylene Chloride	2.16E-02	mg/kg	2.16E-02	mg/kg	M		mg/kg-day	7.50E-03	$(mg/kg\text{-}day)^{-1}$	
	Aluminum	1.41E+04	mg/kg	1.41E+04	mg/kg	M		mg/kg-day		$(mg/kg\text{-}day)^{-1}$	
	Iron	2.13E+04	mg/kg	2.13E+04	mg/kg	M		mg/kg-day		$(mg/kg\text{-}day)^{-1}$	
	Selenium	7.96E-01	mg/kg	7.96E-01	mg/kg	M		mg/kg-day		$(mg/kg\text{-}day)^{-1}$	
	(total)										
										Total Risk Across All Exposure Routes/Pathways	**1.4E-11**

(1) Specify Medium-Specific (M) or Route-Specific (R) EPC selected for risk calculation.

Dermal Absorption Fraction from Soil(ABS) (USEPA 2001):

Volatiles - No ABS value provided

Other Metals - No ABS value provided

TABLE 7.4a - CENTRAL TENDENCY EXPOSURE (CTE)
CALCULATION OF NON-CANCER HAZARDS FROM EXPOSURE OF ADULT RECREATIONAL USERS TO SURFACE SOIL
SWMU 1 - MUSTARD GAS BURIAL GROUND
NSWC CRANE, INDIANA

Scenario Timeframe: Future
Medium: Surface Soil
Exposure Medium: Surface Soil
Exposure Point: Entire Site
Receptor Population: Recreational Users
Receptor Age: Adult

Exposure Route	Chemical of Potential Concern	Medium EPC Value	Medium EPC Units	Route EPC Value	Route EPC Units	EPC Selected for Hazard Calculation (1)	Intake (Non-Cancer)	Intake (Non-Cancer) Units	Reference Dose	Reference Dose Units	Reference Concentration	Reference Concentration Units	Hazard Quotient
Ingestion	Methylene Chloride	2.16E-02	mg/kg	2.16E-02	mg/kg	M	1.1E-09	mg/kg-day	6.00E-02	mg/kg-day	NA	NA	1.8E-08
	Aluminum	1.41E+04	mg/kg	1.41E+04	mg/kg	M	7.2E-04	mg/kg-day	1.00E+00	mg/kg-day	NA	NA	7.2E-04
	Iron	2.13E+04	mg/kg	2.13E+04	mg/kg	M	1.1E-03	mg/kg-day	3.00E-01	mg/kg-day	NA	NA	3.6E-03
	Selenium	7.96E-01	mg/kg	7.96E-01	mg/kg	M	4.1E-08	mg/kg-day	5.00E-03	mg/kg-day	NA	NA	8.1E-06
	(total)												**4.3E-03**
Dermal	Methylene Chloride	2.16E-02	mg/kg	2.16E-02	mg/kg	M		mg/kg-day	6.00E-02	mg/kg-day	NA	NA	
	Aluminum	1.41E+04	mg/kg	1.41E+04	mg/kg	M		mg/kg-day	1.00E+00	mg/kg-day	NA	NA	
	Iron	2.13E+04	mg/kg	2.13E+04	mg/kg	M		mg/kg-day	3.00E-01	mg/kg-day	NA	NA	
	Selenium	7.96E-01	mg/kg	7.96E-01	mg/kg	M		mg/kg-day	5.00E-03	mg/kg-day	NA	NA	
	(total)												
												Total Hazard Index Across All Exposure Routes/Pathways	**4.3E-03**

(1) Specify Medium-Specific (M) or Route-Specific (R) EPC selected for hazard calculation.

Dermal Absorption Fraction from Soil(ABS) (USEPA 2001):

Volatiles - No ABS value provided
Other Metals - No ABS value provided

TABLE 8.4a - CENTRAL TENDENCY EXPOSURE (CTE)
CALCULATION OF CANCER RISKS FROM EXPOSURE OF ADULT RECREATIONAL USERS TO SURFACE SOIL
SWMU 1 - MUSTARD GAS BURIAL GROUND
NSWC CRANE, INDIANA

Scenario Timeframe: Future
Medium: Surface Soil
Exposure Medium: Surface Soil
Exposure Point: Entire Site
Receptor Population: Recreational Users
Receptor Age: Adult

Exposure Route	Chemical of Potential Concern	Medium EPC Value	Medium EPC Units	Route EPC Value	Route EPC Units	EPC Selected for Risk Calculation (1)	Intake (Cancer)	Intake (Cancer) Units	Cancer Slope Factor	Cancer Slope Factor Units	Cancer Risk
Ingestion	Methylene Chloride	2.16E-02	mg/kg	2.16E-02	mg/kg	M	1.4E-10	mg/kg-day	7.50E-03	$(mg/kg\text{-}day)^{-1}$	1.1E-12
	Aluminum	1.41E+04	mg/kg	1.41E+04	mg/kg	M	9.2E-05	mg/kg-day		$(mg/kg\text{-}day)^{-1}$	
	Iron	2.13E+04	mg/kg	2.13E+04	mg/kg	M	1.4E-04	mg/kg-day		$(mg/kg\text{-}day)^{-1}$	
	Selenium	7.96E-01	mg/kg	7.96E-01	mg/kg	M	5.2E-09	mg/kg-day		$(mg/kg\text{-}day)^{-1}$	
	(total)										**1.1E-12**
Dermal	Methylene Chloride	2.16E-02	mg/kg	2.16E-02	mg/kg	M		mg/kg-day	7.50E-03	$(mg/kg\text{-}day)^{-1}$	
	Aluminum	1.41E+04	mg/kg	1.41E+04	mg/kg	M		mg/kg-day		$(mg/kg\text{-}day)^{-1}$	
	Iron	2.13E+04	mg/kg	2.13E+04	mg/kg	M		mg/kg-day		$(mg/kg\text{-}day)^{-1}$	
	Selenium	7.96E-01	mg/kg	7.96E-01	mg/kg	M		mg/kg-day		$(mg/kg\text{-}day)^{-1}$	
	(total)										
										Total Risk Across All Exposure Routes/Pathways	**1.1E-12**

(1) Specify Medium-Specific (M) or Route-Specific (R) EPC selected for risk calculation.

Dermal Absorption Fraction from Soil(ABS) (USEPA 2001):

Volatiles - No ABS value provided

Other Metals - No ABS value provided

TABLE 4.5

VALUES OF DAILY INTAKE CALCULATIONS FOR EXPOSURE OF ADOLESCENT TRESPASSERS TO SURFACE SOIL SWMU 1 - MUSTARD GAS BURIAL GROUND NSWC CRANE, INDIANA

Scenario Timeframe: Current/Future
Medium: Surface Soil
Exposure Medium: Surface Soil
Exposure Point: Entire Site
Receptor Population: Trespasser
Receptor Age: Adolescent

Exposure Route	Parameter Code	Parameter Definition	Units	RME Value	RME Rationale/ Reference	CTE Value	CTE Rationale/ Reference	Intake Equation/ Model Name
Ingestion	Csoil	Chemical Concentration in Soil	mg/kg	Max or 95% UCL	U.S. EPA, May 1992	Max or 95% UCL	U.S. EPA, May 1992	Ingestion CDI (mg/kg/day) =
	IR	Ingestion Rate of Soil	mg/day	100	U.S. EPA, May 1993	50	U.S. EPA, May 1993	Csoil x IR x Fi x EF x ED x CF
	Fi	Fraction Ingested	--(3)	1.0	U.S. EPA, May 1993	1.0	U.S. EPA, May 1993	BW x AT
	EF	Exposure Frequency	days/year	26	Professional Judgement	13	1/2 RME value	USEPA, December 1989
	ED	Exposure Duration	years	11	Adolescent, 6 to 17 years	11	Adolescent, 6 to 17 years	
	CF	Conversion Factor	kg/mg	1.0E-06	U.S. EPA, December 1989	1.0E-06	U.S. EPA, December 1989	
	BW	Body Weight	kg	43	U.S. EPA, December 1989	43	U.S. EPA, December 1989	
	AT-C	Averaging Time (Cancer)	days	25,550	U.S. EPA, December 1989	25,550	U.S. EPA, December 1989	
	AT-N	Averaging Time (Non-Cancer)	days	4,015	U.S. EPA, December 1989	4,015	U.S. EPA, December 1989	
Dermal	Csoil	Chemical Concentration in Soil	mg/kg	Max or 95% UCL	U.S. EPA, May 1992	Max or 95% UCL	U.S. EPA, May 1992	Dermal CDI (mg/kg/day) =
	CF	Conversion Factor	kg/mg	1.0E-06	U.S. EPA, December 1989	1.0E-06	U.S. EPA, December 1989	Csoil x CF x SA x AF x ABS x EF x ED
	SA	Skin Surface Area	cm^2/day	3,280	U.S. EPA, August 1997	3,100	U.S. EPA, August 1997	BW x AT
	AF	Soil to Skin Adherence Factor	mg/cm^2	0.2	U.S. EPA, September 2001	0.04	U.S. EPA, September 2001	USEPA, December 1989
	ABS	Dermal Absorption Factor (Solid)	unitless	chemical specific	U.S. EPA, September 2001	chemical specific	U.S. EPA, September 2001	
	EF	Exposure Frequency	days/year	26	Professional Judgement	13	1/2 RME value	
	ED	Exposure Duration	years	11	Adolescent, 6 to 17 years	11	Adolescent, 6 to 17 years	
	BW	Body Weight	kg	43	U.S. EPA, December 1989	43	U.S. EPA, December 1989	
	AT-C	Averaging Time (Cancer)	days	25,550	U.S. EPA, December 1989	25,550	U.S. EPA, December 1989	
	AT-N	Averaging Time (Non-Cancer)	days	4,015	U.S. EPA, December 1989	4,015	U.S. EPA, December 1989	

Surface soil is defined as soil collected from depths of 0 to 2 foot bgs.

CDI = Chronic Daily Intake

Daily Intake Calculations

Ingestion Intake = (IR x Fi x EF x ED x CF) / (BW x AT)
Dermal Intake = (CF x SA x AF x ABS x EF x ED) / (BW x AT)

Cancer Ingestion Intake - RME = 2.60E-08
Noncancer Ingestion Intake - RME = 1.66E-07

Cancer Ingestion Intake - CTE = 6.51E-09
Noncancer Ingestion Intake - CTE = 4.14E-08

Cancer Dermal Intake - RME = 1.71E-07
Noncancer Dermal Intake - RME = 1.09E-06

Cancer Dermal Intake - CTE = 1.61E-08
Noncancer Dermal Intake - CTE = 1.03E-07

TABLE 7.5 - REASONABLE MAXIMUM EXPOSURE (RME)
CALCULATION OF NON-CANCER HAZARDS FROM EXPOSURE OF ADOLESCENT TRESPASSERS TO SURFACE SOIL
SWMU 1 - MUSTARD GAS BURIAL GROUND
NSWC CRANE, INDIANA

Scenario Timeframe: Current/Future
Medium: Surface Soil
Exposure Medium: Surface Soil
Exposure Point: Entire Site
Receptor Population: Trespasser
Receptor Age: Adolescent

Exposure Route	Chemical of Potential Concern	Medium EPC Value	Medium EPC Units	Route EPC Value	Route EPC Units	EPC Selected for Hazard Calculation (1)	Intake (Non-Cancer)	Intake (Non-Cancer) Units	Reference Dose	Reference Dose Units	Reference Concentration	Reference Concentration Units	Hazard Quotient
Ingestion	Methylene Chloride	2.16E-02	mg/kg	2.16E-02	mg/kg	M	3.6E-09	mg/kg-day	6.00E-02	mg/kg-day	NA	NA	6.0E-08
	Aluminum	1.41E+04	mg/kg	1.41E+04	mg/kg	M	2.3E-03	mg/kg-day	1.00E+00	mg/kg-day	NA	NA	2.3E-03
	Iron	2.13E+04	mg/kg	2.13E+04	mg/kg	M	3.5E-03	mg/kg-day	3.00E-01	mg/kg-day	NA	NA	1.2E-02
	Selenium	7.96E-01	mg/kg	7.96E-01	mg/kg	M	1.3E-07	mg/kg-day	5.00E-03	mg/kg-day	NA	NA	2.6E-05
	(total)												**1.4E-02**
Dermal	Methylene Chloride	2.16E-02	mg/kg	2.16E-02	mg/kg	M		mg/kg-day	6.00E-02	mg/kg-day	NA	NA	
	Aluminum	1.41E+04	mg/kg	1.41E+04	mg/kg	M		mg/kg-day	1.00E+00	mg/kg-day	NA	NA	
	Iron	2.13E+04	mg/kg	2.13E+04	mg/kg	M		mg/kg-day	3.00E-01	mg/kg-day	NA	NA	
	Selenium	7.96E-01	mg/kg	7.96E-01	mg/kg	M		mg/kg-day	5.00E-03	mg/kg-day	NA	NA	
	(total)												
										Total Hazard Index Across All Exposure Routes/Pathways			**1.4E-02**

(1) Specify Medium-Specific (M) or Route-Specific (R) EPC selected for hazard calculation.

Dermal Absorption Fraction from Soil(ABS) (USEPA 2001):

Volatiles - No ABS value provided
Other Metals - No ABS value provided

TABLE 8.5 - REASONABLE MAXIMUM EXPOSURE (RME)
CALCULATION OF CANCER RISKS FROM EXPOSURE OF ADOLESCENT TRESAPSSERS TO SURFACE SOIL
SWMU 1 - MUSTARD GAS BURIAL GROUND
NSWC CRANE, INDIANA

Scenario Timeframe: Current/Future
Medium: Surface Soil
Exposure Medium: Surface Soil
Exposure Point: Entire Site
Receptor Population: Trespasser
Receptor Age: Adolescent

Exposure Route	Chemical of Potential Concern	Medium EPC Value	Medium EPC Units	Route EPC Value	Route EPC Units	EPC Selected for Risk Calculation (1)	Intake (Cancer)	Intake (Cancer) Units	Cancer Slope Factor	Cancer Slope Factor Units	Cancer Risk
Ingestion	Methylene Chloride	2.16E-02	mg/kg	2.16E-02	mg/kg	M	5.6E-10	mg/kg-day	7.50E-03	$(mg/kg\text{-}day)^{-1}$	4.2E-12
	Aluminum	1.41E+04	mg/kg	1.41E+04	mg/kg	M	3.7E-04	mg/kg-day		$(mg/kg\text{-}day)^{-1}$	
	Iron	2.13E+04	mg/kg	2.13E+04	mg/kg	M	5.5E-04	mg/kg-day		$(mg/kg\text{-}day)^{-1}$	
	Selenium	7.96E-01	mg/kg	7.96E-01	mg/kg	M	2.1E-08	mg/kg-day		$(mg/kg\text{-}day)^{-1}$	
	(total)										**4.2E-12**
Dermal	Methylene Chloride	2.16E-02	mg/kg	2.16E-02	mg/kg	M		mg/kg-day	7.50E-03	$(mg/kg\text{-}day)^{-1}$	
	Aluminum	1.41E+04	mg/kg	1.41E+04	mg/kg	M		mg/kg-day		$(mg/kg\text{-}day)^{-1}$	
	Iron	2.13E+04	mg/kg	2.13E+04	mg/kg	M		mg/kg-day		$(mg/kg\text{-}day)^{-1}$	
	Selenium	7.96E-01	mg/kg	7.96E-01	mg/kg	M		mg/kg-day		$(mg/kg\text{-}day)^{-1}$	
	(total)										
										Total Risk Across All Exposure Routes/Pathways	**4.2E-12**

(1) Specify Medium-Specific (M) or Route-Specific (R) EPC selected for risk calculation.

Dermal Absorption Fraction from Soil(ABS) (USEPA 2001):

Volatiles - No ABS value provided
Other Metals - No ABS value provided

TABLE 7.5a - CENTRAL TENDENCY EXPOSURE (CTE)
CALCULATION OF NON-CANCER HAZARDS FROM EXPOSURE OF ADOLESCENT TRESPASSERS TO SURFACE SOIL
SWMU 1 - MUSTARD GAS BURIAL GROUND
NSWC CRANE, INDIANA

Scenario Timeframe: Current/Future
Medium: Surface Soil
Exposure Medium: Surface Soil
Exposure Point: Entire Site
Receptor Population: Trespasser
Receptor Age: Adolescent

Exposure Route	Chemical of Potential Concern	Medium EPC Value	Medium EPC Units	Route EPC Value	Route EPC Units	EPC Selected for Hazard Calculation (1)	Intake (Non-Cancer)	Intake (Non-Cancer) Units	Reference Dose	Reference Dose Units	Reference Concentration	Reference Concentration Units	Hazard Quotient
Ingestion	Methylene Chloride	2.16E-02	mg/kg	2.16E-02	mg/kg	M	9.0E-10	mg/kg-day	6.00E-02	mg/kg-day	NA	NA	1.5E-08
	Aluminum	1.41E+04	mg/kg	1.41E+04	mg/kg	M	5.8E-04	mg/kg-day	1.00E+00	mg/kg-day	NA	NA	5.8E-04
	Iron	2.13E+04	mg/kg	2.13E+04	mg/kg	M	8.8E-04	mg/kg-day	3.00E-01	mg/kg-day	NA	NA	2.9E-03
	Selenium	7.96E-01	mg/kg	7.96E-01	mg/kg	M	3.3E-08	mg/kg-day	5.00E-03	mg/kg-day	NA	NA	6.6E-06
	(total)												**3.5E-03**
Dermal	Methylene Chloride	2.16E-02	mg/kg	2.16E-02	mg/kg	M		mg/kg-day	6.00E-02	mg/kg-day	NA	NA	
	Aluminum	1.41E+04	mg/kg	1.41E+04	mg/kg	M		mg/kg-day	1.00E+00	mg/kg-day	NA	NA	
	Iron	2.13E+04	mg/kg	2.13E+04	mg/kg	M		mg/kg-day	3.00E-01	mg/kg-day	NA	NA	
	Selenium	7.96E-01	mg/kg	7.96E-01	mg/kg	M		mg/kg-day	5.00E-03	mg/kg-day	NA	NA	
	(total)												
												Total Hazard Index Across All Exposure Routes/Pathways	**3.5E-03**

(1) Specify Medium-Specific (M) or Route-Specific (R) EPC selected for hazard calculation.

Dermal Absorption Fraction from Soil(ABS) (USEPA 2001):

Volatiles - No ABS value provided
Other Metals - No ABS value provided

TABLE 8.5a - CENTRAL TENDENCY EXPOSURE (CTE)
CALCULATION OF CANCER RISKS FROM EXPOSURE OF ADOLESCENT TRESAPSSERS TO SURFACE SOIL
SWMU 1 - MUSTARD GAS BURIAL GROUND
NSWC CRANE, INDIANA

Scenario Timeframe: Current/Future
Medium: Surface Soil
Exposure Medium: Surface Soil
Exposure Point: Entire Site
Receptor Population: Trespasser
Receptor Age: Adolescent

Exposure Route	Chemical of Potential Concern	Medium EPC Value	Medium EPC Units	Route EPC Value	Route EPC Units	EPC Selected for Risk Calculation (1)	Intake (Cancer)	Intake (Cancer) Units	Cancer Slope Factor	Cancer Slope Factor Units	Cancer Risk
Ingestion	Methylene Chloride	2.16E-02	mg/kg	2.16E-02	mg/kg	M	1.4E-10	mg/kg-day	7.50E-03	$(mg/kg\text{-}day)^{-1}$	1.1E-12
	Aluminum	1.41E+04	mg/kg	1.41E+04	mg/kg	M	9.2E-05	mg/kg-day		$(mg/kg\text{-}day)^{-1}$	
	Iron	2.13E+04	mg/kg	2.13E+04	mg/kg	M	1.4E-04	mg/kg-day		$(mg/kg\text{-}day)^{-1}$	
	Selenium	7.96E-01	mg/kg	7.96E-01	mg/kg	M	5.2E-09	mg/kg-day		$(mg/kg\text{-}day)^{-1}$	
	(total)										**1.1E-12**
Dermal	Methylene Chloride	2.16E-02	mg/kg	2.16E-02	mg/kg	M		mg/kg-day	7.50E-03	$(mg/kg\text{-}day)^{-1}$	
	Aluminum	1.41E+04	mg/kg	1.41E+04	mg/kg	M		mg/kg-day		$(mg/kg\text{-}day)^{-1}$	
	Iron	2.13E+04	mg/kg	2.13E+04	mg/kg	M		mg/kg-day		$(mg/kg\text{-}day)^{-1}$	
	Selenium	7.96E-01	mg/kg	7.96E-01	mg/kg	M		mg/kg-day		$(mg/kg\text{-}day)^{-1}$	
	(total)										
										Total Risk Across All Exposure Routes/Pathways	**1.1E-12**

(1) Specify Medium-Specific (M) or Route-Specific (R) EPC selected for risk calculation.

Dermal Absorption Fraction from Soil(ABS) (USEPA 2001):

Volatiles - No ABS value provided
Other Metals - No ABS value provided

TABLE 4.6

VALUES OF DAILY INTAKE CALCULATIONS FOR EXPOSURE OF
FUTURE ADULT RESIDENTS TO SURFACE SOIL
SWMU 1 - MUSTARD GAS BURIAL GROUND
NSWC CRANE, INDIANA

Scenario Timeframe: Future
Medium: Surface Soil
Exposure Medium: Surface Soil
Exposure Point: Entire Site
Receptor Population: Residents
Receptor Age: Adult

Exposure Route	Parameter Code	Parameter Definition	Units	RME Value	RME Rationale/ Reference	CTE Value	CTE Rationale/ Reference	Intake Equation/ Model Name
Ingestion	Csoil	Chemical Concentration in Soil	mg/kg	Max or 95% UCL	U.S. EPA, May 1992	Max or 95% UCL	U.S. EPA, May 1992	Ingestion CDI (mg/kg/day) =
	IR	Ingestion Rate of Soil	mg/day	100	U.S. EPA, May 1993	50	U.S. EPA, May 1993	Csoil x IR x Fi x EF x ED x CF
	Fi	Fraction ingested	--(3)	1.0	U.S. EPA, May 1993	1.0	U.S. EPA, May 1993	BW x AT
	EF	Exposure Frequency	days/year	350	U.S. EPA, May 1993	350	U.S. EPA, May 1993	USEPA, December 1989
	ED	Exposure Duration	years	24	U.S. EPA, May 1993	7	U.S. EPA, May 1993	
	CF	Conversion Factor	kg/mg	1.0E-06	U.S. EPA, December 1989	1.0E-06	U.S. EPA, December 1989	
	BW	Body Weight	kg	70	U.S. EPA, May 1993	70	U.S. EPA, May 1993	
	AT-C	Averaging Time (Cancer)	days	25,550	U.S. EPA, December 1989	25,550	U.S. EPA, December 1989	
	AT-N	Averaging Time (Non-Cancer)	days	8,760	U.S. EPA, December 1989	2,555	U.S. EPA, December 1989	
Dermal	Csoil	Chemical Concentration in Soil	mg/kg	Max or 95% UCL	U.S. EPA, May 1992	Max or 95% UCL	U.S. EPA, May 1992	Dermal CDI (mg/kg/day) =
	CF	Conversion Factor	kg/mg	1.0E-06	U.S. EPA, December 1989	1.0E-06	U.S. EPA, December 1989	Csoil x CF x SA x AF x ABS x EF x ED
	SA	Skin Surface Area	cm^2/day	5,700	U.S. EPA, September 2001	5,700	U.S. EPA, September 2001	BW x AT
	AF	Soil to Skin Adherence Factor	mg/cm^2	0.07	U.S. EPA, September 2001	0.01	U.S. EPA, September 2001	USEPA, December 1989
	ABS	Dermal Absorption Factor (Solid)	unitless	chemical specific	U.S. EPA, September 2001	chemical specific	U.S. EPA, September 2001	
	EF	Exposure Frequency	days/year	350	U.S. EPA, May 1993	350	U.S. EPA, May 1993	
	ED	Exposure Duration	years	24	U.S. EPA, May 1993	7	U.S. EPA, May 1993	
	BW	Body Weight	kg	70	U.S. EPA, May 1993	70	U.S. EPA, May 1993	
	AT-C	Averaging Time (Cancer)	days	25,550	U.S. EPA, December 1989	25,550	U.S. EPA, December 1989	
	AT-N	Averaging Time (Non-Cancer)	days	8,760	U.S. EPA, December 1989	2,555	U.S. EPA, December 1989	

Surface soil is defined as soil collected from depths of 0 to 2 foot bgs.
CDI = Chronic Daily Intake

Daily Intake Calculations

Ingestion Intake = (IR x Fi x EF x ED x CF) / (BW x AT)
Dermal Intake = (CF x SA x AF x ABS x EF x ED) / (BW x AT)

Cancer Ingestion Intake - RME = 4.70E-07
Noncancer Ingestion Intake - RME = 1.37E-06

Cancer Ingestion Intake - CTE = 6.85E-08
Noncancer Ingestion Intake - CTE = 6.85E-07

Cancer Dermal Intake - RME = 1.87E-06
Noncancer Dermal Intake - RME = 5.47E-06

Cancer Dermal Intake - CTE = 7.81E-08
Noncancer Dermal Intake - CTE = 7.81E-07

TABLE 7.6 - REASONABLE MAXIMUM EXPOSURE (RME)
CALCULATION OF NON-CANCER HAZARDS FROM EXPOSURE OF FUTURE ADULT RESIDENTS TO SURFACE SOIL
SWMU 1 - MUSTARD GAS BURIAL GROUND
NSWC CRANE, INDIANA

Scenario Timeframe: Future
Medium: Surface Soil
Exposure Medium: Surface Soil
Exposure Point: Entire Site
Receptor Population: Residents
Receptor Age: Adult

Exposure Route	Chemical of Potential Concern	Medium EPC Value	Medium EPC Units	Route EPC Value	Route EPC Units	EPC Selected for Hazard Calculation (1)	Intake (Non-Cancer)	Intake (Non-Cancer) Units	Reference Dose	Reference Dose Units	Reference Concentration	Reference Concentration Units	Hazard Quotient
Ingestion	Methylene Chloride	2.16E-02	mg/kg	2.16E-02	mg/kg	M	3.0E-08	mg/kg-day	6.00E-02	mg/kg-day	NA	NA	4.9E-07
	Aluminum	1.41E+04	mg/kg	1.41E+04	mg/kg	M	1.9E-02	mg/kg-day	1.00E+00	mg/kg-day	NA	NA	1.9E-02
	Iron	2.13E+04	mg/kg	2.13E+04	mg/kg	M	2.9E-02	mg/kg-day	3.00E-01	mg/kg-day	NA	NA	9.7E-02
	Selenium	7.96E-01	mg/kg	7.96E-01	mg/kg	M	1.1E-06	mg/kg-day	5.00E-03	mg/kg-day	NA	NA	2.2E-04
	(total)												**1.2E-01**
Dermal	Methylene Chloride	2.16E-02	mg/kg	2.16E-02	mg/kg	M		mg/kg-day	6.00E-02	mg/kg-day	NA	NA	
	Aluminum	1.41E+04	mg/kg	1.41E+04	mg/kg	M		mg/kg-day	1.00E+00	mg/kg-day	NA	NA	
	Iron	2.13E+04	mg/kg	2.13E+04	mg/kg	M		mg/kg-day	3.00E-01	mg/kg-day	NA	NA	
	Selenium	7.96E-01	mg/kg	7.96E-01	mg/kg	M		mg/kg-day	5.00E-03	mg/kg-day	NA	NA	
	(total)												
												Total Hazard Index Across All Exposure Routes/Pathways	**1.2E-01**

(1) Specify Medium-Specific (M) or Route-Specific (R) EPC selected for hazard calculation.

Dermal Absorption Fraction from Soil(ABS) (USEPA 2001):

Volatiles - No ABS value provided
Other Metals - No ABS value provided

TABLE 8.6 - REASONABLE MAXIMUM EXPOSURE (RME)
CALCULATION OF CANCER RISKS FROM EXPOSURE OF FUTURE ADULT RESIDENTS TO SURFACE SOIL
SWMU 1 - MUSTARD GAS BURIAL GROUND
NSWC CRANE, INDIANA

Scenario Timeframe: Future
Medium: Surface Soil
Exposure Medium: Surface Soil
Exposure Point: Entire Site
Receptor Population: Residents
Receptor Age: Adult

Exposure Route	Chemical of Potential Concern	Medium EPC Value	Medium EPC Units	Route EPC Value	Route EPC Units	EPC Selected for Risk Calculation (1)	Intake (Cancer)	Intake (Cancer) Units	Cancer Slope Factor	Cancer Slope Factor Units	Cancer Risk
Ingestion	Methylene Chloride	2.16E-02	mg/kg	2.16E-02	mg/kg	M	1.0E-08	mg/kg-day	7.50E-03	$(mg/kg\text{-}day)^{-1}$	7.6E-11
	Aluminum	1.41E+04	mg/kg	1.41E+04	mg/kg	M	6.6E-03	mg/kg-day		$(mg/kg\text{-}day)^{-1}$	
	Iron	2.13E+04	mg/kg	2.13E+04	mg/kg	M	1.0E-02	mg/kg-day		$(mg/kg\text{-}day)^{-1}$	
	Selenium	7.96E-01	mg/kg	7.96E-01	mg/kg	M	3.7E-07	mg/kg-day		$(mg/kg\text{-}day)^{-1}$	
	(total)										**7.6E-11**
Dermal	Methylene Chloride	2.16E-02	mg/kg	2.16E-02	mg/kg	M		mg/kg-day	7.50E-03	$(mg/kg\text{-}day)^{-1}$	
	Aluminum	1.41E+04	mg/kg	1.41E+04	mg/kg	M		mg/kg-day		$(mg/kg\text{-}day)^{-1}$	
	Iron	2.13E+04	mg/kg	2.13E+04	mg/kg	M		mg/kg-day		$(mg/kg\text{-}day)^{-1}$	
	Selenium	7.96E-01	mg/kg	7.96E-01	mg/kg	M		mg/kg-day		$(mg/kg\text{-}day)^{-1}$	
	(total)										
										Total Risk Across All Exposure Routes/Pathways	**7.6E-11**

(1) Specify Medium-Specific (M) or Route-Specific (R) EPC selected for risk calculation.

Dermal Absorption Fraction from Soil(ABS) (USEPA 2001):

Volatiles - No ABS value provided
Other Metals - No ABS value provided

TABLE 7.6a - CENTRAL TENDENCY EXPOSURE (CTE)
CALCULATION OF NON-CANCER HAZARDS FROM EXPOSURE OF FUTURE ADULT RESIDENTS TO SURFACE SOIL
SWMU 1 - MUSTARD GAS BURIAL GROUND
NSWC CRANE, INDIANA

Scenario Timeframe: Future
Medium: Surface Soil
Exposure Medium: Surface Soil
Exposure Point: Entire Site
Receptor Population: Residents
Receptor Age: Adult

Exposure Route	Chemical of Potential Concern	Medium EPC Value	Medium EPC Units	Route EPC Value	Route EPC Units	EPC Selected for Hazard Calculation (1)	Intake (Non-Cancer)	Intake (Non-Cancer) Units	Reference Dose	Reference Dose Units	Reference Concentration	Reference Concentration Units	Hazard Quotient
Ingestion	Methylene Chloride	2.16E-02	mg/kg	2.16E-02	mg/kg	M	1.5E-08	mg/kg-day	6.00E-02	mg/kg-day	NA	NA	2.5E-07
	Aluminum	1.41E+04	mg/kg	1.41E+04	mg/kg	M	9.6E-03	mg/kg-day	1.00E+00	mg/kg-day	NA	NA	9.6E-03
	Iron	2.13E+04	mg/kg	2.13E+04	mg/kg	M	1.5E-02	mg/kg-day	3.00E-01	mg/kg-day	NA	NA	4.9E-02
	Selenium	7.96E-01	mg/kg	7.96E-01	mg/kg	M	5.5E-07	mg/kg-day	5.00E-03	mg/kg-day	NA	NA	1.1E-04
	(total)												**5.8E-02**
Dermal	Methylene Chloride	2.16E-02	mg/kg	2.16E-02	mg/kg	M		mg/kg-day	6.00E-02	mg/kg-day	NA	NA	
	Aluminum	1.41E+04	mg/kg	1.41E+04	mg/kg	M		mg/kg-day	1.00E+00	mg/kg-day	NA	NA	
	Iron	2.13E+04	mg/kg	2.13E+04	mg/kg	M		mg/kg-day	3.00E-01	mg/kg-day	NA	NA	
	Selenium	7.96E-01	mg/kg	7.96E-01	mg/kg	M		mg/kg-day	5.00E-03	mg/kg-day	NA	NA	
	(total)												
												Total Hazard Index Across All Exposure Routes/Pathways	**5.8E-02**

(1) Specify Medium-Specific (M) or Route-Specific (R) EPC selected for hazard calculation.

Dermal Absorption Fraction from Soil(ABS) (USEPA 2001):

Volatiles - No ABS value provided
Other Metals - No ABS value provided

TABLE 8.6a - CENTRAL TENDENCY EXPOSURE (CTE)
CALCULATION OF CANCER RISKS FROM EXPOSURE OF FUTURE ADULT RESIDENTS TO SURFACE SOIL
SWMU 1 - MUSTARD GAS BURIAL GROUND
NSWC CRANE, INDIANA

Scenario Timeframe: Future
Medium: Surface Soil
Exposure Medium: Surface Soil
Exposure Point: Entire Site
Receptor Population: Residents
Receptor Age: Adult

Exposure Route	Chemical of Potential Concern	Medium EPC Value	Medium EPC Units	Route EPC Value	Route EPC Units	EPC Selected for Risk Calculation (1)	Intake (Cancer)	Intake (Cancer) Units	Cancer Slope Factor	Cancer Slope Factor Units	Cancer Risk
Ingestion	Methylene Chloride	2.16E-02	mg/kg	2.16E-02	mg/kg	M	1.5E-09	mg/kg-day	7.50E-03	$(mg/kg\text{-}day)^{-1}$	1.1E-11
	Aluminum	1.41E+04	mg/kg	1.41E+04	mg/kg	M	9.6E-04	mg/kg-day		$(mg/kg\text{-}day)^{-1}$	
	Iron	2.13E+04	mg/kg	2.13E+04	mg/kg	M	1.5E-03	mg/kg-day		$(mg/kg\text{-}day)^{-1}$	
	Selenium	7.96E-01	mg/kg	7.96E-01	mg/kg	M	5.5E-08	mg/kg-day		$(mg/kg\text{-}day)^{-1}$	
	(total)										**1.1E-11**
Dermal	Methylene Chloride	2.16E-02	mg/kg	2.16E-02	mg/kg	M		mg/kg-day	7.50E-03	$(mg/kg\text{-}day)^{-1}$	
	Aluminum	1.41E+04	mg/kg	1.41E+04	mg/kg	M		mg/kg-day		$(mg/kg\text{-}day)^{-1}$	
	Iron	2.13E+04	mg/kg	2.13E+04	mg/kg	M		mg/kg-day		$(mg/kg\text{-}day)^{-1}$	
	Selenium	7.96E-01	mg/kg	7.96E-01	mg/kg	M		mg/kg-day		$(mg/kg\text{-}day)^{-1}$	
	(total)										
										Total Risk Across All Exposure Routes/Pathways	**1.1E-11**

(1) Specify Medium-Specific (M) or Route-Specific (R) EPC selected for risk calculation.

Dermal Absorption Fraction from Soil(ABS) (USEPA 2001):

Volatiles - No ABS value provided

Other Metals - No ABS value provided

TABLE 4.7

VALUES OF DAILY INTAKE CALCULATIONS FOR EXPOSURE OF
FUTURE CHILD RESIDENTS TO SURFACE SOIL
SWMU 1 - MUSTARD GAS BURIAL GROUND
NSWC CRANE, INDIANA

Scenario Timeframe: Future
Medium: Surface Soil
Exposure Medium: Surface Soil
Exposure Point: Entire Site
Receptor Population: Residents
Receptor Age: Child

Exposure Route	Parameter Code	Parameter Definition	Units	RME Value	RME Rationale/ Reference	CTE Value	CTE Rationale/ Reference	Intake Equation/ Model Name
Ingestion	Csoil	Chemical Concentration in Soil	mg/kg	Max or 95% UCL	U.S. EPA, May 1992	Max or 95% UCL	U.S. EPA, May 1992	Ingestion CDI (mg/kg/day) =
	IR	Ingestion Rate of Soil	mg/day	200	U.S. EPA, May 1993	100	U.S. EPA, May 1993	Csoil x IR x Fi x EF x ED x CF
	Fi	Fraction ingested	--(3)	1.0	U.S. EPA, May 1993	1.0	U.S. EPA, May 1993	BW x AT
	EF	Exposure Frequency	days/year	350	U.S. EPA, May 1993	350	U.S. EPA, May 1993	USEPA, December 1989
	ED	Exposure Duration	years	6	U.S. EPA, May 1993	2	U.S. EPA, May 1993	
	CF	Conversion Factor	kg/mg	1.0E-06	U.S. EPA, December 1989	1.0E-06	U.S. EPA, December 1989	
	BW	Body Weight	kg	15	U.S. EPA, May 1993	15	U.S. EPA, May 1993	
	AT-C	Averaging Time (Cancer)	days	25,550	U.S. EPA, December 1989	25,550	U.S. EPA, December 1989	
	AT-N	Averaging Time (Non-Cancer)	days	2,190	U.S. EPA, December 1989	730	U.S. EPA, December 1989	
Dermal	Csoil	Chemical Concentration in Soil	mg/kg	Max or 95% UCL	U.S. EPA, May 1992	Max or 95% UCL	U.S. EPA, May 1992	Dermal CDI (mg/kg/day) =
	CF	Conversion Factor	kg/mg	1.0E-06	U.S. EPA, December 1989	1.0E-06	U.S. EPA, December 1989	Csoil x CF x SA x AF x ABS x EF x ED
	SA	Skin Surface Area	cm^2/day	2,800	U.S. EPA, September 2001	2,800	U.S. EPA, September 2001	BW x AT
	AF	Soil to Skin Adherence Factor	mg/cm^2	0.2	U.S. EPA, September 2001	0.04	U.S. EPA, September 2001	USEPA, December 1989
	ABS	Dermal Absorption Factor (Solid)	unitless	chemical specific	U.S. EPA, September 2001	chemical specific	U.S. EPA, September 2001	
	EF	Exposure Frequency	days/year	350	U.S. EPA, May 1993	350	U.S. EPA, May 1993	
	ED	Exposure Duration	years	6	U.S. EPA, May 1993	2	U.S. EPA, May 1993	
	BW	Body Weight	kg	15	U.S. EPA, May 1993	15	U.S. EPA, May 1993	
	AT-C	Averaging Time (Cancer)	days	25,550	U.S. EPA, December 1989	25,550	U.S. EPA, December 1989	
	AT-N	Averaging Time (Non-Cancer)	days	2,190	U.S. EPA, December 1989	730	U.S. EPA, December 1989	

Surface soil is defined as soil collected from depths of 0 to 2 foot bgs.
CDI = Chronic Daily Intake

Daily Intake Calculations

Ingestion Intake = (IR x Fi x EF x ED x CF) / (BW x AT)
Dermal Intake = (CF x SA x AF x ABS x EF x ED) / (BW x AT)

Cancer Ingestion Intake - RME = 1.10E-06
Noncancer Ingestion Intake - RME = 1.28E-05

Cancer Ingestion Intake - CTE = 1.83E-07
Noncancer Ingestion Intake - CTE = 6.39E-06

Cancer Dermal Intake - RME = 3.07E-06
Noncancer Dermal Intake - RME = 3.58E-05

Cancer Dermal Intake - CTE = 2.05E-07
Noncancer Dermal Intake - CTE = 7.16E-06

TABLE 7.7 - REASONABLE MAXIMUM EXPOSURE (RME)
CALCULATION OF NON-CANCER HAZARDS FROM EXPOSURE OF FUTURE CHILD RESIDENTS TO SURFACE SOIL
SWMU 1 - MUSTARD GAS BURIAL GROUND
NSWC CRANE, INDIANA

Scenario Timeframe: Future
Medium: Surface Soil
Exposure Medium: Surface Soil
Exposure Point: Entire Site
Receptor Population: Residents
Receptor Age: Child

Exposure Route	Chemical of Potential Concern	Medium EPC Value	Medium EPC Units	Route EPC Value	Route EPC Units	EPC Selected for Hazard Calculation (1)	Intake (Non-Cancer)	Intake (Non-Cancer) Units	Reference Dose	Reference Dose Units	Reference Concentration	Reference Concentration Units	Hazard Quotient
Ingestion	Methylene Chloride	2.16E-02	mg/kg	2.16E-02	mg/kg	M	2.8E-07	mg/kg-day	6.00E-02	mg/kg-day	NA	NA	4.6E-06
	Aluminum	1.41E+04	mg/kg	1.41E+04	mg/kg	M	1.8E-01	mg/kg-day	1.00E+00	mg/kg-day	NA	NA	1.8E-01
	Iron	2.13E+04	mg/kg	2.13E+04	mg/kg	M	2.7E-01	mg/kg-day	3.00E-01	mg/kg-day	NA	NA	9.1E-01
	Selenium	7.96E-01	mg/kg	7.96E-01	mg/kg	M	1.0E-05	mg/kg-day	5.00E-03	mg/kg-day	NA	NA	2.0E-03
	(total)												**1.1E+00**
Dermal	Methylene Chloride	2.16E-02	mg/kg	2.16E-02	mg/kg	M		mg/kg-day	6.00E-02	mg/kg-day	NA	NA	
	Aluminum	1.41E+04	mg/kg	1.41E+04	mg/kg	M		mg/kg-day	1.00E+00	mg/kg-day	NA	NA	
	Iron	2.13E+04	mg/kg	2.13E+04	mg/kg	M		mg/kg-day	3.00E-01	mg/kg-day	NA	NA	
	Selenium	7.96E-01	mg/kg	7.96E-01	mg/kg	M		mg/kg-day	5.00E-03	mg/kg-day	NA	NA	
	(total)												
												Total Hazard Index Across All Exposure Routes/Pathways	**1.1E+00**

(1) Specify Medium-Specific (M) or Route-Specific (R) EPC selected for hazard calculation.

Dermal Absorption Fraction from Soil(ABS) (USEPA 2001):

Volatiles - No ABS value provided
Other Metals - No ABS value provided

TABLE 8.7 - REASONABLE MAXIMUM EXPOSURE (RME)
CALCULATION OF CANCER RISKS FROM EXPOSURE OF FUTURE CHILD RESIDENTS TO SURFACE SOIL
SWMU 1 - MUSTARD GAS BURIAL GROUND
NSWC CRANE, INDIANA

Scenario Timeframe: Future
Medium: Surface Soil
Exposure Medium: Surface Soil
Exposure Point: Entire Site
Receptor Population: Residents
Receptor Age: Child

Exposure Route	Chemical of Potential Concern	Medium EPC Value	Medium EPC Units	Route EPC Value	Route EPC Units	EPC Selected for Risk Calculation (1)	Intake (Cancer)	Intake (Cancer) Units	Cancer Slope Factor	Cancer Slope Factor Units	Cancer Risk
Ingestion	Methylene Chloride	2.16E-02	mg/kg	2.16E-02	mg/kg	M	2.4E-08	mg/kg-day	7.50E-03	$(mg/kg\text{-}day)^{-1}$	1.8E-10
	Aluminum	1.41E+04	mg/kg	1.41E+04	mg/kg	M	1.5E-02	mg/kg-day		$(mg/kg\text{-}day)^{-1}$	
	Iron	2.13E+04	mg/kg	2.13E+04	mg/kg	M	2.3E-02	mg/kg-day		$(mg/kg\text{-}day)^{-1}$	
	Selenium	7.96E-01	mg/kg	7.96E-01	mg/kg	M	8.7E-07	mg/kg-day		$(mg/kg\text{-}day)^{-1}$	
	(total)										**1.8E-10**
Dermal	Methylene Chloride	2.16E-02	mg/kg	2.16E-02	mg/kg	M		mg/kg-day	7.50E-03	$(mg/kg\text{-}day)^{-1}$	
	Aluminum	1.41E+04	mg/kg	1.41E+04	mg/kg	M		mg/kg-day		$(mg/kg\text{-}day)^{-1}$	
	Iron	2.13E+04	mg/kg	2.13E+04	mg/kg	M		mg/kg-day		$(mg/kg\text{-}day)^{-1}$	
	Selenium	7.96E-01	mg/kg	7.96E-01	mg/kg	M		mg/kg-day		$(mg/kg\text{-}day)^{-1}$	
	(total)										
										Total Risk Across All Exposure Routes/Pathways	**1.8E-10**

(1) Specify Medium-Specific (M) or Route-Specific (R) EPC selected for risk calculation.

Dermal Absorption Fraction from Soil(ABS) (USEPA 2001):

Volatiles - No ABS value provided

Other Metals - No ABS value provided

TABLE 7.7a - CENTRAL TENDENCY EXPOSURE (CTE)
CALCULATION OF NON-CANCER HAZARDS FROM EXPOSURE OF FUTURE CHILD RESIDENTS TO SURFACE SOIL
SWMU 1 - MUSTARD GAS BURIAL GROUND
NSWC CRANE, INDIANA

Scenario Timeframe: Future
Medium: Surface Soil
Exposure Medium: Surface Soil
Exposure Point: Entire Site
Receptor Population: Residents
Receptor Age: Child

Exposure Route	Chemical of Potential Concern	Medium EPC Value	Medium EPC Units	Route EPC Value	Route EPC Units	EPC Selected for Hazard Calculation (1)	Intake (Non-Cancer)	Intake (Non-Cancer) Units	Reference Dose	Reference Dose Units	Reference Concentration	Reference Concentration Units	Hazard Quotient
Ingestion	Methylene Chloride	2.16E-02	mg/kg	2.16E-02	mg/kg	M	1.4E-07	mg/kg-day	6.00E-02	mg/kg-day	NA	NA	2.3E-06
	Aluminum	1.41E+04	mg/kg	1.41E+04	mg/kg	M	9.0E-02	mg/kg-day	1.00E+00	mg/kg-day	NA	NA	9.0E-02
	Iron	2.13E+04	mg/kg	2.13E+04	mg/kg	M	1.4E-01	mg/kg-day	3.00E-01	mg/kg-day	NA	NA	4.5E-01
	Selenium	7.96E-01	mg/kg	7.96E-01	mg/kg	M	5.1E-06	mg/kg-day	5.00E-03	mg/kg-day	NA	NA	1.0E-03
	(total)												**5.4E-01**
Dermal	Methylene Chloride	2.16E-02	mg/kg	2.16E-02	mg/kg	M		mg/kg-day	6.00E-02	mg/kg-day	NA	NA	
	Aluminum	1.41E+04	mg/kg	1.41E+04	mg/kg	M		mg/kg-day	1.00E+00	mg/kg-day	NA	NA	
	Iron	2.13E+04	mg/kg	2.13E+04	mg/kg	M		mg/kg-day	3.00E-01	mg/kg-day	NA	NA	
	Selenium	7.96E-01	mg/kg	7.96E-01	mg/kg	M		mg/kg-day	5.00E-03	mg/kg-day	NA	NA	
	(total)												
												Total Hazard Index Across All Exposure Routes/Pathways	**5.4E-01**

(1) Specify Medium-Specific (M) or Route-Specific (R) EPC selected for hazard calculation.

Dermal Absorption Fraction from Soil(ABS) (USEPA 2001):

Volatiles - No ABS value provided
Other Metals - No ABS value provided

TABLE 8.7a - CENTRAL TENDENCY EXPOSURE (CTE)
CALCULATION OF CANCER RISKS FROM EXPOSURE OF FUTURE CHILD RESIDENTS TO SURFACE SOIL
SWMU 1 - MUSTARD GAS BURIAL GROUND
NSWC CRANE, INDIANA

Scenario Timeframe: Future
Medium: Surface Soil
Exposure Medium: Surface Soil
Exposure Point: Entire Site
Receptor Population: Residents
Receptor Age: Child

Exposure Route	Chemical of Potential Concern	Medium EPC Value	Medium EPC Units	Route EPC Value	Route EPC Units	EPC Selected for Risk Calculation (1)	Intake (Cancer)	Intake (Cancer) Units	Cancer Slope Factor	Cancer Slope Factor Units	Cancer Risk
Ingestion	Methylene Chloride	2.16E-02	mg/kg	2.16E-02	mg/kg	M	4.0E-09	mg/kg-day	7.50E-03	$(mg/kg\text{-}day)^{-1}$	3.0E-11
	Aluminum	1.41E+04	mg/kg	1.41E+04	mg/kg	M	2.6E-03	mg/kg-day		$(mg/kg\text{-}day)^{-1}$	
	Iron	2.13E+04	mg/kg	2.13E+04	mg/kg	M	3.9E-03	mg/kg-day		$(mg/kg\text{-}day)^{-1}$	
	Selenium	7.96E-01	mg/kg	7.96E-01	mg/kg	M	1.5E-07	mg/kg-day		$(mg/kg\text{-}day)^{-1}$	
	(total)										**3.0E-11**
Dermal	Methylene Chloride	2.16E-02	mg/kg	2.16E-02	mg/kg	M		mg/kg-day	7.50E-03	$(mg/kg\text{-}day)^{-1}$	
	Aluminum	1.41E+04	mg/kg	1.41E+04	mg/kg	M		mg/kg-day		$(mg/kg\text{-}day)^{-1}$	
	Iron	2.13E+04	mg/kg	2.13E+04	mg/kg	M		mg/kg-day		$(mg/kg\text{-}day)^{-1}$	
	Selenium	7.96E-01	mg/kg	7.96E-01	mg/kg	M		mg/kg-day		$(mg/kg\text{-}day)^{-1}$	
	(total)										
										Total Risk Across All Exposure Routes/Pathways	**3.0E-11**

(1) Specify Medium-Specific (M) or Route-Specific (R) EPC selected for risk calculation.

Dermal Absorption Fraction from Soil(ABS) (USEPA 2001):

Volatiles - No ABS value provided

Other Metals - No ABS value provided

TABLE 4.8

VALUES OF DAILY INTAKE CALCULATIONS FOR EXPOSURE OF
CONSTRUCTION WORKERS TO GROUNDWATER
SWMU 1 - MUSTARD GAS BURIAL GROUND
NSWC CRANE, INDIANA

Scenario Timeframe: Future
Medium: Groundwater
Exposure Medium: Groundwater
Exposure Point: Entire Site
Receptor Population: Construction Workers
Receptor Age: Adult

Exposure Route	Parameter Code	Parameter Definition	Units	RME Value	RME Rationale/ Reference	CTE Value	CTE Rationale/ Reference	Intake Equation/ Model Name
Dermal	Cgw	Chemical Concentration in Ground Water	mg/L	Maximum	See Table 3.3	Maximum	See Table 3.3	The equations and parameters for for estimating DAevent and the chemical-specific dermally absorbed dose from water (DAD) are provided in Section 6.1 of the text.
	A	Skin Surface Area	cm^2	5,800	USEPA, August 1997	5,000	USEPA, August 1997	
	DAevent	Absorbed Dose per Event	mg/cm^2-event	chemical-specific	USEPA, September 2001	chemical-specific	USEPA, September 2001	
	EV	Event Frequency	event/day	1	Professional Judgement	1	Professional Judgement	
	ED	Exposure Duration	years	1	Professional Judgement	1	Professional Judgement	
	EF	Exposure Frequency	days/year	150	Professional Judgement	150	Professional Judgement	
	t_{event}	Duration of Event	hour/event	2	Professional Judgement	1.5	Professional Judgement	USEPA, September 2001
	t*	Time to reach steady state	hour/event	chemical-specific	USEPA, September 2001	chemical-specific	USEPA, September 2001	
	T	Lag Time	hour/event	chemical-specific	USEPA, September 2001	chemical-specific	USEPA, September 2001	
	B	Bunge Model Constant	dimensionless	chemical-specific	USEPA, September 2001	chemical-specific	USEPA, September 2001	
	Kp	Permeability Coefficient from Water	cm/hour	chemical-specific	USEPA, September 2001	chemical-specific	USEPA, September 2001	
	BW	Body Weight	kg	70	USEPA, March 1991	70	USEPA, March 1991	
	AT-C	Averaging Time (Cancer)	days	25,550	USEPA, December 1989	25,550	USEPA, December 1989	
	AT-N	Averaging Time (Non-Cancer)	days	365	USEPA, December 1989	365	USEPA, December 1989	

Daily Intake Calculations

Dermal Intake = (A x EV x ED x EF) / (BW x AT)

Cancer Dermal Intake(RME) = 4.86E-01
Noncancer Dermal Intake(RME) = 3.41E+01

Cancer Dermal Intake(CTE) = 4.19E-01
Noncancer Dermal Intake(CTE) = 2.94E+01

CALCULATION OF DAevent - EXPOSURES THROUGH DERMAL CONTACT WITH GROUNDWATER
CONSTRUCTION WORKERS - REASONABLE MAXIMUM EXPOSURE (RME)

SITE NAME: **SWMU 1 - MUSTARD GAS BURIAL GROUND**
LOCATION: **NSWC CRANE, INDIANA**
DATE: **09/17/02**

REFERENCES: USEPA, September 2001

DERMAL CONTACT: DAD = (DAevent x EV x ED x EF x A)/(BW x AT)

WHERE: DAD = DERMALLY ABSORBED DOSE (MG/KG/DAY)
DAevent = ABSORBED DOSE PER EVENT (MG/CM^2/EVENT)
A = SKIN SURFACE AREA AVAILABLE FOR CONTACT(CM^2)
EV = EVENT FREQUENCY (EVENTS/DAY)
ED = EXPOSURE DURATION (YEARS)
EF = EXPOSURE FREQUENCY (DAYS/YEAR)
BW = BODY WEIGHT(KG)
AT = AVERAGING TIME (DAYS)

DAevent = Kp x C x tevent x CF
IF tevent < t*, DAevent = 2FA x Kp x C x CF x (6T x tevent/3.1416)$^{0.5}$
IF tevent > t*, DAevent = FA x Kp x C x CF x ((tevent/(1 + B)) + (2T x ((1+3B+3B^2)/(1 + B)^2)))

WHERE: FA = FRACTION ABSORBED (DIMENSIONLESS)
Kp = PERMEABILITY COEFFICIENT FROM WATER (CM/HR)
C = CONCENTRATION OF CHEMICAL IN WATER (MG/L)
tevent = DURATION OF EVENT (HR/EVENT)
CF = CONVERSION FACTOR (1L/1000 CM^3)
t* = TIME IT TAKES TO REACH STEADY-STATE (HOUR/EVENT)
T = LAG TIME (HOUR/EVENT)
B = BUNGE MODEL CONSTANT (DIMENSIONLESS)

CHEMICAL	GW CONC. (mg/L)	ORGANIC OR INORGANIC?	t* (HR)	tevent	T (HR)	Kp (CM/HR)	B	FA	DAevent
1,1,1,2-Tetrachloroethane	2.50E-01	o	2.24E+00	2.00E+00	9.31E-01	6.94E-03	3.46E-02	1	6.54E-06
1,1,2,2-Tetrachloroethane	3.80E+01	o	2.24E+00	2.00E+00	9.31E-01	6.94E-03	3.46E-02	1	9.94E-04
1,1,2-Trichloroethane	6.00E-04	o	1.43E+00	2.00E+00	5.96E-01	6.44E-03	2.86E-02	1	1.22E-08
1,1-Dichloroethene	5.00E-01	o	8.93E-01	2.00E+00	3.72E-01	1.17E-02	4.41E-02	1	1.57E-05
1,2-Dichloroethane	2.50E-01	o	9.18E-01	2.00E+00	3.82E-01	4.20E-03	1.61E-02	1	2.88E-06
Chloroform	8.40E-01	o	1.19E+00	2.00E+00	4.98E-01	6.83E-03	2.87E-02	1	1.70E-05
cis-1,2-Dichloroethene	5.00E-01	o	8.93E-01	2.00E+00	3.72E-01	7.71E-03	2.92E-02	1	1.04E-05
Tetrachloroethene	3.70E-01	o	2.18E+00	2.00E+00	9.06E-01	3.34E-02	1.66E-01	1	4.60E-05
Trichloroethene	1.60E+01	o	1.39E+00	2.00E+00	5.81E-01	1.16E-02	5.13E-02	1	5.82E-04
Bis(2-Ethylhexyl)Phthalate	2.50E-03	o	3.99E+01	2.00E+00	1.66E+01	2.49E-02	1.90E-01	0.8	7.95E-07
Hexachloroethane	5.00E-03	o	5.44E+00	2.00E+00	2.27E+00	3.01E-02	1.78E-01	1	8.85E-07
4-Amino-2,6-Dinitrotoluene	3.25E-04	o	3.21E+00	2.00E+00	1.34E+00	6.41E-04	3.46E-03	1	9.41E-10
Heptachlor	2.00E-05	o	3.19E+01	2.00E+00	1.33E+01	8.64E-03	6.43E-02	1	2.46E-09
Aluminum	2.01E-02	i		2.00E+00		1.00E-03		1	4.02E-08
Antimony	2.55E-03	i		2.00E+00		1.00E-03		1	5.10E-09
Arsenic	1.10E-03	i		2.00E+00		1.00E-03		1	2.20E-09
Iron	2.21E-02	i		2.00E+00		1.00E-03		1	4.42E-08
Manganese	4.34E-01	i		2.00E+00		1.00E-03		1	8.68E-07
Nickel	4.14E-02	i		2.00E+00		2.00E-04		1	1.66E-08
Strontium	2.57E-01	i		2.00E+00		1.00E-03		1	5.14E-07

TABLE 7.8 - REASONABLE MAXIMUM EXPOSURE (RME)
CALCULATION OF NON-CANCER HAZARDS FROM EXPOSURE OF CONSTRUCTION WORKERS TO GROUNDWATER
SWMU 1 - MUSTARD GAS BURIAL GROUND
NSWC CRANE, INDIANA

Scenario Timeframe: Future
Medium: Groundwater
Exposure Medium: Groundwater
Exposure Point: Entire Site
Receptor Population: Construction Workers
Receptor Age: Adult

Exposure Route	Chemical of Potential Concern	Medium EPC Value	Medium EPC Units	Route EPC Value	Route EPC Units	EPC Selected for Hazard Calculation (1)	Intake (Non-Cancer)	Intake (Non-Cancer) Units	Reference Dose	Reference Dose Units	Reference Concentration	Reference Concentration Units	Hazard Quotient
Dermal	1,1,1,2-Tetrachloroethane	2.50E-01	mg/L	2.50E-01	mg/L	M	2.2E-04	mg/kg-day	3.00E-02	mg/kg-day	NA	NA	7.4E-03
	1,1,2,2-Tetrachloroethane	3.80E+01	mg/L	3.80E+01	mg/L	M	3.4E-02	mg/kg-day	6.00E-02	mg/kg-day	NA	NA	5.6E-01
	1,1,2-Trichloroethane	6.00E-04	mg/L	6.00E-04	mg/L	M	4.2E-07	mg/kg-day	4.00E-03	mg/kg-day	NA	NA	1.0E-04
	1,1-Dichloroethene	5.00E-01	mg/L	5.00E-01	mg/L	M	5.3E-04	mg/kg-day	5.00E-02	mg/kg-day	NA	NA	1.1E-02
	1,2-Dichloroethane	2.50E-01	mg/L	2.50E-01	mg/L	M	9.8E-05	mg/kg-day	3.00E-02	mg/kg-day	NA	NA	3.3E-03
	Chloroform	8.40E-01	mg/L	8.40E-01	mg/L	M	5.8E-04	mg/kg-day	1.00E-02	mg/kg-day	NA	NA	5.8E-02
	cis-1,2-Dichloroethene	5.00E-01	mg/L	5.00E-01	mg/L	M	3.6E-04	mg/kg-day	1.00E-02	mg/kg-day	NA	NA	3.6E-02
	Tetrachloroethene	3.70E-01	mg/L	3.70E-01	mg/L	M	1.6E-03	mg/kg-day	1.00E-02	mg/kg-day	NA	NA	1.6E-01
	Trichloroethene	1.60E+01	mg/L	1.60E+01	mg/L	M	2.0E-02	mg/kg-day	3.00E-04	mg/kg-day	NA	NA	6.6E+01
	Bis(2-Ethylhexyl)Phthalate	2.50E-03	mg/L	2.50E-03	mg/L	M	2.7E-05	mg/kg-day	2.00E-02	mg/kg-day	NA	NA	1.4E-03
	Hexachloroethane	5.00E-03	mg/L	5.00E-03	mg/L	M	3.0E-05	mg/kg-day	1.00E-03	mg/kg-day	NA	NA	3.0E-02
	4-Amino-2,6-Dinitrotoluene	3.25E-04	mg/L	3.25E-04	mg/L	M	3.2E-08	mg/kg-day	6.00E-05	mg/kg-day	NA	NA	5.3E-04
	Heptachlor	2.00E-05	mg/L	2.00E-05	mg/L	M	8.4E-08	mg/kg-day	5.00E-04	mg/kg-day	NA	NA	1.7E-04
	Aluminum	2.01E-02	mg/L	2.01E-02	mg/L	M	1.4E-06	mg/kg-day	1.00E+00	mg/kg-day	NA	NA	1.4E-06
	Antimony	2.55E-03	mg/L	2.55E-03	mg/L	M	1.7E-07	mg/kg-day	6.00E-05	mg/kg-day	NA	NA	2.9E-03
	Arsenic	1.10E-03	mg/L	1.10E-03	mg/L	M	7.5E-08	mg/kg-day	3.00E-04	mg/kg-day	NA	NA	2.5E-04
	Iron	2.21E-02	mg/L	2.21E-02	mg/L	M	1.5E-06	mg/kg-day	3.00E-01	mg/kg-day	NA	NA	5.0E-06
	Manganese	4.34E-01	mg/L	4.34E-01	mg/L	M	3.0E-05	mg/kg-day	9.60E-04	mg/kg-day	NA	NA	3.1E-02
	Nickel	4.14E-02	mg/L	4.14E-02	mg/L	M	5.6E-07	mg/kg-day	8.00E-04	mg/kg-day	NA	NA	7.0E-04
	Strontium	2.57E-01	mg/L	2.57E-01	mg/L	M	1.8E-05	mg/kg-day	6.00E-01	mg/kg-day	NA	NA	2.9E-05
	(total)												**6.7E+01**
												Total Hazard Index Across All Exposure Routes/Pathways	**6.7E+01**

(1) Specify Medium-Specific (M) or Route-Specific (R) EPC selected for hazard calculation.

