DEPARTMENT OF THE NAVY
CRANE DIVISION
NAVAL SURFACE WARFARE CENTER
300 HIGHWAY 361
CRANE INDIANA 47522-5001

IN REPLY REFER TO:

5090/S4.7.1
Ser 095/3153

2 MAY 2003

U.S. Environmental Protection Agency, Region V
Waste, Pesticides, & Toxics Division
Waste Management Branch
Illinois, Indiana, and Michigan Section
ATTN: Mr. Peter Ramanauskas (DW-8J)
77 West Jackson Blvd.
Chicago, IL 60604

Dear Mr. Ramanauskas:

Crane Division, Naval Surface Warfare Center (NSWC Crane) submits response to comments for the Draft Resource Conservation and Recovery Act Facility Investigation (RFI) Report and Monitored Natural Attenuation (MNA) for the Ammunition Burning Grounds (ABG) Old Jeep Trail and Little Sulphur Creek (OJT/LSC). Two copies of the response to comments for the RFI report and MNA are provided as enclosures (1) and (2) respectively. The permit required Certification Statement is provided as enclosure (3).

NSWC Crane point of contact is Mr. Thomas J. Brent, Code 09510, telephone 812-854-6160.

Sincerely,

JAMES M. HUNSICKER
Director, Environmental
Protection Department
By direction of the Commander

Encls:
(1) Response to Comments for Draft ABG OJT/LSC RFI Report
(2) Response to Comments MNA
(3) Certification Statement

Copy to:
ADMINISTRATIVE RECORD
SOUTHNAVFACENGCOM (Code ES32) (w/o encl)
IDEM (Doug Griffin)
TTNUS (Ralph Basinski) (w/o encl)

I certify under penalty of law that this document and all attachments were prepared under my direction or supervision in accordance with a system designed to assure that qualified personnel properly gather and evaluate the information submitted. Based on my inquiry of the person or persons who manage the system, or those persons directly responsible for gathering the information, the information submitted is, to the best of my knowledge and belief, true, accurate, and complete. I am aware that there are significant penalties for submitting false information, including the possibility of fine and imprisonment for knowing violations.

James Hunsick

SIGNATURE

Environmental Protection Department Manager 5/2/03

TITLE DATE

RESPONSE TO EPA COMMENTS DATED MARCH 19, 2003 ON THE RFI REPORT FOR SWMU 03 - OLD JEEP TRAIL/LITTLE SULPHUR CREEK DATED NOVEMBER 2002 NAVAL SURFACE WARFARE CENTER CRANE, INDIANA

Comments provided by the United States Environmental Protection Agency (US EPA) are shown in bold font. Responses following each comment are shown in regular font. Changes to RCRA Facility Investigation (RFI) Report text are italicized and enclosed in quotation marks.

GENERAL COMMENTS

Comment GC-1:

The Solid Waste Management Unit (SWMU) 3 RCRA Facility Investigation (RFI) Report, dated November 2002 (RFI Report) is not complete with respect to the proposed groundwater investigation, when compared with the approved Quality Assurance Project Plan for Ammunition Burning Grounds Little Sulphur Creek and Jeep Trail Phase III RCRA Facility Investigation, dated April 2001 (QAPP). Section 4.0 of the QAPP contains the Sampling and Analysis Plan (SAP) for the RFI, and Section 4.4.2 describes the locations, analyses, and rationale for groundwater sampling.

In the QAPP, thirteen new wells were proposed for installation depending upon the results of the first round of sampling at existing wells. These included:

- **two shallow source wells (03MWT01 and 03MWT02) at the Burn Area and Burn Pit;**
- **seven shallow perimeter wells (03MWT03 through 03MWT09) downgradient and beyond the existing monitoring network;**
- **one deep upgradient monitoring well (03MWT10); and**
- **three deep vertical extent wells (03MWT11 through 03MWT13) located in the area of existing wells 03-12, 03-07, and 03-24, respectively.**

It is apparent from the analytical results of the existing monitoring well network that the above new wells are necessary to fully evaluate the nature and extent of contamination at SWMU 3. Section 5.3 of the RFI Report outlines the nature and extent of groundwater contamination, based on the samples collected from the 15 previously existing wells at the

unit. As depicted in Figures 5-5 and 5-6 of the RFI Report, nearly all existing wells sampled yielded organic and inorganic analytical results above health-based standards. The following are examples of results indicating the need for further groundwater characterization:

- **The maximum chlorinated solvent concentrations were found in existing well 03-07, indicating the need for further characterization with depth as proposed for well 03MWT11.**
- **Polynuclear aromatic hydrocarbons (PAHs) and energetics were found in the greatest concentrations in subsurface soil samples near the Burn Area and Burn Pit, where no monitoring wells exist, but where wells 03MWT01 and 03MWT02 were proposed.**
- **Section 5.8 indicates that groundwater concentrations of RDX exceeding chemical of potential concern (COPC) levels extend to the site boundary, indicating the need for wells beyond the existing monitoring network.**
- **Upgradient well 03-16 had the highest levels of RDX, indicating the need for the upgradient monitoring well (03MWTT10) to determine the upgradient concentration at greater depth.**
- **Soil borings 03SB24 and 03SB48 showed the greatest metal concentrations of the investigation. These are located near proposed wells 03MWT02 and 03MWT12, respectively.**

Revise the RFI Report to address these concerns regarding the incomplete characterization of groundwater at the unit.

Response to Comment GC-1: A meeting was held on October 31, 2001 concerning the adequacy of RFI data to support risk assessment and corrective measures studies for SWMU 03. The meeting was attended by representatives of the U.S. Navy Southern Division and NSWC Crane, Tetra Tech NUS, Inc., the U.S.

Army Corps of Engineers Waterways Experiment Station, and Indiana University. During this meeting data gaps were discussed.

A Technical Memorandum addressing the data gaps was prepared in response to the meeting discussion and was submitted to U.S. EPA Region 5 in January of 2002. The Technical Memorandum presented ground water flow contours and chemical concentrations. The Technical Memorandum concluded that additional ground water monitoring wells did not need to be installed to support the RFI. The basis of this conclusion was multifold:

- Proposed wells 03MWT01 and 03MWT02 were designed to monitor potential contaminant source areas, however, they were not required to be installed because there was no significant degree of soil contamination near these proposed well locations. No other wells were needed to monitor potential source areas, either, and soils were concluded to have been adequately characterized for risk assessment and for establishing the extent of contamination.
- Ground water contaminant migration was cited as being minimal between 1994 and 2001 as evident by downgradient concentrations remaining essentially unchanged or decreasing. The chlorinated solvent concentrations in well 03-07 were cited as particular examples of such decreases between 1994 and 2001. This well is in the area of greatest chlorinated solvent concentrations. Decreases of explosives concentrations from 1994 to 2001 in many perimeter wells were also cited. Hence, installation of the remaining 7 proposed shallow wells was concluded not to be necessary for establishing the lateral extent of contamination.
- Near the Burn Pit and Burn Area, the local shallow ground water flow is toward the northeast and southwest along an axis of Little Sulphur Creek. Outside of this area, the ground water flow is toward the south along the Little Sulphur Creek valley. While the local flows are away from the Little Sulphur Creek, regional ground water flow turns toward the creek and physically prevents lateral migration of the SMWU 3

ground water contamination away from the creek. The installation of additional shallow wells was concluded not be warranted because the regional ground water flow redirects outward flowing contamination toward the creek.

- Vertical ground water migration was concluded to be prohibited by the Elwren Shale aquitard located at the base of the shallow ground water zone, hence the installation of 4 deep wells was not warranted.

On June 6, 2002, Mr. Peter Ramanauskas of U.S. EPA Region 5 sent an e-mail message to Mr. Bill Gates of Navy SOUTHDIV indicating concurrence with the Technical Memorandum conclusions and a suggestion that a "proper quantitative test to confirm that the TCE/explosives plume exits at Spring C only" might be conducted in conjunction with either the RFI or the CMS that is planned for SWMU 03. (See Attachment 1 for copy of the June 6, 2002 e-mail.)

On the basis of this information, the Navy disagrees that ground water is inadequately characterized or that new wells should be installed. No change to the RFI Report has been made in response to this comment; however, Figure 1-18 of the RFI Report has been revised in response to Comment SC-4 to more accurately represent the Navy's understanding of regional ground water flow patterns. The text of Section 1.3.4 has also been revised in response to Comment SC-4 to more accurately describe ground water flow patterns.

SPECIFIC COMMENTS

Comment SC-1:

Section 2.5.4, Sediment Sampling. A comparison of Figure 1-7 from the RFI Report and Figure 4-1 from the QAPP indicates that sediment sampling location 03SD10 was collected approximately 100 feet upstream from the proposed sample location. Provide the rationale for this deviation from the QAPP.

Response to Comment SC-1: As described in the RFI report in Section 2.5.4, each sediment sample was collected in a depositional area of the stream channel, where fine sediment had accumulated. In the case

of sediment sample 03SD10, the selected location was preferred to the planned location, which is approximately 100 feet downstream. The following text has been added to the end of Section 2.5.4, paragraph 1, of the RFI report to clarify this:

> *"Based on field conditions, sediment samples (e.g., 03SD10) may have been collected in areas that were slightly different from the planned locations. These conditions include sampling location accessibility, availability of sediments, and predominant sediment grain size. Unless otherwise noted, the actual sampling locations are viewed to be as representative of drainage channel sediments as the originally planned locations."*

Comment SC-2:

Section 5.2, Subsurface Soil, Energetics. The RFI Report indicates that the vertical extent of contamination has not been determined at soil boring 03SB24 and that the deep sample within this boring exceeded COPC screening levels. Since analytical results above COPC screening levels have been found in the deepest soil interval, further deep soil sampling in and around the area of this boring is warranted. Revise the RFI Report to address this issue.

Response to Comment SC-2: The Navy disagrees that additional dioxin and furan sampling is warranted. The following text has been inserted at the end of Section 5.2, Energetics to clarify this:

> *"Nevertheless, the energetic compound concentrations that are in excess of COPC screening levels do not exceed risk-based concentrations at soil boring 03SB24, sample 03SB241215 . This is evident from a review of Figure 5-2 where none of the energetic compound concentrations have a flag next to them in subsurface soil at boring 03SB24. Thus, the concentrations of energetic compounds are sufficiently well bounded to support the evaluation of risk at this site."*

Comment SC-3:

Section 5.2, Subsurface Soil, Dioxins and Furans. Dioxin and furan sampling and analysis was

restricted to only two soil borings at the north and south end of the Burn Pit (03SB19 and 03SB24). These borings yielded positive results for isomers of both dioxins and furans. Therefore, the extent of contamination cannot be determined and is so stated in this section. Based on the apparent subsurface hotspot in the area of monitoring well 03-07 and soil borings 03SB46 through 03SB48, it is suggested that further dioxin and furan sampling and analysis be conducted in this area and in an expanded area around 03SB19 and 03SB24. Revise the RFI Report to address this issue.

Response to Comment SC-3: The Navy disagrees that additional dioxin and furan sampling is warranted. For clarification, the following paragraph has been added to the end of Section 5.2, Dioxins and Furans:

> *"Although the full extent of dioxin and furan contamination greater than COPC screening levels can not be defined from just two samples, the two samples analyzed for these chemicals were located where dioxin/furan contamination, if present, would be detected. The relatively low concentrations of the detected dioxins and furans indicate that these chemicals are not significant site contaminants. They may even represent local anthropogenic background concentrations based on the comparison of site TEQs to literature values, however, there are no available background data for dioxins and furans at NSWC Crane. The insignificance of dioxin and furans at the OJT/LSC is also evident from a review of Figure 5-3 that shows no risk-based criteria flags next to the plotted TEQs. This is the case even at soil boring 03SB24 where several chemicals exhibited the greatest degree of contamination. Therefore, while dioxins and furans were detected at concentrations greater than COPC screening levels, the concentrations are low and additional investigation of dioxins or furans is not warranted."*

Comment SC-4:

Section 6.3.2, Migration of Ground Water Contaminants to Little Sulphur Creek. This section states that the groundwater in the contaminated area around monitoring well 03-07 flows to the northeast, and refers to Figures 1-19 and 1-20. However, according to these figures, it appears that the area

around this monitoring well could potentially be a groundwater recharge area to which groundwater flows not only in a northeastern direction, but also in southeastern, southern, and southwestern directions. Decreasing contamination from the well 03-07 area not only goes in a northeastern direction towards wells 03-15 and 03-24, but also in a southwestern direction toward well 03-12, where contamination was also found. Because of these apparent other directions of groundwater flow, the model of groundwater volatile organic contamination flowing to the northeast, entering the eastern karst conduit, and flowing south toward Spring C (discussed in Section 6.3.2) appears to be incomplete. Revise the RFI Report to address the flow of volatile organic contaminants (VOCs) in these other directions, particularly toward the west and the western karst conduit.

Response to Comment SC-4: TtNUS agrees with the comment that ground water flows away from the OJT area in two different directions (to the east-northeast and the south-southwest). This ground water flow was discussed in more detail in Section 1.3.4.

To address this comment and for further clarification regarding multiple ground water flow directions, the following revisions have been made to the document:

1. Figure 1-18 has been revised to better show the influence of the two karst conduits on local ground water flow,

2. The fourth paragraph of Section 1.3.4 Hydrogeology, Subsection Ground Water Flow Directions has been revised as follows:

   "Potentiometric surface maps for the BC-BC aquifer in the LSC watershed have been presented in previous reports (Murphy and Ciocco, 1990; Murphy, 1994). In general, the highest ground water elevations (560 to 565 feet amsl) in this aquifer were found at the northern end of the LSC watershed (north of ABG and in the vicinity of the Dye Burial Grounds). Ground water was generally flowing from north to south in the watershed, and

flow direction was also inward toward Little Sulphur Creek (i.e., from the perimeter of the watershed in toward the creek and Johnson Hollow). The elevation where ground water discharges from Spring C was about 530 feet amsl. The lowest ground water elevations (about 510 to 515 feet amsl) were recorded at the southern end of the watershed at Spring A and well 03B10. A comprehensive set of elevations was measured on June 12 and 13, 2002. Table 1-3 lists all the known wells and stream gaging locations in the watershed, physical characteristics of each well, and the spatial coordinates and reference elevations for each location. The water elevations that were measured in June 2002 are also listed in this table. Water levels were measured in a total of 120 monitoring wells and at four stream gage locations. A total of 64 monitoring wells are screened in the Big Clifty Sandstone, Beech Creek Limestone, or the collapse breccia material along LSC. The water levels measured in these 64 wells, along with the water levels of three stream gage locations, were used to map the potentiometric surface in the BC-BC aquifer. These water levels and potentiometric contours are presented in Figure 1-18. This figure shows the highest ground water elevation (577.59 feet amsl) was measured in the Dye Burial Grounds (well 02C20) at the northeast end of the watershed. The lowest elevations (511 to 512 feet amsl) were measured at the southern end of the watershed, close to Little Sulphur Creek (wells 03B10 and 03C37 and Spring A). The wells in the ABG area had ground water levels of 543 to 560 feet amsl. Wells in the OJT area had water levels ranging from 535 to 543 ft amsl. The ground water potentiometric map, based on the June 2002 set of measurements, shows that ground water flow is from north to south and from the perimeter of the watershed inward toward two karst ground water conduit systems. The two known conduits run from north to south, one on each side of the valley. The approximate locations of these karst conduits are shown on Figure 1-18. The contours indicate that Little Sulphur Creek is a losing stream (i.e., recharging the ground water system) in the northern part of the watershed and is a gaining stream (i.e., receives ground water discharge) near and south of Spring C. These ground water flow directions are similar to those presented by Murphy (1994)."

3. Section 6.3.2 Contaminant Transport Pathway has been revised as follows:

"A contaminant transport pathway represents the physical path or the mechanism by which a contaminant moves or might move from one location (i.e., the source area) to another. A transport pathway may also involve a phase change for the contaminant (e.g., a contaminant is absorbed to soil, volatilizes to soil gas in the vadose zone, and then migrates into basements as a gas). In addition, contaminant transport pathways typically imply that the contaminant is migrating to a new location, which may result in an unacceptable human health or ecological risk at the contaminant destination. The determination of whether a pathway is currently causing a risk or could potentially cause a future risk depends on the combination of chemical characteristics, the existence of a potential pathway, the physical site conditions, and the potential for exposure to occur now or in the future.

"This section presents a brief overview of contaminant fate and transport pathways that exist at OJT/LSC. Based on the evaluation of existing conditions at OJT/LSC, the following potential contaminant transport pathways may exist at the site:

- *Leaching of soil contaminants to ground water.*
- *Migration of ground water contaminants within the aquifer.*
- *Mixing of ground water (i.e., spring discharges and creekbed seepage) with surface water in LSC.*
- *Erosion and runoff of contaminated particles from soil and deposition in surface water bodies (i.e., Little Sulphur Creek).*
- *Leaching of contaminants from creek sediment to surface water.*
- *Migration of contaminants in surface water to downstream areas as dissolved or sorbed phases.*
- *Volatilization from soil, ground water, or surface water."*

DATA QUALITY COMMENTS

GENERAL COMMENT

Comment DQ-GC-1:

The data quality section provides mean quality control (QC) results. The observed QC range is also reported in some cases. However, when no outliers are discussed it is unclear if all individual associated QC results were acceptable. Clarify if the range represents individual QC results or mean results. If the range applies to mean results, clarify if outliers were detected in cases where only the mean was presented. In addition, clarify if mean or individual QC results have been considered when qualifying the data.

Response to Comment DQ-GC-1: The fifth paragraph of Section 3.3.3 has been deleted. A new second paragraph has been added to Section 3.3, as follows:

> *"All individual QC results have been considered in qualifying the data. If no outliers are discussed for a particular DQI then all data associated with that DQI were acceptable as compared to data quality control criteria specified by the laboratory performing the analysis or by the analytical method performed. However, the data quality review is not meant to identify data that are acceptable or unacceptable according data quality control criteria. Instead, it is designed to provide a quantitative measure of analytical performance that is not provided by data validation. The use of average RPDs is spelled out in the text; in all other cases, RPDs refer to individual RPD values."*

SPECIFIC COMMENT

Comment DQ-SC-1:

Table 3-4, Solid and Aqueous Minimum and Maximum Detection Limits Versus RBTLs and EDQLs.

This table indicates that minimum and maximum detection limits (DLs) that exceed laboratory method detection limits/instrument detection limits (MDLs/IDLs) are highlighted. However, it appears that not all values exceeding the MDL/IDL are highlighted. For example, acetone lists the

observed maximum DL as 26.00 µg/L. The laboratory MDL/IDL is 0.5 µg/L, but the DL value is not highlighted. In addition, it appears that the trichloroethene observed maximum DL of 1.6 µg/L exceeds the laboratory MDL/IDL of 0.5 µg/L, but the maximum detection limit is not highlighted. Also, Page 1 of Table 3-4 indicates that the observed minimum DL for arsenic was 2.8 µg/L and the observed maximum DL was 1.00 µg/L. It appears that these limits were erroneously reported. Revise the table to ensure that it is correctly highlighted, and clarify the arsenic minimum and maximum IDL/MDL.

Response to Comment DA-SC-1: Table 3-4 has been revised as follows:

- The minimum observed aqueous arsenic MDL (formerly, 2.8 µg/L) has been revised to correctly read "*0.20*" µg/L.
- The value of "26.00" (observed maximum DL) for the "acetone" row has been revised to read "*26.0*" and has been highlighted to represent that the reported maximum non-detect value exceeds the nominal laboratory MDL for aqueous samples.
- The value of "5.30" (observed maximum DL) for the "methylene chloride" row has been highlighted to represent that the reported maximum non-detect value exceeds the nominal laboratory MDL for aqueous samples.
- The value of "1.60" (observed maximum DL) for the "trichloroethene" has been highlighted to represent that the reported maximum non-detect value exceeds the nominal laboratory MDL for aqueous samples.

All other maximum and minimum MDLs/IDLs have been compared to the nominal MDLs/IDLs to verify that the highlighting as indicated in Table 3-4 is accurate.

MINOR COMMENT

Comment DQ-MC-1:

Table 3-5, Soil and Sediment Percent Qualification Rates, Qualifier Code Definitions. This section defines the qualifier code "U" as pesticide/polychlorinated biphenyl (PCB) percent difference between columns for positive results. However, it appears that "U" was also used to qualify explosives and herbicides results. Revise the definitions to clarify the qualifier codes for explosives and herbicides.

Response to Comment DA-MC-1: The last footnote in Table 3-5 has been revised to read as follows:

> *"U = Percent difference between columns / detectors for positive results is >25% for GC / HPLC methods."*

HUMAN HEALTH RISK ASSESSMENT COMMENTS

SPECIFIC COMMENTS

Comment HHRA-SC-1:

Executive Summary (Page ES-4). The third and fourth bullet points in this section describe risks to potential future receptors that exceed a target risk of 10^{-4} or a target hazard index of 1.0. However, risks which fall within the National Contingency Plan (NCP) risk range of 10^{-6} to 10^{-4} are not discussed. From the Administrative Authority's perspective, acceptability of risk levels which fall within the NCP's relative risk range is based on the consideration of the inherent degree of conservatism and level of associated uncertainty in the quantitative point estimates of risk, and must be approved by U.S. EPA Region 5 on a case-by-case basis. All estimates of risk which exceed U.S. EPA's lower bound point of departure (10^{-6}) should be presented in summary sections of the risk assessment. Revise the Executive Summary to include a discussion regarding risks within the NCP risk range at SWMU 3.

Response to Comment HHRA-SC-1: The requested information is provided in Table 7-16 of the RFI report. Additionally, Tables 7-12, 7-13, 7-14, and 7-15 have been revised to include this information, however, according to the project decision rules, human health risks less than 1E-04 result in no further action. Therefore, the following text has been added to beginning of the first paragraph of the Executive Summary, Conclusions Section:

> *"The project decision rules presented in Section 1 of the QAPP indicate the levels of risk at which the implementation of a Corrective Measures Study (CMS) would be warranted. For example, unless mitigating circumstances exist, an incremental lifetime cancer risk in excess of 1 x 10^{-4} would trigger a CMS. If the human health risks were less than that value, no further action would be required."*

Comment HHRA-SC-2:

Table ES-1, Summary of Receptor-Specific Human Risks, and Hazards and Ecological Risks, and Recommendations. Although it is stated in the Executive Summary that current exposure scenarios do not result in any adverse risk or hazard, Table ES-1 indicates that current risks to an off-site resident receptor fall within the NCP risk range (9E-06 and 1E-05 for a child and adult residential receptor, respectively). Based on a comparison of the text and tables, it appears that risks that fall within the NCP risk range are not considered to be adverse, and therefore do not indicate a need for remedial action. It is the decision of U.S. EPA Region 5 to determine whether risks to receptors at SWMU 3 that fall within the NCP risk range are acceptable. Replace statements in the RFI report regarding the acceptability of risks that fall within the NCP risk range with something similar to "risk range for which remedial actions are not usually performed."

Response to Comment HHRA-SC-2:

Table ES-1 of the RFI report is designed to summarize the risk characterizations and to identify the actions to be taken based on those characterizations. It is correct that no corrective action was identified for cancer risks that are less than 1E-04. This was in accord with the EPA-approved quality assurance project plan (QAPP) under which this investigation was conducted. Figure 1-23 of the approved QAPP indicates that no corrective action will be implemented unless risks exceed 1E-04 (cancer risk) or HI = 1.0 (non-cancer, target organ effect). If the proposed statement "risk range for which remedial actions are not usually performed" would replace the existing text, then it would be inconclusive as to whether or not further action is recommended. Therefore, no changes have been made to the document in response to this comment.

Comment HHRA-SC-3:

Section 4.2, Selection of Human Health Risk Chemicals of Potential Concern. Constituents were selected as COPCs if detected concentrations were greater than screening levels and also exceeded background concentrations. However, U.S. EPA policy no longer supports excluding COPCs from the risk assessment based on a comparison to background conditions (*Role of Background in the CERCLA Cleanup Program*; OSWER 9285.6-07P; April 26, 2002). This OSWER

directive recommends that naturally-occurring analytes present at concentrations that exceed risk-based criteria should be carried forward into the quantitative estimates of risk and hazard. In particular, the Directive states: "...*This approach involves addressing site-specific background issues at the end of the risk assessment, in the risk characterization. Specifically, the COPCs with high background concentrations should be discussed in the risk characterization, and if data are available, the contribution of background to site concentrations should be distinguished. COPCs that have both release-related and background-related sources should be included in the risk assessment. When concentrations of naturally occurring elements at a site exceed risk-based screening levels, that information should be discussed qualitatively in the risk characterization.*"

EPA-Region 5 recognizes that NSWC Crane has conducted a site-wide sampling program to establish site-specific background data on the presence of naturally-occurring inorganic constituents (i.e., metals). Consequently, the risk assessment for SWMU 3 should be revised to provide a qualitative discussion (in the risk characterization section) which identifies any constituents that exceed risk-based screening levels but were eliminated from the risk assessment based on comparison to site-specific background levels.

Response to Comment HHRA-SC-3: A qualitative discussion, which identifies constituents that exceed risk-based screening levels but were eliminated from the risk assessment based on comparison to site-specific background levels, has been added to the RFI Report as Section 7.5.3.

Comment HHRA-SC-4:

Section 4.2.1, Lead as a COPC. Contrary to what is stated in the text, the screening levels for lead in soil (e.g., the Region 9 Preliminary Remediation Goal [PRG]) do represent risk-based screening levels. They are calculated on the basis of not exceeding a 10 microgram per deciliter (ug/dL) blood-lead concentration, which represents the level above which adverse health effects are known to occur. Revise the human health risk assessment (HHRA) to correct this error.

Response to Comment HHRA-SC-4: The Navy disagrees that soil screening levels for lead presented in the EPA Region 9 PRG table represent risk-based concentrations. The screening level for lead that is presented in the EPA Region 9 PRG table is the OWSER screening level for lead. The OWSER screening level of 400 mg/kg for residential exposures to lead is based on other factors besides risk. For example, inputting the OSWER screening level into EPA's IUEBK model results in unacceptable blood lead levels. No changes have been made to the document in response to this comment.

