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Project No. 112GN8383

Mr. Howard Hickey
NAVFAC MW
201 Decatur Avenue
Building 1A, Code EV
Great Lakes, Illinois 60088

Reference: CLEAN Contract N62467-94-D-0888
Contract Task Order No. 0311

Subject: **Final**
Navy Response to United States Environmental Protection Agency (USEPA) Comments
(Received Electronically: December 21, 2006) Regarding Solid Waste Management Unit
(SWMU) 3 (Ammunitions Burning Grounds) Corrective Measures Proposal (CMP)
Naval Surface Warfare Center (NSWC) Crane
Crane, Indiana

Dear Mr. Hickey:

On April 23, 2007, a working version of the comment responses was sent to Mr. Tom Brent. Comments were received from Mr. Brent on May 2, 2007. Due to the draft nature of the response document, Mr. Brent's comments were directly incorporated without the development of a response document.

The enclosed comment responses have been modified to address EPA's comments dated July 13, 2007 regarding monitoring of explosive degradation products and surface water and groundwater criteria. These July 13 comments which were provided for the SWMU 10 CMIP/QAPP were intended to apply to all SWMUs, including SWMU 3.

Additionally, on October 31, 2007, Mr. Brent noted an inconsistency in the Groundwater Monitoring Plan and the subject CMP Little Sulphur Creek sampling location. This inconsistency has been resolved and the enclosed comment responses and figure have been updated appropriately.

Please note that the CMP has been "marked up" as described in the responses. The revised version of the CMP will be prepared from the markup once the Navy has reviewed and approved these responses.

Please contact Valerie Plachy at 412-921-8389 (e-mail: Valerie.Plachy@ttnus.com) or me at 412-921-8308 (e-mail: Ralph.Basinski@ttnus.com) regarding any questions or comments.

Sincerely,

Ralph R. Basinski
Task Order Manager

RRB:VJP/mlg
Enclosure

cc: Mr. Tom Brent, NSWC Crane (letter and enclosure)
Ms. Debra Humbert, Tetra Tech (letter only)
Mr. Mark Perry, Tetra Tech (letter and enclosure)
Ms. Valerie Plachy, Tetra Tech (letter and enclosure)
Mr. Ralph Basinski, Tetra Tech (letter and enclosure)
Project File – CTO 0311

ENCLOSURE

**UNITED STATES ENVIRONMENTAL PROTECTION AGENCY (EPA) COMMENTS
(DATED DECEMBER 21, 2006) ON
DRAFT CORRECTIVE MEASURES PROPOSAL (CMP) FOR
AMMUNITION BURNING GROUNDS (SWMU 3)
DATED JULY 2006
NAVAL SURFACE WARFARE CENTER (NSWC) CRANE
CRANE, INDIANA**

**UNITED STATES ENVIRONMENTAL PROTECTION AGENCY (EPA) COMMENTS
(DATED DECEMBER 21, 2006) ON
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CRANE, INDIANA**

EPA comments are shown in bold font. Navy responses to each comment are shown in regular font. Text changes to the CMP are shown in italic font enclosed in quotation marks within the response.

Comment EPA-1: Section 1.3.2.2.1 speaks about two empty USTs which were removed in 1994. Were these officially closed by a Federal or State Agency? Were the surrounding soils sampled after tank removal? Referring to the "ash pile" area, was considered a clean closure? Is there any closure information on the "unlined pit" in which pink water sludge was treated or the primer burn box? The text should note whether these areas will require further action at closure of the MTA.

Response EPA-1: To clarify, the USTs were part of the OB operations and were regulated as Hazardous Waste (HW) tanks. These tanks were covered under the Surface Impoundment (SI) Closure Plan. To date, the SIs have undergone partial closure. In attempting to do a clean closure, the Navy determined that it was not feasible to differentiate contamination that resulted from the SIs from contamination that had occurred from past trench burning operations.

Samples were collected after the HW tanks were removed. However, the approximate year in which this occurred was 1994 and limited information can be located (See Attachment 1).

While trying to identify the location of a leak in the transfer line from the SIs to the HW tanks, the Navy encountered historical trenches. Again, it would be difficult to determine what contamination the HW tanks contributed versus contamination from past operational practices.

A new last sentence has been added to the 4th paragraph in Section 1.3.2.1 as follows:

"The USTs were partially closed and further action will be required at closure of the MTA."

To the best of the Navy's knowledge, the Ash Pile was not "clean closed."

A new last sentence has been added to the 5th paragraph in Section 1.3.2.1 as follows:

"However, this was not a 'clean closure' and further action will be required at closure of the MTA."

It is not clear what the "unlined pit" references. During early operations of the ABG, pink water sludges flowed into trenches. The exact location of these trenches is not known. The pink water would have flowed or been drained off and then the concentrated sludges were burned.

Later, the pink water sludges were placed in the SIs, which were initially unlined. A liner was later added, and the SIs were used only briefly.

The primer burn box decommissioning preceded RCRA; as such, there was no closure of the primer burn box. The decommissioning may simply have been a replacement without closure because the primer pit is still an operational unit.

A new last sentence has been added to the 6th paragraph in Section 1.3.2.1 as follows:

"The pit area will require further action at closure of the MTA."

Comment EPA-2: Section 1.4.5.2.3 speaks of the first dye tracer study conducted by Murphy and Ciocco. The text should note where this dye was injected.

Response EPA-2: New 4th and 5th sentences have been added to the 1st paragraph of Section 1.4.5.2.3 as follows:

"Dyes were injected into two Beech Creek aquifer wells (03CO2P2 and 03CO3P2) at the ABG. Dye detectors were placed in several springs north and south of the ABG and in LSC."

Additionally, new 3rd and 4th sentences have been added to the 4th paragraph of Section 1.4.5.2.3 as follows:

"A dye tracer study (Jock and Krothe, June 2002) performed in the OJT area showed that dye injected in well 03-24 traveled 0.3 mile (about 1,600 feet) and first arrived at Spring C in 7 hours. This dye test supports the conclusion that a karst conduit runs from north (near well 03-24) to south and discharges at Spring C."

Comment EPA-3: In Section 1.4.6.2 and in other areas throughout the document, it is stated that groundwater at the MTA is not currently used or anticipated to be used in the future as a potable drinking water source. What about the ABG break room fountain which draws water from the Beaver Bend aquifer? What is the status of this well and what is the Navy's sampling frequency of this well to ensure it meets intended uses. Modify the text throughout the document to appropriately reflect this.

Response EPA-3: As discussed in the RFI Report, the Elwren Formation (uppermost unit of the West Baden Group) lies below the Beech Creek Limestone and below the collapse zone material that lies in the LSC valley. It consists of massive to thinly bedded, dark gray to green shale with interbedded red-brown claystone. The formation averages approximately 20 feet in thickness. The Reelsville Formation lies just below the Elwren Shale and is approximately 10 feet thick. It consists of dark gray to gray-green shale, with thin (less than 3 feet thick) bed of fine-grained sandstone. The Sample Formation is just below the Reelsville and it consists of 40 to 45 feet of dark gray to black, thinly bedded, platy to fissile shale with some interbeds of fine-grained sandstone. Together, the Elwren, Reelsville, and Sample Shales form an aquiclude that is approximately 75 feet thick. These shales virtually prevent the vertical seepage of shallow ground water downward into the underlying Beaver Bend Limestone.

The Beaver Bend Limestone is the deepest geologic unit in the ABG/OJT/LSC area that is considered a significant aquifer and that has been investigated or monitored in the past. The Beaver Bend ranges from 10 to 12 feet thick and consists of medium gray-brown, medium to coarsely crystalline, very hard and dense limestone. This limestone has numerous intersecting joints.

In September 1999, the source of drinking water for the ABG Break Room (e.g., the Beaver Bend aquifer) was sampled and analyzed for the following:

- Explosives⁽¹⁾
- Appendix IX volatile organic compounds (VOCs)
- Appendix IX semivolatile organic compounds (SVOCs)
- Appendix IX organochlorine pesticides and PCBs (pest/PCBs)
- Appendix IX herbicides
- Appendix IX metals, total and dissolved (filtered samples were also analyzed for dissolved calcium, magnesium, potassium, and sodium)

- Appendix IX dioxins and furans
- Chloride
- Cyanide
- Sulfate
- Sulfide
- Phosphorus, total and dissolved
- Total organic carbon (TOC)
- Total organic halogens (TOX)

- 1 -- Explosives list includes 1,3,5-trinitrobenzene, 1,3-dinitrobenzene, TNT, 2,4-dinitrotoluene, 2,6-dinitrotoluene, HMX, 2-nitrotoluene, 3-nitrotoluene, 4-nitrotoluene, 4-amino-2,6-dinitrotoluene, 2-amino-4,6-dinitrotoluene, tetryl, nitrobenzene, RDX, nitroglycerin, PETN, and nitrocellulose.

For the September 1999 sampling event, no organic compounds (i.e., explosives, VOCs, SVOCs, pest/PCBs, herbicides, and dioxins/furans) were detected in the ground water sample or its field duplicate sample. Barium, calcium, chromium, lead, magnesium, potassium, selenium, sodium, zinc, chloride, and sulfate were detected in the ground water sample and/or its field duplicate sample. All detected concentrations were less than associated primary and secondary United States Environmental Protection Agency (EPA) Maximum Contaminant Levels (MCLs).

The Break Room drinking water is tested quarterly for drinking water parameters. Additionally, two rounds of perchlorate sampling has been performed on the Break Room drinking water. No contamination has been identified during the quarterly or perchlorate sampling events.

The RCRA Part B Operating Permit requires quarterly monitoring of upgradient and downgradient wells in the Big Clifty Sandstone/Beech Creek (BC/BC) and Beaver Bend aquifers, the Spring A discharge point for contaminated MTA surface waters, and LSC.

The first paragraph of Section 1.4.6.2 has been modified as follows:

"Contaminated groundwater from the BC/BC aquifer at the MTA and OJT is not currently and is not anticipated to be used in the future as a potable drinking water source. The ABG Break Room drinking water source is the Beaver Bend aquifer. This drinking water source is 190 feet below ground surface (bgs) and hydraulically isolated from the Contaminated BC/BC aquifer (i.e., the BC/BC and Beaver Bend aquifers are not connected). Additionally, the drinking water source is located side gradient to the contamination in the BC/BC aquifer. The RCRA Part B Operating Permit requires monitoring of upgradient and downgradient wells in the BC/BC and Beaver Bend aquifers."

For clarification, the phrase "from the BC/BC aquifer" has been added throughout the document when groundwater is discussed as a drinking water source.

Comment EPA-4: The last sentence of the second paragraph on page 1-21 states that the Sulfur Creek-LSC waterbody segment was not assessed for fish consumption water use by the state. It should be noted that the Navy further evaluated this use when developing ACLs.

Response EPA-4: A new final sentence has been added to the 4th paragraph in Section 1.4.8.2, Subsection Aquatic Habitats as follows:

"However, the Navy evaluated the fish consumption use in developing Alternative Water Quality Criteria (WQC) (See Section 2.6)."

Comment EPA-5: Modify Figure 1-3 to note the Johnson Hollow tributary.

Response EPA-5: Figure 1-3 (Attachment 2) has been modified and the Johnson Hollow tributary is now labeled.

Comment EPA-6: The last sentence on page 2-2 refers to maximum concentrations. Present those in the text.

Response EPA-6: Maximum concentrations have been added to the text. The last sentence of the second paragraph of Section 2.1.1.1.1 has been changed as follows:

"The maximum concentrations of TCE (200 µg/kg), cis-1,2-dichloroethene (DCE) (2,300 µg/kg), and trans-1,2-DCE (290 µg/kg) were detected in boring 03/10-17."

Comment EPA-7: The last sentence of Section 2.1.1.1.1 notes locations where highest concentrations of energetics were detected. List the maximum concentrations.

Response EPA-7: Maximum concentrations have been added to the text. The last sentence of Section 2.1.1.1.1 has been replaced with the following text:

"The highest concentrations of these energetics were found to be located in either the surface grab sample 03/10-61 or boring 03/10-35 as shown in the table below."

	HMX (mg/kg)	RDX (mg/kg)	Trinitrobenzene (mg/kg)	TNT (mg/kg)	DNT (mg/kg)	2A-DNT (mg/kg)	4A-DNT (mg/kg)
03/10-61 (6-18)		1,820				5.65	8.2
03/10-35 (0-30)					0.06		
03/10-35 (30-60)	232		37.5	2,030			

Comment EPA-8: Section 2.1.1.1.3 should include a discussion of lead contamination found at the MTA. The last sentence of this section concludes that it is not possible to identify soil sources of COPCs that could account for the observed groundwater contamination. TCE exists in subsurface soil samples at levels far above migration to groundwater levels.