TABLE 8.8 - REASONABLE MAXIMUM EXPOSURE (RME)
CALCULATION OF CANCER RISKS FROM EXPOSURE OF CONSTRUCTION WORKERS TO GROUNDWATER
SWMU 1 - MUSTARD GAS BURIAL GROUND
NSWC CRANE, INDIANA

Scenario Timeframe: Future
Medium: Groundwater
Exposure Medium: Groundwater
Exposure Point: Entire Site
Receptor Population: Construction Workers
Receptor Age: Adult

Exposure Route	Chemical of Potential Concern	Medium EPC Value	Medium EPC Units	Route EPC Value	Route EPC Units	EPC Selected for Risk Calculation (1)	Intake (Cancer)	Intake (Cancer) Units	Cancer Slope Factor	Cancer Slope Factor Units	Cancer Risk
Dermal	1,1,1,2-Tetrachloroethane	2.50E-01	mg/L	2.50E-01	mg/L	M	3.2E-06	mg/kg-day	2.60E-02	$(mg/kg\text{-}day)^{-1}$	8.3E-08
	1,1,2,2-Tetrachloroethane	3.80E+01	mg/L	3.80E+01	mg/L	M	4.8E-04	mg/kg-day	2.00E-01	$(mg/kg\text{-}day)^{-1}$	9.7E-05
	1,1,2-Trichloroethane	6.00E-04	mg/L	6.00E-04	mg/L	M	6.0E-09	mg/kg-day	5.70E-02	$(mg/kg\text{-}day)^{-1}$	3.4E-10
	1,1-Dichloroethene	5.00E-01	mg/L	5.00E-01	mg/L	M	7.6E-06	mg/kg-day		$(mg/kg\text{-}day)^{-1}$	
	1,2-Dichloroethane	2.50E-01	mg/L	2.50E-01	mg/L	M	1.4E-06	mg/kg-day	9.10E-02	$(mg/kg\text{-}day)^{-1}$	1.3E-07
	Chloroform	8.40E-01	mg/L	8.40E-01	mg/L	M	8.3E-06	mg/kg-day	6.10E-03	$(mg/kg\text{-}day)^{-1}$	5.0E-08
	cis-1,2-Dichloroethene	5.00E-01	mg/L	5.00E-01	mg/L	M	5.1E-06	mg/kg-day		$(mg/kg\text{-}day)^{-1}$	
	Tetrachloroethene	3.70E-01	mg/L	3.70E-01	mg/L	M	2.2E-05	mg/kg-day	5.20E-02	$(mg/kg\text{-}day)^{-1}$	1.2E-06
	Trichloroethene	1.60E+01	mg/L	1.60E+01	mg/L	M	2.8E-04	mg/kg-day	4.00E-01	$(mg/kg\text{-}day)^{-1}$	1.1E-04
	Bis(2-Ethylhexyl)Phthalate	2.50E-03	mg/L	2.50E-03	mg/L	M	3.9E-07	mg/kg-day	1.40E-02	$(mg/kg\text{-}day)^{-1}$	5.4E-09
	Hexachloroethane	5.00E-03	mg/L	5.00E-03	mg/L	M	4.3E-07	mg/kg-day	1.40E-02	$(mg/kg\text{-}day)^{-1}$	6.0E-09
	4-Amino-2,6-Dinitrotoluene	3.25E-04	mg/L	3.25E-04	mg/L	M	4.6E-10	mg/kg-day		$(mg/kg\text{-}day)^{-1}$	
	Heptachlor	2.00E-05	mg/L	2.00E-05	mg/L	M	1.2E-09	mg/kg-day	4.50E+00	$(mg/kg\text{-}day)^{-1}$	5.4E-09
	Aluminum	2.01E-02	mg/L	2.01E-02	mg/L	M	2.0E-08	mg/kg-day		$(mg/kg\text{-}day)^{-1}$	
	Antimony	2.55E-03	mg/L	2.55E-03	mg/L	M	2.5E-09	mg/kg-day		$(mg/kg\text{-}day)^{-1}$	
	Arsenic	1.10E-03	mg/L	1.10E-03	mg/L	M	1.1E-09	mg/kg-day	1.50E+00	$(mg/kg\text{-}day)^{-1}$	1.6E-09
	Iron	2.21E-02	mg/L	2.21E-02	mg/L	M	2.2E-08	mg/kg-day		$(mg/kg\text{-}day)^{-1}$	
	Manganese	4.34E-01	mg/L	4.34E-01	mg/L	M	4.2E-07	mg/kg-day		$(mg/kg\text{-}day)^{-1}$	
	Nickel	4.14E-02	mg/L	4.14E-02	mg/L	M	8.1E-09	mg/kg-day		$(mg/kg\text{-}day)^{-1}$	
	Strontium	2.57E-01	mg/L	2.57E-01	mg/L	M	2.5E-07	mg/kg-day		$(mg/kg\text{-}day)^{-1}$	
	(total)										**2.1E-04**
										Total Risk Across All Exposure Routes/Pathways	**2.1E-04**

CALCULATION OF DAevent - EXPOSURES THROUGH DERMAL CONTACT WITH GROUNDWATER
CONSTRUCTION WORKERS - CENTRAL TENDENCY EXPOSURE (CTE)

SITE NAME: **SWMU 1 - MUSTARD GAS BURIAL GROUND**
LOCATION: **NSWC CRANE, INDIANA**
DATE: **09/17/02**

REFERENCES: USEPA, September 2001

DERMAL CONTACT: DAD = (DAevent x EV x ED x EF x A)/(BW x AT)

WHERE: DAD = DERMALLY ABSORBED DOSE (MG/KG/DAY)
DAevent = ABSORBED DOSE PER EVENT (MG/CM^2/EVENT)
A = SKIN SURFACE AREA AVAILABLE FOR CONTACT(CM^2)
EV = EVENT FREQUENCY (EVENTS/DAY)
ED = EXPOSURE DURATION (YEARS)
EF = EXPOSURE FREQUENCY (DAYS/YEAR)
BW = BODY WEIGHT(KG)
AT = AVERAGING TIME (DAYS)

DAevent = Kp x C x tevent x CF
IF tevent < t*, DAevent = 2FA x Kp x C x CF x (6T x tevent/3.1416)$^{0.5}$
IF tevent > t*, DAevent = FA x Kp x C x CF x ((tevent/(1 + B)) + (2T x ((1+3B+3B^2)/(1 + B)^2)))

WHERE: FA = FRACTION ABSORBED (DIMENSIONLESS)
Kp = PERMEABILITY COEFFICIENT FROM WATER (CM/HR)
C = CONCENTRATION OF CHEMICAL IN WATER (MG/L)
tevent = DURATION OF EVENT (HR/EVENT)
CF = CONVERSION FACTOR (1L/1000 CM^3)
t* = TIME IT TAKES TO REACH STEADY-STATE (HOUR/EVENT)
T = LAG TIME (HOUR/EVENT)
B = BUNGE MODEL CONSTANT (DIMENSIONLESS)

CHEMICAL	GW CONC. (mg/L)	ORGANIC OR INORGANIC?	t* (HR)	tevent	T (HR)	Kp (CM/HR)	B	FA	DAevent
1,1,1,2-Tetrachloroethane	2.50E-01	o	2.24E+00	1.50E+00	9.31E-01	6.94E-03	3.46E-02	1	5.66E-06
1,1,2,2-Tetrachloroethane	3.80E+01	o	2.24E+00	1.50E+00	9.31E-01	6.94E-03	3.46E-02	1	8.61E-04
1,1,2-Trichloroethane	6.00E-04	o	1.43E+00	1.50E+00	5.96E-01	6.44E-03	2.86E-02	1	1.04E-08
1,1-Dichloroethene	5.00E-01	o	8.93E-01	1.50E+00	3.72E-01	1.17E-02	4.41E-02	1	1.29E-05
1,2-Dichloroethane	2.50E-01	o	9.18E-01	1.50E+00	3.82E-01	4.20E-03	1.61E-02	1	2.36E-06
Chloroform	8.40E-01	o	1.19E+00	1.50E+00	4.98E-01	6.83E-03	2.87E-02	1	1.42E-05
cis-1,2-Dichloroethene	5.00E-01	o	8.93E-01	1.50E+00	3.72E-01	7.71E-03	2.92E-02	1	8.58E-06
Tetrachloroethene	3.70E-01	o	2.18E+00	1.50E+00	9.06E-01	3.34E-02	1.66E-01	1	3.99E-05
Trichloroethene	1.60E+01	o	1.39E+00	1.50E+00	5.81E-01	1.16E-02	5.13E-02	1	4.93E-04
Bis(2-Ethylhexyl)Phthalate	2.50E-03	o	3.99E+01	1.50E+00	1.66E+01	2.49E-02	1.90E-01	0.8	6.89E-07
Hexachloroethane	5.00E-03	o	5.44E+00	1.50E+00	2.27E+00	3.01E-02	1.78E-01	1	7.67E-07
4-Amino-2,6-Dinitrotoluene	3.25E-04	o	3.21E+00	1.50E+00	1.34E+00	6.41E-04	3.46E-03	1	8.15E-10
Heptachlor	2.00E-05	o	3.19E+01	1.50E+00	1.33E+01	8.64E-03	6.43E-02	1	2.13E-09
Aluminum	2.01E-02	i		1.50E+00		1.00E-03		1	3.02E-08
Antimony	2.55E-03	i		1.50E+00		1.00E-03		1	3.83E-09
Arsenic	1.10E-03	i		1.50E+00		1.00E-03		1	1.65E-09
Iron	2.21E-02	i		1.50E+00		1.00E-03		1	3.32E-08
Manganese	4.34E-01	i		1.50E+00		1.00E-03		1	6.51E-07
Nickel	4.14E-02	i		1.50E+00		2.00E-04		1	1.24E-08
Strontium	2.57E-01	i		1.50E+00		1.00E-03		1	3.86E-07

TABLE 7.8a - CENTRAL TENDENCY EXPOSURE (CTE)
CALCULATION OF NON-CANCER HAZARDS FROM EXPOSURE OF CONSTRUCTION WORKERS TO GROUNDWATER
SWMU 1 - MUSTARD GAS BURIAL GROUND
NSWC CRANE, INDIANA

Scenario Timeframe: Future
Medium: Groundwater
Exposure Medium: Groundwater
Exposure Point: Entire Site
Receptor Population: Construction Workers
Receptor Age: Adult

Exposure Route	Chemical of Potential Concern	Medium EPC Value	Medium EPC Units	Route EPC Value	Route EPC Units	EPC Selected for Hazard Calculation (1)	Intake (Non-Cancer)	Intake (Non-Cancer) Units	Reference Dose	Reference Dose Units	Reference Concentration	Reference Concentration Units	Hazard Quotient
Dermal	1,1,1,2-Tetrachloroethane	2.50E-01	mg/L	2.50E-01	mg/L	M	1.7E-04	mg/kg-day	3.00E-02	mg/kg-day	NA	NA	5.5E-03
	1,1,2,2-Tetrachloroethane	3.80E+01	mg/L	3.80E+01	mg/L	M	2.5E-02	mg/kg-day	6.00E-02	mg/kg-day	NA	NA	4.2E-01
	1,1,2-Trichloroethane	6.00E-04	mg/L	6.00E-04	mg/L	M	3.0E-07	mg/kg-day	4.00E-03	mg/kg-day	NA	NA	7.6E-05
	1,1-Dichloroethene	5.00E-01	mg/L	5.00E-01	mg/L	M	3.8E-04	mg/kg-day	5.00E-02	mg/kg-day	NA	NA	7.6E-03
	1,2-Dichloroethane	2.50E-01	mg/L	2.50E-01	mg/L	M	6.9E-05	mg/kg-day	3.00E-02	mg/kg-day	NA	NA	2.3E-03
	Chloroform	8.40E-01	mg/L	8.40E-01	mg/L	M	4.2E-04	mg/kg-day	1.00E-02	mg/kg-day	NA	NA	4.2E-02
	cis-1,2-Dichloroethene	5.00E-01	mg/L	5.00E-01	mg/L	M	2.5E-04	mg/kg-day	1.00E-02	mg/kg-day	NA	NA	2.5E-02
	Tetrachloroethene	3.70E-01	mg/L	3.70E-01	mg/L	M	1.2E-03	mg/kg-day	1.00E-02	mg/kg-day	NA	NA	1.2E-01
	Trichloroethene	1.60E+01	mg/L	1.60E+01	mg/L	M	1.4E-02	mg/kg-day	3.00E-04	mg/kg-day	NA	NA	4.8E+01
	Bis(2-Ethylhexyl)Phthalate	2.50E-03	mg/L	2.50E-03	mg/L	M	2.0E-05	mg/kg-day	2.00E-02	mg/kg-day	NA	NA	1.0E-03
	Hexachloroethane	5.00E-03	mg/L	5.00E-03	mg/L	M	2.3E-05	mg/kg-day	1.00E-03	mg/kg-day	NA	NA	2.3E-02
	4-Amino-2,6-Dinitrotoluene	3.25E-04	mg/L	3.25E-04	mg/L	M	2.4E-08	mg/kg-day	6.00E-05	mg/kg-day	NA	NA	4.0E-04
	Heptachlor	2.00E-05	mg/L	2.00E-05	mg/L	M	6.3E-08	mg/kg-day	5.00E-04	mg/kg-day	NA	NA	1.3E-04
	Aluminum	2.01E-02	mg/L	2.01E-02	mg/L	M	8.9E-07	mg/kg-day	1.00E+00	mg/kg-day	NA	NA	8.9E-07
	Antimony	2.55E-03	mg/L	2.55E-03	mg/L	M	1.1E-07	mg/kg-day	6.00E-05	mg/kg-day	NA	NA	1.9E-03
	Arsenic	1.10E-03	mg/L	1.10E-03	mg/L	M	4.8E-08	mg/kg-day	3.00E-04	mg/kg-day	NA	NA	1.6E-04
	Iron	2.21E-02	mg/L	2.21E-02	mg/L	M	9.7E-07	mg/kg-day	3.00E-01	mg/kg-day	NA	NA	3.2E-06
	Manganese	4.34E-01	mg/L	4.34E-01	mg/L	M	1.9E-05	mg/kg-day	9.60E-04	mg/kg-day	NA	NA	2.0E-02
	Nickel	4.14E-02	mg/L	4.14E-02	mg/L	M	3.6E-07	mg/kg-day	8.00E-04	mg/kg-day	NA	NA	4.6E-04
	Strontium	2.57E-01	mg/L	2.57E-01	mg/L	M	1.1E-05	mg/kg-day	6.00E-01	mg/kg-day	NA	NA	1.9E-05
	(total)												**4.9E+01**
												Total Hazard Index Across All Exposure Routes/Pathways	**4.9E+01**

(1) Specify Medium-Specific (M) or Route-Specific (R) EPC selected for hazard calculation.

TABLE 8.8a - CENTRAL TENDENCY EXPOSURE (CTE)
CALCULATION OF CANCER RISKS FROM EXPOSURE OF CONSTRUCTION WORKERS TO GROUNDWATER
SWMU 1 - MUSTARD GAS BURIAL GROUND
NSWC CRANE, INDIANA

Scenario Timeframe: Future
Medium: Groundwater
Exposure Medium: Groundwater
Exposure Point: Entire Site
Receptor Population: Construction Workers
Receptor Age: Adult

Exposure Route	Chemical of Potential Concern	Medium EPC Value	Medium EPC Units	Route EPC Value	Route EPC Units	EPC Selected for Risk Calculation (1)	Intake (Cancer)	Intake (Cancer) Units	Cancer Slope Factor	Cancer Slope Factor Units	Cancer Risk
Dermal	1,1,1,2-Tetrachloroethane	2.50E-01	mg/L	2.50E-01	mg/L	M	2.4E-06	mg/kg-day	2.60E-02	$(mg/kg\text{-}day)^{-1}$	6.2E-08
	1,1,2,2-Tetrachloroethane	3.80E+01	mg/L	3.80E+01	mg/L	M	3.6E-04	mg/kg-day	2.00E-01	$(mg/kg\text{-}day)^{-1}$	7.2E-05
	1,1,2-Trichloroethane	6.00E-04	mg/L	6.00E-04	mg/L	M	4.3E-09	mg/kg-day	5.70E-02	$(mg/kg\text{-}day)^{-1}$	2.5E-10
	1,1-Dichloroethene	5.00E-01	mg/L	5.00E-01	mg/L	M	5.4E-06	mg/kg-day		$(mg/kg\text{-}day)^{-1}$	
	1,2-Dichloroethane	2.50E-01	mg/L	2.50E-01	mg/L	M	9.9E-07	mg/kg-day	9.10E-02	$(mg/kg\text{-}day)^{-1}$	9.0E-08
	Chloroform	8.40E-01	mg/L	8.40E-01	mg/L	M	6.0E-06	mg/kg-day	6.10E-03	$(mg/kg\text{-}day)^{-1}$	3.6E-08
	cis-1,2-Dichloroethene	5.00E-01	mg/L	5.00E-01	mg/L	M	3.6E-06	mg/kg-day		$(mg/kg\text{-}day)^{-1}$	
	Tetrachloroethene	3.70E-01	mg/L	3.70E-01	mg/L	M	1.7E-05	mg/kg-day	5.20E-02	$(mg/kg\text{-}day)^{-1}$	8.7E-07
	Trichloroethene	1.60E+01	mg/L	1.60E+01	mg/L	M	2.1E-04	mg/kg-day	4.00E-01	$(mg/kg\text{-}day)^{-1}$	8.3E-05
	Bis(2-Ethylhexyl)Phthalate	2.50E-03	mg/L	2.50E-03	mg/L	M	2.9E-07	mg/kg-day	1.40E-02	$(mg/kg\text{-}day)^{-1}$	4.0E-09
	Hexachlorcethane	5.00E-03	mg/L	5.00E-03	mg/L	M	3.2E-07	mg/kg-day	1.40E-02	$(mg/kg\text{-}day)^{-1}$	4.5E-09
	4-Amino-2,6-Dinitrotoluene	3.25E-04	mg/L	3.25E-04	mg/L	M	3.4E-10	mg/kg-day		$(mg/kg\text{-}day)^{-1}$	
	Heptachlor	2.00E-05	mg/L	2.00E-05	mg/L	M	8.9E-10	mg/kg-day	4.50E+00	$(mg/kg\text{-}day)^{-1}$	4.0E-09
	Aluminum	2.01E-02	mg/L	2.01E-02	mg/L	M	1.3E-08	mg/kg-day		$(mg/kg\text{-}day)^{-1}$	
	Antimony	2.55E-03	mg/L	2.55E-03	mg/L	M	1.6E-09	mg/kg-day		$(mg/kg\text{-}day)^{-1}$	
	Arsenic	1.10E-03	mg/L	1.10E-03	mg/L	M	6.9E-10	mg/kg-day	1.50E+00	$(mg/kg\text{-}day)^{-1}$	1.0E-09
	Iron	2.21E-02	mg/L	2.21E-02	mg/L	M	1.4E-08	mg/kg-day		$(mg/kg\text{-}day)^{-1}$	
	Manganese	4.34E-01	mg/L	4.34E-01	mg/L	M	2.7E-07	mg/kg-day		$(mg/kg\text{-}day)^{-1}$	
	Nickel	4.14E-02	mg/L	4.14E-02	mg/L	M	5.2E-09	mg/kg-day		$(mg/kg\text{-}day)^{-1}$	
	Strontium	2.57E-01	mg/L	2.57E-01	mg/L	M	1.6E-07	mg/kg-day		$(mg/kg\text{-}day)^{-1}$	
	(total)										**1.6E-04**
										Total Risk Across All Exposure Routes/Pathways	**1.6E-04**

TABLE 4.9

VALUES OF DAILY INTAKE CALCULATIONS FOR EXPOSURE OF
FUTURE ADULT RESIDENTS TO GROUNDWATER
SWMU 1 - MUSTARD GAS BURIAL GROUND
NSWC CRANE, INDIANA

Scenario Timeframe: Future
Medium: Groundwater
Exposure Medium: Groundwater
Exposure Point: Entire Site
Receptor Population: Resident
Receptor Age: Adult

Exposure Route	Parameter Code	Parameter Definition	Units	RME Value	RME Rationale/ Reference	CTE Value	CTE Rationale/ Reference	Intake Equation/ Model Name
Ingestion	Cgw	Chemical Concentration In Ground Water	mg/L	Maximum	See Table 3.3	Maximum	See Table 3.3	Ingestion CDI (mg/kg/day) =
	IRgw	Water Ingestion Rate	L/day	2	USEPA, March 1991	1.4	USEPA, May 1993	Cgw x IRgw x EF x ED
	EF	Exposure Frequency	days/year	350	USEPA, March 1991	350	USEPA, March 1991	BW x AT
	ED	Exposure Duration	years	24	USEPA, March 1991	7	USEPA, May 1993	CDI = Chronic Daily Intake
	BW	Body Weight	kg	70	USEPA, March 1991	70	USEPA, March 1991	USEPA, December 1989
	AT-C	Averaging Time (Cancer)	days	25,550	USEPA, December 1989	25,550	USEPA, December 1989	
	AT-N	Averaging Time (Non-Cancer)	days	8,760	USEPA, December 1989	2,555	USEPA, December 1989	
Dermal	Cgw	Chemical Concentration in Ground Water	mg/L	Maximum	See Table 3.3	Maximum	See Table 3.3	The equations and parameters for
	A	Skin Surface Area	cm^2	18,000	USEPA, September 2001	18,000	USEPA, September 2001	for estimating DAevent and the chemical-
	DAevent	Absorbed Dose per Event	mg/cm^2-event	chemical-specific	USEPA, September 2001	chemical-specific	USEPA, September 2001	specific dermally absorbed dose from
	EV	Event Frequency	event/day	1	Professional Judgement	1	Professional Judgement	water (DAD) are provided in Section 6.1
	ED	Exposure Duration	years	24	USEPA, March 1991	7	USEPA, March 1991	of the text.
	EF	Exposure Frequency	days/year	350	USEPA, March 1991	350	USEPA, March 1991	
	t_{event}	Duration of Event	hour/event	0.25	USEPA, January 1992	0.167	USEPA, January 1992	USEPA, September 2001
	t*	Time to reach steady state	hour/event	chemical-specific	USEPA, September 2001	chemical-specific	USEPA, September 2001	
	T	Lag Time	hour/event	chemical-specific	USEPA, September 2001	chemical-specific	USEPA, September 2001	
	B	Bunge Model Constant	dimensionless	chemical-specific	USEPA, September 2001	chemical-specific	USEPA, September 2001	
	Kp	Permeability Coefficient from Water	cm/hour	chemical-specific	USEPA, September 2001	chemical-specific	USEPA, September 2001	
	BW	Body Weight	kg	70	USEPA, March 1991	70	USEPA, March 1991	
	AT-C	Averaging Time (Cancer)	days	25,550	USEPA, December 1989	25,550	USEPA, December 1989	
	AT-N	Averaging Time (Non-Cancer)	days	8,760	USEPA, December 1989	2,555	USEPA, December 1989	

Daily Intake Calculations
Ingestion Intake = (IRgw x EF x ED) / (BW x AT)
Dermal Intake = (A x EV x ED x EF) / (BW x AT)

Cancer Ingestion Intake(RME) = 9.39E-03
Noncancer Ingestion Intake(RME) = 2.74E-02

Cancer Ingestion Intake(CTE) = 1.92E-03
Noncancer Ingestion Intake(CTE) = 1.92E-02

Cancer Dermal Intake(RME) = 8.45E+01
Noncancer Dermal Intake(RME) = 2.47E+02

Cancer Dermal Intake(CTE) = 2.47E+01
Noncancer Dermal Intake(CTE) = 2.47E+02

CALCULATION OF DAevent - EXPOSURES THROUGH DERMAL CONTACT WITH GROUNDWATER
RESIDENTIAL ADULT - REASONABLE MAXIMUM EXPOSURE (RME)

SITE NAME: SWMU 1 - MUSTARD GAS BURIAL GROUND
LOCATION: NSWC CRANE, INDIANA
DATE: 09/17/02

REFERENCES: USEPA, September 2001

DERMAL CONTACT: DAD = (DAevent x EV x ED x EF x A)/(BW x AT)

WHERE: DAD = DERMALLY ABSORBED DOSE (MG/KG/DAY)
DAevent = ABSORBED DOSE PER EVENT (MG/CM^2/EVENT)
A = SKIN SURFACE AREA AVAILABLE FOR CONTACT(CM^2)
EV = EVENT FREQUENCY (EVENTS/DAY)
ED = EXPOSURE DURATION (YEARS)
EF = EXPOSURE FREQUENCY (DAYS/YEAR)
BW = BODY WEIGHT(KG)
AT = AVERAGING TIME (DAYS)

DAevent = Kp x C x tevent x CF
IF tevent < t*, DAevent = 2FA x Kp x C x CF x (6T x tevent/3.1416)$^{0.5}$
IF tevent > t*, DAevent = FA x Kp x C x CF x ((tevent/(1 + B)) + (2T x ((1+3B+3B^2)/(1 + B)^2)))

WHERE: FA = FRACTION ABSORBED (DIMENSIONLESS)
Kp = PERMEABILITY COEFFICIENT FROM WATER (CM/HR)
C = CONCENTRATION OF CHEMICAL IN WATER (MG/L)
tevent = DURATION OF EVENT (HR/EVENT)
CF = CONVERSION FACTOR (1L/1000 CM^3)
t* = TIME IT TAKES TO REACH STEADY-STATE (HOUR/EVENT)
T = LAG TIME (HOUR/EVENT)
B = BUNGE MODEL CONSTANT (DIMENSIONLESS)

CHEMICAL	GW CONC. (mg/L)	ORGANIC OR INORGANIC?	t* (HR)	tevent	T (HR)	Kp (CM/HR)	B	FA	DAevent
1,1,1,2-Tetrachloroethane	2.50E-01	o	2.24E+00	2.50E-01	9.31E-01	6.94E-03	3.46E-02	1	2.31E-06
1,1,2,2-Tetrachloroethane	3.80E+01	o	2.24E+00	2.50E-01	9.31E-01	6.94E-03	3.46E-02	1	3.52E-04
1,1,2-Trichloroethane	6.00E-04	o	1.43E+00	2.50E-01	5.96E-01	6.44E-03	2.86E-02	1	4.12E-09
1,1-Dichloroethene	5.00E-01	o	8.93E-01	2.50E-01	3.72E-01	1.17E-02	4.41E-02	1	4.92E-06
1,2-Dichloroethane	2.50E-01	o	9.18E-01	2.50E-01	3.82E-01	4.20E-03	1.61E-02	1	8.97E-07
Chloroform	8.40E-01	o	1.19E+00	2.50E-01	4.98E-01	6.83E-03	2.87E-02	1	5.59E-06
cis-1,2-Dichloroethene	5.00E-01	o	8.93E-01	2.50E-01	3.72E-01	7.71E-03	2.92E-02	1	3.25E-06
Tetrachloroethene	3.70E-01	o	2.18E+00	2.50E-01	9.06E-01	3.34E-02	1.66E-01	1	1.63E-05
Trichloroethene	1.60E+01	o	1.39E+00	2.50E-01	5.81E-01	1.16E-02	5.13E-02	1	1.96E-04
Bis(2-Ethylhexyl)Phthalate	2.50E-03	o	3.99E+01	2.50E-01	1.66E+01	2.49E-02	1.90E-01	0.8	2.81E-07
Hexachloroethane	5.00E-03	o	5.44E+00	2.50E-01	2.27E+00	3.01E-02	1.78E-01	1	3.13E-07
4-Amino-2,6-Dinitrotoluene	3.25E-04	o	3.21E+00	2.50E-01	1.34E+00	6.41E-04	3.46E-03	1	3.33E-10
Heptachlor	2.00E-05	o	3.19E+01	2.50E-01	1.33E+01	8.64E-03	6.43E-02	1	8.70E-10
Aluminum	2.01E-02	i		2.50E-01		1.00E-03		1	5.03E-09
Antimony	2.55E-03	i		2.50E-01		1.00E-03		1	6.38E-10
Arsenic	1.10E-03	i		2.50E-01		1.00E-03		1	2.75E-10
Iron	2.21E-02	i		2.50E-01		1.00E-03		1	5.53E-09
Manganese	4.34E-01	i		2.50E-01		1.00E-03		1	1.09E-07
Nickel	4.14E-02	i		2.50E-01		2.00E-04		1	2.07E-09
Strontium	2.57E-01	i		2.50E-01		1.00E-03		1	6.43E-08

TABLE 7.9 - REASONABLE MAXIMUM EXPOSURE (RME)
CALCULATION OF NON-CANCER HAZARDS FROM EXPOSURE OF ADULT RESIDENTS TO GROUNDWATER
SWMU 1 - MUSTARD GAS BURIAL GROUND
NSWC CRANE, INDIANA

Scenario Timeframe: Future
Medium: Groundwater
Exposure Medium: Groundwater
Exposure Point: Entire Site
Receptor Population: Resident
Receptor Age: Adult

Exposure Route	Chemical of Potential Concern	Medium EPC Value	Medium EPC Units	Route EPC Value	Route EPC Units	EPC Selected for Hazard Calculation (1)	Intake (Non-Cancer)	Intake (Non-Cancer) Units	Reference Dose	Reference Dose Units	Reference Concentration	Reference Concentration Units	Hazard Quotient
Ingestion	1,1,1,2-Tetrachloroethane	2.50E-01	mg/L	2.50E-01	mg/L	M	6.8E-03	mg/kg-day	3.00E-02	mg/kg-day	NA	NA	2.3E-01
	1,1,2,2-Tetrachloroethane	3.80E+01	mg/L	3.80E+01	mg/L	M	1.0E+00	mg/kg-day	6.00E-02	mg/kg-day	NA	NA	1.7E+01
	1,1,2-Trichloroethane	6.00E-04	mg/L	6.00E-04	mg/L	M	1.6E-05	mg/kg-day	4.00E-03	mg/kg-day	NA	NA	4.1E-03
	1,1-Dichloroethene	5.00E-01	mg/L	5.00E-01	mg/L	M	1.4E-02	mg/kg-day	5.00E-02	mg/kg-day	NA	NA	2.7E-01
	1,2-Dichloroethane	2.50E-01	mg/L	2.50E-01	mg/L	M	6.8E-03	mg/kg-day	3.00E-02	mg/kg-day	NA	NA	2.3E-01
	Chloroform	8.40E-01	mg/L	8.40E-01	mg/L	M	2.3E-02	mg/kg-day	1.00E-02	mg/kg-day	NA	NA	2.3E+00
	cis-1,2-Dichloroethene	5.00E-01	mg/L	5.00E-01	mg/L	M	1.4E-02	mg/kg-day	1.00E-02	mg/kg-day	NA	NA	1.4E+00
	Tetrachloroethene	3.70E-01	mg/L	3.70E-01	mg/L	M	1.0E-02	mg/kg-day	1.00E-02	mg/kg-day	NA	NA	1.0E+00
	Trichloroethene	1.60E+01	mg/L	1.60E+01	mg/L	M	4.4E-01	mg/kg-day	3.00E-04	mg/kg-day	NA	NA	1.5E+03
	Bis(2-Ethylhexyl)Phthalate	2.50E-03	mg/L	2.50E-03	mg/L	M	6.8E-05	mg/kg-day	2.00E-02	mg/kg-day	NA	NA	3.4E-03
	Hexachloroethane	5.00E-03	mg/L	5.00E-03	mg/L	M	1.4E-04	mg/kg-day	1.00E-03	mg/kg-day	NA	NA	1.4E-01
	4-Amino-2,6-Dinitrotoluene	3.25E-04	mg/L	3.25E-04	mg/L	M	8.9E-06	mg/kg-day	6.00E-05	mg/kg-day	NA	NA	1.5E-01
	Heptachlor	2.00E-05	mg/L	2.00E-05	mg/L	M	5.5E-07	mg/kg-day	5.00E-04	mg/kg-day	NA	NA	1.1E-03
	Aluminum	2.01E-02	mg/L	2.01E-02	mg/L	M	5.5E-04	mg/kg-day	1.00E+00	mg/kg-day	NA	NA	5.5E-04
	Antimony	2.55E-03	mg/L	2.55E-03	mg/L	M	7.0E-05	mg/kg-day	4.00E-04	mg/kg-day	NA	NA	1.7E-01
	Arsenic	1.10E-03	mg/L	1.10E-03	mg/L	M	3.0E-05	mg/kg-day	3.00E-04	mg/kg-day	NA	NA	1.0E-01
	Iron	2.21E-02	mg/L	2.21E-02	mg/L	M	6.1E-04	mg/kg-day	3.00E-01	mg/kg-day	NA	NA	2.0E-03
	Manganese	4.34E-01	mg/L	4.34E-01	mg/L	M	1.2E-02	mg/kg-day	2.40E-02	mg/kg-day	NA	NA	5.0E-01
	Nickel	4.14E-02	mg/L	4.14E-02	mg/L	M	1.1E-03	mg/kg-day	2.00E-02	mg/kg-day	NA	NA	5.7E-02
	Strontium	2.57E-01	mg/L	2.57E-01	mg/L	M	7.0E-03	mg/kg-day	6.00E-01	mg/kg-day	NA	NA	1.2E-02
	(total)												**1.5E+03**
Dermal	1,1,1,2-Tetrachloroethane	2.50E-01	mg/L	2.50E-01	mg/L	M	5.7E-04	mg/kg-day	3.00E-02	mg/kg-day	NA	NA	1.9E-02
	1,1,2,2-Tetrachloroethane	3.80E+01	mg/L	3.80E+01	mg/L	M	8.7E-02	mg/kg-day	6.00E-02	mg/kg-day	NA	NA	1.4E+00
	1,1,2-Trichloroethane	6.00E-04	mg/L	6.00E-04	mg/L	M	1.0E-06	mg/kg-day	4.00E-03	mg/kg-day	NA	NA	2.5E-04
	1,1-Dichloroethene	5.00E-01	mg/L	5.00E-01	mg/L	M	1.2E-03	mg/kg-day	5.00E-02	mg/kg-day	NA	NA	2.4E-02
	1,2-Dichloroethane	2.50E-01	mg/L	2.50E-01	mg/L	M	2.2E-04	mg/kg-day	3.00E-02	mg/kg-day	NA	NA	7.4E-03
	Chloroform	8.40E-01	mg/L	8.40E-01	mg/L	M	1.4E-03	mg/kg-day	1.00E-02	mg/kg-day	NA	NA	1.4E-01
	cis-1,2-Dichloroethene	5.00E-01	mg/L	5.00E-01	mg/L	M	8.0E-04	mg/kg-day	1.00E-02	mg/kg-day	NA	NA	8.0E-02
	Tetrachloroethene	3.70E-01	mg/L	3.70E-01	mg/L	M	4.0E-03	mg/kg-day	1.00E-02	mg/kg-day	NA	NA	4.0E-01
	Trichloroethene	1.60E+01	mg/L	1.60E+01	mg/L	M	4.8E-02	mg/kg-day	3.00E-04	mg/kg-day	NA	NA	1.6E+02
	Bis(2-Ethylhexyl)Phthalate	2.50E-03	mg/L	2.50E-03	mg/L	M	6.9E-05	mg/kg-day	2.00E-02	mg/kg-day	NA	NA	3.5E-03
	Hexachloroethane	5.00E-03	mg/L	5.00E-03	mg/L	M	7.7E-05	mg/kg-day	1.00E-03	mg/kg-day	NA	NA	7.7E-02
	4-Amino-2,6-Dinitrotoluene	3.25E-04	mg/L	3.25E-04	mg/L	M	8.2E-08	mg/kg-day	6.00E-05	mg/kg-day	NA	NA	1.4E-03
	Heptachlor	2.00E-05	mg/L	2.00E-05	mg/L	M	2.1E-07	mg/kg-day	5.00E-04	mg/kg-day	NA	NA	4.3E-04
	Aluminum	2.01E-02	mg/L	2.01E-02	mg/L	M	1.2E-06	mg/kg-day	1.00E+00	mg/kg-day	NA	NA	1.2E-06
	Antimony	2.55E-03	mg/L	2.55E-03	mg/L	M	1.6E-07	mg/kg-day	6.00E-05	mg/kg-day	NA	NA	2.6E-03
	Arsenic	1.10E-03	mg/L	1.10E-03	mg/L	M	6.8E-08	mg/kg-day	3.00E-04	mg/kg-day	NA	NA	2.3E-04
	Iron	2.21E-02	mg/L	2.21E-02	mg/L	M	1.4E-06	mg/kg-day	3.00E-01	mg/kg-day	NA	NA	4.5E-06
	Manganese	4.34E-01	mg/L	4.34E-01	mg/L	M	2.7E-05	mg/kg-day	9.60E-04	mg/kg-day	NA	NA	2.8E-02
	Nickel	4.14E-02	mg/L	4.14E-02	mg/L	M	5.1E-07	mg/kg-day	8.00E-04	mg/kg-day	NA	NA	6.4E-04
	Strontium	2.57E-01	mg/L	2.57E-01	mg/L	M	1.6E-05	mg/kg-day	6.00E-01	mg/kg-day	NA	NA	2.6E-05
	(total)												**1.6E+02**
												Total Hazard Index Across All Exposure Routes/Pathways	**1.6E+03**

(1) Specify Medium-Specific (M) or Route-Specific (R) EPC selected for hazard calculation.

TABLE 8.9 - REASONABLE MAXIMUM EXPOSURE (RME)
CALCULATION OF CANCER RISKS FROM EXPOSURE OF ADULT RESIDENTS TO GROUNDWATER
SWMU 1 - MUSTARD GAS BURIAL GROUND
NSWC CRANE, INDIANA

Scenario Timeframe: Future
Medium: Groundwater
Exposure Medium: Groundwater
Exposure Point: Entire Site
Receptor Population: Resident
Receptor Age: Adult

Exposure Route	Chemical of Potential Concern	Medium EPC Value	Medium EPC Units	Route EPC Value	Route EPC Units	EPC Selected for Risk Calculation (1)	Intake (Cancer)	Intake (Cancer) Units	Cancer Slope Factor	Cancer Slope Factor Units	Cancer Risk
Ingestion	1,1,1,2-Tetrachloroethane	2.50E-01	mg/L	2.50E-01	mg/L	M	2.3E-03	mg/kg-day	2.60E-02	(mg/kg-day)$^{-1}$	6.1E-05
	1,1,2,2-Tetrachloroethane	3.80E+01	mg/L	3.80E+01	mg/L	M	3.6E-01	mg/kg-day	2.00E-01	(mg/kg-day)$^{-1}$	6.9E-02
	1,1,2-Trichloroethane	6.00E-04	mg/L	6.00E-04	mg/L	M	5.6E-06	mg/kg-day	5.70E-02	(mg/kg-day)$^{-1}$	3.2E-07
	1,1-Dichloroethene	5.00E-01	mg/L	5.00E-01	mg/L	M	4.7E-03	mg/kg-day		(mg/kg-day)$^{-1}$	
	1,2-Dichloroethane	2.50E-01	mg/L	2.50E-01	mg/L	M	2.3E-03	mg/kg-day	9.10E-02	(mg/kg-day)$^{-1}$	2.1E-04
	Chloroform	8.40E-01	mg/L	8.40E-01	mg/L	M	7.9E-03	mg/kg-day	6.10E-03	(mg/kg-day)$^{-1}$	4.8E-05
	cis-1,2-Dichloroethene	5.00E-01	mg/L	5.00E-01	mg/L	M	4.7E-03	mg/kg-day		(mg/kg-day)$^{-1}$	
	Tetrachloroethene	3.70E-01	mg/L	3.70E-01	mg/L	M	3.5E-03	mg/kg-day	5.20E-02	(mg/kg-day)$^{-1}$	1.8E-04
	Trichloroethene	1.60E+01	mg/L	1.60E+01	mg/L	M	1.5E-01	mg/kg-day	4.00E-01	(mg/kg-day)$^{-1}$	5.8E-02
	Bis(2-Ethylhexyl)Phthalate	2.50E-03	mg/L	2.50E-03	mg/L	M	2.3E-05	mg/kg-day	1.40E-02	(mg/kg-day)$^{-1}$	3.3E-07
	Hexachloroethane	5.00E-03	mg/L	5.00E-03	mg/L	M	4.7E-05	mg/kg-day	1.40E-02	(mg/kg-day)$^{-1}$	6.6E-07
	4-Amino-2,6-Dinitrotoluene	3.25E-04	mg/L	3.25E-04	mg/L	M	3.1E-06	mg/kg-day		(mg/kg-day)$^{-1}$	
	Heptachlor	2.00E-05	mg/L	2.00E-05	mg/L	M	1.9E-07	mg/kg-day	4.50E+00	(mg/kg-day)$^{-1}$	8.5E-07
	Aluminum	2.01E-02	mg/L	2.01E-02	mg/L	M	1.9E-04	mg/kg-day		(mg/kg-day)$^{-1}$	
	Antimony	2.55E-03	mg/L	2.55E-03	mg/L	M	2.4E-05	mg/kg-day		(mg/kg-day)$^{-1}$	
	Arsenic	1.10E-03	mg/L	1.10E-03	mg/L	M	1.0E-05	mg/kg-day	1.50E+00	(mg/kg-day)$^{-1}$	1.5E-05
	Iron	2.21E-02	mg/L	2.21E-02	mg/L	M	2.1E-04	mg/kg-day		(mg/kg-day)$^{-1}$	
	Manganese	4.34E-01	mg/L	4.34E-01	mg/L	M	4.1E-03	mg/kg-day		(mg/kg-day)$^{-1}$	
	Nickel	4.14E-02	mg/L	4.14E-02	mg/L	M	3.9E-04	mg/kg-day		(mg/kg-day)$^{-1}$	
	Strontium	2.57E-01	mg/L	2.57E-01	mg/L	M	2.4E-03	mg/kg-day		(mg/kg-day)$^{-1}$	
	(total)										**1.3E-01**
Dermal	1,1,1,2-Tetrachloroethane	2.50E-01	mg/L	2.50E-01	mg/L	M	2.0E-04	mg/kg-day	2.60E-02	(mg/kg-day)$^{-1}$	5.1E-06
	1,1,2,2-Tetrachloroethane	3.80E+01	mg/L	3.80E+01	mg/L	M	3.0E-02	mg/kg-day	2.00E-01	(mg/kg-day)$^{-1}$	5.9E-03
	1,1,2-Trichloroethane	6.00E-04	mg/L	6.00E-04	mg/L	M	3.5E-07	mg/kg-day	5.70E-02	(mg/kg-day)$^{-1}$	2.0E-08
	1,1-Dichloroethene	5.00E-01	mg/L	5.00E-01	mg/L	M	4.2E-04	mg/kg-day		(mg/kg-day)$^{-1}$	
	1,2-Dichloroethane	2.50E-01	mg/L	2.50E-01	mg/L	M	7.6E-05	mg/kg-day	9.10E-02	(mg/kg-day)$^{-1}$	6.9E-06
	Chloroform	8.40E-01	mg/L	8.40E-01	mg/L	M	4.7E-04	mg/kg-day	6.10E-03	(mg/kg-day)$^{-1}$	2.9E-06
	cis-1,2-Dichloroethene	5.00E-01	mg/L	5.00E-01	mg/L	M	2.7E-04	mg/kg-day		(mg/kg-day)$^{-1}$	
	Tetrachloroethene	3.70E-01	mg/L	3.70E-01	mg/L	M	1.4E-03	mg/kg-day	5.20E-02	(mg/kg-day)$^{-1}$	7.2E-05
	Trichloroethene	1.60E+01	mg/L	1.60E+01	mg/L	M	1.7E-02	mg/kg-day	4.00E-01	(mg/kg-day)$^{-1}$	6.6E-03
	Bis(2-Ethylhexyl)Phthalate	2.50E-03	mg/L	2.50E-03	mg/L	M	2.4E-05	mg/kg-day	1.40E-02	(mg/kg-day)$^{-1}$	3.3E-07
	Hexachloroethane	5.00E-03	mg/L	5.00E-03	mg/L	M	2.6E-05	mg/kg-day	1.40E-02	(mg/kg-day)$^{-1}$	3.7E-07
	4-Amino-2,6-Dinitrotoluene	3.25E-04	mg/L	3.25E-04	mg/L	M	2.8E-08	mg/kg-day		(mg/kg-day)$^{-1}$	
	Heptachlor	2.00E-05	mg/L	2.00E-05	mg/L	M	7.4E-08	mg/kg-day	4.50E+00	(mg/kg-day)$^{-1}$	3.3E-07
	Aluminum	2.01E-02	mg/L	2.01E-02	mg/L	M	4.2E-07	mg/kg-day		(mg/kg-day)$^{-1}$	
	Antimony	2.55E-03	mg/L	2.55E-03	mg/L	M	5.4E-08	mg/kg-day		(mg/kg-day)$^{-1}$	
	Arsenic	1.10E-03	mg/L	1.10E-03	mg/L	M	2.3E-08	mg/kg-day	1.50E+00	(mg/kg-day)$^{-1}$	3.5E-08
	Iron	2.21E-02	mg/L	2.21E-02	mg/L	M	4.7E-07	mg/kg-day		(mg/kg-day)$^{-1}$	
	Manganese	4.34E-01	mg/L	4.34E-01	mg/L	M	9.2E-06	mg/kg-day		(mg/kg-day)$^{-1}$	
	Nickel	4.14E-02	mg/L	4.14E-02	mg/L	M	1.7E-07	mg/kg-day		(mg/kg-day)$^{-1}$	
	Strontium	2.57E-01	mg/L	2.57E-01	mg/L	M	5.4E-06	mg/kg-day		(mg/kg-day)$^{-1}$	
	(total)										**1.3E-02**

Total Risk Across All Exposure Routes/Pathways **1.4E-01**

CALCULATION OF DAevent - EXPOSURES THROUGH DERMAL CONTACT WITH GROUNDWATER
RESIDENTIAL ADULT - CENTRAL TENDENCY EXPOSURE (CTE)

SITE NAME: **SWMU 1 - MUSTARD GAS BURIAL GROUND**
LOCATION: **NSWC CRANE, INDIANA**
DATE: **09/17/02**

REFERENCES: USEPA, September 2001

DERMAL CONTACT: DAD = (DAevent x EV x ED x EF x A)/(BW x AT)

WHERE: DAD = DERMALLY ABSORBED DOSE (MG/KG/DAY)
DAevent = ABSORBED DOSE PER EVENT (MG/CM^2/EVENT)
A = SKIN SURFACE AREA AVAILABLE FOR CONTACT(CM^2)
EV = EVENT FREQUENCY (EVENTS/DAY)
ED = EXPOSURE DURATION (YEARS)
EF = EXPOSURE FREQUENCY (DAYS/YEAR)
BW = BODY WEIGHT(KG)
AT = AVERAGING TIME (DAYS)

DAevent = Kp x C x tevent x CF
IF tevent < t*, DAevent = 2FA x Kp x C x CF x (6T x tevent/3.1416)$^{0.5}$
IF tevent > t*, DAevent = FA x Kp x C x CF x ((tevent/(1 + B)) + (2T x ((1+3B+3B^2)/(1 + B)^2)))

WHERE: FA = FRACTION ABSORBED (DIMENSIONLESS)
Kp = PERMEABILITY COEFFICIENT FROM WATER (CM/HR)
C = CONCENTRATION OF CHEMICAL IN WATER (MG/L)
tevent = DURATION OF EVENT (HR/EVENT)
CF = CONVERSION FACTOR (1L/1000 CM^3)
t* = TIME IT TAKES TO REACH STEADY-STATE (HOUR/EVENT)
T = LAG TIME (HOUR/EVENT)
B = BUNGE MODEL CONSTANT (DIMENSIONLESS)

CHEMICAL	GW CONC. (mg/L)	ORGANIC OR INORGANIC?	t* (HR)	tevent	T (HR)	Kp (CM/HR)	B	FA	DAevent
1,1,1,2-Tetrachloroethane	2.50E-01	o	2.24E+00	1.67E-01	9.31E-01	6.94E-03	3.46E-02	1	1.89E-06
1,1,2,2-Tetrachloroethane	3.80E+01	o	2.24E+00	1.67E-01	9.31E-01	6.94E-03	3.46E-02	1	2.87E-04
1,1,2-Trichloroethane	6.00E-04	o	1.43E+00	1.67E-01	5.96E-01	6.44E-03	2.86E-02	1	3.37E-09
1,1-Dichloroethene	5.00E-01	o	8.93E-01	1.67E-01	3.72E-01	1.17E-02	4.41E-02	1	4.01E-06
1,2-Dichloroethane	2.50E-01	o	9.18E-01	1.67E-01	3.82E-01	4.20E-03	1.61E-02	1	7.32E-07
Chloroform	8.40E-01	o	1.19E+00	1.67E-01	4.98E-01	6.83E-03	2.87E-02	1	4.56E-06
cis-1,2-Dichloroethene	5.00E-01	o	8.93E-01	1.67E-01	3.72E-01	7.71E-03	2.92E-02	1	2.65E-06
Tetrachloroethene	3.70E-01	o	2.18E+00	1.67E-01	9.06E-01	3.34E-02	1.66E-01	1	1.33E-05
Trichloroethene	1.60E+01	o	1.39E+00	1.67E-01	5.81E-01	1.16E-02	5.13E-02	1	1.60E-04
Bis(2-Ethylhexyl)Phthalate	2.50E-03	o	3.99E+01	1.67E-01	1.66E+01	2.49E-02	1.90E-01	0.8	2.30E-07
Hexachloroethane	5.00E-03	o	5.44E+00	1.67E-01	2.27E+00	3.01E-02	1.78E-01	1	2.56E-07
4-Amino-2,6-Dinitrotoluene	3.25E-04	o	3.21E+00	1.67E-01	1.34E+00	6.41E-04	3.46E-03	1	2.72E-10
Heptachlor	2.00E-05	o	3.19E+01	1.67E-01	1.33E+01	8.64E-03	6.43E-02	1	7.11E-10
Aluminum	2.01E-02	i		1.67E-01		1.00E-03		1	3.35E-09
Antimony	2.55E-03	i		1.67E-01		1.00E-03		1	4.25E-10
Arsenic	1.10E-03	i		1.67E-01		1.00E-03		1	1.83E-10
Iron	2.21E-02	i		1.67E-01		1.00E-03		1	3.68E-09
Manganese	4.34E-01	i		1.67E-01		1.00E-03		1	7.23E-08
Nickel	4.14E-02	i		1.67E-01		2.00E-04		1	1.38E-09
Strontium	2.57E-01	i		1.67E-01		1.00E-03		1	4.28E-08

TABLE 7.9a - CENTRAL TENDENCY EXPOSURE (CTE)
CALCULATION OF NON-CANCER HAZARDS FROM EXPOSURE OF ADULT RESIDENTS TO GROUNDWATER
SWMU 1 - MUSTARD GAS BURIAL GROUND
NSWC CRANE, INDIANA

Scenario Timeframe: Future
Medium: Groundwater
Exposure Medium: Groundwater
Exposure Point: Entire Site
Receptor Population: Resident
Receptor Age: Adult

Exposure Route	Chemical of Potential Concern	Medium EPC Value	Medium EPC Units	Route EPC Value	Route EPC Units	EPC Selected for Hazard Calculation (1)	Intake (Non-Cancer)	Intake (Non-Cancer) Units	Reference Dose	Reference Dose Units	Reference Concentration	Reference Concentration Units	Hazard Quotient
Ingestion	1,1,1,2-Tetrachloroethane	2.50E-01	mg/L	2.50E-01	mg/L	M	4.8E-03	mg/kg-day	3.00E-02	mg/kg-day	NA	NA	1.6E-01
	1,1,2,2-Tetrachloroethane	3.80E+01	mg/L	3.80E+01	mg/L	M	1.0E+00	mg/kg-day	6.00E-02	mg/kg-day	NA	NA	1.7E+01
	1,1,2-Trichloroethane	6.00E-04	mg/L	6.00E-04	mg/L	M	1.2E-05	mg/kg-day	4.00E-03	mg/kg-day	NA	NA	2.9E-03
	1,1-Dichloroethene	5.00E-01	mg/L	5.00E-01	mg/L	M	9.6E-03	mg/kg-day	5.00E-02	mg/kg-day	NA	NA	1.9E-01
	1,2-Dichloroethane	2.50E-01	mg/L	2.50E-01	mg/L	M	4.8E-03	mg/kg-day	3.00E-02	mg/kg-day	NA	NA	1.6E-01
	Chloroform	8.40E-01	mg/L	8.40E-01	mg/L	M	1.6E-02	mg/kg-day	1.00E-02	mg/kg-day	NA	NA	1.6E+00
	cis-1,2-Dichloroethene	5.00E-01	mg/L	5.00E-01	mg/L	M	9.6E-03	mg/kg-day	1.00E-02	mg/kg-day	NA	NA	9.6E-01
	Tetrachloroethene	3.70E-01	mg/L	3.70E-01	mg/L	M	7.1E-03	mg/kg-day	1.00E-02	mg/kg-day	NA	NA	7.1E-01
	Trichloroethene	1.60E+01	mg/L	1.60E+01	mg/L	M	3.1E-01	mg/kg-day	3.00E-04	mg/kg-day	NA	NA	1.0E+03
	Bis(2-Ethylhexyl)Phthalate	2.50E-03	mg/L	2.50E-03	mg/L	M	4.8E-05	mg/kg-day	2.00E-02	mg/kg-day	NA	NA	2.4E-03
	Hexachloroethane	5.00E-03	mg/L	5.00E-03	mg/L	M	9.6E-05	mg/kg-day	1.00E-03	mg/kg-day	NA	NA	9.6E-02
	4-Amino-2,6-Dinitrotoluene	3.25E-04	mg/L	3.25E-04	mg/L	M	6.2E-06	mg/kg-day	6.00E-05	mg/kg-day	NA	NA	1.0E-01
	Heptachlor	2.00E-05	mg/L	2.00E-05	mg/L	M	3.8E-07	mg/kg-day	5.00E-04	mg/kg-day	NA	NA	7.7E-04
	Aluminum	2.01E-02	mg/L	2.01E-02	mg/L	M	3.9E-04	mg/kg-day	1.00E+00	mg/kg-day	NA	NA	3.9E-04
	Antimony	2.55E-03	mg/L	2.55E-03	mg/L	M	4.9E-05	mg/kg-day	4.00E-04	mg/kg-day	NA	NA	1.2E-01
	Arsenic	1.10E-03	mg/L	1.10E-03	mg/L	M	2.1E-05	mg/kg-day	3.00E-04	mg/kg-day	NA	NA	7.0E-02
	Iron	2.21E-02	mg/L	2.21E-02	mg/L	M	4.2E-04	mg/kg-day	3.00E-01	mg/kg-day	NA	NA	1.4E-03
	Manganese	4.34E-01	mg/L	4.34E-01	mg/L	M	8.3E-03	mg/kg-day	2.40E-02	mg/kg-day	NA	NA	3.5E-01
	Nickel	4.14E-02	mg/L	4.14E-02	mg/L	M	7.9E-04	mg/kg-day	2.00E-02	mg/kg-day	NA	NA	4.0E-02
	Strontium	2.57E-01	mg/L	2.57E-01	mg/L	M	4.9E-03	mg/kg-day	6.00E-01	mg/kg-day	NA	NA	8.2E-03
	(total)												**1.0E+03**
Dermal	1,1,1,2-Tetrachloroethane	2.50E-01	mg/L	2.50E-01	mg/L	M	4.7E-04	mg/kg-day	3.00E-02	mg/kg-day	NA	NA	1.6E-02
	1,1,2,2-Tetrachloroethane	3.80E+01	mg/L	3.80E+01	mg/L	M	7.1E-02	mg/kg-day	6.00E-02	mg/kg-day	NA	NA	1.2E+00
	1,1,2-Trichloroethane	6.00E-04	mg/L	6.00E-04	mg/L	M	8.3E-07	mg/kg-day	4.00E-03	mg/kg-day	NA	NA	2.1E-04
	1,1-Dichloroethene	5.00E-01	mg/L	5.00E-01	mg/L	M	9.9E-04	mg/kg-day	5.00E-02	mg/kg-day	NA	NA	2.0E-02
	1,2-Dichloroethane	2.50E-01	mg/L	2.50E-01	mg/L	M	1.8E-04	mg/kg-day	3.00E-02	mg/kg-day	NA	NA	6.0E-03
	Chloroform	8.40E-01	mg/L	8.40E-01	mg/L	M	1.1E-03	mg/kg-day	1.00E-02	mg/kg-day	NA	NA	1.1E-01
	cis-1,2-Dichloroethene	5.00E-01	mg/L	5.00E-01	mg/L	M	6.5E-04	mg/kg-day	1.00E-02	mg/kg-day	NA	NA	6.5E-02
	Tetrachloroethene	3.70E-01	mg/L	3.70E-01	mg/L	M	3.3E-03	mg/kg-day	1.00E-02	mg/kg-day	NA	NA	3.3E-01
	Trichloroethene	1.60E+01	mg/L	1.60E+01	mg/L	M	3.9E-02	mg/kg-day	3.00E-04	mg/kg-day	NA	NA	1.3E+02
	Bis(2-Ethylhexyl)Phthalate	2.50E-03	mg/L	2.50E-03	mg/L	M	5.7E-05	mg/kg-day	2.00E-02	mg/kg-day	NA	NA	2.8E-03
	Hexachloroethane	5.00E-03	mg/L	5.00E-03	mg/L	M	6.3E-05	mg/kg-day	1.00E-03	mg/kg-day	NA	NA	6.3E-02
	4-Amino-2,6-Dinitrotoluene	3.25E-04	mg/L	3.25E-04	mg/L	M	6.7E-08	mg/kg-day	6.00E-05	mg/kg-day	NA	NA	1.1E-03
	Heptachlor	2.00E-05	mg/L	2.00E-05	mg/L	M	1.8E-07	mg/kg-day	5.00E-04	mg/kg-day	NA	NA	3.5E-04
	Aluminum	2.01E-02	mg/L	2.01E-02	mg/L	M	8.3E-07	mg/kg-day	1.00E+00	mg/kg-day	NA	NA	8.3E-07
	Antimony	2.55E-03	mg/L	2.55E-03	mg/L	M	1.0E-07	mg/kg-day	6.00E-05	mg/kg-day	NA	NA	1.7E-03
	Arsenic	1.10E-03	mg/L	1.10E-03	mg/L	M	4.5E-08	mg/kg-day	3.00E-04	mg/kg-day	NA	NA	1.5E-04
	Iron	2.21E-02	mg/L	2.21E-02	mg/L	M	9.1E-07	mg/kg-day	3.00E-01	mg/kg-day	NA	NA	3.0E-06
	Manganese	4.34E-01	mg/L	4.34E-01	mg/L	M	1.8E-05	mg/kg-day	9.60E-04	mg/kg-day	NA	NA	1.9E-02
	Nickel	4.14E-02	mg/L	4.14E-02	mg/L	M	3.4E-07	mg/kg-day	8.00E-04	mg/kg-day	NA	NA	4.3E-04
	Strontium	2.57E-01	mg/L	2.57E-01	mg/L	M	1.1E-05	mg/kg-day	6.00E-01	mg/kg-day	NA	NA	1.8E-05
	(total)												**1.3E+02**
												Total Hazard Index Across All Exposure Routes/Pathways	**1.2E+03**

(1) Specify Medium-Specific (M) or Route-Specific (R) EPC selected for hazard calculation.