Comment HHRA-SC-5:

Section 7.3.1.3, Potential Current and Future Receptors of Concern and Exposure Pathways. It is stated under the first bullet point of this section on page 7-5 that hunting activities are permitted at the base. However, it does not appear that potential exposure to contaminants through ingestion of game species has been considered in the risk assessment. At a minimum, this pathway should be qualitatively evaluated, to ensure that all potential exposure pathways have been addressed, especially in consideration of contaminants which have the capacity to bioaccumulate, bioconcentrate and biomagnify within the food chain. Revise the risk assessment to include an evaluation of potential exposure through food obtained while hunting in the vicinity of SWMU 3.

Response to Comment HHRA-SC-5: Due to the large degree of uncertainty associated with this potential exposure pathway, potential risks to hunters ingesting game that they have caught on-site has been qualitatively evaluated in the Uncertainty Analysis. A new final sentence has been added to end of the first bullet, Trespassers, in Section 7.3.1.3, Potential Current and Future Receptors of Concern and Exposure Pathways as follows:

> *"Potential risks to hunters from ingestion of game species that were caught on-site will be qualitatively evaluated in the Section 7.6, Uncertainty Analysis."*

The following text has been added as a new Subsection after the existing final paragraph in Section 7.6.2, Uncertainty in the Exposure Assessment.

"Potential Risks Associated with the Ingestion of Games Species by Hunters

> *"The general public is restricted from hunting at Crane. For example, only Crane employees, military personnel and their dependents/guests are allowed to hunt at Crane in 2002. Reportedly, white tail deer are the only game species hunted at Crane that would provide a route for any potentially significant exposure to contaminants, in part because they are the only large game species. However, white tail deer have a large home area that encompasses an area much larger than the study area. Consequently, the deer exposures to site-related contaminants are expected to be minimal. Furthermore, based on anecdotal evidence that includes communications with a knowledgeable NSWC Crane employee, it is believed to be unusual for hunters to bag more than four deer a year at Crane. Therefore, any deer consumed by people hunting at Crane will comprise a very small portion of their overall diet. Thus, potential risks through exposure to contaminants through ingestion of game species is expected to be insignificant. The EPA will be notified if additional information becomes available on hunting habits at Crane that would change this conclusion."*

Comment HHRA-SC-6:

Section 7.5.2.1, Noncarcinogenic Risks - RME. The second to last paragraph of this section on page 7-27 discusses the noncarcinogenic risks calculated for a future on-site child resident and future on-site adult resident. The hazard indices (HI) for these two receptors were greater than the target hazard index of 1. It is stated that the highest detected concentrations of 2,4,6-trinitrotoluene and RDX (the risk drivers for this receptor population) occurred in two samples, and that if these two samples were to be removed from the dataset, then HIs for the future on-site child and adult resident would be within "acceptable levels." It is not clear, based on this statement, whether estimates of noncarcinogenic hazard will be used as generated in this risk assessment, or whether HIs will be recalculated using a limited dataset. Revise the risk assessment to clarify whether estimates of noncarcinogenic hazard presented in this document will be used, or whether they will be recalculated.

It is also not clear how the dataset will be limited if estimates of noncarcinogenic hazard are recalculated. Specifically, it is not clear whether the areas of contamination identified by these two samples will be remediated, or whether the samples will be identified as statistical outliers, and removed from the dataset without removing the potential area of contamination. If estimates of noncarcinogenic hazard are recalculated, provide an explanation of how the samples in question are "removed from the dataset" as stated in the current version of the risk assessment.

Response to Comment HHRA-SC-6: As shown in Table 7-16, RDX and 2,4,6-trinitotoluene were identified as major risk drivers in surface soil. In addition Table ES-1 recommended that these chemicals be evaluated in the CMS.

As discussed in the Nature and Extent section, elevated concentrations of RDX and 2,4,6-trinitotoluene were limited to a small area associated with two soil samples,(03SS22 and 03SS24). The purpose of calculating risks excluding the data associated with these two soil samples was to demonstrate that the unacceptable risks were associated with samples 03SS22 and 03SS24 and to further demonstrate that risks from exposures to soil outside of the area bounded by these two soil samples would be within U.S. EPA acceptable levels.

The RFI does not identify these two samples as statistical outliers. The CMS, where risk management issues are address, will discuss whether these two samples will be remediated.

For further clarification, the last two sentences in the fifth paragraph of Section 7.5.2.1, Noncarcinogenic Risks – RME have been revised as follows:

> *"As discussed in Section 5.1,Surface Soil, the highest detected concentrations of 2,4,6-trinitotoluene and RDX occurred in samples 03SS22 and 03SS24. HIs for exposures to surface soil samples collected outside of the area bounded by these two samples would be 0.2 for the adult resident and 2 for the child resident, although the target organ specific*

HIs would be less than or equal to 1, indicating that adverse noncarcinogenic effects would not be anticipated for these receptors. Thus indicating that the unacceptable HIs for child and adult residents are being driven by the elevated concentrations of 2,4,6-trinitotoluene and RDX at sampling locations 03SS22 and 03SS24."

The sixth sentence in the fifth paragraph of Section 7.7, Summary and Conclusions has been to read as revised as follows.

"HIs for exposures to surface soil samples collected outside of the area bounded by these two samples would be within acceptable levels indicating that the unacceptable HIs for child and adult residents are being driven by the elevated concentrations of 2,4,6-trinitotoluene and RDX at sampling locations 03SS22 and 03SS24."

Comment HHRA-SC-7:

Section 7.5.2.2, Carcinogenic Risks - RME. This section discusses the estimates of risk for all receptors based on the Reasonable Maximum Exposure (RME). It is stated in the first paragraph of this section that cumulative lifetime incremental cancer risk (LICR) for the adolescent trespasser, off-site child and adult residents, construction worker, maintenance worker, and child and adult recreational users were "less than or within U.S. EPA's target risk range." However, the only risks discussed in the subsequent text are those that exceed the upper bound target risk of 10^{-4} (occupational worker). It appears that estimates of risk that fall within the risk range of 10^{-6} to 10^{-4} are not considered to be adverse. As discussed above, it is the decision of U.S. EPA Region 5 to determine whether risks to receptor populations at SWMU 3 that fall within the NCP risk range are acceptable, and these risks should therefore be discussed within the risk assessment. Revise the risk assessment to incorporate this change.

Response to Comment HHRA-SC-7: Table 7-16 provides a summary by media and receptor of those chemicals with cancer risks greater than 1×10^{-6} and hazard indices greater than 1. Cancer risks and hazard indices are discussed in the risk characterization section using the target levels presented in the

Quality Assurance Project Plan for Ammunition Burning Grounds, Little Sulphur Creek and Jeep Trail Resources Conservation and Recovery Act (TtNUS, 2001).

No changes have been made to the RFI text, however, for clarification Tables 7-12, 7-13, 7-14, and 7-15 have been revised to include all chemicals by exposure pathway with cancer risks greater than 1×10^{-6} and hazard indices greater than 1. For further discussion, please see the response to Comment HHRA-SC-1.

Comment HHRA-SC-8:

Section 7.5.2.2, Carcinogenic Risks - RME. The second paragraph of this section on page 7-28 discusses the carcinogenic risks calculated for a future on-site lifelong resident. The incremental lifetime cancer risk (ILCR) for this receptor is greater than the upper bound target risk of 10^{-4}. It is stated that the highest detected concentrations of 2,4,6-trinitrotoluene and RDX (the risk drivers for this receptor population) occurred in two samples, and that if these two samples were to be removed from the dataset, then the ILCR for the future on-site lifelong resident would be within "acceptable levels." It is not clear, based on this statement, whether risk estimates will be used as generated in this risk assessment, or whether the ILCR will be recalculated using a limited dataset. Revise the risk assessment to clarify whether risk estimates presented in this document will be used, or whether they will be recalculated.

It is also not clear how the dataset will be limited if risk estimates are recalculated. Specifically, it is not clear whether the areas of contamination identified by these two samples will be remediated, or whether the samples will be identified as statistical outliers, and removed from the dataset without removing the potential area of contamination. If the ILCR is recalculated, provide an explanation of how the samples in question are "removed from the dataset" as stated in the current version of the risk assessment.

Response to Comment HHRA-SC-8: As shown in Table 7-16, RDX and 2,4,6-trinitotoluene were identified as major risk drivers in surface soil. In Table ES-1 Recommendations, these chemicals are indicated as

requiring further evaluation in the CMS.

As discussed in Subsection 5.1, Surface Soil, of Nature and Extent, elevated concentrations of RDX and 2,4,6-trinitotoluene were limited to a small area associated with two soil samples (03SS22 and 03SS24). The purpose of calculating risks without using data from these two soil samples was to show that the unacceptable risks were associated with these two samples and risks from exposures to soil outside of the area bounded by these two soil samples would be within the U.S. EPA target risk range.

The RFI text does not identify these two samples as statistical outliers. The CMS, where risk management issues are addressed, will discuss whether these two samples will be remediated. The last sentence in the first paragraph of Section 7.5.2.2, Carcinogenic Risks – RME, has been revised as follows:

> *"The ILCR for exposures to surface soil samples collected outside of the area bounded by these two samples would be 6 x 10^{-6} for the future on-site lifetime resident, which is within U.S. EPA target risk range. This indicates that the unacceptable ICLRs for child and adult residents are being driven by the elevated concentrations of 2,4,6-trinitotoluene and RDX at sampling locations 03SS22 and 03SS24."*

The fifth sentence in the seventh paragraph of Section 7.7, Summary and Conclusions, has been revised as follows.

> *"The ILCR for exposures to surface soil samples collected outside of the area bounded by these two samples would be within the U.S. EPA target risk range. This indicates that the unacceptable ICLRs for the future lifetime residents are being driven by the elevated concentrations of 2,4,6-trinitotoluene and RDX at sampling locations 03SS22 and 03SS24."*

Comment HHRA-SC-9:

Section 7.5.2.4, Risks from Lead. On page 7-30 the third paragraph of this section discusses the risks from lead calculated for a future on-site child resident. It is stated that lead was detected in

only one sample (03SS240002) at a concentration that exceeded the screening level of 400 mg/kg. It is further stated that if this sample was removed from the dataset, then the average blood-lead level generated using the Integrated Exposure Uptake Biokinetic (IEUBK) model for the future on-site child resident would be within acceptable levels" It is not clear, based on this statement, whether risk estimates will be used as generated in this risk assessment, or whether the blood-lead level will be recalculated using a limited dataset. Revise the risk assessment to clarify whether estimates of risk from lead (estimated as blood-lead levels) presented in this document will be used, or whether they will be recalculated.

It is also not clear how the dataset will be limited if blood-lead levels are recalculated. Specifically, it is not clear whether the areas of contamination identified by sample 03SS240002 will be remediated, or whether the sample will be identified as a statistical outlier, and removed from the dataset without removing the potential area of contamination. If blood-lead levels are recalculated, provide an explanation of how the sample in question is "removed from the dataset" as stated in the current version of the risk assessment.

Response to Comment HHRA-SC-9: As shown in Table 7-16, lead was identified as a major risk driver in surface soil. The purpose of calculating risks without using data from this one soil sample was to show that the unacceptable risks were associated with just one sample and that risks from exposures to soil outside of the area bounded by this one soil sample would be within acceptable levels.

The RFI text does not identify this sample as a statistical outlier. The CMS, where risk management issues are addressed, will discuss whether this sample will be remediated. The third paragraph of Section 7.5.2.4, Risk from Lead, will be revised as follows:

> *"Hypothetical future residential exposures to lead in surface soil were evaluated using the IEUBK lead model (U.S. EPA, 2002a). As recommended by the IEUBK model, the average concentration of lead in surface soil of 1,224 mg/kg was used as the exposure point concentration for soil for the 1-acre EU. The average concentration of lead in ground water*

of 0.34 µg/L was used as the exposure point concentration for drinking water. Default parameters were used for the rest of the model input parameters. IEUBK model outputs are included in Appendix G. The lead concentration of 1,224 mg/kg in surface soil results in 60 percent of future on-site child residents having a blood-lead level greater than 10 µg/dL and a geometric mean blood-lead level of 11 µg/dL. This exceeds the 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. Lead was detected in only one surface soil sample (10,200 mg/kg – 03SS240002) at a concentration that exceeded the screening level of 400 mg/kg. The second highest detected concentration of lead in surface and subsurface soil across the entire site was 244 mg/kg. The average concentration of lead in surface soil outside of the area bounded by sample 03SS24 is 57 mg/kg. Using this value in the IEUBK model results in 0.02 percent of future on-site child residents having a blood-lead level greater than 10 µg/dL and a geometric mean blood-lead level of 1.6 µg/dL. These results are within the goals described in the 1994 OSWER directive, of no more than 5 percent of children exceeding a 10 µg/dL blood-lead level. These results indicate that the unacceptable risks from exposures to lead in surface soil by child residents are being driven by the elevated lead concentrations in sample 03SS24002."

The last sentence in fifth paragraph of Section 7.7, Summary and Conclusions has been revised as follow:

"Exposures to lead in surface soil outside of the area bounded by sample 03SS24002 would be within the goals described in the 1994 OSWER directive, of no more than 5 percent of children exceeding a 10 µg/dL blood-lead level. These results indicate that the unacceptable risks from exposures to lead in surface soil by child residents are being driven by the elevated lead concentrations in sample 03SS24002."

ECOLOGICAL RISK ASSESSMENT COMMENTS

GENERAL COMMENTS

Comment ERA-GC-1:

It is stated throughout the RFI Report that Step 3a is the first step of the baseline ecological risk assessment (BERA) process, and is used to refine the list of COPCs from the screening-level ecological risk assessment (SERA). While the refinement of COPCs after the SERA is acceptable, the scientific management decision point (SMDP), that is recommended to be presented at the completion of the SERA in both the Ecological Risk Assessment Guidance for Superfund: Process for Designing and Conducting Ecological Risk Assessments (1997 U.S. EPA ERA guidance) and the Navy's ERA method (see Figure 8-1), has not been clearly presented.

The presentation of the SMDP should be based on the results of the SERA Steps 1 and 2, and it should be indicated whether data collected for the SERA are adequate for the decision presented in the SMDP. It is understood that a discussion of data gaps and uncertainties is provided in Section 8.5, STEP 3a - COPC REFINEMENT, and it is not intended that this information be restated for the SMDP. However, the information provided throughout the document should be integrated and presented in the context of an SMDP at the end of SERA Steps 1 and 2 to support the decision made for the SMDP in the context of ecological risk. Revise the RFI Report to include a clear presentation of the SMDP at the completion of U.S. EPA Steps 1 and 2 of the SERA based on information provided in the SERA, before progressing to Step 3a.

Response ERA-GC-1: The RFI report has been revised to include the SMDP as a new Section 8.5 (Scientific/Management Decision Point) presented after Steps 1 and 2 of the SERA and prior to Step 3a of the BERA. Note that all following sections have been renumbered to reflect this addition.

Attachment 1 to this comment response document presents the new Section 8.5 (Scientific/Management Decision Point).

Comment ERA-GC-2:

No information is provided in the RFI Report on threatened and endangered (T&E) species for SWMU 3, with the exception of the Indiana Bat. Therefore, it is unclear whether T&E species or other special status species or communities may be present at SWMU 3. Special consideration must be given to T&E species, and measurement and assessment endpoints selected for examining potential exposure to these species should focus on assessing risks to individuals, not populations. Revise the RFI Report to provide information documenting that T&E species and species of special concern, in addition to the Indiana bat, are absent at the site. If complete information cannot be provided to verify that these species are unlikely to use the site, then T&E species and species of special concern must be considered in the SERA. The Illinois natural heritage program or biodiversity database should be consulted in determining the potential presence of special status species or habitats in proximity to SWMU 3, and documentation of the consultation should be provided in the RFI Report as an Appendix.

In terms of the Indiana Bat, it is stated that this species was not used to represent insectivorous mammals for the SWMU 3. This is based on the fact that risk evaluations to the Indiana Bat along Sulphur Creek are considered "low", and the fact that the Navy has not yet received comments on the risk evaluation for the Indiana Bat. However, no information is provided in this document to indicate what "low" risks represent. In addition, although a risk evaluation for the Indiana Bat has been submitted by the Navy (January 2002), no official determination has yet been made on this report. Therefore, until the risk evaluation is officially approved and accepted, the Indiana Bat should be included as a T&E receptor of concern for investigation of the Naval Surface Warfare Center - Crane Division (NSWC Crane) facility. Revise the RFI Report to include this information. Alternatively, the Navy may include the Indiana Bat risk assessment as an Appendix and summarize the risk results and conclusions in the RFI Report.

Response to comment ERA-GC-2: The following discussion of the threatened and endangered

species has been added as the last paragraph of Section 8.2.1, Site Description:

> *"An Endangered Species Management Plan for NSWC Crane was prepared in October 2000 (Comarco Systems, Inc., 2000). As part of this plan, the federal and state endangered, threatened, and species of special concern for the facility were identified. There are numerous species of wildlife located throughout NSWC Crane. Of these species, some are listed as endangered, threatened, or species of special concern, including several birds [bald eagle, osprey, sharp-shinned hawk, red-shouldered hawk, broad-winged hawk, black and white warbler, hooded warbler, worm eating warbler (B&R Environmental, 1997)], two mammals (Indiana Bat, Bobcat), and two reptiles (timber rattlesnake, northern copperhead). There is some uncertainty for potential risks to these protected species at the site because risks to those species were not specifically evaluated in the ERA."*

The following text has been added as the last paragraph in Section 8.2.5.3, Selection of Receptor Species:

> *"As presented in Section 8.2.1, several endangered, threatened, or species of special concern are present at NSWC Crane, and potentially may inhabit SWMU 03, although it is unlikely that bald eagles and ospreys will feed at the site because they usually feed in large open waters. Risks to the endangered, threatened, or species of special concern were not specifically calculated, with the exception of the Indiana bat for reasons presented in this paragraph. As discussed in Section 8.2.5.1, large carnivorous mammals and birds were not selected as assessment endpoints because SWMU 03 is very small compared to the home range of these species and because the greatest exposure to site contaminants is expected to occur to small mammals and birds that ingest invertebrates, fish, or plants.*

Therefore, risks to the bobcat, bald eagle, osprey, sharp-skinned hawk, red-shouldered hawk, and broad-winged hawk are not specifically evaluated in this ERA, but are discussed in the uncertainty analysis section as presented in Section 8.7.1. The black and white warbler, hooded warbler, and worm eating warbler are all invertebrate eating birds that consume insects. These birds may be present in the area around SWMU 03 because of the open grass and wooded area surrounding the SWMU. Therefore, the American robin (an insectivorous bird) will serve as a surrogate for those species and the uncertainties will be discussed in Section 8.7.1. Risks to the endangered reptile species are not evaluated in this ERA because exposure factors are not established for most species, and toxicity data are limited."

The following discussion has been added as new fourth paragraph in the renumbered Section 8.7.1, Endpoints:

"As discussed in Section 8.2.5.3, several endangered, threatened, or species of special concern are present at NSWC Crane, and potentially may inhabit SWMU 03. Risks to these species were not specifically calculated, with the exception of the Indiana bat for reasons presented in Section 8.2.5.3 so the uncertainties of not calculating risks to these species are presented in this paragraph. As discussed above, risks to the large carnivorous mammals and birds are expected to be negligible so risks to the bobcat, bald eagle, osprey, sharp-skinned hawk, red-shouldered hawk, and broad-winged hawk also are expected to be negligible. Warblers consume mostly aboveground insects such as caterpillars, beetles, spiders, and flies, as opposed to the worms consumed by the American robin in the food chain model. Since worms are in direct exposure to the soil, it is expected that they would have greater levels of contaminants at SWMU 03 that the other

aboveground insects. Therefore, risks to the robins from consuming worms are expected to be greater than risks to the warblers from consuming aboveground insects. Risks to the worm eating American robin from chemicals in the surface soil and surface water were determined to be low. Therefore, risks to the warblers also are expected to be low (and should be lower) than risks to robins."

As stated in the fourth paragraph of Section 8.2.5.3, Selection of Receptor Species, the federally endangered Indiana bat was not used to represent insectivorous mammals in the food-chain modeling because of previous evaluations of this species. A study conducted at the ABG in the summer of 2000, determined concentrations of explosive compounds, phosphorus, and metals in the tissues of insects commonly consumed by the Indiana bat. Based on these data, an Ecological Risk Evaluation for the Indiana bat from the consumption of those insects was conducted by the Navy and submitted to Regulators in January, 2002. Comments on this risk evaluation were received from U.S. EPA in January, 2003. Responses to those comments were submitted back to the U.S. EPA in March, 2003. The Navy will include the risk evaluation as an Appendix to this RFI report once the evaluation has been finalized.

Comment ERA-GC-3:

The conclusion reached in this document is that based on the results of the SERA and Step 3a, no COPCs are retained as Chemicals of Concern (COCs) in media sampled for SWMU 3. These conclusions were based mainly on home range considerations, bioavailability considerations, and the fact that hazard quotients [Ecological Effects Quotients (EEQs)] were relatively low.

Rather than using qualitative evaluations of home range and bioavailability to discount the risk results, more site specific exposure assumptions should be incorporated into the wildlife exposure modeling. For the SERA, home ranges should be set at one, in order to provide a conservative

estimate for the potential of ecological risk. Any bioavailability adjustments should be justified and documented with literature citations or site specific information.

An alternative to complete revision of the exposure modeling and risk characterization would be to include a more quantitative assessment of risk uncertainties. This would include bounding the current risk estimates in the Uncertainty Section by recomputing some EEQs using less conservative bioavailability and area use assumptions. This is a preferred alternative to the largely qualitative evaluation of uncertainties presented in Section 8.6. A complete reassessment of COPC risks would not be necessary, and should be focused on those contaminants that exceeded an EEQ of one.

More importantly, based on the information provided, it does not appears that all COPCs should be removed from further consideration for SWMU 3. For example, dose modeling for the American robin shows that based on conservative examinations for both No Observed Adverse Effect Levels (NOAELs) and Lowest Observe Adverse Effect Levels (LOAELs), EEQs for chromium, lead, mercury, and zinc all exceed one. Furthermore, EEQs for these analytes still exceed one for less conservative modeling based on the NOAEL, with lead exceeding an EEQ of one using a LOAEL. Cadmium, lead, copper and zinc follow the same trends for raccoon and kingfisher EEQs for conservative dose modeling, with all of these COPCs retained for the raccoon based on less conservative dose modeling using the NOAEL, and lead and zinc retained for the kingfisher. Raccoon EEQs were also above one for copper and zinc for less conservative modeling based on the LOAEL. In addition, a number of these COPCs exceeded benchmarks for plants, earthworms, and aquatic organisms. Therefore, it appears that these analytes should be retained for further examination as COCs. Revise the RFI Report to include copper, zinc, and lead as COCs, or provide further justification that these chemicals should not be retained as COCs. Additional contaminants must also be considered as potential COCs because they were inappropriately excluded in the COPC evaluation because of uncertainty associated with the source of contamination (See Specific Comment 3).

Response to comment ERC-GC-3: As indicated in the last paragraph of the renumbered Section 8.6.3.1, Methodology, the $LOAEL_{avg}$ was used in Step 3a to further refine the list of COPCs identified during the ecological screening. The $LOAEL_{avg}$ was used as the "cut-off" point for defining the risk drivers at SWMU 03 because it is considered the point where risks may occur verses the $NOAEL_{avg}$ where risks are not expected to occur. It is more appropriate to carry chemicals forwards when risks may occur, versus when risks will not occur. For this reason, lead in the robin model was the only chemical with a $LOAEL_{avg}$ greater than 1.0 and a more specific and quantitative scenario for lead was included by removing the elevated lead sample concentration at 03SS24. This seemed appropriate because the area represented by 03SS24 is relatively small as compared to SWMU 03 overall. As indicated in the newly renumbered Section 8.6.3.2, the average surface soil lead concentration without sample 03SS24 is 40 mg/kg. Under the average exposure scenario, lead EEQs for the robin based on 40 mg/kg are 6.2 (NOAEL-based) and 0.6 (LOAEL-based). It was determined that these relatively low EEQs indicate that potential lead-related risks via the food-chain are negligible for insectivorous avian receptors, except in the vicinity of sample 03SS24. For this reason, lead was retained as a surface soil COC for the potential to cause adverse risks to insectivorous birds in the vicinity of 03SS24.

A recalculation of the EEQs similar to that of lead in the robin model, however, was not conducted for the piscivorous surrogate species and instead a qualitative discussion was incorporated into the text. However, the Navy agrees that a quantitative recalculation using other less conservative scenarios (i.e., area use factors) is appropriate for the kingfisher and raccoon. The following text, including two new paragraphs, have been added to the end of the third paragraph in the renumbered Section 8.6.3.2, Results and Discussion, Subsection, Piscivorous Receptors:

> *"...For this reason, area use factors were used in recalculating the EEQs for both the kingfisher and raccoon models. This assumption was used because it is unlikely that piscivorous birds and mammals will obtain 100 percent of their food from LSC for several reasons. Most of LSC from the headwaters to Spring C is intermittent, and is typically dry. The stream becomes perennial downstream of Spring C (with the exception of the deep*

pools by Springs A and C), however, most of the creek in this area consists of shallow riffles and runs. Therefore, the size and quantity of fish in this portion of LSC is limited by the habitat to mostly small fish, except perhaps in the pools. This is further supported by the biological surveys conducted in 1995 as described in Section 8.2.1 of this report. Based on this survey, the most abundant fish were bluntnose minnows, silverjaw minnows, gizzard shad, and creek chubs; most of which are small fish species. Less then 50 individuals from each species were collected with the exception of the bluntnose minnows, where more than 50 individuals were collected. Although the collected fish samples were not weighed, these species are generally small and weigh only a few grams. Some larger fish may have been collected in the pooled areas but the numbers would be low. Therefore, based on the ingestion rates for the raccoon (1.3 kg/day or 2.9 lbs per day) and the kingfisher (0.068 kg/day or 0.15 lbs/day), it is unlikely that sufficient quantities of fish exist in the creek to support piscivorous wildlife, especially mammals such as raccoons that would require consuming hundreds of minnows each day.