Response EPA-8: A new 2nd paragraph of Section 2.1.1.1.3, Subsection Surface Soil has been revised as follows:

"Lead was detected at concentrations greater than the IDEM industrial migration to groundwater default level of 230 mg/kg in surface soil samples at 03SB088 (511 mg/kg), 03SB120 (14,600 mg/kg), and 03SB160 (7,910 mg/kg)."

Additionally, for clarification, the 4th bullet of Section 2.2.2 has been revised as follows:

- "The area of concern for lead is a sub-area of the southeastern quadrant of the MTA (i.e., the area near soil boring 03SB116 and 03SB120) that has arithmetic mean lead concentrations (681 mg/kg) exceeding the U.S. EPA Region 9 soil PRGs for residential and industrial land use scenarios and the calculated site-specific screening level (550 mg/kg) for the construction worker (see Figure 2-3)."*

The last paragraph of Section 2.1.1.1.3, Subsection Subsurface Soil has been revised as follows:

"Based on these results, it was concluded that it is not possible to identify soil sources of explosives COPCs that could account for the observed groundwater contamination. TCE was found in subsurface soil at concentrations greater than the IDEM industrial migration to groundwater default level of 0.082 mg/kg (82 µg/kg) at 03SB1030610 (330 µg/kg), 03SB1120610 (570 µg/kg), 03SB0610610 (2,300 µg/kg), 03SB1021014 (8,600 µg/kg), and 03SB0610206 (19,000 µg/kg)."

Comment EPA-9: The first subheading of Section 2.1.2.2.2 should be changed to 'Surface/Subsurface Soil'.

Response EPA-9: The first subheading in Section 2.1.2.2.2 has been changed to Surface/Subsurface Soil.

Comment EPA-10: Section 2.1.2.2.4 states that RDX concentration in well 03-21 decreased significantly. Note the RDX value decrease in the text.

Response EPA-10: The concentration decreases for both TCE and RDX have been added to the text. The 2nd sentence of 1st paragraph of Section 2.1.2.2.4, Subsection Groundwater has been revised as follows:

"The 2004 TCE concentration of 920 µg/L in well 03-07 is significantly less than the 1994 concentration of 4,000 µg/L. The 1994 concentration RDX concentration of 120 µg/L in well 03-21 is significantly less than the 1994 concentrations of 365 µg/L."

Comment EPA-11: Section 2.1.2.2.5 states maximum detections of RDX and HMX were in samples from wells 03-21 and 03-12. Note the values in the text. Include a discussion of TCE values detected in groundwater during this investigation.

Response EPA-11: Maximum concentrations have been added to the text and the text has been revised to include discussion of TCE values detected in groundwater. The 2nd sentence in the 2nd paragraph of Section 2.1.2.2.5, Subsection Groundwater has been replaced with the following text:

"During the 2004 investigation, the highest concentrations of RDX (120 µg/L) and HMX (134 µg/L) were in well 03-21. The second highest 2004 concentrations of RDX (39 µg/L) and HMX (82 µg/L) were in well 03-12. The 2007 maximum TCE concentration of 2,400 µg/L in well 03-C20 is significantly less than the 2004 concentration of 4,500 µg/L."

Comment EPA-12: Section 2.2 and the bullets of Section 2.2.1 discuss current receptors at MTA. Why were maintenance workers not evaluated as a current receptor? (Similar comment for Appendix B).

Response EPA-12: Maintenance work at SWMU 3 consists of ground maintenance (i.e., mechanical grass mowing without direct contact) where exposure to soils is not anticipated. Consequently, under current and anticipated future land use, the following receptors are the most likely individuals to be exposed to COPCs in soils at the site.

- Base personnel (typical SWMU workers) specifically assigned work tasks at the ABG
- Construction workers periodically assigned work at the ABG
- Trespassers

Additionally, the base personnel (typical SWMU 3 worker) would have a higher exposure than a SWMU 3 maintenance worker would. Because there is no excess risk to the typical SWMU 3 worker, there would be no excess risk to the maintenance worker.

For clarification, two new sentences have been added to the beginning of the 3rd paragraph of Section 2.0 in Appendix B as follows:

"Typical maintenance work at SWMU 3 consists of ground maintenance (i.e., mechanical non-contact grass mowing) where exposures to soils is less than the exposures for the base personnel. Therefore, for the purposes of this HHRSE, the maintenance worker is considered equivalent to the base personnel."

Comment EPA-13: Section 2.2.1.: As was done for the SWMU 5 CMP, risks to workers from exposure to lead at the MTA should be evaluated using U.S. EPA's Adult Lead Model. Similarly, future residential child lead risks should be calculated using the IEUBK Model.

Response EPA-13: In response to Comment 13, receptor exposure to lead concentrations in the surface soils of the MTA were evaluated using two risk assessment models:

- The U.S. EPA Technical Review Workgroup (TRW) for Lead Model (U.S. EPA, 2003). This model is often referred to as the Adult Lead Model.
- The U.S. EPA Integrated Exposure Uptake Biokinetic (IEUBK) Model (U.S. EPA, 1994).

The results of the risk assessment modeling are presented in the following paragraphs and will be incorporated into the Human Health Risk Screening Evaluation (HHRSE).

Exposure to lead in surface soil by construction workers and industrial workers were evaluated using a slope-factor approach developed by the U.S. EPA TRW for Lead (U.S. EPA, 2003). As recommended by the adult lead model, the average lead concentration in surface soil was used as the exposure point concentration (EPC) for construction workers and occupational (i.e., industrial/site) workers. The following three scenarios were evaluated:

1. The entire site (average concentration = 681 mg/kg),
2. The "Hot Spot" (average concentration = 5,600 mg/kg) (locations 03SB086, 03SB116, 03SB120, and 03SB121), and
3. The entire site minus the "Hot Spot" (average concentration = 40 mg/kg).

Incremental lifetime cancer risks (ILCRs) and hazard indices (HIs) were already calculated for non-lead compounds in the draft version of the HHRSE using reasonable maximum exposure (RME) assumptions; however, the adult lead model guidance recommends the use of central tendency exposure (CTE) assumptions in evaluating adult exposures to lead in soil (U.S. EPA, 2003). Therefore, the incidental ingestion rate was assumed to be 100 mg/day for the construction worker and 50 mg/day for industrial workers (U.S. EPA, 2003). The exposure frequency was assumed to be 219 days/year for both the construction worker and industrial worker. Values of 2.18 and 1.53 µg/dL were used for the standard deviation and baseline blood lead concentration, respectively, which are the recommended values for the midwestern United States (U.S. EPA, 2002). Default parameters were used for the remaining model input parameters. Results of the model runs will be included in Appendix B (i.e., the HHRSE).

The fetus of a pregnant worker is the receptor of concern for the TRW model. For construction workers exposed to lead concentrations across the entire site, the lead concentration of 681 mg/kg results in 6.9 percent of the receptors (fetuses) having a blood lead level greater than 10 µg/dL and a geometric mean blood lead level of 3.5 µg/dL. For construction workers exposed to the "Hot Spot", the average lead concentration of 5,600 mg/kg results in 72 percent of the receptors (fetuses) having a blood lead level greater than 10 µg/dL and a geometric mean blood lead level of 17.7 µg/dL. These results do exceed the U.S. EPA goal of no more than 5 percent of children (fetuses of exposed women) exceeding a 10 µg/dL blood lead level. For construction workers exposed to the entire site minus the "Hot Spot", the lead concentration of 40 mg/kg results in 0.7 percent of the receptors (fetuses) having a blood lead level greater than 10 µg/dL and a geometric mean blood lead level of 1.6 µg/dL. These results do not exceed the U.S. EPA

goal of no more than 5 percent of children (fetuses of exposed women) exceeding a 10 µg/dL blood lead level.

For industrial workers exposed to the entire site, the lead concentration of 681 mg/kg results in 2.8 percent of the receptors (fetuses) having a blood lead level greater than 10.0 µg/dL and a geometric mean blood lead level of 2.5 µg/dL. For industrial workers exposed to the entire site minus the "Hot Spot", the lead concentration of 40 mg/kg results in 0.6 percent of the receptors (fetuses) having a blood lead level greater than 10.0 µg/dL and a geometric mean blood lead level of 1.6 µg/dL. These results do not exceed the U.S. EPA goal of no more than 5 percent of children (fetuses of exposed women) exceeding a 10 µg/dL blood lead level. For industrial workers exposed to the "Hot Spot", the lead concentration of 5,600 mg/kg results in 43 percent of the receptors (fetuses) having a blood lead level greater than 10.0 µg/dL and a geometric mean blood lead level of 9.6 µg/dL. These results do exceed the U.S. EPA goal of no more than 5 percent of children (fetuses of exposed women) exceeding a 10 µg/dL blood lead level.

Hypothetical residential exposures to lead in surface soil were evaluated using the most recent version of the IEUBK lead model (U.S. EPA, 1994). As previously noted, current and expected future land use is military/industrial. Therefore, future residential development of the site is unlikely to occur. Consequently, this residential evaluation is presented for informational purposes only. As recommended by the IEUBK model, the average lead concentration in surface soil was used as the EPC. As with the adult lead model, three scenarios were evaluated, the entire site (681 mg/kg), the "Hot Spot" (5,600 mg/kg) (locations 03SB086, 03SB116, 03SB120, and 03SB121), and the entire site minus the "Hot Spot" (40 mg/kg). Default values were used for the rest of the model input parameters. IEUBK model outputs will be included in Appendix B (i.e., the HHRSE). The average lead concentration for the entire site of 681 mg/kg results in 24.7 percent of hypothetical on-site child residents having a blood lead level greater than 10 µg/dL and results in a geometric mean blood lead level of 7.3 µg/dL. The average lead concentration for the "Hot Spot" of 5,600 mg/kg results in 98.7 percent of hypothetical on-site child residents having a blood lead level greater than 10 µg/dL and results in a geometric mean blood lead level of 28.7 µg/dL. These values exceed the U.S. EPA goal as described in the 1994 OSWER Directive of no more than 5 percent of children exceeding a 10 µg/dL blood lead level. The average lead concentration for the entire site minus the "Hot Spot" of 40 mg/kg results in 0.025 percent of hypothetical on-site child residents having a blood lead level greater than 10 µg/dL and results in a geometric mean blood lead level of 1.95 µg/dL. This value is less than the U.S. EPA goal as described in the 1994 OSWER Directive of no more than 5 percent of children exceeding a 10 µg/dL blood lead level.

Comment EPA-14: Section 2 should include data box figures showing metals/inorganics concentrations detected at MTA surface/subsurface soils. Figures should present a complete picture of the contamination delineation/bounding for explosives, metals, organics at the MTA based on the combination of data from the Tetra Tech studies and the Army Corps of Engineers Studies. This should be discussed in the text as the 2004 sampling event was meant to fill in data gaps from the Army Corps studies.

Response EPA-14: Appendix B contains the Human Health Risk Screening Evaluation (HHRSE) for the Main Treatment Area. This screening was conducted using soil data collected in 1993, 1995, and 2004. However, per direction from the U.S. EPA Region 5, only the explosive compounds data for 1993 soil samples are included in the data assessed. Thirteen of the 26 metals were analyzed for were identified as COPCs because they were present in excess of one or more screening value(s).

Data box figures were developed in the HHRSE (i.e., Appendix B) for selected COPCs as follows:

- | | |
|------------|---|
| Figure 3-1 | Lead Concentrations in Surface Soils (mg/kg) |
| Figure 3-2 | Barium Concentrations in Surface and Subsurface Soils (mg/kg) |

Figure 3-3	Primary Organic Contaminants in Surface and Subsurface Soils (mg/kg)
Figure 3-4	Copper Concentration in Surface Soils (mg/kg)
Figure 3-5	Zinc Concentration in Surface Soils (mg/kg)
Figure 3-6	Antimony Concentration in Surface Soils (mg/kg)
Figure 3-7	Manganese Concentration in Surface Soils (mg/kg)
Figure 3-8	Manganese Concentration in Subsurface Soils (mg/kg)

The information on soil concentrations, which are presented in the HHRSE, is now summarized in Section 2.1.1.1.3. A new 3rd paragraph has been added to Subsection Surface Soil as follows:

“Thirteen metals (aluminum, antimony, arsenic, barium, cadmium, chromium, copper, iron, lead, manganese, mercury, vanadium, and zinc) were present in surface soil at a maximum concentration that exceeded one or more of the HHRSE screening values. Table 2-1 summarizes the comparison of the maximum surface soil metal concentration to the EPA Region 9 Preliminary Remediation Goals (PRGs) screening values and the IDEM Default Direct Contact Closure Levels screening values for residential and industrial receptors. The following summarizes Table 2-1:

- *Eight metals (aluminum, antimony, barium, chromium, iron, mercury, vanadium, and zinc) had concentrations that exceeded the EPA Region 9 PRGs screening values for residential receptors but did not exceed any other screening criteria.*
- *Two metals (copper and manganese) exceeded the EPA Region 9 PRGs for residential and industrial receptors but did not exceed the IDEM Default Direct Contact Closure Levels.*
- *One metal (cadmium) exceed the EPA Region 9 PRGs and the IDEM Default Direct Closure Levels for residential receptors but did not exceed the EPA Region 9 PRGs and the IDEM Default Direct Closure Levels for industrial receptors.*
- *Two metals (arsenic and lead) exceed all screening level criteria.”*

New Table 2-1 is presented as Attachment 3 to this comment response document.