TABLE 8.9a - CENTRAL TENDENCY EXPOSURE (CTE)
CALCULATION OF CANCER RISKS FROM EXPOSURE OF ADULT RESIDENTS TO GROUNDWATER
SWMU 1 - MUSTARD GAS BURIAL GROUND
NSWC CRANE, INDIANA

Scenario Timeframe: Future
Medium: Groundwater
Exposure Medium: Groundwater
Exposure Point: Entire Site
Receptor Population: Resident
Receptor Age: Adult

Exposure Route	Chemical of Potential Concern	Medium EPC Value	Medium EPC Units	Route EPC Value	Route EPC Units	EPC Selected for Risk Calculation (1)	Intake (Cancer)	Intake (Cancer) Units	Cancer Slope Factor	Cancer Slope Factor Units	Cancer Risk
Ingestion	1,1,1,2-Tetrachloroethane	2.50E-01	mg/L	2.50E-01	mg/L	M	4.8E-04	mg/kg-day	2.60E-02	(mg/kg-day)$^{-1}$	1.2E-05
	1,1,2,2-Tetrachloroethane	3.80E+01	mg/L	3.80E+01	mg/L	M	7.3E-02	mg/kg-day	2.00E-01	(mg/kg-day)$^{-1}$	1.4E-02
	1,1,2-Trichloroethane	6.00E-04	mg/L	6.00E-04	mg/L	M	1.2E-06	mg/kg-day	5.70E-02	(mg/kg-day)$^{-1}$	6.6E-08
	1,1-Dichloroethene	5.00E-01	mg/L	5.00E-01	mg/L	M	9.6E-04	mg/kg-day		(mg/kg-day)$^{-1}$	
	1,2-Dichloroethane	2.50E-01	mg/L	2.50E-01	mg/L	M	4.8E-04	mg/kg-day	9.10E-02	(mg/kg-day)$^{-1}$	4.4E-05
	Chloroform	8.40E-01	mg/L	8.40E-01	mg/L	M	1.6E-03	mg/kg-day	6.10E-03	(mg/kg-day)$^{-1}$	9.8E-06
	cis-1,2-Dichloroethene	5.00E-01	mg/L	5.00E-01	mg/L	M	9.6E-04	mg/kg-day		(mg/kg-day)$^{-1}$	
	Tetrachloroethene	3.70E-01	mg/L	3.70E-01	mg/L	M	7.1E-04	mg/kg-day	5.20E-02	(mg/kg-day)$^{-1}$	3.7E-05
	Trichloroethene	1.60E+01	mg/L	1.60E+01	mg/L	M	3.1E-02	mg/kg-day	4.00E-01	(mg/kg-day)$^{-1}$	1.2E-02
	Bis(2-Ethylhexyl)Phthalate	2.50E-03	mg/L	2.50E-03	mg/L	M	4.8E-06	mg/kg-day	1.40E-02	(mg/kg-day)$^{-1}$	6.7E-08
	Hexachloroethane	5.00E-03	mg/L	5.00E-03	mg/L	M	9.6E-06	mg/kg-day	1.40E-02	(mg/kg-day)$^{-1}$	1.3E-07
	4-Amino-2,6-Dinitrotoluene	3.25E-04	mg/L	3.25E-04	mg/L	M	6.2E-07	mg/kg-day		(mg/kg-day)$^{-1}$	
	Heptachlor	2.00E-05	mg/L	2.00E-05	mg/L	M	3.8E-08	mg/kg-day	4.50E+00	(mg/kg-day)$^{-1}$	1.7E-07
	Aluminum	2.01E-02	mg/L	2.01E-02	mg/L	M	3.9E-05	mg/kg-day		(mg/kg-day)$^{-1}$	
	Antimony	2.55E-03	mg/L	2.55E-03	mg/L	M	4.9E-06	mg/kg-day		(mg/kg-day)$^{-1}$	
	Arsenic	1.10E-03	mg/L	1.10E-03	mg/L	M	2.1E-06	mg/kg-day	1.50E+00	(mg/kg-day)$^{-1}$	3.2E-06
	Iron	2.21E-02	mg/L	2.21E-02	mg/L	M	4.2E-05	mg/kg-day		(mg/kg-day)$^{-1}$	
	Manganese	4.34E-01	mg/L	4.34E-01	mg/L	M	8.3E-04	mg/kg-day		(mg/kg-day)$^{-1}$	
	Nickel	4.14E-02	mg/L	4.14E-02	mg/L	M	7.9E-05	mg/kg-day		(mg/kg-day)$^{-1}$	
	Strontium	2.57E-01	mg/L	2.57E-01	mg/L	M	4.9E-04	mg/kg-day		(mg/kg-day)$^{-1}$	
	(total)										**2.7E-02**
Dermal	1,1,1,2-Tetrachloroethane	2.50E-01	mg/L	2.50E-01	mg/L	M	4.7E-05	mg/kg-day	2.60E-02	(mg/kg-day)$^{-1}$	1.2E-06
	1,1,2,2-Tetrachloroethane	3.80E+01	mg/L	3.80E+01	mg/L	M	7.1E-03	mg/kg-day	2.00E-01	(mg/kg-day)$^{-1}$	1.4E-03
	1,1,2-Trichloroethane	6.00E-04	mg/L	6.00E-04	mg/L	M	8.3E-08	mg/kg-day	5.70E-02	(mg/kg-day)$^{-1}$	4.7E-09
	1,1-Dichloroethene	5.00E-01	mg/L	5.00E-01	mg/L	M	9.9E-05	mg/kg-day		(mg/kg-day)$^{-1}$	
	1,2-Dichloroethane	2.50E-01	mg/L	2.50E-01	mg/L	M	1.8E-05	mg/kg-day	9.10E-02	(mg/kg-day)$^{-1}$	1.6E-06
	Chloroform	8.40E-01	mg/L	8.40E-01	mg/L	M	1.1E-04	mg/kg-day	6.10E-03	(mg/kg-day)$^{-1}$	6.9E-07
	cis-1,2-Dichloroethene	5.00E-01	mg/L	5.00E-01	mg/L	M	6.5E-05	mg/kg-day		(mg/kg-day)$^{-1}$	
	Tetrachloroethene	3.70E-01	mg/L	3.70E-01	mg/L	M	3.3E-04	mg/kg-day	5.20E-02	(mg/kg-day)$^{-1}$	1.7E-05
	Trichloroethene	1.60E+01	mg/L	1.60E+01	mg/L	M	3.9E-03	mg/kg-day	4.00E-01	(mg/kg-day)$^{-1}$	1.6E-03
	Bis(2-Ethylhexyl)Phthalate	2.50E-03	mg/L	2.50E-03	mg/L	M	5.7E-06	mg/kg-day	1.40E-02	(mg/kg-day)$^{-1}$	7.9E-08
	Hexachloroethane	5.00E-03	mg/L	5.00E-03	mg/L	M	6.3E-06	mg/kg-day	1.40E-02	(mg/kg-day)$^{-1}$	8.8E-08
	4-Amino-2,6-Dinitrotoluene	3.25E-04	mg/L	3.25E-04	mg/L	M	6.7E-09	mg/kg-day		(mg/kg-day)$^{-1}$	
	Heptachlor	2.00E-05	mg/L	2.00E-05	mg/L	M	1.8E-08	mg/kg-day	4.50E+00	(mg/kg-day)$^{-1}$	7.9E-08
	Aluminum	2.01E-02	mg/L	2.01E-02	mg/L	M	8.3E-08	mg/kg-day		(mg/kg-day)$^{-1}$	
	Antimony	2.55E-03	mg/L	2.55E-03	mg/L	M	1.0E-08	mg/kg-day		(mg/kg-day)$^{-1}$	
	Arsenic	1.10E-03	mg/L	1.10E-03	mg/L	M	4.5E-09	mg/kg-day	1.50E+00	(mg/kg-day)$^{-1}$	6.8E-09
	Iron	2.21E-02	mg/L	2.21E-02	mg/L	M	9.1E-08	mg/kg-day		(mg/kg-day)$^{-1}$	
	Manganese	4.34E-01	mg/L	4.34E-01	mg/L	M	1.8E-06	mg/kg-day		(mg/kg-day)$^{-1}$	
	Nickel	4.14E-02	mg/L	4.14E-02	mg/L	M	3.4E-08	mg/kg-day		(mg/kg-day)$^{-1}$	
	Strontium	2.57E-01	mg/L	2.57E-01	mg/L	M	1.1E-06	mg/kg-day		(mg/kg-day)$^{-1}$	
	(total)										**3.0E-03**
										Total Risk Across All Exposure Routes/Pathways	**3.0E-02**

TABLE 4.10

VALUES OF DAILY INTAKE CALCULATIONS FOR EXPOSURE OF
FUTURE CHILD RESIDENTS TO GROUNDWATER
SWMU 1 - MUSTARD GAS BURIAL GROUND
NSWC CRANE, INDIANA

Scenario Timeframe: Future
Medium: Groundwater
Exposure Medium: Groundwater
Exposure Point: Entire Site
Receptor Population: Resident
Receptor Age: Child (0 - 6 years)

Exposure Route	Parameter Code	Parameter Definition	Units	RME Value	RME Rationale/ Reference	CTE Value	CTE Rationale/ Reference	Intake Equation/ Model Name
Ingestion	Cgw	Chemical Concentration in Ground Water	mg/L	Maximum	See Table 3.3	Maximum	See Table 3.3	Ingestion CDI (mg/kg/day) =
	IRgw	Water Ingestion Rate	L/day	1.5	USEPA, 1997	0.66	USEPA, 1997	Cgw x IRgw x EF x ED / BW x AT
	EF	Exposure Frequency	days/year	350	USEPA, March 1991	350	USEPA, March 1991	
	ED	Exposure Duration	years	6	USEPA, March 1991	2	USEPA, May 1993	CDI = Chronic Daily Intake
	BW	Body Weight	kg	15	USEPA, March 1991	15	USEPA, March 1991	USEPA, December 1989
	AT-C	Averaging Time (Cancer)	days	25,550	USEPA, December 1989	25,550	USEPA, December 1989	
	AT-N	Averaging Time (Non-Cancer)	days	2,190	USEPA, December 1989	730	USEPA, December 1989	
Dermal	Cgw	Chemical Concentration in Ground Water	mg/L	Maximum	See Table 3.3	Maximum	See Table 3.3	The equations and parameters for
	A	Skin Surface Area	cm^2	6,600	USEPA, September 2001	6,600	USEPA, September 2001	for estimating DAevent and the chemical-
	DAevent	Absorbed Dose per Event	mg/cm^2-event	chemical-specific	USEPA, September 2001	chemical-specific	USEPA, September 2001	specific dermally absorbed dose from
	EV	Event Frequency	event/day	1	Professional Judgement	1	Professional Judgement	water (DAD) are provided in Section 6.1
	ED	Exposure Duration	years	6	USEPA, March 1991	2	USEPA, March 1991	of the text.
	EF	Exposure Frequency	days/year	350	USEPA, March 1991	350	USEPA, March 1991	
	t_{event}	Duration of Event	hour/event	1	USEPA, September 2001	0.330	USEPA, September 2001	USEPA, September 2001
	t*	Time to reach steady state	hour/event	chemical-specific	USEPA, September 2001	chemical-specific	USEPA, September 2001	
	T	Lag Time	hour/event	chemical-specific	USEPA, September 2001	chemical-specific	USEPA, September 2001	
	B	Bunge Model Constant	dimensionless	chemical-specific	USEPA, September 2001	chemical-specific	USEPA, September 2001	
	Kp	Permeability Coefficient from Water	cm/hour	chemical-specific	USEPA, September 2001	chemical-specific	USEPA, September 2001	
	BW	Body Weight	kg	15	USEPA, March 1991	15	USEPA, March 1991	
	AT-C	Averaging Time (Cancer)	days	25,550	USEPA, December 1989	25,550	USEPA, December 1989	
	AT-N	Averaging Time (Non-Cancer)	days	2,190	USEPA, December 1989	730	USEPA, December 1989	

Daily Intake Calculations

Ingestion Intake = (IRgw x EF x ED) / (BW x AT)
Dermal Intake = (A x EV x ED x EF) / (BW x AT)

Cancer Ingestion Intake(RME) = 8.22E-03
Noncancer Ingestion Intake(RME) = 9.59E-02

Cancer Ingestion Intake(CTE) = 1.21E-03
Noncancer Ingestion Intake(CTE) = 4.22E-02

Cancer Dermal Intake(RME) = 3.62E+01
Noncancer Dermal Intake(RME) = 4.22E+02

Cancer Dermal Intake(CTE) = 1.21E+01
Noncancer Dermal Intake(CTE) = 4.22E+02

CALCULATION OF DAevent - EXPOSURES THROUGH DERMAL CONTACT WITH GROUNDWATER
RESIDENTIAL CHILD - REASONABLE MAXIMUM EXPOSURE (RME)

SITE NAME: SWMU 1 - MUSTARD GAS BURIAL GROUND
LOCATION: NSWC CRANE, INDIANA
DATE: 09/17/02

REFERENCES: USEPA, September 2001

DERMAL CONTACT: DAD = (DAevent x EV x ED x EF x A)/(BW x AT)

WHERE: DAD = DERMALLY ABSORBED DOSE (MG/KG/DAY)
DAevent = ABSORBED DOSE PER EVENT (MG/CM^2/EVENT)
A = SKIN SURFACE AREA AVAILABLE FOR CONTACT(CM^2)
EV = EVENT FREQUENCY (EVENTS/DAY)
ED = EXPOSURE DURATION (YEARS)
EF = EXPOSURE FREQUENCY (DAYS/YEAR)
BW = BODY WEIGHT(KG)
AT = AVERAGING TIME (DAYS)

DAevent = Kp x C x tevent x CF

IF tevent < t*, DAevent = 2FA x Kp x C x CF x (6T x tevent/3.1416)$^{0.5}$

IF tevent > t*, DAevent = FA x Kp x C x CF x ((tevent/(1 + B)) + (2T x ((1+3B+3B^2)/(1 + B)^2)))

WHERE: FA = FRACTION ABSORBED (DIMENSIONLESS)
Kp = PERMEABILITY COEFFICIENT FROM WATER (CM/HR)
C = CONCENTRATION OF CHEMICAL IN WATER (MG/L)
tevent = DURATION OF EVENT (HR/EVENT)
CF = CONVERSION FACTOR (1L/1000 CM^3)
t* = TIME IT TAKES TO REACH STEADY-STATE (HOUR/EVENT)
T = LAG TIME (HOUR/EVENT)
B = BUNGE MODEL CONSTANT (DIMENSIONLESS)

CHEMICAL	GW CONC. (mg/L)	ORGANIC OR INORGANIC?	t* (HR)	tevent	T (HR)	Kp (CM/HR)	B	DAevent	FA	DAevent
1,1,1,2-Tetrachloroethane	2.50E-01	o	2.24E+00	1.00E+00	9.31E-01	6.94E-03	3.46E-02	4.63E-06	1	4.63E-06
1,1,2,2-Tetrachloroethane	3.80E+01	o	2.24E+00	1.00E+00	9.31E-01	6.94E-03	3.46E-02	7.03E-04	1	7.03E-04
1,1,2-Trichloroethane	6.00E-04	o	1.43E+00	1.00E+00	5.96E-01	6.44E-03	2.86E-02	8.24E-09	1	8.24E-09
1,1-Dichloroethene	5.00E-01	o	8.93E-01	1.00E+00	3.72E-01	1.17E-02	4.41E-02	1.01E-05	1	1.01E-05
1,2-Dichloroethane	2.50E-01	o	9.18E-01	1.00E+00	3.82E-01	4.20E-03	1.61E-02	1.85E-06	1	1.85E-06
Chloroform	8.40E-01	o	1.19E+00	1.00E+00	4.98E-01	6.83E-03	2.87E-02	1.12E-05	1	1.12E-05
cis-1,2-Dichloroethene	5.00E-01	o	8.93E-01	1.00E+00	3.72E-01	7.71E-03	2.92E-02	6.70E-06	1	6.70E-06
Tetrachloroethene	3.70E-01	o	2.18E+00	1.00E+00	9.06E-01	3.34E-02	1.66E-01	3.25E-05	1	3.25E-05
Trichloroethene	1.60E+01	o	1.39E+00	1.00E+00	5.81E-01	1.16E-02	5.13E-02	3.92E-04	1	3.92E-04
Bis(2-Ethylhexyl)Phthalate	2.50E-03	o	3.99E+01	1.00E+00	1.66E+01	2.49E-02	1.90E-01	7.03E-07	0.8	5.62E-07
Hexachloroethane	5.00E-03	o	5.44E+00	1.00E+00	2.27E+00	3.01E-02	1.78E-01	6.26E-07	1	6.26E-07
4-Amino-2,6-Dinitrotoluene	3.25E-04	o	3.21E+00	1.00E+00	1.34E+00	6.41E-04	3.46E-03	6.65E-10	1	6.65E-10
Heptachlor	2.00E-05	o	3.19E+01	1.00E+00	1.33E+01	8.64E-03	6.43E-02	1.74E-09	1	1.74E-09
Aluminum	2.01E-02	i		1.00E+00		1.00E-03		2.01E-08	1	2.01E-08
Antimony	2.55E-03	i		1.00E+00		1.00E-03		2.55E-09	1	2.55E-09
Arsenic	1.10E-03	i		1.00E+00		1.00E-03		1.10E-09	1	1.10E-09
Iron	2.21E-02	i		1.00E+00		1.00E-03		2.21E-08	1	2.21E-08
Manganese	4.34E-01	i		1.00E+00		1.00E-03		4.34E-07	1	4.34E-07
Nickel	4.14E-02	i		1.00E+00		2.00E-04		8.28E-09	1	8.28E-09
Strontium	2.57E-01	i		1.00E+00		1.00E-03		2.57E-07	1	2.57E-07

TABLE 7.10 - REASONABLE MAXIMUM EXPOSURE (RME)
CALCULATION OF NON-CANCER HAZARDS FROM EXPOSURE OF CHILD RESIDENTS TO GROUNDWATER
SWMU 1 - MUSTARD GAS BURIAL GROUND
NSWC CRANE, INDIANA

Scenario Timeframe: Future
Medium: Groundwater
Exposure Medium: Groundwater
Exposure Point: Entire Site
Receptor Population: Resident
Receptor Age: Child (0 - 6 years)

Exposure Route	Chemical of Potential Concern	Medium EPC Value	Medium EPC Units	Route EPC Value	Route EPC Units	EPC Selected for Hazard Calculation (1)	Intake (Non-Cancer)	Intake (Non-Cancer) Units	Reference Dose	Reference Dose Units	Reference Concentration	Reference Concentration Units	Hazard Quotient
Ingestion	1,1,1,2-Tetrachloroethane	2.50E-01	mg/L	2.50E-01	mg/L	M	2.4E-02	mg/kg-day	3.00E-02	mg/kg-day	NA	NA	8.0E-01
	1,1,2,2-Tetrachloroethane	3.80E+01	mg/L	3.80E+01	mg/L	M	3.6E+00	mg/kg-day	6.00E-02	mg/kg-day	NA	NA	6.1E+01
	1,1,2-Trichloroethane	6.00E-04	mg/L	6.00E-04	mg/L	M	5.8E-05	mg/kg-day	4.00E-03	mg/kg-day	NA	NA	1.4E-02
	1,1-Dichloroethene	5.00E-01	mg/L	5.00E-01	mg/L	M	4.8E-02	mg/kg-day	5.00E-02	mg/kg-day	NA	NA	9.6E-01
	1,2-Dichloroethane	2.50E-01	mg/L	2.50E-01	mg/L	M	2.4E-02	mg/kg-day	3.00E-02	mg/kg-day	NA	NA	8.0E-01
	Chloroform	8.40E-01	mg/L	8.40E-01	mg/L	M	8.1E-02	mg/kg-day	1.00E-02	mg/kg-day	NA	NA	8.1E+00
	cis-1,2-Dichloroethene	5.00E-01	mg/L	5.00E-01	mg/L	M	4.8E-02	mg/kg-day	1.00E-02	mg/kg-day	NA	NA	4.8E+00
	Tetrachloroethene	3.70E-01	mg/L	3.70E-01	mg/L	M	3.5E-02	mg/kg-day	1.00E-02	mg/kg-day	NA	NA	3.5E+00
	Trichloroethene	1.60E+01	mg/L	1.60E+01	mg/L	M	1.5E+00	mg/kg-day	3.00E-04	mg/kg-day	NA	NA	5.1E+03
	Bis(2-Ethylhexyl)Phthalate	2.50E-03	mg/L	2.50E-03	mg/L	M	2.4E-04	mg/kg-day	2.00E-02	mg/kg-day	NA	NA	1.2E-02
	Hexachloroethane	5.00E-03	mg/L	5.00E-03	mg/L	M	4.8E-04	mg/kg-day	1.00E-03	mg/kg-day	NA	NA	4.8E-01
	4-Amino-2,6-Dinitrotoluene	3.25E-04	mg/L	3.25E-04	mg/L	M	3.1E-05	mg/kg-day	6.00E-05	mg/kg-day	NA	NA	5.2E-01
	Heptachlor	2.00E-05	mg/L	2.00E-05	mg/L	M	1.9E-06	mg/kg-day	5.00E-04	mg/kg-day	NA	NA	3.8E-03
	Aluminum	2.01E-02	mg/L	2.01E-02	mg/L	M	1.9E-03	mg/kg-day	1.00E+00	mg/kg-day	NA	NA	1.9E-03
	Antimony	2.55E-03	mg/L	2.55E-03	mg/L	M	2.4E-04	mg/kg-day	4.00E-04	mg/kg-day	NA	NA	6.1E-01
	Arsenic	1.10E-03	mg/L	1.10E-03	mg/L	M	1.1E-04	mg/kg-day	3.00E-04	mg/kg-day	NA	NA	3.5E-01
	Iron	2.21E-02	mg/L	2.21E-02	mg/L	M	2.1E-03	mg/kg-day	3.00E-01	mg/kg-day	NA	NA	7.1E-03
	Manganese	4.34E-01	mg/L	4.34E-01	mg/L	M	4.2E-02	mg/kg-day	2.40E-02	mg/kg-day	NA	NA	1.7E+00
	Nickel	4.14E-02	mg/L	4.14E-02	mg/L	M	4.0E-03	mg/kg-day	2.00E-02	mg/kg-day	NA	NA	2.0E-01
	Strontium	2.57E-01	mg/L	2.57E-01	mg/L	M	2.5E-02	mg/kg-day	6.00E-01	mg/kg-day	NA	NA	4.1E-02
	(total)												**5.2E+03**
Dermal	1,1,1,2-Tetrachloroethane	2.50E-01	mg/L	2.50E-01	mg/L	M	2.0E-03	mg/kg-day	3.00E-02	mg/kg-day	NA	NA	6.5E-02
	1,1,2,2-Tetrachloroethane	3.80E+01	mg/L	3.80E+01	mg/L	M	3.0E-01	mg/kg-day	6.00E-02	mg/kg-day	NA	NA	4.9E+00
	1,1,2-Trichloroethane	6.00E-04	mg/L	6.00E-04	mg/L	M	3.5E-06	mg/kg-day	4.00E-03	mg/kg-day	NA	NA	8.7E-04
	1,1-Dichloroethene	5.00E-01	mg/L	5.00E-01	mg/L	M	4.3E-03	mg/kg-day	5.00E-02	mg/kg-day	NA	NA	8.5E-02
	1,2-Dichloroethane	2.50E-01	mg/L	2.50E-01	mg/L	M	7.8E-04	mg/kg-day	3.00E-02	mg/kg-day	NA	NA	2.6E-02
	Chloroform	8.40E-01	mg/L	8.40E-01	mg/L	M	4.7E-03	mg/kg-day	1.00E-02	mg/kg-day	NA	NA	4.7E-01
	cis-1,2-Dichloroethene	5.00E-01	mg/L	5.00E-01	mg/L	M	2.8E-03	mg/kg-day	1.00E-02	mg/kg-day	NA	NA	2.8E-01
	Tetrachloroethene	3.70E-01	mg/L	3.70E-01	mg/L	M	1.4E-02	mg/kg-day	1.00E-02	mg/kg-day	NA	NA	1.4E+00
	Trichloroethene	1.60E+01	mg/L	1.60E+01	mg/L	M	1.7E-01	mg/kg-day	3.00E-04	mg/kg-day	NA	NA	5.5E+02
	Bis(2-Ethylhexyl)Phthalate	2.50E-03	mg/L	2.50E-03	mg/L	M	2.4E-04	mg/kg-day	2.00E-02	mg/kg-day	NA	NA	1.2E-02
	Hexachloroethane	5.00E-03	mg/L	5.00E-03	mg/L	M	2.6E-04	mg/kg-day	1.00E-03	mg/kg-day	NA	NA	2.6E-01
	4-Amino-2,6-Dinitrotoluene	3.25E-04	mg/L	3.25E-04	mg/L	M	2.8E-07	mg/kg-day	6.00E-05	mg/kg-day	NA	NA	4.7E-03
	Heptachlor	2.00E-05	mg/L	2.00E-05	mg/L	M	7.3E-07	mg/kg-day	5.00E-04	mg/kg-day	NA	NA	1.5E-03
	Aluminum	2.01E-02	mg/L	2.01E-02	mg/L	M	8.5E-06	mg/kg-day	1.00E+00	mg/kg-day	NA	NA	8.5E-06
	Antimony	2.55E-03	mg/L	2.55E-03	mg/L	M	1.1E-06	mg/kg-day	6.00E-05	mg/kg-day	NA	NA	1.8E-02
	Arsenic	1.10E-03	mg/L	1.10E-03	mg/L	M	4.6E-07	mg/kg-day	3.00E-04	mg/kg-day	NA	NA	1.5E-03
	Iron	2.21E-02	mg/L	2.21E-02	mg/L	M	9.3E-06	mg/kg-day	3.00E-01	mg/kg-day	NA	NA	3.1E-05
	Manganese	4.34E-01	mg/L	4.34E-01	mg/L	M	1.8E-04	mg/kg-day	9.60E-04	mg/kg-day	NA	NA	1.9E-01
	Nickel	4.14E-02	mg/L	4.14E-02	mg/L	M	3.5E-06	mg/kg-day	8.00E-04	mg/kg-day	NA	NA	4.4E-03
	Strontium	2.57E-01	mg/L	2.57E-01	mg/L	M	1.1E-04	mg/kg-day	6.00E-01	mg/kg-day	NA	NA	1.8E-04
	(total)												**5.6E+02**
												Total Hazard Index Across All Exposure Routes/Pathways	**5.8E+03**

(1) Specify Medium-Specific (M) or Route-Specific (R) EPC selected for hazard calculation.

TABLE 8.10 - REASONABLE MAXIMUM EXPOSURE (RME)
CALCULATION OF CANCER RISKS FROM EXPOSURE OF CHILD RESIDENTS TO GROUNDWATER
SWMU 1 - MUSTARD GAS BURIAL GROUND
NSWC CRANE, INDIANA

Scenario Timeframe: Future
Medium: Groundwater
Exposure Medium: Groundwater
Exposure Point: Entire Site
Receptor Population: Resident
Receptor Age: Child (0 - 6 years)

Exposure Route	Chemical of Potential Concern	Medium EPC Value	Medium EPC Units	Route EPC Value	Route EPC Units	EPC Selected for Risk Calculation (1)	Intake (Cancer)	Intake (Cancer) Units	Cancer Slope Factor	Cancer Slope Factor Units	Cancer Risk
Ingestion	1,1,1,2-Tetrachloroethane	2.50E-01	mg/L	2.50E-01	mg/L	M	2.1E-03	mg/kg-day	2.60E-02	(mg/kg-day)$^{-1}$	5.3E-05
	1,1,2,2-Tetrachloroethane	3.80E+01	mg/L	3.80E+01	mg/L	M	3.1E-01	mg/kg-day	2.00E-01	(mg/kg-day)$^{-1}$	6.1E-02
	1,1,2-Trichloroethane	6.00E-04	mg/L	6.00E-04	mg/L	M	4.9E-06	mg/kg-day	5.70E-02	(mg/kg-day)$^{-1}$	2.8E-07
	1,1-Dichloroethene	5.00E-01	mg/L	5.00E-01	mg/L	M	4.1E-03	mg/kg-day		(mg/kg-day)$^{-1}$	
	1,2-Dichloroethane	2.50E-01	mg/L	2.50E-01	mg/L	M	2.1E-03	mg/kg-day	9.10E-02	(mg/kg-day)$^{-1}$	1.9E-04
	Chloroform	8.40E-01	mg/L	8.40E-01	mg/L	M	6.9E-03	mg/kg-day	6.10E-03	(mg/kg-day)$^{-1}$	4.2E-05
	cis-1,2-Dichloroethene	5.00E-01	mg/L	5.00E-01	mg/L	M	4.1E-03	mg/kg-day		(mg/kg-day)$^{-1}$	
	Tetrachloroethene	3.70E-01	mg/L	3.70E-01	mg/L	M	3.0E-03	mg/kg-day	5.20E-02	(mg/kg-day)$^{-1}$	1.6E-04
	Trichloroethene	1.60E+01	mg/L	1.60E+01	mg/L	M	1.3E-01	mg/kg-day	4.00E-01	(mg/kg-day)$^{-1}$	5.1E-02
	Bis(2-Ethylhexyl)Phthalate	2.50E-03	mg/L	2.50E-03	mg/L	M	2.1E-05	mg/kg-day	1.40E-02	(mg/kg-day)$^{-1}$	2.9E-07
	Hexachloroethane	5.00E-03	mg/L	5.00E-03	mg/L	M	4.1E-05	mg/kg-day	1.40E-02	(mg/kg-day)$^{-1}$	5.8E-07
	4-Amino-2,6-Dinitrotoluene	3.25E-04	mg/L	3.25E-04	mg/L	M	2.7E-06	mg/kg-day		(mg/kg-day)$^{-1}$	
	Heptachlor	2.00E-05	mg/L	2.00E-05	mg/L	M	1.6E-07	mg/kg-day	4.50E+00	(mg/kg-day)$^{-1}$	7.4E-07
	Aluminum	2.01E-02	mg/L	2.01E-02	mg/L	M	1.7E-04	mg/kg-day		(mg/kg-day)$^{-1}$	
	Antimony	2.55E-03	mg/L	2.55E-03	mg/L	M	2.1E-05	mg/kg-day		(mg/kg-day)$^{-1}$	
	Arsenic	1.10E-03	mg/L	1.10E-03	mg/L	M	9.0E-06	mg/kg-day	1.50E+00	(mg/kg-day)$^{-1}$	1.4E-05
	Iron	2.21E-02	mg/L	2.21E-02	mg/L	M	1.8E-04	mg/kg-day		(mg/kg-day)$^{-1}$	
	Manganese	4.34E-01	mg/L	4.34E-01	mg/L	M	3.6E-03	mg/kg-day		(mg/kg-day)$^{-1}$	
	Nickel	4.14E-02	mg/L	4.14E-02	mg/L	M	3.4E-04	mg/kg-day		(mg/kg-day)$^{-1}$	
	Strontium	2.57E-01	mg/L	2.57E-01	mg/L	M	2.1E-03	mg/kg-day		(mg/kg-day)$^{-1}$	
	(total)										**1.1E-01**
Dermal	1,1,1,2-Tetrachloroethane	2.50E-01	mg/L	2.50E-01	mg/L	M	1.7E-04	mg/kg-day	2.60E-02	(mg/kg-day)$^{-1}$	4.3E-06
	1,1,2,2-Tetrachloroethane	3.80E+01	mg/L	3.80E+01	mg/L	M	2.5E-02	mg/kg-day	2.00E-01	(mg/kg-day)$^{-1}$	5.1E-03
	1,1,2-Trichloroethane	6.00E-04	mg/L	6.00E-04	mg/L	M	3.0E-07	mg/kg-day	5.70E-02	(mg/kg-day)$^{-1}$	1.7E-08
	1,1-Dichloroethene	5.00E-01	mg/L	5.00E-01	mg/L	M	3.7E-04	mg/kg-day		(mg/kg-day)$^{-1}$	
	1,2-Dichloroethane	2.50E-01	mg/L	2.50E-01	mg/L	M	6.7E-05	mg/kg-day	9.10E-02	(mg/kg-day)$^{-1}$	6.1E-06
	Chloroform	8.40E-01	mg/L	8.40E-01	mg/L	M	4.0E-04	mg/kg-day	6.10E-03	(mg/kg-day)$^{-1}$	2.5E-06
	cis-1,2-Dichloroethene	5.00E-01	mg/L	5.00E-01	mg/L	M	2.4E-04	mg/kg-day		(mg/kg-day)$^{-1}$	
	Tetrachloroethene	3.70E-01	mg/L	3.70E-01	mg/L	M	1.2E-03	mg/kg-day	5.20E-02	(mg/kg-day)$^{-1}$	6.1E-05
	Trichloroethene	1.60E+01	mg/L	1.60E+01	mg/L	M	1.4E-02	mg/kg-day	4.00E-01	(mg/kg-day)$^{-1}$	5.7E-03
	Bis(2-Ethylhexyl)Phthalate	2.50E-03	mg/L	2.50E-03	mg/L	M	2.0E-05	mg/kg-day	1.40E-02	(mg/kg-day)$^{-1}$	2.8E-07
	Hexachloroethane	5.00E-03	mg/L	5.00E-03	mg/L	M	2.3E-05	mg/kg-day	1.40E-02	(mg/kg-day)$^{-1}$	3.2E-07
	4-Amino-2,6-Dinitrotoluene	3.25E-04	mg/L	3.25E-04	mg/L	M	2.4E-08	mg/kg-day		(mg/kg-day)$^{-1}$	
	Heptachlor	2.00E-05	mg/L	2.00E-05	mg/L	M	6.3E-08	mg/kg-day	4.50E+00	(mg/kg-day)$^{-1}$	2.8E-07
	Aluminum	2.01E-02	mg/L	2.01E-02	mg/L	M	7.3E-07	mg/kg-day		(mg/kg-day)$^{-1}$	
	Antimony	2.55E-03	mg/L	2.55E-03	mg/L	M	9.2E-08	mg/kg-day		(mg/kg-day)$^{-1}$	
	Arsenic	1.10E-03	mg/L	1.10E-03	mg/L	M	4.0E-08	mg/kg-day	1.50E+00	(mg/kg-day)$^{-1}$	6.0E-08
	Iron	2.21E-02	mg/L	2.21E-02	mg/L	M	8.0E-07	mg/kg-day		(mg/kg-day)$^{-1}$	
	Manganese	4.34E-01	mg/L	4.34E-01	mg/L	M	1.6E-05	mg/kg-day		(mg/kg-day)$^{-1}$	
	Nickel	4.14E-02	mg/L	4.14E-02	mg/L	M	3.0E-07	mg/kg-day		(mg/kg-day)$^{-1}$	
	Strontium	2.57E-01	mg/L	2.57E-01	mg/L	M	9.3E-06	mg/kg-day		(mg/kg-day)$^{-1}$	
	(total)										1.1E-02
										Total Risk Across All Exposure Routes/Pathways	**1.2E-01**

CALCULATION OF DAevent - EXPOSURES THROUGH DERMAL CONTACT WITH GROUNDWATER
RESIDENTIAL CHILD - CENTRAL TENDENCY EXPOSURE (CTE)

SITE NAME: **SWMU 1 - MUSTARD GAS BURIAL GROUND**
LOCATION: **NSWC CRANE, INDIANA**
DATE: **09/17/02**

REFERENCES: USEPA, September 2001

DERMAL CONTACT: DAD = (DAevent x EV x ED x EF x A)/(BW x AT)

WHERE: DAD = DERMALLY ABSORBED DOSE (MG/KG/DAY)
DAevent = ABSORBED DOSE PER EVENT (MG/CM^2/EVENT)
A = SKIN SURFACE AREA AVAILABLE FOR CONTACT(CM^2)
EV = EVENT FREQUENCY (EVENTS/DAY)
ED = EXPOSURE DURATION (YEARS)
EF = EXPOSURE FREQUENCY (DAYS/YEAR)
BW = BODY WEIGHT(KG)
AT = AVERAGING TIME (DAYS)

DAevent = Kp x C x tevent x CF
IF tevent < t*, DAevent = 2FA x Kp x C x CF x (6T x tevent/3.1416)$^{0.5}$
IF tevent > t*, DAevent = FA x Kp x C x CF x ((tevent/(1 + B)) + (2T x ((1+3B+3B^2)/(1 + B)^2)))

WHERE: FA = FRACTION ABSORBED (DIMENSIONLESS)
Kp = PERMEABILITY COEFFICIENT FROM WATER (CM/HR)
C = CONCENTRATION OF CHEMICAL IN WATER (MG/L)
tevent = DURATION OF EVENT (HR/EVENT)
CF = CONVERSION FACTOR (1L/1000 CM^3)
t* = TIME IT TAKES TO REACH STEADY-STATE (HOUR/EVENT)
T = LAG TIME (HOUR/EVENT)
B = BUNGE MODEL CONSTANT (DIMENSIONLESS)

CHEMICAL	GW CONC. (mg/L)	ORGANIC OR INORGANIC?	t* (HR)	tevent	T (HR)	Kp (CM/HR)	B	FA	DAevent
1,1,1,2-Tetrachloroethane	2.50E-01	o	2.24E+00	3.30E-01	9.31E-01	6.94E-03	3.46E-02	1	2.66E-06
1,1,2,2-Tetrachloroethane	3.80E+01	o	2.24E+00	3.30E-01	9.31E-01	6.94E-03	3.46E-02	1	4.04E-04
1,1,2-Trichloroethane	6.00E-04	o	1.43E+00	3.30E-01	5.96E-01	6.44E-03	2.86E-02	1	4.74E-09
1,1-Dichloroethene	5.00E-01	o	8.93E-01	3.30E-01	3.72E-01	1.17E-02	4.41E-02	1	5.65E-06
1,2-Dichloroethane	2.50E-01	o	9.18E-01	3.30E-01	3.82E-01	4.20E-03	1.61E-02	1	1.03E-06
Chloroform	8.40E-01	o	1.19E+00	3.30E-01	4.98E-01	6.83E-03	2.87E-02	1	6.42E-06
cis-1,2-Dichloroethene	5.00E-01	o	8.93E-01	3.30E-01	3.72E-01	7.71E-03	2.92E-02	1	3.74E-06
Tetrachloroethene	3.70E-01	o	2.18E+00	3.30E-01	9.06E-01	3.34E-02	1.66E-01	1	1.87E-05
Trichloroethene	1.60E+01	o	1.39E+00	3.30E-01	5.81E-01	1.16E-02	5.13E-02	1	2.25E-04
Bis(2-Ethylhexyl)Phthalate	2.50E-03	o	3.99E+01	3.30E-01	1.66E+01	2.49E-02	1.90E-01	0.8	3.23E-07
Hexachloroethane	5.00E-03	o	5.44E+00	3.30E-01	2.27E+00	3.01E-02	1.78E-01	1	3.60E-07
4-Amino-2,6-Dinitrotoluene	3.25E-04	o	3.21E+00	3.30E-01	1.34E+00	6.41E-04	3.46E-03	1	3.82E-10
Heptachlor	2.00E-05	o	3.19E+01	3.30E-01	1.33E+01	8.64E-03	6.43E-02	1	1.00E-09
Aluminum	2.01E-02	i		3.30E-01		1.00E-03		1	6.63E-09
Antimony	2.55E-03	i		3.30E-01		1.00E-03		1	8.42E-10
Arsenic	1.10E-03	i		3.30E-01		1.00E-03		1	3.63E-10
Iron	2.21E-02	i		3.30E-01		1.00E-03		1	7.29E-09
Manganese	4.34E-01	i		3.30E-01		1.00E-03		1	1.43E-07
Nickel	4.14E-02	i		3.30E-01		2.00E-04		1	2.73E-09
Strontium	2.57E-01	i		3.30E-01		1.00E-03		1	8.48E-08

TABLE 7.10a - CENTRAL TENDENCY EXPOSURE (CTE)
CALCULATION OF NON-CANCER HAZARDS FROM EXPOSURE OF CHILD RESIDENTS TO GROUNDWATER
SWMU 1 - MUSTARD GAS BURIAL GROUND
NSWC CRANE, INDIANA

Scenario Timeframe: Future
Medium: Groundwater
Exposure Medium: Groundwater
Exposure Point: Entire Site
Receptor Population: Resident
Receptor Age: Child (0 - 6 years)

Exposure Route	Chemical of Potential Concern	Medium EPC Value	Medium EPC Units	Route EPC Value	Route EPC Units	EPC Selected for Hazard Calculation (1)	Intake (Non-Cancer)	Intake (Non-Cancer) Units	Reference Dose	Reference Dose Units	Reference Concentration	Reference Concentration Units	Hazard Quotient
Ingestion	1,1,1,2-Tetrachloroethane	2.50E-01	mg/L	2.50E-01	mg/L	M	1.1E-02	mg/kg-day	3.00E-02	mg/kg-day	NA	NA	3.5E-01
	1,1,2,2-Tetrachloroethane	3.80E+01	mg/L	3.80E+01	mg/L	M	1.6E+00	mg/kg-day	6.00E-02	mg/kg-day	NA	NA	2.7E+01
	1,1,2-Trichloroethane	6.00E-04	mg/L	6.00E-04	mg/L	M	2.5E-05	mg/kg-day	4.00E-03	mg/kg-day	NA	NA	6.3E-03
	1,1-Dichloroethene	5.00E-01	mg/L	5.00E-01	mg/L	M	2.1E-02	mg/kg-day	5.00E-02	mg/kg-day	NA	NA	4.2E-01
	1,2-Dichloroethane	2.50E-01	mg/L	2.50E-01	mg/L	M	1.1E-02	mg/kg-day	3.00E-02	mg/kg-day	NA	NA	3.5E-01
	Chloroform	8.40E-01	mg/L	8.40E-01	mg/L	M	3.5E-02	mg/kg-day	1.00E-02	mg/kg-day	NA	NA	3.5E+00
	cis-1,2-Dichloroethene	5.00E-01	mg/L	5.00E-01	mg/L	M	2.1E-02	mg/kg-day	1.00E-02	mg/kg-day	NA	NA	2.1E+00
	Tetrachloroethene	3.70E-01	mg/L	3.70E-01	mg/L	M	1.6E-02	mg/kg-day	1.00E-02	mg/kg-day	NA	NA	1.6E+00
	Trichloroethene	1.60E+01	mg/L	1.60E+01	mg/L	M	6.8E-01	mg/kg-day	3.00E-04	mg/kg-day	NA	NA	2.3E+03
	Bis(2-Ethylhexyl)Phthalate	2.50E-03	mg/L	2.50E-03	mg/L	M	1.1E-04	mg/kg-day	2.00E-02	mg/kg-day	NA	NA	5.3E-03
	Hexachloroethane	5.00E-03	mg/L	5.00E-03	mg/L	M	2.1E-04	mg/kg-day	1.00E-03	mg/kg-day	NA	NA	2.1E-01
	4-Amino-2,6-Dinitrotoluene	3.25E-04	mg/L	3.25E-04	mg/L	M	1.4E-05	mg/kg-day	6.00E-05	mg/kg-day	NA	NA	2.3E-01
	Heptachlor	2.00E-05	mg/L	2.00E-05	mg/L	M	8.4E-07	mg/kg-day	5.00E-04	mg/kg-day	NA	NA	1.7E-03
	Aluminum	2.01E-02	mg/L	2.01E-02	mg/L	M	8.5E-04	mg/kg-day	1.00E+00	mg/kg-day	NA	NA	8.5E-04
	Antimony	2.55E-03	mg/L	2.55E-03	mg/L	M	1.1E-04	mg/kg-day	4.00E-04	mg/kg-day	NA	NA	2.7E-01
	Arsenic	1.10E-03	mg/L	1.10E-03	mg/L	M	4.6E-05	mg/kg-day	3.00E-04	mg/kg-day	NA	NA	1.5E-01
	Iron	2.21E-02	mg/L	2.21E-02	mg/L	M	9.3E-04	mg/kg-day	3.00E-01	mg/kg-day	NA	NA	3.1E-03
	Manganese	4.34E-01	mg/L	4.34E-01	mg/L	M	1.8E-02	mg/kg-day	2.40E-02	mg/kg-day	NA	NA	7.6E-01
	Nickel	4.14E-02	mg/L	4.14E-02	mg/L	M	1.7E-03	mg/kg-day	2.00E-02	mg/kg-day	NA	NA	8.7E-02
	Strontium	2.57E-01	mg/L	2.57E-01	mg/L	M	1.1E-02	mg/kg-day	6.00E-01	mg/kg-day	NA	NA	1.9E-02
	(total)												**2.3E+03**
Dermal	1,1,1,2-Tetrachloroethane	2.50E-01	mg/L	2.50E-01	mg/L	M	1.1E-03	mg/kg-day	3.00E-02	mg/kg-day	NA	NA	3.7E-02
	1,1,2,2-Tetrachloroethane	3.80E+01	mg/L	3.80E+01	mg/L	M	1.7E-01	mg/kg-day	6.00E-02	mg/kg-day	NA	NA	2.8E+00
	1,1,2-Trichloroethane	6.00E-04	mg/L	6.00E-04	mg/L	M	2.0E-06	mg/kg-day	4.00E-03	mg/kg-day	NA	NA	5.0E-04
	1,1-Dichloroethene	5.00E-01	mg/L	5.00E-01	mg/L	M	2.4E-03	mg/kg-day	5.00E-02	mg/kg-day	NA	NA	4.8E-02
	1,2-Dichloroethane	2.50E-01	mg/L	2.50E-01	mg/L	M	4.3E-04	mg/kg-day	3.00E-02	mg/kg-day	NA	NA	1.4E-02
	Chloroform	8.40E-01	mg/L	8.40E-01	mg/L	M	2.7E-03	mg/kg-day	1.00E-02	mg/kg-day	NA	NA	2.7E-01
	cis-1,2-Dichloroethene	5.00E-01	mg/L	5.00E-01	mg/L	M	1.6E-03	mg/kg-day	1.00E-02	mg/kg-day	NA	NA	1.6E-01
	Tetrachloroethene	3.70E-01	mg/L	3.70E-01	mg/L	M	7.9E-03	mg/kg-day	1.00E-02	mg/kg-day	NA	NA	7.9E-01
	Trichloroethene	1.60E+01	mg/L	1.60E+01	mg/L	M	9.5E-02	mg/kg-day	3.00E-04	mg/kg-day	NA	NA	3.2E+02
	Bis(2-Ethylhexyl)Phthalate	2.50E-03	mg/L	2.50E-03	mg/L	M	1.4E-04	mg/kg-day	2.00E-02	mg/kg-day	NA	NA	6.8E-03
	Hexachloroethane	5.00E-03	mg/L	5.00E-03	mg/L	M	1.5E-04	mg/kg-day	1.00E-03	mg/kg-day	NA	NA	1.5E-01
	4-Amino-2,6-Dinitrotoluene	3.25E-04	mg/L	3.25E-04	mg/L	M	1.6E-07	mg/kg-day	6.00E-05	mg/kg-day	NA	NA	2.7E-03
	Heptachlor	2.00E-05	mg/L	2.00E-05	mg/L	M	4.2E-07	mg/kg-day	5.00E-04	mg/kg-day	NA	NA	8.4E-04
	Aluminum	2.01E-02	mg/L	2.01E-02	mg/L	M	2.8E-06	mg/kg-day	1.00E+00	mg/kg-day	NA	NA	2.8E-06
	Antimony	2.55E-03	mg/L	2.55E-03	mg/L	M	3.6E-07	mg/kg-day	6.00E-05	mg/kg-day	NA	NA	5.9E-03
	Arsenic	1.10E-03	mg/L	1.10E-03	mg/L	M	1.5E-07	mg/kg-day	3.00E-04	mg/kg-day	NA	NA	5.1E-04
	Iron	2.21E-02	mg/L	2.21E-02	mg/L	M	3.1E-06	mg/kg-day	3.00E-01	mg/kg-day	NA	NA	1.0E-05
	Manganese	4.34E-01	mg/L	4.34E-01	mg/L	M	6.0E-05	mg/kg-day	9.60E-04	mg/kg-day	NA	NA	6.3E-02
	Nickel	4.14E-02	mg/L	4.14E-02	mg/L	M	1.2E-06	mg/kg-day	8.00E-04	mg/kg-day	NA	NA	1.4E-03
	Strontium	2.57E-01	mg/L	2.57E-01	mg/L	M	3.6E-05	mg/kg-day	6.00E-01	mg/kg-day	NA	NA	6.0E-05
	(total)												**3.2E+02**
												Total Hazard Index Across All Exposure Routes/Pathways	**2.6E+03**

(1) Specify Medium-Specific (M) or Route-Specific (R) EPC selected for hazard calculation.

TABLE 8.10a - CENTRAL TENDENCY EXPOSURE (CTE)
CALCULATION OF CANCER RISKS FROM EXPOSURE OF CHILD RESIDENTS TO GROUNDWATER
SWMU 1 - MUSTARD GAS BURIAL GROUND
NSWC CRANE, INDIANA

Scenario Timeframe: Future
Medium: Groundwater
Exposure Medium: Groundwater
Exposure Point: Entire Site
Receptor Population: Resident
Receptor Age: Child (0 - 6 years)

Exposure Route	Chemical of Potential Concern	Medium EPC Value	Medium EPC Units	Route EPC Value	Route EPC Units	EPC Selected for Risk Calculation (1)	Intake (Cancer)	Intake (Cancer) Units	Cancer Slope Factor	Cancer Slope Factor Units	Cancer Risk
Ingestion	1,1,1,2-Tetrachloroethane	2.50E-01	mg/L	2.50E-01	mg/L	M	3.0E-04	mg/kg-day	2.60E-02	(mg/kg-day)$^{-1}$	7.8E-06
	1,1,2,2-Tetrachloroethane	3.80E+01	mg/L	3.80E+01	mg/L	M	4.6E-02	mg/kg-day	2.00E-01	(mg/kg-day)$^{-1}$	9.2E-03
	1,1,2-Trichloroethane	6.00E-04	mg/L	6.00E-04	mg/L	M	7.2E-07	mg/kg-day	5.70E-02	(mg/kg-day)$^{-1}$	4.1E-08
	1,1-Dichloroethene	5.00E-01	mg/L	5.00E-01	mg/L	M	6.0E-04	mg/kg-day		(mg/kg-day)$^{-1}$	
	1,2-Dichloroethane	2.50E-01	mg/L	2.50E-01	mg/L	M	3.0E-04	mg/kg-day	9.10E-02	(mg/kg-day)$^{-1}$	2.7E-05
	Chloroform	8.40E-01	mg/L	8.40E-01	mg/L	M	1.0E-03	mg/kg-day	6.10E-03	(mg/kg-day)$^{-1}$	6.2E-06
	cis-1,2-Dichloroethene	5.00E-01	mg/L	5.00E-01	mg/L	M	6.0E-04	mg/kg-day		(mg/kg-day)$^{-1}$	
	Tetrachloroethene	3.70E-01	mg/L	3.70E-01	mg/L	M	4.5E-04	mg/kg-day	5.20E-02	(mg/kg-day)$^{-1}$	2.3E-05
	Trichloroethene	1.60E+01	mg/L	1.60E+01	mg/L	M	1.9E-02	mg/kg-day	4.00E-01	(mg/kg-day)$^{-1}$	7.7E-03
	Bis(2-Ethylhexyl)Phthalate	2.50E-03	mg/L	2.50E-03	mg/L	M	3.0E-06	mg/kg-day	1.40E-02	(mg/kg-day)$^{-1}$	4.2E-08
	Hexachloroethane	5.00E-03	mg/L	5.00E-03	mg/L	M	6.0E-06	mg/kg-day	1.40E-02	(mg/kg-day)$^{-1}$	8.4E-08
	4-Amino-2,6-Dinitrotoluene	3.25E-04	mg/L	3.25E-04	mg/L	M	3.9E-07	mg/kg-day		(mg/kg-day)$^{-1}$	
	Heptachlor	2.00E-05	mg/L	2.00E-05	mg/L	M	2.4E-08	mg/kg-day	4.50E+00	(mg/kg-day)$^{-1}$	1.1E-07
	Aluminum	2.01E-02	mg/L	2.01E-02	mg/L	M	2.4E-05	mg/kg-day		(mg/kg-day)$^{-1}$	
	Antimony	2.55E-03	mg/L	2.55E-03	mg/L	M	3.1E-06	mg/kg-day		(mg/kg-day)$^{-1}$	
	Arsenic	1.10E-03	mg/L	1.10E-03	mg/L	M	1.3E-06	mg/kg-day	1.50E+00	(mg/kg-day)$^{-1}$	2.0E-06
	Iron	2.21E-02	mg/L	2.21E-02	mg/L	M	2.7E-05	mg/kg-day		(mg/kg-day)$^{-1}$	
	Manganese	4.34E-01	mg/L	4.34E-01	mg/L	M	5.2E-04	mg/kg-day		(mg/kg-day)$^{-1}$	
	Nickel	4.14E-02	mg/L	4.14E-02	mg/L	M	5.0E-05	mg/kg-day		(mg/kg-day)$^{-1}$	
	Strontium	2.57E-01	mg/L	2.57E-01	mg/L	M	3.1E-04	mg/kg-day		(mg/kg-day)$^{-1}$	
	(total)										**1.7E-02**
Dermal	1,1,1,2-Tetrachloroethane	2.50E-01	mg/L	2.50E-01	mg/L	M	3.2E-05	mg/kg-day	2.60E-02	(mg/kg-day)$^{-1}$	8.3E-07
	1,1,2,2-Tetrachloroethane	3.80E+01	mg/L	3.80E+01	mg/L	M	4.9E-03	mg/kg-day	2.00E-01	(mg/kg-day)$^{-1}$	9.7E-04
	1,1,2-Trichloroethane	6.00E-04	mg/L	6.00E-04	mg/L	M	5.7E-08	mg/kg-day	5.70E-02	(mg/kg-day)$^{-1}$	3.3E-09
	1,1-Dichloroethene	5.00E-01	mg/L	5.00E-01	mg/L	M	6.8E-05	mg/kg-day		(mg/kg-day)$^{-1}$	
	1,2-Dichloroethane	2.50E-01	mg/L	2.50E-01	mg/L	M	1.2E-05	mg/kg-day	9.10E-02	(mg/kg-day)$^{-1}$	1.1E-06
	Chloroform	8.40E-01	mg/L	8.40E-01	mg/L	M	7.7E-05	mg/kg-day	6.10E-03	(mg/kg-day)$^{-1}$	4.7E-07
	cis-1,2-Dichloroethene	5.00E-01	mg/L	5.00E-01	mg/L	M	4.5E-05	mg/kg-day		(mg/kg-day)$^{-1}$	
	Tetrachloroethene	3.70E-01	mg/L	3.70E-01	mg/L	M	2.3E-04	mg/kg-day	5.20E-02	(mg/kg-day)$^{-1}$	1.2E-05
	Trichloroethene	1.60E+01	mg/L	1.60E+01	mg/L	M	2.7E-03	mg/kg-day	4.00E-01	(mg/kg-day)$^{-1}$	1.1E-03
	Bis(2-Ethylhexyl)Phthalate	2.50E-03	mg/L	2.50E-03	mg/L	M	3.9E-06	mg/kg-day	1.40E-02	(mg/kg-day)$^{-1}$	5.5E-08
	Hexachloroethane	5.00E-03	mg/L	5.00E-03	mg/L	M	4.3E-06	mg/kg-day	1.40E-02	(mg/kg-day)$^{-1}$	6.1E-08
	4-Amino-2,6-Dinitrotoluene	3.25E-04	mg/L	3.25E-04	mg/L	M	4.6E-09	mg/kg-day		(mg/kg-day)$^{-1}$	
	Heptachlor	2.00E-05	mg/L	2.00E-05	mg/L	M	1.2E-08	mg/kg-day	4.50E+00	(mg/kg-day)$^{-1}$	5.4E-08
	Aluminum	2.01E-02	mg/L	2.01E-02	mg/L	M	8.0E-08	mg/kg-day		(mg/kg-day)$^{-1}$	
	Antimony	2.55E-03	mg/L	2.55E-03	mg/L	M	1.0E-08	mg/kg-day		(mg/kg-day)$^{-1}$	
	Arsenic	1.10E-03	mg/L	1.10E-03	mg/L	M	4.4E-09	mg/kg-day	1.50E+00	(mg/kg-day)$^{-1}$	6.6E-09
	Iron	2.21E-02	mg/L	2.21E-02	mg/L	M	8.8E-08	mg/kg-day		(mg/kg-day)$^{-1}$	
	Manganese	4.34E-01	mg/L	4.34E-01	mg/L	M	1.7E-06	mg/kg-day		(mg/kg-day)$^{-1}$	
	Nickel	4.14E-02	mg/L	4.14E-02	mg/L	M	3.3E-08	mg/kg-day		(mg/kg-day)$^{-1}$	
	Strontium	2.57E-01	mg/L	2.57E-01	mg/L	M	1.0E-06	mg/kg-day		(mg/kg-day)$^{-1}$	
	(total)										**2.1E-03**

Total Risk Across All Exposure Routes/Pathways **1.9E-02**

TABLE 4.11

VALUES USED FOR DAILY INTAKE CALCULATIONS
EXPOSURE OF FUTURE ADULT RESIDENTS TO VAPORS FROM GROUNDWATER WHILE SHOWERING
SWMU 1 - MUSTARD GAS BURIAL GROUND
NSWC CRANE, INDIANA

Scenario Timeframe: Future
Medium: Groundwater
Exposure Medium: Groundwater
Exposure Point: Tap Water
Receptor Population: Resident
Receptor Age: Adult

Exposure Route	Parameter Code	Parameter Definition	Units	RME Value	RME Rationale/ Reference	CTE Value	CTE Rationale/ Reference	Intake Equation/ Model Name
Inhalation	S	Volatile Chemical Generation Rate	(ug/m^3-min shower)	Derived	Foster&Chrostowski 1987	Derived	Foster & Chrostowski 1987	Chronic Daily Intake (CDI) (mg/kg-day)=
	IRsh	Inhalation Rate of volatiles in shower	(L/min)	10	U.S. EPA, December 1989	10	U.S. EPA, December 1989	S x IRsh x K x EF x ED
	EF	Exposure Frequency	(days/year)	350	U.S. EPA, May 1993	234	U.S. EPA, May 1993	BW x AT x Ra x CF
	K	Masss Transfer Coefficient	(min)	Derived	Foster&Chrostowski 1987	Derived	Foster & Chrostowski 1987	K = Ds + exp(-Ra x Dt)/Ra - [exp(Ra) x (Ds-Dt)]/Ra
	ED	Exposure Duration	(years)	24	U.S. EPA, May 1993	7	U.S. EPA, May 1993	
	BW	Body Weight	(kg)	70	U.S. EPA, December 1989	70	U.S. EPA, December 1989	
	Ra	Air Exchange Rate	(min^{-1})	0.025	Foster&Chrostowski 1987	0.025	Foster & Chrostowski 1987	
	Ds	Shower Duration	(min)	15	U.S. EPA, September 2001	10	Professional Judgement	
	Dt	Total Time in Bathroom	(min)	20	Professional judgement	15	Professional Judgement	
	AT-C	Averaging Time (Cancer)	(days)	25,550	U.S. EPA, December 1989	25550	U.S. EPA, December 1989	
	AT-N	Averaging Time (Noncancer)	(days)	8,760	U.S. EPA, December 1989	2,555	U.S. EPA, December 1989	

TABLE 7.11 - REASONABLE MAXIMUM EXPOSURE (RME)

CALCULATION OF NON-CANCER HAZARDS
EXPOSURE OF FUTURE ADULT RESIDENTS TO VAPORS FROM GROUNDWATER WHILE SHOWERING
SWMU 1 - MUSTARD GAS BURIAL GROUND
NSWC CRANE, INDIANA

Scenario Timeframe: Future
Medium: Groundwater
Exposure Medium: Air
Exposure Point: Shower Room
Receptor Population: Resident
Receptor Age: Adult

Exposure Route	Chemical of Potential Concern	Medium EPC Value	Medium EPC Units	Route EPC Value	Route EPC Units	EPC Selected for Hazard Calculation (1)	Intake (Non-Cancer)	Intake (Non-Cancer) Units	Reference Dose	Reference Dose Units	Reference Concentration	Reference Concentration Units	Hazard Quotient
Inhalation	1,1,1,2-Tetrachloroethane	2.50E-01	mg/L	6.96E-02	(mg/m^3- min)	R	1.5E-03	mg/kg-day		mg/kg-day	NA	NA	
	1,1,2,2-Tetrachloroethane	3.80E+01	mg/L	7.24E+00	(mg/m^3- min)	R	1.6E-01	mg/kg-day		mg/kg-day	NA	NA	
	1,1,2-Trichloroethane	6.00E-04	mg/L	1.63E-04	(mg/m^3- min)	R	3.5E-06	mg/kg-day		mg/kg-day	NA	NA	
	1,1-Dichloroethene	5.00E-01	mg/L	1.85E-01	(mg/m^3- min)	R	4.0E-03	mg/kg-day	5.71E-02	mg/kg-day	NA	NA	7.0E-02
	1,2-Dichloroethane	2.50E-01	mg/L	7.75E-02	(mg/m^3- min)	R	1.7E-03	mg/kg-day	1.40E-03	mg/kg-day	NA	NA	1.2E+00
	Chloroform	8.40E-01	mg/L	2.75E-01	(mg/m^3- min)	R	6.0E-03	mg/kg-day	8.60E-05	mg/kg-day	NA	NA	6.9E+01
	cis-1,2-Dichloroethene	5.00E-01	mg/L	1.78E-01	(mg/m^3- min)	R	3.9E-03	mg/kg-day		mg/kg-day	NA	NA	
	Tetrachloroethene	3.70E-01	mg/L	1.11E-01	(mg/m^3- min)	R	2.4E-03	mg/kg-day	1.40E-01	mg/kg-day	NA	NA	1.7E-02
	Trichloroethene	1.60E+01	mg/L	5.21E+00	(mg/m^3- min)	R	1.1E-01	mg/kg-day	1.00E-02	mg/kg-day	NA	NA	1.1E+01
	(total)												8.2E+01
												Total Hazard Index Across All Exposure Routes/Pathways	**8.2E+01**

(1) Specify Medium-Specific (M) or Route-Specific (R) EPC selected for hazard calculation.