"Based on the above discussion, the food chain models for the kingfisher and raccoon were recalculated using area use factors (AUFs) of 25 percent and 10 percent, respectively. The AUFs are different for the species based on the amount of food that they (and the species they represent) consume. These AUFs are still considered conservative. The recalculated values are presented in Appendix H.5. Only the NOAEL-based EEQs for lead and zinc exceed 1.0 under the kingfisher conservative scenario. No EEQs exceeded 1.0 under the average exposure scenario. For the raccoon conservative scenario, cadmium, copper, lead, and zinc had NOAEL-based EEQs greater than 1.0 with copper and zinc LOAEL-based EEQs of 2.84 and 1.72, respectively. However, no EEQs exceeded 1.0 under the average exposure scenario. Additionally, when only copper and zinc sample concentrations for sediment samples 03SD14 through 03SD19 (i.e., area representing viable fish habitat and the area most likely for piscivorous mammals to be feeding along LSC) are considered, the NOAEL EEQ drops to 0.357 and 0.31, respectively (see Appendix H.5).

"Additionally, other contaminants that were disregarded because of uncertainty associated with the source of contamination were reviewed for inclusion as potential COCs. Even though chemical concentrations for 2,4-D, barium, lead, and zinc were elevated in areas of LSC that are typically dry and do not support aquatic receptors, these chemicals have been retained as final COCs in the sediment as a conservative measure for the potential to cause adverse risks to aquatic organisms."

SPECIFIC COMMENTS

Comment ERA-SC-1:

Executive Summary, Page ES-1 to ES-5. The Executive Summary does not adequately convey the ecological risk results, and makes a risk management conclusion that "no acceptable ecological risks were found". Risk management conclusions should be removed and only risk results and uncertainties should be presented in the Executive Summary. The Executive Summary should be revised to include a brief summary of the COPCs identified in both the SERA and Step 3a screening. Additionally, Table ES-1 should be revised by replacing the 'not applicable' (N/A) summary of ecological risks with EEQs for the major constituents of concern identified in both the Step 2 SERA and Step 3a screening.

Response to comment ERA-SC-1: The former fifth bullet, which is now a new sixth bullet, in the Executive Summary, Subsection Conclusions has been rephrased to give a better summation of risk results and uncertainties. The text has been modified as follows:

"Several chemicals were retained as COPCs in the initial ecological screening process in sediment, surface soil, and surface water due to exceedence of direct contact risk-based COPC screening levels, or because no current media specific EDQLs are available. During the refined Step 3a process, 2,4-D, barium, lead, and zinc were retained as COCs in sediment with the possibility of presenting unacceptable risks to benthic

macroinvertebrates in the northern portion of LSC. Table ES-1 presents the EEQs for the main risk drivers. Although, currently the most elevated levels of chemicals in LSC are in areas where the creek is intermittent and there is little viable aquatic habitat, the chemicals in that area may migrate to areas of the creek that are perennial and cause risks to aquatic receptors in the future. Additional uncertainties associated with the risks are described in Section 8.7."

Additionally, Table ES-1 has been revised by replacing the "not applicable" summary for the ecological critical pathways and COCs with actual EEQs for the major constituents identified in both the Step 2 SERA and Step 3a screening process.

Comment ERA-SC-2:

Section 4.3, Selection of Ecological Risk Chemicals of Potential Concern. It is stated in the fourth paragraph on page 4-13 that surface soils will be investigated to examine ecological exposures at the site, but it appears that surface soil investigation for ecological receptors will focus on the zero to 2 feet below ground surface (bgs) interval. Soil intervals typically used to evaluate ecological exposures are zero to 0.5 feet bgs for surface soil and 0.5 to 2 feet bgs for subsurface soil. Depending on the nature of contamination and distribution, a composite of data from the zero to 2 feet bgs interval may underestimate risk through extrapolation of a chemical concentration across the entire sampling column, or could overestimate risk for one of the two sampling intervals. Revise this SERA to use the zero to 0.5 feet bgs for surface soil exposures, and the 0.5 to 2 feet bgs for subsurface exposure. If data for surficial soils are lacking, provide a detailed discussion of this information as a data gap and discuss this in the uncertainty section.

It is also noted in Section 4.3 that standard ecological screening values are not available for a number of explosive compounds. Screening values from Lotufo et al. (2001, listed below), based on explosives toxicity to soil dwelling organisms, aquatic organisms and wildlife, should be considered for use in the SERA process. Additionally, U.S. EPA (2000, listed below) has

established a wildlife screening value for RDX in soil. It should also be noted that the U.S. Army Center for Health Promotion and Preventative Medicine has recently completed mammalian and avian toxicology studies, which include information on some explosives compounds. Revise the RFI Report to consider these values in the SERA process.

Response ERA-SC-2: The surface soil samples comply with the definition of surface soil as stated in Section 4.4.1 of the approved April 2001, QAPP. Also, ecological receptors such as worms and plant roots may extend deeper than 0.5 feet into the soil, so risks are not necessarily being underestimated by combining data over the 0 to 2 foot range. For further clarification, the fifth paragraph of the renumbered Section 8.7.2, Exposure Characterization, has been replaced with the following text:

> *"Surface soil was collected from the 0' to 2' bgs depth interval. Background surface soil data were collected from 0' to 1' bgs depth interval as a compromise depth for all NSWC Crane projects for which a variety of surface soil depths may be used. There is uncertainty in this approach depending on the source of contamination and how it was disposed at the site (i.e., deposited on the surface as a result of burning activities, buried, etc.) because the two different depth intervals represent slightly different soil populations. However, the uncertainty was not viewed to be unnecessarily large given all of the other uncertainties associated with environmental investigations."*

A variety of references were used in compiling the information used to determine standard ecological screening values for explosive compounds. The Lotufo reference listed in the comment only has values for marine/estuarine benthic invertebrates, and not for soil dwelling organisms or wildlife. As presented in the renumbered Section 8.6.2.2, Sediment, the referenced document by Steevens, et al., of which Lotufo was a co-author, evaluated the toxicity of the same chemicals to freshwater benthic invertebrates. These freshwater values are more appropriate than the marine/estuarine values in the Lotufo reference. Also, those values are more appropriate in Step 3a refinement vs. the initial screening because they are "not" screening values. NSWC also researched the listed document U.S. EPA 2000, however this document is in a draft version and the soil screening levels in this document should not be cited. Finally, the cited U.S. Army

documents only have data for mammalian and avian toxicity. The explosives were not carried through the FCM because they are not bioaccumulative. Therefore these documents were not used in the ERA.

Comment ERA-SC-3:

Section 8.5.2.2, Sediment. While the majority of information in this section is appropriate and provides useful information, a number of analytes are removed as sediment COCs based on the fact that it can not be determined whether detected COPCs are present due to contamination originating from the Old Jeep Trail (OJT), or the Ammunition Burning Ground (ABG). Examples of the COPCs removed from further consideration include 2,4-D, barium, lead and zinc. However, while the origin of sediment COPCs should be determined, it is not acceptable to remove COPCs from further consideration based on the fact that another SWMU, that is not being dealt with in this document, might be the source of contamination. Therefore, all COPCs that were removed from further consideration due to the uncertainty of the source, should be included in this assessment. Revise the RFI Report to incorporate these analytes in the risk assessment process.

Response ERA-SC-3: NSWC agrees that certain contaminants should not be removed as COCs based on the sole fact that it cannot be determined whether detected COPCs are present due to contamination originating from the OJT. 2,4-D, barium, lead, and zinc were not dismissed solely on that assumption as presented in the renumbered Section 8.6, Step 3a, COPC Refinement. However, as a conservative measure these chemicals have been retained as final COCs for the potential that elevated concentrations may occur in the future in areas where LSC becomes perennial and has better aquatic habitat.

U. S, EPA References

U.S. EPA. 2000. Ecological Soil Screening Level Guidance. Draft. July 10, 2000. U.S. Environmental Protection Agency, Washington, DC. http://www.epa.gov/superfund/programs/risk/ecorisk/ecossl.htm

Lotufo GR., Farrar JD, Inouye LS, Bridges TS, Ringelberg DB. 2001. Toxicity of sediment-associated nitroaromatic and cyclonitramine compounds to benthic invertebrates. Environ Toxicol Chem 20:1762–1771.

ADDITIONALL MODIFICATION TO THE RFI REPORT:

Non-Technical Changes

1. Various grammar, punctuation, spelling, typing, and capitalization errors have been corrected throughout the RFI Report.
2. Miscellaneous acronyms have been defined and added to the RFI Report acronym list.
3. Miscellaneous references have been updated to reflect revisions to the documents.

Technical Changes

1. The following bullet text has been added as a new fifth bullet under "CONCLUSIONS" in the Executive Summary:

   - *"Unacceptable exposure of the future child resident to surface soils was identified, primarily because of high lead concentrations at surface soil sampling location 03SB24."*

   Additionally, a new column has been added to Table ES-1 entitled "Lead Exposure," and this column has been populated with appropriate data to reflect lead exposures. Footnotes to the table have been added or changed, as appropriate.

2. The fourth sentence in the second paragraph of Section 5.5, Deep Sediment, Subsection Metals has been revised to reflect the downstream location of the sample as follows:

   "This sample is located downstream of the OJT Burn Area and Burn Pit where most site activities are known or suspected to have taken place."

ATTACHMENT I

TABLES ES-1, 3-4, 3-5, 7-12, 7-13, 7-14, and 7-15
AND
NEW APPENDIX H.5 TABLES

TABLE ES-1

SUMMARY OF RECEPTOR-SPECIFIC HUMAN RISKS, AND HAZARDS AND ECOLOGICAL RISKS, AND RECOMMENDATIONS
SWMU 03 - OLD JEEP TRAIL/LITTLE SULPHUR CREEK
NSWC CRANE
CRANE, INDIANA

Receptor Population	Environmental Media	Overall Carcinogenic Risk (Human)	Overall Hazard Index (Human)	Lead Exposure[1]	Overall Risk (Ecological)[4]	Critical Pathways & Chemicals of Concern	Recommendations
Current/Future Trespasser (Adolescent)	Surface Soil, Surface Water and Sediment	5E-07	0.04	No unacceptable exposure to lead[2]	N/A	N/A	NFA
Current/Future Off-Site Resident (Child)	Surface Water	9E-06	1	No unacceptable exposure to lead[2]	N/A	N/A	NFA
Current/Future Off-Site Resident (Adult)	Surface Water	1E-05	0.3	No unacceptable exposure to lead[2]	N/A	N/A	NFA
Current/Future Off-Site Resident (Lifelong)	Surface Water	2E-05	N/A	No unacceptable exposure to lead[2]	N/A	N/A	NFA
Future Construction Worker (Adult)	Soil and Ground Water	4E-07	0.5	No unacceptable exposure to lead[3]	N/A	N/A	NFA
Future Maintenance Worker (Adult)	Surface Soil, Surface Water, and Sediment	1E-07	0.02	N/A	N/A	N/A	NFA
Future Occupational Worker (Adult)	Surface Soil and Ground Water	1E-04	2	No unacceptable exposure to lead[3]	N/A	Ingestion of ground water (trichloroethene)	Proceed to CMS

TABLE ES-1

SUMMARY OF RECEPTOR-SPECIFIC HUMAN RISKS, AND HAZARDS AND ECOLOGICAL RISKS, AND RECOMMENDATIONS
SWMU 03 - OLD JEEP TRAIL/LITTLE SULPHUR CREEK
NSWC CRANE
CRANE, INDIANA

Receptor Population	Environmental Media	Overall Carcinogenic Risk (Human)	Overall Hazard Index (Human)	Lead Exposure[1]	Overall Risk (Ecological)[4]	Critical Pathways & Chemicals of Concern	Recommendations
Future Recreational User (Child)	Surface Soil, Ground Water, Surface Water, and Sediment	3E-05	2	No unacceptable exposure to lead[2]	N/A	Ingestion of ground water (trichloroethene)	Proceed to CMS
Future Recreational User (Adult)	Surface Soil, Ground Water, Surface Water, and Sediment	2E-05	0.5	No unacceptable exposure to lead[2]	N/A	N/A	NFA
Future Recreational User (Lifelong)	Surface Soil, Ground Water, Surface Water, and Sediment	5E-05	N/A	No unacceptable exposure to lead[2]	N/A	N/A	NFA
Future On-Site Resident (Child) 1 Acre Exposure Unit	Surface Soil, Surface Water, and Sediment	2.E-04	33	Blood lead >10 ug/dL for surface soil; <10 ug/dL for sediment. Surface water was evaluated qualitatively	N/A	Incidental ingestion and dermal contact with surface soil (2,4,6-trinitrotoluene; RDX; lead) Ingestion of surface water (2-amino-4,6-dinitrotoluene; 4-amino-2,6-dinitrotoluene; RDX)	Proceed to CMS
Future On-Site Resident (Child) 6 Acre Exposure Unit	Surface Soil, Surface Water, and Sediment	6.E-05	11	No unacceptable exposure to lead[2]	N/A	Ingestion of surface water (2-amino-4,6-dinitrotoluene; 4-amino-2,6-dinitrotoluene; RDX)	Proceed to CMS

TABLE ES-1

SUMMARY OF RECEPTOR-SPECIFIC HUMAN RISKS, AND HAZARDS AND ECOLOGICAL RISKS, AND RECOMMENDATIONS
SWMU 03 - OLD JEEP TRAIL/LITTLE SULPHUR CREEK
NSWC CRANE
CRANE, INDIANA

Receptor Population	Environmental Media	Overall Carcinogenic Risk (Human)	Overall Hazard Index (Human)	Lead Exposure[1]	Overall Risk (Ecological)[4]	Critical Pathways & Chemicals of Concern	Recommendations
Future On-Site Resident (Child) 1 Acre Exposure Unit	Surface Soil, Ground Water, and Sediment	5.E-04	45	N/A	N/A	Incidental ingestion and dermal contact with surface soil (2,4,6-trinitrotoluene) Ingestion of ground water (trichloroethene; 4-amino-2,6-dinitrotoluene)	Proceed to CMS
Future On-Site Resident (Child) 6 Acre Exposure Unit	Surface Soil, Ground Water, and Sediment	3.E-04	23	N/A	N/A	Ingestion of ground water (trichloroethene; 4-amino-2,6-dinitrotoluene)	Proceed to CMS
Future On-Site Resident (Adult) 1 Acre Exposure Unit	Surface Soil, Surface Water, and Sediment	1.E-04	5	No unacceptable exposure to lead[2]	N/A	Incidental ingestion of surface soil (2,4,6-trinitrotoluene) Ingestion of surface water (4-amino-2,6-dinitrotoluene)	Proceed to CMS
Future On-Site Resident (Adult) 6 Acre Exposure Unit	Surface Soil, Surface Water, and Sediment	7.E-05	3	No unacceptable exposure to lead[2]	N/A	Ingestion of surface water (4-amino-2,6-dinitrotoluene)	Proceed to CMS
Future On-Site Resident (Adult) 1 Acre Exposure Unit	Surface Soil, Ground Water, and Sediment	4.E-04	9	N/A	N/A	Incidental ingestion of surface soil (2,4,6-trinitrotoluene) Ingestion of ground water (trichloroethene)	Proceed to CMS
Future On-Site Resident (Adult) 6 Acre Exposure Unit	Surface Soil, Ground Water, and Sediment	4.E-04	7	N/A	N/A	Ingestion of ground water (trichloroethene)	Proceed to CMS

TABLE ES-1

SUMMARY OF RECEPTOR-SPECIFIC HUMAN RISKS, AND HAZARDS AND ECOLOGICAL RISKS, AND RECOMMENDATIONS
SWMU 03 - OLD JEEP TRAIL/LITTLE SULPHUR CREEK
NSWC CRANE
CRANE, INDIANA

Receptor Population	Environmental Media	Overall Carcinogenic Risk (Human)	Overall Hazard Index (Human)	Lead Exposure[1]	Overall Risk (Ecological)[4]	Critical Pathways & Chemicals of Concern	Recommendations
Future On-Site Resident (Lifelong) 1 Acre Exposure Unit	Surface Soil, Surface Water, and Sediment	3.E-04	N/A	No unacceptable exposure to lead[2]	N/A	Incidental ingestion and dermal contact with surface soil (RDX) Ingestion of surface water (RDX)	Proceed to CMS
Future On-Site Resident (Lifelong) 6 Acre Exposure Unit	Surface Soil, Surface Water, and Sediment	1.E-04	N/A	No unacceptable exposure to lead[2]	N/A	Ingestion of surface water (RDX)	NFA
Future On-Site Resident (Lifelong) 1 Acre Exposure Unit	Surface Soil, Ground Water, and Sediment	9.E-04	N/A	N/A	N/A	Incidental ingestion and dermal contact with surface soil (RDX) Ingestion of ground water (1,1,2,2-trichloroethane; trichloroethene)	Proceed to CMS
Future On-Site Resident (Lifelong) 6 Acre Exposure Unit	Surface Soil, Ground Water, and Sediment	7.E-04	N/A	N/A	N/A	Ingestion of ground water (1,1,2,2-trichloroethane; trichloroethene)	Proceed to CMS
Terrestrial Plants and Invertebrates	Surface Soil	N/A	N/A	N/A	low	N/A	NFA
Aquatic Organisms	Surface Water and Sediment	N/A	N/A	N/A	low	N/A	NFA

TABLE ES-1

SUMMARY OF RECEPTOR-SPECIFIC HUMAN RISKS, AND HAZARDS AND ECOLOGICAL RISKS, AND RECOMMENDATIONS
SWMU 03 - OLD JEEP TRAIL/LITTLE SULPHUR CREEK
NSWC CRANE
CRANE, INDIANA

Receptor Population	Environmental Media	Overall Carcinogenic Risk (Human)	Overall Hazard Index (Human)	Lead Exposure[1]	Overall Risk (Ecological)[4]	Critical Pathways & Chemicals of Concern	Recommendations
Mammals and Birds	Surface Soil and Surface Water[5]	N/A	N/A	N/A	**American Robin** Lead: 24 (all samples); 0.6 (excluding sample 03SS24)	Incidental ingestion of surface soil through worms by birds (lead)	NFA
Mammals and Birds	Sediment and Surface Water[5]	N/A	N/A	N/A	**Raccoon** AUF-100% Copper: 2.76 Selenium: 1.99 Zinc: 1.55 AUF-10% Copper: 0.276 Selenium: 0.199 Zinc: 0.155	Incidental ingestion of sediment through fish and invertebrates by piscivirous mammals (copper, selenium, zinc)	NFA

1 The IEUBK model was used for evaluating child exposures and the Adult Lead Model was used for evaluating adult exposures. Refer to Section 7.0.
2 This receptor evaluated for exposure to lead in surace water only.
3 This worker evaluated for exposure to lead in soil only.
4 The LOAEL avergae is shown because it was used in defining the risk drivers at SWMU 03.
5 Ingestion of surface water is included in the food-chain models for evaluating risks from soil and sediment. However, the surface water component does not contribute appreciably to the overall risks to birds or mammals.

N/A = Not applicable
NFA = No further action
CMS = Corrective Measures Study
AUF = Area use factor

TABLE 3-4

SOLID AND AQUEOUS MINIMUM AND MAXIMUM DETECTION LIMITS VERSUS RBTLs AND EDQLs
SWMU 03- OLD JEEP TRAIL/LITTLE SULPHUR CREEK
NSWC CRANE
CRANE, INDIANA

Parameter	Aqueous Matrix				Solid Matrix			
	Observed Min DL (µg/L)	Observed Max DL (µg/L)	Laboratory MDL/IDL[1] (µg/L)	Risk-Based Target Level [2] (µg/L)	Observed Min DL (mg/kg)	Observed Max DL (mg/kg)	Laboratory MDL/IDL[1] (mg/kg)	Lower of Soil and Sediment RBTLs (mg/kg)
EXPLOSIVES (SW-846 METHOD 8330)								
1,3,5-Trinitrobenzene	0.35	0.35	0.35	1100	0.25	0.25	0.25	1800
1,3-Dinitrobenzene	0.35	0.35	0.35	2.36	0.25	0.25	0.25	0.000924
2,4,6-Trinitrotoluene (TNT)	0.35	0.35	0.35	2.2	0.25	0.25	0.25	16
2,4-Dinitrotoluene	0.35	0.35	0.35	1.2	0.25	0.33	0.25	0.00004
2,6-Dinitrotoluene	0.35	0.35	0.35	1.2	0.25	0.25	0.25	0.00003
2-Amino-4,6-dinitrotoluene	0.12	0.35	0.35	2	0.25	0.25	0.25	--
2-Nitrotoluene	0.35	0.35	0.35	61	0.25	0.25	0.25	370
3-Nitrotoluene	0.35	0.35	0.35	61	0.25	0.25	0.25	370
4-Amino-2,6-dinitrotoluene	0.35	0.35	0.35	--	0.25	1	0.25	--
4-Nitrotoluene	0.35	0.35	0.35	61	0.25	0.25	0.25	370
Hexahydro-1,3,5-trinitro-1,3,5-triazine (RDX)	0.35	0.35	0.35	0.61	0.25	0.25	0.25	4.4
Methyl-2,4,6-trinitrophenylnitramine (Tetryl)	0.35	0.35	0.35	360	0.25	0.25	0.25	610
Nitrobenzene	0.35	0.35	0.35	3.4	0.25	0.25	0.25	0.007
Octahydro-1,3,5,7-tetranitro-1,3,5,7-tetrazocine (HMX)	0.35	0.35	0.35	1800	0.25	0.34	0.25	3100
Pentaerythritol Tetranitrate (PETN)	0.35	0.35			0.025	2.1		
Nitroglycerin	3.50	3.50	3.50	---	2.5	2.5	2.5	---
EXPLOSIVES (EPA METHOD 353.2/MODIFIED ARMY CORPS METHOD)								
Nitrocellulose	750	1000		---	0.25	830		---
APPENDIX IX METALS (SW-846 Method 6020 ICP/MS)								
Antimony	0.02	0.96	0.1	6	0.08	3.5	0.05	0.1423
Arsenic	0.20	1.00	0.1	0.045	2.80	4.4	0.05	0.0059
Barium	---	---	0.1	2000	---	---	0.05	1.04
Beryllium	0.20	0.50	0.1	4	0.20	0.2	0.05	0.1
Cadmium	0.28	3.50	0.1	0.66	0.28	0.33	0.05	0.00222
Chromium (total)	0.10	0.49	0.1	11	---	---	0.05	2

TABLE 3-4

SOLID AND AQUEOUS MINIMUM AND MAXIMUM DETECTION LIMITS VERSUS RBTLs AND EDQLs
SWMU 03- OLD JEEP TRAIL/LITTLE SULPHUR CREEK
NSWC CRANE
CRANE, INDIANA

Parameter	Aqueous Matrix				Solid Matrix			
	Observed Min DL (µg/L)	Observed Max DL (µg/L)	Laboratory MDL/IDL[1] (µg/L)	Risk-Based Target Level [2] (µg/L)	Observed Min DL (mg/kg)	Observed Max DL (mg/kg)	Laboratory MDL/IDL[1] (mg/kg)	Lower of Soil and Sediment RBTLs (mg/kg)
Cobalt	0.10	0.50	0.1	5	---	---	0.05	0.14033
Copper	0.19	0.87	0.1	5	---	---	0.05	2.96
Lead	0.10	0.50	0.1	1.3	---	---	0.05	0.05373
Mercury (SW-846 Method 7470A/7471A)	0.08	0.10	0.1	0.0013	0.015	0.03	0.02	0.073
Nickel	---	---	0.1	29	---	---	0.05	7
Selenium	0.16	2.00	0.3	5	0.16	0.8	0.15	0.02765
Silver	0.04	0.50	0.1	1	0.04	0.92	0.05	0.5
Thallium	0.10	0.50	0.1	0.56	0.04	0.08	0.05	0.04
Tin	0.07	7.00	0.1	73	0.07	11	0.05	7.62
Vanadium	0.10	0.78	0.1	19	---	---	0.05	1.59
Zinc	0.50	9.70	0.4	58.9	---	---	0.2	6.62
MISCELLANEOUS METALS (SW-846 METHOD 6010B Trace) [3]								
Aluminum	2.6	200	81	87	---	---	8.1	76000
Calcium	5000	5000	150	--	---	---	15	--
Iron	100	100	13	300	---	---	1.3	23000
Magnesium	5000	5000	7.6	--	---	---	0.76	--
Manganese	0.540	15.00	0.2	50	---	---	0.02	1800
Potassium	5000	5000	16	--	---	---	1.6	--
Sodium	5000	5000	76	--	3.40	237	7.6	--
APPENDIX IX VOLATILE ORGANIC COMPOUNDS (SW-846 METHOD 8260B WITH 25 mL PURGE FOR WATER, 5 g PURGE FOR SOIL or 8015B)								
1,1,1-Trichloroethane	0.50	0.50	0.5	88	0.0009	0.013	0.001	0.1
1,1,1,2-Tetrachloroethane	0.30	0.30	0.3	0.43	0.0009	0.013	0.001	0.01089
1,1,2,2-Tetrachloroethane	0.30	0.30	0.3	0.055	0.0009	0.013	0.001	0.0002
1,1,2-Trichloroethane	0.30	0.30	0.3	0.2	0.0009	0.013	0.001	0.0009
1,2,3-Trichloropropane	0.30	0.30	0.3	0.0016	0.0009	0.013	0.001	0.0014
1,1-Dichloroethane	0.50	0.50	0.5	47	0.0009	0.013	0.001	0.000575

TABLE 3-4

SOLID AND AQUEOUS MINIMUM AND MAXIMUM DETECTION LIMITS VERSUS RBTLs AND EDQLs
SWMU 03- OLD JEEP TRAIL/LITTLE SULPHUR CREEK
NSWC CRANE
CRANE, INDIANA