Additionally, a new 4th paragraph has been added to Subsection Subsoil as follows:

“Ten metals (aluminum, antimony, arsenic, barium, chromium, copper, iron, lead, manganese, and vanadium) were present in subsurface soil at a maximum concentration that exceeded one or more of the HHRSE screening values. Table 2-2 summarizes the comparison of the maximum surface soil metal concentration to the EPA Region 9 PRGs screening values and the IDEM Default Direct Contact Closure Levels screening values for residential and industrial receptors. The following summarizes Table 2-2:

- *Six metals (aluminum, antimony, barium, copper, iron, and vanadium) had concentrations that exceeded the EPA Region 9 PRGs screening values for residential receptors but did not exceed any other screening criteria.*
- *Three metals (arsenic, chromium, and manganese) exceeded the EPA Region 9 PRGs for residential and industrial receptors but did not exceed the IDEM Default Direct Contact Closure Levels.*
- *One metal (lead) exceed the EPA Region 9 PRGs and the IDEM Default Direct Closure Levels for residential receptors but did not exceed the EPA Region 9 PRGs and the IDEM Default Direct Closure Levels for industrial receptors.*

New Table 2-2 is presented as Attachment 4 to this comment response document.

Comment EPA-15: Section 2.3 should discuss how new data obtained from 2004 Tetra Tech investigations would or would not change conclusions drawn from the ecological risk assessment done in the CCCRA.

Response EPA-15: As discussed in Section 2.3.1, the MTA is an active treatment unit where there is no ecological habitat. The CCCRA evaluated ecological impacts in areas of the Ammunitions Burning Grounds (ABG) where ecological habitat existed. The contamination at the MTA existed at the time that the CCCRA was conducted. The CMP merely provided additional details regarding this contamination. Therefore, the results of the 2004 Tetra Tech investigations do not impact or change the ecological risk conclusions of the CCCRA (i.e., there are no significant impacts to ecological receptors at the MTA).

A new 3rd sentence has been added to the 1st paragraph in Section 2.3.3 as follows:

"The 2004 investigation provided additional details regarding this contamination. The results of the 2004 investigations do not impact or change the ecological risk conclusions of the CCCRA (i.e., there are no significant impacts to ecological receptors at the MTA)."

Comment EPA-16: Referring to the 5th bullet, additional information is needed to show how large of an area location 03SS24 represents. Compare this and the overall exposure area to the expected foraging area for the receptors (e.g., American robin and raccoon).

Response EPA-16: A new 3rd sentence has been added to the 3rd bullet of the 2nd paragraph in Section 2.5 as follows:

"The area represented by 03SS24 is approximately 2,000 square feet (40 feet by 50 feet) when assuming that the impacted area is half the distance to the next closest samples. 2,000 square feet is less than 0.05 acres, which is much smaller than the home range for small mammals and birds (usually assumed to be a minimum of 1 acre)."

Comment EPA-17: Section 2.6 should include a discussion of why the human health risks from incidental contact / ingestion of surface water are not an issue. This section should be modified to include discussion of the complete explosive/organic breakdown products that could potentially be present in groundwater at MTA/OJT. A discussion of the expected types and fate of explosives breakdown products for RDX, TNT, HMX, which could be present in site groundwater and/or surface water should be presented. For example, the ATSDR Toxicity Profile for RDX identifies formaldehyde and nitrosamines as photoproducts identified from photolysis of RDX in aqueous solution; anaerobic biodegradation products included MNX, DNX, and TNX. Similarly, the ATSDR Toxicity Profiles identifies a number of photodecomposition products for TNT and nitrate, nitrite, and formaldehyde for HMX. A study of the photolytic half-lives of RDX, HMX, and TNT in LSC surface waters would provide information how long the site contaminants would be expected to be present in surface water.

Water quality criteria for PCA, TCA, and TCE and their breakdown products should be presented as they are known contaminants in site groundwater. Their discharge to surface waters must be monitored as long as site groundwater continues to be impacted.

The RDX chronic aquatic criterion needs to be revised to 1,870 µg/L as noted in Comment 33.

Response EPA-17: This comment identifies several separate issues. These are discussed in sequence below.

Comment EPA-17(1): Section 2.6 should include a discussion of why the human health risks from incidental contact/ingestion of surface water are not an issue,

Response EPA-17(1): The alternative water quality standards that were developed considered the human health risks from incidental contact/ingestion of surface water. Section 2.6 second bullet states the following:

- “2. For the full body contact recreational user (i.e. public health criterion, incidental water intake)...”

This is the recreational user for which criterion are listed in Table 2-3 (formerly Table 2-1). The revised Table 2-3 (formerly Table 2-1) is presented as Attachment 5 to this comment response document.

Comment EPA-17(2): This section should be modified to include discussion of the complete explosive/organic breakdown products, which could potentially be present in groundwater at MTA/OJT,

Response EPA-17(2): The US ACE WES proposed that groundwater monitoring be conducted at the ABG for the following degradation products of explosives.

- 2,4-Diamino-6-nitrotoluene
- 2,6-Diamino-4-nitrotoluene
- 2,2',6,6'-Tetranitro-4,4'-azoxytoluene (4,4'-TN-AZOXY)
- 3,5-Dinitroaniline
- 1,3,5-Trinitroso-1,3,5-hexahydrotriazine (TNX)
- 1-Nitroso-3,5-dinitro-1,3,5-hexahydrotriazine (MNX)

Eight rounds of groundwater monitoring have been conducted at SWMU 3 for these constituents as part of the RCRA Part B permit groundwater-monitoring program for the MTA. The details of the groundwater monitoring program are described in the Groundwater Monitoring Plan (TtNUS, 1999a), the Quality Assurance Project Plan (TtNUS, 1999b), and The Field Sampling Plan (TtNUS, 1999c). The monitoring plan included monitoring of 18 wells, 2 springs, and 2 surface water locations. All samples were analyzed utilizing SW-846 Method 8330 (i.e., standard explosive suite). Additionally, 8 wells, 2 springs, and 2 surface water location samples were analyzed using the modified SW-846 Method 8330 for the explosive degradation products, which are listed above. The results are included in the annual groundwater monitoring reports for CY 2000 and 2001.

The following summarizes the data collected during the eight rounds of the groundwater sampling for explosive degradation products, which were identified by the USACE WES:

- 2,4-Diamino-6-nitrotoluene was not detected,
- 2,6-Diamino-4-nitrotoluene: 1 detection in 64 samples (0.8 µg/L in 03C10),
- 4,4'-TN-AZOXY: 2 detections in 64 samples (0.66 and 1.8 µg/L in 03C10),
- 3,5-Dinitroaniline was not detected
- TNX was not detected,
- MNX: 8 detections in 64 samples (7 in 03C10 ranging from 2.2 to 3.1 µg/L, 1 in 03C12 at 0.32, and 1 at Spring A at 2.4 µg/L).

There is adequate information to suggest that the data collected during the eight rounds of monitoring is sufficient and that the concentration of the degradation products is not significant enough to warrant inclusion in subsequent groundwater monitoring rounds. However, analysis of the degradation products would be conducted in the final round of sampling.

TtNUS (Tetra Tech, NUS, Inc.), 1999a. Final Ground Water Monitoring Plan for the Ammunition Burning Grounds, Old Rifle Range, and Demolition Range. Naval Surface Warfare Center Crane Division, Crane, Indiana. Southern Division Naval Facilities Engineering Command. September.

TtNUS, 1999b. Final Quality Assurance Project Plan for RCRA Ground Water Monitoring at the Ammunition Burning Grounds, Old Rifle Range, and Demolition Range. Naval Surface Warfare Center Crane Division, Crane, Indiana. Southern Division Naval Facilities Engineering Command. February.

TtNUS, 1999c. Final Field Sampling Plan for RCRA Ground Water Monitoring at the Ammunition Burning Grounds, Old Rifle Range, Demolition Range, and Old Jeep Trail. Naval Surface Warfare Center Crane Division, Crane, Indiana. Southern Division Naval Facilities Engineering Command. September.

Comment EPA-17(3): A discussion of the expected types and fate of explosives breakdown products for RDX, TNT, HMX, which could be present in site groundwater and/or surface water should be presented. For example, the ATSDR Toxicity Profile for RDX identifies formaldehyde and nitrosamines as photoproducts identified from photolysis of RDX in aqueous solution; anaerobic biodegradation products included MNX, DNX, and TNS. Similarly, the ATSDR Toxicity Profiles identify a number of photodecomposition products for TNT and nitrate, nitrite, and formaldehyde for HMX; and

Response EPA-17(3): A literature study was conducted and various experts in the field were consulted. The White Paper describes the study, the technical evaluations, and the resulting recommendations for monitoring of degradation products of explosives in groundwater and surface water.

None of the primary RDX degradation products (MNX, DNX, and TNX) are included in the analytical suite for the routine SW-846 Method 8330 analytical procedure for explosives in water. However, these primary RDX degradation products can be analyzed by a modification to SW-846 Method 8330.

None of the primary TNT degradation products (4-hydroxylamino-2,6-dinitrotoluene, 2-hydroxylamino-4,6-dinitrotoluene, and 2,4,6-trinitrobenzylalcohol) are included in the analytical suite for the routine SW-846 Method 8330 analytical procedure for explosives in groundwater. However, five intermediate TNT degradation products (1,3,5-trinitrobenzene, 2,4-dinitrotoluene, 2,6-dinitrotoluene, 2-amino-4,6-dinitrotoluene, and 4-amino-2,6-dinitrotoluene) are included in the SW-846 Method 8330 analyte list and three intermediate TNT degradation products (2,2',6,6'-tetranitro-4,4'-azoxytoluene, 2,4-diamino-6-nitrotoluene, and 2,6-diamino-6-nitrotoluene) can be analyzed by using the modification to SW-846 Method 8330.

Therefore, the Navy is proposing to include, the modified SW-846 Method 8330 analytical procedure for the RDX degradation products (MNX, DNX, and TNX) and the TNT degradation products (2,2',6,6'-tetranitro-4,4'-azoxytoluene, 2,4-diamino-6-nitrotoluene, and 2,6-diamino-6-nitrotoluene) in the final round of sampling at SWMU 3.

Section 2.6 has been modified to include MNX, DNX, TNX, 2,4-diamino-6-nitrotoluene, 2,6-diamino-4-nitrotoluene, and 2,2',6,6'-tetranitro-4,4'-azoxytoluene. The 5th paragraph in Section 2.6 has been modified as follows:

"In accordance with Indiana requirements [327 IAC 2-1-6(a)(2)(E)], surface WQC must be met at the location of the point of use. For consumption of organisms from the waterbody and only incidental ingestion of the water, this will be outside the mixing zone. For public water systems, this will be at the point of the public water system intake. For protection of off-site receptors, these locations (see Figure 1-3) are defined as follows:

1. For warm water aquatic receptors, this location would be at the first accessible point downstream of the mixing zone at a point where a bridge on the county road crosses LSC.
2. For the full body contact recreational user (i.e., public health criterion, incidental water intake), this location would be at the first accessible point downstream of the mixing zone at a point where a bridge on the county road crosses LSC.
3. For protection of public water supplies, this location would be the closest location from which LSC surface waters are withdrawn for public water supply (i.e., Shoals Water Intake)."

Section 2.6, Subsection RDX, 2A-DNT, and 4A-DNT has been revised as follows:

"RDX, MNX, DNX, TNX, TNT, 2,4-DNT, 2,6-DNT, 4,4'-TN-AZOXY, 2A-DNT, and 4A-DNT

"Alternative WQC were developed for RDX, RDX degradation products [MNX (hexahydro-1,3,5-mononitroso-1,3,5-triazine), DNX (hexahydro-1,3,5-dinitroso-1,3,5-triazine), TNX (hexahydro-1,3,5-trinitroso-1,3,5-triazine)], TNT, and TNT degradation products [2,4-diamino-6-nitrotoluene (2,4-DNT), 2,6-diamino-4-nitrotoluene (2,6-DNT), and 2,2'-6,6'-tetraamino-4,4'-azoxyltoluene (4,4'-TN-AZOXY), 2A-DNT, and 4A-DNT]. Appendix E includes the data for RDX and these RDX degradation products in groundwater, spring, and surface water samples collected at the ABG since 1998.