TABLE 8.11 - REASONABLE MAXIMUM EXPOSURE (RME)

CALCULATION OF CANCER RISKS
EXPOSURE OF FUTURE ADULT RESIDENTS TO VAPORS FROM GROUNDWATER WHILE SHOWERING
SWMU 1 - MUSTARD GAS BURIAL GROUND
NSWC CRANE, INDIANA

Scenario Timeframe: Future
Medium: Groundwater
Exposure Medium: Groundwater
Exposure Point: Tap Water
Receptor Population: Resident
Receptor Age: Adult

Exposure Route	Chemical of Potential Concern	Medium EPC Value	Medium EPC Units	Route EPC Value	Route EPC Units	EPC Selected for Risk Calculation (1)	Intake (Cancer)	Intake (Cancer) Units	Cancer Slope Factor	Cancer Slope Factor Units	Cancer Risk
Inhalation	1,1,1,2-Tetrachloroethane	2.50E-01	mg/L	6.96E-02	(mg/m^3- min)	R	5.18E-04	mg/kg-day	2.60E-02	(mg/kg-day)$^{-1}$	1.3E-05
	1,1,2,2-Tetrachloroethane	3.80E+01	mg/L	7.24E+00	(mg/m^3- min)	R	5.4E-02	mg/kg-day	2.00E-01	(mg/kg-day)$^{-1}$	1.1E-02
	1,1,2-Trichloroethane	6.00E-04	mg/L	1.63E-04	(mg/m^3- min)	R	1.2E-06	mg/kg-day	5.60E-02	(mg/kg-day)$^{-1}$	6.8E-08
	1,1-Dichloroethene	5.00E-01	mg/L	1.85E-01	(mg/m^3- min)	R	1.4E-03	mg/kg-day		(mg/kg-day)$^{-1}$	
	1,2-Dichloroethane	2.50E-01	mg/L	7.75E-02	(mg/m^3- min)	R	5.8E-04	mg/kg-day	9.10E-02	(mg/kg-day)$^{-1}$	5.3E-05
	Chloroform	8.40E-01	mg/L	2.75E-01	(mg/m^3- min)	R	2.0E-03	mg/kg-day	8.10E-02	(mg/kg-day)$^{-1}$	1.7E-04
	cis-1,2-Dichloroethene	5.00E-01	mg/L	1.78E-01	(mg/m^3- min)	R	1.3E-03	mg/kg-day		(mg/kg-day)$^{-1}$	
	Tetrachloroethene	3.70E-01	mg/L	1.11E-01	(mg/m^3- min)	R	8.2E-04	mg/kg-day	1.00E-02	(mg/kg-day)$^{-1}$	8.2E-06
	Trichloroethene	1.60E+01	mg/L	5.21E+00	(mg/m^3- min)	R	3.9E-02	mg/kg-day	4.00E-01	(mg/kg-day)$^{-1}$	1.6E-02
	(total)										2.7E-02
										Total Risk Across All Exposure Routes/Pathways	**2.7E-02**

(1) Specify Medium-Specific (M) or Route-Specific (R) EPC selected for risk calculation.

TABLE 7.11a - CENTRAL TENDENCY EXPOSURE (CTE)

CALCULATION OF NON-CANCER HAZARDS
EXPOSURE OF FUTURE ADULT RESIDENTS TO VAPORS FROM GROUNDWATER WHILE SHOWERING
SWMU 1 - MUSTARD GAS BURIAL GROUND
NSWC CRANE, INDIANA

Scenario Timeframe: Future
Medium: Groundwater
Exposure Medium: Air
Exposure Point: Shower Room
Receptor Population: Resident
Receptor Age: Adult

Exposure Route	Chemical of Potential Concern	Medium EPC Value	Medium EPC Units	Route EPC Value	Route EPC Units	EPC Selected for Hazard Calculation (1)	Intake (Non-Cancer)	Intake (Non-Cancer) Units	Reference Dose	Reference Dose Units	Reference Concentration	Reference Concentration Units	Hazard Quotient
Inhalation	1,1,1,2-Tetrachloroethane	2.50E-01	mg/L	6.96E-02	(mg/m^3- min)	R	8.4E-04	mg/kg-day		mg/kg-day	NA	NA	
	1,1,2,2-Tetrachloroethane	3.80E+01	mg/L	7.24E+00	(mg/m^3- min)	R	8.7E-02	mg/kg-day		mg/kg-day	NA	NA	
	1,1,2-Trichloroethane	6.00E-04	mg/L	1.63E-04	(mg/m^3- min)	R	2.0E-06	mg/kg-day		mg/kg-day	NA	NA	
	1,1-Dichloroethene	5.00E-01	mg/L	1.85E-01	(mg/m^3- min)	R	2.2E-03	mg/kg-day	5.71E-02	mg/kg-day	NA	NA	3.9E-02
	1,2-Dichloroethane	2.50E-01	mg/L	7.75E-02	(mg/m^3- min)	R	9.3E-04	mg/kg-day	1.40E-03	mg/kg-day	NA	NA	6.7E-01
	Chloroform	8.40E-01	mg/L	2.75E-01	(mg/m^3- min)	R	3.3E-03	mg/kg-day	8.60E-05	mg/kg-day	NA	NA	3.8E+01
	cis-1,2-Dichloroethene	5.00E-01	mg/L	1.78E-01	(mg/m^3- min)	R	2.1E-03	mg/kg-day		mg/kg-day	NA	NA	
	Tetrachloroethene	3.70E-01	mg/L	1.11E-01	(mg/m^3- min)	R	1.3E-03	mg/kg-day	1.40E-01	mg/kg-day	NA	NA	9.5E-03
	Trichloroethene	1.60E+01	mg/L	5.21E+00	(mg/m^3- min)	R	6.3E-02	mg/kg-day	1.00E-02	mg/kg-day	NA	NA	6.3E+00
	(total)												4.5E+01
												Total Hazard Index Across All Exposure Routes/Pathways	**4.5E+01**

(1) Specify Medium-Specific (M) or Route-Specific (R) EPC selected for hazard calculation.

TABLE 8.11a - CENTRAL TENDENCY EXPOSURE (CTE)

CALCULATION OF CANCER RISKS
EXPOSURE OF FUTURE ADULT RESIDENTS TO VAPORS FROM GROUNDWATER WHILE SHOWERING
SWMU 1 - MUSTARD GAS BURIAL GROUND
NSWC CRANE, INDIANA

Scenario Timeframe: Future
Medium: Groundwater
Exposure Medium: Groundwater
Exposure Point: Tap Water
Receptor Population: Resident
Receptor Age: Adult

Exposure Route	Chemical of Potential Concern	Medium EPC Value	Medium EPC Units	Route EPC Value	Route EPC Units	EPC Selected for Risk Calculation (1)	Intake (Cancer)	Intake (Cancer) Units	Cancer Slope Factor	Cancer Slope Factor Units	Cancer Risk
Inhalation	1,1,1,2-Tetrachloroethane	2.50E-01	mg/L	6.96E-02	(mg/m^3- min)	R	2.9E-04	mg/kg-day	2.60E-02	(mg/kg-day)$^{-1}$	7.5E-06
	1,1,2,2-Tetrachloroethane	3.80E+01	mg/L	7.24E+00	(mg/m^3- min)	R	3.0E-02	mg/kg-day	2.00E-01	(mg/kg-day)$^{-1}$	6.0E-03
	1,1,2-Trichloroethane	6.00E-04	mg/L	1.63E-04	(mg/m^3- min)	R	6.7E-07	mg/kg-day	5.60E-02	(mg/kg-day)$^{-1}$	3.8E-08
	1,1-Dichloroethene	5.00E-01	mg/L	1.85E-01	(mg/m^3- min)	R	7.6E-04	mg/kg-day		(mg/kg-day)$^{-1}$	
	1,2-Dichloroethane	2.50E-01	mg/L	7.75E-02	(mg/m^3- min)	R	3.2E-04	mg/kg-day	9.10E-02	(mg/kg-day)$^{-1}$	2.9E-05
	Chloroform	8.40E-01	mg/L	2.75E-01	(mg/m^3- min)	R	1.1E-03	mg/kg-day	8.10E-02	(mg/kg-day)$^{-1}$	9.2E-05
	cis-1,2-Dichloroethene	5.00E-01	mg/L	1.78E-01	(mg/m^3- min)	R	7.3E-04	mg/kg-day		(mg/kg-day)$^{-1}$	
	Tetrachloroethene	3.70E-01	mg/L	1.11E-01	(mg/m^3- min)	R	4.6E-04	mg/kg-day	1.00E-02	(mg/kg-day)$^{-1}$	4.6E-06
	Trichloroethene	1.60E+01	mg/L	5.21E+00	(mg/m^3- min)	R	2.1E-02	mg/kg-day	4.00E-01	(mg/kg-day)$^{-1}$	8.6E-03
	(total)										1.5E-02
										Total Risk Across All Exposure Routes/Pathways	**1.5E-02**

(1) Specify Medium-Specific (M) or Route-Specific (R) EPC selected for risk calculation.

TABLE 4.12

VALUES USED FOR DAILY INTAKE CALCULATIONS
EXPOSURE OF FUTURE CHILD RESIDENTS TO VAPORS FROM GROUNDWATER WHILE SHOWERING
SWMU 1 - MUSTARD GAS BURIAL GROUND
NSWC CRANE, INDIANA

Scenario Timeframe: Future
Medium: Groundwater
Exposure Medium: Air
Exposure Point: Shower Room
Receptor Population: Resident
Receptor Age: Child (0 to 6 years)

Exposure Route	Parameter Code	Parameter Definition	Units	RME Value	RME Rationale/ Reference	CTE Value	CTE Rationale/ Reference	Intake Equation/ Model Name
Inhalation	S	Volatile Chemical Generation Rate	(ug/m^3-min shower)	Derived	Foster&Chrostowski 1987	Derived	Foster & Chrostowski 1987	Chronic Daily Intake (CDI) (mg/kg-day)=
	IRsh	Inhalation Rate of volatiles in shower	(L/min)	10	USEPA, March 1991	10	USEPA, March 1991	S x IRsh x K x EF x ED / BW x AT x Ra x CF
	EF	Exposure Frequency	(days/year)	350	EPA May 1993	234	EPA May 1993	
	K	Masss Transfer Coefficient	(min)	Derived	Foster&Chrostowski 1987	Derived	Foster & Chrostowski 1987	K = Ds + exp(-Ra x Dt)/Ra - [exp(Ra) x (Ds-Dt)]/Ra
	ED	Exposure Duration	(years)	6	EPA May 1993	2	EPA May 1993	
	BW	Body Weight	(kg)	15	EPA, December 1989	15	EPA, December 1989	
	Ra	Air Exchange Rate	(min^{-1})	0.025	Foster&Chrostowski 1987	0.025	Foster & Chrostowski 1987	
	Ds	Shower Duration	(min)	15	EPA, September 2001	10	EPA, September 2001	
	Dt	Total Time in Bathroom	(min)	20	Professional judgement	15	Professional Judgement	
	AT-C	Averaging Time (Cancer)	(days)	25,550	EPA, December 1989	25550	EPA, December 1989	
	AT-N	Averaging Time (Noncancer)	(days)	2,190	EPA, December 1989	730	EPA, December 1989	

TABLE 7.12 - REASONABLE MAXIMUM EXPOSURE (RME)

CALCULATION OF NON-CANCER HAZARDS
EXPOSURE OF FUTURE CHILD RESIDENTS TO VAPORS FROM GROUNDWATER WHILE SHOWERING
SWMU 1 - MUSTARD GAS BURIAL GROUND
NSWC CRANE, INDIANA

Scenario Timeframe: Future
Medium: Groundwater
Exposure Medium: Air
Exposure Point: Shower Room
Receptor Population: Resident
Receptor Age: Child (0 to 6 years)

Exposure Route	Chemical of Potential Concern	Medium EPC Value	Medium EPC Units	Route EPC Value	Route EPC Units	EPC Selected for Hazard Calculation (1)	Intake (Non-Cancer)	Intake (Non-Cancer) Units	Reference Dose	Reference Dose Units	Reference Concentration	Reference Concentration Units	Hazard Quotient
Inhalation	1,1,1,2-Tetrachloroethane	2.50E-01	mg/L	6.96E-02	(mg/m^3- min)	R	7.1E-03	mg/kg-day		mg/kg-day	NA	NA	
	1,1,2,2-Tetrachloroethane	3.80E+01	mg/L	7.24E+00	(mg/m^3- min)	R	7.3E-01	mg/kg-day		mg/kg-day	NA	NA	
	1,1,2-Trichloroethane	6.00E-04	mg/L	1.63E-04	(mg/m^3- min)	R	1.7E-05	mg/kg-day		mg/kg-day	NA	NA	
	1,1-Dichloroethene	5.00E-01	mg/L	1.85E-01	(mg/m^3- min)	R	1.9E-02	mg/kg-day	5.71E-02	mg/kg-day	NA	NA	3.3E-01
	1,2-Dichloroethane	2.50E-01	mg/L	7.75E-02	(mg/m^3- min)	R	7.9E-03	mg/kg-day	1.40E-03	mg/kg-day	NA	NA	5.6E+00
	Chloroform	8.40E-01	mg/L	2.75E-01	(mg/m^3- min)	R	2.8E-02	mg/kg-day	8.60E-05	mg/kg-day	NA	NA	3.2E+02
	cis-1,2-Dichloroethene	5.00E-01	mg/L	1.78E-01	(mg/m^3- min)	R	1.8E-02	mg/kg-day		mg/kg-day	NA	NA	
	Tetrachloroethene	3.70E-01	mg/L	1.11E-01	(mg/m^3- min)	R	1.1E-02	mg/kg-day	1.40E-01	mg/kg-day	NA	NA	8.0E-02
	Trichloroethene	1.60E+01	mg/L	5.21E+00	(mg/m^3- min)	R	5.3E-01	mg/kg-day	1.00E-02	mg/kg-day	NA	NA	5.3E+01
	(total)												3.8E+02
												Total Hazard Index Across All Exposure Routes/Pathways	**3.8E+02**

(1) Specify Medium-Specific (M) or Route-Specific (R) EPC selected for hazard calculation.

TABLE 8.12 - REASONABLE MAXIMUM EXPOSURE (RME)

CALCULATION OF CANCER RISKS
EXPOSURE OF FUTURE CHILD RESIDENTS TO VAPORS FROM GROUNDWATER WHILE SHOWERING
SWMU 1 - MUSTARD GAS BURIAL GROUND
NSWC CRANE, INDIANA

Scenario Timeframe: Future
Medium: Groundwater
Exposure Medium: Air
Exposure Point: Shower Room
Receptor Population: Resident
Receptor Age: Child (0 to 6 years)

Exposure Route	Chemical of Potential Concern	Medium EPC Value	Medium EPC Units	Route EPC Value	Route EPC Units	EPC Selected for Risk Calculation (1)	Intake (Cancer)	Intake (Cancer) Units	Cancer Slope Factor	Cancer Slope Factor Units	Cancer Risk
Inhalation	1,1,1,2-Tetrachloroethane	2.50E-01	mg/L	6.96E-02	(mg/m^3- min)	R	6.0E-04	mg/kg-day	2.60E-02	(mg/kg-day)$^{-1}$	1.6E-05
	1,1,2,2-Tetrachloroethane	3.80E+01	mg/L	7.24E+00	(mg/m^3- min)	R	6.3E-02	mg/kg-day	2.00E-01	(mg/kg-day)$^{-1}$	1.3E-02
	1,1,2-Trichloroethane	6.00E-04	mg/L	1.63E-04	(mg/m^3- min)	R	1.4E-06	mg/kg-day	5.60E-02	(mg/kg-day)$^{-1}$	7.9E-08
	1,1-Dichloroethene	5.00E-01	mg/L	1.85E-01	(mg/m^3- min)	R	1.6E-03	mg/kg-day		(mg/kg-day)$^{-1}$	
	1,2-Dichloroethane	2.50E-01	mg/L	7.75E-02	(mg/m^3- min)	R	6.7E-04	mg/kg-day	9.10E-02	(mg/kg-day)$^{-1}$	6.1E-05
	Chloroform	8.40E-01	mg/L	2.75E-01	(mg/m^3- min)	R	2.4E-03	mg/kg-day	8.10E-02	(mg/kg-day)$^{-1}$	1.9E-04
	cis-1,2-Dichloroethene	5.00E-01	mg/L	1.78E-01	(mg/m^3- min)	R	1.5E-03	mg/kg-day		(mg/kg-day)$^{-1}$	
	Tetrachloroethene	3.70E-01	mg/L	1.11E-01	(mg/m^3- min)	R	9.6E-04	mg/kg-day	1.00E-02	(mg/kg-day)$^{-1}$	9.6E-06
	Trichloroethene	1.60E+01	mg/L	5.21E+00	(mg/m^3- min)	R	4.5E-02	mg/kg-day	4.00E-01	(mg/kg-day)$^{-1}$	1.8E-02
	(total)										3.1E-02
										Total Risk Across All Exposure Routes/Pathways	**3.1E-02**

(1) Specify Medium-Specific (M) or Route-Specific (R) EPC selected for risk calculation.

TABLE 7.12a - CENTRAL TENDENCY EXPOSURE (CTE)

CALCULATION OF NON-CANCER HAZARDS
EXPOSURE OF FUTURE CHILD RESIDENTS TO VAPORS FROM GROUNDWATER WHILE SHOWERING
SWMU 1 - MUSTARD GAS BURIAL GROUND
NSWC CRANE, INDIANA

Scenario Timeframe: Future
Medium: Groundwater
Exposure Medium: Air
Exposure Point: Shower Room
Receptor Population: Resident
Receptor Age: Child (0 to 6 years)

Exposure Route	Chemical of Potential Concern	Medium EPC Value	Medium EPC Units	Route EPC Value	Route EPC Units	EPC Selected for Hazard Calculation (1)	Intake (Non-Cancer)	Intake (Non-Cancer) Units	Reference Dose	Reference Dose Units	Reference Concentration	Reference Concentration Units	Hazard Quotient
Inhalation	1,1,1,2-Tetrachloroethane	2.50E-01	mg/L	6.96E-02	(mg/m^3- min)	R	3.9E-03	mg/kg-day		mg/kg-day	NA	NA	
	1,1,2,2-Tetrachloroethane	3.80E+01	mg/L	7.24E+00	(mg/m^3- min)	R	4.1E-01	mg/kg-day		mg/kg-day	NA	NA	
	1,1,2-Trichloroethane	6.00E-04	mg/L	1.63E-04	(mg/m^3- min)	R	9.2E-06	mg/kg-day		mg/kg-day	NA	NA	
	1,1-Dichloroethene	5.00E-01	mg/L	1.85E-01	(mg/m^3- min)	R	1.0E-02	mg/kg-day	5.71E-02	mg/kg-day	NA	NA	1.8E-01
	1,2-Dichloroethane	2.50E-01	mg/L	7.75E-02	(mg/m^3- min)	R	4.3E-03	mg/kg-day	1.40E-03	mg/kg-day	NA	NA	3.1E+00
	Chloroform	8.40E-01	mg/L	2.75E-01	(mg/m^3- min)	R	1.5E-02	mg/kg-day	8.60E-05	mg/kg-day	NA	NA	1.8E+02
	cis-1,2-Dichloroethene	5.00E-01	mg/L	1.78E-01	(mg/m^3- min)	R	1.0E-02	mg/kg-day		mg/kg-day	NA	NA	
	Tetrachloroethene	3.70E-01	mg/L	1.11E-01	(mg/m^3- min)	R	6.2E-03	mg/kg-day	1.40E-01	mg/kg-day	NA	NA	4.4E-02
	Trichloroethene	1.60E+01	mg/L	5.21E+00	(mg/m^3- min)	R	2.9E-01	mg/kg-day	1.00E-02	mg/kg-day	NA	NA	2.9E+01
	(total)												2.1E+02
												Total Hazard Index Across All Exposure Routes/Pathways	**2.1E+02**

(1) Specify Medium-Specific (M) or Route-Specific (R) EPC selected for hazard calculation.

TABLE 8.12a - CENTRAL TENDENCY EXPOSURE (CTE)

CALCULATION OF CANCER RISKS
EXPOSURE OF FUTURE CHILD RESIDENTS TO VAPORS FROM GROUNDWATER WHILE SHOWERING
SWMU 1 - MUSTARD GAS BURIAL GROUND
NSWC CRANE, INDIANA

Scenario Timeframe: Future
Medium: Groundwater
Exposure Medium: Air
Exposure Point: Shower Room
Receptor Population: Resident
Receptor Age: Child (0 to 6 years)

Exposure Route	Chemical of Potential Concern	Medium EPC Value	Medium EPC Units	Route EPC Value	Route EPC Units	EPC Selected for Risk Calculation (1)	Intake (Cancer)	Intake (Cancer) Units	Cancer Slope Factor	Cancer Slope Factor Units	Cancer Risk
Inhalation	1,1,1,2-Tetrachloroethane	2.50E-01	mg/L	6.96E-02	(mg/m^3- min)	R	3.3E-04	mg/kg-day	2.60E-02	(mg/kg-day)$^{-1}$	8.7E-06
	1,1,2,2-Tetrachloroethane	3.80E+01	mg/L	7.24E+00	(mg/m^3- min)	R	3.5E-02	mg/kg-day	2.00E-01	(mg/kg-day)$^{-1}$	7.0E-03
	1,1,2-Trichloroethane	6.00E-04	mg/L	1.63E-04	(mg/m^3- min)	R	7.8E-07	mg/kg-day	5.60E-02	(mg/kg-day)$^{-1}$	4.4E-08
	1,1-Dichloroethene	5.00E-01	mg/L	1.85E-01	(mg/m^3- min)	R	8.9E-04	mg/kg-day		(mg/kg-day)$^{-1}$	
	1,2-Dichloroethane	2.50E-01	mg/L	7.75E-02	(mg/m^3- min)	R	3.7E-04	mg/kg-day	9.10E-02	(mg/kg-day)$^{-1}$	3.4E-05
	Chloroform	8.40E-01	mg/L	2.75E-01	(mg/m^3- min)	R	1.3E-03	mg/kg-day	8.10E-02	(mg/kg-day)$^{-1}$	1.1E-04
	cis-1,2-Dichloroethene	5.00E-01	mg/L	1.78E-01	(mg/m^3- min)	R	8.5E-04	mg/kg-day		(mg/kg-day)$^{-1}$	
	Tetrachloroethene	3.70E-01	mg/L	1.11E-01	(mg/m^3- min)	R	5.3E-04	mg/kg-day	1.00E-02	(mg/kg-day)$^{-1}$	5.3E-06
	Trichloroethene	1.60E+01	mg/L	5.21E+00	(mg/m^3- min)	R	2.5E-02	mg/kg-day	4.00E-01	(mg/kg-day)$^{-1}$	1.0E-02
	(total)										1.7E-02

(1) Specify Medium-Specific (M) or Route-Specific (R) EPC selected for risk calculation.

Total Risk Across All Exposure Routes/Pathways **1.7E-02**

TABLE 4.13

VALUES USED FOR DAILY INTAKE CALCULATIONS
EXPOSURE OF CONSTRUCTION WORKERS TO AMBIENT AIR
SWMU 1 - MUSTARD GAS BURIAL GROUND
NSWC CRANE, INDIANA

Scenario Timeframe: Future
Medium: Groundwater
Exposure Medium: Air
Exposure Point: Ambient Air
Receptor Population: Construction Worker
Receptor Age: Adult

Exposure Route	Parameter Code	Parameter Definition	Units	RME Value	RME Rationale/ Reference	CTE Value	CTE Rationale/ Reference	Intake Equation/ Model Name
Inhalation	Cair	Chemical Concentration in Air	(mg/m^3)	Derived	VDEQ, August 2002	Derived	VDEQ, August 2002	Chronic Daily Intake (CDI) (mg/kg-day)=
	IRa	Inhalation Rate of volatiles	(m^3/hr)	2.5	USEPA, December 1989	2.5	USEPA, December 1989	Cair x IRa x ET x EF x ED / BW x AT
	EF	Exposure Frequency	(days/year)	150	Professional Judgement	150	Professional Judgement	
	ED	Exposure Duration	(years)	1	USEPA, May 1993	1	USEPA, May 1993	
	ET	Exposure Time	(hr/day)	2	Professional judgement	1.5	Professional Judgement	
	BW	Body Weight	(kg)	70	USEPA, December 1989	70	USEPA, December 1989	
	AT-C	Averaging Time (Cancer)	(days)	25,550	USEPA, December 1989	25,550	USEPA, December 1989	
	AT-N	Averaging Time (Noncancer)	(days)	365	USEPA, December 1989	365	USEPA, December 1989	

Daily Intake Calculations

Inhalation Intake = (IRa x ET x EF x ED) / (BW x AT)

Cancer Inhalation Intake(RME) = 4.19E-04
Noncancer Inhalation Intake(RME) = 2.94E-02

Cancer Inhalation Intake(CTE) = 3.15E-04
Noncancer Inhalation Intake(CTE) = 2.20E-02

TABLE 7.13. REASONABLE MAXIMUM EXPOSURE (RME)

CALCULATION OF NON-CANCER HAZARDS
EXPOSURE OF CONSTRUCTION WORKERS TO AMBIENT AIR
SWMU 1 - MUSTARD GAS BURIAL GROUND
NSWC CRANE, INDIANA

Scenario Timeframe: Future
Medium: Groundwater
Exposure Medium: Air
Exposure Point: Ambient Air
Receptor Population: Construction Worker
Receptor Age: Adult

Exposure Route	Chemical of Potential Concern	Medium EPC Value	Medium EPC Units	Route EPC Value	Route EPC Units	EPC Selected for Hazard Calculation (1)	Intake (Non-Cancer)	Intake (Non-Cancer) Units	Reference Dose	Reference Dose Units	Reference Concentration	Reference Concentration Units	Hazard Quotient
Inhalation	1,1,1,2-Tetrachloroethane	2.50E-01	mg/L	7.01E-03	mg/m^3	R	2.1E-04	mg/kg-day		mg/kg-day	NA	NA	
	1,1,2,2-Tetrachloroethane	3.80E+01	mg/L	9.41E-01	mg/m^3	R	2.8E-02	mg/kg-day		mg/kg-day	NA	NA	
	1,12-Trichloroethane	6.00E-04	mg/L	1.82E-05	mg/m^3	R	5.3E-07	mg/kg-day		mg/kg-day	NA	NA	
	1,1-Dichloroethene	5.00E-01	mg/L	1.88E-05	mg/m^3	R	5.5E-07	mg/kg-day	5.71E-02	mg/kg-day	NA	NA	9.7E-06
	1,2-Dichloroethane	2.50E-01	mg/L	8.80E-03	mg/m^3	R	2.6E-04	mg/kg-day	1.40E-03	mg/kg-day	NA	NA	1.8E-01
	Chloroform	8.40E-01	mg/L	2.81E-02	mg/m^3	R	8.2E-04	mg/kg-day	8.60E-05	mg/kg-day	NA	NA	9.6E+00
	cis-1,2-Dichloroethene	5.00E-01	mg/L	1.86E-02	mg/m^3	R	5.5E-04	mg/kg-day		mg/kg-day	NA	NA	
	Tetrachloroethene	3.70E-01	mg/L	1.06E-02	mg/m^3	R	3.1E-04	mg/kg-day	1.40E-01	mg/kg-day	NA	NA	2.2E-03
	Trichloroethene	1.60E+01	mg/L	5.15E-01	mg/m^3	R	1.5E-02	mg/kg-day	1.00E-02	mg/kg-day	NA	NA	1.5E+00
	(total)												1.1E+01
												Total Hazard Index Across All Exposure Routes/Pathways	**1.1E+01**

(1) Specify Medium-Specific (M) or Route-Specific (R) EPC selected for hazard calculation.

TABLE 8.13. REASONABLE MAXIMUM EXPOSURE (RME)

CALCULATION OF CANCER RISKS
EXPOSURE OF CONSTRUCTION WORKERS TO AMBIENT AIR
SWMU 1 - MUSTARD GAS BURIAL GROUND
NSWC CRANE, INDIANA

Scenario Timeframe: Future
Medium: Groundwater
Exposure Medium: Air
Exposure Point: Ambient Air
Receptor Population: Construction Worker
Receptor Age: Adult

Exposure Route	Chemical of Potential Concern	Medium EPC Value	Medium EPC Units	Route EPC Value	Route EPC Units	EPC Selected for Risk Calculation (1)	Intake (Cancer)	Intake (Cancer) Units	Cancer Slope Factor	Cancer Slope Factor Units	Cancer Risk
Inhalation	1,1,1,2-Tetrachloroethane	2.50E-01	mg/L	7.01E-03	mg/m^3	R	2.9E-06	mg/kg-day	2.60E-02	$(mg/kg\text{-}day)^{-1}$	7.6E-08
	1,1,2,2-Tetrachloroethane	3.80E+01	mg/L	9.41E-01	mg/m^3	R	3.9E-04	mg/kg-day	2.00E-01	$(mg/kg\text{-}day)^{-1}$	7.9E-05
	1,12-Trichloroethane	6.00E-04	mg/L	1.82E-05	mg/m^3	R	7.6E-09	mg/kg-day	5.60E-02	$(mg/kg\text{-}day)^{-1}$	4.3E-10
	1,1-Dichloroethene	5.00E-01	mg/L	1.88E-05	mg/m^3	R	7.9E-09	mg/kg-day		$(mg/kg\text{-}day)^{-1}$	
	1,2-Dichloroethane	2.50E-01	mg/L	8.80E-03	mg/m^3	R	3.7E-06	mg/kg-day	9.10E-02	$(mg/kg\text{-}day)^{-1}$	3.4E-07
	Chloroform	8.40E-01	mg/L	2.81E-02	mg/m^3	R	1.2E-05	mg/kg-day	8.10E-02	$(mg/kg\text{-}day)^{-1}$	9.5E-07
	cis-1,2-Dichloroethene	5.00E-01	mg/L	1.86E-02	mg/m^3	R	7.8E-06	mg/kg-day		$(mg/kg\text{-}day)^{-1}$	
	Tetrachloroethene	3.70E-01	mg/L	1.06E-02	mg/m^3	R	4.5E-06	mg/kg-day	1.00E-02	$(mg/kg\text{-}day)^{-1}$	4.5E-08
	Trichloroethene	1.60E+01	mg/L	5.15E-01	mg/m^3	R	2.2E-04	mg/kg-day	4.00E-01	$(mg/kg\text{-}day)^{-1}$	8.6E-05
	(total)										1.7E-04
										Total Risk Across All Exposure Routes/Pathways	**1.7E-04**

(1) Specify Medium-Specific (M) or Route-Specific (R) EPC selected for risk calculation.

TABLE 8.13a. CENTRAL TENDENCY EXPOSURE (CTE)

CALCULATION OF CANCER RISKS
EXPOSURE OF CONSTRUCTION WORKERS TO AMBIENT AIR
SWMU 1 - MUSTARD GAS BURIAL GROUND
NSWC CRANE, INDIANA

Scenario Timeframe: Future
Medium: Groundwater
Exposure Medium: Air
Exposure Point: Ambient Air
Receptor Population: Construction Worker
Receptor Age: Adult

Exposure Route	Chemical of Potential Concern	Medium EPC Value	Medium EPC Units	Route EPC Value	Route EPC Units	EPC Selected for Risk Calculation (1)	Intake (Cancer)	Intake (Cancer) Units	Cancer Slope Factor	Cancer Slope Factor Units	Cancer Risk
Inhalation	1,1,1,2-Tetrachloroethane	2.50E-01	mg/L	7.01E-03	mg/m^3	R	2.2E-06	mg/kg-day	2.60E-02	$(mg/kg\text{-}day)^{-1}$	5.7E-08
	1,1,2,2-Tetrachloroethane	3.80E+01	mg/L	9.41E-01	mg/m^3	R	3.0E-04	mg/kg-day	2.00E-01	$(mg/kg\text{-}day)^{-1}$	5.9E-05
	1,12-Trichloroethane	6.00E-04	mg/L	1.82E-05	mg/m^3	R	5.7E-09	mg/kg-day	5.60E-02	$(mg/kg\text{-}day)^{-1}$	3.2E-10
	1,1-Dichloroethene	5.00E-01	mg/L	1.88E-05	mg/m^3	R	5.9E-09	mg/kg-day		$(mg/kg\text{-}day)^{-1}$	
	1,2-Dichloroethane	2.50E-01	mg/L	8.80E-03	mg/m^3	R	2.8E-06	mg/kg-day	9.10E-02	$(mg/kg\text{-}day)^{-1}$	2.5E-07
	Chloroform	8.40E-01	mg/L	2.81E-02	mg/m^3	R	8.8E-06	mg/kg-day	8.10E-02	$(mg/kg\text{-}day)^{-1}$	7.2E-07
	cis-1,2-Dichloroethene	5.00E-01	mg/L	1.86E-02	mg/m^3	R	5.8E-06	mg/kg-day		$(mg/kg\text{-}day)^{-1}$	
	Tetrachloroethene	3.70E-01	mg/L	1.06E-02	mg/m^3	R	3.3E-06	mg/kg-day	1.00E-02	$(mg/kg\text{-}day)^{-1}$	3.3E-08
	Trichloroethene	1.60E+01	mg/L	5.15E-01	mg/m^3	R	1.6E-04	mg/kg-day	4.00E-01	$(mg/kg\text{-}day)^{-1}$	6.5E-05
	(total)										1.3E-04
										Total Risk Across All Exposure Routes/Pathways	**1.3E-04**

(1) Specify Medium-Specific (M) or Route-Specific (R) EPC selected for risk calculation.

TABLE 7.13a. CENTRAL TENDENCY EXPOSURE (CTE)

CALCULATION OF NON-CANCER HAZARDS
EXPOSURE OF CONSTRUCTION WORKERS TO AMBIENT AIR
SWMU 1 - MUSTARD GAS BURIAL GROUND
NSWC CRANE, INDIANA

Scenario Timeframe: Future
Medium: Groundwater
Exposure Medium: Air
Exposure Point: Ambient Air
Receptor Population: Construction Worker
Receptor Age: Adult

Exposure Route	Chemical of Potential Concern	Medium EPC Value	Medium EPC Units	Route EPC Value	Route EPC Units	EPC Selected for Hazard Calculation (1)	Intake (Non-Cancer)	Intake (Non-Cancer) Units	Reference Dose	Reference Dose Units	Reference Concentration	Reference Concentration Units	Hazard Quotient
Inhalation	1,1,1,2-Tetrachloroethane	2.50E-01	mg/L	7.01E-03	mg/m^3	R	1.5E-04	mg/kg-day		mg/kg-day	NA	NA	
	1,1,2,2-Tetrachloroethane	3.80E+01	mg/L	9.41E-01	mg/m^3	R	2.1E-02	mg/kg-day		mg/kg-day	NA	NA	
	1,12-Trichloroethane	6.00E-04	mg/L	1.82E-05	mg/m^3	R	4.0E-07	mg/kg-day		mg/kg-day	NA	NA	
	1,1-Dichloroethene	5.00E-01	mg/L	1.88E-05	mg/m^3	R	4.1E-07	mg/kg-day	5.71E-02	mg/kg-day	NA	NA	7.2E-06
	1,2-Dichloroethane	2.50E-01	mg/L	8.80E-03	mg/m^3	R	1.9E-04	mg/kg-day	1.40E-03	mg/kg-day	NA	NA	1.4E-01
	Chloroform	8.40E-01	mg/L	2.81E-02	mg/m^3	R	6.2E-04	mg/kg-day	8.60E-05	mg/kg-day	NA	NA	7.2E+00
	cis-1,2-Dichloroethene	5.00E-01	mg/L	1.86E-02	mg/m^3	R	4.1E-04	mg/kg-day		mg/kg-day	NA	NA	
	Tetrachloroethene	3.70E-01	mg/L	1.06E-02	mg/m^3	R	2.3E-04	mg/kg-day	1.40E-01	mg/kg-day	NA	NA	1.7E-03
	Trichloroethene	1.60E+01	mg/L	5.15E-01	mg/m^3	R	1.1E-02	mg/kg-day	1.00E-02	mg/kg-day	NA	NA	1.1E+00
	(total)												8.5E+00
												Total Hazard Index Across All Exposure Routes/Pathways	**8.5E+00**

(1) Specify Medium-Specific (M) or Route-Specific (R) EPC selected for hazard calculation.

TABLE 9.1. REASONABLE MAXIMUM EXPOSURE (RME)
SUMMARY OF RECEPTOR RISKS AND HAZARDS FOR COPCs - CONSTRUCTION WORKERS
SWMU 1 - MUSTARD GAS BURIAL GROUND
NSWC CRANE, INDIANA

Scenario Timeframe: Future
Receptor Population: Construction Workers
Receptor Age: Adult

Medium	Exposure Medium	Exposure Point	Chemical	Carcinogenic Risk				Chemical	Non-Carcinogenic Hazard Quotient				
				Ingestion	Inhalation	Dermal	Exposure Routes Total		*Primary* Target Organ	Ingestion	Inhalation	Dermal	Exposure Routes Total
Soil	Soil	Surface and Subsurface Soil	1,1,2,2-Tetrachloroethene	1.3E-11			1.3E-11	1,1,2,2-Tetrachloroethene	Liver	7.5E-08			7.5E-08
			Methylene Chloride	6.5E-12			6.5E-12	Methylene Chloride	Liver	1.0E-06			1.0E-06
			Benzo(a)anthracene	2.3E-10		1.1E-10	3.4E-10	Benzo(a)anthracene					
			Benzo(a)pyrene	2.4E-09		1.1E-09	3.5E-09	Benzo(a)pyrene					
			Benzo(b)fluoranthene	2.5E-10		1.2E-10	3.7E-10	Benzo(b)fluoranthene					
			Aluminum					Aluminum	Body Weight	3.0E-02			3.0E-02
			Barium					Barium	Blood	3.1E-03			3.1E-03
			Cadmium					Cadmium	Kidney	1.6E-03		1.2E-04	1.7E-03
			Chromium					Chromium	NOAEL	1.4E-02			1.4E-02
			Iron					Iron	Liver, Blood, GI Trac	1.9E-01			1.9E-01
			Manganese					Manganese	CNS	3.5E-02			3.5E-02
			Nickel					Nickel	Decreased Organ/ Body Weights	1.8E-03			1.8E-03
			Selenium					Selenium	Blood/Skin/CNS	3.6E-04			3.6E-04
Groundwater	Water	Onsite	1,1,1,2-Tetrachloroethane		7.6E-08	8.3E-08	1.6E-07	1,1,1,2-Tetrachloroethane	Liver, Kidney			7.4E-03	7.4E-03
			1,1,2,2-Tetrachloroethane		7.9E-05	9.7E-05	1.8E-04	1,1,2,2-Tetrachloroethane	Liver			5.6E-01	5.6E-01
			1,1,2-Trichloroethane		4.3E-10	3.4E-10	7.7E-10	1,1,2-Trichloroethane	Liver			1.0E-04	1.0E-04
			1,1-Dichloroethene					1,1-Dichloroethene	Liver		9.7E-06	1.1E-02	1.1E-02
			1,2-Dichloroethane		3.4E-07	1.3E-07	4.6E-07	1,2-Dichloroethane	NOAEL		1.8E-01	3.3E-03	1.9E-01
			Chloroform		9.5E-07	5.0E-08	1.0E-06	Chloroform	Liver		9.6E+00	5.8E-02	9.6E+00
			cis-1,2-Dichloroethene					cis-1,2-Dichloroethene	Blood			3.6E-02	3.6E-02
			Tetrachloroethene		4.5E-08	1.2E-06	1.2E-06	Tetrachloroethene	Liver		2.2E-03	1.6E-01	1.6E-01
			Trichloroethene		8.6E-05	1.1E-04	2.0E-04	Trichloroethene	CNS		1.5E+00	6.6E+01	6.8E+01
			Bis(2-Ethylhexyl)Phthalate			5.4E-09	5.4E-09	Bis(2-Ethylhexyl)Phthalate	Liver			1.4E-03	1.4E-03
			Hexachloroethane			6.0E-09	6.0E-09	Hexachloroethane	Kidney			3.0E-02	3.0E-02
			4-Amino-2,6-Dinitrotoluene					4-Amino-2,6-Dinitrotoluene	Liver			5.3E-04	5.3E-04
			Heptachlor			5.4E-09	5.4E-09	Heptachlor	Liver			1.7E-04	1.7E-04
			Aluminum					Aluminum	Body Weight			1.4E-06	1.4E-06
			Antimony					Antimony	Lifespan			2.9E-03	2.9E-03
			Arsenic			1.6E-09	1.6E-09	Arsenic	Skin, Vascular			2.5E-04	2.5E-04
			Iron					Iron	Liver, Blood, GI Tract			5.0E-06	5.0E-06
			Manganese					Manganese	CNS			3.1E-02	3.1E-02
			Nickel					Nickel	Decreased body / organ weights			7.0E-04	7.0E-04
			Strontium					Strontium	Bone			2.9E-05	2.9E-05
						Total Risk Across Surface/Subsurface Soil	4.2E-09					Total Hazard Index Across All Media and All Exposure Routes	7.8E+01
						Total Risk Across Groundwater	3.8E-04						

Total Risk Across All Media and All Exposure Routes	3.8E-04

Total Liver HI =	1.1E+01
Total Kidney HI =	3.9E-02
Total GI Tract HI =	1.9E-01
Total Blood HI =	2.3E-01
Total CNS HI =	6.8E+01
Total Skin HI =	6.1E-04
Total Vascular HI =	2.5E-04
Total Body Weight HI =	2.5E-03
Total Lifespan HI =	2.9E-03
Total Bone HI =	2.9E-05

TABLE 9.2. REASONABLE MAXIMUM EXPOSURE (RME)
SUMMARY OF RECEPTOR RISKS AND HAZARDS FOR COPCs - MAINTENANCE WORKERS
SWMU 1 - MUSTARD GAS BURIAL GROUND
NSWC CRANE, INDIANA

Scenario Timeframe: Future
Receptor Population: Maintenance Workers
Receptor Age: Adult

Medium	Exposure Medium	Exposure Point	Chemical	Carcinogenic Risk				Chemical	Non-Carcinogenic Hazard Quotient				
				Ingestion	Inhalation	Dermal	Exposure Routes Total		Primary Target Organ	Ingestion	Inhalation	Dermal	Exposure Routes Total
Soil	Soil	Surface Soil	Methylene Chloride	5.4E-12			5.4E-12	Methylene Chloride	Liver	3.4E-08			3.4E-08
			Aluminum					Aluminum	Body Weight	1.3E-03			1.3E-03
			Iron					Iron	Liver, Blood, GI Trac	6.7E-03			6.7E-03
			Selenium					Selenium	Blood/Skin/CNS	1.5E-05			1.5E-05
						Total Risk Across Surface Soil	5.4E-12		Total Hazard Index Across All Media and All Exposure Routes				8.0E-03

Total Risk Across All Media and All Exposure Routes 5.4E-12

Total Liver HI =	6.7E-03
Total GI Tract HI =	6.7E-03
Total Blood HI =	6.7E-03
Total CNS HI =	1.5E-05
Total Skin HI =	1.5E-05
Total Body Weight HI =	1.3E-03

TABLE 9.3. REASONABLE MAXIMUM EXPOSURE (RME)
SUMMARY OF RECEPTOR RISKS AND HAZARDS FOR COPCs - OCCUPATIONAL WORKERS
SWMU 1 - MUSTARD GAS BURIAL GROUND
NSWC CRANE, INDIANA

Scenario Timeframe: Future
Receptor Population: Occupational Workers
Receptor Age: Adult

Medium	Exposure Medium	Exposure Point	Chemical	Carcinogenic Risk				Chemical	Non-Carcinogenic Hazard Quotient				
				Ingestion	Inhalation	Dermal	Exposure Routes Total		Primary Target Organ	Ingestion	Inhalation	Dermal	Exposure Routes Total
Soil	Soil	Surface Soil	Methylene Chloride	5.7E-11			5.7E-11	Methylene Chloride	Liver	3.5E-07			3.5E-07
			Aluminum					Aluminum	Body Weight	1.4E-02			1.4E-02
			Iron					Iron	Liver, Blood, GI Trac	6.9E-02			6.9E-02
			Selenium					Selenium	Blood/Skin/CNS	1.6E-04		–	1.6E-04
						Total Risk Across Surface Soil	5.7E-11					Total Hazard Index Across All Media and All Exposure Routes	8.3E-02

Total Risk Across All Media and All Exposure Routes: 5.7E-11

Total Liver HI =	6.9E-02
Total GI Tract HI =	6.9E-02
Total Blood HI =	7.0E-02
Total CNS HI =	1.6E-04
Total Skin HI =	1.6E-04
Total Body Weight HI =	1.4E-02

TABLE 9.4. REASONABLE MAXIMUM EXPOSURE (RME)
SUMMARY OF RECEPTOR RISKS AND HAZARDS FOR COPCs - ADULT RECREATIONAL USERS
SWMU 1 - MUSTARD GAS BURIAL GROUND
NSWC CRANE, INDIANA

Scenario Timeframe: Future
Receptor Population: Recreational Users
Receptor Age: Adult

Medium	Exposure Medium	Exposure Point	Chemical	Carcinogenic Risk				Chemical	Non-Carcinogenic Hazard Quotient				
				Ingestion	Inhalation	Dermal	Exposure Routes Total		Primary Target Organ	Ingestion	Inhalation	Dermal	Exposure Routes Total
Soil	Soil	Surface Soil	Methylene Chloride	1.4E-11			1.4E-11	Methylene Chloride	Liver	7.3E-08			7.3E-08
			Aluminum					Aluminum	Body Weight	2.9E-03			2.9E-03
			Iron					Iron	Liver, Blood, GI Trac	1.4E-02			1.4E-02
			Selenium					Selenium	Blood/Skin/CNS	3.2E-05			3.2E-05
							Total Risk Across Surface Soil 1.4E-11						Total Hazard Index Across All Media and All Exposure Routes 1.7E-02

Total Risk Across All Media and All Exposure Routes 1.4E-11

Total Liver HI =	1.4E-02
Total GI Tract HI =	1.4E-02
Total Blood HI =	1.4E-02
Total CNS HI =	3.2E-05
Total Skin HI =	3.2E-05
Total Body Weight HI =	2.9E-03

TABLE 9.5. REASONABLE MAXIMUM EXPOSURE (RME)
SUMMARY OF RECEPTOR RISKS AND HAZARDS FOR COPCs - ADOLESCENT TRESPASSERS
SWMU 1 - MUSTARD GAS BURIAL GROUND
NSWC CRANE, INDIANA

Scenario Timeframe: Current/Future
Receptor Population: Trespassers
Receptor Age: Adolescent (6 to 17 years)

Medium	Exposure Medium	Exposure Point	Chemical	Carcinogenic Risk				Chemical	Non-Carcinogenic Hazard Quotient				
				Ingestion	Inhalation	Dermal	Exposure Routes Total		Primary Target Organ	Ingestion	Inhalation	Dermal	Exposure Routes Total
Soil	Soil	Surface Soil	Methylene Chloride	4.2E-12			4.2E-12	Methylene Chloride	Liver	6.0E-08			6.0E-08
			Aluminum					Aluminum	Body Weight	2.3E-03			2.3E-03
			Iron					Iron	Liver, Blood, GI Trac	1.2E-02			1.2E-02
			Selenium					Selenium	Blood/Skin/CNS	2.6E-05			2.6E-05
						Total Risk Across Surface Soil	4.2E-12					Total Hazard Index Across All Media and All Exposure Routes	1.4E-02

Total Risk Across All Media and All Exposure Routes: 4.2E-12

Total Liver HI =	1.2E-02
Total GI Tract HI =	1.2E-02
Total Blood HI =	1.2E-02
Total CNS HI =	2.6E-05
Total Skin HI =	2.6E-05
Total Body Weight HI =	2.3E-03

TABLE 9.6. REASONABLE MAXIMUM EXPOSURE (RME)
SUMMARY OF RECEPTOR RISKS AND HAZARDS FOR COPCs - FUTURE ADULT RESIDENT
SWMU 1 - MUSTARD GAS BURIAL GROUND
NSWC CRANE, INDIANA

Scenario Timeframe: Future
Receptor Population: Resident
Receptor Age: Adult

Medium	Exposure Medium	Exposure Point	Chemical	Carcinogenic Risk				Chemical	Non-Carcinogenic Hazard Quotient				
				Ingestion	Inhalation	Dermal	Exposure Routes Total		Primary Target Organ	Ingestion	Inhalation	Dermal	Exposure Routes Total
Soil	Soil	Surface Soil	Methylene Chloride	7.6E-11			7.6E-11	Methylene Chloride	Liver	4.9E-07			4.9E-07
			Aluminum					Aluminum	Body Weight	1.9E-02			1.9E-02
			Iron					Iron	Liver, Blood, GI Trac	9.7E-02			9.7E-02
			Selenium					Selenium	Blood/Skin/CNS	2.2E-04			2.2E-04
Groundwater	Water	Onsite	1,1,1,2-Tetrachloroethane	6.1E-05	1.3E-05	5.1E-06	8.0E-05	1,1,1,2-Tetrachloroethane	Liver, Kidney	2.3E-01		1.9E-02	2.5E-01
			1,1,2,2-Tetrachloroethane	6.9E-02	1.1E-02	5.9E-03	8.6E-02	1,1,2,2-Tetrachloroethane	Liver	1.7E+01		1.4E+00	1.9E+01
			1,1,2-Trichloroethane	3.2E-07	6.8E-08	2.0E-08	4.1E-07	1,1,2-Trichloroethane	Liver	4.1E-03		2.5E-04	4.4E-03
			1,1-Dichloroethene					1,1-Dichloroethene	Liver	2.7E-01	7.0E-02	2.4E-02	3.7E-01
			1,2-Dichloroethane	2.1E-04	5.3E-05	6.9E-06	2.7E-04	1,2-Dichloroethane	NOAEL	2.3E-01	1.2E+00	7.4E-03	1.4E+00
			Chloroform	4.8E-05	1.7E-04	2.9E-06	2.2E-04	Chloroform	Liver	2.3E+00	6.9E+01	1.4E-01	7.2E+01
			cis-1,2-Dichloroethene					cis-1,2-Dichloroethene	Blood	1.4E+00		8.0E-02	1.5E+00
			Tetrachloroethene	1.8E-04	8.2E-06	7.2E-05	2.6E-04	Tetrachloroethene	Liver	1.0E+00	1.7E-02	4.0E-01	1.4E+00
			Trichloroethene	5.8E-02	1.6E-02	6.6E-03	8.1E-02	Trichloroethene	CNS	1.5E+03	1.1E+01	1.6E+02	1.6E+03
			Bis(2-Ethylhexyl)Phthalate	3.3E-07		3.3E-07	6.6E-07	Bis(2-Ethylhexyl)Phthalate	Liver	3.4E-03		3.5E-03	6.9E-03
			Hexachloroethane	6.6E-07		3.7E-07	1.0E-06	Hexachloroethane	Kidney	1.4E-01		7.7E-02	2.1E-01
			4-Amino-2,6-Dinitrotoluene					4-Amino-2,6-Dinitrotoluene	Liver	1.5E-01		1.4E-03	1.5E-01
			Heptachlor	8.5E-07		3.3E-07	1.2E-06	Heptachlor	Liver	1.1E-03		4.3E-04	1.5E-03
			Aluminum					Aluminum	Body Weight	5.5E-04		1.2E-06	5.5E-04
			Antimony					Antimony	Lifespan	1.7E-01		2.6E-03	1.8E-01
			Arsenic	1.5E-05		3.5E-08	1.6E-05	Arsenic	Skin, Vascular	1.0E-01		2.3E-04	1.0E-01
			Iron					Iron	Liver, Blood, GI Trac	2.0E-03		4.5E-06	2.0E-03
			Manganese					Manganese	CNS	5.0E-01		2.8E-02	5.2E-01
			Nickel					Nickel	Decreased body / organ weights	5.7E-02		6.4E-04	5.7E-02
			Strontium					Strontium	Bone	1.2E-02		2.6E-05	1.2E-02

Total Risk Across Surface Soil	7.6E-11
Total Risk Across Groundwater	1.7E-01
Total Risk Across Surface Water	NC
Total Risk Across Sediment	NC
Total Risk Across All Media and All Exposure Routes	1.7E-01

Total Hazard Index Across All Media and All Exposure Routes	1.7E+03
Total Liver HI =	9.3E+01
Total Kidney HI =	4.6E-01
Total GI Tract HI =	9.9E-02
Total Blood HI =	1.5E+00
Total CNS HI =	1.6E+03
Total Skin HI =	1.0E-01
Total Vascular HI =	1.0E-01
Total Body Weight HI =	7.7E-02
Total Lifespan HI =	1.8E-01
Total Bone HI =	1.2E-02

TABLE 9.7. REASONABLE MAXIMUM EXPOSURE (RME)
SUMMARY OF RECEPTOR RISKS AND HAZARDS FOR COPCs - FUTURE CHILD RESIDENT
SWMU 1 - MUSTARD GAS BURIAL GROUND
NSWC CRANE, INDIANA

Scenario Timeframe: Future
Receptor Population: Resident
Receptor Age: Child (0 to 6 years)