Parameter	Aqueous Matrix				Solid Matrix			
	Observed Min DL (µg/L)	Observed Max DL (µg/L)	Laboratory MDL/IDL[1] (µg/L)	Risk-Based Target Level [2] (µg/L)	Observed Min DL (mg/kg)	Observed Max DL (mg/kg)	Laboratory MDL/IDL[1] (mg/kg)	Lower of Soil and Sediment RBTLs (mg/kg)
1,1-Dichloroethene	0.30	0.30	0.3	0.046	0.0009	0.013	0.001	0.003
1,2-Dibromo-3-chloropropane	0.30	0.30	0.3	0.048	0.0009	0.013	0.001	0.01998
1,2-Dibromoethane	0.30	0.30	0.3	0.00076	0.0009	0.013	0.001	0.0069
1,2-Dichloroethane	0.30	0.30	0.3	0.12	0.0009	0.013	0.001	0.001
1,2-Dichloropropane	0.30	0.30	0.3	0.16	0.0009	0.013	0.001	0.001
1,4-Dioxane (8015B)	44	44	44	6.1	0.085	0.27	0.1	0.00000543
2-Butanone	0.50	0.50	0.5	1900	0.0009	0.013	0.001	0.13696
2-Chloro-1,3-butadiene (chloroprene)	0.50	0.50	0.5	14	0.000001	0.013	0.001	0.00106
2-Hexanone	0.50	0.50	0.5	1500	0.0009	0.013	0.001	1.01
4-Methyl-2-pentanone	0.50	0.50	0.5	160	0.0009	0.013	0.001	0.54437
Acetone	0.50	26.0	0.5	610	0.00093	0.32	0.001	0.45337
Acetonitrile (8015B)	0.50	0.50	3.7	79	0.00008	0.11	0.04	0.13905
Acrolein	---	---	0.5	0.042	0.00096	0.013	0.001	0.0000144
Acrylonitrile	0.50	0.50	0.5	0.039	---	---	0.001	0.0000157
Allyl chloride (3-chloro-1-propene)	0.50	0.50	0.5	1800	0.0009	0.013	0.001	0.000266
Benzene	0.30	0.30	0.3	0.41	0.0009	0.013	0.001	0.002
Bromodichloromethane	0.30	0.30	0.3	0.18	0.0009	0.013	0.001	0.00113
Bromoform	0.50	0.50	0.5	8.5	0.0009	0.013	0.001	0.04
Bromomethane	0.50	0.50	0.5	8.7	0.0009	0.013	0.001	0.01
Carbon disulfide	0.50	0.50	0.5	84.1	0.0009	0.013	0.001	0.09412
Carbon tetrachloride	0.30	0.30	0.3	0.17	0.0009	0.013	0.001	0.003
Chlorobenzene	0.50	0.50	0.5	10	0.0009	0.013	0.001	0.06194
Chloroethane	0.50	0.50	0.5	4.6	0.0009	0.013	0.001	3
Chloroform	0.30	0.30	0.3	0.16	0.0009	0.013	0.001	0.027
Chloromethane	0.50	0.50	0.5	1.5	0.0009	0.013	0.001	0.0000785
cis-1,2-Dichloroethene	0.50	0.50	0.5	61	0.0009	0.013	0.001	0.02

TABLE 3-4

SOLID AND AQUEOUS MINIMUM AND MAXIMUM DETECTION LIMITS VERSUS RBTLs AND EDQLs
SWMU 03- OLD JEEP TRAIL/LITTLE SULPHUR CREEK
NSWC CRANE
CRANE, INDIANA

Parameter	Aqueous Matrix				Solid Matrix			
	Observed Min DL (µg/L)	Observed Max DL (µg/L)	Laboratory MDL/IDL[1] (µg/L)	Risk-Based Target Level [2] (µg/L)	Observed Min DL (mg/kg)	Observed Max DL (mg/kg)	Laboratory MDL/IDL[1] (mg/kg)	Lower of Soil and Sediment RBTLs (mg/kg)
cis-1,3-Dichloropropene	0.30	0.30	0.3	0.081	0.0009	0.013	0.001	0.0002
Dibromochloromethane	0.30	0.30	0.3	0.13	0.0009	0.013	0.001	0.02
Dibromomethane	0.50	0.50	0.5	61	0.0009	0.013	0.001	0.0000859
Dichlorodifluoromethane	0.50	0.50	0.5	390	0.0009	0.013	0.001	0.00133
Ethylbenzene	0.50	0.50	0.5	17.2	0.0009	0.013	0.001	0.0001
Ethyl methacrylate	0.50	0.50	0.5	550	0.0009	0.013	0.001	0.000602
Isobutanol (8015B)	6.3	6.3	6.3	1800	0.0335	0.11	0.04	3.35
Methacrylonitrile	0.50	0.50	0.5	1	0.0009	0.013	0.001	0.0000297
Methylene chloride	0.50	5.30	0.5	4.3	0.001	0.064	0.001	0.001
Methyl iodide	0.50	0.50	0.5	--	0.0009	0.013	0.001	--
Methyl methacrylate	0.50	0.50	0.5	1400	0.0009	0.013	0.001	0.16756
Propionitrile (8015B)	4.6	4.6	4.6	6080	0.0335	0.11	0.04	0.04983
Styrene	0.50	0.50	0.5	56	0.0009	0.013	0.001	0.2
Tetrachloroethene	0.50	0.50	0.5	1.1	0.0009	0.013	0.001	0.003
Toluene	0.50	0.50	0.5	253	0.0009	0.013	0.001	0.6
trans-1,2-Dichloroethene	0.50	0.50	0.5	100	0.0009	0.013	0.001	0.03
trans-1,3-Dichloropropene	0.30	0.30	0.3	0.081	0.0009	0.013	0.001	0.0002
trans-1,4-Dichloro-2-butene	0.50	0.50	0.5	0.0012	0.0009	0.013	0.001	0.00182
Trichloroethene	0.50	1.60	0.5	1.6	0.0009	0.013	0.001	0.003
Trichlorofluoromethane	0.50	0.50	0.5	1300	0.0009	0.013	0.001	0.00307
Vinyl acetate	0.50	0.50	0.5	248.03	0.0009	0.013	0.001	0.01295
Vinyl chloride	0.30	0.30	0.3	0.02	0.0009	0.013	0.001	0.0007
Total Xylenes	0.50	0.50	0.5	117	0.0009	0.013	0.001	1.88

TABLE 3-4

SOLID AND AQUEOUS MINIMUM AND MAXIMUM DETECTION LIMITS VERSUS RBTLs AND EDQLs
SWMU 03- OLD JEEP TRAIL/LITTLE SULPHUR CREEK
NSWC CRANE
CRANE, INDIANA

Parameter	Aqueous Matrix				Solid Matrix			
	Observed Min DL (µg/L)	Observed Max DL (µg/L)	Laboratory MDL/IDL[1] (µg/L)	Risk-Based Target Level [2] (µg/L)	Observed Min DL (mg/kg)	Observed Max DL (mg/kg)	Laboratory MDL/IDL[1] (mg/kg)	Lower of Soil and Sediment RBTLs (mg/kg)
APPENDIX IX SEMIVOLATILE ORGANIC COMPOUNDS (SW-846 METHOD 8270C OR 8270C - SELECTIVE ION MONITORING)								
1,2,4,5-Tetrachlorobenzene	0.94	1.10	1	11	0.067	0.11	0.067	2.02
1,2,4-Trichlorobenzene	0.94	1.10	1	69.2	0.067	0.11	0.067	0.3
1,2-Dichlorobenzene	0.94	1.10	1	11	0.067	0.11	0.067	0.23132
1,3-Dichlorobenzene	0.94	1.10	1	5.5	0.067	0.11	0.067	0.42
1,4-Dichlorobenzene	0.94	1.10	1	0.5	0.067	0.11	0.067	0.1
1,4-Naphthoquinone	0.94	1.10	1	--	0.067	0.11	0.067	--
1,4-Phenylenediamine	0.94	1.00	1	6900	0.067	0.098	0.067	0.00000568
1-Naphthylamine	0.94	1.10	1	0.67	0.067	0.11	0.067	--
2,3,4,6-Tetrachlorophenol	0.94	1.10	1	14.06	0.067	0.11	0.067	0.19878
2,4,5-Trichlorophenol	0.94	1.10	1	3600	0.067	0.11	0.067	0.08556
2,4,6-Trichlorophenol	0.94	1.10	1	2	0.067	0.11	0.067	0.008
2,4-Dichlorophenol	0.94	1.10	1	18	0.067	0.11	0.067	0.05
2,4-Dimethylphenol	0.94	1.10	1	100.17	0.067	0.11	0.067	0.01
2,4-Dinitrophenol	0.94	1.10	1	4.07	0.067	0.11	0.067	0.00133
2,6-Dichlorophenol	0.94	1.10	1	--	0.067	0.11	0.067	0.00394
2-Acetylaminofluorene	0.94	1.10	1	534.97	0.067	0.11	0.067	0.01532
2-Chloronaphthalene	0.94	1.10	1	0.396	0.067	0.11	0.067	0.01218
2-Chlorophenol	0.94	1.10	1	8.8	0.067	0.11	0.067	0.0117
2-Methylnaphthalene (SIM)	0.019	0.021	0.02	329.55	0.0013	0.055	0.0013	0.0202
2-Methylphenol	0.94	1.10	1	1800	0.067	0.11	0.067	0.000826
2-Naphthylamine	0.94	1.10	1	--	0.067	0.11	0.067	0.00174
2-Nitroaniline	0.94	1.10	1	2.1	0.067	0.11	0.067	0.000222
2-Nitrophenol	0.94	1.10	1	13.5	0.067	0.11	0.067	0.00777
2-Picoline	0.94	1.10	1	3790	0.067	0.11	0.067	0.75305
3,3'-Dichlorobenzidine	0.94	1.10	1	0.15	0.067	0.11	0.067	0.0003

TABLE 3-4

SOLID AND AQUEOUS MINIMUM AND MAXIMUM DETECTION LIMITS VERSUS RBTLs AND EDQLs
SWMU 03- OLD JEEP TRAIL/LITTLE SULPHUR CREEK
NSWC CRANE
CRANE, INDIANA

Parameter	Aqueous Matrix				Solid Matrix			
	Observed Min DL (µg/L)	Observed Max DL (µg/L)	Laboratory MDL/IDL[1] (µg/L)	Risk-Based Target Level [2] (µg/L)	Observed Min DL (mg/kg)	Observed Max DL (mg/kg)	Laboratory MDL/IDL[1] (mg/kg)	Lower of Soil and Sediment RBTLs (mg/kg)
3,3'-Dimethylbenzidine	0.94	1.10	1	0.0073	0.067	0.11	0.067	0.002
3-Methylcholanthrene	0.94	1.10	1	0.0891	0.067	0.11	0.067	0.07794
3-Methylphenol[4]	0.94	1.10	1	1800	0.067	0.11	0.067	0.000808
4-Methylphenol[4]	0.94	1.10	1	180	0.067	0.11	0.067	0.000845
3-Nitroaniline	0.94	1.10	1	--	0.067	0.11	0.067	0.000222
4,6-Dinitro-2-methylphenol	0.94	1.10	1	2.3	0.067	0.11	0.067	0.01038
4-Aminobiphenyl	0.94	1.10	1	--	0.067	0.11	0.067	0.00305
4-Bromophenyl phenyl ether	0.94	1.10	1	1.5	0.067	0.11	0.067	1.68
4-Chloro-3-methylphenol	0.94	1.10	1	20	0.067	0.11	0.067	0.38818
4-Chloroaniline	0.94	1.10	1	150	0.067	0.11	0.067	0.03
4-Chlorophenyl phenyl ether	0.94	1.10	1	--	0.067	0.11	0.067	0.656112
4-Nitroaniline	0.94	1.10	1	--	0.067	0.11	0.067	0.000222
4-Nitrophenol	0.94	1.10	1	35	0.067	0.11	0.067	0.00778
4-Nitroquinoline-1-oxide	0.94	1.10	1	--	0.073	0.11	0.067	0.00124
5-Nitro-o-toluidine	0.94	1.10	1	2	0.067	0.11	0.067	0.000845
7,12-Dimethylbenz(a)anthracene	0.94	1.10	1	--	0.067	0.11	0.067	--
Acenaphthene (SIM)	0.019	0.021	0.02	9.9	0.0013	0.055	0.0013	0.00671
Acenaphthylene (SIM)	0.019	0.021	0.02	370	0.0013	0.055	0.0013	0.00587
Acetophenone	0.94	1.10	1	0.042	0.067	0.22	0.067	0.246
Aniline	0.94	1.10	1	0.44	0.067	0.11	0.067	0.0000338
Aramite	0.94	1.10	1	2.7	0.067	0.11	0.067	0.00000111
Anthracene (SIM)	0.019	0.021	0.02	0.029	0.0013	0.38	0.0013	0.0469
Benzo(a)anthracene (SIM)	0.019	0.021	0.02	0.092	0.0013	0.38	0.0013	0.0317
Benzo(a)pyrene (SIM)	0.019	0.021	0.02	0.0092	0.0013	0.055	0.0013	0.0319
Benzo(b)fluoranthene (SIM)	0.019	0.021	0.02	0.092	0.0013	0.055	0.0013	0.2
Benzo(g,h,i)perylene (SIM)	0.019	0.021	0.02	6.2	0.0013	0.055	0.0013	0.17

TABLE 3-4

SOLID AND AQUEOUS MINIMUM AND MAXIMUM DETECTION LIMITS VERSUS RBTLs AND EDQLs
SWMU 03- OLD JEEP TRAIL/LITTLE SULPHUR CREEK
NSWC CRANE
CRANE, INDIANA

Parameter	Aqueous Matrix				Solid Matrix			
	Observed Min DL (µg/L)	Observed Max DL (µg/L)	Laboratory MDL/IDL[1] (µg/L)	Risk-Based Target Level [2] (µg/L)	Observed Min DL (mg/kg)	Observed Max DL (mg/kg)	Laboratory MDL/IDL[1] (mg/kg)	Lower of Soil and Sediment RBTLs (mg/kg)
Benzo(k)fluoranthene (SIM)	0.019	0.021	0.02	0.0056	0.0013	0.055	0.0013	0.24
Benzyl alcohol	0.94	1.10	1	281.24	0.067	0.11	0.067	0.03394
Bis(2-chloroethoxy)methane	0.94	1.10	1	6400	0.067	0.11	0.067	0.34971
Bis(2-chloroethyl)ether	0.94	1.10	1	0.0098	0.067	0.11	0.067	0.00002
Bis(2-chloroisopropyl)ether	0.94	1.10	1	0.27	0.067	0.11	0.067	0.027
Bis(2-ethylhexyl)phthalate	0.94	1.10	1	2.1	0.067	0.26	0.067	0.182
Butyl benzyl phthalate	0.94	1.10	1	49	0.067	0.11	0.067	0.23889
Chlorobenzilate	0.94	1.10	1	0.25	0.067	0.11	0.067	0.86029
Chrysene (SIM)	0.019	0.021	0.02	0.033	0.0013	0.38	0.0013	0.0571
Diallate	0.94	1.10	1	1.1	0.067	0.11	0.067	0.00151
Di-n-butyl phthalate	0.94	1.10	1	3	0.067	0.49	0.067	0.1105
Di-n-octyl phthalate	0.94	1.10	1	20	0.067	0.11	0.067	40.6
Dibenzo(a,h)anthracene (SIM)	0.019	0.021	0.02	0.0016	0.0013	0.055	0.0013	0.00622
Dibenzofuran	0.94	1.10	1	20	0.067	0.11	0.067	1.52
Diethyl phthalate	0.94	1.10	1	3	0.067	0.11	0.067	0.00804
p-(Dimethylamino)azobenzene	0.94	1.10	1	--	0.067	0.11	0.067	--
a,a-Dimethylphenethylamine [5]	0.94	1.10	1	37	0.067	0.11	0.067	61
Dimethyl phthalate	0.94	1.10	1	73	0.067	0.11	0.067	0.02495
Diphenylamine [6]	0.94	1.10	1	412.51	0.067	0.11	0.067	0.0346
Ethyl methane sulfonate	0.94	1.10	1	--	0.067	0.11	0.067	--
Ethyl parathion	0.94	1.10	1	0.008	0.067	0.11	0.067	0.00034
Fluoranthene (SIM)	0.019	0.021	0.02	8.1	0.0013	0.055	0.0013	0.1113
Fluorene (SIM)	0.019	0.021	0.02	3.9	0.0013	0.055	0.0013	0.0212
Hexachlorobenzene	0.94	1.10	1	0.00024	0.067	0.11	0.067	0.02
Hexachlorobutadiene	0.94	1.10	1	0.223	0.067	0.11	0.067	0.03976
Hexachlorocyclopentadiene	0.94	1.10	1	50	0.067	0.11	0.067	0.75537

TABLE 3-4

SOLID AND AQUEOUS MINIMUM AND MAXIMUM DETECTION LIMITS VERSUS RBTLs AND EDQLs
SWMU 03- OLD JEEP TRAIL/LITTLE SULPHUR CREEK
NSWC CRANE
CRANE, INDIANA

Parameter	Aqueous Matrix				Solid Matrix			
	Observed Min DL (µg/L)	Observed Max DL (µg/L)	Laboratory MDL/IDL[1] (µg/L)	Risk-Based Target Level [2] (µg/L)	Observed Min DL (mg/kg)	Observed Max DL (mg/kg)	Laboratory MDL/IDL[1] (mg/kg)	Lower of Soil and Sediment RBTLs (mg/kg)
Hexachloroethane	0.94	1.10	1	4.8	0.067	0.11	0.067	0.02
Hexachlorophene	0.01	0.01	1	0.228	0.0073	0.011	0.067	0.19878
Hexachloropropene	0.94	1.10	1	20	0.067	0.11	0.067	0.0002
Indeno(1,2,3-cd)pyrene (SIM)	0.019	0.021	0.02	0.092	0.0013	0.055	0.0013	0.2
Isodrin	0.94	1.10	1	0.0309	0.067	0.11	0.067	0.00332
Isophorone	0.94	1.10	1	71	0.067	0.11	0.067	0.03
Isosafrole	0.94	1.10	1	--	0.067	0.11	0.067	0.00412
Kepone	---	---	1	0.0037	0.081	0.081	0.067	0.00331
Methapyrilene	0.94	1.10	1	--	0.067	0.11	0.067	0.0000144
Methyl methane sulfonate	0.94	1.10	1	--	0.067	0.11	0.067	--
Methyl parathion	0.94	1.10	1	9.1	0.067	0.11	0.067	0.000292
n-Nitrosodi-n-butylamine	0.94	1.10	1	0.002	0.067	0.11	0.067	0.024
n-Nitrosodiethylamine	0.94	1.10	1	0.00045	0.067	0.11	0.067	0.0032
n-Nitrosodimethylamine	0.94	1.10	1	0.0013	0.067	0.11	0.067	0.00000275
n-Nitrosodi-n-propylamine	0.94	1.10	1	0.0096	0.067	0.11	0.067	0.000002
n-Nitrosomethylethylamine	0.94	1.10	1	0.0031	0.067	0.11	0.067	0.00000485
n-Nitrosomorpholine	0.94	1.10	1	--	0.067	0.11	0.067	0.0000037
n-Nitrosopiperidine	0.94	1.10	1	--	0.067	0.11	0.067	0.0000226
n-Nitrosopyrrolidine	0.94	1.10	1	0.032	0.067	0.11	0.067	0.000000908
Naphthalene (SIM)	0.019	0.021	0.02	6.2	0.0013	0.055	0.0013	0.0346
Pentachlorobenzene	0.94	1.10	1	0.47	0.067	0.11	0.067	0.49695
Pentachloroethane	0.94	1.10	1	56.42	0.067	0.11	0.067	0.68918
Pentachloronitrobenzene	0.94	1.10	1	0.26	0.067	0.11	0.067	1.9
Phenacetin	0.94	1.10	1	--	0.067	0.11	0.067	0.00225
Phenanthrene (SIM)	0.019	0.021	0.02	2.1	0.0013	0.055	0.0013	0.0419
Phenol	0.94	1.10	1	100	0.067	0.11	0.067	0.02726

TABLE 3-4

SOLID AND AQUEOUS MINIMUM AND MAXIMUM DETECTION LIMITS VERSUS RBTLs AND EDQLs
SWMU 03- OLD JEEP TRAIL/LITTLE SULPHUR CREEK
NSWC CRANE
CRANE, INDIANA

Parameter	Aqueous Matrix				Solid Matrix			
	Observed Min DL (µg/L)	Observed Max DL (µg/L)	Laboratory MDL/IDL[1] (µg/L)	Risk-Based Target Level [2] (µg/L)	Observed Min DL (mg/kg)	Observed Max DL (mg/kg)	Laboratory MDL/IDL[1] (mg/kg)	Lower of Soil and Sediment RBTLs (mg/kg)
Pronamide	0.94	1.10	1	160	0.067	0.11	0.067	0.0016
Pyrene (SIM)	0.019	0.021	0.02	0.3	0.0013	0.081	0.0013	0.053
Pyridine	0.94	1.10	1	37	0.067	0.11	0.0013	0.10617
Safrole	0.94	1.10	1	40	0.067	0.11	0.067	0.16486
o-Toluidine	0.94	1.10	1	0.28	0.067	0.11	0.067	0.000199
O,O,O-Triethyl phosphorothioate	0.94	1.10	1	58.25	0.067	0.11	0.067	--
APPENDIX IX ORGANOCHLORINE PESTICIDES and PCBs (SW-846 METHOD 8081A and 8082)								
Aldrin	0.0047	0.006	0.005	0.004	0.00098	0.0015	0.0009	0.002
Alpha-BHC	0.0047	0.006	0.005	0.011	0.00098	0.0015	0.0009	0.00003
Alpha-chlordane	0.014	0.017	0.015	0.00029	0.00098	0.0015	0.0009	0.0045
Beta-BHC	0.014	0.017	0.015	0.037	0.00098	0.0015	0.0009	0.0001
4,4'-DDD	0.024	0.028	0.025	0.0011	0.0019	0.0028	0.0017	0.00553
4,4'-DDE	0.024	0.028	0.025	4.51E-09	0.0019	0.0028	0.0017	0.00142
4,4'-DDT	0.024	0.028	0.025	0.001	0.0019	0.0028	0.0017	0.00119
Delta-BHC	0.024	0.028	0.025	0.011	0.00098	0.0015	0.0009	9.94
Dieldrin	0.009	0.011	0.01	0.000026	0.0019	0.0028	0.0017	0.0002
Endosulfan I	0.024	0.028	0.025	0.003	0.00098	0.0015	0.0009	0.000175
Endosulfan II	0.024	0.028	0.025	0.003	0.0019	0.0028	0.0017	0.000104
Endosulfan sulfate	0.047	0.056	0.05	0.22	0.0019	0.0028	0.0017	0.0346
Endrin	0.028	0.033	0.03	0.002	0.0019	0.0028	0.0017	0.00267
Endrin aldehyde	0.047	0.056	0.05	0.15	0.0019	0.0028	0.0017	0.0105
Gamma-BHC (Lindane)	0.024	0.028	0.025	0.01	0.00098	0.0015	0.0009	0.0005
Gamma-chlordane	0.014	0.017	0.015	0.00029	0.00098	0.0015	0.0009	0.0045
Heptachlor	0.014	0.017	0.015	0.00039	0.00098	0.0015	0.0009	0.0006
Heptachlor epoxide	0.0047	0.006	0.005	0.00048	0.00098	0.0015	0.0009	0.0006
Methoxychlor	0.057	0.067	0.06	0.005	0.0098	0.015	0.009	0.00359

TABLE 3-4

SOLID AND AQUEOUS MINIMUM AND MAXIMUM DETECTION LIMITS VERSUS RBTLs AND EDQLs
SWMU 03- OLD JEEP TRAIL/LITTLE SULPHUR CREEK
NSWC CRANE
CRANE, INDIANA

Parameter	Aqueous Matrix				Solid Matrix			
	Observed Min DL (µg/L)	Observed Max DL (µg/L)	Laboratory MDL/IDL[1] (µg/L)	Risk-Based Target Level[2] (µg/L)	Observed Min DL (mg/kg)	Observed Max DL (mg/kg)	Laboratory MDL/IDL[1] (mg/kg)	Lower of Soil and Sediment RBTLs (mg/kg)
Toxaphene	1.4	1.7	1.5	0.0002	0.098	0.15	0.09	0.000109
Aroclor-1016	0.24	0.28	0.25	0.000029	0.019	0.028	0.017	0.0341
Aroclor-1221	0.24	0.28	0.25	0.000029	0.037	0.056	0.034	0.0341
Aroclor-1232	0.24	0.28	0.25	0.000029	0.019	0.028	0.017	0.0341
Aroclor-1242	0.24	0.28	0.25	0.000029	0.019	0.028	0.017	0.0341
Aroclor-1248	0.24	0.28	0.25	0.000029	0.019	0.028	0.017	0.0341
Aroclor-1254	0.24	0.28	0.25	0.000029	0.019	0.028	0.017	0.0341
Aroclor-1260	0.24	0.28	0.25	0.000029	0.019	0.028	0.017	0.0341
APPENDIX IX HERBICIDES (SW-846 METHOD 8151A)								
2,4-D	0.04	0.04	0.04	70	0.0015	0.002	0.0014	0.00579
2,4,5-T	0.04	0.04	0.04	360	0.0015	0.0023	0.0014	0.59634
2,4,5-TP (Silvex)	0.04	0.04	0.04	50	0.0015	0.0023	0.0014	0.1088
Dinoseb[7]	0.04	0.04	0.04	0.39	0.0015	0.0023	0.0014	0.01178
Pentachlorophenol	0.01	0.01	0.01	0.56	0.00037	0.00048	0.00034	0.001
DIOXINS/FURANS (SW-846 METHOD 8290)[8]								
2,3,7,8-Tetrachlorodibenzodioxin (2,3,7,8-TCDD)	ANR	ANR			6.00E-08	2.00E-04		3.90E-06
1.2.3.7.8-Pentachlorodibenzodioxin (1,2,3,7,8-PeCDD)	ANR	ANR			7.00E-08	2.00E-04		3.90E-06
1,2,3,6,7,8-Hexachlorodibenzodioxin (1,2,3,6,7,8-HxCDD)	ANR	ANR			1.00E-07	7.60E-04		3.90E-05
1,2,3,4,7,8-Hexachlorodibenzodioxin (1,2,3,4,7,8-HxCDD)	ANR	ANR			1.00E-07	7.40E-04		3.90E-05
1,2,3,7,8,9-Hexachlorodibenzodioxin (1,2,3,7,8,9-HxCDD)	ANR	ANR			1.00E-07	7.60E-04		3.90E-05
1,2,3,4,6,7,8-Heptachlorodibenzodioxin (1,2,3,4,6,7,8-HpCDD)	ANR	ANR			---	---		3.90E-04
1,2,3,4,6,7,8,9-Octachlorodibenzodioxin (OCDD)	ANR	ANR			---	---		3.90E-02
2,3,7,8-Tetrachlorodibenzofuran (2,3,7,8-TCDF)	ANR	ANR			5.00E-08	8.50E-04		3.90E-05
1.2.3.7.8-Pentachlorodibenzofuran (1,2,3,7,8-PeCDF)	ANR	ANR			6.00E-08	3.80E-04		7.80E-05
2,3,4,7,8-Pentachlorodibenzofuran (2,3,4,7,8-PeCDF)	ANR	ANR			6.00E-08	6.70E-04		7.80E-06
1,2,3,6,7,8-Hexachlorodibenzofuran (1,2,3,6,7,8-HxCDF)	ANR	ANR			6.00E-08	2.00E-04		3.90E-05

TABLE 3-4

SOLID AND AQUEOUS MINIMUM AND MAXIMUM DETECTION LIMITS VERSUS RBTLs AND EDQLs
SWMU 03- OLD JEEP TRAIL/LITTLE SULPHUR CREEK
NSWC CRANE
CRANE, INDIANA

Parameter	Aqueous Matrix				Solid Matrix			
	Observed Min DL (µg/L)	Observed Max DL (µg/L)	Laboratory MDL/IDL[1] (µg/L)	Risk-Based Target Level [2] (µg/L)	Observed Min DL (mg/kg)	Observed Max DL (mg/kg)	Laboratory MDL/IDL[1] (mg/kg)	Lower of Soil and Sediment RBTLs (mg/kg)
1,2,3,7,8,9-Hexachlorodibenzofuran (1,2,3,7,8,9-HxCDF)	ANR	ANR			8.00E-08	6.50E-04		3.90E-05
1,2,3,4,7,8-Hexachlorodibenzofuran (1,2,3,4,7,8-HxCDF)	ANR	ANR			7.00E-08	2.10E-03		3.90E-05
2,3,4,6,7,8- Hexachlorodibenzofuran (2,3,4,6,7,8-HxCDF)	ANR	ANR			7.00E-08	1.30E-04		3.90E-05
1,2,3,4,6,7,8-Heptachlorodibenzofuran (1,2,3,4,6,7,8-HpCDF)	ANR	ANR			1.00E-07	7.10E-04		5E-6
1,2,3,4,7,8,9- Heptachlorodibenzofuran (1,2,3,4,7,8,9-HpCDF)	ANR	ANR			1.00E-07	4.00E-04		5E-6
1,2,3,4,6,7,8,9-Octachlorodibenzofuran (OCDF)	ANR	ANR			2.00E-07	2.10E-03		1E-5
Total Tetrachlorodibenzodioxin (Total TCDD)	ANR	ANR		1E-5	8.00E-08	7.50E-03		1E-6
Total Pentachlorodibenzodioxin (Total PCDD)	ANR	ANR		5E-5	8.00E-08	1.04E-02		5E-6
Total Hexachlorodibenzodioxin (Total HxCDD)	ANR	ANR		5E-5	1.60E-07	5.91E-02		5E-6
Total Heptachlorodibenzodioxin (Total HpCDD)	ANR	ANR		5E-5	2.00E-07	6.90E-03		5E-6
Total Tetrachlorodibenzofuran (Total TCDF)	ANR	ANR		1E-5	5.00E-08	2.59E-02		1E-6
Total Pentachlorodibenzofuran (Total PCDF)	ANR	ANR		5E-5	6.00E-08	2.09E-02		5E-6
Total Hexachlorodibenzofuran (Total HxCDF)	ANR	ANR		5E-5	7.00E-08	6.12E-02		5E-6
Total Heptachlorodibenzofuran (Total HpCDF)	ANR	ANR		5E-5	1.00E-07	9.39E-02		5E-6
MISCELLANEOUS PARAMETERS								
Perchlorate (EPA Method 314.0)	4	4		18	0.02	0.033		---
Nitrate (SW-846 Method 9056)	ANR	ANR		---	0.6	1.3		
Nitrite (SW-846 Method 9056)	ANR	ANR		---	2	110		

MDL = Method detection limit.
IDL = Instrument detection limit.
RL = Reporting limit.
µg/L = Micrograms per liter.
mg/kg = Milligrams per kilogram.
mg/L = Milligrams per liter.