"Based on the Indiana WQC for surface waters, the concentrations of RDX, RDX degradation products, TNT, and TNT degradation products concentrations in LSC must be limited to concentrations that would ensure maintenance of a balanced warm water aquatic community, that would protect the recreational user, and that would protect public water supplies (at the point where water is withdrawn for drinking water or industrial use) for the most stringent of the three criterion. Applicable State and federal criteria, standards, and regulations are as follows:

- *Under 327 Indiana Administrative Code (IAC) 2-1-6(a)(2)(C), Procedures for Calculation of Criteria, the RDX chronic aquatic criterion (CAC) was determined to be 1,870 µg/L (see Appendix E), and the RDX terrestrial life cycle safe concentration (TLSC) was determined to be 2,800 µg/L (see Appendix D, Table E-1).*
- *The CAC for 4,4'-TN-AZOXY as 1,3,5-trinitrobenzene was determined to be 11 µg/L, and the 4,4'-TN-AZOXY TLSC was determined to be 2,000 µg/L.(see Appendix D; Tables E-2 and E-3).*
- *The TNT CAC was determined to be 90 µg/L; and, the TNT TLSC was determined to be 67 µg/L (see Appendix D; Tables E-2 and E-3).*
- *Springs A, A', B, and C can be considered to be equivalent to National Pollution Discharge Elimination System (NPDES) discharge points.*
- *The RDX and degradation products water quality-based effluent limitation (WQBEL) established under 327 IAC 5-2-11.1 for public health criteria (incidental water intake only) was determined to be 86 µg/L for RDX compounds (Appendix D; Calculation Sheet C.1.1).*
- *The 2,4-D-6-NT, 2,6-D-4-NT, 2A-DNT or 4A-DNT WQBELs established under 327 IAC 2-1-8-5 and 2-1-8-6 for public health criteria (incidental water intake only) were each determined to be 1,350 µg/L (Appendix D; Calculation Sheets C.2.1, C.2.2, and C.4.1).*

- The 4,4'-TN-AZOXY WQBELs established under 327 IAC 5-2-11.1 for public health criteria (incidental water intake only) were each determined to be 19,000 µg/L for 1,3,5-trinitrobenzene as its surrogate (Appendix D; Calculation Sheets C.5).
- The RDX and degradation products public water supply point of intake criterion is 3 µg/L for RDX compounds (Appendix D; Calculation Sheet C.1).
- The 2,4-DNT, 2,6-DNT, 2A-DNT, or 4A-DNT WQBELs for public water supply intake were determined to be 67 µg/L for amino-dinitrotoluene compounds (Appendix D; Calculation Sheets C.2.1, C.2.2, and C.4.1).
- The 4,4'-TN-AZOXY WQBELs for public water supply intake were determined to be 1,000 µg/L for 1,3,5-trinitrobenzene as its surrogate (Appendix D; Calculation Sheets C.5)."

Comment EPA-17(4): A study of the photolytic half-lives of RDX, HMX, and TNT in LSC surface waters would provide information how long the site contaminants would be expected to be present in surface water.

Response EPA-17(4): There is no information available for LSC regarding photolytic half-lives of RDX, HMX, or TNT. Literature information on photolytic half-lives of these explosives in surface water is sparse. The White Paper (see the response to the previous comment) contains the photolytic half-life information that was available.

No change was made in response to this comment.

Comment EPA-17(5): Water quality criteria for PCA, TCA, and TCE and their breakdown products should be presented as they are known contaminants in site groundwater. Their discharge to surface waters must be monitored as long as site groundwater continues to be impacted.

Response EPA-17(5): Monitoring of groundwater, surface water, and spring waters will be conducted for volatile organics. These will include PCA, PCE, TCE, 1,1-DCE, cis-1,2-DCE, trans-1,2-DCE and vinyl chloride. MCLs for spring and surface waters are now presented.

Comment EPA-17(6): The RDX chronic aquatic criterion needs to be revised to 1,870 ug/L as noted in Comment 33.

Response EPA-17(6): See the response to Comment EPA-33.

Comment EPA-18: The last paragraph of Section 2.7 states that only MCS for current receptors are presented in Table 2-1, yet the future lifelong resident is present in the table. This paragraph also states that groundwater MCSs have not been developed because LUCs will be implemented. Groundwater MCS for COCs and their breakdown products should be developed so that a groundwater monitoring endpoint will be known under the CMIP.

Response EPA-18: The last sentence of Section 2.7 has been replaced with the following two sentences:

"Groundwater usage will be prevented through the implementation of LUCs. However, MCSs have been developed so that endpoints can be established in the Corrective Measures Implementation Plan CMIP."

Comment EPA-19: Section 2.8 Conceptual Site Model, Last Bullet on Page 2-24: Delete the term "excess" and replace it with "adverse."

Response EPA-19: The former 12th Bullet (now the 13th Bullet) of the 2nd paragraph in Section 2.8 has been revised as follows:

- *"No adverse risk to ecological receptors at the OJT or in LSC has been identified."*

Comment EPA-20: Referring to the first bullet on page 2-23, it would be useful if additional text could be included to better explain why studies conducted to date have not been able to determine the relative distribution of RDX and TCE.

Response EPA-20: To date, no studies have been conducted to quantify the mass of sorbed RDX and TCE within the bedrock aquifer. Performing this type of evaluation would be costly and subject to numerous technical problems, assumptions, and significant uncertainties in the spatial distribution of contaminants within the bedrock aquifer units (i.e., the technical feasibility of an accurate evaluation and correlation is prone to significant error).

The 2nd bullet in the 1st paragraph of Section 2.8 has been modified as follows:

- *"The relative distribution of RDX and TCE contamination sources between the overburden, bedrock, and karst system is not known because studies to determine their absorption into the aquifer bedrock are subject to numerous technical problems, assumptions, and significant uncertainties in the spatial distribution of contaminants within the bedrock aquifer units (i.e., the technical feasibility of an accurate evaluation and correlation is prone to significant error)."*

Comment EPA-21: The second to the last bullet on page 2-24 should include lead as presenting excess risk to a future child receptor at the OJT.

Response EPA-21: Lead was detected in only one surface soil sample (10,200 mg/kg, 03SS24002) at a concentration that exceeds the OSWER screening level of 400 mg/kg for residential exposures to lead in soil. The second highest detected concentration of lead in surface and subsurface soil at the OJT was 244 mg/kg. Excessive risk is anticipated for a hypothetical future child resident exposed to lead in surface soil in the vicinity of 03SS24002. Reasonable future uses for the OJT do not include residential housing.

A new 12th Bullet has been added to the 2nd paragraph of Section 2.8 as follows:

- *"Excess risk from lead is present for the future child resident. However, exposures to lead in surface soil outside of one OJT surface soil sample (03SS24002) would be within the goals described in the 1994 OSWER directive of no more than 5 percent of children with blood-lead levels exceeding 10 microgram per deciliter (µg/dL). Reasonable future uses for the OJT do not include residential housing."*

Comment EPA-22: Table 2-1 should note the source of the surface soil lead value for MTA construction worker and TCE surface water for OJT worker.

Response EPA-22: The 540 mg/kg value for the surface soil MSC for the construction worker is a calculated value. This calculation has been added to end of Appendix A in the HHRSE (Appendix B) and is provided as Attachment 6 to this comment response document. Calculations are based on Source: U.S. EPA (1996). Recommendations of the Technical Review Workgroup for Lead for an Interim Approach to Assessing Risks Associated with Adult Exposures to Lead in Soil.

The footnotes contain a typo: "MSC".

Response EPA-22 (continued): The "MSC" typographical error has been corrected to "MCS" see Attachment 5.

The MCS values presented in the table for LSC surface waters will need to be changed. The LSC surface water receptor exposure ACLs/MCSs developed under 327 IAC Article 2 for consumption of organisms and incidental intake (e.g. RDX = 86 ug/L) should be applied at the appropriate point of compliance for all COCs and their corresponding full degradation product chains.

Response EPA-22 (continued): The appropriate point was utilized to calculate the alternative WQC [i.e., the edge of the mixing zone for indirect contact (Creek B; CR-B) and the point of use for public water system (Shoals Intake)].

For the public water system, the concentrations were back calculated to the edge of the mixing zone point of compliance (i.e., Creek B; CR-B) based on flow data for LSC.

No change was made in response to this comment.

Under 327 IAC Article 5, the calculated surface water ACLs/MCSs shall apply outside the mixing zone. The Navy needs to determine an appropriate mixing zone and surface water monitoring location under 327 IAC 2-1-4. If all dry weather flow in the upstream portions of LSC emanates from Springs A and C, perhaps an appropriate monitoring point would be an area some short distance away from the inflow (mixing zone) of Johnson Hollow.

Response EPA-22 (continued): The Navy is collecting samples in LSC at existing sample location Creek B (CR-B) that is located downstream of Spring A. The Navy proposes the point of compliance to be the current sample location at Creek B.

The next to the last paragraph in Section 2.7 has been revised as follows:

"In accordance with Indiana requirements [327 IAC 2-1-6(a)(2)(E)], surface WQCs must be met at the location of the point of use. For consumption of organisms from the waterbody and only incidental ingestion of the water, this will be outside the mixing zone. For public water systems, this will be at the point of the public water system intake. For protection of off-site receptors, these locations (see Figure 1-3) are defined as follows:

1. *For warm water aquatic receptors, this location would be outside the mixing zone in LSC (Creek B; CR-B) that is located approximately ¼ mile downstream of where Spring A enters LSC.*
2. *For the full body contact recreational user (i.e., public health criterion, incidental water intake), this location would be outside the mixing zone at CR-B which is located approximately ¼ mile downstream of where Spring A enters LSC.*
3. *For protection of public water supplies, this location would be the closest location from which LSC surface waters are withdrawn for public water supply (i.e., Shoals Water Intake)."*

MCS for Spring discharge monitoring should be developed using groundwater criteria. The discussion and calculations in Appendix D should be modified accordingly.

Response EPA-22 (continued): Groundwater, springs, and surface waters will be monitored for explosives, metals, and volatile organic compounds (VOCs). The springs are the locations where groundwater becomes surface water. Protection of surface water uses will be a primary objective of the overall monitoring program. The calculations that are provided in Appendix C apply only to

surface waters. Therefore, it is not appropriate to modify the discussion and calculations in Appendix D.

No change was made in response to this comment.

Comment EPA-23: Figure 2-1, 03SB061 contains a typo 'CE'. What are the soil borings noted, but without associated data boxes? See also Comment 14.

Response EPA-23: The "CE" for 03SB061 on Figure 2-1 has been revised to "TCE." The soil borings shown on Figure 2-1 (Attachment 7) that do not have an associated data boxes are locations where surface / subsurface soils samples were collected. However, there were no detections of HMX, RDX, TNT, or TCE.

Comment EPA-24: The corrective measures alternatives presented in Sections 3.0 and 4.0 for the MTA should evaluate limited soil removals for lead and TCE. Lead is present at the surface at 14,600 ppm. There should also be discussion of Tetra Tech's evaluation of constructed wetlands/photochemical degradation potential of RDX in LSC surface waters. This could be a useful contingency treatment technology.

Response EPA-24:

Lead Removal: Limited soil removals for lead have not been evaluated because the area with the lead contamination is an operating OB unit that is under the complete control of the Navy. Remedial actions will be evaluated when the operating OB unit is shut down and closed.

No change has been made in response to this comment.

TCE Remediation: The distribution of TCE contamination between the overburden soil and bedrock is unknown. It is likely that there is a significant source of TCE in the bedrock resulting in the impact of remediation of any TCE contaminated soil on groundwater being highly doubtful. Even if the identified soils were the only source of TCE, successful TCE cleanup would still leave the aquifer as an unusable source of drinking water due to RDX contamination. Therefore, TCE remediation would not restore the aquifer.

No change was made in response to this comment.

Constructed Wetlands / Photochemical Degradation: Constructed wetlands were considered. However, the extremely high hydraulic loads during storm events (i.e., high flow conditions), makes it virtually impossible to construct a wetlands that would not be destroyed (i.e., washout periodically) during storm conditions resulting in periodic wetland reconstruction. Therefore, constructed wetlands / photochemical degradation does not appear to be a feasible contingency treatment technology.

No change was made in response to this comment.

Comment EPA-25: Table 3-3 contains a typo in the 3rd bullet under remedy: 'revives'.

Response EPA-25: The 3rd Bullet in the Remedy column for Surface water has been revised as follows:

- *"Recommended alternative: Periodic reviews to verify that concentrations of explosives are less than applicable criteria at any new public supply intakes"*

Comment EPA-26: Section 4.2.1.2, Source Control: Limited sources of VOC contamination exceeding migration to groundwater screening values exist at the MTA subsurface soils. RDX/explosives have been detected in soils and could be considered sources of contamination to groundwater. Similar comment for RDX at OJT (Section 4.2.2.1).

Response EPA-26: See response to Comment EPA-33

Comment EPA-27: The first bullet of Section 4.4.2 states that detailed evaluations of alternatives for the MTA are not necessary as the HHRA determined no unacceptable risk to current receptors and references the OJT RFI (TtNUS, 2005a). The MTA was not evaluated in that document.