Medium	Exposure Medium	Exposure Point	Chemical	Carcinogenic Risk				Chemical	Non-Carcinogenic Hazard Quotient				
				Ingestion	Inhalation	Dermal	Exposure Routes Total		Primary Target Organ	Ingestion	Inhalation	Dermal	Exposure Routes Total
Soil	Soil	Surface Soil	Methylene Chloride	1.8E-10			1.8E-10	Methylene Chloride	Liver	4.6E-06			4.6E-06
			Aluminum					Aluminum	Body Weight	1.8E-01			1.8E-01
			Iron					Iron	Liver, Blood, GI Trac	9.1E-01			9.1E-01
			Selenium					Selenium	Blood/Skin/CNS	2.0E-03			2.0E-03
Groundwater	Water	Onsite	1,1,1,2-Tetrachloroethane	5.3E-05	1.6E-05	4.3E-06	7.3E-05	1,1,1,2-Tetrachloroethane	Liver, Kidney	8.0E-01		6.5E-02	8.6E-01
			1,1,2,2-Tetrachloroethane	6.1E-02	1.3E-02	5.1E-03	7.8E-02	1,1,2,2-Tetrachloroethane	Liver	6.1E+01		4.9E+00	6.6E+01
			1,1,2-Trichloroethane	2.8E-07	7.9E-08	1.7E-08	3.8E-07	1,1,2-Trichloroethane	Liver	1.4E-02		8.7E-04	1.5E-02
			1,1-Dichloroethene					1,1-Dichloroethene	Liver	9.6E-01	3.3E-01	6.5E-02	1.4E+00
			1,2-Dichloroetnane	1.9E-04	6.1E-05	6.1E-06	2.5E-04	1,2-Dichloroethane	NOAEL	8.0E-01	5.6E+00	2.6E-02	6.4E+00
			Chloroform	4.2E-05	1.9E-04	2.5E-06	2.4E-04	Chloroform	Liver	8.1E+00	3.2E+02	4.7E-01	3.3E+02
			cis-1,2-Dichloroethene					cis-1,2-Dichloroethene	Blood	4.8E+00		2.8E-01	5.1E+00
			Tetrachloroethene	1.6E-04	9.6E-06	6.1E-05	2.3E-04	Tetrachloroethene	Liver	3.5E+00	8.0E-02	1.4E+00	5.0E+00
			Trichloroethene	5.1E-02	1.8E-02	5.7E-03	7.5E-02	Trichloroethene	CNS	5.1E+03	5.3E+01	5.5E+02	5.7E+03
			Bis(2-Ethylhexyl)Phthalate	2.9E-07		2.8E-07	5.7E-07	Bis(2-Ethylhexyl)Phthalate	Liver	1.2E-02		1.2E-02	2.4E-02
			Hexachloroethane	5.8E-07		3.2E-07	8.9E-07	Hexachloroethane	Kidney	4.8E-01		2.6E-01	7.4E-01
			4-Amino-2,6-Dinitrotoluene					4-Amino-2,6-Dinitrotoluene	Liver	5.2E-01		4.7E-03	5.2E-01
			Heptachlor	7.4E-07		2.8E-07	1.0E-06	Heptachlor	Liver	3.8E-03		1.5E-03	5.3E-03
			Aluminum					Aluminum	Body Weight	1.9E-03		8.5E-06	1.9E-03
			Antimony					Antimony	Lifespan	6.1E-01		1.8E-02	6.3E-01
			Arsenic	1.4E-05		6.0E-08	1.4E-05	Arsenic	Skin, Vascular	3.5E-01		1.5E-03	3.5E-01
			Iron					Iron	Liver, Blood, GI Trac	7.1E-03		3.1E-05	7.1E-03
			Manganese					Manganese	CNS	1.7E+00		1.9E-01	1.9E+00
			Nickel					Nickel	Decreased body / organ weights	2.0E-01		4.4E-03	2.0E-01
			Strontium					Strontium	Bone	4.1E-02		1.8E-04	4.1E-02

Total Risk Across Surface Soil	1.8E-10
Total Risk Across Groundwater	1.5E-01
Total Risk Across Surface Water	NC
Total Risk Across Sediment	NC
Total Risk Across All Media and All Exposure Routes	1.5E-01

Total Hazard Index Across All Media and All Exposure Routes	6.1E+03
Total Liver HI =	4.1E+02
Total Kidney HI =	1.6E+00
Total GI Tract HI =	9.1E-01
Total Blood HI =	6.0E+00
Total CNS HI =	5.7E+03
Total Skin HI =	3.6E-01
Total Vascular HI =	3.5E-01
Total Body Weight HI =	3.8E-01
Total Lifespan HI =	6.3E-01
Total Bone HI =	4.1E-02

TABLE 9.1a. CENTRAL TENDENCY EXPOSURE (CTE)
SUMMARY OF RECEPTOR RISKS AND HAZARDS FOR COPCs - CONSTRUCTION WORKERS
SWMU 1 - MUSTARD GAS BURIAL GROUND
NSWC CRANE, INDIANA

Scenario Timeframe: Future
Receptor Population: Construction Workers
Receptor Age: Adult

Medium	Exposure Medium	Exposure Point	Chemical	Carcinogenic Risk				Chemical	Non-Carcinogenic Hazard Quotient				
				Ingestion	Inhalation	Dermal	Exposure Routes Total		Primary Target Organ	Ingestion	Inhalation	Dermal	Exposure Routes Total
Soil	Soil	Surface and Subsurface Soil	1,1,2,2-Tetrachloroethene	6.4E-12			6.4E-12	1,1,2,2-Tetrachloroethene	Liver	3.7E-08			3.7E-08
			Methylene Chloride	3.3E-12			3.3E-12	Methylene Chloride	Liver	5.1E-07			5.1E-07
			Benzo(a)anthracene	1.1E-10		3.1E-11	1.4E-10	Benzo(a)anthracene					
			Benzo(a)pyrene	1.2E-09		3.2E-10	1.5E-09	Benzo(a)pyrene					
			Benzo(b)fluoranthene	1.2E-10		3.4E-11	1.6E-10	Benzo(b)fluoranthene					
			Aluminum					Aluminum	Body Weight	1.5E-02			1.5E-02
			Barium					Barium	Blood	1.6E-03			1.6E-03
			Cadmium					Cadmium	Kidney	7.9E-04		3.3E-05	8.3E-04
			Chromium					Chromium	NOAEL	7.0E-03			7.0E-03
			Iron					Iron	Liver, Blood, GI Trac	9.7E-02			9.7E-02
			Manganese					Manganese	CNS	1.8E-02			1.8E-02
			Nickel					Nickel	Decreased Organ/ Body Weights	9.0E-04			9.0E-04
			Selenium					Selenium	Blood/Skin/CNS	1.8E-04			1.8E-04
Groundwater	Water	Onsite	1,1,1,2-Tetrachloroethane		5.7E-08	6.2E-08	1.2E-07	1,1,1,2-Tetrachloroethane	Liver, Kidney			5.5E-03	5.5E-03
			1,1,2,2-Tetrachloroethane		5.9E-05	7.2E-05	1.3E-04	1,1,2,2-Tetrachloroethane	Liver			4.2E-01	4.2E-01
			1,1,2-Trichloroethane		3.2E-10	2.5E-10	5.7E-10	1,1,2-Trichloroethane	Liver			7.6E-05	7.6E-05
			1,1-Dichloroethene					1,1-Dichloroethene	Liver		7.2E-06	7.6E-03	7.6E-03
			1,2-Dichloroethane		2.5E-07	9.0E-08	3.4E-07	1,2-Dichloroethane	NOAEL		1.4E-01	2.3E-03	1.4E-01
			Chloroform		7.2E-07	3.6E-08	7.5E-07	Chloroform	Liver		7.2E+00	4.2E-02	7.2E+00
			cis-1,2-Dichloroethene					cis-1,2-Dichloroethene	Blood			2.5E-02	2.5E-02
			Tetrachloroethene		3.3E-08	8.7E-07	9.0E-07	Tetrachloroethene	Liver		1.7E-03	1.2E-01	1.2E-01
			Trichloroethene		6.5E-05	8.3E-05	1.5E-04	Trichloroethene	CNS		1.1E+00	4.8E+01	4.9E+01
			Bis(2-Ethylhexyl)Phthalate			4.0E-09	4.0E-09	Bis(2-Ethylhexyl)Phthalate	Liver			1.0E-03	1.0E-03
			Hexachloroethane			4.5E-09	4.5E-09	Hexachloroethane	Kidney			2.3E-02	2.3E-02
			4-Amino-2,6-Dinitrotoluene					4-Amino-2,6-Dinitrotoluene	Liver			4.0E-04	4.0E-04
			Heptachlor			4.0E-09	4.0E-09	Heptachlor	Liver			1.3E-04	1.3E-04
			Aluminum					Aluminum	Body Weight			8.9E-07	8.9E-07
			Antimony					Antimony	Lifespan			1.9E-03	1.9E-03
			Arsenic			1.0E-09	1.0E-09	Arsenic	Skin, Vascular			1.6E-04	1.6E-04
			Iron					Iron	Liver, Blood, GI Tract			3.2E-06	3.2E-06
			Manganese					Manganese	CNS			2.0E-02	2.0E-02
			Nickel					Nickel	Decreased body / organ weights			4.6E-04	4.6E-04
			Strontium					Strontium	Bone			1.9E-05	1.9E-05

Total Risk Across Surface/Subsurface Soil: 1.8E-09
Total Risk Across Groundwater: 2.6E-04

Total Risk Across All Media and All Exposure Routes: 2.8E-04

Total Hazard Index Across All Media and All Exposure Routes: 5.8E+01

Total Liver HI =	7.9E+00
Total Kidney HI =	2.9E-02
Total GI Tract HI =	9.7E-02
Total Blood HI =	1.2E-01
Total CNS HI =	4.9E+01
Total Skin HI =	3.4E-04
Total Vascular HI =	1.6E-04
Total Body Weight HI =	1.4E-03
Total Lifespan HI =	1.9E-03
Total Bone HI =	1.9E-05

TABLE 9.2a. CENTRAL TENDENCY EXPOSURE (CTE)
SUMMARY OF RECEPTOR RISKS AND HAZARDS FOR COPCs - MAINTENANCE WORKERS
SWMU 1 - MUSTARD GAS BURIAL GROUND
NSWC CRANE, INDIANA

Scenario Timeframe: Future
Receptor Population: Maintenance Workers
Receptor Age: Adult

Medium	Exposure Medium	Exposure Point	Chemical	Carcinogenic Risk				Chemical	Non-Carcinogenic Hazard Quotient				
				Ingestion	Inhalation	Dermal	Exposure Routes Total		Primary Target Organ	Ingestion	Inhalation	Dermal	Exposure Routes Total
Soil	Soil	Surface Soil	Methylene Chloride	4.9E-13			4.9E-13	Methylene Chloride	Liver	8.5E-09			8.5E-09
			Aluminum					Aluminum	Body Weight	3.3E-04			3.3E-04
			Iron					Iron	Liver, Blood, GI Trac	1.7E-03			1.7E-03
			Selenium					Selenium	Blood/Skin/CNS	3.7E-06			3.7E-06
							Total Risk Across Surface Soil 4.9E-13						Total Hazard Index Across All Media and All Exposure Routes 2.0E-03

Total Risk Across All Media and All Exposure Routes 4.9E-13

Total Liver HI =	1.7E-03
Total GI Tract HI =	1.7E-03
Total Blood HI =	1.7E-03
Total CNS HI =	3.7E-06
Total Skin HI =	3.7E-06

TABLE 9.3a. CENTRAL TENDENCY EXPOSURE (CTE)
SUMMARY OF RECEPTOR RISKS AND HAZARDS FOR COPCs - OCCUPATIONAL WORKERS
SWMU 1 - MUSTARD GAS BURIAL GROUND
NSWC CRANE, INDIANA

Scenario Timeframe: Future
Receptor Population: Occupational Workers
Receptor Age: Adult

Medium	Exposure Medium	Exposure Point	Chemical	Carcinogenic Risk				Chemical	Non-Carcinogenic Hazard Quotient				
				Ingestion	Inhalation	Dermal	Exposure Routes Total		Primary Target Organ	Ingestion	Inhalation	Dermal	Exposure Routes Total
Soil	Soil	Surface Soil	Methylene Chloride	8.9E-12			8.9E-12	Methylene Chloride	Liver	1.5E-07			1.5E-07
			Aluminum					Aluminum	Body Weight	6.0E-03			6.0E-03
			Iron					Iron	Liver, Blood, GI Trac	3.0E-02			3.0E-02
			Selenium					Selenium	Blood/Skin/CNS	6.8E-05			6.8E-05
						Total Risk Across Surface Soil	8.9E-12					Total Hazard Index Across All Media and All Exposure Routes	3.6E-02

Total Risk Across All Media and All Exposure Routes: 8.9E-12

Total Liver HI =	3.0E-02
Total GI Tract HI =	3.0E-02
Total Blood HI =	3.0E-02
Total CNS HI =	6.8E-05
Total Skin HI =	6.8E-05
Total Body Weight HI =	6.0E-03

TABLE 9.4a. CENTRAL TENDENCY EXPOSURE (CTE)
SUMMARY OF RECEPTOR RISKS AND HAZARDS FOR COPCs - ADULT RECREATIONAL USERS
SWMU 1 - MUSTARD GAS BURIAL GROUND
NSWC CRANE, INDIANA

Scenario Timeframe: Future
Receptor Population: Recreational Users
Receptor Age: Adult

Medium	Exposure Medium	Exposure Point	Chemical	Carcinogenic Risk				Chemical	Non-Carcinogenic Hazard Quotient				
				Ingestion	Inhalation	Dermal	Exposure Routes Total		Primary Target Organ	Ingestion	Inhalation	Dermal	Exposure Routes Total
Soil	Soil	Surface Soil	Methylene Chloride	1.1E-12			1.1E-12	Methylene Chloride	Liver	1.8E-08			1.8E-08
			Aluminum					Aluminum	Body Weight	7.2E-04			7.2E-04
			Iron					Iron	Liver, Blood, GI Trac	3.6E-03			3.6E-03
			Selenium					Selenium	Blood/Skin/CNS	8.1E-06			8.1E-06
						Total Risk Across Surface Soil	1.1E-12		Total Hazard Index Across All Media and All Exposure Routes				4.3E-03

Total Risk Across All Media and All Exposure Routes: 1.1E-12

Total Liver HI =	3.6E-03
Total GI Tract HI =	3.6E-03
Total Blood HI =	3.6E-03
Total CNS HI =	8.1E-06
Total Skin HI =	8.1E-06
Total Body Weight HI =	7.2E-04

TABLE 9.5a. CENTRAL TENDENCY EXPOSURE (CTE)
SUMMARY OF RECEPTOR RISKS AND HAZARDS FOR COPCs - ADOLESCENT TRESPASSERS
SWMU 1 - MUSTARD GAS BURIAL GROUND
NSWC CRANE, INDIANA

Scenario Timeframe: Current/Future
Receptor Population: Trespassers
Receptor Age: Adolescent (6 to 17 years)

Medium	Exposure Medium	Exposure Point	Chemical	Carcinogenic Risk				Chemical	Non-Carcinogenic Hazard Quotient				
				Ingestion	Inhalation	Dermal	Exposure Routes Total		Primary Target Organ	Ingestion	Inhalation	Dermal	Exposure Routes Total
Soil	Soil	Surface Soil	Methylene Chloride	1.1E-12			1.1E-12	Methylene Chloride	Liver	1.5E-08			1.5E-08
			Aluminum					Aluminum	Body Weight	5.8E-04			5.8E-04
			Iron					Iron	Liver, Blood, GI Trac	2.9E-03			2.9E-03
			Selenium					Selenium	Blood/Skin/CNS	6.6E-06			6.6E-06
						Total Risk Across Surface Soil	1.1E-12					Total Hazard Index Across All Media and All Exposure Routes	3.5E-03

Total Risk Across All Media and All Exposure Routes 1.1E-12

Total Liver HI =	2.9E-03
Total GI Tract HI =	2.9E-03
Total Blood HI =	2.9E-03
Total CNS HI =	6.6E-06
Total Skin HI =	6.6E-06
Total Body Weight HI =	5.8E-04

TABLE 9.6a. CENTRAL TENDENCY EXPOSURE (CTE)
SUMMARY OF RECEPTOR RISKS AND HAZARDS FOR COPCs - FUTURE ADULT RESIDENT
SWMU 1 - MUSTARD GAS BURIAL GROUND
NSWC CRANE, INDIANA

Scenario Timeframe: Future
Receptor Population: Resident
Receptor Age: Adult

Medium	Exposure Medium	Exposure Point	Chemical	Carcinogenic Risk				Chemical	Non-Carcinogenic Hazard Quotient				
				Ingestion	Inhalation	Dermal	Exposure Routes Total		Primary Target Organ	Ingestion	Inhalation	Dermal	Exposure Routes Total
Soil	Soil	Surface Soil	Methylene Chloride	1.1E-11			1.1E-11	Methylene Chloride	Liver	2.5E-07			2.5E-07
			Aluminum					Aluminum	Body Weight	9.6E-03			9.6E-03
			Iron					Iron	Liver, Blood, GI Trac	4.9E-02			4.9E-02
			Selenium					Selenium	Blood/Skin/CNS	1.1E-04			1.1E-04
Groundwater	Water	Onsite	1,1,1,2-Tetrachloroethane	1.2E-05	7.5E-06	1.2E-06	2.1E-05	1,1,1,2-Tetrachloroethane	Liver, Kidney	1.6E-01		1.6E-02	1.8E-01
			1,1,2,2-Tetrachloroethane	1.4E-02	6.0E-03	1.4E-03	2.2E-02	1,1,2,2-Tetrachloroethane	Liver	1.7E+01		1.2E+00	1.9E+01
			1,1,2-Trichloroethane	6.6E-08	3.8E-08	4.7E-09	1.1E-07	1,1,2-Trichloroethane	Liver	2.9E-03		2.1E-04	3.1E-03
			1,1-Dichloroethene					1,1-Dichloroethene	Liver	1.9E-01	3.9E-02	2.0E-02	2.5E-01
			1,2-Dichloroethane	4.4E-05	2.9E-05	1.6E-06	7.4E-05	1,2-Dichloroethane	NOAEL	1.6E-01	6.7E-01	6.0E-03	8.3E-01
			Chloroform	9.8E-06	9.2E-05	6.9E-07	1.0E-04	Chloroform	Liver	1.6E+00	3.8E+01	1.1E-01	4.0E+01
			cis-1,2-Dichloroethene					cis-1,2-Dichloroethene	Blood	9.6E-01		6.5E-02	1.0E+00
			Tetrachloroethene	3.7E-05	4.6E-06	1.7E-05	5.8E-05	Tetrachloroethene	Liver	7.1E-01	9.5E-03	3.3E-01	1.0E+00
			Trichloroethene	1.2E-02	8.6E-03	1.6E-03	2.2E-02	Trichloroethene	CNS	1.0E+03	6.3E+00	1.3E+02	1.2E+03
			Bis(2-Ethylhexyl)Phthalate	6.7E-08		7.9E-08	1.5E-07	Bis(2-Ethylhexyl)Phthalate	Liver	2.4E-03		2.8E-03	5.2E-03
			Hexachloroethane	1.3E-07		8.8E-08	2.2E-07	Hexachloroethane	Kidney	9.6E-02		6.3E-02	1.6E-01
			4-Amino-2,6-Dinitrotoluene					4-Amino-2,6-Dinitrotoluene	Liver	1.0E-01		1.1E-03	1.0E-01
			Heptachlor	1.7E-07		7.9E-08	2.5E-07	Heptachlor	Liver	7.7E-04		3.5E-04	1.1E-03
			Aluminum					Aluminum	Body Weight	3.9E-04		8.3E-07	3.9E-04
			Antimony					Antimony	Lifespan	1.2E-01		1.7E-03	1.2E-01
			Arsenic	3.2E-06		6.8E-09	3.2E-06	Arsenic	Skin, Vascular	7.0E-02		1.5E-04	7.0E-02
			Iron					Iron	Liver, Blood, GI Trac	1.4E-03		3.0E-06	1.4E-03
			Manganese					Manganese	CNS	3.5E-01		1.9E-02	3.7E-01
			Nickel					Nickel	Decreased body / organ weights	4.0E-02		4.3E-04	4.0E-02
			Strontium					Strontium	Bone	8.2E-03		1.8E-05	8.2E-03

Total Risk Across Surface Soil	1.1E-11
Total Risk Across Groundwater	4.5E-02
Total Risk Across Surface Water	NC
Total Risk Across Sediment	NC
Total Risk Across All Media and All Exposure Routes	4.5E-02

Total Hazard Index Across All Media and All Exposure Routes	1.2E+03
Total Liver HI =	6.0E+01
Total Kidney HI =	3.3E-01
Total GI Tract HI =	5.0E-02
Total Blood HI =	1.1E+00
Total CNS HI =	1.2E+03
Total Skin HI =	7.1E-02
Total Vascular HI =	7.0E-02
Total Body Weight HI =	5.0E-02
Total Lifespan HI =	1.2E-01
Total Bone HI =	8.2E-03

TABLE 9 7a. CENTRAL TENDENCY EXPOSURE (CTE)
SUMMARY OF RECEPTOR RISKS AND HAZARDS FOR COPCs - FUTURE CHILD RESIDENT
SWMU 1 - MUSTARD GAS BURIAL GROUND
NSWC CRANE, INDIANA

Scenario Timeframe: Future
Receptor Population: Resident
Receptor Age: Child (0 to 6 years)

Medium	Exposure Medium	Exposure Point	Chemical	Carcinogenic Risk				Chemical	Non-Carcinogenic Hazard Quotient				
				Ingestion	Inhalation	Dermal	Exposure Routes Total		Primary Target Organ	Ingestion	Inhalation	Dermal	Exposure Routes Total
Soil	Soil	Surface Soil	Methylene Chloride	3.0E-11			3.0E-11	Methylene Chloride	Liver	2.3E-06			2.3E-06
			Aluminum					Aluminum	Body Weight	9.0E-02			9.0E-02
			Iron					Iron	Liver, Blood, GI Trac	4.5E-01			4.5E-01
			Selenium					Selenium	Blood/Skin/CNS	1.0E-03			1.0E-03
Groundwater	Water	Onsite	1,1,1,2-Tetrachloroethane	7.8E-06	8.7E-06	8.3E-07	1.7E-05	1,1,1,2-Tetrachloroethane	Liver, Kidney	3.5E-01		3.7E-02	3.9E-01
			1,1,2,2-Tetrachloroethane	9.2E-03	7.0E-03	9.7E-04	1.7E-02	1,1,2,2-Tetrachloroethane	Liver	2.7E+01		2.8E+00	3.0E+01
			1,1,2-Trichloroethane	4.1E-08	4.4E-08	3.3E-09	8.8E-08	1,1,2-Trichloroethane	Liver	6.3E-03		5.0E-04	6.8E-03
			1,1-Dichloroethene					1,1-Dichloroethene	Liver	4.2E-01	1.8E-01	4.8E-02	6.5E-01
			1,2-Dichloroethane	2.7E-05	3.4E-05	1.1E-06	6.2E-05	1,2-Dichloroethane	NOAEL	3.5E-01	3.1E+00	1.4E-02	3.5E+00
			Chloroform	6.2E-06	1.1E-04	4.7E-07	1.1E-04	Chloroform	Liver	3.5E+00	1.8E+02	2.7E-01	1.8E+02
			cis-1,2-Dichloroethene					cis-1,2-Dichloroethene	Blood	2.1E+00		1.6E-01	2.3E+00
			Tetrachloroethene	2.3E-05	5.3E-06	1.2E-05	4.0E-05	Tetrachloroethene	Liver	1.6E+00	4.4E-02	7.9E-01	2.4E+00
			Trichloroethene	7.7E-03	1.0E-02	1.1E-03	1.9E-02	Trichloroethene	CNS	2.3E+03	2.9E+01	3.2E+02	2.6E+03
			Bis(2-Ethylhexyl)Phthalate	4.2E-08		5.5E-08	9.7E-08	Bis(2-Ethylhexyl)Phthalate	Liver	5.3E-03		6.8E-03	1.2E-02
			Hexachloroethane	8.4E-08		6.1E-08	1.5E-07	Hexachloroethane	Kidney	2.1E-01		1.5E-01	3.6E-01
			4-Amino-2,6-Dinitrotoluene					4-Amino-2,6-Dinitrotoluene	Liver	2.3E-01		2.7E-03	2.3E-01
			Heptachlor	1.1E-07		5.4E-08	1.6E-07	Heptachlor	Liver	1.7E-03		8.4E-04	2.5E-03
			Aluminum					Aluminum	Body Weight	8.5E-04		2.8E-06	8.5E-04
			Antimony					Antimony	Lifespan	2.7E-01		5.9E-03	2.7E-01
			Arsenic	2.0E-06		6.6E-09	2.0E-06	Arsenic	Skin, Vascular	1.5E-01		5.1E-04	1.6E-01
			Iron					Iron	Liver, Blood, GI Trac	3.1E-03		1.0E-05	3.1E-03
			Manganese					Manganese	CNS	7.6E-01		6.3E-02	8.3E-01
			Nickel					Nickel	Decreased body / organ weights	8.7E-02		1.4E-03	8.9E-02
			Strontium					Strontium	Bone	1.8E-02		6.0E-05	1.8E-02

Total Risk Across Surface Soil	3.0E-11
Total Risk Across Groundwater	3.6E-02
Total Risk Across Surface Water	NC
Total Risk Across Sediment	NC
Total Risk Across All Media and All Exposure Routes	3.6E-02

Total Hazard Index Across All Media and All Exposure Routes	2.8E+03
Total Liver HI =	2.2E+02
Total Kidney HI =	7.5E-01
Total GI Tract HI =	4.6E-01
Total Blood HI =	2.7E+00
Total CNS HI =	2.6E+03
Total Skin HI =	1.6E-01
Total Vascular HI =	1.6E-01
Total Body Weight HI =	1.8E-01
Total Lifespan HI =	2.7E-01
Total Bone HI =	1.8E-02

APPENDIX G-3

EXAMPLE RISK ASSESSMENT CALCULATIONS

CLIENT: NSWC, CRANE, INDIANA		JOB NUMBER: 3959
SUBJECT: CALCULATION OF INTAKE/RISK FROM DERMAL CONTACT WITH GROUNDWATER FUTURE ADULT RESIDENT - SWMU 1 - MUSTARD GAS BURIAL GROUND		
BASED ON: USEPA, DECEMBER 1989, SEPTEMBER 2001		
BY: T.JACKMAN	CHECKED BY:	DATE: 09/16/02

PURPOSE: To estimate intake, carcinogenic and noncarcinogenic risks from dermal contact with groundwater by the future adult resident.

EQUATION:

$$DAD = \frac{DAevent \times EV \times ED \times EF \times A}{BW \times AT}$$

Where:

DAD	=	dermally absorbed dose (mg/kg/day)
DAevent	=	absorbed does per event (mg/cm^2/event)
EV	=	event frequency (events/day)
EF	=	exposure frequency (days/year)
ED	=	exposure duration (years)
A	=	skin surface available for contact (cm^2)
BW	=	body weight (kg)
AT	=	averaging time (days)
CSFd	=	dermal carcinogenic slope factor ((mg/kg/day)$^{-1}$)
RfDd	=	dermal noncarcinogenic reference dose (mg/kg/day)

RISKS:

ICLR (Carcinogens) = DAD (mg/kg/day) x CSFd (mg/kg/day)$^{-1}$
HQ (Noncarcinogens) = DAD (mg/kg/day) / RFDd (mg/kg/day)

EQUATIONS for DAevent:

For Inorganics:

$$DA_{event} = (K_p)(C_{gw})(t_{event})$$

For Organics:

$$\text{If } t_{event} < t^*, \text{then}: DA_{event} = FA(2K_p)(C_{gw})(CF)\left(\sqrt{\frac{6\tau t_{event}}{\pi}}\right)$$

$$\text{If } t_{event} > t^*, \text{then}: DA_{event} = FA(K_p)(C_{gw})(CF)\left(\frac{t_{event}}{1+B} + 2\tau\left(\frac{1+3B+3B^2}{(1+B)^2}\right)\right)$$

CLIENT: NSWC, CRANE, INDIANA		JOB NUMBER: 3959
SUBJECT: CALCULATION OF INTAKE/RISK FROM DERMAL CONTACT WITH GROUNDWATER FUTURE ADULT RESIDENT - SWMU 1 - MUSTARD GAS BURIAL GROUND		
BASED ON: USEPA, DECEMBER 1989, SEPTEMBER 2001		
BY: T.JACKMAN	CHECKED BY:	DATE: 09/16/02

Where:

FA	=	fraction absorbed (dimensionless)
Kp	=	permeability coefficient from water (cm/hr)
Cgw	=	concentration of chemical in groundwater (mg/L)
tevent	=	duration of event (hr/event)
CF	=	conversion factor (0.001 L/cm^3)
t*	=	time it takes to reach steady-state (hr/event)
τ	=	lag time (hr/event)
B	=	Bunge Model Constant (dimensionless)

EXAMPLE CALCULATION OF DAevent

ASSUMPTIONS:

Cgw	=	3.70E-01	mg/L	Tetrachloroethene (PCE)
Kp	=	3.34E-02	cm/hr	
tevent	=	0.25	hr/event	
CF	=	0.001	L/cm^3	
t*	=	2.18E+00	hr/event	
τ	=	9.06E-01	hr/event	
B	=	1.66E-01		
FA	=	1		

tevent < t*, therefore,

$$DAevent = 1 \times (2 \times 0.0334\ cm/hr)\ (0.37\ mg/L)\ (0.001\ L/cm3) \times \sqrt{\frac{6 \times 0.906\ hr/event \times 0.25\ hr/event}{\pi}}$$

DAevent = 1.63E-05 mg/cm^2-event

RISK CALCULATIONS

ASSUMPTIONS:

A	=	18,000	cm^2/day
EV	=	1	event/day
ED	=	24	years
EF	=	350	days/year
BW	=	70	kg
ATc	=	25550	days
ATnc	=	8760	days
CSFd	=	5.20E-02	(mg/kg/day)$^{-1}$
RfDd	=	1.00E-02	(mg/kg/day)

CLIENT: NSWC, CRANE, INDIANA		JOB NUMBER: 3959
SUBJECT: CALCULATION OF INTAKE/RISK FROM DERMAL CONTACT WITH GROUNDWATER FUTURE ADULT RESIDENT - SWMU 1 - MUSTARD GAS BURIAL GROUND		
BASED ON: USEPA, DECEMBER 1989, SEPTEMBER 2001		
BY: T.JACKMAN	CHECKED BY:	DATE: 09/16/02

EXAMPLE CARCINOGENIC CALCULATION

$$DADc = \frac{1.63E\text{-}05 \text{ mg/cm2-event} \times 1 \text{ event/day} \times 24 \text{ years} \times 350 \text{ days/year} \times 18000 \text{ cm2/day}}{70 \text{ kg} \times 25550 \text{ days}}$$

DADc = 1.4E-03 mg/kg/day

DADc = 1.37E-03 mg/kg/day x 0.052 (mg/kg/day)-1 = Incremental Lifetime Cancer Risk

ICLR = 7.15E-05

EXAMPLE NONCARCINOGENIC CALCULATION

$$DADnc = \frac{1.63E\text{-}05 \text{ mg/cm2-event} \times 1 \text{ event/day} \times 24 \text{ years} \times 350 \text{ days/year} \times 18000 \text{ cm2/day}}{70 \text{ kg} \times 8760 \text{ days}}$$

DADnc = 4.0E-03 mg/kg/day

HQ = 4.01E-03 mg/kg/day / 0.01 (mg/kg/day) = Hazard Quotient

HQ = 0.4

CALCULATION WORKSHEET

CLIENT: NSWC, CRANE, INDIANA		**JOB NUMBER:** 3959
SUBJECT: CALCULATION OF INTAKE/RISK FROM INHALATION OF VAPORS IN A TRENCH BY EXCAVATION/CONSTRUCTION WORKERS - SWMU 1 - MUSTARD GAS BURIAL GROUND		
BASED ON: USEPA, DEC. 1989		
BY: T. JACKMAN	**CHECKED BY:**	**DATE:** 09/16/02

PURPOSE: To estimate intake, carcinogenic and noncarcinogenic risks from inhalation of vapors in a trench by excavation/construction workers for the RME.

EQUATION:

$$IEX = \frac{Ca \times IR \times ET \times EF \times ED}{BW \times AT}$$

Where:

IEX	=	estimated exposure intake (mg/kg-day)
Ca	=	exposure point concentration in air (mg/m^3) generated by VDEQ model
IR	=	inhlation rate (m^3/hr)
ET	=	exposure time (hrs/day)
EF	=	exposure frequency (days/year)
ED	=	exposure duration (years)
BW	=	body weight (kg)
AT	=	averaging time (days)
CSFi	=	inhalation carcinogenic slope factor (kg-day/mg)
RfDi	=	inhalation noncarcinogenic reference dose (mg/kg-day)

RISKS:

ICLR (Carcinogens) = Intake (mg/kg/day) x CSFi (kg-day/mg)
HQ (Noncarcinogens) = Intake (mg/kg/day) / RFDi (mg/kg-day)

ASSUMPTIONS:

Ca	=	1.1E-02	mg/m^3	Tetrachloroethene
IR	=	2.50	m^3/hr	
ET	=	2	hr/day	
EF	=	150	days/year	
ED	=	1	year	
BW	=	70	kg	
ATc	=	25550	days	
ATnc	=	365	days	
CSFi	=	1.00E-02	(kg-day/mg)	
RfDi	=	1.40E-01	mg/kg-day	

CLIENT: NSWC, CRANE, INDIANA		JOB NUMBER: 3959
SUBJECT: CALCULATION OF INTAKE/RISK FROM INHALATION OF VAPORS IN A TRENCH BY EXCAVATION/CONSTRUCTION WORKERS - SWMU 1 - MUSTARD GAS BURIAL GROUND		
BASED ON: USEPA, DEC. 1989		
BY: T. JACKMAN	CHECKED BY:	DATE: 09/16/02

EXAMPLE CARCINOGENIC CALCULATION

$$IEXc = \frac{1.1E\text{-}02\ mg/m3 \times 2.5\ m3/hr \times 2\ hr/day \times 150\ days/year \times 1\ year}{70\ kg \times 25550\ days}$$

IEXc = 4.46E-06 mg/kg-day ✓

ICLR = 4.46E-06 mg/kg-day x 0.01 (kg-day/mg) = Incremental Lifetime Cancer Risk

ICLR = 4.5E-08 ✓

EXAMPLE NONCARCINOGENIC CALCULATION

$$IEXnc = \frac{1.1E\text{-}02\ mg/m3 \times 2.5\ m3/hr \times 2\ hr/day \times 150\ days/year \times 1\ year}{70\ kg \times 365\ days}$$

IEXnc = 3.12E-04 mg/kg-day ✓

HQ = 3.12E-04 mg/kg-day / 1.4E-01 mg/kg-day

HQ = **2.2E-03** ✓

CLIENT: NSWC, CRANE, INDIANA		**JOB NUMBER:** 3959
SUBJECT: CALCULATION OF INTAKE/RISK FROM INHALATION OF VOLATILES WHILE SHOWERING BY AN ADULT RESIDENT - SWMU 1 - MUSTARD GAS BURIAL GROUND		
BASED ON: EPA, 1989 AND FOSTER AND CHROSTOWSKI, 1987		
BY: T. JACKMAN	**CHECKED BY:**	**DATE:** 09/16/02

PURPOSE: To estimate intake, carcinogenic and noncarcinogenic risks from inhalation of volatiles while showering by an adult resident.

EQUATIONS:

$$\text{Intake} = \frac{S \times IRsh \times K \times EF \times ED}{BW \times AT \times Ra \times CF}$$

Where:

$$K = Ds + \frac{\exp(-Ra \times Dt) - \exp[Ra \times (Ds - Dt)]}{Ra}$$

$S = Cwd \times FR/SV$ $\quad$ $Cwd = Cw \times [1-\exp(-Kal \times ts/60d)]$

$Kal = Kl \times [(T1 \times Us)/(Ts \times U1)^{-0.5}$ $\quad$ $Kl = 1/[1/k1 + RT/(H \times kg)]$

$k1 = 20\ cm/hr \times (44/MW)^{0.5}$ $\quad$ $kg = 3000\ cm/hr \times (18/MW)^{0.5}$

RISKS:

ICLR (Carcinogens) = Intake (mg/kg/day) x CSFi $(mg/kg/day)^{-1}$
HQ (Noncarcinogens) = Intake (mg/kg/day) / RFDi (mg/kg/day)

Where:

Intake	=	estimated exposure intake (mg/kg/day)
S	=	volatile chemical generation rate (mg/m3-min - shower)
IRsh	=	inhalation rate (m3/hr)
EF	=	exposure frequency (showers/year)
ED	=	exposure duration (years)
BW	=	body weight (kg)
AT	=	averaging time (days)
Ra	=	air exchange rate (1/min)
Ds	=	shower duration (min)
Dt	=	total time in bathroom (min)
FR	=	shower water flow rate (L/min)
SV	=	shower room air volume (m3)
ts	=	shower droplet drop time (sec)
d	=	shower droplet diameter (mm)
MW	=	molecular weight of compound (g/mole)
H	=	Henry's Law constant (atm-m3/mole)
T1	=	calibration water temperature (K)
Ts	=	shower water temperature (K)
U1	=	water viscosity at T1 (cp)
Us	=	water viscosity at Ts (cp)
CSFi	=	inhalation carcinogenic slope factor ($(mg/kg/day)^{-1}$)
RfDi	=	inhalation noncarcinogenic reference dose (mg/kg/day)

CLIENT: NSWC, CRANE, INDIANA		JOB NUMBER: 3959
SUBJECT: CALCULATION OF INTAKE/RISK FROM INHALATION OF VOLATILES WHILE SHOWERING BY AN ADULT RESIDENT - SWMU 1 - MUSTARD GAS BURIAL GROUND		
BASED ON: EPA, 1989 AND FOSTER AND CHROSTOWSKI, 1987		
BY: T. JACKMAN	CHECKED BY:	DATE: 09/16/02

ASSUMPTIONS: Chemical: Tetrachloroethene (PCE)

IRsh	=	0.6	m3/hr
EF	=	350	showers/year
ED	=	24	years
BW	=	70	kg
ATc	=	25550	days
Atn	=	8760	days
Ra	=	0.025	1/min
CF	=	60	min/hr
Ds	=	15	min
Dt	=	20	min
FR	=	10	L/min
SV	=	12	m3
Cw	=	0.37	mg/L
ts	=	2	sec
d	=	1	mm
MW	=	166	g/mole
H	=	1.84E-02	atm-m3/mole
RT	=	2.40E-02	atm-m3/mole
T1	=	293	K
Ts	=	318	K
U1	=	0.982	centipoise
Us	=	0.616	centipoise
CSFi	=	1.00E-02	(mg/kg/day)-1
RfDi	=	1.40E-01	(mg/kg/day)

EXAMPLE CALCULATION:

k1 = 20 cm/hr x (44 g/mole / 166 g/mole)^0.5

k1 = **10.3 cm/hr** ✓

kg = 3000 cm/hr x (18 g/mole / 166 g/mole)^0.5

kg = **987.9 cm/hr** ✓

Kl = 1/[1/10.3 cm/hr + 2.40E-02 atm-m3/mole/(1.84E-02 atm-m3/mole x 987.9 cm/hr)]

Kl = **1.02E+01 cm/hr** ✓

CLIENT: NSWC, CRANE, INDIANA		**JOB NUMBER:** 3959
SUBJECT: CALCULATION OF INTAKE/RISK FROM INHALATION OF VOLATILES WHILE SHOWERING BY AN ADULT RESIDENT - SWMU 1 - MUSTARD GAS BURIAL GROUND		
BASED ON: EPA, 1989 AND FOSTER AND CHROSTOWSKI, 1987		
BY: T. JACKMAN	**CHECKED BY:**	**DATE:** 09/16/02

Kal = 1.02E+01 cm/hr x [(293 K x 0.616 centipoise)/(318 K x 0.982 centipoise)]^-0.5

Kal = **13.4 cm/hr** ✓

Cwd = 0.37 mg/L x [1 - exp((-13.4 cm/hr x 2 sec)/(60 x 1 mm))]

Cwd = **1.33E-01 mg/L** ✓

S = 1.33E-01 mg/L x 10 L/min / 12 m3

S = **1.11E-01 mg/m3-min-shower** ✓

$$K = 15\text{ min} + \frac{\exp(-0.025\text{ 1/min} \times 20\text{ min}) - \exp[0.025\text{ 1/min} \times (15\text{ min} - 20\text{ min})]}{0.025\text{ 1/min}}$$

K = **3.96 min** ✓

CARCINOGENIC INTAKE:

$$\text{Intake} = \frac{1.11\text{E-01 mg/m3-min-shower} \times 0.6\text{ m3/hr} \times 3.96\text{ min} \times 350\text{ showers/year} \times 24\text{ years}}{70\text{ kg} \times 25550\text{ days} \times 0.025\text{ 1/min} \times 60\text{ min/hr}}$$

intake = **8.25E-04 mg/kg-day** ✓

Risk = 0.01 (mg/kg/day)-1 x 8.25E-04 mg/kg-day

Risk = **8.25E-06** ✓

NONCARCINOGENIC INTAKE:

$$\text{Intake} = \frac{1.11\text{E-01 mg/m3-min-shower} \times 0.6\text{ m3/hr} \times 3.96\text{ min} \times 350\text{ showers/year} \times 24\text{ years}}{70\text{ kg} \times 8760\text{ days} \times 0.025\text{ 1/min} \times 60\text{ min/hr}}$$

intake = **2.41E-03 mg/kg-day** ✓

HQ = 2.41E-03 mg/kg-day / 1.40E-01 (mg/kg/day)

HQ = **0.017** ✓

CALCULATION WORKSHEET

CLIENT: NSWC, CRANE, INDIANA		**JOB NUMBER:** 3959
SUBJECT: CALCULATION OF INTAKE/RISK FROM DERMAL CONTACT WITH SOIL EXCAVATION/CONSTRUCTION WORKER - SWMU 1- MUSTARD GAS BURIAL GROUND		
BASED ON: USEPA, DEC. 1998		
BY: T. JACKMAN	**CHECKED BY:**	**DATE:** 09/16/02

PURPOSE: To estimate intake, carcinogenic and noncarcinogenic risks from dermal contact with soil by the excavation/construction worker for the Reasonable Maximum Exposure (RME).

EQUATION:

$$DEX = \frac{Cs \times CF \times SA \times AF \times ABS \times EF \times ED}{BW \times AT}$$

Where:

DEX	=	estimated exposure intake (mg/kg/day)
Cs	=	exposure point concentration in sediment (mg/kg)
CF	=	conversion factor (1.0E-6 kg/mg)
SA	=	skin surface available for contact (cm^2/day)
ABS	=	absorption factor (unitless)
AF	=	adherence factor (mg/cm^2)
EF	=	exposure frequency (days/year)
ED	=	exposure duration (years)
BW	=	body weight (kg)
AT	=	averaging time (days)
CSFd	=	dermal carcinogenic slope factor ((mg/kg/day)$^{-1}$)
RfDd	=	dermal noncarcinogenic reference dose (mg/kg/day)

RISKS:

ICLR (Carcinogens) = Intake (mg/kg/day) x CSFd (mg/kg/day)$^{-1}$

HQ (Noncarcinogens) = Intake (mg/kg/day) / RFDd (mg/kg/day)

ASSUMPTIONS:

Cs	=	0.008	mg/kg	Benzo(a)pyrene
CF	=	1.0E-06	kg/mg	
SA	=	5,800	cm^2/day	
AF	=	0.3	mg/cm^2	
ABS	=	0.13		
EF	=	150	days/year	
ED	=	1	years	
BW	=	70	kg	
ATc	=	25550	days	
ATnc	=	365	days	
CSFd	=	7.3	(mg/kg/day)$^{-1}$	
RfDd	=	NA	(mg/kg/day)	

CLIENT: NSWC, CRANE, INDIANA		JOB NUMBER: 3959
SUBJECT: CALCULATION OF INTAKE/RISK FROM DERMAL CONTACT WITH SOIL EXCAVATION/CONSTRUCTION WORKER - SWMU 1- MUSTARD GAS BURIAL GROUND		
BASED ON: USEPA, DEC. 1998		
BY: T. JACKMAN	CHECKED BY:	DATE: 09/16/02

EXAMPLE CARCINOGENIC CALCULATION

$$DEXc = \frac{0.008\ mg/kg \times 0.000001\ kg/mg \times 5800cm2/day \times 0.3mg/cm2 \times 0.13 \times 150\ days/year \times 1\ years}{70\ kg \times 25550\ days}$$

DEXc = 1.52E-10 mg/kg/day

ICLR = 1.52E-10 mg/kg/day x 7.3 (mg/kg/day)-1 = Incremental Lifetime Cancer Risk

ICLR = 1.1E-09

EXAMPLE NONCARCINOGENIC CALCULATION

$$DEXnc = \frac{0.008\ mg/kg \times 0.000001\ kg/mg \times 5800cm2/day \times 0.3mg/cm2 \times 0.13 \times 150\ days/year \times 1\ years}{70\ kg \times 365\ days}$$

DEXnc = 1.06E-08 mg/kg/day

HQ = 1.06E-08 mg/kg/day / NA (mg/kg/day) = Hazard Quotient

HQ = NA

CALCULATION WORKSHEET

CLIENT: NSWC, CRANE, INDIANA		**JOB NUMBER:** 3959
SUBJECT: CALCULATION OF INTAKE/RISK FROM INCIDENTAL INGESTION OF SOIL EXCAVATION/CONSTRUCTION WORKER - SWMU 1- MUSTARD GAS BURIAL GROUND		
BASED ON: USEPA, DEC. 1989		
BY: T. JACKMAN	**CHECKED BY:**	**DATE:** 09/16/02

PURPOSE: To estimate intake, carcinogenic and noncarcinogenic risks from incidental ingestion of soil by the excavation/construction worker for the Reasonable Maximum Exposure (RME).

EQUATION:

$$IEX = \frac{Cs \times IR \times EF \times ED \times FI \times CF}{BW \times AT}$$

Where:

IEX	=	estimated exposure intake (mg/kg/day)
Cs	=	exposure point concentration in sediment (mg/kg)
IR	=	incidental soil ingestion rate (mg/day)
EF	=	exposure frequency (days/year)
ED	=	exposure duration (years)
FI	=	fraction ingested from contaminated source (unitless)
CF	=	conversion factor (1.0E-6 kg/mg)
BW	=	body weight (kg)
AT	=	averaging time (days)
CSFo	=	oral carcinogenic slope factor ($(mg/kg/day)^{-1}$)
RfDo	=	oral noncarcinogenic reference dose (mg/kg/day)

RISKS:

ICLR (Carcinogens) = Intake (mg/kg/day) x CSFo $(mg/kg/day)^{-1}$
HQ (Noncarcinogens) = Intake (mg/kg/day) / RFDo (mg/kg/day)

ASSUMPTIONS:

Cs	=	0.00159	mg/kg	1,1,2,2-Tetrachloroethene
IR	=	480	mg/day	
EF	=	150	days/year	
ED	=	1	years	
FI	=	1		
CF	=	1.0E-06	kg/mg	
BW	=	70	kg	
ATc	=	25550	days	
ATnc	=	365	days	
CSFo	=	0.2	$(mg/kg/day)^{-1}$	
RfDo	=	6.00E-02	(mg/kg/day)	

CLIENT: NSWC, CRANE, INDIANA		JOB NUMBER: 3959
SUBJECT: CALCULATION OF INTAKE/RISK FROM INCIDENTAL INGESTION OF SOIL EXCAVATION/CONSTRUCTION WORKER - SWMU 1- MUSTARD GAS BURIAL GROUND		
BASED ON: USEPA, DEC. 1989		
BY: T. JACKMAN	CHECKED BY:	DATE: 09/16/02

EXAMPLE CARCINOGENIC CALCULATION

$$IEXc = \frac{0.00159 \text{ mg/kg} \times 480 \text{ mg/day} \times 150 \text{ days/year} \times 1 \text{ years} \times 0.000001 \text{ kg/mg}}{70 \text{ kg} \times 25550 \text{ days}}$$

IEXc = 6.40E-11 mg/kg/day ✓

ICLR = 6.40E-11 mg/kg/day x 0.2 (mg/kg/day)-1 = Incremental Lifetime Cancer Risk

ICLR = 1.3E-11 ✓

EXAMPLE CARCINOGENIC CALCULATION

$$IEXnc = \frac{0.00159 \text{ mg/kg} \times 480 \text{ mg/day} \times 150 \text{ days/year} \times 1 \text{ years} \times 0.000001 \text{ kg/mg}}{70 \text{ kg} \times 365 \text{ days}}$$

IEXnc = 4.48E-09 mg/kg/day ✓

HQ = 4.48E-09 mg/kg/day / 0.06 (mg/kg/day) = Hazard Quotient

HQ = 7.5E-08 ✓

CALCULATION WORKSHEET

CLIENT: NSWC, CRANE, INDIANA		**JOB NUMBER:** 3959
SUBJECT: CALCULATION OF INTAKE/RISK FROM INGESTION OF GROUNDWATER FUTURE ADULT RESIDENT - SWMU 1 - MUSTARD GAS BURIAL GROUND		
BASED ON: USEPA, DEC. 1989		
BY: T. JACKMAN	**CHECKED BY:**	**DATE:** 09/16/02

PURPOSE: To estimate intake, carcinogenic and noncarcinogenic risks from ingestion of groundwater by the future adult resident (RME).

EQUATION:

$$IEX = \frac{Cgw \times CF \times IRgw \times EF \times ED}{BW \times AT}$$

Where:

IEX	=	estimated exposure intake (mg/kg/day)
Cgw	=	exposure point concentration in groundwater (µg/L)
CF	=	conversion factor (1.0E-3 mg/µg)
IRgw	=	ingestion rate (L/hour)
EF	=	exposure frequency (days/year)
ED	=	exposure duration (years)
BW	=	body weight (kg)
AT	=	averaging time (days)
CSFo	=	oral carcinogenic slope factor ((mg/kg/day)$^{-1}$)
RfDo	=	oral noncarcinogenic reference dose (mg/kg/day)

RISKS:

ICLR (Carcinogens) = Intake (mg/kg/day) x CSFo (mg/kg/day)$^{-1}$

HQ (Noncarcinogens) = Intake (mg/kg/day) / RFDo (mg/kg/day)

ASSUMPTIONS:

Cgw	=	3.70E+02	ug/L	Tetrachloroethene (PCE)
IRgw	=	2	L/day	
CF	=	1.0E-03	mg/ug	
EF	=	350	days/year	
ED	=	24	years	
BW	=	70	kg	
ATc	=	25,550	days	
ATnc	=	8,760	days	
CSFo	=	5.20E-02	(mg/kg/day)$^{-1}$	
RfDo	=	1.00E-02	(mg/kg/day)	

CLIENT: NSWC, CRANE, INDIANA		JOB NUMBER: 3959
SUBJECT: CALCULATION OF INTAKE/RISK FROM INGESTION OF GROUNDWATER FUTURE ADULT RESIDENT - SWMU 1 - MUSTARD GAS BURIAL GROUND		
BASED ON: USEPA, DEC. 1989		
BY: T. JACKMAN	CHECKED BY:	DATE: 09/16/02

EXAMPLE CARCINOGENIC CALCULATION

$$IEXc = \frac{370\ ug/L \times 0.001\ mg/ug \times 2\ L/day \times 350\ days/year \times 24\ years}{70\ kg \times 25550\ days}$$

IEXc = 3.48E-03 mg/kg/day ✓

ICLR = 3.48E-03 mg/kg/day x 0.052 (mg/kg/day)-1 = Incremental Lifetime Cancer Risk

ICLR = 1.81E-04 ✓

EXAMPLE NONCARCINOGENIC CALCULATION

$$IEXnc = \frac{370\ ug/L \times 0.001\ mg/ug \times 2\ L/day \times 350\ days/year \times 24\ years}{70\ kg \times 8760\ days}$$

IEXnc = 1.01E-02 mg/kg/day ✓

HQ = 1.01E-02 mg/kg/day / 0.01 (mg/kg/day) = Hazard Quotient

HQ = 1.0 ✓

Volatilization From Showering - RME
Source: Foster & Chrostowski, 1987.
SWMU 1 - MUSTARD GAS BURIAL GROUND

Parameter	Value	Definition
Ra	0.025	air exchange rate, (min^{-1})
Ds	15	shower duration, (min)
Dt	20	total time in bathroom, (min)
Fr	10	shower water flow rate, (L/min)
Sv	12	shower room air volume, (m^3)
ts	2	shower dropler drop time, (sec)
d	1	shower droplet diameter, (mm)
T1	293	calibration water temperature, (K)
Ts	318	shower water temperature, (K)
m1	0.982	water viscosity at T1, (cp)
ms	0.616	water viscosity at Ts, (cp)
K	3.96	mass transfer coefficient, (min)

Chemical	Cw	MW	H	Kl	Kg	KL	Kal	Cwd	S	S x K
	(mg/L)	(g/mole)	(atm-m^3/mol	(cm/hr)	(cm/hr)	(cm/hr)	(cm/hr)	mg/L		Ra x CF
1,1,1,2-Tetrachloroethane	2.50E-01	167.85	2.42E-03	1.02E+01	9.82E+02	9.28E+00	1.22E+01	8.36E-02	6.96E-02	4.41E-02
1,1,2,2-Tetrachloroethane	3.80E+01	168	3.44E-04	1.02E+01	9.82E+02	5.92E+00	7.79E+00	8.69E+00	7.24E+00	3.02E-02
1,1,2-Trichloroethane	6.00E-04	133	9.12E-04	1.15E+01	1.10E+03	9.03E+00	1.19E+01	1.96E-04	1.63E-04	4.32E-02
1,1-Dichloroethene	5.00E-01	97	2.61E-02	1.35E+01	1.29E+03	1.33E+01	1.75E+01	2.21E-01	1.85E-01	5.85E-02
1,2-Dichloroethane	2.50E-01	99	9.78E-04	1.33E+01	1.28E+03	1.06E+01	1.40E+01	9.30E-02	7.75E-02	4.91E-02
Chloroform	8.40E-01	119	3.66E-03	1.22E+01	1.17E+03	1.14E+01	1.50E+01	3.30E-01	2.75E-01	5.19E-02
cis-1,2-Dichloroethene	5.00E-01	97	4.07E-03	1.35E+01	1.29E+03	1.27E+01	1.67E+01	2.13E-01	1.78E-01	5.63E-02
Tetrachloroethene	3.70E-01	166	1.84E-02	1.03E+01	9.88E+02	1.02E+01	1.34E+01	1.33E-01	1.11E-01	4.75E-02
Trichloroethene	1.60E+01	131	1.03E-02	1.16E+01	1.11E+03	1.13E+01	1.49E+01	6.26E+00	5.21E+00	5.16E-02

RISK ASSESSMENT SPREADSHEET - INHALATION OF VOLATILES FROM GROUNDWATER

SITE NAME: SWMU 1 - MUSTARD GAS BURIAL GROUND
LOCATION: NSWC CRANE, INDIANA
EXPOSURE SCENARIO: INHALATION OF VAPOR WHILE SHOWERING- ADULT RESIDENT - RME
MEDIA: GROUNDWATER TO INDOOR AIR
DATE: 09/17/02

HAZARD INDICES AND INCREMENTAL CANCER RISKS ARE CALCULATED BY THIS SPREADSHEET.
EXPOSURES THROUGH THE INHALATION OF VOLATILES WHILE SHOWERING ARE CONSIDERED.
INTAKE EQUATION IS BASED ON EPA, 1989 AND FOSTER AND CHROSTOWSKI, 1987.
ASSUMPTIONS ARE OUTLINED BELOW.

RELEVANT EQUATION: $$\text{Intake} = \frac{S \times IR_{SW} \times K \times EF \times ED}{BW \times AT \times R_a \times CF}$$

WHERE:			
	K = :	3.96	Mass transfer coefficient (min)
	IR_{sh} = :	10	Inhalation rate (L/min)
	S = :	Chem-specific	Volatile chemical generation rate (mg/m^3-min-shower)
	EF = :	350	Exposure Frequency (showers/year)
	ED = :	24	Exposure Duration (years)
	BW = :	70	Body Weight (kg)
	ATc = :	25,550	Averaging time for carcinogenic exposures (days)
	Atn = :	8,760	Averaging time for noncarcinogenic exposures (days)
	R_a = :	0.025	Air exchange rate (min^{-1})
	CF = :	1.00E+03	Convesrion Factor (L/m^3)

Unit Dose

Lifetime Chronic Daily Intake =	7.4E-03	(min-m^3-shower)/(kg-day)
Chronic Daily Intake = :	2.2E-02	(min-m^3-shower)/(kg-day)

RISK ASSESSMENT SPREADSHEET - INHALATION OF VOLATILES FROM GROUNDWATER

SITE NAME: SWMU 1 - MUSTARD GAS BURIAL GROUND
LOCATION: NSWC CRANE, INDIANA
EXPOSURE SCENARIO: INHALATION OF VAPOR WHILE SHOWERING- ADULT RESIDENT - RME
MEDIA: GROUNDWATER TO INDOOR AIR
DATE: 09/17/02

CHEMICAL	S (mg/m^3- min - shower)	Lifetime Chronic Daily Intake (mg/kg/day)	Chronic Daily Intake (mg/kg/day)	Cancer Slope Factor $(mg/kg/day)^{-1}$	Reference Dose (mg/kg/day)	Lifetime Cancer Risk	Percent Cancer Risk	Hazard Quotient	Percent Hazard Quotient
1,1,1,2-Tetrachloroethane	6.96E-02	5.2E-04	1.5E-03	2.60E-02		1.3E-05	0.1%	NA	NA
1,1,2,2-Tetrachloroethane	7.24E+00	5.4E-02	1.6E-01	2.00E-01		1.1E-02	40.6%	NA	NA
1,1,2-Trichloroethane	1.63E-04	1.2E-06	3.5E-06	5.60E-02		6.8E-08	0.0%	NA	NA
1,1-Dichloroethene	1.85E-01	1.4E-03	4.0E-03		5.71E-02	NA	NA	7.0E-02	0.1%
1,2-Dichloroethane	7.75E-02	5.8E-04	1.7E-03	9.10E-02	1.40E-03	5.3E-05	0.2%	1.2E+00	1.5%
Chloroform	2.75E-01	2.0E-03	6.0E-03	8.10E-02	8.60E-05	1.7E-04	0.6%	6.9E+01	84.6%
cis-1,2-Dichloroethene	1.78E-01	1.3E-03	3.9E-03			NA	NA	NA	NA
Tetrachloroethene	1.11E-01	8.2E-04	2.4E-03	1.00E-02	1.40E-01	8.2E-06	0.0%	1.7E-02	0.0%
Trichloroethene	5.21E+00	3.9E-02	1.1E-01	4.00E-01	1.00E-02	1.6E-02	58.5%	1.1E+01	13.8%
					Total	**2.7E-02**	**100.0%**	**8.2E+01**	**100.0%**

RISK ASSESSMENT SPREADSHEET - INHALATION OF VOLATILES FROM GROUNDWATER

SITE NAME: SWMU 1 - MUSTARD GAS BURIAL GROUND
LOCATION: NSWC-WHITE OAK SILVER SPRING, MARYLAND
EXPOSURE SCENARIO: INHALATION OF VAPOR WHILE SHOWERING- CHILD RESIDENT - RME
MEDIA: GROUNDWATER TO INDOOR AIR
DATE: 09/17/02

HAZARD INDICES AND INCREMENTAL CANCER RISKS ARE CALCULATED BY THIS SPREADSHEET.
EXPOSURES THROUGH THE INHALATION OF VOLATILES WHILE SHOWERING ARE CONSIDERED.
INTAKE EQUATION IS BASED ON EPA, 1989 AND FOSTER AND CHROSTOWSKI, 1987.
ASSUMPTIONS ARE OUTLINED BELOW.