TBD = To be determined.
NA = Not applicable.
ANR = Analyte not required.

TABLE 3-4

SOLID AND AQUEOUS MINIMUM AND MAXIMUM DETECTION LIMITS VERSUS RBTLs AND EDQLs
SWMU 03- OLD JEEP TRAIL/LITTLE SULPHUR CREEK
NSWC CRANE
CRANE, INDIANA

Parameter	Aqueous Matrix				Solid Matrix			
	Observed Min DL (µg/L)	Observed Max DL (µg/L)	Laboratory MDL/IDL[1] (µg/L)	Risk-Based Target Level [2] (µg/L)	Observed Min DL (mg/kg)	Observed Max DL (mg/kg)	Laboratory MDL/IDL[1] (mg/kg)	Lower of Soil and Sediment RBTLs (mg/kg)

Shaded cells indicate observed minimum or maximum DLs that exceed laboratory MDL/IDLs.

1 Method Detection Limits (MDLs) (all parameters except metals) and instrument detection limits (IDLs) (metals only) as provided by Laucks Testing Laboratories, Inc. and Triangle Laboratories, Inc. (dioxins/furans only).

2 Value is based on the lowest human health or ecological risk-based criteria as presented in Appendix B, Tables B-1 (aqueous) and B-2 (solids) OJT / LSC QAPP (TtNUS April, 2001).

3 These are not Appendix 9 metals. They are being analyzed for general ground-water-quality information. If these elements are within linear range on the ICPMS analysis, they will be quantitated by ICPMS, rather than ICP Trace.

4 3-Methylphenol and 4-methylphenol coelute; therefore, one analytical result for 3-methylphenol plus 4-methylphenol will be reported.

5 This compound does not recover well through the extraction technique. Periodically, the extraction exhibits zero recoveries at low spiking levels (typical of MDL determination levels).

6 N-Nitrosodiphenylamine is more toxic than diphenylamine. However, n-nitrosodiphenylamine rapidly degrades to diphenylamine. Therefore, only diphenylamine will be reported, but results for diphenylamine will be treated as n-nitrosodiphenylamine during risk assessment.

7 Laucks Low Calibration Standard is 2.7 ug/kg (soil) for Dinoseb, but Laucks prefers not to report below 5.4 ug/kg (soil)

8 The target level is calculated using the target level for 2,3,7,8-TCDD and the toxicity equivalent factor (TEF) presented in current U.S. EPA guidance (U.S. EPA, March 1989).

TABLE 3-5

SOIL AND SEDIMENT PERCENT QUALIFICATION RATES
SWMU 03 - OLD JEEP TRAIL/LITTLE SULPHUR CREEK
NSWC CRANE
CRANE, INDIANA

FRACTION	PARAMETER	QUALIFICATION CODE	QUALIFIER						
			BJ	BU	J	R	U	UJ	UR
EXPLOSIVE	1,3,5-TRINITROBENZENE	R	0	0	100	0	0	0	0
	2,4,6-TRINITROTOLUENE	P	0	0	100	0	0	0	0
	2,4,6-TRINITROTOLUENE	R	0	0	100	0	0	0	0
	2,4-DINITROTOLUENE	B	0	0	0	0	100	0	0
	2,4-DINITROTOLUENE	R	0	0	100	0	0	0	0
	2,4-DINITROTOLUENE	U	0	0	100	0	0	0	0
	2-AMINO-4,6-DINITROTOLUENE	P	0	0	100	0	0	0	0
	2-AMINO-4,6-DINITROTOLUENE	R	0	0	100	0	0	0	0
	2-NITROTOLUENE	P	0	0	100	0	0	0	0
	4-AMINO-2,6-DINITROTOLUENE	B	0	0	0	0	100	0	0
	4-AMINO-2,6-DINITROTOLUENE	P	0	0	100	0	0	0	0
	4-AMINO-2,6-DINITROTOLUENE	UR	0	0	100	0	0	0	0
	HMX	B	0	0	0	0	100	0	0
	HMX	P	0	0	100	0	0	0	0
	HMX	R	0	0	100	0	0	0	0
	HMX	U	0	0	0	100	0	0	0
	NITROCELLULOSE	E	0	0	0	0	0	100	0
	NITROGLYCERIN	H	0	0	0	0	0	100	0
	PETN	H	0	0	0	0	0	100	0
	RDX	P	0	0	100	0	0	0	0
	RDX	R	0	0	100	0	0	0	0
	RDX	U	0	0	100	0	0	0	0
HERBICIDE	2,4,5-T	G	0	0	50	0	0	50	0
	2,4,5-T	GU	0	0	100	0	0	0	0
	2,4,5-T	R	0	0	0	0	0	100	0
	2,4,5-T	U	0	0	100	0	0	0	0
	2,4,5-TP (SILVEX)	G	0	0	100	0	0	0	0

TABLE 3-5

SOIL AND SEDIMENT PERCENT QUALIFICATION RATES
SWMU 03 - OLD JEEP TRAIL/LITTLE SULPHUR CREEK
NSWC CRANE
CRANE, INDIANA

FRACTION	PARAMETER	QUALIFICATION CODE	QUALIFIER						
			BJ	BU	J	R	U	UJ	UR
	2,4,5-TP (SILVEX)	P	0	0	100	0	0	0	0
	2,4,5-TP (SILVEX)	R	0	0	0	0	0	100	0
	2,4,5-TP (SILVEX)	U	0	0	83.3	16.7	0	0	0
	2,4-D	G	0	0	100	0	0	0	0
	2,4-D	U	0	0	58.3	41.7	0	0	0
	2,4-D	UR	0	0	100	0	0	0	0
	DINOSEB	D	0	0	0	0	0	100	0
	DINOSEB	DU	0	0	100	0	0	0	0
	DINOSEB	G	0	0	0	0	0	100	0
	DINOSEB	GP	0	0	100	0	0	0	0
	DINOSEB	P	0	0	100	0	0	0	0
	DINOSEB	R	0	0	0	0	0	100	0
	DINOSEB	U	0	0	57.1	42.9	0	0	0
	HEXACHLOROPHENE	D	0	0	0	0	0	100	0
	HEXACHLOROPHENE	R	0	0	0	0	0	100	0
	HEXACHLOROPHENE	U	0	0	100	0	0	0	0
	PENTACHLOROPHENOL	D	0	0	0	0	0	100	0
	PENTACHLOROPHENOL	U	0	0	28.6	71.4	0	0	0
	PENTACHLOROPHENOL	UR	0	0	100	0	0	0	0
METALS	ALUMINUM	AF	0	0	100	0	0	0	0
	ALUMINUM	B	0	0	100	0	0	0	0
	ALUMINUM	BI	0	0	100	0	0	0	0
	ALUMINUM	F	0	0	100	0	0	0	0
	ALUMINUM	FA	0	0	100	0	0	0	0
	ALUMINUM	I	0	0	100	0	0	0	0
	ANTIMONY	A	0	0	23.4	0	76.6	0	0
	ANTIMONY	AFG	0	0	100	0	0	0	0

TABLE 3-5

SOIL AND SEDIMENT PERCENT QUALIFICATION RATES
SWMU 03 - OLD JEEP TRAIL/LITTLE SULPHUR CREEK
NSWC CRANE
CRANE, INDIANA

FRACTION	PARAMETER	QUALIFICATION CODE	QUALIFIER						
			BJ	BU	J	R	U	UJ	UR
	ANTIMONY	AG	0	0	0	0	100	0	0
	ANTIMONY	F	0	0	0	0	0	100	0
	ANTIMONY	FA	0	0	100	0	0	0	0
	ARSENIC	A	0	0	86.7	0	13.3	0	0
	ARSENIC	ADFI	0	0	100	0	0	0	0
	ARSENIC	D	0	0	100	0	0	0	0
	ARSENIC	DFI	0	0	100	0	0	0	0
	BARIUM	A	0	0	100	0	0	0	0
	BARIUM	AD	0	0	100	0	0	0	0
	BARIUM	AFI	0	0	100	0	0	0	0
	BARIUM	B	0	0	100	0	0	0	0
	BARIUM	BG	0	0	100	0	0	0	0
	BARIUM	F	0	0	100	0	0	0	0
	BARIUM	FI	0	0	100	0	0	0	0
	BARIUM	I	0	0	100	0	0	0	0
	BERYLLIUM	I	0	0	100	0	0	0	0
	CADMIUM	F	0	0	100	0	0	0	0
	CALCIUM	A	0	0	100	0	0	0	0
	CALCIUM	ADGI	0	0	100	0	0	0	0
	CALCIUM	ADI	0	0	100	0	0	0	0
	CALCIUM	AGI	0	0	100	0	0	0	0
	CALCIUM	AI	0	0	100	0	0	0	0
	CALCIUM	BFI	0	0	100	0	0	0	0
	CALCIUM	G	0	0	100	0	0	0	0
	CHROMIUM	ADI	0	0	100	0	0	0	0
	CHROMIUM	AFI	0	0	100	0	0	0	0
	CHROMIUM	AI	0	0	100	0	0	0	0

TABLE 3-5

SOIL AND SEDIMENT PERCENT QUALIFICATION RATES
SWMU 03 - OLD JEEP TRAIL/LITTLE SULPHUR CREEK
NSWC CRANE
CRANE, INDIANA

FRACTION	PARAMETER	QUALIFICATION CODE	QUALIFIER						
			BJ	BU	J	R	U	UJ	UR
	CHROMIUM	B	0	0	100	0	0	0	0
	CHROMIUM	BDI	0	0	100	0	0	0	0
	CHROMIUM	BG	0	0	100	0	0	0	0
	COBALT	AI	0	0	100	0	0	0	0
	COBALT	FI	0	0	100	0	0	0	0
	COBALT	G	0	0	100	0	0	0	0
	COBALT	I	0	0	100	0	0	0	0
	COPPER	A	0	0	100	0	0	0	0
	COPPER	AD	0	0	100	0	0	0	0
	COPPER	ADF	0	0	100	0	0	0	0
	COPPER	ADFI	0	0	100	0	0	0	0
	COPPER	ADG	0	0	100	0	0	0	0
	COPPER	AFI	0	0	100	0	0	0	0
	COPPER	B	0	0	100	0	0	0	0
	IRON	A	0	0	100	0	0	0	0
	IRON	AF	0	0	100	0	0	0	0
	IRON	AFI	0	0	100	0	0	0	0
	IRON	AI	0	0	100	0	0	0	0
	IRON	BI	0	0	100	0	0	0	0
	IRON	I	0	0	100	0	0	0	0
	LEAD	A	0	0	100	0	0	0	0
	LEAD	ADFI	0	0	100	0	0	0	0
	LEAD	AG	0	0	100	0	0	0	0
	LEAD	D	0	0	100	0	0	0	0
	LEAD	DF	0	0	100	0	0	0	0
	LEAD	DFI	0	0	100	0	0	0	0
	LEAD	I	0	0	100	0	0	0	0

TABLE 3-5

SOIL AND SEDIMENT PERCENT QUALIFICATION RATES
SWMU 03 - OLD JEEP TRAIL/LITTLE SULPHUR CREEK
NSWC CRANE
CRANE, INDIANA

FRACTION	PARAMETER	QUALIFICATION CODE	QUALIFIER						
			BJ	BU	J	R	U	UJ	UR
	MAGNESIUM	AFGI	0	0	100	0	0	0	0
	MAGNESIUM	AFI	0	0	100	0	0	0	0
	MAGNESIUM	AGI	0	0	100	0	0	0	0
	MAGNESIUM	AI	0	0	100	0	0	0	0
	MAGNESIUM	BDF	0	0	100	0	0	0	0
	MAGNESIUM	F	0	0	100	0	0	0	0
	MAGNESIUM	I	0	0	100	0	0	0	0
	MANGANESE	A	0	0	100	0	0	0	0
	MANGANESE	AF	0	0	100	0	0	0	0
	MANGANESE	AFGI	0	0	100	0	0	0	0
	MANGANESE	AFI	0	0	100	0	0	0	0
	MANGANESE	AI	0	0	100	0	0	0	0
	MANGANESE	BFGI	0	0	100	0	0	0	0
	MANGANESE	I	0	0	100	0	0	0	0
	MERCURY	DH	0	0	100	0	0	0	0
	MERCURY	E	0	0	100	0	0	0	0
	MERCURY	EH	0	0	100	0	0	0	0
	MERCURY	H	0	0	85.7	0	0	14.3	0
	NICKEL	A	0	0	100	0	0	0	0
	NICKEL	AFI	0	0	100	0	0	0	0
	NICKEL	AI	0	0	100	0	0	0	0
	NICKEL	B	0	0	100	0	0	0	0
	NICKEL	BDI	0	0	100	0	0	0	0
	NICKEL	I	0	0	100	0	0	0	0
	POTASSIUM	A	0	0	100	0	0	0	0
	POTASSIUM	ADI	0	0	100	0	0	0	0
	POTASSIUM	ADIK	0	0	100	0	0	0	0

TABLE 3-5

SOIL AND SEDIMENT PERCENT QUALIFICATION RATES
SWMU 03 - OLD JEEP TRAIL/LITTLE SULPHUR CREEK
NSWC CRANE
CRANE, INDIANA

FRACTION	PARAMETER	QUALIFICATION CODE	QUALIFIER						
			BJ	BU	J	R	U	UJ	UR
	POTASSIUM	AFI	0	0	100	0	0	0	0
	POTASSIUM	AI	0	0	100	0	0	0	0
	POTASSIUM	B	0	0	100	0	0	0	0
	POTASSIUM	BI	0	0	100	0	0	0	0
	SELENIUM	A	0	0	0	0	100	0	0
	SELENIUM	D	0	0	70.6	0	0	29.4	0
	SELENIUM	I	0	0	100	0	0	0	0
	SILVER	A	0	0	29.3	0	70.7	0	0
	SILVER	AD	0	0	100	0	0	0	0
	SODIUM	A	0	0	10.9	0	89.1	0	0
	SODIUM	AE	0	0	100	0	0	0	0
	SODIUM	B	0	0	42.9	0	57.1	0	0
	TIN	A	0	0	11.1	0	88.9	0	0
	TIN	B	0	0	6.8	0	93.2	0	0
	TIN	BF	0	0	100	0	0	0	0
	VANADIUM	ADI	0	0	100	0	0	0	0
	VANADIUM	AI	0	0	100	0	0	0	0
	VANADIUM	FI	0	0	100	0	0	0	0
	VANADIUM	I	0	0	100	0	0	0	0
	ZINC	B	0	0	100	0	0	0	0
	ZINC	BD	0	0	100	0	0	0	0
	ZINC	BDK	0	0	100	0	0	0	0
	ZINC	BGD	0	0	100	0	0	0	0
	ZINC	BI	0	0	100	0	0	0	0
	ZINC	BIK	0	0	100	0	0	0	0
	ZINC	FI	0	0	100	0	0	0	0

TABLE 3-5

SOIL AND SEDIMENT PERCENT QUALIFICATION RATES
SWMU 03 - OLD JEEP TRAIL/LITTLE SULPHUR CREEK
NSWC CRANE
CRANE, INDIANA

FRACTION	PARAMETER	QUALIFICATION CODE	QUALIFIER						
			BJ	BU	J	R	U	UJ	UR
MISCELLANOUS	NITRATE	H	0	0	66.7	0	0	33.3	0
	NITRITE	D	0	0	5.6	0	0	18.5	75.9
	NITRITE	DH	0	0	16.7	0	0	83.3	0
	NITRITE	H	0	0	7.1	0	0	92.9	0
	NITRITE	HD	0	0	25	0	0	75	0
	NITRITE/NITRATE	H	0	0	97.1	0	0	2.9	0
	PERCHLORATE	C	0	0	100	0	0	0	0
	PERCHLORATE	H	0	0	4.3	0	0	95.7	0
	PH	H	0	0	100	0	0	0	0
	TOTAL ORGANIC CARBON	D	0	0	100	0	0	0	0
SEMIVOLATILE	1,2,4,5-TETRACHLOROBENZENE	H	0	0	0	0	0	100	0
	1,2,4,5-TETRACHLOROBENZENE	R	0	0	0	0	0	100	0
	1,2,4-TRICHLOROBENZENE	D	0	0	0	0	0	100	0
	1,2,4-TRICHLOROBENZENE	H	0	0	0	0	0	100	0
	1,2,4-TRICHLOROBENZENE	R	0	0	0	0	0	100	0
	1,2-DICHLOROBENZENE	H	0	0	0	0	0	100	0
	1,2-DICHLOROBENZENE	R	0	0	0	0	0	100	0
	1,3-DICHLOROBENZENE	H	0	0	0	0	0	100	0
	1,3-DICHLOROBENZENE	R	0	0	0	0	0	100	0
	1,4-DICHLOROBENZENE	H	0	0	0	0	0	100	0
	1,4-DICHLOROBENZENE	R	0	0	0	0	0	100	0
	1,4-NAPHTHOQUINONE	H	0	0	0	0	0	100	0
	1,4-NAPHTHOQUINONE	R	0	0	0	0	0	100	0
	1,4-PHENYLENEDIAMINE	C	0	0	0	0	0	37.6	62.4
	1,4-PHENYLENEDIAMINE	CH	0	0	0	0	0	0	100
	1,4-PHENYLENEDIAMINE	CP	0	0	100	0	0	0	0
	1,4-PHENYLENEDIAMINE	CR	0	0	0	0	0	80	20

TABLE 3-5

SOIL AND SEDIMENT PERCENT QUALIFICATION RATES
SWMU 03 - OLD JEEP TRAIL/LITTLE SULPHUR CREEK
NSWC CRANE
CRANE, INDIANA

FRACTION	PARAMETER	QUALIFICATION CODE	QUALIFIER						
			BJ	BU	J	R	U	UJ	UR
	1-NAPHTHYLAMINE	C	0	0	0	0	0	100	0
	1-NAPHTHYLAMINE	H	0	0	0	0	0	100	0
	1-NAPHTHYLAMINE	R	0	0	0	0	0	100	0
	2,2'-OXYBIS(100-CHLOROPROPANE)	C	0	0	0	0	0	100	0
	2,2'-OXYBIS(100-CHLOROPROPANE)	CR	0	0	0	0	0	100	0
	2,2'-OXYBIS(100-CHLOROPROPANE)	H	0	0	0	0	0	100	0
	2,2'-OXYBIS(100-CHLOROPROPANE)	R	0	0	0	0	0	100	0
	2,3,4,6-TETRACHLOROPHENOL	C	0	0	0	0	0	100	0
	2,3,4,6-TETRACHLOROPHENOL	H	0	0	0	0	0	100	0
	2,3,4,6-TETRACHLOROPHENOL	R	0	0	0	0	0	93.8	6.3
	2,4,5-TRICHLOROPHENOL	D	0	0	0	0	0	100	0
	2,4,5-TRICHLOROPHENOL	H	0	0	0	0	0	100	0
	2,4,5-TRICHLOROPHENOL	R	0	0	0	0	0	100	0
	2,4,6-TRICHLOROPHENOL	C	0	0	0	0	0	100	0
	2,4,6-TRICHLOROPHENOL	H	0	0	0	0	0	100	0
	2,4,6-TRICHLOROPHENOL	R	0	0	0	0	0	100	0
	2,4-DICHLOROPHENOL	C	0	0	0	0	0	100	0
	2,4-DICHLOROPHENOL	H	0	0	0	0	0	100	0
	2,4-DICHLOROPHENOL	R	0	0	0	0	0	100	0
	2,4-DIMETHYLPHENOL	C	0	0	0	0	0	0	100
	2,4-DIMETHYLPHENOL	D	0	0	0	0	0	71.4	28.6
	2,4-DIMETHYLPHENOL	H	0	0	0	0	0	100	0
	2,4-DIMETHYLPHENOL	R	0	0	0	0	0	100	0
	2,4-DINITROPHENOL	C	0	0	0	0	0	100	0
	2,4-DINITROPHENOL	CH	0	0	0	0	0	100	0
	2,4-DINITROPHENOL	CR	0	0	0	0	0	90.9	9.1
	2,4-DINITROPHENOL	H	0	0	0	0	0	100	0

TABLE 3-5

SOIL AND SEDIMENT PERCENT QUALIFICATION RATES
SWMU 03 - OLD JEEP TRAIL/LITTLE SULPHUR CREEK
NSWC CRANE
CRANE, INDIANA

FRACTION	PARAMETER	QUALIFICATION CODE	QUALIFIER						
			BJ	BU	J	R	U	UJ	UR
	2,4-DINITROPHENOL	R	0	0	0	0	0	100	0
	2,6-DICHLOROPHENOL	C	0	0	0	0	0	100	0
	2,6-DICHLOROPHENOL	H	0	0	0	0	0	100	0
	2,6-DICHLOROPHENOL	R	0	0	0	0	0	100	0
	2-ACETYLAMINOFLUORENE	C	0	0	0	0	0	100	0
	2-ACETYLAMINOFLUORENE	H	0	0	0	0	0	100	0
	2-ACETYLAMINOFLUORENE	R	0	0	0	0	0	100	0
	2-CHLORONAPHTHALENE	D	0	0	0	0	0	100	0
	2-CHLORONAPHTHALENE	DR	0	0	0	0	0	100	0
	2-CHLORONAPHTHALENE	H	0	0	0	0	0	100	0
	2-CHLORONAPHTHALENE	R	0	0	0	0	0	100	0
	2-CHLOROPHENOL	D	0	0	0	0	0	100	0
	2-CHLOROPHENOL	DR	0	0	0	0	0	100	0
	2-CHLOROPHENOL	H	0	0	0	0	0	100	0
	2-CHLOROPHENOL	R	0	0	0	0	0	93.3	7.7
	2-METHYLNAPHTHALENE	H	0	0	0	0	0	100	0
	2-METHYLPHENOL	D	0	0	0	0	0	100	0
	2-METHYLPHENOL	DR	0	0	0	0	0	100	0
	2-METHYLPHENOL	H	0	0	0	0	0	100	0
	2-METHYLPHENOL	P	0	0	100	0	0	0	0
	2-METHYLPHENOL	R	0	0	0	0	0	92.3	7.7
	2-NAPHTHYLAMINE	H	0	0	0	0	0	100	0
	2-NAPHTHYLAMINE	R	0	0	0	0	0	100	0
	2-NITROANILINE	C	0	0	0	0	0	100	0
	2-NITROANILINE	H	0	0	0	0	0	100	0
	2-NITROANILINE	R	0	0	0	0	0	100	0
	2-NITROPHENOL	C	0	0	0	0	0	100	0