Response EPA-27: The 1st Bullet in Section 4.4.2 has been revised as follows:

- *"Screening and detailed evaluations of alternatives to address excess risk from exposure to explosives, VOCs, and metals in groundwater at the MTA are not necessary because groundwater from the BC/BC aquifer is not currently used; and, LUCs will be implemented to prevent future groundwater use."*

Comment EPA-28: Section 4.4.3 is titled Surface Water yet the first bullet discusses MTA groundwater.

Response EPA-28: As discussed in Section 2, the source of surface water (LSC) is Springs A, B, and C, which are groundwater outcroppings. However, for clarity, the 1st Bullet in Section 4.4.3 has been revised as follows:

- *"Screening and detailed evaluations of alternatives to address excess risk from exposure to explosives, VOCs, and metals in surface water at the MTA are not necessary because the CMP has determined that there is no unacceptable risk for current receptors."*

Appendix B Comments

Comment EPA-29: Section 1: Please add text to explain that because of data validation issues, only the explosives data from 1993 were found suitable for risk assessment use.

Response EPA-29: The following text replaces the 3rd sentence of the 1st paragraph in Section 1:

"U.S. EPA conducted a review of the historical data for three SWMUs at Naval Surface Warfare Center (NSWC) Crane including SWMU 3. After their review was conducted, a procedural memorandum (U.S. EPA, 1997) was issued that listed the historical data that is acceptable for use in risk assessments. With respect to SWMU 3, only the explosives data was found to be acceptable for use in risk assessments."

Additionally, the following has been added to the references for the HHRSE:

"U.S. EPA (United States Environmental Protection Agency), 1997. Internal Memorandum to Carol Witt-Smith from Allen A. Debus, RCRA QAPP Coordinator. Historical Data Review for U.S. Navy Crane - 5 Laboratories (Southwest, Enseco, Anacon, Synergic, WES). June 24."

Comment EPA-30: The background screening value column contains a typo for Mercury: ND?

Response EPA-30: The Background Screening Value for mercury has been revised as follows: "ND."

Comment EPA-31: There appear to be a couple of typos towards the bottom of page 3-1: '1E-06' is present after the semicolon and '??' appears in the denominator on the right side of the equals sign.

Response EPA-31: To maintain the equation in the format as presented by U.S. EPA Region 9, the variable which is being solved for is indicated by "???" prefix.

The "1E-06" after the ":" in the 2nd paragraph of Section 3.0 has been deleted.

Appendix D Comments

Comment EPA-32: The second paragraph of Section 3.1 erroneously states that 120 ug/L is 'well below the public health WQC of 86 ug/L.' This error is repeated in the first paragraph of page 3-2 and Section 5.0.

Response EPA-32: The 2nd paragraph of Section 3.1 has been revised as follows:

"The information presented in Attachment F demonstrates that RDX concentrations generally decrease with increasing flow. The worst-case combination of RDX concentrations and flow rates was a Spring A RDX concentration of 120 µg/L at an estimated flow rate of 4 gpm. This is greater than the public health WQC (incidental water intake only) of 86 µg/L. However, this low flow condition (4 gpm) would preclude recreational use due to the lack of water in LSC. Additionally, 120 µg/L is greater than the public water supply intake WQC of 3 µg/L, which applies at the point of intake."

Additionally, the 5th paragraph of Section 3.1 has been revised as follows:

"Additionally, the impact to human receptors from incidental ingestion of surface water and consumption of stream fish (i.e., "sport-fishing" on Indian Creek immediately below the point where Sulfur Creek enters Indian Creek) was evaluated by development of a WQC. This WQC of 86 µg/L included the incidental ingestion of surface water [0.01 liters per day (L/day)] and consumption of stream fish [0.0065 kilograms of fish per day (kg/day)]. The maximum RDX concentration at either Spring A or Spring C (140 µg/L) is above this WQC (Appendix D, Tables D-1.1 and D-1.2). The worst-case combination of RDX concentrations and flow rates was a Spring A RDX concentration of 140 µg/L at an estimated flow rate of 4 gpm. However, this low flow condition (4 gpm) would preclude recreation use due to the lack of water in LSC. Additionally, 140 µg/L is above the public water supply intake WQC of 3 µg/L, which applies at the point of intake."

In addition, the 2nd paragraph of Section 5.0, Subsection RDX, has been revised as follows:

"The maximum Spring A or Spring C concentration of 140 µg/L exceeds the surface WQC for locations where there is no public water supply of 86 µg/L."

Comment EPA-33: Section 4.1, Paragraph 2, Last sentence, Page 4-1: A sentence needs to be inserted which states the chronic WQC for RDX was incorrectly calculated in the Parametrix and ENSR 2005 report. The chronic WQC value for RDX needs to be revised to 1.87 mg/L or 1,870 ug/L based on Comment 38 below.

Response EPA-33: The last two sentences in 2nd paragraph of Section 4.1 have been revised as follows:

"Acute and chronic WQC were developed for RDX as 3,100 and 3,070 µg/L, respectively (Parametrix and ENSR, 2005). However, U.S. EPA Region 5 has noted an error in the way the chronic value was calculated. The authors of one of the studies (Peters et al. 1991) incorrectly applied the toxicity test RDX solubility concentration of 17 mg/L to represent an acute value and inappropriately generated an acute-to-chronic ratio (ACR) of 3.6325. The correct freshwater ACR in Table 7-2 of ENSR (2005) should be the geometric mean of the two freshwater fish (Pimephales promelas) ACR values in Table 6-2 of ENSR (2005) which is 3.3047. This would cause the chronic RDX water screening

value to become 1.87 mg/L. Therefore, a chronic value of 1,870 µg/L will be used as the screening level for RDX in surface water at NSW Crane."

Additionally, a hand written note of these revisions have been made to Table 7-2 of the Parametric and ENSR 2005 report in Appendix D of the CMP.

Comment EPA-34: Section 4.1, Paragraph 3, Page 4-1: The text for the first sentence needs to delete the double entry for "terrestrial life."

Response EPA-34: The double entry for "terrestrial life" in the referenced section will be deleted.

The calculated terrestrial life cycle safe concentration (TLSC) is limited to ingestion of water by mammals. This value does not address mammalian exposure to contaminants from the ingestion of aquatic organisms and sediment.

Response EPA-34 (continued): TtNUS understands that the terrestrial life cycle safe concentration is limited to ingestion of water by mammals and does not address mammalian exposure to contaminants from the ingestion of aquatic organisms and sediment. However, RDX is not expected to accumulate in aquatic organisms or bind strongly to sediment. Therefore, these pathways are not a concern to mammals.

No change has been made to Appendix D in response to this comment.

Comment EPA-35: Section 4.1, Paragraph 4, Last Sentence, Page 4-1: The term "marine" needs to be deleted and replaced with "fresh water." As noted in Comment 33, the chronic WQC value for RDX needs to be revised to 1.87 mg/L or 1,870 ug/L.

Response EPA-35: The last sentence in 4th paragraph 4 of Section 4.1 has been revised as follows:

"The aquatic water quality for any location along LSC, Sulfur Creek, and East Fork White River indicates that RDX concentrations will not exceed the TLSC of 2,800 µg/L, or chronic WQC for freshwater organisms of 1,870 µg/L."

Note that the reference to acute WQC has been deleted from Section 4.1.

Comment EPA-36: Section 4.1, Paragraph 5, Last Sentence, Page 4-1: The aquatic life criterion needs to be the chronic value of 1.87 mg/L or 1,870 ug/L as noted in Comment 33. If an acute criterion is used, the rationale for using an acute criterion needs to be provided.

Response EPA-36: The aquatic life criterion in the referenced section has been changed to 1,870 µg/L. Note that the reference to acute WQC has been deleted from the 4th paragraph of Section 4.1.

Appendix E Comments

Comment EPA-37: Page 1-1, 2nd paragraph: The chronic WQC for RDX was incorrect calculated as discussed in Comment 33 and needs to be revised to 1.87 mg/L or 1,870 ug/L.

Response EPA-37: The last two sentences of the 2nd paragraph of Section 1 in Appendix E of the Alternative Water Quality Criteria has been revised as follows:

Acute and chronic WQC were developed for RDX as 3,100 and 3,070 µg/L, respectively (Parametrix and ENSR, 2005). However, U.S. EPA Region 5 indicated that there was an error in the way the chronic value was calculated. U.S. EPA Region 5 noted that the

authors incorrectly applied the toxicity test RDX solubility concentration of 17 mg/L from one of the studies (Peters et al. 1991) to represent an acute value and inappropriately generated an acute-to-chronic ratio (ACR) of 3.6325. The correct freshwater ACR in Table 7-2 of ENSR (2005) should be the geometric mean of the two freshwater fish (Pimephales promelas) ACR values in Table 6-2 of ENSR (2005) which is 3.3047. This would cause the chronic RDX water screening value to become 1.87 mg/L. Therefore, a chronic value of 1,870 µg/L will be used as the screening level for RDX in surface water at NSWC Crane."

Comment EPA-38: Attachment A, Section 3.2.1, Invertebrates, Page 3-3, Last Sentence:

The study by Peters et al. 1991 clearly stated that "RDX was not acutely toxic to any of the three invertebrates tested at the solubility limit of RDX in water." Both this report (ENSR 2005) and the ENSR 2001 report (The Toxicity and Bioaccumulation of Hexahydro-1,3,5-trinitro-1,3,5-triazine (RDX) to Aquatic Organisms: Literature Review and Recommendations) incorrectly applied the toxicity test RDX solubility concentration of 17 mg/L from the Peters et al. 1991 study to represent an acute value and inappropriately generated an acute-to-chronic ratio (ACR) of 3.6325 for *Ceriodaphnia dubia* as follows:

$$\text{ACR} = \text{acute/chronic} = 17 \text{ mg/L} / 4.68 \text{ mg/L} = 3.6325$$

Since an acute value for *C. dubia* does not exist, a specific ACR for *C. dubia* can not be calculated and the ACR for *C. dubia* needs to be deleted from the 2005 report discussion and Tables 3-2 and 6-2. Likewise, the ACR for Table 7-2 needs to be revised using the fish (*P. promelas*) ACR values (personal communication with U.S. EPA, ORD staff Dave Mount and Charles Stephan, author of the 1985 Guidelines EPA 822/A85/100) in Table 6-2. A default ACR of 18 needs to be deleted since it applies only to the development of a secondary chronic value under the Great Lakes Initiative Tier II procedure and was not intended to revise the 1985 Guidelines. The freshwater ACR in Table 7-2 will be the geometric mean of the two fish (*P. promelas*) ACR values in Table 6-2 which is 3.3047 and the chronic RDX water screening value will become 1.87 mg/L.

Response EPA-38: Please see the Navy's responses to Comments EPA-33, 35, 36 and 37. No further revision to the text were necessary to address this comment.

ATTACHMENT 1

HAZARDOUS WASTE TANK REMOVAL INFORMATION

ENVIRONMENTAL PROTECTION SAMPLING RECORD

Department of the Navy
Naval Surface Warfare Center
Crane, IN 47522

SAMPLING SITE <i>ABG - SI Holding TANK</i>		PURPOSE <i>Closure - to Surface Impoundment</i>	
SAMPLE DATE <i>8/31/94</i>		TIME <i>1400 - 1430</i>	
SAMPLE NUMBER <i>SI TANK-1-08044</i>	SAMPLE NUMBER <i>SI TANK-2-08044</i>	SAMPLE NUMBER <i>SI TANK-3-08044</i>	
LOCATION <i>From below excavated</i>	LOCATION <i>From below excavated</i>	LOCATION <i>From below excavated</i>	
<i>Explosive waste water</i>	<i>Explosive waste water</i>	<i>explosive waste water</i>	
<i>TANK</i>	<i>TANK</i>	<i>TANK</i>	
OBSERVATIONS <i>Clay Gravel</i>	OBSERVATIONS <i>SAND / Clay</i>	OBSERVATIONS <i>Clay - very wet</i>	
<input checked="" type="checkbox"/> GRAB	<input type="checkbox"/> COMPOSITE	<input checked="" type="checkbox"/> GRAB	<input type="checkbox"/> COMPOSITE
ANALYTICAL PARAMETERS Clay / Gravel		ANALYTICAL PARAMETERS	
SAMPLER'S SIGNATURE			CODE
DATE SAMPLES SENT		ANALYTICAL LAB	
REMARKS			