RELEVANT EQUATION: $$\text{Intake} = \frac{S \times IR_{SW} \times K \times EF \times ED}{BW \times AT \times R_a \times CF}$$

WHERE:			
	K = :	3.96	Mass transfer coefficient (min)
	IR_{sh} = :	10	Inhalation rate (L/min)
	S = :	Chem-specific	Volatile chemical generation rate (mg/m^3-min-shower)
	EF = :	350	Exposure Frequency (showers/year)
	ED = :	6	Exposure Duration (years)
	BW = :	15	Body Weight (kg)
	ATc = :	25,550	Averaging time for carcinogenic exposures (days)
	Atn = :	2,190	Averaging time for noncarcinogenic exposures (days)
	R_a = :	0.025	Air exchange rate (min^{-1})
	CF = :	1.00E+03	Convesrion Factor (L/m^3)

Unit Dose
Lifetime Chronic Daily Intake = 8.7E-03 (min-m^3-shower)/(kg-day)
Chronic Daily Intake = : 1.0E-01 (min-m^3-shower)/(kg-day)

RISK ASSESSMENT SPREADSHEET - INHALATION OF VOLATILES FROM GROUNDWATER

SITE NAME: SWMU 1 - MUSTARD GAS BURIAL GROUND
LOCATION: NSWC-WHITE OAK SILVER SPRING, MARYLAND
EXPOSURE SCENARIO: INHALATION OF VAPOR WHILE SHOWERING- CHILD RESIDENT - RME
MEDIA: GROUNDWATER TO INDOOR AIR
DATE: 09/17/02

CHEMICAL	S (mg/m^3- min - shower)	Lifetime Chronic Daily Intake (mg/kg/day)	Chronic Daily Intake (mg/kg/day)	Cancer Slope Factor $(mg/kg/day)^{-1}$	Reference Dose (mg/kg/day)	Lifetime Cancer Risk	Percent Cancer Risk	Hazard Quotient	Percent Hazard Quotient
1,1,1,2-Tetrachloroethane	6.96E-02	6.0E-04	7.1E-03	2.60E-02		1.6E-05	0.1%	NA	NA
1,1,2,2-Tetrachloroethane	7.24E+00	6.3E-02	7.3E-01	2.00E-01		1.3E-02	40.6%	NA	NA
1,1,2-Trichloroethane	1.63E-04	1.4E-06	1.7E-05	5.60E-02		7.9E-08	0.0%	NA	NA
1,1-Dichloroethene	1.85E-01	1.6E-03	1.9E-02		5.71E-02	NA		3.3E-01	0.1%
1,2-Dichloroethane	7.75E-02	6.7E-04	7.9E-03	9.10E-02	1.40E-03	6.1E-05	0.2%	5.6E+00	1.5%
Chloroform	2.75E-01	2.4E-03	2.8E-02	8.10E-02	8.60E-05	1.9E-04	0.6%	3.2E+02	84.6%
cis-1,2-Dichloroethene	1.78E-01	1.5E-03	1.8E-02			NA	NA	NA	NA
Tetrachloroethene	1.11E-01	9.6E-04	1.1E-02	1.00E-02	1.40E-01	9.6E-06	0.0%	8.0E-02	0.0%
Trichloroethene	5.21E+00	4.5E-02	5.3E-01	4.00E-01	1.00E-02	1.8E-02	58.5%	5.3E+01	13.8%
					Total	**3.1E-02**	**100.0%**	**3.8E+02**	**100.0%**

Volatilization From Showering - CTE
Source: Foster & Chrostowski, 1987.
SWMU 1 - MUSTARD GAS BURIAL GROUND

Parameter	Value	Definition
Ra	0.025	air exchange rate, (min^{-1})
Ds	10	shower duration, (min)
Dt	15	total time in bathroom, (min)
Fr	10	shower water flow rate, (L/min)
Sv	12	shower room air volume, (m^3)
ts	2	shower dropler drop time, (sec)
d	1	shower droplet diameter, (mm)
T1	293	calibration water temperature, (K)
Ts	318	shower water temperature, (K)
m1	0.982	water viscosity at T1, (cp)
ms	0.616	water viscosity at Ts, (cp)
K	2.19	mass transfer coefficient, (min)

Chemical	Cw	MW	H	Kl	Kg	KL	Kal	Cwd	S	S x K
	(mg/L)	(g/mole)	(atm-m^3/mol	(cm/hr)	(cm/hr)	(cm/hr)	(cm/hr)	mg/L		Ra x CF
1,1,1,2-Tetrachloroethane	2.50E-01	167.85	2.42E-03	1.02E+01	9.82E+02	9.28E+00	1.22E+01	8.36E-02	6.96E-02	2.44E-02
1,1,2,2-Tetrachloroethane	3.80E+01	168	3.44E-04	1.02E+01	9.82E+02	5.92E+00	7.79E+00	8.69E+00	7.24E+00	1.67E-02
1,1,2-Trichloroethane	6.00E-04	133	9.12E-04	1.15E+01	1.10E+03	9.03E+00	1.19E+01	1.96E-04	1.63E-04	2.39E-02
1,1-Dichloroethene	5.00E-01	97	2.61E-02	1.35E+01	1.29E+03	1.33E+01	1.75E+01	2.21E-01	1.85E-01	3.24E-02
1,2-Dichloroethane	2.50E-01	99	9.78E-04	1.33E+01	1.28E+03	1.06E+01	1.40E+01	9.30E-02	7.75E-02	2.72E-02
Chloroform	8.40E-01	119	3.66E-03	1.22E+01	1.17E+03	1.14E+01	1.50E+01	3.30E-01	2.75E-01	2.87E-02
cis-1,2-Dichloroethene	5.00E-01	97	4.07E-03	1.35E+01	1.29E+03	1.27E+01	1.67E+01	2.13E-01	1.78E-01	3.12E-02
Tetrachloroethene	3.70E-01	166	1.84E-02	1.03E+01	9.88E+02	1.02E+01	1.34E+01	1.33E-01	1.11E-01	2.63E-02
Trichloroethene	1.60E+01	131	1.03E-02	1.16E+01	1.11E+03	1.13E+01	1.49E+01	6.26E+00	5.21E+00	2.86E-02

RISK ASSESSMENT SPREADSHEET - INHALATION OF VOLATILES FROM GROUNDWATER

SITE NAME: SWMU 1 - MUSTARD GAS BURIAL GROUND
LOCATION: NSWC CRANE, INDIANA
EXPOSURE SCENARIO: INHALATION OF VAPOR WHILE SHOWERING- ADULT RESIDENT - CTE
MEDIA: GROUNDWATER TO INDOOR AIR
DATE: 09/17/02

HAZARD INDICES AND INCREMENTAL CANCER RISKS ARE CALCULATED BY THIS SPREADSHEET.
EXPOSURES THROUGH THE INHALATION OF VOLATILES WHILE SHOWERING ARE CONSIDERED.
INTAKE EQUATION IS BASED ON EPA, 1989 AND FOSTER AND CHROSTOWSKI, 1987.
ASSUMPTIONS ARE OUTLINED BELOW.

RELEVANT EQUATION: $$\text{Intake} = \frac{S \times IR_{SW} \times K \times EF \times ED}{BW \times AT \times R_a \times CF}$$

WHERE:			
	K = :	2.19	Mass transfer coefficient (min)
	IR_{sh} = :	10	Inhalation rate (L/min)
	S = :	Chem-specific	Volatile chemical generation rate (mg/m^3-min-shower)
	EF = :	350	Exposure Frequency (showers/year)
	ED = :	24	Exposure Duration (years)
	BW = :	70	Body Weight (kg)
	ATc = :	25,550	Averaging time for carcinogenic exposures (days)
	Atn = :	8,760	Averaging time for noncarcinogenic exposures (days)
	R_a = :	0.025	Air exchange rate (min^{-1})
	CF = :	1.00E+03	Convesrion Factor (L/m^3)

Unit Dose

Lifetime Chronic Daily Intake =	4.1E-03	(min-m^3-shower)/(kg-day)
Chronic Daily Intake = :	1.2E-02	(min-m^3-shower)/(kg-day)

RISK ASSESSMENT SPREADSHEET - INHALATION OF VOLATILES FROM GROUNDWATER

SITE NAME: SWMU 1 - MUSTARD GAS BURIAL GROUND
LOCATION: NSWC CRANE, INDIANA
EXPOSURE SCENARIO: INHALATION OF VAPOR WHILE SHOWERING- ADULT RESIDENT - CTE
MEDIA: GROUNDWATER TO INDOOR AIR
DATE: 09/17/02

CHEMICAL	S (mg/m^3- min - shower)	Lifetime Chronic Daily Intake (mg/kg/day)	Chronic Daily Intake (mg/kg/day)	Cancer Slope Factor $(mg/kg/day)^{-1}$	Reference Dose (mg/kg/day)	Lifetime Cancer Risk	Percent Cancer Risk	Hazard Quotient	Percent Hazard Quotient
1,1,1,2-Tetrachloroethane	6.96E-02	2.9E-04	8.4E-04	2.60E-02		7.5E-06	0.1%	NA	NA
1,1,2,2-Tetrachloroethane	7.24E+00	3.0E-02	8.7E-02	2.00E-01		6.0E-03	40.6%	NA	NA
1,1,2-Trichloroethane	1.63E-04	6.7E-07	2.0E-06	5.60E-02		3.8E-08	0.0%	NA	NA
1,1-Dichloroethene	1.85E-01	7.6E-04	2.2E-03		5.71E-02	NA	NA	3.9E-02	0.1%
1,2-Dichloroethane	7.75E-02	3.2E-04	9.3E-04	9.10E-02	1.40E-03	2.9E-05	0.2%	6.7E-01	1.5%
Chloroform	2.75E-01	1.1E-03	3.3E-03	8.10E-02	8.60E-05	9.2E-05	0.6%	3.8E+01	84.6%
cis-1,2-Dichloroethene	1.78E-01	7.3E-04	2.1E-03			NA	NA	NA	NA
Tetrachloroethene	1.11E-01	4.6E-04	1.3E-03	1.00E-02	1.40E-01	4.6E-06	0.0%	9.5E-03	0.0%
Trichloroethene	5.21E+00	2.1E-02	6.3E-02	4.00E-01	1.00E-02	8.6E-03	58.5%	6.3E+00	13.8%
					Total	**1.5E-02**	**100.0%**	**4.5E+01**	**100.0%**

RISK ASSESSMENT SPREADSHEET - INHALATION OF VOLATILES FROM GROUNDWATER

SITE NAME: SWMU 1 - MUSTARD GAS BURIAL GROUND
LOCATION: NSWC-WHITE OAK SILVER SPRING, MARYLAND
EXPOSURE SCENARIO: INHALATION OF VAPOR WHILE SHOWERING- CHILD RESIDENT - CTE
MEDIA: GROUNDWATER TO INDOOR AIR
DATE: 09/17/02

HAZARD INDICES AND INCREMENTAL CANCER RISKS ARE CALCULATED BY THIS SPREADSHEET.
EXPOSURES THROUGH THE INHALATION OF VOLATILES WHILE SHOWERING ARE CONSIDERED.
INTAKE EQUATION IS BASED ON EPA, 1989 AND FOSTER AND CHROSTOWSKI, 1987.
ASSUMPTIONS ARE OUTLINED BELOW.

RELEVANT EQUATION: $$\text{Intake} = \frac{S \times IR_{SW} \times K \times EF \times ED}{BW \times AT \times R_a \times CF}$$

WHERE:			
	K = :	2.19	Mass transfer coefficient (min)
	IR_{sh} = :	10	Inhalation rate (L/min)
	S = :	Chem-specific	Volatile chemical generation rate (mg/m^3-min-shower)
	EF = :	350	Exposure Frequency (showers/year)
	ED = :	6	Exposure Duration (years)
	BW = :	15	Body Weight (kg)
	ATc = :	25,550	Averaging time for carcinogenic exposures (days)
	Atn = :	2,190	Averaging time for noncarcinogenic exposures (days)
	R_a = :	0.025	Air exchange rate (min^{-1})
	CF = :	1.00E+03	Convesrion Factor (L/m^3)

Unit Dose

Lifetime Chronic Daily Intake =	4.8E-03	(min-m^3-shower)/(kg-day)
Chronic Daily Intake = :	5.6E-02	(min-m^3-shower)/(kg-day)

RISK ASSESSMENT SPREADSHEET - INHALATION OF VOLATILES FROM GROUNDWATER

SITE NAME: SWMU 1 - MUSTARD GAS BURIAL GROUND
LOCATION: NSWC-WHITE OAK SILVER SPRING, MARYLAND
EXPOSURE SCENARIO: INHALATION OF VAPOR WHILE SHOWERING- CHILD RESIDENT - CTE
MEDIA: GROUNDWATER TO INDOOR AIR
DATE: 09/17/02

CHEMICAL	S (mg/m^3- min - shower)	Lifetime Chronic Daily Intake (mg/kg/day)	Chronic Daily Intake (mg/kg/day)	Cancer Slope Factor $(mg/kg/day)^{-1}$	Reference Dose (mg/kg/day)	Lifetime Cancer Risk	Percent Cancer Risk	Hazard Quotient	Percent Hazard Quotient
1,1,1,2-Tetrachloroethane	6.96E-02	3.3E-04	3.9E-03	2.60E-02		8.7E-06	0.1%	NA	NA
1,1,2,2-Tetrachloroethane	7.24E+00	3.5E-02	4.1E-01	2.00E-01		7.0E-03	40.6%	NA	NA
1,1,2-Trichloroethane	1.63E-04	7.8E-07	9.2E-06	5.60E-02		4.4E-08	0.0%	NA	NA
1,1-Dichloroethene	1.85E-01	8.9E-04	1.0E-02		5.71E-02	NA		1.8E-01	0.1%
1,2-Dichloroethane	7.75E-02	3.7E-04	4.3E-03	9.10E-02	1.40E-03	3.4E-05	0.2%	3.1E+00	1.5%
Chloroform	2.75E-01	1.3E-03	1.5E-02	8.10E-02	8.60E-05	1.1E-04	0.6%	1.8E+02	84.6%
cis-1,2-Dichloroethene	1.78E-01	8.5E-04	1.0E-02			NA	NA	NA	NA
Tetrachloroethene	1.11E-01	5.3E-04	6.2E-03	1.00E-02	1.40E-01	5.3E-06	0.0%	4.4E-02	0.0%
Trichloroethene	5.21E+00	2.5E-02	2.9E-01	4.00E-01	1.00E-02	1.0E-02	58.5%	2.9E+01	13.8%
					Total	**1.7E-02**	**100.0%**	**2.1E+02**	**100.0%**

CALCULATION OF AIR CONCENTRATIONS IN A TRENCH
SWMU 1 - MUSTARD GAS BURIAL GROUND
NSWC CRANE, INDIANA

For Mass-Transfer Coefficients			For Emission Flux and Concentration in Trench			Trench dimensions		
Kg,H2O	0.833	cm/s	CF1	1.00E-03	L/cm3	Length	8	ft
MWH2O	18		CF2	1.00E+04	cm2/m2		2.44	m
Kg,O2	0.002	cm/s	CF3	3600	s/hr	Width	11	ft
MWO2	32		F	1			3.35	m
T	77	F	ACH	360	hr-1	Depth	10	ft
T	298	K					3.05	m
R	8.20E-05	atm-m3/mol-K				Width/Depth	1.10	

Table 3.8 Exposure-point concentrations (Inhalation) for construction/utility workers in a trench: Groundwater less than 15 feet deep

	CAS No.	Molecular Weight MWi g/mol	Henry's Law Constant Hi atm-m3/mol	Gas-Phase Mass Transfer Coefficient KiG cm/s	Liquid-Phase Mass Transfer Coefficient KiL cm/s	Overall Mass Transfer Coefficient Ki cm/s	Concentration of Contaminant in Groundwater Cgw ug/L	Volatilization Factor VF L/m3	Concentration of Contaminant in Trench Ctrench ug/m3
Volatile Organic Compounds (VOCs)									
1,1,1,2-Tetrachloroethane	630-20-6	167.85	2.42E-03	3.94E-01	8.73E-04	8.54E-04	2.50E+02	2.80E-02	7.01E+00
1,1,2,2-Tetrachloroethane	79-34-5	167.85	3.45E-04	3.94E-01	8.73E-04	7.55E-04	3.80E+04	2.48E-02	9.41E+02
1,12-Trichloroethane	79-00-5	133.40	9.13E-04	4.26E-01	9.80E-04	9.23E-04	6.00E-01	3.03E-02	1.82E-02
1,1-Dichloroethene	75-35-4	96.94	2.61E-02	4.74E-01	1.15E-03	1.15E-03	5.00E+02	3.76E-02	1.88E+01
1,2-Dichloroethane	107-06-2	98.96	9.79E-04	4.71E-01	1.14E-03	1.07E-03	2.50E+02	3.52E-02	8.80E+00
Chloroform	67-66-3	119.38	3.67E-03	4.42E-01	1.04E-03	1.02E-03	8.40E+02	3.35E-02	2.81E+01
cis-1,2-Dichloroethene	156-59-2	96.94	4.08E-03	4.74E-01	1.15E-03	1.13E-03	5.00E+02	3.72E-02	1.86E+01
Tetrachloroethene	127-18-4	165.83	1.84E-02	3.96E-01	8.79E-04	8.76E-04	3.70E+02	2.87E-02	1.06E+01
Trichloroethene	79-01-6	131.39	1.03E-02	4.28E-01	9.87E-04	9.82E-04	1.60E+04	3.22E-02	5.15E+02

EXAMPLE CALCULATION
AIR CONCENTRATION OF VOCS IN A TRENCH - CONSTRUCTION WORKER SCENARIO
SWMU 1 - MUSTARD GAS BURIAL GROUND

Ctrench = CGW x VF

Where:

Ctrench = concentration of contaminant in the trench $\mu g/m^3$
CGW = concentration of contaminant in groundwater µg/L
VF = volatilization factor L/m^3

1. Calculate kiG (gas-phase mass transfer coefficient of component i)

$kiG = (MWH2O/MWi)^{0.335} \times (T/298)^{1.005} \times kG, H2O$

Where:

kiG = gas-phase mass transfer coefficient of component i cm/s
MW_{H2O} = molecular weight of water = 18 g/mol
MW_{TCE} = molecular weight of TCE = **131.39** g/mol
kG,H_2O = gas-phase mass transfer coefficient of water vapor at 25°C cm/s = 0.833 cm/s
T = average system absolute temperature = **298**
The value of kG, H_2O is 0.833 cm/s (Superfund Exposure Assessment Manual, U. S. EPA, April 1988)

$kiG = (18/131.39)^{0.335} \times (298/298)^{1.005} \times 0.833$ cm/s = **4.28E-01** cm/s

2. Calculate kiL (liquid-phase mass transfer coefficient of component i)

$kiL = (MWO_2/MWi)^{0.5} \times (T/298) \times kL, O_2$

Where:
kiL = liquid-phase mass transfer coefficient of component i cm/s
MW_{O2} = molecular weight of O_2 = 32 g/mol
MW_{TCE} = molecular weight of TCE = **131.39** g/mol
T = average system absolute temperature = **298**
kL, O_2 = liquid-phase mass transfer coefficient of oxygen at 25°C cm/s = 0.002 cm/s

$kiL = (32/131.39)^{0.5} \times (298/298) \times 0.002$ cm/s = **9.87E-04 cm/s**

EXAMPLE CALCULATION
AIR CONCENTRATION OF VOCS IN A TRENCH - CONSTRUCTION WORKER SCENARIO
SWMU 1 - MUSTARD GAS BURIAL GROUND

3. Calculate Ki (overall mass transfer coefficient of contaminant)

Ki = 1 / {(1/kiL) + [(RT) / (Hi x kiG)]}

Where:

kiL = liquid-phase mass transfer coefficient of i cm/s =	**9.87E-04**
R = ideal gas constant atm-m^3/mole-°K =	8.20E-05
T = average system absolute temperature =	**298**
Hi = Henry's Law constant of TCE (atm-m^3/mol) =	**1.03E-02**
KiG = gas-phase mass transfer coefficient of i cm/s	**4.28E-01**

Ki = 1 / {(1/9.78E-4) + [(298 x 8.2E-5) / (1.03E-2 x 0.428]} = 9.82E-04 cm/s

4. Calculation of VF (Volatilization Factor)

VF = (Ki x A x F x 10^{-3} x 10^4 x 3,600) / (ACH x V)

Where:

VF = volatilization factor (L/m^3)		
Ki = overall mass transfer coefficient of contaminant =		**9.82E-04** cm/s
A = area of the trench =		**8.18** m^2
F = fraction of floor through which contaminant can enter (unitless) =		**1**
ACH = air changes per hour =		**360** h^{-1}
V = volume of trench =		**24.92** m^3
10^{-3} = conversion factor L/cm^3	0.001	
10^4 = conversion factor cm^2/m^2	10000	
3,600 = conversion factor seconds/hr	3600	

VF = (9.82E-4 x 8.18 x 1 x 10^{-3} x 10^4 x 3,600) / (360 x 24.92) = 3.22E-02 L/m^3

5. Calculation of C_{trench} (concentration of contaminant in the trench)

C_{trench} = C_{GW} x VF

Where:

C_{trench} = concentration of contaminant in the trench (µg/m^3)	
C_{GW} = concentration of TCE in groundwater =	**16000** µg/L
VF = volatilization factor =	**3.22E-02** L/m^3

C_{trench} = 16000 ug/L x 3.22E-2 L/m^3 = 5.15E+02 µg/m^3

TETRA TECH NUS, INC. **CALCULATION WORKSHEET**

CLIENT NSWC CRANE	JOB NUMBER N3959
SUBJECT SAMPLE CALCULATIONS OF STATISTICAL ANALYSIS	
BASED ON MGBG SURFACE SOIL IRON RESULTS	DRAWING NUMBER
BY TSK / CHECKED BY T. Johnson	APPROVED BY T. Johnson / DATE 05/19/03

THE DATA USED FOR THE FOLLOWING SAMPLE CALCULATIONS ARE THE IRON RESULTS COLLECTED FROM SURFACE SOIL AT THE MUSTARD GAS BURIAL GROUND.

NSAMPLE	PARAMETER	RESULT	QUALIFIER	VALUE	LOG VALUE	SAMPLE DATE
01SS010002	IRON	16300		16300	9.70	8/26/2001
01SS020002	IRON	24600		24600	10.11	8/26/2001
01SS030002	IRON	25500		25500	10.15	8/26/2001
01SS040002	IRON	23100		23100	10.05	8/26/2001
01SS050002	IRON	20300		20300	9.918	8/26/2001
01SS060002	IRON	18100		18100	9.804	8/27/2001
01SS070002	IRON	24000		24000	10.09	8/27/2001
01SS080002	IRON	19100		19100	9.857	8/21/2001
01SS090002	IRON	18300		18300	9.815	8/26/2001
01SS100002	IRON	24700		24700	10.11	8/27/2001
01SS110002	IRON	19000		19000	9.852	8/22/2001
01SS120002	IRON	15700		15700	9.661	8/25/2001
01SS130002	IRON	16300		16300	9.699	8/24/2001
01SS140002	IRON	23500		23500	10.06	8/24/2001
01SS150002	IRON	23500		23500	10.06	8/22/2001
01SS160002	IRON	19900		19900	9.898	8/21/2001
01SS170002	IRON	24600		24600	10.11	8/24/2001
01SS180002	IRON	17200		17200	9.753	8/24/2001
01SS190002	IRON	22800		22800	10.03	8/24/2001
01SS200002	IRON	18000		18000	9.798	8/21/2001
01TPL01	IRON	15400		15400	9.642	8/27/2001
01TPL02	IRON	14600		14600	9.589	8/27/2001
01TPL03	IRON	15000		15000	9.616	8/27/2001
01TPL04	IRON	17600		17600	9.776	8/27/2001

CLIENT NSWC CRANE		JOB NUMBER N3959	
SUBJECT SAMPLE CALCULATIONS OF STATISTICAL ANALYSIS			
BASED ON MGBG SURFACE SOIL IRON RESULTS		DRAWING NUMBER	
BY TSK	CHECKED BY	APPROVED BY	DATE 05/19/03

① CALCULATE THE ARITHMETIC MEAN ($\bar{x}$):

$$\bar{X} = \frac{\sum_{i=1}^{n} x_i}{n}$$

$$\sum_{i=1}^{20} = 16300 + 24600 + 25500 + 23100 + 20300 + 18100 + 24000 + 19100 + 18300 + 24700 + 19000 + 15700 + 16300 + 23500 + 23500 + 19900 + 24600 + 17200 + 22800 + 18000 + 15400 + 14600 + 15000 + 17600$$

$$= 477100 \qquad \bar{x} = \frac{477100}{24} = 19879.17$$

② CALCULATE THE STANDARD DEVIATION (S_x):

$$S_x = \sqrt{\frac{\sum_{i=1}^{n} (x_i - \bar{x})^2}{n-1}}$$

$$\sum_{i=1}^{n} (x_i - \bar{x})^2 = (16300-19879.17)^2 + (24600-19879.17)^2 + (25500-19879.17)^2 + (23100-19879.17)^2 + (20300-19879.17)^2 + (18100-19879.17)^2 + (24000-19879.17)^2 + (19100-19879.17)^2 + (18300-19879.17)^2 + (24700-19879.17)^2 + (19000-19879.17)^2 + (15700-19879.17)^2 + (16300-19879.17)^2 + (23500-19879.17)^2 + (23500-19879.17)^2 + (19900-19879.17)^2 + (24600-19879.17)^2 + (17200-19879.17)^2 + (22800-19879.17)^2 + (18000-19879.17)^2 + (15400-19879.17)^2 + (14600-19879.17)^2 + (15000-19879.17)^2 + (17600-19879.17)^2$$

$$= (-3579.17)^2 + (4720.83)^2 + (5620.83)^2 + (3220.83)^2 + (420.83)^2 + (-1779.17)^2 + (4120.83)^2 + (-779.17)^2 + (-1579.17)^2 + (4820.83)^2 + (-879.17) + (-4179.17)^2 + (-3579.17)^2 + (3620.83)^2 + (3620.83)^2 + (20.83)^2 + (4720.83)^2 + (-2679.17)^2 + (2920.83)^2 + (-1879.17)^2 + (-4479.17)^2 + (-5279.17)^2 + (-4879.17)^2 + (-2279.17)^2$$

CLIENT NSWC CRANE	JOB NUMBER N3959
SUBJECT SAMPLE CALCULATIONS OF STATISTICAL ANALYSIS	
BASED ON MGBG SURFACE SOIL IRON RESULTS	DRAWING NUMBER
BY TSK / CHECKED BY T. Jensen	APPROVED BY / DATE 05/19/03

$$\sum_{i=1}^{n}(x_i-\bar{x})^2 = 12810434.03 + 22286267.36 + 31593767.36 + 10373767.36 + 177100.69$$
$$+ 3165434.03 + 16981267.36 + 607100.69 + 2493767.36 + 23240434.03$$
$$+ 772934.03 + 17465434.03 + 12810434.03 + 13110434.03 + 13110434.03$$
$$+ 434.03 + 22286267.36 + 7177934.03 + 8531267.36 + 3531267.36$$
$$+ 20062934.03 + 27869600.69 + 23806267.36 + 5194600.69$$

$$= 299459583.3$$

$$S_x = \sqrt{\frac{\sum_{i=1}^{n}(x_i-\bar{x})^2}{n-1}} = \sqrt{\frac{299459583.3}{24-1}} = \sqrt{13019981.88} = 3608.32$$

③ CALCULATE THE SHAPIRO WILK W-STATISTIC (W_{CALC}):

$$W_{CALC} = \left(\frac{b}{S_x\sqrt{n-1}}\right)^2$$

CALCULATE b BY CREATING THE FOLLOWING TABLE:

COLUMN 1: VALUE ORDERED FROM SMALLEST TO LARGEST (R_i)
COLUMN 2: VALUE ORDERED FROM LARGEST TO SMALLEST (R_{n-i+1})
COLUMN 3: COLUMN 2 − COLUMN 1 ($R_{n-i+1} - R_i$)
COLUMN 4: COEFFICIENT a_i FOUND IN TABLE 1
COLUMN 5: COLUMN 3 × COLUMN 4 = $b_i = a_i(R_{n-i+1} - R_i)$

$$b = \sum_{i=1}^{K} b_i$$

* WHERE K IS THE GREATEST INTEGER LESS THAN OR EQUAL TO $n/2$

$$K \rightarrow n/2 = 24/2 = 12$$

CLIENT: NSWC CRANE	JOB NUMBER: N3959
SUBJECT: SAMPLE CALCULATIONS OF STATISTICAL ANALYSIS	
BASED ON: MGBG SURFACE SOIL IRON RESULTS	DRAWING NUMBER:
BY: TSK / CHECKED BY: T. Jackson	APPROVED BY: / DATE: 05/19/03

R_i	R_{n-i+1}	$R_{n-i+1}-R_i$	a_i	b_i	i
14600	25500	10900	0.4493	4897.37	1
15000	24700	9700	0.3098	3005.06	2
15400	24600	9200	0.2554	2349.68	3
15700	24600	8900	0.2145	1909.05	4
16300	24000	7700	0.1807	1391.39	5
16300	23500	7200	0.1512	1088.64	6
17200	23500	6300	0.1245	784.35	7
17600	23100	5500	0.0997	548.35	8
18000	22800	4800	0.0764	366.72	9
18100	20300	2200	0.0539	118.58	10
18300	19900	1600	0.0321	51.36	11
19000	19100	100	0.0107	1.07	12
19100	19000			+	13
19900	18300				14
20300	18100			$b = 16511.62$	15
22800	18000				16
23100	17600				17
23500	17200				18
23500	16300				19
24000	16300				20
24600	15700				21
24600	15400				22
24700	15000				23
25500	14600				24

$$W_{CALC} = \left(\frac{b}{S_x\sqrt{n-1}}\right)^2$$

$$= \left(\frac{16511.62}{3608.32\sqrt{23}}\right)^2 = \left(\frac{16511.62}{17304.891}\right)^2 = (0.95416)^2 = 0.9104$$

CLIENT NSWC CRANE	JOB NUMBER N3959
SUBJECT SAMPLE CALCULATIONS OF STATISTICAL ANALYSIS	
BASED ON MGBG SURFACE SOIL IRON RESULTS	DRAWING NUMBER
BY TSK / CHECKED BY T. Jackson	APPROVED BY / DATE 05/19/03

- DETERMINE W_{TEST} AT A 5% LEVEL OF SIGNIFICANCE FROM TABLE 2.

$$W_{TEST} = 0.916$$

- COMPARE W_{CALC} TO W_{TEST}

$$W_{CALC} = 0.9104 < 0.916 = W_{TEST}$$

SINCE $W_{CALC} < W_{TEST}$ WE DO NOT ACCEPT THE NULL HYPOTHESIS THAT THE DATA SET HAS A NORMAL DISTRIBUTION. AFTER RUNNING THE SHAPIRO WILK W TEST ON THE LOG-TRANSFORMED DATA, FURTHER ANALYSIS SHOWED:

$$W_{CALC\,(LOG)} = 0.919 > 0.916 = W_{TEST}$$

THUS, THE NULL HYPOTHESIS FOR THE SHAPIRO WILK W TEST USING LOG-TRANSFORMED DATA IS ACCEPTED SHOWING THE DATA IS BEST REPRESENTED AS LOGNORMALLY DISTRIBUTED.

(4) CALCULATE THE 95% UPPER CONFIDENCE LIMIT: ($UCL_{0.95}$)

$$UCL_{0.95} = \bar{x} + t_{0.95,n-1}\left(S_x/\sqrt{n}\right)$$

- DETERMINE $t_{0.95,23}$ FROM TABLE 3: $t_{0.95,23} = 1.714$

$$UCL_{0.95} = 19879.17 + \left[1.714\left(3608.32/\sqrt{24}\right)\right]$$

$$= 19879.17 + \left[1.714(736.545)\right]$$

$$= 19879.17 + \left[1262.4385\right]$$

$$UCL_{0.95} = 21141.608$$

CLIENT NSWC CRANE	JOB NUMBER N3959
SUBJECT SAMPLE CALCULATIONS OF STATISTICAL ANALYSIS	
BASED ON MGBG SURFACE SOIL IRON RESULTS	DRAWING NUMBER
BY TSK / CHECKED BY T Jackson	APPROVED BY / DATE 05/19/03

⑤ CALCULATE THE 95% UPPER CONFIDENCE LIMIT FOR LOGNORMAL VALUES:

* FIRST, FIND $\bar{Y}$ & S_Y USING LOG-TRANSFORMED VALUES OF THE ORIGINAL DATA BY THE SAME PROCEDURE ON PAGES 1 & 2 FOR $\bar{X}$ & S_X.

$$\bar{y} = 9.88 \qquad S_y = 0.1825$$

$$UCL_{0.95\,(LOG)} = e^{\left[\bar{y} + 0.5(S_y)^2 + \frac{S_y(H_{0.95,n})}{\sqrt{n-1}}\right]}$$

* FIND $H_{0.95,n}$ FROM TABLE 4 BY INTERPOLATION:

$$y - y_1 = \frac{y_2 - y_1}{x_2 - x_1}(x - x_1)$$

WHERE: $x = S_y$ $\qquad n = 21$

$x_1 = S_y < 0.1825 = 0.10$ $\qquad y_1$ = RESPECTIVE $H_{0.95}$ AT X_1 FROM TABLE 4

$x_2 = S_y > 0.1825 = 0.20$ $\qquad y_2$ = RESPECTIVE $H_{0.95}$ AT X_2 FROM TABLE 4

$$y - 1.722 = \left(\frac{1.771 - 1.722}{0.20 - 0.10}\right)(0.1825 - 0.10)$$

$$y = (0.49)(0.0825) + 1.722$$

$$= 1.7624$$

NOW CALCULATE USING X_1 & X_2 FOR $n = 31$

$$H_{0.95,31} = y = 1.7348$$

CLIENT NSWC CRANE	JOB NUMBER N3959
SUBJECT SAMPLE CALCULATION OF STATISTICAL ANALYSIS	
BASED ON MGBG SURFACE SOIL IRON RESULTS	DRAWING NUMBER
BY TSK / CHECKED BY T. Jackson	APPROVED BY / DATE 05/19/03

LAST INTERPULATION, CALCULATE THE FOLLOWING:

$x = n$

$x_1 = n < 24 = 21$ $\quad y_1 = 1.7624$

$x_2 = n > 24 = 31$ $\quad y_2 = 1.7348$

$$y - 1.7624 = \frac{1.7348 - 1.7624}{31 - 21}(24 - 21)$$

$$y = 1.754145$$

$$UCL_{0.95\,(1-\alpha)} = e^{\left[9.88153 + 0.5(0.1825)^2 + \frac{0.1825(1.754145)}{\sqrt{23}}\right]}$$

$$= e^{\left[9.88153 + 0.01665 + 0.667520243\right]}$$

$$= e^{\left[9.964932\right]}$$

$$UCL_{0.95\,(1-\alpha)} = 21267.4$$

APPENDIX G-4

TOXICITY PROFILES

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1.0 1,1,1,2-TETRACHLOROETHANE (CAS NO. 630-20-6)

Very little information is available in the literature regarding the human health effects of 1,1,1,2-tetrachloroethane.

1.1 Noncancer Toxicity

The following effects have been documented for persons exposed to 1,1,1,2-tetrachloroethane.

A high percentage of large mononuclear cells were found in circulating blood of a person in the early stages of tetrachloroethane poisoning. Symptoims included: cccasional complaints of tired feeling, gastric symptoms, lack of appetite, slight nausea, and slight headache.

In a study of 380 workers in small factories in India exposed by inhalation of 1,1,1,2-tetrachloroethane used as cleaning agent, a high percentage developed nervous symptoms, such as headache, vertigo, nervousness, numbness, and tremors. 1,1,1,2- Tetrachloroethane at an air concentrations of 9-17 ppm induced tremors in 14% of the personnel; at 40-74 ppm, in 33%; at 50-61 ppm, in 41%; and at 65-98 ppm, in 50%.

An oral reference dose of 0.03 mg/kg/day for chronic exposure to 1,1,1,2-tetrachloroethane was developed by the USEPA based on mineralization of the kidneys in male rats and hepatic clear cell change in female rats and a lowest observed adverse effects level (LOAEL) of 89.3 mg/kg/day (Uncertainty Factor of 3,000).

1.2 Carcinogenicity

No epidemiological data relevant to the carcinogenicity of 1,1,1,2-tetrachloroethane were available. There is limited evidence in experimental animals for the carcinogenicity of 1,1,1,2-tetrachloroethane. 1,1,1,2-Tetrachloroethane is not classifiable as to its carcinogenicity to humans.

Classification: C, possible human carcinogen. Basis for classification: increased incidence of combined hepatocellular adenomas and carcinomas in female mice; inadequate evidence from human studies.

The USEPA developed an oral slope factor (CSF) of 2.6E-2 $(mg/kg/day)^{-1}$ based on hepatocellular adenomas or carcinomas in female mice. The inhalation slope factor and unit risk are 2.6E-2 $(mg/kg/day)^{-1}$ and 7.4E-3 $(\mu g/m^3)^{-1}$, respectively, based on the same study.

2.0 1,1,2,2-TETRACHLOROETHANE

1,1,2,2-Tetrachloroethane is a volatile organic compound which has been used as a chemical intermediate, industrial solvent, and extractant. Chemical degradation occurs by the loss of chlorine atoms, and the half-life of 1,1,2,2-tetrachloroethane in air is about 2 months and in groundwater 1 to 3 months. Bioaccumulation of 1,1,2,2-tetrachloroethane in fish and other aquatic organisms is not expected to be significant.

2.1 Noncancer Toxicity

Two human studies suggested that between 50 and 97% of inspired 1,1,2,2-tetrachloroethane is retained in the body. Humans acutely exposed by the oral route had clinical signs inclusive of pulmonary congestion and edema, lung collapse, shallow breathing during unconsciousness, low blood pressure, a faint pulse, and epicardial and endocardial anoxic hemorrhage. Acute inhalation exposure studies of humans to concentrations ranging from 116 to 262 ppm for 10 to 30 minutes resulted in mucosal irritation, nausea and vomiting, eye mucosal irritation, and dizziness. Chronic exposures in humans have resulted in reports of headache, tremors, dizziness, numbness, drowsiness, gastrointestinal distress, liver destruction, fatty degeneration in the liver. Jaundice and enlarged livers have also been reported in exposed workers. The USEPA's National Center for Environmental Assessment (NCEA) has developed a provisional oral RfD of 0.006 mg/kg/day for 1,1,2,2-tetrachloroethane.

2.2 Carcinogenicity

Army workers exposed to 1,1,2,2-tetrachloroethane vapor in a clothing processing plant had a very slight increase in death due to genital cancers, leukemia, or other lymphomas than workers not employed in a clothing plant. Male and female mice orally administered 142 and 284 mg/kg/day for 78 weeks had an increase in hepatocellular carcinomas. Based on these results, 1,1,2,2-tetrachloroethane has been classified as Group C, possible human carcinogen. For oral exposures, the slope factor is 0.2 $(mg/kg/day)^{-1}$, and the unit risk is 5.8E-06$(g/L)^{-1}$. For inhalation exposures, the slope factor is 0.2 $(mg/kg/day)^{-1}$ and the unit risk is 5.8E-05 $(g/m^3)^{-1}$.

3.0 1,1,2-TRICHLOROETHANE

1,1,2-Trichloroethane (CAS Reg. No. 79-00-5), also known as vinyl trichloride, is a nonflammable liquid that is used in the manufacture of 1,1-dichloroethene; as a solvent for fats, waxes, resins, and alkaloids; and in organic synthesis. 1,1,2-Trichloroethane is released to the environment as a result of

anthropogenic activity. The chemical has been identified in the United States at 45 of 1177 hazardous waste sites on the National Priorities List. Based on release patterns of related chemicals, it is estimated that 70-90% of the total release is to air, 10-30% to land, and a few percent to water. Removal of 1,1,2-trichloroethane from the atmosphere is thought to occur by reaction with photochemically produced hydroxyl radicals (estimated half-life 49 days) and from washout by precipitation; however, most of the 1,1,2-trichloroethane removed by washout is expected to reenter the atmosphere by volatilization. If released to soil, 1,1,2-trichloroethane is expected to partially leach into groundwater and to partially volatilize. In surface water, volatilization is the primary removal process.

3.1 Noncancer Toxicity

1,1,2-Trichloroethane is rapidly absorbed, widely distributed in organs and tissues, and extensively metabolized. 1,1,2-Trichloroethane and/or its metabolites are primarily excreted through the lungs and urine. Very limited human data were available to evaluate the toxicity of 1,1,2-trichloroethane. The chemical exerts a narcotic action at "low" concentrations and is irritating to the eyes and mucous membranes of the respiratory tract. When in contact with skin, 1,1,2-trichloroethane may cause cracking and erythema. The oral LD50 for mice (378 to 491 mg/kg) indicates that in animals the acute oral toxicity of 1,1,2-trichloroethane is moderate. 1,1,2-Trichloroethane is a central nervous system depressant, inducing sedation in mice at oral doses of 378 mg/kg and drowsiness, incoordination, and narcosis in dogs at 289 mg/kg. Male and female CD-1 mice ingesting 384 mg/kg in drinking water for 90 days exhibited alterations in serum enzyme and hepatic microsomal enzyme activities, indicating adverse liver effects. In addition, depressed immune function in both sexes and decreased hemoglobin and hematocrit values in females were noted. Decreased survival was reported in female mice exposed to 195 or 390 mg/kg/day for 78 weeks. One study found that a single 7-hour exposure to 250 or 500 ppm resulted in the death of more than half of the exposed female rats, with surviving animals exhibiting marked liver and kidney damage. As noted previously, 1,1,2-trichloroethane is a central nervous system depressant inducing narcosis; death results from respiratory arrest. In mice, a concentration of 3750 ppm for 30 minutes produced central nervous system depression and significantly increased liver enzyme activity within 18 minutes and death in half the animals within 10 hours. No adverse effects were observed in rats, guinea pigs, and rabbits exposed to 15 ppm for 7 hours/day, 5 days/week for 6 months, but female rats exposed to 30 ppm (16 exposures; 7 hours/day, 5 days/week) exhibited minor hepatic effects. Repeated topical applications of 0.1 mL 1,1,2-trichloroethane produced erythema, edema, fissuring, and scaling of rabbit and guinea pig skin.

An oral reference dose of 0.04 mg/kg/day for subchronic exposure and 0.004 mg/kg/day for chronic exposure to 1,1,2-trichloroethane was calculated based on a no observed adverse effects level (NOAEL) of 3.9 mg/kg/day and a lowest observed adverse effects level (LOAEL) of 44 mg/kg/day from a 90-day

drinking water study with mice. Clinical chemistry alterations indicative of liver damage were identified as critical effects. An inhalation reference concentration for 1,1,2-trichloroethane is under review by EPA.

3.2 Carcinogenicity

No epidemiologic studies or case reports addressing the carcinogenicity of 1,1,2-trichloroethane in humans were available. In a rodent bioassay, 1,1,2-trichloroethane was administered by gavage to Osborne-Mendel rats (46 or 92 mg/kg/day) and B6C3F1 mice (195 or 390 mg/kg/day), 5 days/week for 78 weeks. No effects on tumor development were noted in rats. Treated mice had significantly ($p<0.01$) increased incidences of hepatocellular carcinomas. The tumor incidences in treated males were 37% and 76% in the low- and high-dose groups, respectively, compared with 10% in vehicle controls, and 33% and 89% in females, respectively, compared to no observed tumors in vehicle controls. An increased incidence of adrenal pheochromocytomas was also observed in male and female mice. In a cancer initiation/promotion study with rats, 1,1,2-trichloroethane did not exhibit tumor initiating or promoting activity. Based on United States Environmental Protection Agency (EPA) guidelines, 1,1,2-trichloroethane was assigned to weight-of-evidence group C, possible human carcinogen. For oral exposure, the slope factor is 5.7E-2 $(mg/kg/day)^{-1}$ and the unit risk for drinking water is 1.6E-6 $(\mu g/L)^{-1}$. The inhalation slope factor and unit risk are 5.6E-2 $(mg/kg/day)^{-1}$ and 1.6E-5 $(\mu g/m^3)^{-1}$, respectively.

4.0 1,1-DICHLOROETHENE

1,1-Dichloroethylene (CAS No. 75-35-4), also known as 1,1-dichloroethene and vinylidine chloride, is a colorless liquid that is used primarily in the production of polyvinylidine chloride (PVC) copolymers and as an intermediate for synthesis of organic chemicals. The major application for PVC copolymers is the production of flexible films for food packaging such as Saran® wrap. 1,1-Dichloroethene does not occur naturally but is found in the environment due to releases associated with its production and transport and with the production of its polymers. Because of its high volatility, releases to the atmosphere are the greatest source of ambient 1,1-dichloroethene. Smaller amounts are released to surface waters and soils. Loss of 1,1-dichloroethene from water and soils is primarily due to volatilization. In the atmosphere, reaction with photochemically generated hydroxyl radicals is expected to be the predominant removal mechanism. Human exposure to 1,1-dichloroethene is potentially highest in workplace settings and in the vicinity of hazardous waste sites where the compound may contaminate environmental media.

4.1 Noncancer Toxicity

The primary effect of acute exposure to high concentrations (approximately 4000 ppm) of 1,1-dichloroethene vapor in humans is central nervous system (CNS) depression which may progress to

unconsciousness. Occupational exposure has been reported to cause liver dysfunction in workers . 1,1-Dichloroethene is irritating when applied to the skin and prolonged contact can cause first degree burns. Direct contact with the eyes may cause conjunctivitis and transient corneal injury. In experimental animals, the liver and kidneys are target organs for the toxic effects of 1,1-dichloroethene. Subchronic oral exposure for 90 days to 1,1-dichloroethylene in drinking water produced slight hepatotoxic effects at 200 ppm and chronic oral exposure to drinking water for 2 years produced hepatocellular changes in males at >=100 ppm and in females at >=50 ppm. Gavage administration of 10 mg/kg/day, 5 days/week for 2 years produced chronic inflammation of the kidney in male and female rats and liver necrosis in male and female mice. Exposure by inhalation to 55 ppm 1,1-dichloroethene, 6 hours/day, 5 days/week for up to 1 year produced fatty liver changes in rats and focal degeneration and necrosis in mice. In a three-generation study, no treatment-related effects on reproduction or neonatal development were seen in male and female Sprague-Dawley rats administered up to 200 ppm of 1,1-dichloroethene in the drinking water. However, inhalation exposure during gestation produced increased resorptions and minor skeletal alterations in rodents at concentrations that caused maternal toxicity. These effects were reported in rats and mice at >=15 ppm and in rats and rabbits at >=80 ppm and >=160 ppm, respectively. An oral Reference Dose (RfD) of 9E-3 mg/kg/day was derived for chronic exposure and subchronic exposure to 1,1-dichloroethylene, based on liver lesions seen in rats in a 2-year drinking water study. The oral RfD is currently under review and may be subject to change. An inhalation Reference Concentration (RfC) for 1,1-dichloroethene is under review.

4.2 Carcinogenicity

An epidemiology study using a small cohort found no association between the occurrence of cancer or cancer mortality and exposure to 1,1-dichloroethene. Oral carcinogenicity bioassays (drinking water or gavage exposures) with experimental animals gave generally negative results. In one inhalation study, statistically significant increases in renal adenocarcinomas were noted in male Swiss mice exposed to 25 ppm for 12 months. Also observed were statistically significant increases in mammary gland carcinomas in females and lung tumors in both sexes. Results of other inhalation studies with rats, mice, and hamsters have been negative. Based on EPA guidelines, 1,1-dichloroethene was assigned to weight-of-evidence group C, possible human carcinogen. For oral exposure, the slope factor is 6E-1 $(mg/kg/day)^{-1}$ and the unit risk is 1.7E-5 $(ug/L)^{-1}$. The inhalation slope factor is 0.175 $(mg/kg/day)^{-1}$.

5.0 1,2-DICHLOROETHANE

1,2-Dichloroethane is used primarily in the manufacture of vinyl chloride, as well as in the synthesis of tetrachloroethylene, trichloroethylene, 1,1,1-trichloroethane, vinylidene chloride, aziridines, and ethylenediamines. It is added to gasoline as a lead-scavenging agent, and, in the past, has been used as

a metal degreasing agent; a solvent; and a fumigant for grain, upholstery, and carpets. It has also been used in paints, coatings, adhesives, varnishes, finish removers, soaps, and scouring agents. 1,2-Dichloroethane is expected to be highly mobile in most soils, and consequently, contamination of groundwater is possible. Adsorption to soil particles is low, particularly for soils with a low organic carbon content. Volatilization from soils and surface waters may be an important transport process. Microbial biodegradation is not expected to be significant.

5.1 Noncancer Toxicity

1,2-Dichloroethane is absorbed through the lungs, gastrointestinal system, and skin. It is distributed throughout the body but may be concentrated in adipose tissue. The compound can also accumulate in breast milk and may cross the placenta. Metabolism of 1,2-dichloroethane most likely involves conjugation with glutathione. Excretion occurs primarily through elimination of soluble urinary metabolites.

Bronchitis, hemorrhagic gastritis and colitis, hepatocellular damage, renal tubular necrosis, central nervous system depression, and histopathological changes in the brain have been reported in cases of acute oral poisoning of humans. Animal data indicate that short-term exposures may produce immune system deficiencies, and subchronic or chronic oral exposures may affect the liver or kidney. Subchronic or chronic oral reference doses for 1,2-dichloroethane have not been adopted by the United States Environmental Protection Agency. However, a provisional reference dose (RfD) of 0.03 mg/kg/day has been calculated by the Superfund Health Risk Technical Support Center (EPA, 1994) from a no-observed-adverse-effects level (NOAEL) of 26 mg/kg/day for rats tested in a subchronic gavage study .

Acute inhalation exposures to 1,2-dichloroethane (75-125 ppm) can result in irritation of the eyes, nose and throat, dizziness, nausea, vomiting, increasing stupor, cyanosis, rapid pulse, delirium, anesthesia, partial paralysis, loss of tactile sense, degenerative changes in the myocardium, abnormal EEG, liver and kidney damage, pulmonary edema, and hemorrhages throughout the body. Short-term exposures to animals have resulted in central nervous system depression (inactivity or stupor, tremors, uncertain gait, narcosis); pulmonary congestion; renal tubular degeneration; fatty degeneration of the liver and, less commonly, necrosis and hemorrhage of the adrenal cortex; chronic splenitis; fatty infiltration of the myocardium; and immuno-deficiency. Chronic occupational exposure to 1,2-dichloroethane may result in central nervous systems effects including irritability, sleeplessness, and decreased heart rate; loss of appetite; nausea; vomiting; epigastric pain, as well as irritation of the mucous membranes; and liver and kidney impairment. Subchronic or chronic inhalation exposures to animals resulted in pathological lesions in the kidney, liver, heart, lungs, and testes. A subchronic or chronic inhalation reference concentration for 1,2-dichloroethane has not been adopted and verified by EPA. However, a provisional inhalation RfD

of 0.0014 mg/kg-day has been calculated by the Superfund Health Risk Technical Support Center from a LOAEL gastrointestinal disturbances and liver and gallbladder disease) of 10 mg/m^3 for occupationally exposed workers.

5.2 Carcinogenicity

1,2-Dichloroethane is classified by EPA in Group B2 as a probable human carcinogen by both the oral and inhalation exposure routes, based on evidence for the induction of several types of tumors in rats and mice. Male rats treated by gavage with 1,2-dichloroethane exhibited increased incidences of fibromas of the subcutaneous tissue; hemangiosarcomas of the spleen, liver, pancreas, and adrenal gland; and squamous-cell carcinomas of the forestomach. Female rats treated by gavage developed mammary adenocarcinomas. Increased incidences of hepatocellular carcinomas and pulmonary adenomas were observed in male mice treated by gavage, and increased incidences of mammary adenocarcinomas, pulmonary adenocarcinomas, and endometrial polyps and sarcomas were observed in female mice. Mice treated by topical application of 1,2-dichloroethane exhibited an increased incidence of lung papillomas. The oral slope factor for 1,2-dichloroethane is 9.1E-2 $(mg/kg/day)^{-1}$, and the drinking water unit risk is 2.6E-6 $(ug/L)^{-1}$. The inhalation slope factor is 9.1E-2 $(mg/kg/day)^{-1}$, and the inhalation unit risk is 2.6E-5 $(ug/m^3)^{-1}$.

6.0 CIS- and TRANS-1,2-DICHLOROETHENE

6.1 Noncancer Toxicity

Information on the toxicity of 1,2-dichloroethene in humans and animals is limited. Workers exposed to 1,2-dichloroethene have been reported to suffer from drowsiness, dizziness, nausea, fatigue, and eye irritation. Acute and subchronic oral and inhalation animal studies of trans-1,2-dichloroethene and acute inhalation animal studies of cis-1,2-dichloroethene suggest that the liver is the primary target organ with secondary target organs being the central nervous system and lung.

Based on an unpublished study describing decreased hemoglobin and hematocrits in rats treated by gavage for 90 days, the EPA developed a chronic oral RfD of 0.01 mg/kg/day based on a NOAEL and an uncertainty factor of 3000.

6.2 Carcinogenicity

The EPA has placed both cis-1,2-dichloro-ethene and trans-1,2-dichloroethene in weight-of-evidence group D, not classifiable as to human carcinogenicity, based on the lack of human or animal carcinogenicity data and on essentially negative mutagenicity data.

7.0 CHLOROFORM

7.1 Noncancer Toxicity

Oral or inhalation exposure of animals to chloroform was associated with liver and kidney damage. In humans, acute inhalation exposure to high levels induced narcosis, ventricular fibrillation, and death. Limited occupational data associated chronic exposure to chloroform with CNS depression, digestive disturbances, and enlarged livers. The EPA derived a chronic oral RfD of 0.01 mg/kg/day based on an LOAEL for fatty cyst formation in the livers of dogs treated orally for 7.5 years and an uncertainty factor of 1000. The inhalation RfD for chloroform is 8.6E-05 mg/kg/day. Target organs for the toxicity of chloroform include the liver and kidney for oral and inhalation exposure, and the heart and CNS for inhalation exposure.

7.2 Carcinogenicity

Chloroform is classified as a cancer weight-of-evidence group B2 compound (probable human carcinogen), based on increased incidence of several tumor types in rats and liver tumors in mice. Human carcinogenicity data are inadequate. An oral slope factor of 0.0061 per mg/kg/day was derived from the incidence of kidney tumors in rats treated with chloroform in drinking water for two years. An inhalation unit risk of 2.3E-05 per mg/m^3 was based on the incidence of hepatocellular carcinomas in mice treated by gavage for 78 weeks. The inhalation unit risk is equivalent to 0.081 per mg/kg/day, assuming an inhalation rate of 20 m^3/day and a body weight of 70 kg for humans.

8.0 METHYLENE CHLORIDE

Methylene chloride (CH2Cl2, CAS No. 75-09-2), also known as dichloromethane is a colorless volatile liquid with a penetrating ether-like odor. In industry, methylene chloride is widely used as a solvent in paint removers, degreasing agents, and aerosol propellants; as a polyurethane foam-blowing agent; and as a process solvent in the pharmaceutical industry. The compound is also used as an extraction solvent for spice oleoresins, hops, and caffeine.

8.1 Noncancer Toxicity

Methylene chloride is readily absorbed from the lungs, the gastrointestinal tract, and to some extent through the skin. Metabolism of methylene chloride produces CO2 and CO, which readily binds with blood hemoglobin to form carboxyhemoglobin (CO-Hb). The primary adverse health effects associated with methylene chloride exposure are central nervous system (CNS) depression and mild liver effects. Neurological symptoms described in individuals occupationally exposed to methylene chloride included headaches, dizziness, nausea, memory loss, paresthesia, tingling hands and feet, and loss of consciousness. Major effects following acute inhalation exposure include fatigue, irritability, analgesia, narcosis, and death. CNS effects have also been demonstrated in animals following acute exposure to methylene chloride. Impaired liver function has been associated with occupational exposure to methylene chloride. Liver effects have also been documented in a number of inhalation studies with laboratory animals. Subchronic exposure of rats, mice, dogs, and monkeys caused mild hepatic effects such as cytoplasmic vacuolization and fatty changes. Hepatocellular foci, fatty changes, and necrosis were reported following chronic inhalation exposure of rats and mice. Chronic oral exposure to methylene chloride via drinking water resulted in histopathological alterations of the liver in rats and mice. In addition, inhalation exposure of rats caused nonspecific degenerative and regenerative changes in the kidneys. A subchronic and chronic oral reference dose (RfD) of 6E-2 mg/kg/day and reference air concentration (RfC) of 3E+0 mg/m^3 for methylene chloride has been calculated by U.S. EPA.

8.2 Carcinogenicity

Studies of workers exposed to methylene chloride have not recorded a significant increase in cancer cases above the number of cases expected for nonexposed workers. However, long-term inhalation studies with rats and mice demonstrated that methylene chloride causes cancer in laboratory animals. Mice exposed via inhalation to high concentrations of methylene chloride (2000 or 4000 ppm) exhibited a significant increase of malignant liver and lung tumors compared with nonexposed controls. Rats of both sexes exposed to concentrations of methylene chloride ranging from 500 to 4000 ppm showed increases of benign mammary tumors. An inhalation study with rats and hamsters revealed sarcomas of the salivary

gland in male rats, but not in female rats or hamsters. Liver tumors observed in rats and mice that ingested methylene chloride in drinking water for 2 years provided suggestive evidence of carcinogenicity. Based on inadequate evidence of carcinogenicity in humans and on sufficient evidence in animals, U.S. EPA has placed methylene chloride in weight-of-evidence group B2, probable human carcinogen. A slope factor and unit risk of 7.5E-3 $(mg/kg/day)^{-1}$ and 2.1E-7 $(ug/L)^{-1}$, respectively, were derived for oral exposure to methylene chloride. The inhalation slope factor is 1.65E-3 $(mg/kg/day)^{-1}$.

9.0 TETRACHLOROETHENE (PCE)

Tetrachloroethylene (CAS No. 127-18-4) is a halogenated aliphatic hydrocarbon with a vapor pressure of 17.8 mm Hg at 25C. The chemical is used primarily as a solvent in industry and, less frequently, in commercial dry-cleaning operations.

9.1 Noncancer Toxicity

Occupational exposure to tetrachloroethylene occurs via inhalation, resulting in systemic effects, and via dermal contact, resulting in local effects. Exposure to the general population can occur through contaminated air, food and water .The respiratory tract is the primary route of entry for tetrachloroethene. The chemical is rapidly absorbed by this route and reaches an equilibrium in the blood within 3 hours after the initiation of exposure. Tetrachloroethene is also significantly absorbed by the gastrointestinal (g.i.) tract, but not through the skin. The chemical accumulates in tissues with high lipid content, where the half-life is estimated to be 55 hours, and has been identified in perirenal fat, brain, liver, placentofetal tissue, and amniotic fluid.