TABLE 3-5

SOIL AND SEDIMENT PERCENT QUALIFICATION RATES
SWMU 03 - OLD JEEP TRAIL/LITTLE SULPHUR CREEK
NSWC CRANE
CRANE, INDIANA

FRACTION	PARAMETER	QUALIFICATION CODE	QUALIFIER						
			BJ	BU	J	R	U	UJ	UR
	2-NITROPHENOL	H	0	0	0	0	0	100	0
	2-NITROPHENOL	R	0	0	0	0	0	93.3	6.7
	2-PICOLINE	C	0	0	0	0	0	100	0
	2-PICOLINE	H	0	0	0	0	0	100	0
	2-PICOLINE	R	0	0	0	0	0	100	0
	3&4-METHYLPHENOL	D	0	0	0	0	0	100	0
	3&4-METHYLPHENOL	DR	0	0	0	0	0	100	0
	3&4-METHYLPHENOL	H	0	0	0	0	0	100	0
	3&4-METHYLPHENOL	P	0	0	100	0	0	0	0
	3&4-METHYLPHENOL	R	0	0	0	0	0	92.9	7.1
	3,3'-DICHLOROBENZIDINE	C	0	0	0	0	0	100	0
	3,3'-DICHLOROBENZIDINE	D	0	0	0	0	0	12.5	87.5
	3,3'-DICHLOROBENZIDINE	H	0	0	0	0	0	100	0
	3,3'-DICHLOROBENZIDINE	R	0	0	0	0	0	100	0
	3,3'-DIMETHYLBENZIDINE	C	0	0	0	0	0	100	0
	3,3'-DIMETHYLBENZIDINE	CR	0	0	0	0	0	100	0
	3,3'-DIMETHYLBENZIDINE	H	0	0	0	0	0	100	0
	3,3'-DIMETHYLBENZIDINE	R	0	0	0	0	0	100	0
	3-METHYLCHOLANTHRENE	H	0	0	0	0	0	100	0
	3-METHYLCHOLANTHRENE	N	0	0	0	0	0	100	0
	3-METHYLCHOLANTHRENE	R	0	0	0	0	0	100	0
	3-NITROANILINE	C	0	0	0	0	0	100	0
	3-NITROANILINE	D	0	0	0	0	0	100	0
	3-NITROANILINE	DR	0	0	0	0	0	100	0
	3-NITROANILINE	H	0	0	0	0	0	100	0
	3-NITROANILINE	NR	0	0	0	0	0	100	0
	3-NITROANILINE	R	0	0	0	0	0	100	0

TABLE 3-5

SOIL AND SEDIMENT PERCENT QUALIFICATION RATES
SWMU 03 - OLD JEEP TRAIL/LITTLE SULPHUR CREEK
NSWC CRANE
CRANE, INDIANA

FRACTION	PARAMETER	QUALIFICATION CODE	QUALIFIER						
			BJ	BU	J	R	U	UJ	UR
	4,6-DINITRO-2-METHYLPHENOL	C	0	0	0	0	0	100	0
	4,6-DINITRO-2-METHYLPHENOL	CH	0	0	0	0	0	100	0
	4,6-DINITRO-2-METHYLPHENOL	CR	0	0	0	0	0	100	0
	4,6-DINITRO-2-METHYLPHENOL	H	0	0	0	0	0	100	0
	4,6-DINITRO-2-METHYLPHENOL	R	0	0	0	0	0	92.9	7.1
	4-AMINOBIPHENYL	H	0	0	0	0	0	100	0
	4-AMINOBIPHENYL	R	0	0	0	0	0	100	0
	4-BROMOPHENYL PHENYL ETHER	D	0	0	0	0	0	100	0
	4-BROMOPHENYL PHENYL ETHER	H	0	0	0	0	0	100	0
	4-BROMOPHENYL PHENYL ETHER	R	0	0	0	0	0	100	0
	4-CHLORO-3-METHYLPHENOL	D	0	0	0	0	0	100	0
	4-CHLORO-3-METHYLPHENOL	DR	0	0	0	0	0	100	0
	4-CHLORO-3-METHYLPHENOL	H	0	0	0	0	0	100	0
	4-CHLORO-3-METHYLPHENOL	R	0	0	0	0	0	92.9	7.1
	4-CHLOROANILINE	D	0	0	0	0	0	71.4	28.6
	4-CHLOROANILINE	H	0	0	0	0	0	100	0
	4-CHLOROANILINE	R	0	0	0	0	0	100	0
	4-CHLOROPHENYL PHENYL ETHER	H	0	0	0	0	0	100	0
	4-CHLOROPHENYL PHENYL ETHER	R	0	0	0	0	0	100	0
	4-NITROANILINE	D	0	0	0	0	0	100	0
	4-NITROANILINE	H	0	0	0	0	0	100	0
	4-NITROANILINE	R	0	0	0	0	0	100	0
	4-NITROPHENOL	C	0	0	0	0	0	100	0
	4-NITROPHENOL	CH	0	0	0	0	0	100	0
	4-NITROPHENOL	CR	0	0	0	0	0	100	0
	4-NITROPHENOL	H	0	0	0	0	0	100	0
	4-NITROPHENOL	R	0	0	0	0	0	93.3	6.7

TABLE 3-5

SOIL AND SEDIMENT PERCENT QUALIFICATION RATES
SWMU 03 - OLD JEEP TRAIL/LITTLE SULPHUR CREEK
NSWC CRANE
CRANE, INDIANA

FRACTION	PARAMETER	QUALIFICATION CODE	QUALIFIER						
			BJ	BU	J	R	U	UJ	UR
	4-NITROQUINOLINE-100-OXIDE	C	0	0	0	0	0	42.5	57.5
	4-NITROQUINOLINE-100-OXIDE	CH	0	0	0	0	0	0	100
	4-NITROQUINOLINE-100-OXIDE	CR	0	0	0	0	0	80	20
	5-NITRO-O-TOLUIDINE	H	0	0	0	0	0	100	0
	5-NITRO-O-TOLUIDINE	N	0	0	0	0	0	100	0
	5-NITRO-O-TOLUIDINE	R	0	0	0	0	0	100	0
	7,1002-DIMETHYLBENZ(A)ANTHRACENE	C	0	0	0	0	0	100	0
	7,1002-DIMETHYLBENZ(A)ANTHRACENE	H	0	0	0	0	0	100	0
	7,1002-DIMETHYLBENZ(A)ANTHRACENE	N	0	0	0	0	0	100	0
	7,1002-DIMETHYLBENZ(A)ANTHRACENE	NR	0	0	0	0	0	100	0
	7,1002-DIMETHYLBENZ(A)ANTHRACENE	R	0	0	0	0	0	100	0
	A,A-DIMETHYLPHENETHYLAMINE	C	0	0	0	0	0	100	0
	A,A-DIMETHYLPHENETHYLAMINE	CR	0	0	0	0	0	100	0
	A,A-DIMETHYLPHENETHYLAMINE	H	0	0	0	0	0	100	0
	A,A-DIMETHYLPHENETHYLAMINE	R	0	0	0	0	0	100	0
	ACENAPHTHENE	H	0	0	0	0	0	100	0
	ACENAPHTHYLENE	H	0	0	0	0	0	100	0
	ACETOPHENONE	A	0	100	0	0	0	0	0
	ACETOPHENONE	C	0	0	0	0	0	100	0
	ACETOPHENONE	H	0	0	0	0	0	100	0
	ACETOPHENONE	P	0	0	100	0	0	0	0
	ACETOPHENONE	R	0	0	0	0	0	100	0
	ANILINE	H	0	0	0	0	0	100	0
	ANILINE	R	0	0	0	0	0	100	0
	ANTHRACENE	H	0	0	0	0	0	100	0
	ARAMITE	C	0	0	0	0	0	100	0
	ARAMITE	H	0	0	0	0	0	100	0

TABLE 3-5

SOIL AND SEDIMENT PERCENT QUALIFICATION RATES
SWMU 03 - OLD JEEP TRAIL/LITTLE SULPHUR CREEK
NSWC CRANE
CRANE, INDIANA

FRACTION	PARAMETER	QUALIFICATION CODE	QUALIFIER						
			BJ	BU	J	R	U	UJ	UR
	ARAMITE	R	0	0	0	0	0	100	0
	BENZO(A)ANTHRACENE	H	0	0	0	0	0	100	0
	BENZO(A)ANTHRACENE	N	0	0	0	0	0	100	0
	BENZO(A)PYRENE	H	0	0	0	0	0	100	0
	BENZO(A)PYRENE	N	0	0	0	0	0	100	0
	BENZO(B)FLUORANTHENE	H	0	0	0	0	0	100	0
	BENZO(B)FLUORANTHENE	N	0	0	0	0	0	100	0
	BENZO(G,H,I)PERYLENE	H	0	0	0	0	0	100	0
	BENZO(G,H,I)PERYLENE	N	0	0	0	0	0	100	0
	BENZO(K)FLUORANTHENE	CH	0	0	0	0	0	100	0
	BENZO(K)FLUORANTHENE	H	0	0	0	0	0	100	0
	BENZO(K)FLUORANTHENE	N	0	0	0	0	0	100	0
	BENZYL ALCOHOL	H	0	0	0	0	0	100	0
	BENZYL ALCOHOL	R	0	0	0	0	0	100	0
	BIS(2-CHLOROETHOXY)METHANE	D	0	0	0	0	0	100	0
	BIS(2-CHLOROETHOXY)METHANE	H	0	0	0	0	0	100	0
	BIS(2-CHLOROETHOXY)METHANE	R	0	0	0	0	0	100	0
	BIS(2-CHLOROETHYL)ETHER	H	0	0	0	0	0	100	0
	BIS(2-CHLOROETHYL)ETHER	R	0	0	0	0	0	100	0
	BIS(2-ETHYLHEXYL)PHTHALATE	A	0	58.3	8.3	0	33.3	0	0
	BIS(2-ETHYLHEXYL)PHTHALATE	D	0	0	0	0	0	50	50
	BIS(2-ETHYLHEXYL)PHTHALATE	G	0	0	0	0	0	100	0
	BIS(2-ETHYLHEXYL)PHTHALATE	H	0	0	0	0	0	100	0
	BIS(2-ETHYLHEXYL)PHTHALATE	P	0	0	100	0	0	0	0
	BIS(2-ETHYLHEXYL)PHTHALATE	PR	0	0	100	0	0	0	0
	BIS(2-ETHYLHEXYL)PHTHALATE	R	0	0	0	0	0	100	0
	BUTYL BENZYL PHTHALATE	D	0	0	0	0	0	100	0

TABLE 3-5

SOIL AND SEDIMENT PERCENT QUALIFICATION RATES
SWMU 03 - OLD JEEP TRAIL/LITTLE SULPHUR CREEK
NSWC CRANE
CRANE, INDIANA

FRACTION	PARAMETER	QUALIFICATION CODE	QUALIFIER						
			BJ	BU	J	R	U	UJ	UR
	BUTYL BENZYL PHTHALATE	H	0	0	0	0	0	100	0
	BUTYL BENZYL PHTHALATE	R	0	0	0	0	0	100	0
	CHLOROBENZILATE	C	0	0	0	0	0	100	0
	CHLOROBENZILATE	H	0	0	0	0	0	100	0
	CHLOROBENZILATE	R	0	0	0	0	0	100	0
	CHRYSENE	H	0	0	0	0	0	100	0
	CHRYSENE	N	0	0	0	0	0	100	0
	DIALLATE	C	0	0	0	0	0	100	0
	DIALLATE	H	0	0	0	0	0	100	0
	DIALLATE	R	0	0	0	0	0	100	0
	DIBENZO(A,H)ANTHRACENE	H	0	0	0	0	0	100	0
	DIBENZO(A,H)ANTHRACENE	N	0	0	0	0	0	100	0
	DIBENZOFURAN	D	0	0	0	0	0	100	0
	DIBENZOFURAN	H	0	0	0	0	0	100	0
	DIBENZOFURAN	R	0	0	0	0	0	100	0
	DIETHYL PHTHALATE	H	0	0	0	0	0	100	0
	DIETHYL PHTHALATE	R	0	0	0	0	0	100	0
	DIMETHYL PHTHALATE	H	0	0	0	0	0	100	0
	DIMETHYL PHTHALATE	R	0	0	0	0	0	100	0
	DI-N-BUTYL PHTHALATE	A	0	100	0	0	0	0	0
	DI-N-BUTYL PHTHALATE	D	0	0	0	0	0	0	100
	DI-N-BUTYL PHTHALATE	H	0	0	0	0	0	100	0
	DI-N-BUTYL PHTHALATE	P	0	0	100	0	0	0	0
	DI-N-BUTYL PHTHALATE	R	0	0	0	0	0	100	0
	DI-N-OCTYL PHTHALATE	C	0	0	0	0	0	0	100
	DI-N-OCTYL PHTHALATE	CPR	0	0	100	0	0	0	0
	DI-N-OCTYL PHTHALATE	G	0	0	0	0	0	100	0

TABLE 3-5

SOIL AND SEDIMENT PERCENT QUALIFICATION RATES
SWMU 03 - OLD JEEP TRAIL/LITTLE SULPHUR CREEK
NSWC CRANE
CRANE, INDIANA

FRACTION	PARAMETER	QUALIFICATION CODE	QUALIFIER						
			BJ	BU	J	R	U	UJ	UR
	DI-N-OCTYL PHTHALATE	H	0	0	0	0	0	100	0
	DI-N-OCTYL PHTHALATE	N	0	0	0	0	0	100	0
	DI-N-OCTYL PHTHALATE	NR	0	0	0	0	0	100	0
	DI-N-OCTYL PHTHALATE	P	0	0	100	0	0	0	0
	DI-N-OCTYL PHTHALATE	R	0	0	0	0	0	100	0
	DIPHENYLAMINE	D	0	0	0	0	0	100	0
	DIPHENYLAMINE	H	0	0	0	0	0	100	0
	DIPHENYLAMINE	P	0	0	100	0	0	0	0
	DIPHENYLAMINE	R	0	0	0	0	0	100	0
	ETHYL METHANE SULFONATE	C	0	0	0	0	0	100	0
	ETHYL METHANE SULFONATE	H	0	0	0	0	0	100	0
	ETHYL METHANE SULFONATE	R	0	0	0	0	0	100	0
	ETHYL PARATHION	C	0	0	0	0	0	100	0
	ETHYL PARATHION	H	0	0	0	0	0	100	0
	ETHYL PARATHION	R	0	0	0	0	0	100	0
	FLUORANTHENE	G	0	0	100	0	0	0	0
	FLUORANTHENE	H	0	0	0	0	0	100	0
	FLUORENE	H	0	0	0	0	0	100	0
	HEXACHLOROBENZENE	H	0	0	0	0	0	100	0
	HEXACHLOROBENZENE	R	0	0	0	0	0	100	0
	HEXACHLOROBUTADIENE	H	0	0	0	0	0	100	0
	HEXACHLOROBUTADIENE	R	0	0	0	0	0	100	0
	HEXACHLOROCYCLOPENTADIENE	C	0	0	0	0	0	100	0
	HEXACHLOROCYCLOPENTADIENE	CD	0	0	0	0	0	100	0
	HEXACHLOROCYCLOPENTADIENE	CH	0	0	0	0	0	100	0
	HEXACHLOROCYCLOPENTADIENE	CR	0	0	0	0	0	100	0
	HEXACHLOROCYCLOPENTADIENE	D	0	0	0	0	0	80	20

TABLE 3-5

SOIL AND SEDIMENT PERCENT QUALIFICATION RATES
SWMU 03 - OLD JEEP TRAIL/LITTLE SULPHUR CREEK
NSWC CRANE
CRANE, INDIANA

FRACTION	PARAMETER	QUALIFICATION CODE	QUALIFIER						
			BJ	BU	J	R	U	UJ	UR
	HEXACHLOROCYCLOPENTADIENE	DR	0	0	0	0	0	100	0
	HEXACHLOROCYCLOPENTADIENE	R	0	0	0	0	0	100	0
	HEXACHLOROETHANE	D	0	0	0	0	0	100	0
	HEXACHLOROETHANE	H	0	0	0	0	0	100	0
	HEXACHLOROETHANE	R	0	0	0	0	0	100	0
	HEXACHLOROPROPENE	H	0	0	0	0	0	100	0
	HEXACHLOROPROPENE	R	0	0	0	0	0	100	0
	INDENO(100,2,3-CD)PYRENE	C	0	0	100	0	0	0	0
	INDENO(100,2,3-CD)PYRENE	H	0	0	0	0	0	100	0
	INDENO(100,2,3-CD)PYRENE	N	0	0	0	0	0	100	0
	ISODRIN	H	0	0	0	0	0	100	0
	ISODRIN	R	0	0	0	0	0	100	0
	ISOPHORONE	H	0	0	0	0	0	100	0
	ISOPHORONE	R	0	0	0	0	0	100	0
	ISOSAFROLE	H	0	0	0	0	0	100	0
	ISOSAFROLE	R	0	0	0	0	0	100	0
	KEPONE	C	0	0	0	0	0	0	100
	KEPONE	CH	0	0	0	0	0	0	100
	KEPONE	CR	0	0	0	0	0	0	100
	METHAPYRILENE	C	0	0	0	0	0	97.6	2.4
	METHAPYRILENE	CR	0	0	0	0	0	100	0
	METHAPYRILENE	H	0	0	0	0	0	100	0
	METHAPYRILENE	R	0	0	0	0	0	100	0
	METHYL METHANE SULFONATE	C	0	0	0	0	0	100	0
	METHYL METHANE SULFONATE	H	0	0	0	0	0	100	0
	METHYL METHANE SULFONATE	R	0	0	0	0	0	100	0
	METHYL PARATHION	C	0	0	0	0	0	100	0

TABLE 3-5

SOIL AND SEDIMENT PERCENT QUALIFICATION RATES
SWMU 03 - OLD JEEP TRAIL/LITTLE SULPHUR CREEK
NSWC CRANE
CRANE, INDIANA

FRACTION	PARAMETER	QUALIFICATION CODE	QUALIFIER						
			BJ	BU	J	R	U	UJ	UR
	METHYL PARATHION	CR	0	0	0	0	0	100	0
	METHYL PARATHION	H	0	0	0	0	0	100	0
	METHYL PARATHION	R	0	0	0	0	0	100	0
	NAPHTHALENE	H	0	0	0	0	0	100	0
	N-NITROSODIETHYLAMINE	C	0	0	0	0	0	100	0
	N-NITROSODIETHYLAMINE	H	0	0	0	0	0	100	0
	N-NITROSODIETHYLAMINE	R	0	0	0	0	0	100	0
	N-NITROSODIMETHYLAMINE	C	0	0	0	0	0	100	0
	N-NITROSODIMETHYLAMINE	CR	0	0	0	0	0	100	0
	N-NITROSODIMETHYLAMINE	H	0	0	0	0	0	100	0
	N-NITROSODIMETHYLAMINE	R	0	0	0	0	0	100	0
	N-NITROSO-DI-N-BUTYLAMINE	C	0	0	0	0	0	100	0
	N-NITROSO-DI-N-BUTYLAMINE	H	0	0	0	0	0	100	0
	N-NITROSO-DI-N-BUTYLAMINE	R	0	0	0	0	0	100	0
	N-NITROSO-DI-N-PROPYLAMINE	C	0	0	0	0	0	100	0
	N-NITROSO-DI-N-PROPYLAMINE	CR	0	0	0	0	0	100	0
	N-NITROSO-DI-N-PROPYLAMINE	D	0	0	0	0	0	100	0
	N-NITROSO-DI-N-PROPYLAMINE	DR	0	0	0	0	0	100	0
	N-NITROSO-DI-N-PROPYLAMINE	H	0	0	0	0	0	100	0
	N-NITROSO-DI-N-PROPYLAMINE	R	0	0	0	0	0	100	0
	N-NITROSOMETHYLETHYLAMINE	C	0	0	0	0	0	100	0
	N-NITROSOMETHYLETHYLAMINE	H	0	0	0	0	0	100	0
	N-NITROSOMETHYLETHYLAMINE	R	0	0	0	0	0	100	0
	N-NITROSOMORPHOLINE	C	0	0	0	0	0	100	0
	N-NITROSOMORPHOLINE	CR	0	0	0	0	0	100	0
	N-NITROSOMORPHOLINE	H	0	0	0	0	0	100	0
	N-NITROSOMORPHOLINE	R	0	0	0	0	0	100	0

TABLE 3-5

SOIL AND SEDIMENT PERCENT QUALIFICATION RATES
SWMU 03 - OLD JEEP TRAIL/LITTLE SULPHUR CREEK
NSWC CRANE
CRANE, INDIANA

FRACTION	PARAMETER	QUALIFICATION CODE	QUALIFIER						
			BJ	BU	J	R	U	UJ	UR
	N-NITROSOPIPERIDINE	C	0	0	0	0	0	100	0
	N-NITROSOPIPERIDINE	CR	0	0	0	0	0	100	0
	N-NITROSOPIPERIDINE	H	0	0	0	0	0	100	0
	N-NITROSOPIPERIDINE	R	0	0	0	0	0	100	0
	N-NITROSOPYRROLIDINE	C	0	0	0	0	0	100	0
	N-NITROSOPYRROLIDINE	CH	0	0	0	0	0	100	0
	N-NITROSOPYRROLIDINE	R	0	0	0	0	0	100	0
	O,O,O-TRIETHYL PHOSPHOROTHIOATE	H	0	0	0	0	0	100	0
	O,O,O-TRIETHYL PHOSPHOROTHIOATE	R	0	0	0	0	0	100	0
	O-TOLUIDINE	H	0	0	0	0	0	100	0
	O-TOLUIDINE	R	0	0	0	0	0	100	0
	P-(DIMETHYLAMINO)AZOBENZENE	C	0	0	0	0	0	100	0
	P-(DIMETHYLAMINO)AZOBENZENE	H	0	0	0	0	0	100	0
	P-(DIMETHYLAMINO)AZOBENZENE	R	0	0	0	0	0	100	0
	PENTACHLOROBENZENE	H	0	0	0	0	0	100	0
	PENTACHLOROBENZENE	R	0	0	0	0	0	100	0
	PENTACHLOROETHANE	H	0	0	0	0	0	100	0
	PENTACHLOROETHANE	R	0	0	0	0	0	100	0
	PENTACHLORONITROBENZENE	C	0	0	0	0	0	100	0
	PENTACHLORONITROBENZENE	H	0	0	0	0	0	100	0
	PENTACHLORONITROBENZENE	R	0	0	0	0	0	100	0
	PHENACETIN	H	0	0	0	0	0	100	0
	PHENACETIN	R	0	0	0	0	0	100	0
	PHENANTHRENE	G	0	0	100	0	0	0	0
	PHENANTHRENE	H	0	0	0	0	0	100	0
	PHENOL	DR	0	0	0	0	0	100	0
	PHENOL	H	0	0	0	0	0	100	0

TABLE 3-5

SOIL AND SEDIMENT PERCENT QUALIFICATION RATES
SWMU 03 - OLD JEEP TRAIL/LITTLE SULPHUR CREEK
NSWC CRANE
CRANE, INDIANA

FRACTION	PARAMETER	QUALIFICATION CODE	QUALIFIER						
			BJ	BU	J	R	U	UJ	UR
	PHENOL	P	0	0	100	0	0	0	0
	PHENOL	R	0	0	0	0	0	92.3	7.7
	PRONAMIDE	H	0	0	0	0	0	100	0
	PRONAMIDE	R	0	0	0	0	0	100	0
	PYRENE	C	0	0	16.7	0	0	83.3	0
	PYRENE	CH	0	0	0	0	0	100	0
	PYRENE	H	0	0	0	0	0	100	0
	PYRIDINE	C	0	0	0	0	0	100	0
	PYRIDINE	CR	0	0	0	0	0	100	0
	PYRIDINE	H	0	0	0	0	0	100	0
	PYRIDINE	R	0	0	0	0	0	100	0
	SAFROLE	H	0	0	0	0	0	100	0
	SAFROLE	R	0	0	0	0	0	100	0
VOLATILE	1,1,1-TRICHLOROETHANE	G	0	0	0	0	0	100	0
	1,1,1-TRICHLOROETHANE	P	0	0	100	0	0	0	0
	1,1,2,2-TETRACHLOROETHANE	D	0	0	0	0	0	100	0
	1,1,2,2-TETRACHLOROETHANE	P	0	0	100	0	0	0	0
	1,1,2-TRICHLOROETHANE	D	0	0	0	0	0	100	0
	1,1-DICHLOROETHANE	D	0	0	0	0	0	100	0
	1,1-DICHLOROETHENE	D	0	0	0	0	0	100	0
	1,2-DICHLOROPROPANE	D	0	0	0	0	0	100	0
	1,4-DIOXANE	R	0	0	0	0	0	100	0
	2-BUTANONE	C	0	0	5	0	0	95	0
	2-BUTANONE	CD	0	0	0	0	0	100	0
	2-BUTANONE	CP	0	0	100	0	0	0	0
	2-BUTANONE	D	0	0	0	0	0	100	0
	2-HEXANONE	C	0	0	0	0	0	100	0

TABLE 3-5

SOIL AND SEDIMENT PERCENT QUALIFICATION RATES
SWMU 03 - OLD JEEP TRAIL/LITTLE SULPHUR CREEK
NSWC CRANE
CRANE, INDIANA

FRACTION	PARAMETER	QUALIFICATION CODE	QUALIFIER						
			BJ	BU	J	R	U	UJ	UR
	2-HEXANONE	CD	0	0	0	0	0	100	0
	2-HEXANONE	D	0	0	0	0	0	100	0
	2-HEXANONE	G	0	0	0	0	0	100	0
	2-HEXANONE	P	0	0	100	0	0	0	0
	3-CHLOROPROPENE	C	0	0	0	0	0	100	0
	4-METHYL-2-PENTANONE	C	0	0	0	0	0	100	0
	4-METHYL-2-PENTANONE	CD	0	0	0	0	0	100	0
	4-METHYL-2-PENTANONE	CGP	0	0	100	0	0	0	0
	4-METHYL-2-PENTANONE	P	0	0	100	0	0	0	0
	ACETONE	A	0	64	12	0	24	0	0
	ACETONE	AC	100	0	0	0	0	0	0
	ACETONE	C	0	0	0	0	0	50	50
	ACETONITRILE	R	0	0	0	0	0	100	0
	ACROLEIN	C	0	0	0	0	0	1.5	98.5
	ACRYLONITRILE	C	0	0	0	0	0	0	100
	ACRYLONITRILE	CR	0	0	0	0	0	0	100
	BENZENE	D	0	0	0	0	0	100	0
	BROMOFORM	C	0	0	0	0	0	100	0
	BROMOFORM	D	0	0	0	0	0	100	0
	BROMOMETHANE	C	0	0	0	0	0	100	0
	BROMOMETHANE	CD	0	0	0	0	0	100	0
	BROMOMETHANE	D	0	0	0	0	0	100	0
	CARBON DISULFIDE	C	0	0	0	0	0	100	0
	CARBON DISULFIDE	CG	0	0	0	0	0	100	0
	CARBON DISULFIDE	CP	0	0	83.3	0	0	16.7	0
	CARBON DISULFIDE	D	0	0	0	0	0	100	0
	CARBON TETRACHLORIDE	C	0	0	0	0	0	100	0