ENVIRONMENTAL PROTECTION SAMPLING RECORD

Department of the Navy
Naval Surface Warfare Center
Crane, IN 47522

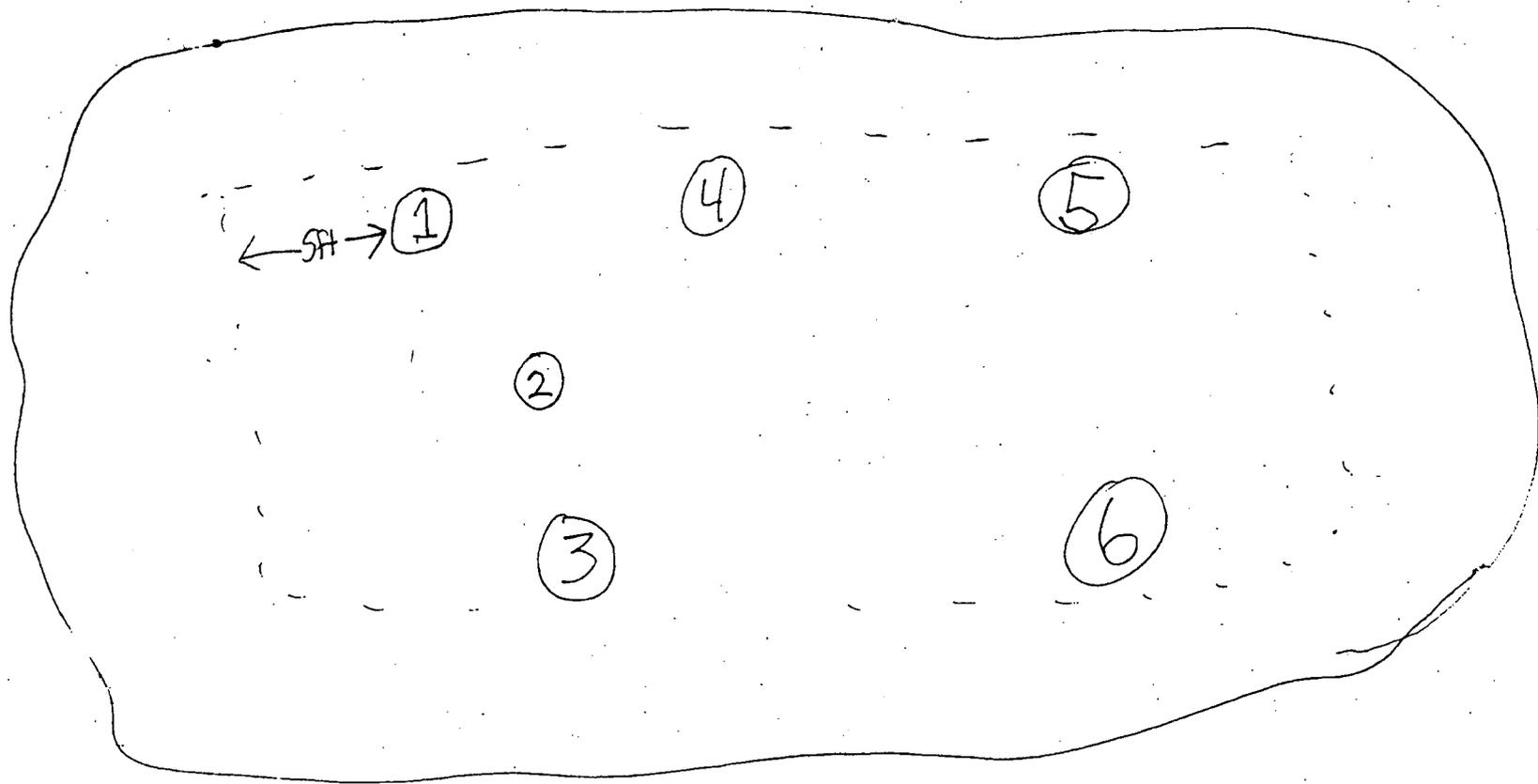
SAMPLING SITE <i>ABG-SI Holding TANK</i>	PURPOSE <i>Closure Surface Impoundment</i>
SAMPLE DATE <i>8/4/94</i>	TIME <i>1400-1430</i>

SAMPLE NUMBER	SAMPLE NUMBER	SAMPLE NUMBER
<i>SI TANK-4-08044</i>	<i>SI TANK-5-08044</i>	<i>SI TANK-6-08044</i>
LOCATION <i>From below excavated</i>	LOCATION <i>From below excavated</i>	LOCATION <i>From below excavated</i>
<i>Explosive waste water</i>	<i>Explosive waste water</i>	<i>explosive waste water</i>
<i>TANK</i>	<i>TANK</i>	<i>TANK</i>
OBSERVATIONS <i>SAND/clay</i>	OBSERVATIONS <i>Clay/Gravel</i>	OBSERVATIONS <i>Clay/sand</i>
<input checked="" type="checkbox"/> GRAB <input type="checkbox"/> COMPOSITE ANALYTICAL PARAMETERS	<input checked="" type="checkbox"/> GRAB <input type="checkbox"/> COMPOSITE ANALYTICAL PARAMETERS	<input checked="" type="checkbox"/> GRAB <input type="checkbox"/> COMPOSITE ANALYTICAL PARAMETERS

SAMPLER'S SIGNATURE	CODE

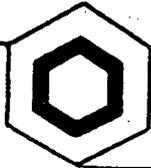
DATE SAMPLES SENT	ANALYTICAL LAB

REMARKS



ANACON, INC.

730 FM 1959
HOUSTON, TX 77034
(713) 922-7000



ANALYTICAL AND CONSULTING LABORATORIES
Environmental, Chemical, and Petroleum

NON-NPDES SAMPLES

COMMANDER CRANE DIVISION
NAVAL SURFACE WARFARE CENTER
CODE 09510, BLDG.# 2694
CRANE, INDIANA 47522-5009
ATTN: PHIL KEITH

ANACON NO: 11221
DATE RECEIVED: 09/09/94
DATE OF REPORT: 09/23/94

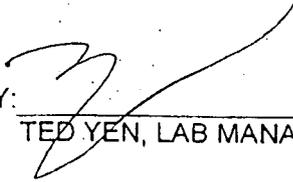
CONTRACT NO.: N62472-90-D-7205

PARAMETERS	CODE	SAMPLE ID						
		S1-TANK 1-08044	S1-TANK 2-08044	S1-TANK 3-08044	S1-TANK 4-08044	S1-TANK 5-08044	S1-TANK 6-08044	BLDG. 34- 09024
ARSENIC	AA	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	
BARIIUM	AA	193.8	8.8	942.0	198.3	136.3	186.7	
CADMIUM	AA	5.2	1.2	6.5	5	5.6	3.4	
CHROMIUM	AA	12.8	3.5	12.4	11.4	7.9	7.7	
LEAD	AA	14.6	2.4	55.1	19	20.5	13.9	
MERCURY	AA	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	
SELENIUM	AA	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	
ZINC	AA							
CYANIDE	AC							
BARIIUM	AA							
NICKEL	AA							
OIL & GREASE	AB							
NO3-N	AC							
NO2-N	2AH							
EXPLOSIVES	AD							
TNT								
RDX								
HMX								
% SOLID	AC							
PCB	AH							<1.0
CHLORIDE	AA							
PHOSPHORUS	AB							

ALL RESULTS ARE IN mg/kg

CONTROL NO. 155

SUBMITTED BY:


TED YEN, LAB MANAGER

ENVIRONMENTAL PROTECTION TEST SAMPLES CUSTODY CHAIN
 NWSCC 5090/6 (7/88)

SAMPLING DATE	SAMPLE I.D.	CONTAINER (PARAMETERS)
8/4/94	SI-TANK-1-08044	REACTIVITY, HMX, RDX, TNT, PETN
8/4/94	SI-TANK-2-08044	REACTIVITY, HMX, RDX, TNT, PETN
8/4/94	SI-TANK-3-08044	REACTIVITY, HMX, RDX, TNT, PETN
8/4/94	SI-TANK-4-08044	REACTIVITY, HMX, RDX, TNT, PETN
8/4/94	SI-TANK-5-08044	REACTIVITY, HMX, RDX, TNT, PETN
8/4/94	SI-TANK-6-08044	REACTIVITY, HMX, RDX, TNT, PETN

SAMPLER PREPARER (SIGNATURE)	TRANSFERRED TO (SIGNATURE)	DATE	TIME	ORGANIZATION
<i>Danny D. Garland</i>		14 Sept. 94	12:20	CODE 095
	<i>Sandra Bishop</i>	14 Sep 94	12:55	CODE 4076

PRELIMINARY RESULTS

PW SOIL SAMPLES EXPLOSIVE DETERMINATION
HPLC METHOD

SAMPLE ID.	HMX MG/KG	RDX MG/KG	TNT MG/K	PETN MG/KG
SI-TANK-1-08044	0.4	0.6	< 0.1	< 0.5
SI-TANK-2-08044	0.3	0.3	< 0.1	< 0.5
SI-TANK-3-08044	8.8	0.2	< 0.1	0.5
SI-TANK-4-08044	< 0.1	< 0.1	< 0.1	< 0.5
SI-TANK-5-08044	0.2	< 0.1	< 0.1	2.4
SI-TANK-6-08044	< 0.1	< 0.1	< 0.1	< 0.5

DETECTION LIMITS = HNX < 0.1 MG/KG
RDX < 0.1 "
TNT < 0.1 "
PETN < 0.5 "

ANALYTICAL METHODS: HMX, RDX and TNT were determined by High Pressure Liquid Chromatography (HPLC) using a C18 Reversed-Phase analytical column, Ultra Violet (UV) detector, set at 425 nanometers absorption wavelength. PETN explosive was determined by HPLC utilizing four C18 Reversed-Phase analytical columns, and a Varex ELSD-MKIIA Evaporative Light Scattering Mass Detector.

REACTIVITY RESULTS

<u>SAMPLE ID</u>	<u>IMPACT SENSITIVITY,</u> <u>CM/KG-CM</u>	<u>FRICITION SENSITIVITY</u>
SI-TANK-1-08044	NON-REACTIVE	NON-REACTIVE
SI-TANK-2-08044	50% FIRE HEIGHT GREATER THAN MAX. HEIGHT OF 159 CENTIMETERS	NON-REACTIVE
SI-TANK-3-08044	NON-REACTIVE	NON-REACTIVE
SI-TANK-4-08044	NON-REACTIVE	NON-REACTIVE
SI-TANK-5-08044	NON-REACTIVE	NON-REACTIVE
SI-TANK-6-08044	NON-REACTIVE	NON-REACTIVE

NOTE 1: Sample SI-TANK-08044 exhibited two fires at 159 centimeters during the first 10 drops. Then 15 more drops were made with three more fires exhibited at 159 centimeters. The mass of the weight dropped was 2 kilograms.

NOTE: Title 40, Code of Federal Regulations, part 261.23, Characteristic of reactivity, paragraph (a)-6, states that a solid waste exhibits the characteristic of reactivity if a representative sample of the waste has the following property; It is capable of detonation or explosive reaction if it is subjected to a strong initiating source or if heated under confinement.

REACTIVITY DATA GENERAL COMMENTS

IMPACT: The 50% fire height or energy is the value at which there is a 50% probability that, should the material be subjected to the equivalent of that energy impulse, displays an energetic reaction. The 50% fire energy, in Kg-cm, is now the preferred method of presenting this value, as it may easily account for variations in the mass of the impact producing object. The mass of the impacting object, times the distance through which it falls to achieve the velocity with which it impacts, gives the impact energy in Kg-cm.

FRICITION: The frictional forces are applied by a semi-contained spinning rod. The foot-pound energies that are recorded, however, may be translated into linear motions as well. For example, a 150 foot-pound result may be equated to a 15-pound mass moving over 10 feet, or a 1.5 pound mass moving over 100 feet, and so on. The prime factor is that the same portion of material is subjected to the entire force.

CLASSIFICATION CRITERIA

The following table represents the energy levels required to classify a material with respect to its sensitivity to various forms of external energy input.

Sensitivity Level	Impact height (cm)	50% fire energy (Kg-cm)	Friction (Foot-pound)
Dangerous	<10	<20	<30
High	<32	<65	<100
Moderate	<100	<200	<500
Low	<159	<320	<1000
Very Low	< 50% fires at 159 cm/320 Kg-cm		>1000

Non-reactive No energetic reactions observed at upper limit of apparatus being used.

09/28/94

STATUS OF SURFACE IMPOUNDMENT CLOSURE
16 SEPTEMBER 1994

1. THE FOLLOWING PORTIONS OF THE SURFACE IMPOUNDMENT HAVE BEEN COMPLETED.

A. SURFACE IMPOUNDMENT #1 (SI #1) HAS HAD THE LAYER OF SOIL ABOVE THE LINER SAMPLED, ANALYZED AND FLASH BURNED.

B. THE LINER HAS BEEN REMOVED FROM SI #1. IT CAME APART DURING REMOVAL AND WAS ALSO FLASH BURNED FOR DECONTAMINATION.

C. SURFACE IMPOUNDMENT #2 (SI #2) HAS BEEN SAMPLED AND ANALYZED. WITH THE ANALYTICAL IT WAS DETERMINED THAT ONLY A SMALL AREA SHOWED EXPLOSIVE CONTAMINATION AND THAT MATERIAL WAS REMOVED AND FLASHED.

D. SURFACE IMPOUNDMENT #3 (SI #3) HAS HAD THE SOIL ABOVE THE LINER SAMPLED AND ANALYZED. THERE WAS ACTUALLY VERY LITTLE CONTAMINATION FOUND.