The main targets of tetrachloroethylene toxicity are the liver and kidney by both oral and inhalation exposure, and the central nervous system by inhalation exposure. Acute exposure to high concentrations of the chemical (estimated to be greater than 1,500 ppm for a 30-minute exposure) may be fatal to humans. Chronic exposure causes respiratory tract irritation, headache, nausea, sleeplessness, abdominal pains, constipation, cirrhosis of the liver, hepatitis, and nephritis in humans; and microscopic changes in renal tubular cells, squamous metaplasia of the nasal epithelium, necrosis of the liver, and congestion of the lungs in animals. Some epidemiology studies have found an association between inhalation exposure to tetrachloroethylene and an increased risk for spontaneous abortion, idiopathic infertility, and sperm abnormalities among dry-cleaning workers, but others have not found similar effects. The adverse effects in humans are supported in part by the results of animal studies in which tetrachloroethylene induced fetotoxicity (but did not cause malformations) in the offspring of treated dams.

Reference doses (RfDs) for subchronic and chronic oral exposure to tetrachloroethylene are 1E-1 mg/kg/day and 1E-2 mg/kg/day, respectively. These values are based on hepatotoxicity observed in mice given 100 mg tetrachloroethylene/kg body weight for 6 weeks and a no-observed-adverse effect level (NOAEL) of 20 mg/kg. EPA-NCEA has developed an inhalation RfD of 0.14 mg/kg-day for PCE.

9.2 Carcinogenicity

Epidemiology studies of dry cleaning and laundry workers have demonstrated excesses in mortality due to various types of cancer, including liver cancer, but the data are regarded as inconclusive because of various confounding factors. The tenuous finding of an excess of liver tumors in humans is strengthened by the results of carcinogenicity bioassays in which tetrachloroethylene, administered either orally or by inhalation, induced hepatocellular tumors in mice. The chemical also induced mononuclear cell leukemia and renal tubular cell tumors in rats. Tetrachloroethylene was negative for tumor initiation in a dermal study and for tumor induction in a pulmonary tumor assay. Although U.S. EPA's Science Advisory Board recommended a weight-of-evidence classification of C-B2 continuum (C = possible human carcinogen; B2 = probable human carcinogen), the agency has not adopted a current position on the weight-of-evidence classification. In an earlier evaluation, tetrachloroethylene was assigned to weight-of-evidence Group B2, probable human carcinogen, based on sufficient evidence from oral and inhalation studies for carcinogenicity in animals and no or inadequate evidence for carcinogenicity to humans. The unit risk and slope factor values for tetrachloroethylene have been withdrawn from IRIS and HEAST. Upper bound risk estimates provided by EPA-NCEA are as follows: for oral exposure, the slope factor is 5.2E-2 $(mg/kg/day)^{-1}$; for inhalation exposure, the slope factor is 1.0E-2 $(mg/kg/day)^{-1}$.

10.0 TRICHLOROETHENE

Trichloroethene (TCE) is an industrial solvent used primarily in metal degreasing and cleaning operations. TCE can be absorbed through the lungs, mucous membranes, gastrointestinal tract, and the skin.

10.1 Pharmacokinetics

TCE is extensively metabolized in humans to trichloroacetic acid and trichloroethanol, as well as to several minor metabolites, with most of the absorbed dose excreted in urine.

10.2 Noncancer Toxicity

Human and animal data indicate that exposure to TCE can result in toxic effects on a number of organs and systems, including the liver, kidney, blood, skin, immune system, reproductive system, nervous system, and cardiovascular system. In humans, acute inhalation exposure to TCE causes central nervous

system symptoms such as headache, dizziness, nausea, and unconsciousness. Among the reported effects from occupational exposure studies are fatigue, light-headedness, sleepiness, vision distortion, abnormal reflexes, tremors, ataxia, nystagmus, increased respiration, as well as neurobehavioral or psychological changes. Cardiovascular effects include tachycardia, extrasystoles, EKG abnormalities, and precordial pain. The use of TCE as an anesthetic has been associated with cardiac arrhythmias. Cases of severe liver and kidney damage, including necrosis, have been reported in humans following acute exposure to TCE, but these effects generally are not associated with long-term occupational exposures. In animals, TCE has produced liver enlargement with hepatic biochemical and/or histological changes and kidney enlargement, renal tubular alterations and/or toxic nephropathy. Also observed in animals were hematological effects and immunosuppression. Inhalation studies with rats indicate that TCE is a developmental toxicant causing skeletal ossification anomalies and other effects consistent with delayed maturation. TCE may cause dermatitis and dermographism.

Reference Doses (RfDs) and Reference Concentrations (RfCs) for subchronic and chronic oral and inhalation exposure to TCE are presently under review by EPA. However, EPA-NCEA has published an oral RfD of 0.006 mg/kg-day for TCE.

10.3 Carcinogenicity

Epidemiologic studies have been inadequate to determine if a correlation exists between exposure to TCE and increased cancer risk. Chronic oral exposure to TCE increased the incidences of hepatocellular carcinomas in mice and renal adenocarcinomas and leukemia in rats. Chronic inhalation exposure induced lung and liver tumors in mice and testicular Leydig cell tumors in rats. Although U.S. EPA's Science Advisory Board recommended a weight-of-evidence classification of C-B2 continuum (C = possible human carcinogen; B2 = probable human carcinogen), the agency has not adopted a current position on the weight-of-evidence classification. In an earlier evaluation, TCE was assigned to weight-of-evidence Group B2, probable human carcinogen, based on tumorigenic responses in rats and mice for both oral and inhalation exposure and on inadequate data in humans. Carcinogen slope factors are 1.1E-2 $(mg/kg/day)^{-1}$ and 6.0E-3 $(mg/kg/day)^{-1}$ for oral and inhalation exposure, respectively. The corresponding unit risks are 3.2E-7 $(\mu g/L)^{-1}$ and 1.7E-6 $(\mu g/m^3)^{-1}$, respectively.

11.0 BENZO (A) ANTHRACENE

11.1 Noncancer Toxicity

The oral and inhalation RfD and RfC are not available at this time.

11.2 Carcinogenicity

Benzo[a]anthracene has a weight of evidence classification of B2, a probable human carcinogen. The classification was based on sufficient data from animal bioassays. Benzo[a]anthracene produced tumors in mice exposed by gavage; intraperitoneal, subcutaneous or intramuscular injection; and topical application. Benzo[a]anthracene produced mutations in bacteria and in mammalian cells, and transformed mammalian cells in culture.

Although there are no human data that specifically link exposure to benzo[a]anthracene to human cancers, benzo[a]anthracene is a component of mixtures that have been associated with human cancer. These include coal tar, soot, coke oven emissions and cigarette smoke.

Benzo[a]anthracene administration caused an increase in the incidence of tumors by gavage; dermal application; and both subcutaneous injection and intraperitoneal injection assays. A group of male mice was exposed to gavage solutions containing 3% benzo[a]anthracene for 5 weeks. There was an increased incidence of pulmonary adenomas and hepatomas.

Supporting data for carcinogenicity include genetic mutations in five different strains of Salmonella typhimurium. Benzo[a]anthracene produced positive results in an assay for mutations in Drosophila melongaster.

The currently used Oral Slope Factor (CSF) for benzo[a]anthracene is 7.3E-01 per (mg/kg)/day which is extrapolated from the CSF for benzo[a]pyrene (BaP), i.e., 0.1 x 7.3 (BaP) = 7.3E-01 per (mg/kg)/day).

12.0 BENZO (A)PYRENE (BAP)

12.1 Pharmacokinetics

Benzo (a)pyrene was readily absorbed across the GI and respiratory epithelia. Benzo(a)pyrene was distributed widely in the tissues of treated rats and mice, but primarily to tissues high in fat, such as adipose tissue and mammary gland.

Studies of the metabolism of benzo(a)pyrene provide information relevant to other PAHs because of the structural similarities of all members of the class. Metabolism involves microsomal mixed function oxidase hydroxylation of one or more of the phenyl rings with the formation of phenols and dihydrodiols, probably via formation of arene oxide intermediates. The dihydrodiols may be further oxidized to diol epoxides, which, for certain members of the class, are known to be the ultimate carcinogens. Conjugation with glutathione or glucuronic acid, and reduction to tetrahydrotetrols are important detoxification pathways.

Excretion of benzo(a)pyrene residue was reported to be rapid, although quantitative data were not located. Excretion occurred mainly via the feces, probably largely due to biliary secretion. The EPA concluded that accumulation in the body tissues of PAHs from chronic low level exposure would be unlikely.

12.2 Noncancer Toxicity

The oral RfD and inhalation RfC are not available at this time.

12.3 Carcinogenicity

The PAHs are ubiquitous, being released to the environment from anthropogenic as well as from natural sources. Benzo (a)pyrene is the most extensively studied member of the class, inducing tumors in multiple tissues of virtually all laboratory species tested by all routes of exposure. Although epidemiology studies suggested that complex mixtures that contain PAHs (coal tar, soots, coke oven emissions, cigarette smoke) are carcinogenic to humans, the carcinogenicity cannot be attributed to PAHs alone because of the presence of other potentially carcinogenic substances in these mixtures. In addition, recent investigations showed that the PAH fraction of roofing tar, cigarette smoke, and coke oven emissions accounted for only 0.1 to 8 percent of the total mutagenic activity of the unfractionated complex mixture in Salmonella. Aromatic amines, nitrogen heterocyclic compounds, highly oxygenated quinones, diones, and nitrooxygenated compounds, none of which would be expected to arise from in vivo metabolism of PAHs, probably accounted for the majority of the mutagenicity of coke oven emissions and cigarette smoke. Coal tar, which contains a mixture of many PAHs, has a long history of use in the clinical treatment of a variety of skin disorders in humans.

Because of the lack of human cancer data, assignment of individual PAHs to EPA cancer weight-of-evidence groups was based largely on the results of animal studies with large doses of purified compound. Frequently, unnatural routes of exposure, including implants of the test chemical in beeswax and trioctanoin in the lungs of female Osborne-Mendel rats, intratracheal instillation, and subcutaneous or intraperitoneal injection, were used. Benzo (a)anthracene, benzo(a)pyrene, benzo(b)fluoranthene, dibenzo(a,h)anthracene, and indeno(1,2,3-cd)pyrene were classified in Group B2 (probable human carcinogens).

The EPA verified a slope factor for oral exposure to benzo(a)pyrene of 7.3 per mg/kg/day, based on several dietary studies in mice and rats. Neither verified nor provisional quantitative risk estimates were available for the other PAHs in Group B2. The EPA promulgated an ambient water quality criterion for "total carcinogenic PAHs," based on an oral slope factor derived from a study with benzo(a)pyrene, as being sufficiently protective for the class. Largely because of this precedent, the quantitative risk estimates for

benzo(a)pyrene were adopted for the other carcinogenic PAHs when quantitative estimates were needed. The EPA has calculated an inhalation slope factor for benzo(a)pyrene of 3.1 per mg/kg/day.

Human data specifically linking benzo(a)pyrene to a carcinogenic effect are lacking. There are, however, multiple animal studies in many species demonstrating benzo(a)pyrene to be carcinogenic following administration by numerous routes. In addition, benzo(a)pyrene has produced positive results in numerous genotoxicity assays.

The data for animal carcinogenicity is sufficient. The animal data consist of dietary, gavage, inhalation, intratracheal instillation, dermal and subcutaneous studies in numerous strains of at least four species of rodents and several primates. Repeated benzo(a)pyrene administration has been associated with increased incidences of total tumors and of tumors at the site of exposure. The tumor types in mice from oral diet studies include forestomach, squamous cell papillomas and carcinomas.

Benzo(a)pyrene has been shown to cause genotoxic effects in a broad range of prokaryotic and mammalian cell assay systems.

13.0 BENZO (B)FLUORANTHENE

13.1 Noncancer Toxicity

Little information is available on benzo (b)fluoranthene. However, based on the similarities of chemical structures, most properties should be similar to benzo (a)pyrene.

13.2 Carcinogenicity

The EPA has classified benzo (b)fluoranthene in cancer weight-of-evidence Group B2 (Probable Human Carcinogen, sufficient evidence of carcinogenicity in animals with inadequate or lack of evidence in humans) based on lung tumors in mice. The currently used Oral Slope Factor (CSF) for benzo(b)fluoranthene is 7.3E-01 per (mg/kg)/day which is extrapolated from the CSF for Benzo[a]pyrene (BaP), i.e., 0.1 x 7.3 (BaP) = 7.3E-01 per (mg/kg)/day).

14.0 BIS(2-ETHYLHEXYL)PHTHALATE (DI[2-ETHYLHEXYL]PHTHALATE)

14.1 Noncancer Toxicity

The acute oral toxicity of bis(2-ethylhexyl)phthalate is very low; oral $LD_{50/30}$ (lethal dose to 50 percent of population within 30 days without medical testament) values in rats and mice were 33,800 and 26,300 mg/kg, respectively. Repeated high-dose oral exposures were associated with decreased growth, altered organ weights, testicular degeneration, and developmental effects. The USEPA has developed a verified chronic oral RfD of 0.02 mg/kg/day based on an LOAEL for increased relative liver weight in guinea pings and an uncertainty factor of 1000. The principal target organs for the toxicity of bis(2-ethylhexyl)phthalate are the liver and testis.

14.2 Carcinogenicity

The EPA classifies bis(2-ethylhexyl)phthalate in cancer weight-of evidence Group B2 (probable human carcinogen), based on inadequate human cancer date (one limited occupational study) and sufficient cancer data in laboratory animals. An oral slope factor of 0.014 per mg/kg/day was based on the increased incidence of liver tumors in a dietary study in male mice. An inhalation slope factor of 0.014 per mg/kg/day was determined by the USEPA.

15.0 HEXACHLOROETHANE (CAS# 67-72-1)

Hexachloroethane is a colorless solid that gradually evaporates when it is exposed to air. It is also called HCE, perchloroethane, and carbon hexachloride. Its vapors smell like camphor. In the United States, about half of the hexachloroethane is used by the military for smoke-producing devices. It is also used to remove air bubbles in melted aluminum. Hexachloroethane may be present as an ingredient in some fungicides, insecticides, lubricants, and plastics. Hexachloroethane does not occur naturally in the environment. It is no longer made in the United States, but it is formed as a by-product in the production of some chemicals. Some hexachloroethane can be formed by incinerators when materials containing chlorinated hydrocarbons are burned. Hexachloroethane itself does not catch fire easily. Some hexachloroethane can also be formed when chlorine reacts with carbon compounds in drinking water.

Hexachloroethane can be released to the environment during its production, use, transport, or disposal. In air, hexachloroethane does not break down to other compounds. Some hexachloroethane that is in lakes or streams and surface soils will evaporate into the air. Microscopic organisms can break it down more easily without oxygen than with oxygen. Hexachloroethane does not appear to build up in plants or animals used for food.

15.1 Noncancer Toxicity

Mild skin irritation has been reported by workers at a munitions factory who were exposed to low levels of hexachloroethane. The workers were wearing protective clothing that greatly reduced exposure. No other information is available concerning health effects in people exposed to hexachloroethane. It act primarily as a central nervous system depressant at high concentrations. It also may be moderately irritating to the skin, mucous membranes and liver. Affects of exposure to hexachloroethane may cause the followin: mucous membranes, skin, lung, cornea irritation, liver, kidney damage, central nervous system effects. The USEPA has developed a chronic oral RfD of 0.001 mg/kg/day from a NOAEL based on atrophy and degeneration of the renal tubules and an uncertainty factor of 1000.

Animal studies have not shown hexachloroethane to cause birth defects or to affect reproduction.

15.2 Carcinogenicity

Liver tumors developed in mice that were orally exposed to hexachloroethane for their whole lifetime. Male rats that were exposed to hexachloroethane for their lifetime developed kidney tumors. This type of tumor is not found in people, so it is unlikely that exposure to hexachloroethane would cause cancer of the kidney. The USEPA has determined that hexachloroethane may reasonably be anticipated to be a carcinogen based on sufficient evidence in experimental animals. There is inadequate evidence in humans for the carcinogenicity of hexachloroethane. Hexachloroethane has been classified as Class C, possible human carcinogen based on observation of carcinomas in one mouse strain after oral exposure. An oral slope factor of 0.014 per mg/kg/day was based hepatocellular carcinomas in male mice

The Occupational Safety and Health Administration (OSHA) has set a limit of 1 part hexachloroethane per million parts of workplace air (1 ppm) over an 8-hour workday, 40-hour work week. The EPA suggests that water consumed over a lifetime contain no more than 1 part hexachloroethane per billion parts water (1 ppb).

16.0 HEPTACHLOR (76-44-8)

Heptachlor, a cyclodiene insecticide, was extensively used until the 1970s for the control of a variety of insects. At the present time, its only permitted commercial use in the United States is fire ant control in power transformers. Heptachlor is converted to heptachlor epoxide and other degradation products in the environment. The epoxide degrades more slowly and, as a result, is more persistent than heptachlor.

Both heptachlor and heptachlor epoxide are bioconcentrated in terrestrial and aquatic organisms. Heptachlor is subject to long-range transport and removal from the atmosphere by wet deposition.

Heptachlor is absorbed from the gastrointestinal tract, lungs, and skin. It is distributed to various tissues, with highest levels occurring in adipose tissue. Transplacental transfer to the fetus has been reported . Metabolism produces primarily heptachlor epoxide, which is more toxic than its parent compound. Heptachlor and its metabolites are eliminated primarily via feces.

16.1 Noncancer Toxicity

The primary adverse health effects associated with heptachlor are central nervous system and liver effects. For humans, acute oral exposure has resulted in abnormal behavior, hyperirritability, tremors, and convulsions. Various central nervous system effects such as hyperexcitability, incoordination, tremors, muscle spasms, and seizures have also been reported in animals following acute and subchronic oral exposure. Oral LD50 values for rabbits, rats, sheep, and calves are 2000, 90 to 160, 50, and 20 mg/kg, respectively. Although hepatic effects have not been reported in humans, chronic dietary exposure of rodents to 10 ppm heptachlor or to 10 ppm of a 25:75 mixture of heptachlor/heptachlor epoxide for 18 months has produced increased liver weights, liver lesions, and decreased body weight gains.

Other effects reported in humans include blood dyscrasias as a result of exposure to heptachlor during home termite treatment and increased mortality from cerebrovascular disease in workers manufacturing pesticides. However, cardiovascular effects were not seen in a cohort of pesticide applicators with potentially high exposures to heptachlor. Reduced fertility, increased resorptions, and decreased survival of offspring was noted in rats fed diets containing 0.25 mg/kg/day for 60 days prior to mating, with the females. Reduced fertility and an increased incidence of cataracts, particularly in offspring, was reported in rats fed 6 mg/kg/day over a an 18-month period.

An oral reference dose (RfD) of 5E-4 mg/kg/day for chronic exposure to heptachlor was calculated based on a no-observed-adverse-effect level (NOAEL) of 0.15 mg/kg/day from a 2-year dietary study with rats. Increased relative liver weight was identified as the critical effect. An inhalation reference concentration (RfC) for heptachlor has not been derived.

16.2 Carcinogenicity

Existing epidemiological studies on heptachlor are inadequate to establish a clear assessment of heptachlor exposure and human risk of developing cancer. Large-scale occupational cohort studies on workers engaged in the manufacture of heptachlor and pesticide applicators have not identified

significantly increased cancer deaths. Several bioassays have shown that heptachlor can cause liver cancer in mice. Bioassays with rats were generally negative. Benign liver tumors and hepatocellular carcinomas developed in both sexes of mice fed 10 ppm heptachlor for 2 years; hepatocellular carcinomas developed in both sexes of mice fed 6-18 ppm technical grade heptachlor for 80 weeks; and nodular hyperplasia benign hepatomas and hepatocellular carcinomas developed in mice fed 5 ppm (both sexes) or 10 ppm (males) of a 25:75 heptachlor/heptachlor epoxide mixture for 18 months.

Based on EPA guidelines, heptachlor was assigned to weight-of-evidence group B2, probable human carcinogen. For oral exposure, the slope factor is 4.5 $(mg/kg/day)^{-1}$ and the unit risk is 1.3E-4 $(g/L)^{-1}$ based on hepatocellular carcinomas in mice. The inhalation slope factor and unit risk are 4.5 $(mg/kg/day)^{-1}$ and 1.3E-3 $(\mu g/m^3)^{-1}$, respectively.

17.0 AMINODINITROTOLUENES

Little information regarding the toxicology of aminodinitrotoluenes (2-amino-2,6-dtrinitrotoluene and 4-amino-2,6-dtrinitrotoluene) is available in the literature. These compounds are degradation products of 2,4,6-TNT and other nitrogen-containing explosives and are expected to exhibit toxicological effects similar to these compounds (TOXNET, online, 2001). The USEPA has derived an oral RfD of 6.0E-5 mg/kg/day for the aminodinitrotoluenes and the target organ is considered to be the liver.

18.0 ALUMINUM

Aluminum is a silver-white flexible metal with a vast number of uses. It is poorly absorbed and efficiently eliminated; however, when absorption does occur, aluminum is distributed mainly in bone, liver, testes, kidneys, and brain.

18.1 Noncancer Toxicity

Aluminum may be involved in Alzheimer's disease (dialysis dementia) and in Amyotrophic Lateral Sclerosis and Parkinsonism-Dementia Syndromes of Guam (Guam ALS-PD complex). Aluminum content of brain, muscle, and bone increases in Alzheimer's patients. Neurofibrillary tangles (NFTs) are found in patients suffering from aluminum encephalopathy and Alzheimer's disease. Symptoms of "dialysis dementia" include speech disorders, dementia, convulsions, and myoclonus. People of Guam and Rota have an unusually high incidence of neurodegenerative diseases. The volcanic soil in the region of Guam where the high incidence of ALS-PD occurs contains high levels of aluminum and manganese. Neurological effects have also been observed in rats orally exposed to aluminum compounds.

The respiratory system appears to be the primary target following inhalation exposure to aluminum. Alveolar proteinosis has been observed in guinea pigs, rats, and hamsters exposed to aluminum powders. No decrease in reproductive capacity, hormonal abnormalities, or testicular histopathology was observed in male rats exposed to aluminum in drinking water for 90 days. However, male rats exposed to aluminum (as aluminum chloride) via gavage for 6 months exhibited decreased spermatozoa counts and sperm motility, and testicular histological and histochemical changes.

Subchronic and chronic reference doses and reference concentrations have not been derived for aluminum. However, the EPA's National Center for Environmental Assessment (NCEA) has developed a provisional oral RfD of 1.00 mg/kg/day and an inhalation reference dose of 0.001 mg/kg/day.

18.2 Carcinogenicity

The U.S. EPA has not evaluated aluminum or aluminum compounds for carcinogenicity, and a weight-of-evidence classification is currently not assigned.

19.0 ANTIMONY

19.1 Pharmacokinetics

Ingested antimony is absorbed slowly and incompletely from the gastrointestinal (GI) tract. Within a few days of acute exposure, highest tissue concentrations are found in the liver, kidney, and thyroid. Organs of storage include skin, bones, and teeth. Highest concentrations in deceased smelter workers (inhalation exposure) occurred in the lungs and skeleton. Excretion is largely via the urine or feces, although some is incorporated into the hair.

19.2 Noncancer Toxicity

Acute intoxication from ingestion of large doses of antimony induces GI disturbances, dehydration, and cardiac effects in humans. Chronic effects from occupational exposure include irritation of the respiratory tract, pneumoconiosis, pustular eruptions of the skin called "antimony spots," allergic contact dermatitis, and cardiac effects, including abnormalities of the electrocardiograph (ECG) and myocardial changes. Cardiac effects were also observed in rats and rabbits exposed by inhalation for six weeks and in animals (dogs, and possibly other species) treated by intravenous injection.

Chronic oral exposure studies in laboratory animals include two briefly reported lifetime drinking water studies in rates and mice. The only dose tested, 5 ppm potassium antimony tartrate, resulted in reduced

longevity in both species and in reduced mean heart weight in rats. The EPA verified an RfD of 0.0004 mg/kg/day for chronic oral exposure to antimony from the LOAEL of 5 ppm potassium antimony tartrate (0.35 mg/antimony/kg body weight-day) in the lifetime study in rats. An uncertainty factor of 1000 was applied; factors of 10 each for inter- and intraspecies variation were used to estimate an NOAEL from an LOAEL. The heart is considered a likely target organ for chronic oral exposure of humans.

19.3 Carcinogenicity

Data were not located regarding the carcinogenicity of antimony to humans. Antimony fed to rats did not produce an excess of tumors, but a high frequency of lung tumors was observed in rats exposed by inhalation to antimony trioxide for one year. Antimony is classified as EPA cancer weight-of-evidence Group D (not classifiable as a carcinogenicity to humans).

20.0 ARSENIC

20.1 Pharmacokinetics

Several studies confirm that soluble inorganic arsenic compounds and organic arsenic compounds are almost completely (>90 percent) absorbed from the GI tract in both animals and humans. The absorption efficiency of insoluble inorganic arsenic compounds depends on particle size an stomach pH. Initial distribution of absorbed arsenic is to the liver, kidneys, and lungs, flowed by redistribution to hair, nails, teeth, bone, and skin, which are considered tissues of accumulation. Arsenic has a long half-life in the blood of rats, compared with other animals and humans, because of firm binding to the hemoglobin in erythrocytes.

Metabolism of inorganic arsenic includes reversible oxidation-reduction so that both arsenite (valence of 3) and arsenate (valence of 5) are present in the urine of animals treated with arsenic of either valence. Arsenite is subsequently oxidized and methylated by a saturable mechanism to form mono- or dimethylarsenate; the latter is the predominant metabolite in the urine of animals or humans. Organic arsenic compounds (arsenilic acid, cacodylic acid) are not readily converted to inorganic arsenic. Excretion of organic or inorganic arsenic is largely via the urine, but considerable species variation exists. Continuously exposed humans appear to excrete 60 to 70 percent of their daily intake of arsenate or arsenite via the urine.

20.2 Noncancer Toxicity

A lethal dose of arsenic trioxide in humans is 70 to 180 milligrams (approximately 50 to 140 mg arsenic. Acute oral exposure of humans to high doses of arsenic produce liver swelling, skin lesions, disturbed heart function, and neurological effects. The only noncancer effects in humans clearly attributable to chronic oral exposure to arsenic are dermal hyperpigmentation and keratosis, as revealed by studies of several hundred Chinese exposed to naturally occurring arsenic in well water. Similar effects were observed in persons exposed to high levels of arsenic in water in Utah and the northern part of Mexico. Occupational (predominantly inhalation) exposure is also associated with neurological deficits, anemia, and cardiovascular effects, but concomitant exposure to other chemicals cannot be ruled out. The EPA derived an RfD of 0.0003 mg/kg/day for chronic oral exposure, based on an NOAEL of 0.0008 mg/kg/day for skin lesions from Chinese data. The principal target organ for arsenic appears to be the skin. The nervous system and cardiovascular systems appear to be less significant target organs. Inorganic arsenic may be an essential nutrient, exerting beneficial effects on growth, health, and feed conversion efficiency .

20.3 Carcinogenicity

Inorganic arsenic is clearly a carcinogen in humans. Inhalation exposure is associated with increased risk of lung cancer in persons employed as smelter workers, in arsenical pesticide applicators, and in a population residing near a pesticide manufacturing plant. Oral exposure to high levels in well water is associated with increased risk of skin cancer. Extensive animal testing with various forms of arsenic given by many routes of exposure to several species, however, has not demonstrated the carcinogenicity of arsenic. The EPA classifies inorganic arsenic in cancer weight-of-evidence Group A (human carcinogen), and recommends an oral unit risk of 0.00005 ug/L in drinking water, based on the incidence of skin cancer in the Chinese study. The EPA presents a chronic oral slope factor of 1.5 per mg/kg/day based on the same information. The EPA notes that the uncertainties associated with the oral unit risk are considerably less than those for most carcinogens, so that the unit risk might be reduced in order of magnitude. An inhalation unit risk of 0.0043 per mg/m^3 was derived for inorganic arsenic from the incidence of lung cancer in occupationally exposed men, equivalent to 15.1 per mg/kg/day, was derived from the same data assuming an inhalation rate of 20 m^3/day and a body weight of 70 kg for humans.

21.0 BARIUM

21.1 Noncancer Toxicity

The soluble salts of barium, an alkaline earth metal, are toxic in mammalian systems. They are absorbed rapidly from the gastrointestinal tract and are deposited in the muscles, lungs, and bone. Barium is

excreted primarily in the feces. At low doses, barium acts as a muscle stimulant and at higher doses affects the nervous system eventually leading to paralysis. Acute and subchronic oral doses of barium cause vomiting and diarrhea, followed by decreased heart rate and elevated blood pressure. Higher doses result in cardiac irregularities, weakness, tremors, anxiety, and dyspnea. Subchronic and chronic oral or inhalation exposure primarily affects the cardiovascular system resulting in elevated blood pressure. Human data were used by the EPA to calculate a chronic and subchronic oral reference dose (RfD) of 0.07 mg/kg/day. Subchronic and chronic inhalation exposure of human populations to barium-containing dust can result in a benign pneumoconiosis called "baritosis." This condition is often accompanied by an elevated blood pressure but does not result in a change in pulmonary function. However, Reproductive and developmental effects and increased fetal mortality in rats were also observed after inhalation exposures. An inhalation reference concentration (RfC) of 0.005 mg/m3 for subchronic and 0.0005 mg/m3 for chronic exposure was calculated by the EPA based on the NOAEL for developmental effects which have not been substantiated in humans.

21.2 Carcinogenicity

Barium has not been evaluated by the EPA for evidence of human carcinogenic potential.

22.0 CADMIUM

22.1 Pharmacokinetics*

Estimates of cadmium uptake by the respiratory tract range from 10 to 50 percent; uptake is greatest for fumes and small particles and least for large dust particles. GI absorption of ingested cadmium is ordinarily 5 to 8 percent, but may reach 20 percent in cases of serious dietary ion deficiency. Highest tissue levels are normally found in the kidneys followed by the liver, although levels in the liver may exceed those in the kidneys of persons suffering from cadmium-induced renal dysfunction. The half-life of cadmium in the kidneys and liver may be as long as 10-30 years. Fecal and urinary excretion of cadmium are approximately equivalent to normal humans exposed to small amounts. Urinary excretion increases markedly in humans with cadmium-induced renal disease.

22.2 Noncancer Toxicity

Acute inhaltion exposure to fumes or particles of cadmium induces respiratory symptoms, general weakness, and, in severe cases, respiratory insufficiency, shock, and death. Acute oral exposure induces GI disturbances. Chronic inhalation exposure induces pulmonary emphysema, and chronic exposure by either route consistently produces renal tubular disease in humans and laboratory animals.

Proteinuria is a reliable early indicator of cadmium-induced kidney disease. The combination of pulmonary emphysema and renal tubular disease, if severe, may result in early mortality. Painful osteomalacia and osteoporosis may arise from altered metabolism of bone minerals secondary to renal damage. The combination of renal and skeletal damage is called itai-itai disease in Japan. Cadmium exposure has been associated with liver damage, but the liver appears to be less sensitive than the kidney. The kidney is the primary target organ of cadmium toxicity. The EPA derived chronic oral RfD values of 0.0005 mg/kg/day for cadmium ingested in water and 0.001 mg/kg/day for cadmium ingested in food, based on a toxicokinetic model that predicted NOAELs from renal cortical concentration of cadmium. The different RfD values reflect assumed differences in GI absorption of cadmium from water (5 percent) and food (2.5 percent). The EPA currently employs an inhalation reference dose of 5.7E-05 mg/kg/day for cadmium.

22.3 Carcinogenicity

Carcinogenicity data in humans consist of several occupational studies that associate cadmium exposure with lung cancer, but concomitant exposure to other carcinogenic chemicals and smoking were not adequately controlled. Other occupational studies reported significantly increased risk of prostatic cancer, but this effect was not observed in the largest occupational study of workers exposed to high levels. The animal data consist of an inhalation study in rats that showed a significant increase in lung tumors, and several parenteral injection studies that produced injection site tumors. No evidence of carcinogenicity, however, was observed in seven oral studies in rats and mice. The EPA classifies cadmium a cancer weight-of-evidence Group B1 substance for inhalation exposure on the basis of limited evidence of carcinogenicity in humans and sufficient evidence in animals. The data were insufficient to classify cadmium as carcinogenic to humans exposed by the oral route. An inhalation unit risk of 0.0018 mg/m^3, equivalent to 6.3 per mg/kg/day, was derived from an occupational exposure study assuming an inhalation rate of 20 m^3/day and a body weight of 70 kg for humans.

23.0 CHROMIUM

23.1 Noncancer Toxicity

In nature, chromium (III) predominates over chromium (VI). Little chromium (VI) exists in biological materials, except shortly after exposure, because reduction to chromium (III) occurs rapidly. Chromium (III) is considered a nutritionally essential trace element and is considerably less toxic than chromium (VI). No effects were observed in rats consuming 5% chromium (III)/kg/day in the diet for over two years. The No-Observed-Effect-Level (NOEL) of 5% Cr_2O_3 was the basis for a verified chronic oral RfD of 1.5 mg/kg/day. The same NOEL and an uncertainty factor of 1000 were the basis for a provisional subchronic oral RfD of 1 mg/kg/day.

Acute oral exposure of humans to high doses of chromium (VI) induced neurological effects, GI hemorrhage and fluid loss, and kidney and liver effects. Parenteral dosing of animals with chromium (VI) is selectively toxic to the kidney tubules. An NOAEL of 2.4 mg chromium (VI) /kg/day in a one-year drinking water study in rats and an uncertainty factor of 500 was the basis of a verified RfD of 0.003 mg/kg/day for chronic oral exposure.

Occupational (inhalation and dermal) exposure to chromium (III) compounds induced dermatitis. Similar exposure to chromium (VI) induced ulcerative and allergic contact dermatitis, irritation of the upper respiratory tract including ulceration of the mucosa and perforation of the nasal septum, and possibly kidney effects. An inhalation RfC values has not been determined for chromium (III), however, EPA has established an inhalation RfD of 3.0E-5 mg/kg/day for chromium (VI).

A target organ was not identified for chromium (III). The kidney appears to be the principal target organ for repeated oral dosing with chromium (VI). Additional target organs for dermal and inhalation exposure include the skin and respiratory tract.

23.2 Carcinogenicity

Data were not located regarding the carcinogenicity of chromium (III). The EPA classifies chromium (VI) in cancer weight-of-evidence Group A (human carcinogen), based on the consistent observation of increased risk of lung cancer in occupational studies of workers in chromate production or the chrome pigment industry. Parenteral dosing of animals with chromium (VI) compounds consistently induced injection-site tumors. There is no evidence that oral exposure to chromium (VI) induces cancer. An inhalation unit risk of 0.012 per mg/m^3, equivalent to 41 per mg/kg/day, assuming humans inhale 20 m^3/day and weigh 70 kg, was based on increased risk of lung cancer deaths in chromate production workers.

24.0 IRON

24.1 Noncancer Toxicity

Iron is potentially toxic in all forms and by all routes of exposure. Inorganic iron is a poison by the intraperitoneal route. The inhalation of large amounts of iron dust may result in iron pneumoconiosis or arc welders lung. Chronic exposure to excess levels of iron (>50-100 mg Iron/day) can result in pathological deposition of iron in tissues. The target organs are the pancreas and liver.

Iron compounds are of varying toxicity. Iron oxides are a potential risk in all industrial settings. In general, ferrous compounds are more toxic than ferric compounds. Acute exposure to excessive levels of ferrous compounds can cause liver and kidney damage, altered respiratory rates and convulsions. An oral RfD of 0.3 mg/kg/day has been published for iron by the EPA based on based on allowable intakes rather than adverse effect levels. No inhalation RfD has been established for iron.

24.2 Carcinogenicity

Some iron compounds are suspected human carcinogens. Iron dust is an experimental neoplastigen and an increased incidence of lung cancer has been associated with exposure to iron dust. Iron oxide is an experimental tumorigen and a suspected human carcinogen. EPA has not published oral or inhalation slope factors for iron.

25.0 MANGANESE

25.1 Noncancer Toxicity

Manganese is nutritionally required in humans for normal growth and health. Humans exposed to approximately 0.8 mg manganese/kg/day in drinking water exhibited lethargy, mental disturbances (1/16 committed suicide), and other neurologic effects. The elderly appeared to be more sensitive than children. Oral treatment of laboratory rodents induced biochemical changes in the brain, but rodents did not exhibit the neurological signs exhibited by humans. Occupational exposure to high concentrations in air induced a generally typical spectrum of neurological effects and an increased incidence of pneumonia.

EPA has established an oral RfD of 0.02 mg/kg/day for manganese based on drinking water and an oral RfD of 0.14 mg/kg/day based on food. The EPA presented a verified chronic inhalation RfC based on a LOAEL for impairment of neurobehaviorial function in occupationally exposed humans. The inhalation RfC is equivalent to 1.43E-5 mg/kg/day, assuming humans inhale 20 m^3 of air/day and weigh 70 kg. The CNS and respiratory tract are target organs of inhalation exposure to manganese.

25.2 Carcinogenicity

The EPA classifies manganese in cancer weight-of-evidence Group D (not classifiable as to carcinogenicity to humans). Quantitative cancer risk estimates are not derived from Group D chemicals.

26.0 NICKEL AND NICKEL COMPOUNDS

26.1 Noncancer Toxicity

Nickel is a naturally occurring element that may exist in various mineral forms. It is used in a wide variety of applications including metallurgical processes and electrical components, such as batteries. Some evidence suggests that nickel may be an essential trace element for mammals. The absorption of nickel is dependent on its physicochemical form, with watersoluble forms being more readily absorbed. The metabolism of nickel involves conversion to various Chemical forms and binding to various ligands. Nickel is excreted in the urine and feces with relative amounts for each route being dependent on the route of exposure and chemical form. Most nickel enters the body via food and water consumption, although inhalation exposure in occupational settings is a primary route for nickel-induced toxicity. In large doses (>0.5 g), some forms of nickel may be acutely toxic to humans when taken orally. Oral LD50 values for rats range from 67 mg nickel/kg (nickel sulfate hexahydrate) to >9000 mg nickel/kg (nickel powder). Toxic effects of oral exposure to nickel usually involve the kidneys with some evidence from animal studies showing a possible developmental/reproductive toxicity effect.

Inhalation exposure to some nickel compounds will cause toxic effects in the respiratory tract and immune system. Inhalation LC50 values for animals range from 0.97 mg nickel/m^3 for rats (6-hour exposure) to 15 mg nickel/m^3 for guinea pigs (time not specified). Acute inhalation exposure of humans to nickel may produce headache, nausea,respiratory disorders, and death. Asthmatic conditions have also been documented for inhalation exposure to nickel. Soluble nickel compounds tend to be more toxic than insoluble compounds. In addition, nickel carbonyl is known to be extremely toxic to humans upon acute inhalation exposure. Data on nickel-induced reproductive/developmental effects in humans following inhalation exposure are equivocal. No clinical evidence of developmental or reproductive toxicity were reported for women working in a nickel refinery, possible reproductive and developmental effects in humans of occupational exposure to nickel (0.13-0.2 mg nickel/m^3)have been reported. Furthermore, sensitivity reactions to nickel are well documented and usually involve contact dermatitis reactions resulting from contact with nickel-containing items such as cooking utensils, jewelry, coins, etc.

A chronic and subchronic oral reference dose (RfD) of 0.02 mg/kg/day for soluble nickel salts is based on changes in organ and body weights of rats receiving dietary nickel sulfate hexahydrate (5 mg/kg/day) for 2 years. A no-observed-adverse-effect level (NOAEL) and lowest-observed-adverse-effects level (LOAEL) of 5 mg/kg/day and 50 mg/kg/day, respectively, were reported in the key study. An uncertainty factor of 300 reflects interspecies extrapolation uncertainty, protection of sensitive populations, and a modifying factor of 3 for a database deficient in reproductive/developmental studies. An inhalation reference concentration (RfC) for soluble nickel salts is under review by the RfD/RfC Work Group and currently is not available.

26.2 Carcinogenicity

The primary target organs for nickel-induced systemic toxicity are the lungs and upper respiratory tract for inhalation exposure and the kidneys for oral exposure. Other target organs include the cardiovascular system, immune system, and the blood.

Epidemiologic studies have shown that occupational inhalation exposure to nickel dust (primarily nickel subsulfate) at refineries has resulted in increased incidences of pulmonary and nasal cancer. Inhalation studies using rats have also shown nickel subsulfate or nickel carbonyl to be carcinogenic. Based on these data, the EPA has classified nickel subsulfate and nickel refinery dust in weight-of-evidence group A, human carcinogen. Carcinogenicity slope factors of 1.7E+0 and 8.4E-01$(mg/kg/day)^{-1}$ have been calculated for nickel subsulfide and nickel refinery dust, respectively

27.0 SELENIUM

Selenium is an essential trace element important in many biochemical and physiological processes. Recommended human dietary allowances (average daily intake) for selenium are as follows: infants up to 1 year, 10-15 g; children 1-10 years, 20-30 g; adult males 11-51+ years, 40-70 g; adult females 11-51+ years, 45-55 g; pregnant or lactating women, 65-75 g. There appears to be a relatively narrow range between levels of selenium intake resulting in deficiency and those causing toxicity.

27.1 Noncancer Toxicity

Toxicity of selenium varies with valence state and water solubility of the compound in which it occurs. The latter can affect gastrointestinal absorption rates. Gastrointestinal absorption in animals and humans for various selenium compounds ranges from about 44% to 95% of the ingested dose. Selenium is found in all tissues of the body; highest concentrations occur in the kidney, liver, spleen, and pancreas. In humans, acute oral exposures can result in excessive salivation, garlic odor to the breath, shallow

breathing, diarrhea, pulmonary edema, and death. Other reported signs and symptoms of acute selenosis include tachycardia, nausea, vomiting, abdominal pain, abnormal liver function, muscle aches and pains, irritability, chills, and tremors. General signs and symptoms of chronic selenosis in humans include loss of hair and nails, acropachia (clubbing of the fingers), skin lesions (redness, swelling, blistering, and ulcerations), tooth decay (mottling, erosion and pitting), and nervous system abnormalities attributed to polyneuritis (peripheral anesthesia, acroparaethesia, pain in the extremities, hyperreflexia of the tendon, numbness, convulsions, paralysis, motor disturbances, and hemiplegia). Selenium is teratogenic in birds and possibly also in domesticated animals (pigs, sheep, and cattle), but evidence of teratogenicity in humans and laboratory animals is lacking. However, adverse reproductive and developmental effects (decreased rates of conception, increased rates of fetal resorption, and reduced fetal body weights) have been reported for domesticated and laboratory animals. The Reference Dose (RfD) for chronic oral exposures is 0.09 mg/kg/day for both rachitic bone.

27.2 Carcinogenicity

EPA has placed selenium and selenious acid in Group D, not classifiable as to carcinogenicity in humans while selenium sulfide is placed in Group B2, probable human carcinogen. Quantitative data are, however, insufficient to derive a slope factor for selenium sulfide.

28.0 STRONTIUM

Little information is available regarding the carcinogenic and noncarcinogenic heath effects of elemental strontium. The USEPA had published (in IRIS) an oral reference dose (RfDo) of 0.06 mg/kg/day with an uncertainty factor of 300 for chronic oral exposures based on 20-day, 9-week, and 3-year oral studies in young and adult rats.

SOURCES

The information contained in the Toxicological Profiles has been extracted from the following sources:

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U.S. Department of Energy, August 2002. Toxicity Profiles (Summary), Risk Assessment Information System (RAIS), Office of Environmental Management, Oak Ridge Operations (ORO), http://risk.lsd.ornl.gov/rap_hp.shtml.

U.S. Environmental Protection Agency (USEPA), Region IX, November 2000. "Region 9 Preliminary Remediation Goals (PRGs) 2000", EPA Region IX, 75 Hawthorne Street, San Francisco, California, 94105.

U.S. Environmental Protection Agency (USEPA), Region III, April 2002. Risk-Based Concentration Table. EPA Region III, 841 Chestnut Street, Philadelphia, Pennsylvania 19107.

USEPA, July 1997, Health Effects Assessment Summary Tables (HEAST)

APPENDIX G-5

INHALATION EXPOSURE TO VOLATILE ORGANIC CONTAMINANTS IN THE SHOWER

87-42.6

INHALATION EXPOSURES TO VOLATILE ORGANIC CONTAMINANTS IN THE SHOWER

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The Association Dedicated to Air Pollution Control and Hazardous Waste Management

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INTRODUCTION

Over the past few years, the potential importance of inhalation exposures to volatile organic chemicals (VOCs) through the use of contaminated household water supplies has been recognized. Due to their strong tendency to volatilize, VOCs present in tap water may be readily released into indoor air as a result of showering, bathing, dishwashing, laundering, and cooking.[1,2,3] Several researchers have already concluded that inhalation exposures to volatile compounds released during typical water uses in the home may be as large as or larger than exposures from water ingestion.[1,3,4,5,6] Of particular concern to human health is the potential for elevated VOC exposures to occur in the confined space of the shower. Detailed empirical data on the levels of VOCs released into shower room air are, however, scarce.[1,7] Andelman and his colleagues, relying on experiments conducted using trichloroethylene and chloroform in a scaled-down model shower, are responsible for the bulk of the data that are currently available.

Exposure modeling may provide the best means of estimating inhalation exposures to VOCs while showering. Such modeling can be validated to a limited extent at present using Andelman's data and will be further validated in the future with whatever reliable data become available.

The purpose of this paper is to expand on previous work in which we developed a dynamic model for the behavior of VOCs in shower water.[8] In this paper we present a model that estimates exposures to VOCs in the shower, both while showering and after the shower has been turned off. The model has been programmed using Microsoft C and is run on an IBM PC. Typically a model run, including data input, takes less than one minute.

Previous efforts to estimate exposures to VOCs in the shower have relied upon the simple assumption that a certain percentage of VOC in water is released into air (e.g., 40-100%).[2,4,5] Our model, unlike the previous approaches, takes into account many of the variable factors that influence the release of VOCs from water and their subsequent buildup in shower room air. The kinetic model presented in this paper estimates VOC air concentrations and the magnitude of chemical exposures for the duration of exposure.

METHODOLOGY

Inhalation exposures to VOCs are modeled by estimating the rate of chemical release into the air (generation rate), the buildup (shower on) and decay (shower off) of VOCs in shower room air, and the quantity of airborne VOCs inhaled while the shower is both on and off.

Estimation of the rate of VOC release into the air is based upon Liss and Slater's[9] adaptation of the two-film gas-liquid mass transfer theory which has been described in our previous paper.[8] The two-film boundary theory provides the basis for estimating the overall mass transfer coefficient (K_L) for each VOC of interest according to the following equation:

$$K_L = (1/k_l + RT/Hk_g)^{-1} \quad (1)$$

where

K_L = overall mass transfer coefficient (cm/hr),
H = Henry's Law Constant (atm-m^3/mol-K),
RT = 2.4×10^{-2} atm-m^3/mole (gas constant of 8.2×10^{-5} atm-m^3/mol-K times absolute temperature of 293 K),
k_g = gas-film mass transfer coefficient (cm/hr), and
k_l = liquid-film mass transfer coefficient (cm/hr).

Equation 1 describes the mass transfer rate of a compound at an air-water interface where diffusion may be limited by both liquid- and gas-phase resistances. For most VOCs, however, with Henry's Law Constants greater than 1×10^{-3} atm-m^3/mol-K, mass transfer is limited by only liquid-phase resistance.[10]

Typical values of k_l (20 cm/hr) and k_g (3,000 cm/hr), which have been measured for CO_2 and H_2O, respectively,[9] may be used to estimate VOC-specific values for these parameters:

$$k_{g(VOC)} = k_g(H_2O)(18/MW_{VOC})^{0.5} \quad (2)$$

$$k_{l(VOC)} = k_l(CO_2)(44/MW_{VOC})^{0.5} \quad (3)$$

where

MW = molecular weight (g/mol).

The mass transfer coefficient, K_L, is adjusted to the shower water temperature, T_s, according to a semi-empirical equation developed to estimate the effect of temperature on oxygen mass-transfer rate:[11]

$$K_{aL} = K_L(T_l\mu_s/T_s\mu_l)^{-0.5} \quad (4)$$

where

K_{aL} = adjusted overall mass transfer coefficient (cm/hr),
T_l = calibration water temperature of K_L (K),
T_s = shower water temperature (K),
μ_l = water viscosity at T_l (cp), and
μ_s = water viscosity at T_s (cp).

The concentration leaving the shower droplet, C_{wd}, is obtained from an integrated rate equation based on a mass-balance approach:

$$C_{wd} = C_{wO}(1-\exp[-K_{aL}t_s/60d]) \quad (5)$$

where

C_{wd} = concentration leaving shower droplet after time t_s (μg/l),
C_{wO} = shower water concentration (μg/l),
d = shower droplet diameter (mm), and
t_s = shower droplet drop time (sec).

The term $K_{aL}/60d$ combines both the rate of transfer and the available interfacial area across which volatilization can occur. The value 1/60d equals the specific interfacial area, 6/d, for a spherical shower droplet of diameter d multiplied by conversion factors (hr/3600 sec and 10 mm/cm).

Inherent in equation 5 is the assumption that the shower water is immediately disaggregated into droplets of equal size and that volatilization occurs from each droplet only between the time it is released from the shower head until it impacts the shower bottom. In reality, the shower water will disaggregate into droplets of different diameters and will also agglomerate into layers as it runs over the showering individual and impacts nearby surfaces. The model presented in this paper does not take into account volatilization from these "non-droplet" air-water surfaces, many of which increase the residence time during which volatilization could occur (relative to an unimpeded droplet). In addition, this model does not estimate the additional volatilization from water as it drains from the shower bottom. Volatilization from water running over a showering individual and draining from the shower bottom may, however, contribute significantly to overall VOC air concentrations in the shower.[12] By not taking into account volatilization from water running down nearby surfaces and the showering individual and draining from the shower bottom, our model is more likely to underestimate than overestimate indoor VOC air concentrations and exposures.

The VOC generation rate in the shower room, S, can then be calculated by the equation:

$$S = C_{wd}(FR)/SV \tag{6}$$

where

S = indoor VOC generation rate (μg/m^3-min),
FR = shower water flow rate (l/min), and
SV = shower room air volume (m^3).

A simple one-box indoor air pollution model was used to estimate VOC air concentrations in the shower room. This model can be expressed as a differential equation describing the rate of change of the indoor pollutant concentration with time:

$$dC_a/dt = -RC_a + S \tag{7}$$

where

C_a = indoor VOC air concentration ($\mu g/m^3$), and
R = air exchange rate (min^{-1}).

This indoor air model assumes instantaneous mixing of the shower room air and no chemical decay of VOCs once they are released into the indoor air. It is likely, however, that air concentrations of VOCs will be higher immediately adjacent to the shower spray (i.e., within the individual's breathing zone) than in the rest of the shower room. As a result, the model may underestimate inhalation exposures during showering by assuming a completely mixed indoor environment. Because modeling the incremental exposure due to showering only is the focus of this paper, it is also assumed that the initial VOC air concentration indoors before the shower is turned on is zero (i.e., there are no other sources of VOCs contributing to indoor air pollutant levels).

In the model, the air exchange rate is kept constant throughout the exposure period. The generation rate is allowed only two values, off (i.e., zero) and on. In general, both the air exchange rate and the generation rate may vary over time; however, for the short periods modeled in this paper (no more than one or two hours), we consider that the assumptions of constant air exchange and generation rates are likely to be valid.

When equation 7 is integrated, the time-dependent indoor concentration can be estimated as follows:

$$C_a(t) = (S/R)(1 - \exp[-Rt]) \text{ for } t \leq D_s$$

and

$$C_a(t) = (S/R)(\exp[RDs] - 1)\exp(-Rt) \quad \text{for } t > D_s$$

where

$C_a(t)$ = indoor air VOC concentration at time t ($\mu g/m^3$),
D_s = shower duration (min), and
t = time (min).

The inhalation exposure per shower can then be calculated according to the equation:

$$E_{inh} = [Vr/(BW)(10^6)] \int_0^{D_t} C_a(t)dt$$

where

E_{inh} = inhalation exposure per shower (mg/kg/shower),
VR = ventilation rate (l/min),
BW = body weight (kg), and
D_t = total duration in shower room (min).

This equation can be solved as:

$$E_{inh} = (Vr)(S)/[(BW)(R)(10^6)] \quad D_s - 1/R + \exp(-RD_s)/R$$

for the duration of the shower, and as:

$$E_{inh} = (Vr)(S)/[(BW)(R)(10^6)]$$

$$\left[D_s + \exp(-RD_t)/R - \exp[R(D_s - D_t)]/R\right]$$

for both the duration of the shower and the duration in the room after the shower is turned off.

MODEL APPLICATION I. COMPARISON WITH EXPERIMENTAL RESULTS

The only experimental data currently available and sufficiently detailed to apply in our model have been developed by Andelman et al.[1] Experimental data presented by these researchers for trichloroethylene (TCE) were input into our model (Table I) to predict indoor air concentrations and to compare these with the measured levels. Figure I shows that our model's estimates of air concentrations compare favorably with Andelman's results for both the buildup and decay of concentrations in shower room air. The model only slightly underpredicts indoor air concentrations. This difference is not surprising since the model does not, as has been described, take into account volatilization from water after it has impacted on nearby surfaces or as it drains from the shower bottom. This comparison also indicates that for short exposure periods (e.g., less than 20 minutes), the modeled air concentrations may approximate actual concentrations quite well.

MODEL APPLICATION II. SENSITIVITY OF AIR CONCENTRATIONS TO INPUT PARAMETERS

To determine the sensitivity of our model to several important input parameters, we examined the changes in estimated air concentrations associated with different air exchange rates, shower water concentrations, and water temperatures. We focused on only one VOC, TCE, in this model application. Cothern et al.[4] estimate that as many as 212,000 and 128,000 individuals in the United States may be using public water supplies containing >10-20 μg/l and >70-80 μg/l TCE, respectively. To make our results comparable with these estimates, we assumed two shower water concentrations of 15 μg/l and 75 μg/l. Three air exchange rates, 0.5, 1.0, and 1.5 hr^{-1}, were used to simulate leaky, average, and tight homes, respectively.[13] The changes in air concentrations associated with four shower water temperatures, 35°, 40°, 45°, and 50°C, were also evaluated. Table II lists the values of the input parameters used to develop the information presented in this sensitivity analysis (Figures II and III).

Figure II illustrates the effects of changing air exchange rates and TCE water concentrations on TCE air concentrations in the shower room. As expected, predicted indoor air concentrations are highly sensitive to water concentrations. Figure II shows that as the water concentration increases from 15 μg/l to 75 μg/l (a factor of five), air concentrations also increase by about a factor of five or more. As the air exchange rate increases from 0.5 hr^{-1} to 1.5 hr^{-1}, indoor air concentrations are

predicted to decrease, and the differences between air levels become increasingly large with time.

Figure III shows the impact that different shower water temperatures have on indoor air concentrations. As water temperature increases, predicted air concentrations increase. After the shower has been on for 60 minutes, every 5°C increase in water temperature increases indoor TCE air levels by approximately 0.08 mg/m^3. For shorter shower durations, however, the effect of changing temperature is less pronounced, with every 5°C increase in water temperature increasing indoor air concentrations by approximately 0.03 mg/m^3 at 20 minutes and 0.02 mg/m^3 at 10 minutes.

These results indicate that the model presented in this paper behaves as expected; it predicts that indoor air levels increase as water concentrations increase, air exchange rates decrease, and water temperatures increase. The effects of changing these variables become increasingly important with time after the shower has been turned on. However, for short shower durations (e.g., less than 20 minutes), water concentration appears to have a greater impact on indoor air levels than air exchange rate or water temperature. In addition, the increase in air concentration with time appears to be approximately linear for short shower durations.

MODEL APPLICATION III. COMPARATIVE RISK ASSESSMENT

In order to estimate potential human VOC inhalation exposures and risks from showering, we applied our model to five VOCs that have been found in U.S. public water supplies;[4,14] TCE, chloroform, tetrachloroethylene, vinyl chloride, and benzene. Benzene and vinyl chloride have been classified by EPA as Group A carcinogens—human carcinogens based on adequate evidence from human studies. The remaining three chemicals have been classified as Group B2 carcinogens—probable human carcinogens based on inadequate evidence from human studies and adequate evidence from animal studies. Two plausible exposure scenarios were evaluated. The two scenarios differ with respect to three variables: water concentration, shower duration, and air exchange rate. For the lower bound exposure scenario, the water concentration, shower duration, and air exchange rate were assumed to be 15 μg/l, 10 minutes, and 1.5 hr^{-1}, respectively. For the upper bound exposure scenario, the values for these three variables were assumed to be 75 μg/l, 15 minutes, and 0.5 hr^{-1}, respectively. Table III summarizes the input parameters used in this comparative risk assessment. These exposure scenarios are clearly not applicable to all homes and individuals, but they are probably representative of conditions that may exist in some homes in the United States.

Figure IV compares the estimated exposures for the five VOCs. The predicted exposures for the upper bound exposure scenario are approximately an order of magnitude larger than the exposures for the lower bound exposure scenario. The largest exposures are predicted for vinyl chloride, the VOC with the largest Henry's Law Constant and lowest molecular weight. The next largest exposures are predicted for benzene, a chemical with the next smallest molecular weight but the second smallest Henry's Law Constant. Both of these chemical-specific parameters are important factors affecting exposure. This figure also shows that exposures received over an assumed five minute period in the shower room after the shower has been turned off are almost as large as exposures received while showering for 10 or 15 minutes.

The potential excess upper bound lifetime cancer risks associated with these estimated exposures are shown in Table IV. These calculations assume that an individual takes one 10- or 15-minute shower per day for a 70-year lifetime. The excess lifetime risks are highest for chloroform, $2x10^{-5}$ and $2x10^{-4}$ for the lower bound and upper bound exposure scenarios, respectively. The predicted risks are lowest for tetrachloroethylene, $3x10^{-7}$ and $3x10^{-6}$, respectively.

The risks associated with inhaling VOCs in the shower for the two exposure scenarios are compared in Table V to the risks associated with ingestion of tap water at the same water concentrations (15 µg/l and 75 µg/l). It is important to recognize that all the VOCs evaluated except chloroform are more potent by ingestion than by inhalation. In calculating ingestion exposures, it was assumed that an individual drinks 2 liters of water per day for a 70-year lifetime. Table V shows that the ingestion cancer risks range from the same order of magnitude as the inhalation risks to approximately two orders of magnitude greater than the inhalation risks. For example, the risks associated with ingestion of chloroform in drinking water are essentially the same as the risks associated with chloroform inhalation in the shower room. For vinyl chloride, the ingestion risks are about two orders of magnitude greater than the inhalation risks. Thus, for the specific shower exposure scenarios evaluated in this comparative risk assessment, the estimated risks associated with the inhalation of VOCs in the shower room may be as large as the risks associated with VOC ingestion, depending on the particular chemical.

SUMMARY AND CONCLUSIONS

A kinetic model which can be used to estimate inhalation exposures to VOCs in the shower, both while showering and after the shower has been turned off, has been presented in this paper. Inhalation exposures to VOCs are modeled by estimating the rate of VOC release from water into air, the buildup (shower on) and decay (shower off) of VOCs in shower room air, and the quantity of airborne VOCs inhaled while the shower is both on and off.

The model was validated with one set of experimental data for TCE presented by Andelman et al.[1] The predicted air concentrations compared very favorably with the experimental results. In subsequent model runs, the predicted air concentrations were observed to be particularly sensitive to changes in shower water concentration and air exchange rate, but, in comparison, less sensitive to changes in water temperature.