TABLE 3-5

SOIL AND SEDIMENT PERCENT QUALIFICATION RATES
SWMU 03 - OLD JEEP TRAIL/LITTLE SULPHUR CREEK
NSWC CRANE
CRANE, INDIANA

FRACTION	PARAMETER	QUALIFICATION CODE	QUALIFIER						
			BJ	BU	J	R	U	UJ	UR
	CHLOROBENZENE	D	0	0	0	0	0	100	0
	CHLORODIBROMOMETHANE	D	0	0	0	0	0	100	0
	CHLOROETHANE	C	0	0	0	0	0	100	0
	CHLOROMETHANE	D	0	0	0	0	0	100	0
	CHLOROPRENE	C	0	0	0	0	0	100	0
	CIS-100,2-DICHLOROETHENE	D	0	0	0	0	0	100	0
	CIS-100,2-DICHLOROETHENE	P	0	0	100	0	0	0	0
	CIS-100,3-DICHLOROPROPENE	D	0	0	0	0	0	100	0
	DICHLORODIFLUOROMETHANE	C	0	0	0	0	0	100	0
	ETHYLBENZENE	D	0	0	0	0	0	100	0
	ISOBUTANOL	R	0	0	0	0	0	100	0
	METHYL IODIDE	C	0	0	0	0	0	100	0
	METHYL IODIDE	CV	0	0	0	0	0	100	0
	METHYLENE CHLORIDE	A	0	81.8	0	0	18.2	0	0
	PROPIONITRILE	R	0	0	0	0	0	100	0
	STYRENE	D	0	0	0	0	0	100	0
	TETRACHLOROETHENE	D	0	0	0	0	0	100	0
	TETRACHLOROETHENE	DP	0	0	100	0	0	0	0
	TETRACHLOROETHENE	P	0	0	100	0	0	0	0
	TOLUENE	D	0	0	0	0	0	100	0
	TOTAL XYLENES	D	0	0	0	0	0	100	0
	TRANS-100,2-DICHLOROETHENE	D	0	0	0	0	0	100	0
	TRANS-100,3-DICHLOROPROPENE	D	0	0	0	0	0	100	0
	TRANS-100,4-DICHLORO-2-BUTENE	C	0	0	0	0	0	100	0
	TRICHLOROETHENE	B	0	16.7	83.3	0	0	0	0
	TRICHLOROETHENE	BD	0	0	100	0	0	0	0
	TRICHLOROETHENE	BP	0	0	100	0	0	0	0

TABLE 3-5

SOIL AND SEDIMENT PERCENT QUALIFICATION RATES
SWMU 03 - OLD JEEP TRAIL/LITTLE SULPHUR CREEK
NSWC CRANE
CRANE, INDIANA

FRACTION	PARAMETER	QUALIFICATION CODE	QUALIFIER						
			BJ	BU	J	R	U	UJ	UR
	TRICHLOROETHENE	D	0	0	100	0	0	0	0
	TRICHLOROFLUOROMETHANE	C	0	0	0	0	0	100	0
	TRICHLOROFLUOROMETHANE	P	0	0	100	0	0	0	0
	VINYL ACETATE	C	0	0	0	0	0	100	0
PESTICIDE/PCB	4,4'-DDD	C	0	0	0	0	0	100	0
	4,4'-DDT	C	0	0	0	0	0	100	0
	ALDRIN	U	0	0	0	100	0	0	0
	ALPHA-BHC	C	0	0	0	0	0	100	0
	AROCLOR-100260	C	0	0	0	0	0	100	0
	DIELDRIN	C	0	0	0	0	0	100	0
	ENDOSULFAN I	C	0	0	0	0	0	100	0
	ENDOSULFAN II	C	0	0	0	0	0	100	0
	ENDRIN	C	0	0	0	0	0	100	0
	ENDRIN	U	0	0	0	100	0	0	0
	ENDRIN ALDEHYDE	D	0	0	0	0	0	100	0
	ENDRIN KETONE	C	0	0	0	0	0	100	0
	GAMMA-BHC (LINDANE)	C	0	0	0	0	0	100	0
	GAMMA-CHLORDANE	U	0	0	0	100	0	0	0
	HEPTACHLOR	C	0	0	0	0	0	100	0
	METHOXYCHLOR	C	0	0	0	0	0	100	0
	METHOXYCHLOR	U	0	0	100	0	0	0	0

TABLE 3-5

SOIL AND SEDIMENT PERCENT QUALIFICATION RATES
SWMU 03 - OLD JEEP TRAIL/LITTLE SULPHUR CREEK
NSWC CRANE
CRANE, INDIANA

FRACTION	PARAMETER	QUALIFICATION CODE	QUALIFIER						
			BJ	BU	J	R	U	UJ	UR

Qualifier Code Definitions:

A = Lab blank contamination.
B = Field blank contamination.
C = Calibration (i.e., % RSDs, %Ds, ICVs, CCVs, RPDs, or RRFs, etc.) are noncompliant with analytical method requirements.
D = MS/MSD noncompliance.
E = LCS/LCSD noncompliance.
F = Lab duplicate imprecision.
G = Field duplicate imprecision.
H = Holding time exceedance.
I = ICP serial dilution noncompliance.
K = ICP interference - include ICSAB % Rs.
N = Internal standard noncompliance.
P = Uncertainty near detection limit (< 2 x IDL for inorganics and <CRQL for organics).
R = Surrogates recovery noncompliance.
U = Percent difference between columns / detectros for positive results is >25% for GC / HPLC methods.

Qualifier Definitions - see page 3-1 of text.

TABLE 7-12
CUMULATIVE RISKS SUMMARY - REASONABLE MAXIMUM EXPOSURES
SWMU 03 - OLD JEEP TRAIL/LITTLE SULPHUR CREEK
NSWC CRANE
CRANE INDIANA

Receptor	Media	Exposure Route	Cancer Risk	Chemicals with Cancer Risks $> 10^{-4}$	Chemicals with Cancer Risks $> 10^{-6}$ and $\leq 10^{-4}$	Chemicals with Cancer Risks $> 10^{-6}$ and $\leq 10^{-5}$	Hazard Index	Chemicals with HI > 1
Adolescent Trespasser	Surface Soil	Incidental Ingestion	4E-08	--	--	--	0.02	--
		Dermal Contact	1E-08	--	--	--	0.002	--
		Total Surface Soil	5E-08				0.02	
	Surface Water	Incidental Ingestion	4E-07	--	--	--	0.02	--
		Dermal Contact	5E-08	--	--	--	0.001	--
		Total Surface Water	4E-07				0.02	
	Sediment	Incidental Ingestion	--	--	--	--	0.006	--
		Dermal Contact	--	--	--	--	0.0004	--
		Total Sediment	--				0.006	
	Total All Media (Study Area)		5E-07				0.04	
Off-Site Child Resident	Surface Water	Ingestion	9E-06	--	--	--	1	--
		Dermal Contact	3E-08	--	--	--	0.005	--
		Total Surface Water	9E-06				1	
Off-Site Adult Resident	Surface Water	Ingestion	1E-05	--	--	RDX	0.3	--
		Dermal Contact	6E-08	--	--	--	0.003	--
		Total Surface Water	1E-05				0.3	
Off-Site Lifelong (Child and Adult) Resident	Surface Water	Ingestion	2E-05	--	RDX	--	NE	--
		Dermal Contact	9E-08	--	--	--	NE	--
		Total Surface Water	2E-05				NE	
Construction Worker	Surface Soil / Subsurface Soil	Incidental Ingestion	6E-08	--	--	--	0.3	--
		Dermal Contact	7E-09	--	--	--	0.01	--
		Total All Soil	7E-08				0.3	
	Ground Water	Dermal Contact	3E-07	--	--	--	0.1	--
		Inhalation[2]	3E-08	--	--	--	0.0005	--
		Total Groundwater	3E-07				0.1	
	Total All Media (Study Area)		4E-07				0.5	
Maintenance Worker	Surface Soil	Incidental Ingestion	5E-08	--	--	--	0.01	--
		Dermal Contact	2E-08	--	--	--	0.001	--
		Total Soil	7E-08				0.01	
	Surface Water	Dermal Contact	4E-08	--	--	--	0.0005	--
	Sediment	Incidental Ingestion	--	--	--	--	0.003	--
		Dermal Contact	--	--	--	--	0.0002	--
		Total Sediment	--				0.003	
	Total All Media (Study Area)		1E-07				0.02	

TABLE 7-12
CUMULATIVE RISKS SUMMARY - REASONABLE MAXIMUM EXPOSURES
SWMU 03 - OLD JEEP TRAIL/LITTLE SULPHUR CREEK
NSWC CRANE
CRANE INDIANA

Receptor	Media	Exposure Route	Cancer Risk	Chemicals with Cancer Risks $> 10^{-4}$	Chemicals with Cancer Risks $> 10^{-6}$ and $\leq 10^{-4}$	Chemicals with Cancer Risks $> 10^{-6}$ and $\leq 10^{-6}$	Hazard Index	Chemicals with HI > 1
Occupational Worker	Surface Soil	Incidental Ingestion	6E-07	--	--	--	0.1	--
		Dermal Contact	2E-07	--	--	--	0.01	--
		Total Surface Soil	7E-07				0.1	
	Ground Water	Ingestion	1E-04	--	1,1,2,2-Tetrachloroethane, Trichloroethene, RDX	Vinly Chloride	2.0	Trichloroethene
		Dermal Contact	4E-06	--	--	Trichloroethene	0.07	--
		Total Ground Water	1E-04				2	
	Total All Media (Study Area)		1E-04				2	
Child Recreational User	Surface Soil	Incidental Ingestion	1E-07	--	--	--	0.1	--
		Dermal Contact	4E-08	--	--	--	0.01	--
		Total Surface Soil	2E-07				0.1	
	Groundwater	Ingestion	3E-05	--	Trichloroethene	1,1,2,2-Tetrachloroethane, RDX	2	Trichloroethene
		Dermal Contact Contac	9E-07	--	--	--	0.07	--
		Total Groundwater	3E-05				2	
	Surface Water	Ingestion	1E-06	--	--	RDX	0.09	--
		Dermal Contact	1E-07	--	--	--	0.008	--
		Total Surface Water	1E-06				0.1	
	Sediment	Incidental Ingestion	--	--	--	--	0.03	--
		Dermal Contact	--	--	--	--	0.002	--
		Total Sediment	--				0.03	
	Total All Media (Study Area)		3E-05				2	
Adult Recreational User	Surface Soil	Incidental Ingestion	6E-08	--	--	--	0.01	--
		Dermal Contact	4E-08	--	--	--	0.003	--
		Total Surface Soil	9E-08				0.01	
	Groundwater	Ingestion	2E-05	--	Trichloroethene	1,1,2,2-Tetrachloroethane, RDX	0.4	--
		Dermal Contact Contac	2E-06	--	--	Trichloroethene	0.04	--
		Total Groundwater	2E-05				0.4	
	Surface Water	Ingestion	2E-07	--	--	--	0.004	--
		Dermal Contact	3E-07	--	--	--	0.005	--
		Total Surface Water	5E-07				0.009	
	Sediment	Incidental Ingestion	--	--	--	--	0.003	--
		Dermal Contact	--	--	--	--	0.0005	--
		Total Sediment	--				0.004	
	Total All Media (Study Area)		2E-05				0.5	

TABLE 7-12
CUMULATIVE RISKS SUMMARY - REASONABLE MAXIMUM EXPOSURES
SWMU 03 - OLD JEEP TRAIL/LITTLE SULPHUR CREEK
NSWC CRANE
CRANE INDIANA

Receptor	Media	Exposure Route	Cancer Risk	Chemicals with Cancer Risks $> 10^{-4}$	Chemicals with Cancer Risks $> 10^{-5}$ and $\leq 10^{-4}$	Chemicals with Cancer Risks $> 10^{-6}$ and $\leq 10^{-5}$	Hazard Index	Chemicals with HI > 1
Lifelong Recreational User (Child and Adult)	Surface Soil	Incidental Ingestion	2E-07	--	--	--	NE	--
		Dermal Contact	8E-08	--	--	--	NE	--
		Total Surface Soil	3E-07				NE	
	Groundwater	Ingestion	5E-05	--	1,1,2,2-Tetrachloroethane, Trichloroethene	RDX	NE	--
		Dermal Contact	3E-06	--	--	Trichloroethene	NE	--
		Total Groundwater	5E-05				NE	
	Surface Water	Ingestion	1E-06	--	--	RDX	NE	--
		Dermal Contact	5E-07	--	--	--	NE	--
		Total Surface Water	2E-06				NE	
	Sediment	Incidental Ingestion	--	--	--	--	NE	--
		Dermal Contact	--	--	--	--	NE	--
		Total Sediment	--				NE	
	Total All Media (Study Area)		5E-05				NE	

NE = Exposure route not evaluated.
Chemical-specific risks are presented in Appendix G.

TABLE 7-13
CUMULATIVE RISK SUMMARY - CENTRAL TENDANCY EXPOSURE
SWMU 03 - OLD JEEP TRAIL/LITTLE SULPHUR CREEK
NSWC CRANE
CRANE INDIANA

Receptor	Media	Exposure Route	Cancer Risk	Chemicals with Cancer Risks $> 10^{-4}$	Chemicals with Cancer Risks $> 10^{-5}$ and $\leq 10^{-4}$	Chemicals with Cancer Risks $> 10^{-6}$ and $\leq 10^{-5}$	Hazard Index	Chemicals with HI > 1
Adolescent Trespasser	Surface Soil	Incidental Ingestion	1E-08	--	--	--	0.005	--
		Dermal Contact	1E-09	--	--	--	0	--
		Total Surface Soil	1E-08				0.005	
	Surface Water	Incidental Ingestion	9E-08	--	--	--	0.00	--
		Dermal Contact	2E-08	--	--	--	0.0004	--
		Total Surface Water	1E-07				0.004	
	Sediment	Incidental Ingestion	--	--	--	--	0.001	--
		Dermal Contact	--	--	--	--	0.00004	--
		Total Sediment	--				0.001	
	Total All Media (Study Area)		1E-07				0.01	
Off-Site Child Resident	Surface Water	Ingestion	9E-07	--	--	--	0.3	--
		Dermal Contact	5E-09	--	--	--	0.003	--
		Total Surface Water	9E-07				0.4	
Off-Site Adult Resident	Surface Water	Ingestion	1E-06	--	--	RDX	0.2	--
		Dermal Contact	1E-08	--	--	--	0.002	--
		Total Surface Water	1E-06				0.2	
Off-Site Lifelong (Child and Adult) Resident	Surface Water	Ingestion	2E-06	--	--	RDX	NE	--
		Dermal Contact	1E-08	--	--	--	NE	--
		Total Surface Water	2E-06				NE	
Construction Worker	Surface Soil / Subsurface Soil	Incidental Ingestion	3E-08	--	--	--	0.2	--
		Dermal Contact	2E-09	--	--	--	0.004	--
		Total All Soil	3E-08				0.2	
	Ground Water	Dermal Contact	2E-07	--	--	--	0.2	--
		Inhalation[2]	3E-08	--	--	--	0.0004	--
		Total Groundwater	2E-07				0.2	
	Total All Media (Study Area)		3E-07				0.4	
Maintenance Worker	Surface Soil	Incidental Ingestion	5E-09	--	--	--	0.003	--
		Dermal Contact	3E-10	--	--	--	0.00006	--
		Total Soil	5E-09				0.003	
	Surface Water	Dermal Contact	6E-09	--	--	--	0.0002	--
	Sediment	Incidental Ingestion	--	--	--	--	0.0008	--
		Dermal Contact	--	--	--	--	0.00001	--
		Total Sediment	--				0.0008	
	Total All Media (Study Area)		1E-08				0.004	

TABLE 7-13
CUMULATIVE RISK SUMMARY - CENTRAL TENDANCY EXPOSURE
SWMU 03 - OLD JEEP TRAIL/LITTLE SULPHUR CREEK
NSWC CRANE
CRANE INDIANA

Receptor	Media	Exposure Route	Cancer Risk	Chemicals with Cancer Risks > 10^{-4}	Chemicals with Cancer Risks > 10^{-6} and ≤ 10^{-4}	Chemicals with Cancer Risks > 10^{-6} and ≤ 10^{-6}	Hazard Index	Chemicals with HI > 1
Occupational Worker	Surface Soil	Incidental Ingestion	9E-08	--	--	--	0.05	--
		Dermal Contact	6E-09	--	--	--	0.001	--
		Total Surface Soil	9E-08				0.05	
	Ground Water	Ingestion	4E-05	--	Trichloroethene	1,1,2,2-Tetrachloroethane, RDX	2	Trichloroethene
		Dermal Contact	1E-06	--	--	--	0.05	--
		Total Ground Water	4E-05				2	
	Total All Media (Study Area)		4E-05				2	
Child Recreational User	Surface Soil	Incidental Ingestion	1E-08	--	--	--	0.03	--
		Dermal Contact	1E-09	--	--	--	0.001	--
		Total Surface Soil	1E-08				0.03	
	Groundwater	Ingestion	4E-06	--		1,1,2,2-Tetrachloroethane, Trichloroethene	1	--
		Dermal Contact	1E-07	--	--	--	0	--
		Total Groundwater	4E-06				1	
	Surface Water	Ingestion	1E-07	--	--	--	0.02	--
		Dermal Contact	2E-08	--	--	--	0.003	--
		Total Surface Water	1E-07				0.02	
	Sediment	Incidental Ingestion	--	--	--	--	0.0008	--
		Dermal Contact	--	--	--	--	0.0002	--
		Total Sediment	--				0.001	
	Total All Media (Study Area)		5E-06				1	
Adult Recreational User	Surface Soil	Incidental Ingestion	4E-09	--	--	--	0.003	--
		Dermal Contact	7E-10	--	--	--	0.0002	--
		Total Surface Soil	5E-09				0.003	
	Groundwater	Ingestion	3E-06	--	--	Trichloroethene	0.2	--
		Dermal Contact	3E-07	--	--	--	0.02	--
		Total Groundwater	3E-06				0.2	
	Surface Water	Ingestion	1E-08	--	--	--	0.001	--
		Dermal Contact	3E-08	--	--	--	0.002	--
		Total Surface Water	5E-08				0.003	
	Sediment	Incidental Ingestion	--	--	--	--	0.0009	--
		Dermal Contact	--	--	--	--	0.00003	--
		Total Sediment	--				0.0009	
	Total All Media (Study Area)		4E-06				0.2	

TABLE 7-13
CUMULATIVE RISK SUMMARY - CENTRAL TENDANCY EXPOSURE
SWMU 03 - OLD JEEP TRAIL/LITTLE SULPHUR CREEK
NSWC CRANE
CRANE INDIANA

Receptor	Media	Exposure Route	Cancer Risk	Chemicals with Cancer Risks $> 10^{-4}$	Chemicals with Cancer Risks $> 10^{-6}$ and $\leq 10^{-4}$	Chemicals with Cancer Risks $> 10^{-6}$ and $\leq 10^{-6}$	Hazard Index	Chemicals with HI > 1
Lifelong Recreational User (Child and Adult)	Surface Soil	Incidental Ingestion	2E-08	--	--	--	NE	--
		Dermal Contact	2E-09	--	--	--	NE	--
		Total Surface Soil	2E-08				NE	
	Groundwater	Ingestion	8E-06	--	--	1,1,2,2-Tetrachloroethane, Trichloroethene	NE	--
		Dermal Contact	4E-07	--	--	--	NE	--
		Total Groundwater	8E-06				NE	
	Surface Water	Ingestion	1E-07	--	--	--	NE	--
		Dermal Contact	5E-08	--	--	--	NE	--
		Total Surface Water	2E-07				NE	
	Sediment	Incidental Ingestion	--	--	--	--	NE	--
		Dermal Contact	--	--	--	--	NE	--
		Total Sediment	--				NE	
	Total All Media (Study Area)		8E-06				NE	

Notes:
NE = Exposure route not evaluated.
Chemical-specific risks are presented in Appendix G.

TABLE 7-14
CUMULATIVE RISK SUMMARY - REASONABLE MAXIMUM EXPOSURES
FUTURE ON-SITE RESIDENTS
SWMU 03 - OLD JEEP TRAIL/LITTLE SULPHUR CREEK
NSWC CRANE
CRANE INDIANA

Receptor	Media	Exposure Route	Cancer Risk	Chemicals with Cancer Risks > 10^{-4}	Chemicals with Cancer Risks > 10^{-6} and ≤ 10^{-4}	Chemicals with Cancer Risks > 10^{-6} and ≤ 10^{-6}	Hazard Index	Chemicals with HI > 1
On-Site Child Resident	Surface Soil (1-Acre Exposure Unit)	Incidental Ingestion	8E-05	--	2,4,6-Trinitrotoluene, RDX	2,3,7,8-TCDD Equivalents	19	2,4,6-Trinitrotoluene, RDX
		Dermal Contact	2E-05	--	RDX	2,4,6-Trinotrotoluene	5	2,4,6-Trinitrotoluene
		Total Surface Soil	1E-04				24	
	Surface Soil (6-Acre Exposure Unit)	Incidental Ingestion	2E-06	--	--	2,3,7,8-TCDD Equivalents	1	--
		Dermal Contact	2E-07	--	--	--	0.7	--
		Total Surface Soil	2E-06				2	
	Ground Water	Ingestion	3E-04	Trichloroethene	1,1,2,2-Tetrachloroehane, RDX	1,1-Dichloroethene, Vinyl Chloride	20	Trichloroethene
		Dermal Contact	1E-05	--	--	1,1,2,2-Tetrachloroethane, Trichloroethene	0.9	--
		Inhalation[2]	7E-05	--	1,1,2,2-Tetrachloroethane, Trichloroethene	--	0.2	--
		Total Groundwater	3E-04				21	
	Surface Water	Ingestion	6E-05	--	RDX	--	9	2-Amino-4,6-Dinitrotoluene, 4-Amino-2,6-dinitrotoluene, RDX
		Dermal Contact	2E-07	--	--	--	0.04	--
		Inhalation[2]	--	--	--	--	0	--
		Total Surface Water	6E-05				9	
	Sediment	Incidental Ingestion	--	--	--	--	0.03	--
		Dermal Contact	--	--	--	--	0.002	--
		Total Sediment	--				0.03	
	Total All Media (1-Acre EU & Surface Water)[1]		**2E-04**				**33**	
	Total All Media (6-Acre EU & Surface Water)[1]		**6E-05**				**11**	
	Total All Media (1-Acre EU & Ground Water)[2]		**5E-04**				**45**	
	Total All Media (6-Acre EU & Ground Water)[2]		**3E-04**				**23**	

TABLE 7-14
CUMULATIVE RISK SUMMARY - REASONABLE MAXIMUM EXPOSURES
FUTURE ON-SITE RESIDENTS
SWMU 03 - OLD JEEP TRAIL/LITTLE SULPHUR CREEK
NSWC CRANE
CRANE INDIANA

Receptor	Media	Exposure Route	Cancer Risk	Chemicals with Cancer Risks $> 10^{-4}$	Chemicals with Cancer Risks $> 10^{-5}$ and $\leq 10^{-4}$	Chemicals with Cancer Risks $> 10^{-6}$ and $\leq 10^{-5}$	Hazard Index	Chemicals with HI > 1
On-Site Adult Resident	Surface Soil (1-Acre Exposure Unit)	Incidental Ingestion	4E-05	--	RDX	2,4,6-Trinitrotoluene	2	2,4,6-Trinitrotoluene
		Dermal Contact	1E-05	--	RDX	2,4,6-Trinitrotoluene	0.8	--
		Total Surface Soil	5E-05				3	
	Surface Soil (6-Acre Exposure Unit)	Incidental Ingestion	7E-07	--	--	--	0.2	--
		Dermal Contact	2E-07	--	--	--	0.01	--
		Total Surface Soil	9E-07				0.2	
	Ground Water	Ingestion	3E-04	Trichloroethene	1,1,2,2-Tetrachloroethane, RDX	1,1-Dichloroethene, Vinyl Chloride	6	Trichloroethene
		Dermal Contact	3E-05	--	Trichloroethene	1,1,2,2-Tetrachloroethane	0.5	--
		Inhalation[2]	6E-05	--	1,1,2,2-Tetrachloroethane, Trichloroethene	--	0.04	--
		Total Groundwater	4E-04				6	
	Surface Water	Ingestion	7E-05	--	RDX	--	3	4-Aminno-2,6-Dinitrotoluene
		Dermal Contact	4E-07	--	--	--	0.02	--
		Inhalation[2]	--	--	--	--	0	--
		Total Surface Water	7E-05				3	
	Sediment	Incidental Ingestion	--	--	--	--	0.003	--
		Dermal Contact	--	--	--	--	0.0003	--
		Total Sediment	--				0.004	
	Total All Media (1-Acre EU & Surface Water)[1]		**1E-04**				**5**	
	Total All Media (6-Acre EU & Surface Water)[1]		**7E-05**				**3**	
	Total All Media (1-Acre EU & Ground Water)[2]		**4E-04**				**9**	
	Total All Media (6-Acre EU & Ground Water)[2]		**4E-04**				**7**	

TABLE 7-14
CUMULATIVE RISK SUMMARY - REASONABLE MAXIMUM EXPOSURES
FUTURE ON-SITE RESIDENTS
SWMU 03 - OLD JEEP TRAIL/LITTLE SULPHUR CREEK
NSWC CRANE
CRANE INDIANA

Receptor	Media	Exposure Route	Cancer Risk	Chemicals with Cancer Risks $> 10^{-4}$	Chemicals with Cancer Risks $> 10^{-6}$ and $\leq 10^{-4}$	Chemicals with Cancer Risks $> 10^{-6}$ and $\leq 10^{-5}$	Hazard Index	Chemicals with HI > 1
On-Site Lifelong Resident (Child and Adult)	Surface Soil (1-Acre Exposure Unit)	Incidental Ingestion	1E-04	--	2,4,6-Trinitrotoluene, RDX	--	NE	--
		Dermal Contact	4E-05	--	RDX	2,4,6-Trinitrotoluene	NE	--
		Total Surface Soil	2E-04				NE	
	Surface Soil (6-Acre Exposure Unit)	Incidental Ingestion	2E-06	--	--	2,3,7,8-TCDD Equivalents	NE	--
		Dermal Contact	4E-07	--	--	--	NE	--
		Total Surface Soil	3E-06				NE	
	Ground Water	Ingestion	6E-04	1,1,2,2-Tetrachloroethane, Trichloroethene	RDX	1,1,2-Trichloroethane, 1,1,-Dichloroethene, Vinyl Chloride	NE	--
		Dermal Contact	4E-05	--	Trichloroethene	1,1,2,2-Trichloroethane	NE	--
		Inhalation(2)	1E-04	Trichloroethene	1,1,2,2-Trichloroethane	--	NE	--
		Total Groundwater	7E-04				NE	
	Surface Water	Ingestion	1E-04	RDX	--	--	NE	--
		Dermal Contact	5E-07	--	--	--	NE	--
		Total Surface Water	1E-04				NE	
	Sediment	Incidental Ingestion	--	--	--	--	NE	--
		Dermal Contact	--	--	--	--	NE	--
		Total Sediment	--				NE	
	Total All Media (1-Acre EU & Surface Water)(1)		**3E-04**				NE	
	Total All Media (6-Acre EU & Surface Water)(1)		**1E-04**				NE	
	Total All Media (1-Acre EU & Ground Water)(2)		**9E-04**				NE	
	Total All Media (6-Acre EU & Ground Water)(2)		**7E-04**				NE	

Notes:
(1) - Assumes that surface water is used a a drinking water source.
(2) - Assumes that ground water is used as a drinking water source.
NE = Exposure route not evaluated.
Chemical-specific risks are presented in Appendix G.