E. BOTH TANKS HAVE BEEN REMOVED AND FLASHED FOR DECON WITH THE TANKS BEING CUT UP AND MANAGED THROUGH DRMO AS SCRAP METAL.

F. SAMPLES HAVE BEEN PULLED FROM BELOW THE EXPLOSIVE WASTE WATER TANK. ANALYTICAL DATA HAS NOT BEEN RECEIVED FROM ANACON OR B-2707. SAMPLES WERE SENT THE WEEK OF 19 SEPTEMBER.

G. SAMPLES HAVE NOT BEEN PULLED FROM BELOW THE PHOSPHOROUS WASTE WATER TANK. A FRESH WATER SPRING KEEPS WATER IN THIS HOLE. IT SHOULD ALSO BE NOTED THAT THE PHOSPHOROUS TANK WAS PLACED IN THE GROUND WHERE THERE HAD BEEN AN OPEN BURN TRENCH IN THE PAST. THIS IS EVIDENT DUE TO THE ASH RESIDUES THAT IS IN THE BOTTOM OF THE HOLE.

H. THE FLOW PIPE THAT RUNS FROM SI #1 AND SI #2 HAS HAD APPROXIMATELY 25% FLUID TESTED. THERE APPEARS TO BE A LEAK IN THE REMAINING 75%.

I. SI #1 WAS SAMPLED BELOW THE LINER AND MORE CONTAMINATION WAS FOUND HERE THAN ABOVE. WHEN TALKING TO THE ABG PERSONNEL IT IS MY OPINION THAT THIS IS DUE TO THE FACT THAT BURNING TOOK PLACE IN THESE UNITS BEFORE THEY WERE UPGRADED WITH THE LINER. WITH THIS DATA IT WAS DECIDED TO SAMPLE DEEPER TO ATTEMPT TO DETERMINE HOW MUCH SOIL MAY BE INVOLVED. SAMPLES WERE PULLED 18 TO 24 INCHES AND CONTAMINATION WAS FOUND MOST OF THE WAY DOWN. THIS WILL MAKE CLEAN CLOSURE VERY HARD TO ATTAIN.

09/28/94

1

STATUS OF SURFACE IMPOUNDMENT CLOSURE
16 SEPTEMBER 1994
PAGE 2

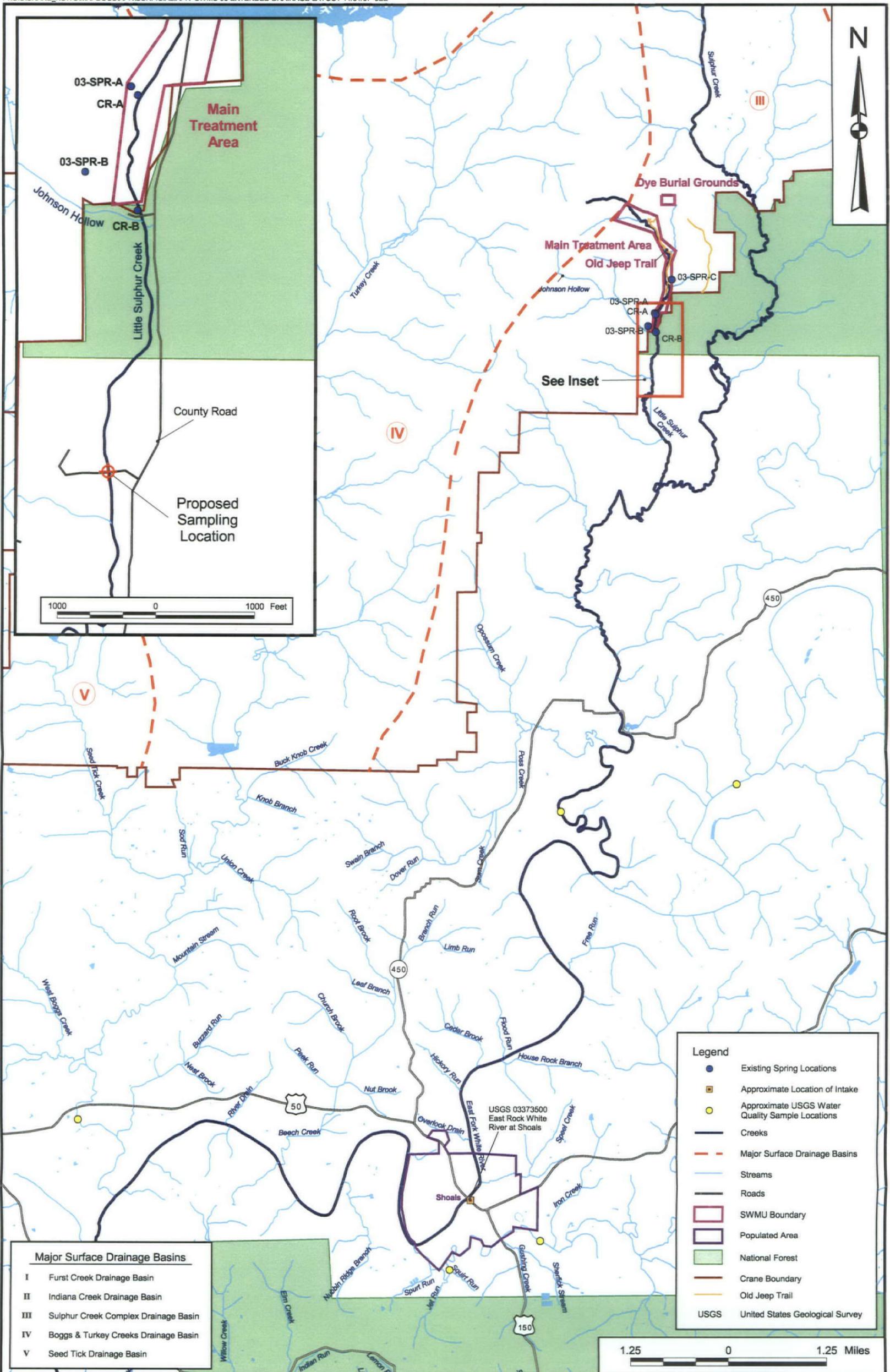
2. WITH THE DATA THAT WE HAVE AT THIS POINT AND THE FACT THAT WE ARE SO FAR BEHIND SCHEDULE, I CONTACTED PAULA BANSCH AT IDEM ON THURSDAY 15 SEPTEMBER TO DISCUSS OUR OPTION AND TO GAIN ADVICE. THERE IS NO SPECIFIC REGULATION THAT WOULD BE APPLIED THAT SHE WAS AWARE OF.

WE DISCUSSED VARIOUS WATS WE COULD APPROACH THIS. BASICALLY THEY INCLUDE A PROPOSAL BY US, BASED ON OUR DATA, TO MODIFY THE PLAN TO CHANGE FROM ATTEMPTING CLEAN CLOSURE TO CLOSING THE UNITS IN PLACE. THIS WILL INCLUDE IDEM ESTABLISHING POST CLOSURE ACTIVITIES. THIS WOULD POSSIBLY RUN IN CONJUNCTION WITH THE CORRECTIVE ACTION ACTIVITIES AT THE ABG. THIS COULD ALLOW US TO ACTUALLY CLOSE THE HOLES.

3. PAULA AND I BOTH AGREED THAT IT WOULD BE BEST IF WE COULD MEET TO BRIEF HER AND ALLOW HER TO LOOK AT THE DATA AND THE SURFACE IMPOUNDMENT. PAULA INDICATED SHE WOULD BE AVAILABLE FROM 27 SEPTEMBER TO 14 OCTOBER TO COME DOWN. I AM TO CALL HER ON FRIDAY 16 SEPTEMBER TO ESTABLISH A DATE AND TIME.

ATTACHMENT 2

FIGURE 1-3

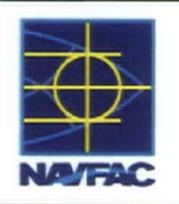


Major Surface Drainage Basins	
I	Furst Creek Drainage Basin
II	Indiana Creek Drainage Basin
III	Sulphur Creek Complex Drainage Basin
IV	Boggs & Turkey Creeks Drainage Basin
V	Seed Tick Drainage Basin

Legend	
●	Existing Spring Locations
	Approximate Location of Intake
●	Approximate USGS Water Quality Sample Locations
—	Creeks
	Major Surface Drainage Basins
—	Streams
—	Roads
	SWMU Boundary
	Populated Area
	National Forest
	Crane Boundary
	Old Jeep Trail
USGS	United States Geological Survey



DRAWN BY J. ENGLISH	DATE 11/01/07
CHECKED BY V. PLACHY	DATE 11/01/07
COST/SCHEDULE-AREA	
SCALE AS NOTED	



SURFACE WATER FEATURES ASSOCIATED
WITH LITTLE SULPHUR CREEK
CMP REPORT FOR SWMU 3 - AMMUNITION BURNING GROUNDS
NSWC CRANE
CRANE, INDIANA

CONTRACT NUMBER CTO 0311	
APPROVED BY	DATE
APPROVED BY	DATE
DRAWING NO.	REV
FIGURE 1-3	0

ATTACHMENT 3

NEW TABLE 2-1

TABLE 2-1

SUMMARY OF DESCRIPTIVE STATISTICS FOR METALS IN
SURFACE SOIL - SWMU 3 (AMMUNITION BURNING GROUND)
NSWC CRANE
CRANE, INDIANA

Parameter	Frequency of Detection	Concentration		Region 9 PRG for Soil - Residential ⁽¹⁾	Region 9 PRG for Soil - Industrial ⁽¹⁾	IDEM Default Direct Contact Closure Levels for Soil - Residential ⁽²⁾	IDEM Default Direct Contact Closure Levels for Soil - Industrial ⁽²⁾
		Minimum	Maximum				
Metals (mg/kg)							
Aluminum	35/35	4,500	26,600	7,600	100,000	---	---
Antimony	19/35	0.34 J	32 J	3.1	41	140	620
Arsenic	35/35	4.3 J	27.9 J	0.39	1.6	3.9	20
Barium	35/35	25.5 J	4,120 J	540	6,700	23,000	98,000
Beryllium	33/35	0.29 J	1.8	15	190	680	2,900
Cadmium	20/35	0.22 J	38.5	3.7	45	12	990
Calcium	35/35	177 J	78,200 J	---	---	---	---
Chromium	35/35	10.4 J	56.6 J	30 ⁽³⁾	64 ⁽³⁾	430 ⁽³⁾	650 ⁽³⁾
Cobalt	35/35	3.6 J	20.6 J	900	1,900	---	---
Copper	35/35	5 J	10,700 J	310	4100	13,000	57,000
Iron	35/35	10,800 J	68,900 J	2,300	31,000 ⁽⁴⁾	---	---
Lead	35/35	9.8 J	14,600 J	400	800	400	1,300
Magnesium	35/35	500 J	11,300 J	---	---	---	---
Manganese	35/35	57.1 J	5,390 J	180	1900	---	---
Mercury	26/35	0.012 J	5.5	2.3	31	100	470
Nickel	35/35	4.8 J	67.6 J	160	2,000	6,900	31,000
Potassium	35/35	325 J	3,080 J	---	---	---	---
Selenium	11/35	0.27 J	0.53 J	39	510	1700	7,800
Silver	9/35	0.11 J	15.7	39	510	1700	7,800
Sodium	19/35	52.4 J	684 J	---	---	---	---
Thallium	8/35	0.08 J	0.12 J	0.52	6.7	24	110
Tin	11/35	0.44 J	44.2 J	4,700	61,000 ⁽⁴⁾	---	---
Vanadium	35/35	8.8 J	29.6 J	7.8	100	---	---
Zinc	34/35	15 J	11,100 J	2,300	31,000 ⁽⁴⁾	100,000	470,000

Parameter maximum concentration exceed COPC screening criteria.

- 1 - Value presented is the screening level based on U.S. EPA Region 9 Preliminary Remediation Goal (PRG) for residential or industrial soils (U.S. EPA Region 9, October 2004, Updated December 2004). The screening level for noncarcinogenic compounds are 1/10th the PRG presented in the Region 9 PRG Table.
- 2 - Indiana Department of Environmental Management (IDEM), Risk Integrated System of Closure (RISC) residential or industrial default closure levels for soil (IDEM, January 2004). Values added to table as a point of comparison.
- 3 - The values for hexavalent chromium are presented.
- 4 - The printed PRG table lists a ceiling limit of 100,000 mg/kg as the PRG. The value presented is 1/10 of the actual risk-based PRG presented in the electronic version of the PRG table.