Potential risks associated with inhalation in shower room air of five VOCs that have been measured in U.S. drinking water supplies were estimated for two plausible exposure scenarios. The lower bound exposure scenario assumed a 15 µg/l water concentration, a 10 minute shower, and an air exchange rate of 1.5 hr^{-1}. The upper bound exposure scenario assumed a 75 µg/l water concentration, a 15 minute shower, and an air exchange rate of 0.5 hr^{-1}. All other input variables, except those that are chemical specific, were held constant. The exposures and excess lifetime cancer risks estimated for the upper bound exposure scenario were approximately one order of magnitude greater than the exposures and risks estimated for the lower bound exposure scenario. Excess upper bound lifetime cancer risks were highest for chloroform, ranging from $2x10^{-5}$ to $2x10^{-4}$ for the lower bound and upper bound exposure scenarios, respectively.

These inhalation risks were compared to the risks associated with daily ingestion of 2 liters of water per day at the same concentrations, 15 µg/l and 75 µg/l. For the specific shower exposure scenarios evaluated, the estimated inhalation risks in the shower room were equivalent to the risks associated with ingestion for chloroform, but were two orders of magnitude lower than the ingestion risks for vinyl chloride.

Based on this analysis, our model can be applied to estimate inhalation exposures to VOCs in shower room air. The model has been validated with one set of experimental laboratory data in this paper, but additional data, particularly collected in the home, is required to conduct a more thorough validation. Further research is also needed to characterize more accurately the model's input parameters.

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NOTE TO EDITORS

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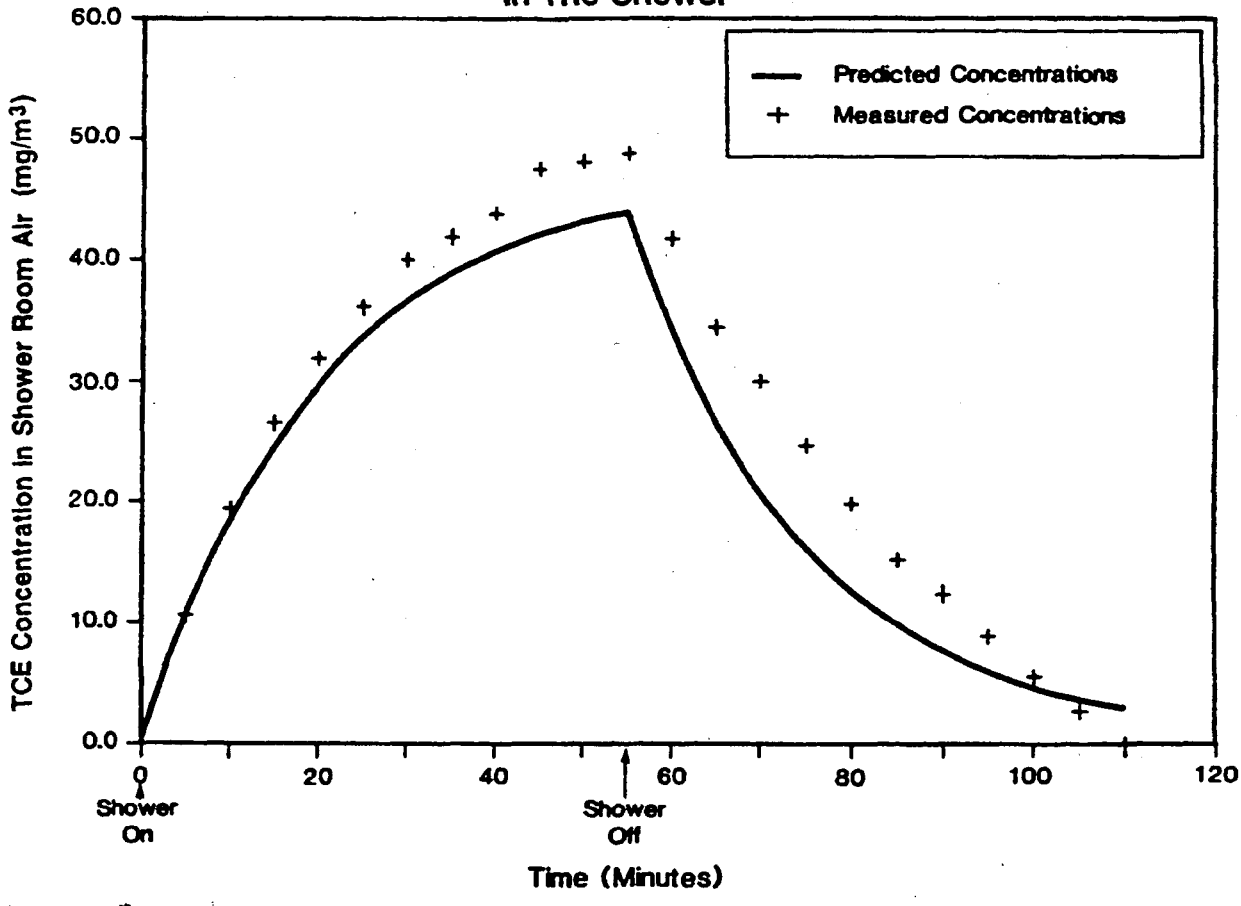
Table I. Model Application Using Experimental Data From Andelman et al.[1]

Input Parameter	Value
Andelman's data:	
Chemical	Trichloroethylene
Shower water concentration	2,000 μg/l[a]
Shower water temperature	43°C (316 K)
Shower water flow rate	0.3 l/min
Droplet diameter	0.25 mm
Droplet drop time	0.5 sec[b]
Air flow rate	0.005 m^3/min
Shower chamber volume	0.1 m^3
Shower duration	55 min
Duration after shower	55 min
Other model input data:	
Molecular weight	131 g/mol
Henry's Law Constant	1.0×10^{-2} atm-m^3/mol-K
Water viscosity	0.6178 cp

[a]Measured range 1,500-2,900 μg/l.
[b]Measured range 0.25-0.75 sec.

Figure I
Comparison Of Predicted And Measured*
Trichloroethylene Air Concentrations
In The Shower



*Source Of Measured Data: Andleman et al.[1]

Table II. Input Parameters for Sensitivity Analysis of Shower Room Air Concentrations

Input Parameter	Value	
	Figure II	Figure III
Chemical	TCE	TCE
Molecular weight	131 g/mol	131 g/mol
Henry's Law Constant	1.0×10^{-2} atm-m^3/mol-K	1.0×10^{-2} atm-m^3/mol-K
Shower water concentration	15, 75 µg/l	75 µg/l
Shower water temperature	45°C	35°, 40°, 45°, 50°C
Water viscosity	0.596 cp	0.7194, 0.6529, 0.5996, 0.5468 cp
Shower water flow rate	10 l/min	10 l/min
Droplet diameter	1 mm	1 mm
Droplet drop time	2 sec	2 sec
Air exchange rate	0.5, 1.0, 1.5 hr^{-1}	1.0 hr^{-1}
Shower room air volume	6 m^3	6 m^3
Shower duration	60 min	60 min
Duration in room after shower turned off	60 min	60 min

Figure II

Effect Of Different Air Exchange Rates And TCE Water Concentrations On TCE Air Concentrations In The Shower

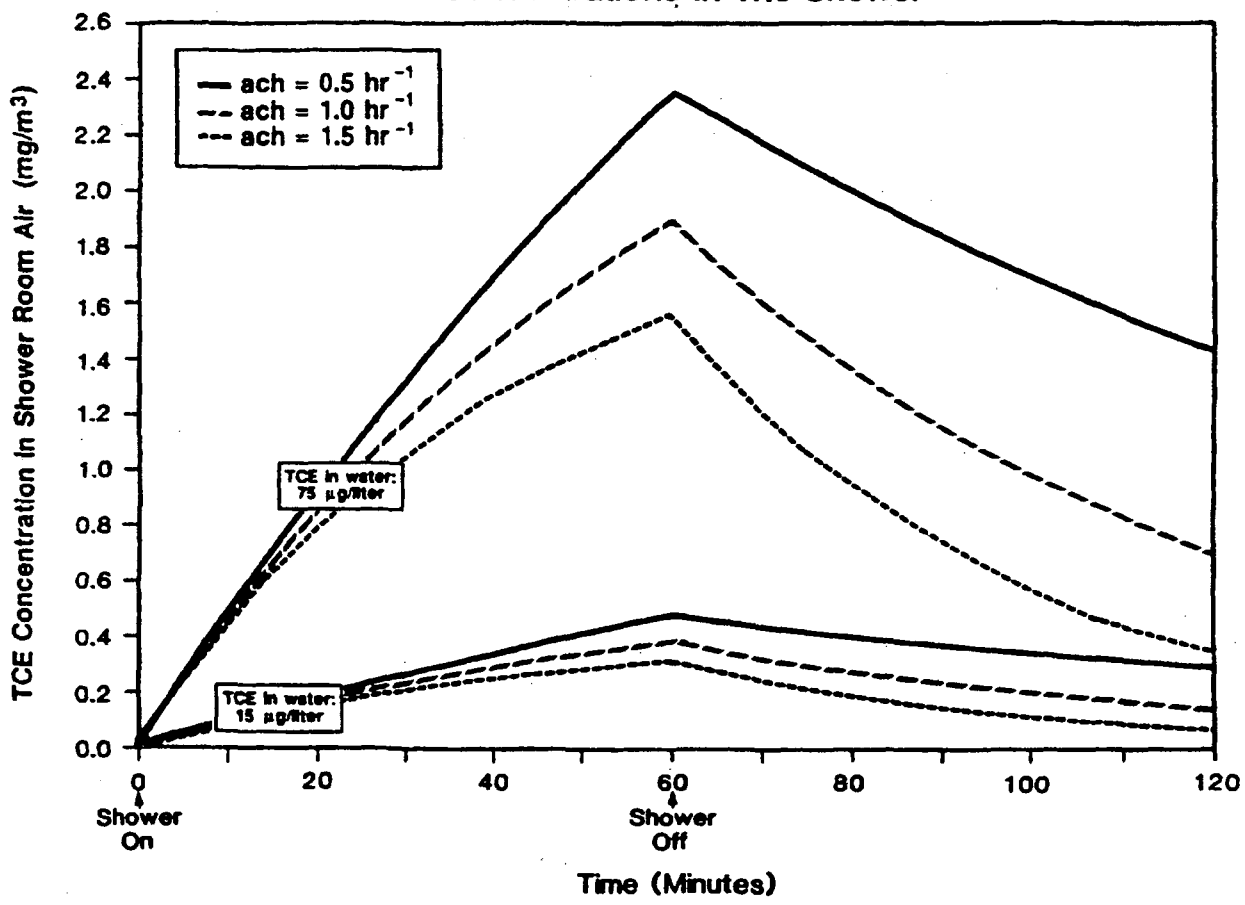


Figure III

Effect Of Different Water Temperatures On Trichloroethylene Air Concentrations In The Shower

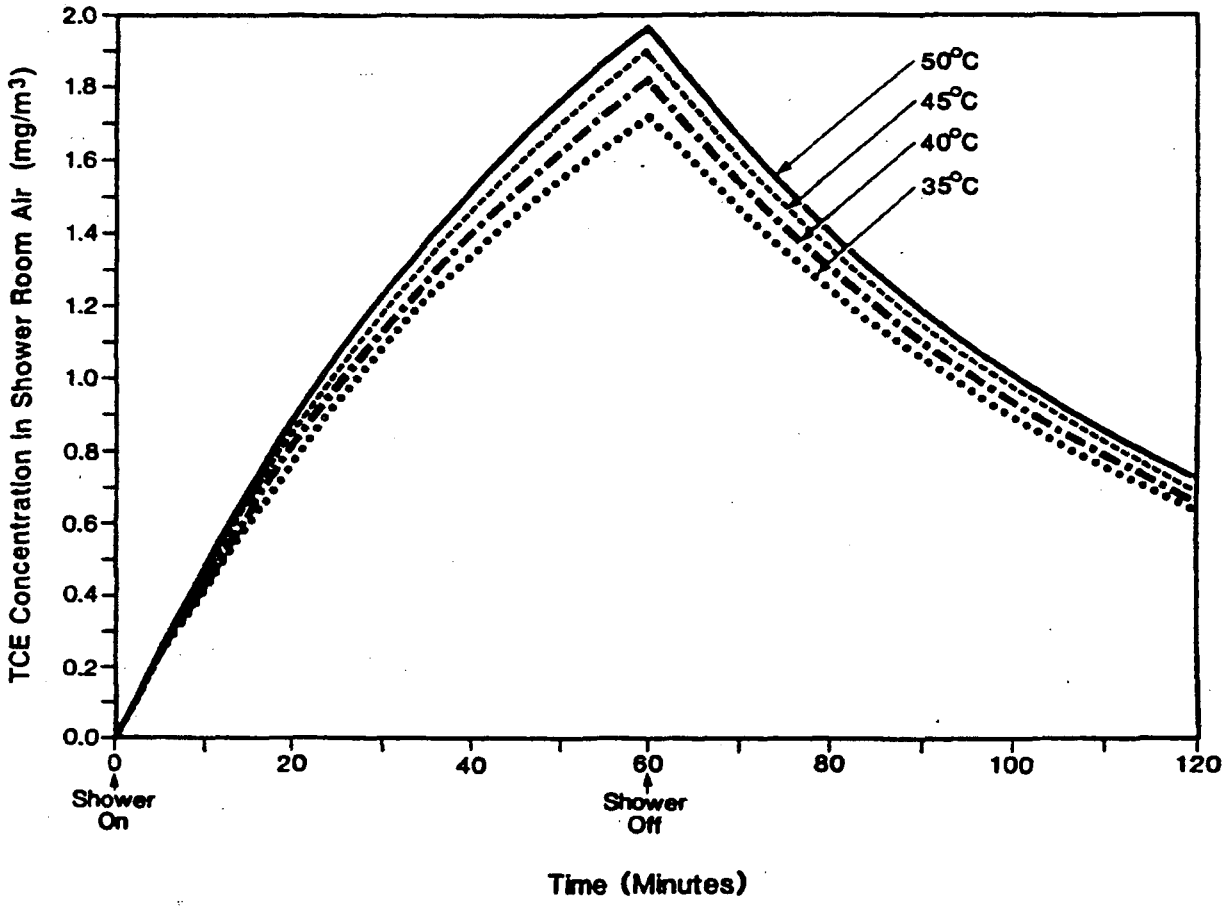


Table III. Input Parameters for Comparative Risk Assessment of Exposure to Five Volatile Organic Chemicals in Shower Room Air

Input Parameter	Value
Chemical (Henry's Law Constant, molecular weight)	Benzene (78 g/mol, 5.5×10^{-3} atm-m^3/mol-K) Chloroform (119 g/mol, 2.87×10^{-3} atm-m^3/mol-K) Tetrachloroethylene (166 g/mol, 2.6×10^{-2} atm-m^3/mol-K) Trichloroethylene (131 g/mol, 1.0×10^{-2} atm-m^3/mol-K) Vinyl chloride (63 g/mol, (8.2×10^{-2} atm-m^3/mol-K)
Shower water concentration	75 µg/l (upper bound scenario) 15 µg/l (lower bound scenario)
Shower water temperature	45°C (318 K)
Water viscosity	0.596 cp
Shower water flow rate	10 l/min
Droplet diameter	1 mm
Droplet drop time	2 sec
Air exchange rate	0.5 hr^{-1} (upper bound scenario) 1.5 hr^{-1} (lower bound scenario)
Shower room air volume	6 m^3
Shower duration	15 min (upper bound scenario) 10 min (lower bound scenario)
Duration in room after shower is turned off	5 min
Ventilation rate	15 l/min
Inhalation absorption factor	1.0
Body weight	70 kg
Cancer potency factor for inhalation [EPA weight of evidence classification for carcinogenic effects][a]	Benzene-2.6×10^{-2} $(mg/kg/day)^{-1}$ [A] Chloroform-8.1×10^{-2} $(mg/kg/day)^{-1}$ [B2] Tetrachloroethylene-1.7×10^{-3} $(mg/kg/day)^{-1}$ [B2] Trichloroethylene-4.6×10^{-3} $(mg/kg/day)^{-1}$ [B2] Vinyl chloride-2.5×10^{-2} $(mg/kg/day)^{-1}$ [A]

[a][A] = human carcinogen based on adequate evidence from human studies; [B2] = probable human carcinogen based on inadequate evidence from human studies and adequate evidence from animal studies.

Figure IV
Comparison of Inhalation Exposures to Five Volatile Organic Compounds in the Shower

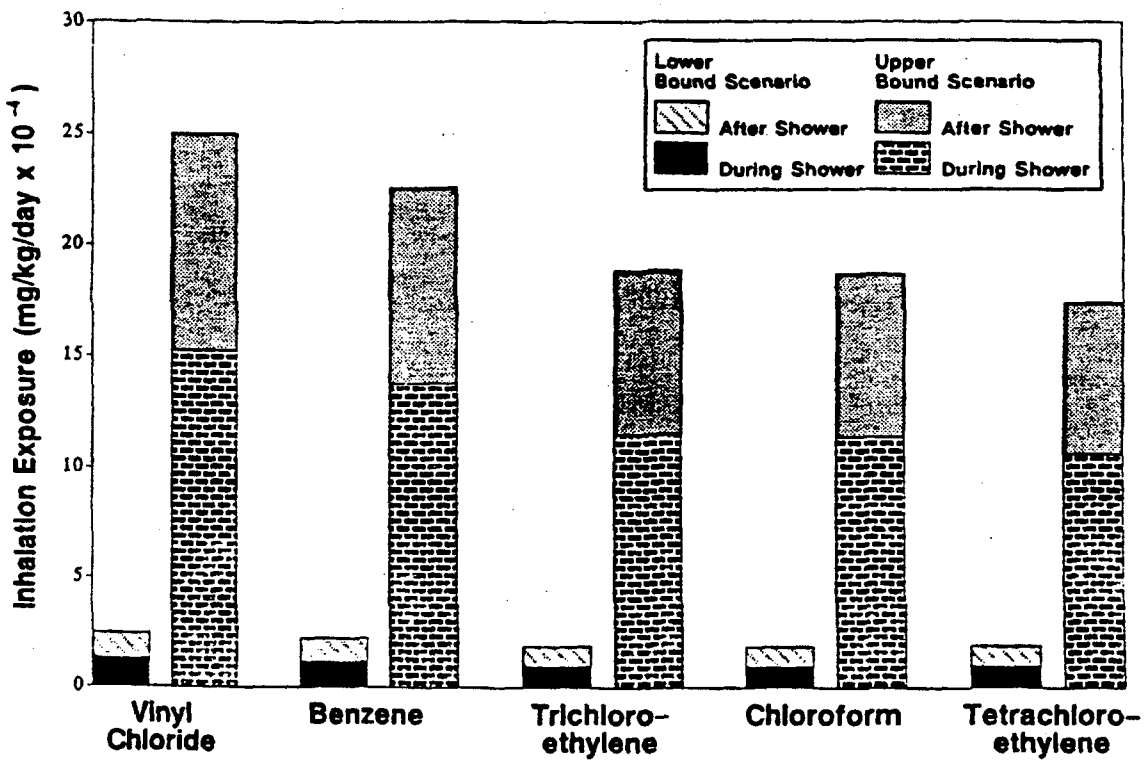


Table IV. Comparative Risk Assessment for Inhalation of Five Volatile Organic Compounds in Shower Room Air

Chemical	Exposure (mg/kg/day)[a]		Cancer Potency Factor for Inhalation $(mg/kg/day)^{-1}$	Excess Lifetime Cancer Risk	
	Lower Bound Scenario[b]	Upper Bound Scenario[c]		Lower Bound Scenario[b]	Upper Bound Scenario[c]
Benzene	2.24×10^{-4}	2.26×10^{-3}	2.6×10^{-2} [A][d]	6×10^{-6}	6×10^{-5}
Chloroform	1.86×10^{-4}	1.88×10^{-3}	8.1×10^{-2} [B2][d]	2×10^{-5}	2×10^{-4}
Tetrachloroethylene	1.73×10^{-4}	1.75×10^{-3}	1.7×10^{-3} [B2][d]	3×10^{-7}	3×10^{-6}
Trichloroethylene	1.87×10^{-4}	1.89×10^{-3}	4.6×10^{-3} [B2][d]	9×10^{-7}	9×10^{-6}
Vinyl chloride	2.48×10^{-4}	2.50×10^{-3}	2.5×10^{-2} [A][d]	6×10^{-6}	6×10^{-5}

[a]Assumes one shower per day over a 70-year lifetime.

[b]Lower-case scenario: Water concentration = 15 μg/l, ach = 1.5 hr^{-1}, 10-minute shower, and 5 minutes in shower room after shower off. See Table III for all input parameter values.

[c]Upper-case scenario: Water concentration = 75 μg/l, ach = 0.5 hr^{-1}, 15-minute shower, and 5 minutes in shower room after shower off. See Table III for all input parameter values.

[d]EPA weight of evidence classification for carcinogenic effects (see Table III).

Table V. Comparison of Excess Lifetime Cancer Risks Associated With Inhalation of VOCs in Shower Room Air and Ingestion of VOCs in Tap Water

Chemical	Range of Excess Lifetime Cancer Risks[a]	
	Inhalation[b]	Ingestion[c]
Benzene	$6x10^{-6}$ - $6x10^{-5}$	$2x10^{-5}$ - $1x10^{-4}$
Chloroform	$2x10^{-5}$ - $2x10^{-4}$	$3x10^{-5}$ - $2x10^{-4}$
Tetrachloroethylene	$3x10^{-7}$ - $3x10^{-6}$	$2x10^{-5}$ - $1x10^{-4}$
Trichloroethylene	$9x10^{-7}$ - $9x10^{-6}$	$5x10^{-6}$ - $2x10^{-5}$
Vinyl Chloride	$6x10^{-6}$ - $6x10^{-5}$	$1x10^{-3}$ - $5x10^{-3}$

[a]Lower value in range assumes water concentration = 15 µg/l; upper value in range assumes water concentration = 75 µg/l.

[b]Assumes one 10- or 15-minute shower per day for a 70-year lifetime. Detailed exposure conditions are shown in Table III.

[c]Assumes ingestion of 2 liters of water per day over a 70-year lifetime.

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APPENDIX H

SUPPORTING MATERIALS FOR THE ECOLOGICAL RISK ASSESSMENT

APPENDIX H.1

CHECKLIST FOR ECOLOGICAL ASSESSMENT/SAMPLING

CHECKLIST FOR ECOLOGICAL ASSESSMENT/SAMPLING

INTRODUCTION

The checklist that follows provides guidance in making observations for an ecological assessment. It is not intended for limited or emergency response actions (e.g., removal of a few drums) or for purely industrial settings with no discharges. The checklist is a screening tool for preliminary site evaluation and may also be useful in planning more extensive site investigations. It must be completed as thoroughly as time allows. The results of the checklist will serve as a starting point for the collection of appropriate biological data to be used in developing a response action. It is recognized that certain questions in this checklist are not universally applicable and that site-specific conditions will influence interpretation. Therefore, a site synopsis is requested to facilitate final review of the checklist by a trained ecologist.

CHECKLIST

The checklist has been divided into sections that correspond to data collection methods and ecosystem types. These sections are:

I. Site Description
   - IA. Summary of Observations and Site Setting

II. Terrestrial Habitat Checklist
   - IIA. Wooded
   - IIB. Shrub/Scrub
   - IIC. Open Field
   - IID. Miscellaneous

III. Aquatic Habitat Checklist – Non-Flowing Systems

IV. Aquatic Habitat Checklist – Flowing Systems

V. Wetlands Habitat Checklist

APPENDIX H.2

CHEMICAL CLASS INFORMATION

This appendix presents a discussion of the different chemical classes that were detected at SWMU 1, Mustard Gas Burial Grounds including toxicity information, potential food chain and trophic transfer, and bioaccumulation potential (Attachment Table H.2-1).

Metals

Many metals occur naturally at various concentrations in the surface soil and sediment primarily to chemical weathering of rocks and fallout from volcanoes. Most metals are toxic to aquatic (i.e., fish, invertebrates) and terrestrial (i.e., plants, invertebrates, vertebrates) ecological receptors above certain concentrations, with some metals being more toxic at lower concentrations than others. Also, different chemical forms of the metals may be more toxic than other forms. For example, hexavalent chromium is typically more toxic than trivalent chromium, and methylmercury is more toxic than inorganic mercury.

Many factors (e.g., pH, Eh, clay content, organic matter content) influence the bioavailability of metals to invertebrates in sediment. One way to estimate the bioavailable portion of certain divalent metals (cadmium, copper, lead, nickel, and zinc) in sediment is to measure the amount of acid volatile sulfides (AVS) and simultaneously extracted metals (SEM) in a sediment sample. If the molar concentration of AVS is higher than the molar concentration of SEM, than the SEM metals are expected to be unavailable to aquatic invertebrates and, therefore, nontoxic. AVS plays little or no role in determining interstitial water concentrations of metals in aerobic systems or those with low productivity (i.e., where the absence of organic carbon limits sulfate reduction) (Ankley et al., 1995), or when ingestion of sediments is the primary exposure route (Lee at al., 2000). Samples for AVS/SEM analyses were not collected at MGBG because the sediment is not likely sustaining a benthic community.

Semivolatile Organic Compounds

The most common semivolatile organic compounds that are found at naval facilities include polynuclear aromatic hydocarbons (PAHs) and phthalates. PAHs are a diverse group of compounds consisting of two or more substituted and unsubstituted polynuclear aromatic rings formed by the incomplete combustion of carbonaceous materials. PAHs are ubiquitous in the modern environment and are common constituents of coal tar, soot, vehicle exhaust, cigarette smoke, certain petroleum products, road tar, mineral oils, creosote, and many cooked foods. PAHs are also released to the environment through natural sources such as volcanoes and forest fires.

In soil and sediments, microbial metabolism is the major process for degradation of PAHs (ATSDR, 1989a). Although PAHs accumulate in terrestrial and aquatic plants, many organisms are able to metabolize and eliminate these compounds. Vertebrates can readily metabolize PAHs, but lower forms (insects and worms) cannot metabolize PAHs as quickly.

Phthalates are semivolatile organic compounds that are used in production of plastics (ATSDR, 1993). Most phthalates are expected to sorb to soil or sediment particles after their release because of their high Log K_{OC} values (Howard, 1989).

Pesticides and Herbicides

Pesticides are used to control pestiferous invertebrates while herbicides are used to combat unwanted vegetation. Pesticides and herbicides are toxic to many soil and aquatic invertebrates. In addition, many pesticides are toxic to ecological receptors at higher trophic levels such as mammals and birds. For example, DDT compounds have been linked to eggshell thinning and subsequent decreased survival of several birds of prey (such as eagles and falcons). Other pesticides such as chlordanes, dieldrin, aldrin, endrin, and heptachlor are also very toxic to mammals and birds (Newell et al., 1987).

Organochlorine insecticides such as DDT, chlordane, aldrin, dieldrin, heptachlor, endosulfan, endrin, and their associated breakdown products generally degrade very slowly and tend to be soluble in lipids. These result in bioaccumulation and possible increases in concentrations through food webs (Newman, 1998). Pesticides have high Log K_{oc} values so they are expected to sorb strongly to soil and sediment particles when released to the environment. Consequently, these compounds may migrate from their site of application when the soil is eroded, although they will not have a tendency to leach to groundwater.

PCBs

The term polychlorinated biphenyls (PCBs) commonly refers to a variety of mixtures of individual biphenyl isomers, each consisting of two joined benzene rings and up to 10 chlorine atoms. Mixtures of these isomers are known by their commercial designation of Aroclor. This trade name is followed by a four-digit number; the first two numbers indicate the type of isomer mixture and the last two numbers indicate the approximate weight percent of chlorine in the mixture (U.S. EPA, 1985).

PCBs released into water adsorb to sediments and other organic matter. Typically, PCB concentrations are greater in the sediment and suspended material than in the water column. Substantial quantities of PCBs in aquatic sediments can act as an environmental reservoir from which PCBs may be released slowly over a long period of time (ATSDR, 1989b). For PCBs that exist in the dissolved state in water, volatilization becomes the primary fate process. PCBs have the capability to bioaccumulate and biomagnify (U.S. EPA, 1985).

Degradation of PCBs in the environment is dependent upon the degree of chlorination. Generally, the more chlorinated the PCB molecule, the more persistent it will be in the environment. Factors that

determine biodegradability include the amount of chlorination, concentration, type of microbial population, available nutrients, and the temperature (ATSDR, 1989b).

Because PCBs are highly lipophilic, they can bioaccumulate in the lipid portions of animals. Bioconcentration factors in the thousands have been reported for various aquatic species (Eisler, 1986a). PCBs can also accumulate in upper trophic level animals that feed on contaminated prey items (Eisler, 1986).

Adverse effects of PCBs on terrestrial wildlife include increased mortality, reproductive effects, and behavioral effects (U.S. EPA, 1985). As a group, birds are more resistant to acutely toxic effects of PCBs than mammals (Eisler, 1986). Among sensitive avian species, PCBs disrupt the normal pattern of growth, reproduction, metabolism, and behavior (Eisler, 1986). Of the mammals, the mink is the most sensitive wildlife species tested for which data are available (Eisler, 1986). Impacts to mink include anorexia, weight loss, lethargy, reproductive effects, and death (Eisler, 1986).

Volatile Organic Compounds

VOCs are usually very mobile in the environment because they are poorly adsorbed to soil and sediment particles. Also, because they are very volatile, they typically are only detected in the surface soil and sediment at low concentrations.

Most VOCs have very little potential to bioaccumulate in ecological receptors; therefore, biomagnification through the food chain does not appear to be significant. VOCs are not expected to biomagnify in plants and are typically toxic to ecological receptors at relatively high concentrations.

Explosives

Some of the more common explosives include nitroaromatic compounds such as 2,4,6-trinitrotoluene, hexahydro-1,3,5-trinitro-1,3,5-triazine, octahydro-1,3,5,7-tetranitro-1,3,5-tetrazocine, N-methyl-N,2,4,6-tetranitroaniline, and associated by-products and degradation products that may have been released to the environment during manufacturing and load, assembly, and packaging processes at military facilities (Talmage et al., 1999). These explosives are moderately to highly toxic to freshwater organisms, with chronic screening values less than 1 mg/L, although some of the screening values are low because of the conservative methods used to develop them based on an absence of data (Talmage et al., 1999). Available data indicate that none of the compounds are expected to bioconcentrate (Talmage et al., 1999). Most of the explosives do not appear to be highly toxic to mammals. Terrestrial reference values (TRVs) are greater than 1 mg/kg-day.

Explosives have little to moderate potential to adsorb to soil and sediment (Talmage et al., 1999). Therefore, explosives will have moderate to high mobility in soils and sediment and most of the explosives will be found in the water column (Talmage et al., 1999).

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TABLE H.2-1

SOIL UPTAKE FACTORS
NAVAL SURFACE WARFARE CENTER, CRANE, INDIANA

Chemicals	Plant Uptake Factors[1,2]		Earthworm Uptake Factors[3]	
	Conservative[4]	Average[4]	Conservative[4]	Average[4]
Herbicides				
2,4-D	1.00E+00	1.00E+00	1.00E+00	1.00E+00
Inorganics				
Copper	1.88E-01	3.72E-02	2.45E-01	8.24E-02
Selenium	9.04E-01	2.02E-01	2.14E-01	1.58E-01
Zinc	5.46E-01	1.10E-01	2.06E+00	5.12E-01

Notes:
1 - ORNL (2000) for organics; only one value is available for conservative and average exposures
2 - Sample et al., (1997) for inorganics; conservative value is 90th percentile; average value is median value
3 - Sample et al., (1998) for all chemicals; conservative value is 90th percentile; average value is median value
4 - Conservative and average refers to the exposure scenarios for which the uptake factors are used
The plant and invertebrate uptake factors from Sample (1997 and 1998) were multiplied by 0.3 and 0.16 to convert the uptake factors for plants and earthworms, respectively, from dry weight to wet weight

Default value of 1 is assigned to parameters without uptake factors

APPENDIX H.3

RECEPTOR PROFILES

This appendix presents the receptor profiles for the meadow vole, American robin, short-tailed shrew, and the northern bobwhite quail. The majority of the information for the profiles was obtained from the Wildlife Exposure Factors Handbook (U.S. EPA, 1993). The data for the incidental soil ingestion rates were obtained from the Estimates of Soil Ingestion by Wildlife (Beyer, 1993) except for the shrew which was in Talmage and Walton (undated). The exposure parameters that were selected for this SERA work plan are based on animals collected in or near southern Indiana, when available.

The food and water ingestion rates are presented in g/g (of body weight)-day on a wet weight basis. The home ranges are presented in hectares in U.S. EPA (1993) but were converted to acres in this SERA by multiplying the number of hectares by 2.471. Also note that the estimated percent of soil in the diets are listed in dry weight, while the other exposure factors are in wet weight. The soil dry weight was not converted to a wet weight in this SERA because the percent moisture of the soils is not known.

The attached table presents the calculation of the exposure parameters. Note that in this table the ingestion rates in kg/day (or L/day) for the conservative scenario was calculated by multiplying the maximum ingestion rate in g/g-day by the average body weight, while the ingestion rates in kg/day (or L/day) for the average scenario was calculated by multiplying the average ingestion rate in g/g-day by the average body weight. Typically, a minimum body weight is used in the conservative models. However, using the minimum body weight to calculate the maximum ingestion rate sometimes causes the conservative ingestion rate to be lower that the average ingestion rate. Therefore, the average body weight was selected to ensure that the ingestion rate for the conservative scenario was higher than the ingestion rate for the average scenario. The minimum body weight was used in the dose equation for the conservative scenario. The only exception to this was for the water ingestion rates for the shrew and robin. Because only one ingestion rate was available, the maximum body weights were used to calculate the conservative ingestion rates and the average body weights were used to calculate the average ingestion rates.

Meadow Vole (*Microtus pennsylvanicus*)

Meadow voles inhabit grassy fields, marshes, and bogs; however, they prefer fields with more grass, more cover, and fewer woody plants. They typically consume green succulent vegetation, sedges, seeds, roots, bark, fungi, insects, and animal matter. Green succulent vegetation makes up the majority of their diet.

The adult body weight for the vole in southern Indiana ranged from 0.0329 to 0.039 kg with an average of 0.0366 kg. The only listed food ingestion rates were for voles in Russia which ranged from 0.30 to 0.35 g/g-day, with an average of 0.325 g/g-day. The water ingestion rates are 0.14 (estimated) and 0.21 g/g-day, with an average of 0.175 g/g-day. Finally, the incidental soil ingestion rate was calculated by multiplying the ingestion rate by the percentage of soil that is incidentally ingested (2.4 percent) from Beyer, (1993).

The home range for the meadow vole was calculated using data from a Michigan old field. The values ranged from 0.0297 to 1.06 acres with an average home range of 0.164 acres.

American Robin (*Turdus migratorius*)

American robins habitats include parks, lawns, moist forests, swamps, open woodlands, and orchards. Robins forage on the ground in open areas, along habitat edges, or the edges of streams. They also may forage above ground in shrubs and within the lower branches of trees. In the months preceding and during the breeding season, robins feed primarily on invertebrates and on some fruits. During the rest of the year their diet consists primarily of fruits.

The adult body weight for the American robin in New York woodlands and forests, and in Pennsylvania ranged from 0.0773 to 0.0862 kg with an average of 0.081 kg. The only listed food ingestion rates were for robins in Kansas (1.52 g/g-day) and California (0.89 g/g-day), with an average of 1.205 g/g-day. The water ingestion rate was estimated as 0.14 g/g-day. The incidental soil ingestion rate was calculated by multiplying the ingestion rate by the percentage of soil that is incidentally ingested (10.4 percent for the woodcock) from Beyer, (1993).

The home range for the robin was calculated using data from an Ontario forest. The values ranged from 0.37 to 2 acres with an average home range of 1.19 acres.

Northern Bobwhite Quail *(Colinus virginianus)*

Quails inhabit grasslands, idle fields, pastures, and large clumps of grasses. Bobwhites forage in areas with open vegetation, some bare ground, and light litter. Seeds from weeds, woody plants, and grasses comprise the majority of an adult's diet, although green vegetation has been found to dominate their diet in winter in the south.

The adult body weight for the bobwhite quail in southern Illinois agricultural areas ranged from 0.162 to 0.1855 kg with an average of 0.177 kg. The listed food ingestion rates are for quails in Kansas and Texas lab studies, and in a captive study from Massachusetts. The values ranged from 0.067 to 0.093 g/g-day, with an average of 0.082 g/g-day. The water ingestion rate was estimated as 0.10 and 0.11 g/g-day, and measured in a Texas lab (0.86 to 0.131 g/g-day), for an average water ingestion rate of 0.104 g/g-day. The incidental soil ingestion rate is calculated by multiplying the food ingestion rate by the percentage of soil that is incidentally ingested (0.082 percent for a Canada goose) from Beyer (1993).

The home range for the quail was calculated using data from southern Illinois idle farms, woods, brush, and cornfields. The values for individuals ranged from 15.8 to 41.3 acres with an average home range of 28.6 acres.

Short-Tailed Shrew (*Blarina brevicauda*)

Shrews inhabit a wide variety of habitats and are common in areas with abundant vegetative cover. They need cool, moist habitats because of their high metabolic and water-loss rates. The short-tailed shrew is primarily carnivorous, eating insects such as earthworms, slugs, and snails.

The adult body weight for the short-tailed shrew in various Pennsylvania habitats ranged from 0.01525 to 0.01921kg with an average of 0.01687 kg. The listed food ingestion rates are for shrews in labs on Ohio (0.49 g/g-day), Wisconsin (0.43 to 0.96 g/g-day), and Virginia (0.541 g/g-day), with an average of 0.61 g/g-day. The water ingestion rate was determined as 0.223 g/g-day in an Illinois laboratory. The incidental soil ingestion rate was calculated by multiplying the ingestion rate by the percentage of soil that is incidentally ingested (13 percent) from Talmage and Walton (undated).

The home range for the shrew was calculated using data from a tamarak bog in Manitoba (only value available). The value was 0.97 acres.

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TABLE H.3-1

EXPOSURE PARAMETERS FOR TEST SPECIES AND SURROGATE WILDLIFE SPECIES
NAVAL SURFACE WARFARE CENTER, CRANE, INDIANA

Species	Body Weight (kg)			Food Ingestion Rate (kg/day)		Water Ingestion Rate (L/day)		Soil/Sediment Ingestion Rate (kg/day)		Home Range (acres)		
	Avg.	Min.	Max.	Avg.	Conserv.	Avg.	Conserv.	Avg.	Conserv.	Avg.	Min.	Max.
Potential Test Species[1]												
Rat[2]	0.35	NA	NA	NA		NA		NA		NA		
Old field mouse[3]	0.014	NA	NA	NA		NA		NA		NA		
Mouse[2]	0.03	NA	NA	NA		NA		NA		NA		
Rabbit	3.8	NA	NA	NA		NA		NA		NA		
Mink[4]	1	NA	NA	NA		NA		NA		NA		
Rhesus monkey[5]	5	NA	NA	NA		NA		NA		NA		
Beagle[2]	10	NA	NA	NA		NA		NA		NA		
Surrogate Wildlife Species[6]												
Bobwhite Quail	0.177	0.162	0.1855	0.0144	0.0164	0.0184	0.0231	0.001181	0.001345	28.6	15.8	41.3
American Robin	0.081	0.0773	0.0862	0.0976	0.1231	0.0113	0.0121	0.01015	0.012802	1.19	0.37	2
Short-Tailed Shrew	0.01687	0.01525	0.01921	0.0103	0.0162	0.0038	0.0043	0.001339	0.002106	0.97	0.97	0.97
Meadow Vole	0.03663	0.0329	0.0391	0.0119	0.0128	0.0064	0.0077	0.000286	0.000307	0.03	0.164	1.06

Notes:

See Table 8-1 for the exposure factors.
NA - Not Applicable
1 - Only one value was provided so it was placed in the average column and some generic body weights may have been replaced by study-specific body weights.
2 - U.S. EPA, 1998
3 - Silva and Downing, 1996
4 - U.S. EPA 1993
5 - Barsotti et al., 1976
6 - U.S. EPA, 1993 for all factors except soil ingestion; Beyer (1993) or Talmage and Walton (in press) for soil ingestion rates

TABLE H.3-2

CALCULATION OF EXPOSURE PARAMETERS FOR WILDLIFE RECEPTORS
NAVAL SURFACE WARFARE CENTER, CRANE, INDIANA

Exposure Parameters	Meadow Vole		Short-Tailed Shrew		American Robin	Bobwhite Quail	
Body Weights (g)	32.9	35.5	17.61	16.87	77.3	180	181
	39.1	39	17.33	15.58	80.8	168	183
			19.21	15.7	86.2	162	179
			17.4	15.25	83.6	175	175
					77.4	178	183.2
					80.6	179	185.5
						180	173
						162.8	180.4
Minimum	***32.9***		***15.25***		***77.3***	***162***	
Maximum	***39.1***		***19.21***		***86.2***	***185.5***	
Average	***36.63***		***16.87***		***81.0***	***177***	
Food Ingestion Rate (g/g-day) [1]	0.3	0.35	0.49	0.77	0.89	0.067	0.079
			0.62	0.55	1.52	0.072	0.093
			0.43	0.96		0.09	0.089
			0.52	0.54			
Minimum	***0.3***		***0.43***		***0.89***	***0.067***	
Maximum	***0.35***		***0.96***		***1.52***	***0.093***	
Average	***0.325***		***0.61***		***1.205***	***0.082***	
Food Ingestion Rate (kg/day)							
Conservative	***0.0128***		***0.0162***		***0.1231***	***0.0164***	
Average	***0.0119***		***0.0103***		***0.0976***	***0.0144***	
Water Ingestion Rate (g/g-day)	0.14	0.21	0.223		0.14	0.115	0.1
						0.106	0.131
						0.093	0.101
						0.086	0.102
						0.11	0.1
Minimum	***0.14***		***0.223***		***0.14***	***0.086***	
Maximum	***0.21***		***0.223***		***0.14***	***0.131***	
Average	***0.175***		***0.223***		***0.14***	***0.104***	
Water Ingestion Rate (L/day)							
Conservative	***0.0077***		***0.0043***		***0.0121***	***0.0231***	
Average	***0.0064***		***0.0038***		***0.0113***	***0.0184***	
Home Range (Ha) [2]	0.43	0.097	0.3925		0.15	7.6	6.4
	0.019	0.041			0.81	16.7	15.6
	0.013	0.033					
	0.012	0.013					
	0.043	0.057					
	0.023	0.032					
	0.051	0.078					
	0.058	0.061					
Minimum (acres) [2]	***0.0297***		***0.9699***		***0.37***	***15.8***	
Maximum (acres) [2]	***1.06***		***0.97***		***2.00***	***41.3***	
Average (acres) [2]	***0.164***		***0.970***		***1.19***	***28.6***	

Notes:

Source of data is U.S. EPA, 1993.
Ingestion Rates (L/day) (if only 1 ingestion rate is available)
- Conservative value = Ingestion Rate (g/g-day)* Max. Body Weight
- Average value = Ingestion Rate (g/g-day)*Avg. Body Weight

APPENDIX H.4

TOXICITY REFERENCE VALUES SOURCES

REFERENCES FOR TOXICITY REFERENCE VALUES (TRVS):

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Heinz, G.H., D.J. Hoffman, A.J. Krynitsky, and D.M.G. Weller. 1987. "Reproduction in Mallards Fed Selenium". Environ. Toxicol. Chem. 6:423-433.

Mehring, A. L. Jr., J. H. Brumbaugh, A. J. Sutherland, and H. W. Titus. 1960. The tolerance of growing chickens for dietary copper. *Poult. Sci.* 39: 713-719.

Rosenfeld, I., and O.A. Beath. 1964. Selenium: Geobotany, Biochemistry, Toxicity and Nutrition. Academic Press, New York. p. 198-208.

Sample, B.E., D.M. Opresko, and G.W. Suter II. 1996. Toxicological Benchmarks for Wildlife: 1996 Revision. Oak Ridge National Laboratory. June. ES/ER/TM-86/R3.

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Stahl, J. L., J. L. Greger, and M. E. Cook. 1990. Breeding-hen and progeny performance when hens are fed excessive dietary zinc. *Poult. Sci.* 69: 259-263.

TABLE H.4-1

NOAELS AND LOAELS FOR BIRDS
NAVAL SURFACE WARFACE CENTER, CRANE, INDIANA

Parameter	Birds	
	NOAEL (mg/kg-day)	LOAEL (mg/kg-day)
HERBICIDES		
2,4-D	NV	NV
INORGANICS		
Copper	46.97	61.72
Selenium	0.4	0.8
Zinc	14.49	130.9

Notes:

The sources of these NOAELS and LOAELS are presented in the table titled "Sources and Endpoints for NOAELS and LOAELS for Terrestrial Wildlife" in this appendix.

The NOAELS and LOAELS in the source table were divided by 10 if a subchronic study was the basis for the value. Also, if only a NOAEL was available, the value was multiplied by 10 to estimate the LOAEL. If only a LOAEL was available, the value was divided by 10 to estimate the NOAEL.

TABLE H.4-2

DERIVATIONS OF MAMMAL TRVS - AVERAGE BODY WEIGHT
NAVAL SURFACE WARFACE CENTER, CRANE, INDIANA

Parameter	Mammals				Short-tailed Shrew		Meadow Vole		Raccoon		Brown Bat	
	NOAEL	LOAEL	Test Species	Body Weight (kg)	NOAEL	LOAEL	NOAEL	LOAEL	NOAEL	LOAEL	NOAEL	LOAEL
HERBICIDES (mg/kg)												
2,4-D	1	5	rat	0.35	20.7	103.7	9.6	47.8	0.05	0.3	48.6	243.1
INORGANICS (mg/kg)												
Copper	11.71	15.14	mink	1	694.1	897.5	319.7	413.3	1.7	2.2	1626.4	2102.8
Selenium	0.2	0.33	rat	0.35	4.15	6.85	1.91	3.15	0.01	0.02	9.72	16.04
Zinc	160	320	rat	0.35	3320	6639	1529	3058	8.2	16	7778	15556

Notes:

The sources of these NOAELS and LOAELS are presented in the table titled "Sources and Endpoints for NOAELS and LOAELS for Terrestrial Wildlife" in this appendix.

The NOAELS and LOAELS in the source table were divided by 10 if a subchronic study was the basis for the value. Also, if only a NOAEL was available, the value was multiplied by 10 to estimate the LOAEL and if only a LOAEL was available, the value was divided by 10 to estimate the NOAEL.

Derivation NOAEL/LOAEL Equation:

Derived NOAEL = NOAEL*(test species bw/surrogate species average body weight)
Derived LOAEL = LOAEL*(test species bw/surrogate species average body weight)

Average body weight for surrogate wildlife species can be found in Table 8-3 and Appendix H.3.

TABLE H.4-3

SOURCES AND ENDPOINTS FOR NOAELS AND LOAELS FOR TERRESTRIAL WILDLIFE
NAVAL SURFACE WARFARE CENTER, CRANE, INDIANA

Parameter	Concentration (mg/kg-day)	Endpoint	Effect	Chronic/ Subchronic	Species	Primary Reference	Source of Reference
Herbicides							
2,4-D	1	NOAEL	systemic	chronic	rat	Dow Chemical, 1983	IRIS, 2001
2,4-D	5	LOAEL	systemic	chronic	rat	Dow Chemical, 1983	IRIS, 2001
Inorganics							
Copper	11.71	NOAEL	reproductive	chronic	mink	Aulerich et al., 1982	Sample et.al., 1996
Copper	15.14	LOAEL	reproductive	chronic	mink	Aulerich et al., 1982	Sample et.al., 1996
Copper	46.97	NOAEL	mortality	chronic	chicks	Mehring et al., 1960	Sample et.al., 1996
Copper	61.72	LOAEL	mortality	chronic	chicks	Mehring et al., 1960	Sample et.al., 1996
Selenium	0.5	NOAEL	reproductive	chronic	mallard duck	Heinz, et al., 1987	Sample et.al., 1996
Selenium	1	LOAEL	reproductive	chronic	mallard duck	Heinz, et al., 1987	Sample et.al., 1996
Selenium	0.2	NOAEL	reproductive	chronic	rat	Rosenfeld and Beath, 1964	Sample et.al., 1996
Selenium	0.33	LOAEL	reproductive	chronic	rat	Rosenfeld and Beath, 1964	Sample et.al., 1996
Zinc	160	NOAEL	reproductive	chronic	rat	Schlicker and Cox, 1968	Sample et.al., 1996
Zinc	320	LOAEL	reproductive	chronic	rat	Schlicker and Cox, 1968	Sample et.al., 1996
Zinc	14.49	NOAEL	reproductive	chronic	white leghorn hen	Stahl et al., 1990	Sample et.al., 1996
Zinc	130.9	LOAEL	reproductive	chronic	white leghorn hen	Stahl et al., 1990	Sample et.al., 1996

APPENDIX H.5

FOOD- CHAIN MODEL CALCULATIONS

TABLE H.5-1

SWMU 01 - MUSTARD GAS BURIAL GROUND
TERRESTRIAL WILDLIFE MODEL ECOLOGICAL EFFECTS QUOTIENT CALCULATION
BOBWHITE QUAIL - CONSERVATIVE INPUTS
NSWC CRANE, INDIANA

Parameter	95% UCL Soil Concentration (mg/kg)	95% UCL SW Concentration (mg/L)	Biotransfer Factor (soil to veg.)	Vegetation Concentration (mg/kg)	Dose (mg/kg/day)	NOAEL (mg/kg/day)	LOAEL (mg/kg/day)	NOAEL EEQ	LOAEL EEQ
Herbicides									
2,4-D	6.96E-02	0.00E+00	1.00E+00	6.96E-02	7.63E-03	NV	NV	#VALUE!	#VALUE!
Inorganics									
Copper	1.36E+01	0.00E+00	1.88E-01	2.56E+00	3.72E-01	4.70E+01	6.17E+01	7.93E-03	6.03E-03
Selenium	7.96E-01	0.00E+00	9.04E-01	7.19E-01	7.94E-02	4.00E-01	8.00E-01	1.99E-01	9.93E-02
Zinc	4.88E+01	0.00E+00	5.46E-01	2.66E+01	3.10E+00	1.45E+01	1.31E+02	2.14E-01	2.37E-02

Cells are shaded if the EEQ is greater than 1.0.

Definitions:
EEQ - Ecological Effects Quotient
NOAEL - No Observed Adverse Effects Level
LOAEL - Lowest Observed Adverse Effects Level

Dose=[(If*Cv+Is*Cs+Iw*Cw)H]/BW

Body Weight = (BW)	1.620E-01	kg
Food Ingestion Rate = (If)	1.640E-02	kg/day
Water Ingestion Rate = (Iw)	2.310E-02	L/day
Soil Ingestion Rate = (Is)	1.345E-03	kg/day
Home Range = (HR)	Assume 100% on site	
Contaminated Area = (CA)	Assume equal to home range	

H=HR/CA (Assume = to 1 for maximum exposure)

Cs = Contaminant concentration in soil
Cw = Contaminant concentration in water
Cv = Contaminant conc. in vegetation (=soil conc. * Biotransfer Factor)

TABLE H.5-2

SWMU 01 - MUSTARD GAS BURIAL GROUND
TERRESTRIAL WILDLIFE MODEL ECOLOGICAL EFFECTS QUOTIENT CALCULATION
AMERICAN ROBIN - CONSERVATIVE INPUTS
NSWC CRANE, INDIANA

Parameter	95% UCL Soil Concentration (mg/kg)	95% UCL SW Concentration (mg/L)	Biotransfer Factor (soil to inv.)	Invertebrate Concentration (mg/kg)	Dose (mg/kg/day)	NOAEL (mg/kg/day)	LOAEL (mg/kg/day)	NOAEL EEQ	LOAEL EEQ
Herbicides									
2,4-D	6.96E-02	0.00E+00	1.00E+00	6.96E-02	1.22E-01	NV	NV	#VALUE!	#VALUE!
Inorganics									
Copper	1.36E+01	0.00E+00	2.45E-01	3.34E+00	7.58E+00	4.70E+01	6.17E+01	1.61E-01	1.23E-01
Selenium	7.96E-01	0.00E+00	2.14E-01	1.71E-01	4.04E-01	4.00E-01	8.00E-01	1.01E+00	5.05E-01
Zinc	4.88E+01	0.00E+00	2.06E+00	1.01E+02	1.68E+02	1.45E+01	1.31E+02	1.16E+01	1.29E+00

Cells are shaded if the EEQ is greater than 1.0.

Definitions:
EEQ - Ecological Effects Quotient
NOAEL - No Observed Adverse Effects Level
LOAEL - Lowest Observed Adverse Effects Level

Dose=[(If*Ci+Is*Cs+Iw*Cw)H]/BW

Body Weight = (BW)	7.730E-02	kg
Food Ingestion Rate = (If)	1.231E-01	kg/day
Water Ingestion Rate = (Iw)	1.210E-02	L/day
Soil Ingestion Rate = (Is)	1.280E-02	kg/day
Home Range = (HR)	Assume 100% on site	
Contaminated Area = (CA)	Assume equal to home range	

H=HR/CA (Assume = to 1 for maximum exposure)

Cs = Contaminant concentration in soil
Cw = Contaminant concentration in water
Ci = Contaminant conc. in soil invertebrates (=soil conc. * Biotransfer Factor)

TABLE H.5-3

SWMU 01 - MUSTARD GAS BURIAL GROUND
TERRESTRIAL WILDLIFE MODEL ECOLOGICAL EFFECTS QUOTIENT CALCULATION
AMERICAN ROBIN - AVERAGE INPUTS
NSWC CRANE, INDIANA

Parameter	Avg. All Soil Concentration (mg/kg)	Avg. SW Concentration (mg/L)	Biotransfer Factor (soil to inv.)	Invertebrate Concentration (mg/kg)	Dose (mg/kg/day)	NOAEL (mg/kg/day)	LOAEL (mg/kg/day)	NOAEL EEQ	LOAEL EEQ
Inorganics									
Selenium	6.00E-01	0.00E+00	1.58E-01	9.46E-02	1.89E-01	4.00E-01	8.00E-01	4.73E-01	2.36E-01
Zinc	4.48E+01	0.00E+00	5.12E-01	2.29E+01	3.33E+01	1.45E+01	1.31E+02	2.30E+00	2.54E-01

Cells are shaded if the EEQ is greater than 1.0.
The average concentrations were used except for lead in the soil; the 95% UCL was used because it was lower than the average concentration.

Definitions:
EEQ - Ecological Effects Quotient
NOAEL - No Observed Adverse Effects Level
LOAEL - Lowest Observed Adverse Effects Level

Dose=[(If*Ci+Is*Cs+Iw*Cw)H]/BW

Body Weight = (BW)	8.100E-02	kg
Food Ingestion Rate = (If)	9.760E-02	kg/day
Water Ingestion Rate = (Iw)	1.130E-02	L/day
Soil Ingestion Rate = (Is)	1.015E-02	kg/day
Home Range = (HR)	Assume 100% on site	
Contaminated Area = (CA)	Assume equal to home range	

H=HR/CA (Assume = to 1 for maximum exposure)

Cs = Contaminant concentration in soil
Cw = Contaminant concentration in water
Ci = Contaminant conc. in soil invertebrates (=soil conc. * Biotransfer Factor)

TABLE H.5-4

SWMU 01 - MUSTARD GAS BURIAL GROUND
TERRESTRIAL WILDLIFE MODEL ECOLOGICAL EFFECTS QUOTIENT CALCULATION
MEADOW VOLE - CONSERVATIVE INPUTS
NSWC CRANE, INDIANA

Parameter	95% UCL Soil Concentration (mg/kg)	95% UCL SW Concentration (mg/L)	Biotransfer Factor (soil to veg.)	Vegetation Concentration (mg/kg)	Dose (mg/kg/day)	NOAEL (mg/kg/day)	LOAEL (mg/kg/day)	NOAEL EEQ	LOAEL EEQ
Herbicides									
2,4-D	6.96E-02	0.00E+00	1.00E+00	6.96E-02	2.77E-02	8.95E+00	4.48E+01	3.10E-03	6.20E-04
Inorganics									
Copper	1.36E+01	0.00E+00	1.88E-01	2.56E+00	1.12E+00	2.99E+02	3.87E+02	3.75E-03	2.90E-03
Selenium	7.96E-01	0.00E+00	9.04E-01	7.19E-01	2.87E-01	1.79E+00	2.95E+00	1.60E-01	9.73E-02
Zinc	4.88E+01	0.00E+00	5.46E-01	2.66E+01	1.08E+01	1.43E+03	2.86E+03	7.56E-03	3.78E-03

Cells are shaded if the EEQ is greater than 1.0.

Definitions:
EEQ - Ecological Effects Quotient
NOAEL - No Observed Adverse Effects Level
LOAEL - Lowest Observed Adverse Effects Level

Dose=[(If*Cv+Is*Cs+Iw*Cw)H]/BW

Body Weight = (BW) 0.0329000 kg
Food Ingestion Rate = (If) 0.0128000 kg/day
Water Ingestion Rate = (Iw) 0.0077000 L/day
Soil Ingestion Rate = (Is) 0.0003070 kg/day
Home Range = (HR) Assume 100% on site
Contaminated Area = (CA) Assume equal to home range
H=HR/CA (Assume = to 1 for maximum exposure)

Cs = Contaminant concentration in soil
Cw = Contaminant concentration in water
Cv = Contaminant conc. in vegetation (=soil conc. * Biotransfer Factor)

TABLE H.5-5

SWMU 01 - MUSTARD GAS BURIAL GROUND
TERRESTRIAL WILDLIFE MODEL ECOLOGICAL EFFECTS QUOTIENT CALCULATION
SHORT-TAILED SHREW - CONSERVATIVE INPUTS
NSWC CRANE, INDIANA

Parameter	95% UCL Soil Concentration (mg/kg)	95% UCL SW Concentration (mg/L)	Biotransfer Factor (soil to inv.)	Invertebrate Concentration (mg/kg)	Dose (mg/kg/day)	NOAEL (mg/kg/day)	LOAEL (mg/kg/day)	NOAEL EEQ	LOAEL EEQ
Herbicides									
2,4-D	6.96E-02	0.00E+00	1.00E+00	6.96E-02	8.36E-02	1.82E+01	9.11E+01	4.59E-03	9.18E-04
Inorganics									
Copper	1.36E+01	0.00E+00	2.45E-01	3.34E+00	5.43E+00	6.10E+02	7.88E+02	8.92E-03	6.90E-03
Selenium	7.96E-01	0.00E+00	2.14E-01	1.71E-01	2.91E-01	3.64E+00	6.01E+00	7.99E-02	4.84E-02
Zinc	4.88E+01	0.00E+00	2.06E+00	1.01E+02	1.14E+02	2.92E+03	5.83E+03	3.90E-02	1.95E-02

Cells are shaded if the EEQ is greater than 1.0.

Definitions:
EEQ - Ecological Effects Quotient
NOAEL - No Observed Adverse Effects Level
LOAEL - Lowest Observed Adverse Effects Level

Dose=[(If*Ci+Is*Cs+Iw*Cw)H]/BW

Body Weight = (BW) 0.0152500 kg
Food Ingestion Rate = (If) 0.0162000 kg/day
Water Ingestion Rate = (Iw) 0.0043000 L/day
Soil Ingestion Rate = (Is) 0.0021060 kg/day
Home Range = (HR) Assume 100% on site
Contaminated Area = (CA) Assume equal to home range
H=HR/CA (Assume = to 1 for maximum exposure)

Cs = Contaminant concentration in soil
Cw = Contaminant concentration in water
Ci = Contaminant conc. in soil invertebrates (=soil conc. * Biotransfer Factor)