µg/kg - microgram per kilogram

COPC - chemical of potential concern

HMX - hexahydro-1,3,5-trinitro-1,3,5-triazine

IDEM - Indiana Department of Environmental Management

IND - industrial

mg/kg - milligram per kilogram

MXN - monomitoxylylene

ng/kg - nanogram per kilogram

RBC - Risk-Based Concentration

RDX - hexahydro-1,3,5-trinitro-1,3,5-triazine

RES - residential

RISC - Risk Integrated System of Closure

TETRYL - methyl-2,4,6-trinitrophenyl nitramine

U.S. EPA - United States Environmental Protection Agency

ATTACHMENT 4

NEW TABLE 2-2

TABLE 2-2

SUMMARY OF DESCRIPTIVE STATISTICS
 SUBSURFACE SOIL - SWMU 3 (AMMUNITION BURNING GROUND)
 NSWC CRANE
 CRANE, INDIANA

Parameter	Frequency of Detection	Concentration		Region 9 PRG for Soil - Residential ⁽¹⁾	Region 9 PRG for Soil - Industrial ⁽¹⁾	IDEM Default Direct Contact Closure Levels for Soil - Residential ⁽²⁾	IDEM Default Direct Contact Closure Levels for Soil - Industrial ⁽²⁾
		Minimum	Maximum				
Metals (mg/kg)							
Aluminum	82/82	20.4 J	47,200 J	7,600	100,000	---	---
Antimony	42/82	0.27 J	32.6 J	3.1	41	140	620
Arsenic	81/82	1.3 J	22 J	0.39	1.6	3.9	20
Barium	81/82	18.3 J	595 J	540	6,700	23,000	98,000
Beryllium	70/82	0.23 J	2.3 J	15	190	680	2,900
Cadmium	33/82	0.18 J	3.5	3.7	45	12	990
Calcium	80/82	81.2 J	129,000 J	---	---	---	---
Chromium	81/82	6.7 J	65.3 J	30 ⁽³⁾	64 ⁽³⁾	430 ⁽³⁾	650 ⁽³⁾
Cobalt	81/82	0.2 J	39.9 J	900	1,900	---	---
Copper	81/82	3.9 J	508 J	310	4,100	13,000	57,000
Iron	81/82	7170 J	86,000 J	2,300	31,000 ⁽⁴⁾	---	---
Lead	81/82	7.6 J	524 J	400	800	400	1,300
Magnesium	81/82	334 J	23,900 J	---	---	---	---
Manganese	81/82	46.4	7,380	180	1,900	---	---
Mercury	45/82	0.008 J	1.5 J	2.3	31	100	470
Nickel	82/82	0.25 J	48.4 J	160	2,000	6,900	31,000
Potassium	81/82	312 J	8,980 J	---	---	---	---
Selenium	18/82	0.25 J	0.56 J	39	510	1,700	7,800
Silver	4/82	0.05 J	16.8	39	510	1,700	7,800
Sodium	40/82	44.8 J	520 J	---	---	---	---
Thallium	15/82	0.08 J	0.14 J	0.52	6.7	24	110
Tin	22/82	0.26 J	58.6 J	4,700	61,000 ⁽⁴⁾	---	---
Vanadium	82/82	0.21 J	39.5 J	7.8	100	---	---
Zinc	81/82	13.4 J	1,430 J	2,300	31,000 ⁽⁴⁾	100,000	470,000

Parameter maximum concentration exceed COPC screening criteria.

- 1 - Value presented is the screening level based on U.S. EPA Region 9 Preliminary Remediation Goal (PRG) for residential or industrial soils (U.S. EPA Region 9, October 2004, Updated December 2004). The screening level for noncarcinogenic compounds are 1/10th the PRG presented in the Region 9 PRG Table.
- 2 - Indiana Department of Environmental Management (IDEM), Risk Integrated System of Closure (RISC) residential or industrial default closure levels for soil
- 3 - The values for hexavalent chromium are presented.
- 4 - The printed PRG table lists a ceiling limit of 100,000 mg/kg as the PRG. The value presented is 1/10 of the actual risk-based PRG presented in the electronic version of the PRG table.

µg/kg - microgram per kilogram

COPC - chemical of potential concern

HMX - hexahydro-1,3,5-trinitro-1,3,5-triazine

IDEM - Indiana Department of Environmental Management

IND - industrial

mg/kg - milligram per kilogram

MNX - monomitoxylene

ng/kg - nanogram per kilogram

RBC - Risk-Based Concentration

RDX - hexahydro-1,3,5-trinitro-1,3,5-triazine

RES - residential

RISC - Risk Integrated System of Closure

TETRYL - methyl-2,4,6-trinitrophenylnitramine

U.S. EPA - United States Environmental Protection Agency

ATTACHMENT 5

REVISED TABLE 2-3 (FORMERLY TABLE 2-1)

TABLE 2-3

**HUMAN HEALTH MEDIA CLEANUP STANDARDS
CMP REPORT FOR SMWU 3 - AMMUNITION BURNING GROUNDS
NSWC CRANE
CRANE, INDIANA
PAGE 1 OF 2**

COC	Media Cleanup Standards		
	Surface Soil (mg/kg)	Surface Water (µg/L)	Groundwater (µg/L)
MTA			
Construction Worker			
Lead ⁽¹⁾	540	N/A	N/A
OJT			
SWMU Worker			
TCE	N/A	21	N/A
LSC			
Future Life-Long Resident			
RDX ⁽²⁾	4.4	3	N/A
TCE	N/A	5	N/A
TNT ⁽³⁾	N/A	10	N/A
Recreational User			
2,4-diamino-6-nitrotoluene	N/A	1,350	N/A
2,4-dinitrotoluene	N/A	195	N/A
2,6-diamino-4-nitrotoluene	N/A	1,350	N/A
2,6-dinitrotoluene	N/A	150	N/A
4,4'-TN-AZOXY	N/A	19,000	N/A
A-DNT	N/A	1,350	N/A
DNX	N/A	86	N/A
HMX	N/A	51,000	N/A
MNX	N/A	86	N/A
RDX	N/A	86	N/A
TNT	N/A	84	N/A
TNX	N/A	86	N/A
Public Water Supply Back Calculated to the Mixing Zone Concentration⁽⁴⁾			
2,4-diamino-6-nitrotoluene	N/A	355,000	N/A
2,4-dinitrotoluene	N/A	1,849,000	N/A
2,6-diamino-4-nitrotoluene	N/A	355,000	N/A
2,6-dinitrotoluene	N/A	1,029,000	N/A
4,4'-TN-AZOXY	N/A	355,000	N/A
A-DNT	N/A	2,380,000	N/A
HMX	N/A	60,400,000	N/A
DNX	N/A	106,707	N/A
MNX	N/A	106,707	N/A
RDX	N/A	106,707	N/A

TABLE 2-3

HUMAN HEALTH MEDIA CLEANUP STANDARDS
 CMP REPORT FOR SMWU 3 - AMMUNITION BURNING GROUNDS
 NSWC CRANE
 CRANE, INDIANA
 PAGE 2 OF 2

COC	Media Cleanup Standards		
	Surface Soil (mg/kg)	Surface Water (µg/L)	Groundwater (µg/L)
LSC (continued)			
Public Water Supply Back Calculated to the Mixing Zone Concentration (continued)⁽⁵⁾			
TNT	N/A	355,000	N/A
TNX	N/A	106,707	N/A

1 - Source: U.S. EPA (1996). Recommendations of the Technical Review Workgroup for Lead for an Interim Approach to Assessing Risks Associated with Adult Exposures to Lead in Soil. The lead MCS calculations are presented in Appendix B.1.

2 - The RDX and degradation products (MNX, TNX, and DNX) MCSs are based upon a public water supply point of intake alternative water quality criterion of 3 µg/L as presented in Appendix D.

3 - The TNT and degradation products (2,4-diamino-6-nitrotoluene, 2,6-diamino-4-nitrotoluene, and 4,4'-TN-AZOXY) MCSs are based upon a public water supply point of intake alternative water quality criterion of 10 µg/L as presented in Appendix D.

4 - The A-DNT MCSs are based upon a public water supply point of intake alternative water quality criterion of 67 µg/L as presented in Appendix D.

5 - These concentrations concentrations at the mixing zone are back calculated based upon alternative WQC (i.e., protection of public water supply) as presented in Appendix D.

µg/L - Micrograms per liter.

4,4'-TN-AZOXY - 2,2',4,4'-Tetranitro-6,6'-azoxytoluene.

A-DNT - 2-Amino-4,6-dinitrotoluene/4-amino-2,6-dinitrotoluene.

COC - Chemical of concern.

DNX - Hexahydro-1,3,5-dinitroso-1,3,5-triazine.

HMX - Octahydro-1,3,5,7-tetranitro-1,3,5,7-tetrazocine.

LSC - Little Sulfur Creek.

MCS - Media cleanup standard.

mg/kg - Milligrams per kilogram.

MNX - Hexahydro-1,3,5-mononitroso-1,3,5-triazine.

MTA - Main Treatment Area.

N/A - Not applicable to this medium for this COC.

OJT - Old Jeep Trail.

RDX - Hexahydro-1,3,5-trinitro-1,3,5-triazine.

TCE - Trichloroethylene.

TNT - 2,4,6-Trinitrotoluene.

TNX - Hexahydro-1,3,5-trinitroso-1,3,5-triazine.

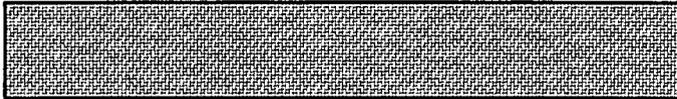
WQC - Water Quality Criterion.

ATTACHMENT 6

**CALCULATION FOR LEAD MEDIA CLEANUP STANDARD
(CONSTRUCTION WORKER)**

SITE NAME: SWMU 3
LOCATION: NSWC CRANE, CRANE, INDIANA
RECEPTOR: CONSTRUCTION WORKER
MEDIA: SURFACE SOIL (SITE)
DATE: FEBRUARY 1, 2007

Calculations of Preliminary Remediation Goals (PRGs)
 U.S. EPA Technical Review Workgroup for Lead, Adult Lead Committee



Version date 05/19/03

Exposure Variable	PRG Equation ¹		Description of Exposure Variable	Units	Values for Non-Residential Exposure Scenario			
	1*	2**			Using Equation 1		Using Equation 2	
					Construction Worker		Construction Worker	
PbB _{fetal, 0.95}	X	X	95 th percentile PbB in fetus	ug/dL	10		10	
R _{fetal/maternal}	X	X	Fetal/maternal PbB ratio	--	0.9		0.9	
BKSF	X	X	Biokinetic Slope Factor	ug/dL per ug/day	0.4		0.4	
GSD _i	X	X	Geometric standard deviation PbB	--	2.18		2.18	
PbB ₀	X	X	Baseline PbB	ug/dL	1.53		1.53	
IR _S	X		Soil ingestion rate (including soil-derived indoor dust)	g/day	0.100		--	
IR _{S+D}		X	Total ingestion rate of outdoor soil and indoor dust	g/day	--		0.100	
W _S		X	Weighting factor; fraction of IR _{S+D} ingested as outdoor soil	--	--		1.0	
K _{SD}		X	Mass fraction of soil in dust	--	--		0.7	
AF _{S,D}	X	X	Absorption fraction (same for soil and dust)	--	0.12		0.12	
EF _{S,D}	X	X	Exposure frequency (same for soil and dust)	days/yr	219		219	
AT _{S,D}	X	X	Averaging time (same for soil and dust)	days/yr	365		365	
PRG			Preliminary Remediation Goal	ppm	539		539	

¹ Equation 1 does not apportion exposure between soil and dust ingestion (excludes W_S, K_{SD}).
 When IR_S = IR_{S+D} and W_S = 1.0, the equations yield the same PRG.

*Equation 1, based on Eq. 4 in USEPA (1996).

$$PRG = \frac{([PbB_{95\text{fetal}}/(R*(GSD_i^{1.645}))]-PbB_0)*AT_{S,D}}{BKSF*(IR_{S+D}*AF_{S,D}*EF_{S,D})}$$

**Equation 2, alternate approach based on Eq. 4 and Eq. A-19 in USEPA (1996).

$$PRG = \frac{([PbB_{fetal,0.95}/(R*(GSD_i^{1.645}))]-PbB_0)*AT_{S,D}}{BKSF*([(IR_{S+D})*AF_S*EF_S*W_S]+[K_{SD}*(IR_{S+D})*(1-W_S)*AF_D*EF_D])}$$

ATTACHMENT 7

FIGURE 2-1



CONTRACT NO. CTO 0311

APPROVED BY _____ DATE _____

APPROVED BY _____ DATE _____

DRAWING NO. FIGURE 2-1

REV 0

PRIMARY ORGANIC CONTAMINANTS IN SURFACE AND SUBSURFACE SOILS
CMP REPORT FOR SWMU 3 - AMMUNITION BURNING GROUNDS
(MAIN TREATMENT AREA)
NSWC CRANE
CRANE, INDIANA

DRAWN BY A. JANOSHA DATE 9/14/04

CHECKED BY V. PLACHY DATE 10/02/07

COST/SCHED-AREA

SCALE AS NOTED