TABLE 7-15
CUMULATIVE RISK SUMMARY - CENTRAL TENDANCY EXPOSURES
FUTURE ON-SITE RESIDENTS
SWMU 03 - OLD JEEP TRAIL/LITTLE SULPHUR CREEK
NSWC CRANE
CRANE INDIANA

Receptor	Media	Exposure Route	Cancer Risk	Chemicals with Cancer Risks > 10^{-4}	Chemicals with Cancer Risks > 10^{-6} and ≤ 10^{-4}	Chemicals with Cancer Risks > 10^{-6} and ≤ 10^{-5}	Hazard Index	Chemicals with HI > 1
On-Site Child Resident	Surface Soil (1-Acre Exposure Unit)	Incidental Ingestion	9E-06	--	--	2,4,6-Trinitrotoluene, RDX	6	2,4,6-Trinitrotoluene
		Dermal Contact	1E-06	--	--	--	0.7	--
		Total Surface Soil	1E-05				7	
	Surface Soil (6-Acre Exposure Unit)	Incidental Ingestion	2E-07	--	--	--	0.5	--
		Dermal Contact	1E-08	--	--	--	0.01	--
		Total Surface Soil	2E-07				0.5	
	Ground Water	Ingestion	3E-05	--	Trichloroethene	1,1,2,2-Tetrachloroehane, RDX	6	Trichloroethene
		Dermal Contact	2E-06	--	--	Trichloroethene	0.5	--
		Inhalation(2)	9E-06	--	--	1,1,2,2-Tetrachloroethane, Trichloroethene	0.06	--
		Total Groundwater	4E-05				7	
	Surface Water	Ingestion	6E-06	--	--	RDX	3.0	4-Amino-2,6-dinitrotoluene
		Dermal Contact	3E-08	--	--	--	0.02	--
		Inhalation(2)	--	--	--	--	0.02	--
		Total Surface Water	6E-06				3	
	Sediment	Incidental Ingestion	--	--	--	--	0.008	--
		Dermal Contact	--	--	--	--	0.0002	--
		Total Sediment	--				0.008	
	Total All Media (1-Acre EU & Surface Water)(1)		**2E-05**				**10**	
	Total All Media (6-Acre EU & Surface Water)(1)		**6E-06**				**3**	
	Total All Media (1-Acre EU & Ground Water)(2)		**5E-05**				**13**	
	Total All Media (6-Acre EU & Ground Water)(2)		**4E-05**				**7**	

TABLE 7-15
CUMULATIVE RISK SUMMARY - CENTRAL TENDANCY EXPOSURES
FUTURE ON-SITE RESIDENTS
SWMU 03 - OLD JEEP TRAIL/LITTLE SULPHUR CREEK
NSWC CRANE
CRANE INDIANA

Receptor	Media	Exposure Route	Cancer Risk	Chemicals with Cancer Risks > 10^{-4}	Chemicals with Cancer Risks > 10^{-5} and ≤ 10^{-4}	Chemicals with Cancer Risks > 10^{-6} and ≤ 10^{-5}	Hazard Index	Chemicals with HI > 1
On-Site Adult Resident	Surface Soil (1-Acre Exposure Unit)	Incidental Ingestion	4E-06	--	--	RDX	0.7	--
		Dermal Contact	4E-07	--	--	--	0.07	--
		Total Surface Soil	4E-06				0.8	
	Surface Soil (6-Acre Exposure Unit)	Incidental Ingestion	7E-08	--	--	--	0.05	--
		Dermal Contact	4E-09	--	--	--	0.001	--
		Total Surface Soil	8E-08				0.05	
	Ground Water	Ingestion	4E-05	--	1,1,2,2-Tetrachloroethane, Trichloroethene	RDX	3	Trichloroethene
		Dermal Contact	4E-06	--	--	1,1,2,2-Tetrachloroethane, Trichloroethene	0.3	--
		Inhalation[2]	7E-06	--	--	1,1,2,2-Tetrachloroethane, Trichloroethene	0.01	--
		Total Groundwater	5E-05				3	
	Surface Water	Ingestion	9E-06	--	--	RDX	1	--
		Dermal Contact	6E-08	--	--	--	0.01	--
		Inhalation[2]	--	--	--	--	0.003	--
		Total Surface Water	9E-06				1	
	Sediment	Incidental Ingestion	--	--	--	--	0.0009	--
		Dermal Contact	--	--	--	--	0.00002	--
		Total Sediment	--				0.0009	
	Total All Media (1-Acre EU & Surface Water)[1]		**1E-05**				**2**	
	Total All Media (6-Acre EU & Surface Water)[1]		**9E-06**				**1**	
	Total All Media (1-Acre EU & Ground Water)[2]		**6E-05**				**4**	
	Total All Media (6-Acre EU & Ground Water)[2]		**5E-05**				**3**	

TABLE 7-15
CUMULATIVE RISK SUMMARY - CENTRAL TENDANCY EXPOSURES
FUTURE ON-SITE RESIDENTS
SWMU 03 - OLD JEEP TRAIL/LITTLE SULPHUR CREEK
NSWC CRANE
CRANE INDIANA

Receptor	Media	Exposure Route	Cancer Risk	Chemicals with Cancer Risks $> 10^{-4}$	Chemicals with Cancer Risks $> 10^{-6}$ and $\leq 10^{-4}$	Chemicals with Cancer Risks $> 10^{-6}$ and $\leq 10^{-6}$	Hazard Index	Chemicals with HI > 1
On-Site Lifelong Resident (Child and Adult)	Surface Soil (1-Acre Exposure Unit)	Incidental Ingestion	1E-05	--	--	2,4,6-Trinitrotoluene, RDX	NE	--
		Dermal Contact	1E-06	--	--	RDX	NE	--
		Total Surface Soil	1E-05				NE	
	Surface Soil (6-Acre Exposure Unit)	Incidental Ingestion	3E-07	--	--	--	NE	--
		Dermal Contact	2E-08	--	--	--	NE	--
		Total Surface Soil	3E-07				NE	
	Ground Water	Ingestion	7E-05	--	1,1,2,2-Tetrachloroethane, Trichloroethene	RDX	NE	--
		Dermal Contact	7E-06	--	--	1,1,2,2-Trichloroethane, Trichloroethene	NE	--
		Inhalation(2)	2E-05	--	Trichloroethene	1,1,2,2-Trichloroethane	NE	--
		Total Groundwater	9E-05				NE	
	Surface Water	Ingestion	1E-05	--	RDX	--	NE	--
		Dermal Contact	9E-08	--	--	--	NE	--
		Total Surface Water	1E-05				NE	
	Sediment	Incidental Ingestion	--	--	--	--	NE	--
		Dermal Contact	--	--	--	--	NE	--
		Total Sediment	--				NE	
	Total All Media (1-Acre EU & Surface Water)(1)		**3E-05**				NE	
	Total All Media (6-Acre EU & Surface Water)(1)		**1E-05**				NE	
	Total All Media (1-Acre EU & Ground Water)(2)		**1E-04**				NE	
	Total All Media (6-Acre EU & Ground Water)(2)		**9E-05**				NE	

Notes:
(1) - Assumes that surface water is used a a drinking water source.
(2) - Assumes that ground water is used as a drinking water source.
NE = Exposure route not evaluated.
Chemical-specific risks are presented in Appendix G.

NEW APPENDIX H TABLES

TABLE H-6
MINE FILL B INITIAL CHARACTERIZATION SAMPLING
RINSE BLANK RESULTS
EXPLOSIVES (mg/L)

ANALYTE		135TNB	13DNB	246TNT	24DNT	26DNT	2A46DT	2NT	3NT	4A26DT	4NT	HMX	NB	PETN	RDX	TETRYL
Sample ID	Sample Date															
MFBRB101599	10/15/99	0.0003 U	0.0001 U	0.0001 U	0.0001 U	0.0003 U	0.0001 U	0.001 U	0.001 U	0.0001 U	0.001 U	0.001 U	0.001 U	0.001 U	0.0008 U	0.001 U
MFBRB102899	10/28/99	0.0003 U	0.0001 U	0.0001 U	0.0001 U	0.0003 U	0.0001 U	0.001 U	0.001 U	0.0001 U	0.001 U	0.001 U	0.001 U	0.001 U	0.0008 U	0.001 U
MFBRB012600	1/26/00	0.0003 U	0.0001 U	0.0001 U	0.0001 U	0.0003 U	0.0001 U	0.001 U	0.001 U	0.0001 U	0.001 U	0.001 U	0.001 U	0.001 U	0.0008 U	0.001 U
MFBRB030700	3/7/00	0.0003 U	0.0001 U	0.0001 U	0.0001 U	0.0003 U	0.0001 U	0.001 U	0.001 U	0.0001 U	0.001 U	0.0001 J	0.001 U	0.001 U	0.0008 U	0.001 U
MFBRB071800	7/18/00	0.0003 U	0.0001 U	0.0001 U	0.0001 U	0.0003 U	0.0001 U	0.001 U	0.001 U	0.0001 U	0.001 U	0.0001 J	0.001 U	0.001 U	0.0008 U	0.001 U
MFBRB082901	8/29/01	0.0023 J	0.0001 U	0.0001 U	0.0001 U	0.0003 U	0.0001 U	0.001 U	0.001 U	0.0001 U	0.001 U	0.0001 J	0.001 U	0.001 U	0.0008 U	0.001 U
MFBRB092601	9/26/01	0.0065 U	0.0065 U	0.0065 U	0.0065 U	0.0065 U	0.0065 U	0.0065 U	0.0065 U	0.0065 U	0.0065 U	0.0065 U	0.0065 U	0.0065 U	0.0065 U	0.0065 U

SWMU 3 - JEEP TRAIL
TERRESTRIAL WILDLIFE MODEL HAZARD QUOTIENT CALCULATION
BELTED KINGFISHER - AVERAGE INPUTS
NSWC CRANE, INDIANA

Parameters	Avg. Sed. Concentration (mg/kg)	Avg. SW Concentration (mg/L)	BAF/ BSAF (sed to fish)[1]	Fish Concentration (mg/kg)	Dose (mg/kg/day)	NOAEL (mg/kg/day)	LOAEL (mg/kg/day)	NOAEL EEQ	LOAEL EEQ
Semi-Volatiles									
Acenaphthene	1.43E-03	0.00E+00	2.90E-01	1.56E-03	7.21E-04	2.00E+00	2.00E+01	3.60E-04	3.60E-05
Pesticides									
Methoxychlor	6.16E-03	0.00E+00	1.80E+00	4.16E-02	1.89E-02	NV	NV		
Herbicides									
2,4-D	6.67E-03	6.00E-05	1.00E+00	2.50E-02	1.14E-02	NV	NV		
Inorganics									
Cadmium	1.29E+00	4.77E-04	1.74E-01	2.24E-01	1.13E-01	1.45E+00	2.00E+01	7.82E-02	5.67E-03
Copper	5.73E+01	5.22E-03	4.51E-01	2.59E+01	1.22E+01	4.70E+01	6.17E+01	2.61E-01	1.98E-01
Lead	1.20E+02	2.91E-02	2.06E-02	2.47E+00	2.21E+00	1.13E+00	1.13E+01	1.96E+00	1.96E-01
Selenium	1.57E-01	2.57E-04	1.00E+00	1.57E-01	7.25E-02	4.00E-01	8.00E-01	1.81E-01	9.07E-02
Zinc	1.98E+02	2.16E-02	5.61E-01	1.11E+02	5.22E+01	1.45E+01	1.31E+02	3.60E+00	3.98E-01

Cells are shaded if the EEQ is greater than 1.0.

1 - The sediment to invertebrate BAF was used for metals because no sediment to fish BAFs were available for metals.

The average concentrations were used except for acenaphthene in the sediment; 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
BAF - Bioaccumulation factor (for metals)
BSAF - Bioaccumulation factor (for organics)

Dose=[(If*Cf+Is*Cs+Iw*Cw)H]/BW

Body Weight = (BW)	0.152	kg
Food Ingestion Rate = (If)	0.069	kg/day
Water Ingestion Rate = (Iw)	0.017	L/day
Sediment Ingestion Rate = (Is)	0.001378	kg/day
Home Range = (HR)	Assume 100% on site	
Contaminated Area = (CA)	Assume equal to home range	

Cs = Contaminant concentration in sediment
Cw = Contaminant concentration in water
Cf = Contaminant conc. in food:
Metals = sediment concentration * BAF
Organics = (sediment concentration * BSAF * %lipids)/(% total organic carbon)
Where:
% Lipids = 3.56 % (see Appendix H.5)
% TOC = 0.9483 % (average of all sediment samples)

SWMU 3 - JEEP TRAIL
TERRESTRIAL WILDLIFE MODEL HAZARD QUOTIENT CALCULATION
RACCOON - CONSERVATIVE INPUTS
NSWC CRANE, INDIANA

Parameters	Max. Sed. Concentration (mg/kg)	95% UCL SW Concentration (mg/L)	BAF/ BSAF (sed to fish)[1]	Fish Concentration (mg/kg)	Dose (mg/kg/day)	NOAEL (mg/kg/day)	LOAEL (mg/kg/day)	NOAEL EEQ	LOAEL EEQ
Semi-Volatiles									
Acenaphthene	1.43E-03	0.00E+00	2.90E-01	1.56E-03	5.25E-04	5.93E-02	1.19E-01	8.85E-03	4.43E-03
Pesticides									
Methoxychlor	6.59E-03	0.00E+00	1.80E+00	4.46E-02	1.40E-02	1.58E-01	3.16E-01	8.84E-02	4.42E-02
Herbicides									
2,4-D	1.83E-02	9.39E-05	1.00E+00	6.87E-02	2.18E-02	3.95E-02	1.98E-01	5.51E-01	1.10E-01
Inorganics									
Cadmium	1.78E+00	5.82E-04	2.32E+00	4.11E+00	1.32E+00	3.42E-02	3.42E-01	3.87E+01	3.87E+00
Copper	9.69E+01	1.16E-02	1.52E+00	1.48E+02	4.84E+01	1.32E+00	1.71E+00	3.67E+01	2.84E+01
Lead	2.10E+02	2.85E-01	1.76E-01	3.70E+01	1.76E+01	3.16E-01	3.16E+00	5.56E+01	5.56E+00
Selenium	1.89E-01	3.05E-04	1.00E+00	1.89E-01	6.40E-02	7.90E-03	1.30E-02	8.11E+00	4.91E+00
Zinc	3.09E+02	7.70E-02	2.18E+00	6.74E+02	2.17E+02	6.32E+00	1.26E+01	3.44E+01	1.72E+01

Cells are shaded if the EEQ is greater than 1.0.

1 - The sediment to invertebrate BAF was used for metals because no sediment to fish BAFs were available for metals.

Definitions:
EEQ - Ecological Effects Quotient
NOAEL - No Observed Adverse Effects Level
LOAEL - Lowest Observed Adverse Effects Level
BAF - Bioaccumulation factor (for metals)
BSAF - Bioaccumulation factor (for organics)

Dose=[(If*Cf+Is*Cs+Iw*Cw)H]/BW

Body Weight = (BW)	5.34E+00	kg
Food Ingestion Rate = (If)	1.65E+00	kg/day
Water Ingestion Rate = (Iw)	5.70E-01	L/day
Sediment Ingestion Rate = (Is)	1.55E-01	kg/day
Home Range = (HR)	Assume 100% on site	
Contaminated Area = (CA)	Assume equal to home range	

Cs = Contaminant concentration in sediment
Cw = Contaminant concentration in water
Cf = Contaminant conc. in food:
Metals = sediment concentration * BAF
Organics = (sediment concentration * BSAF * %lipids)/(% total organic carbon)
Where:
% Lipids = 3.56 % (see Appendix H.5)
% TOC = 0.9483 % (average of all sediment samples)

SWMU 3 - JEEP TRAIL
TERRESTRIAL WILDLIFE MODEL HAZARD QUOTIENT CALCULATION
RACCOON - AVERAGE INPUTS
NSWC CRANE, INDIANA

Parameters	Avg. Sed. Concentration (mg/kg)	Avg. SW Concentration (mg/L)	BAF/ BSAF (sed to fish)[1]	Fish Concentration (mg/kg)	Dose (mg/kg/day)	NOAEL (mg/kg/day)	LOAEL (mg/kg/day)	NOAEL EEQ	LOAEL EEQ
Semi-Volatiles									
Acenaphthene	1.43E-03	0.00E+00	2.90E-01	1.56E-03	3.31E-04	7.65E-02	1.53E-01	4.33E-03	2.16E-03
Pesticides									
Methoxychlor	6.16E-03	0.00E+00	1.80E+00	4.16E-02	8.24E-03	2.04E-01	4.08E-01	4.04E-02	2.02E-02
Herbicides									
2,4-D	6.67E-03	6.00E-05	1.00E+00	2.50E-02	5.01E-03	5.10E-02	2.55E-01	9.83E-02	1.97E-02
Inorganics									
Cadmium	1.29E+00	4.77E-04	1.74E-01	2.24E-01	6.74E-02	4.41E-02	4.41E-01	1.53E+00	1.53E-01
Copper	5.73E+01	5.22E-03	4.51E-01	2.59E+01	6.09E+00	1.71E+00	2.21E+00	3.57E+00	2.76E+00
Lead	1.20E+02	2.91E-02	2.06E-02	2.47E+00	2.68E+00	4.08E-01	4.08E+00	6.58E+00	6.58E-01
Selenium	1.57E-01	2.57E-04	1.00E+00	1.57E-01	3.35E-02	1.02E-02	1.68E-02	3.28E+00	1.99E+00
Zinc	1.98E+02	2.16E-02	5.61E-01	1.11E+02	2.53E+01	8.16E+00	1.63E+01	3.10E+00	1.55E+00

Cells are shaded if the EEQ is greater than 1.0.

1 - The sediment to invertebrate BAF was used for metals because no sediment to fish BAFs were available for metals.

The average concentrations were used except for acenaphthene in the sediment; 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
BAF - Bioaccumulation factor (for metals)
BSAF - Bioaccumulation factor (for organics)

Dose=[(If*Cf+Is*Cs+Iw*Cw)H]/BW

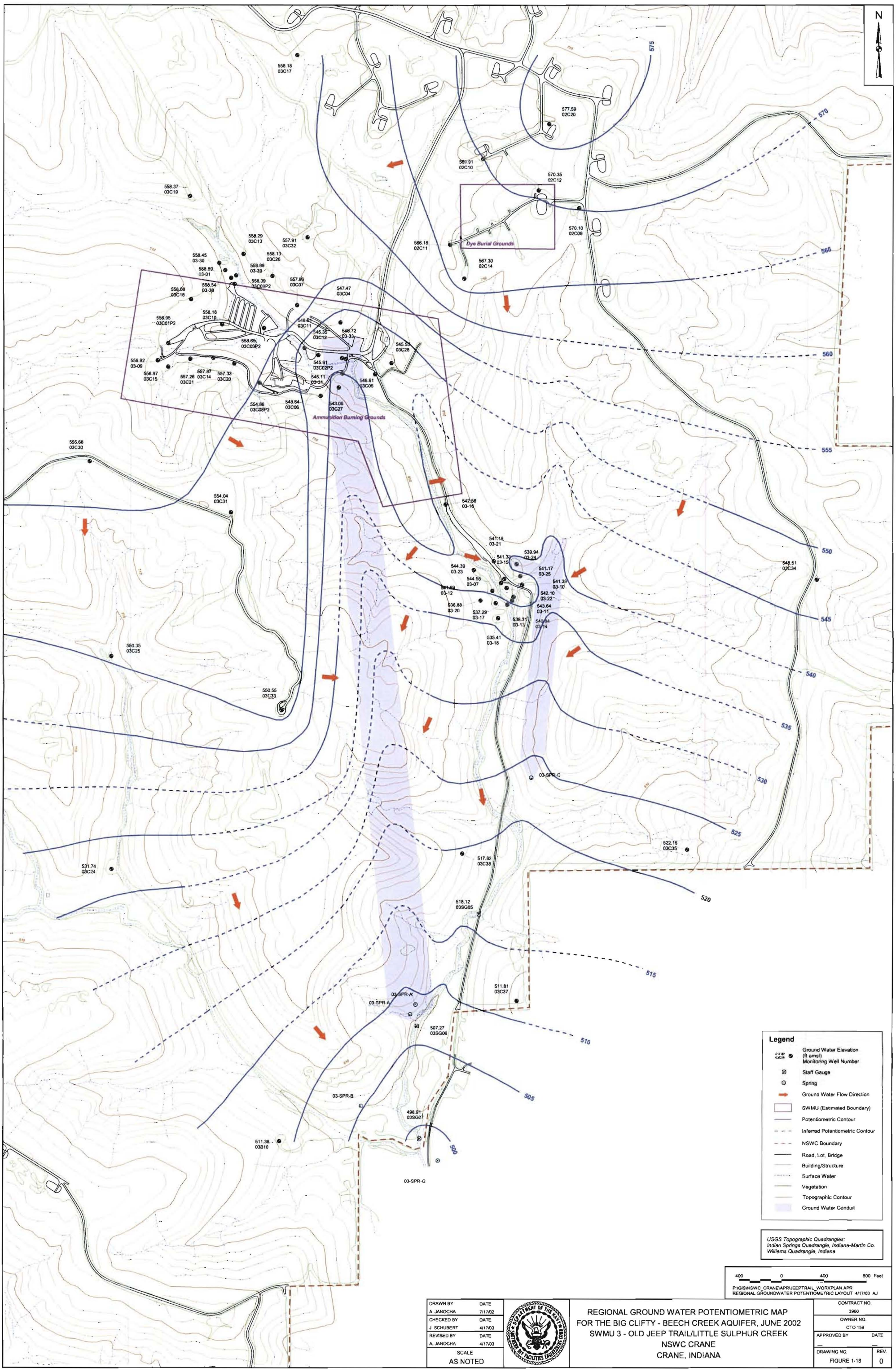
Body Weight = (BW)		6.86E+00 kg
Food Ingestion Rate = (If)		1.34E+00 kg/day
Water Ingestion Rate = (Iw)		5.66E-01 L/day
Sediment Ingestion Rate = (Is)		1.26E-01 kg/day
Home Range = (HR)	Assume 100% on site	
Contaminated Area = (CA)	Assume equal to home range	
H=HR/CA (Assume = to 1)		

Dose=[(If*Cf+Is*Cs+Iw*Cw)H]/BW

Cs = Contaminant concentration in sediment
Cw = Contaminant concentration in water
Cf = Contaminant conc. in food:
Metals = sediment concentration * BAF
Organics = (sediment concentration * BSAF * %lipids)/(% total organic carbon)
Where:
% Lipids = 3.56 % (see Appendix H.5)
% TOC = 0.9483 % (average of all sediment samples)

FIGURE 1-18

(REDUCED SIZE
RFI REPORT WILL CONTAIN D-SIZE VERSION OF THIS FIGURE)



Legend

- Ground Water Elevation (ft amsl) Monitoring Well Number
- Staff Gauge
- Spring
- Ground Water Flow Direction
- SWMU (Estimated Boundary)
- Potentiometric Contour
- Inferred Potentiometric Contour
- NSWC Boundary
- Road, Lot, Bridge
- Building/Structure
- Surface Water
- Vegetation
- Topographic Contour
- Ground Water Conduit

USGS Topographic Quadrangles:
Indian Springs Quadrangle, Indiana-Martin Co.
Williams Quadrangle, Indiana

400 0 400 800 Feet

P:\GIS\NSWC_CRANE\APR\JEEPTRAIL_WORKPLAN.APR
REGIONAL GROUNDWATER POTENTIOMETRIC LAYOUT 4/17/03 AJ

DRAWN BY	DATE
A. JANOCHA	7/17/02
CHECKED BY	DATE
J SCHUBERT	4/17/03
REVISED BY	DATE
A. JANOCHA	4/17/03
SCALE	
AS NOTED	

REGIONAL GROUND WATER POTENTIOMETRIC MAP
FOR THE BIG CLIFTY - BEECH CREEK AQUIFER, JUNE 2002
SWMU 3 - OLD JEEP TRAIL/LITTLE SULPHUR CREEK
NSWC CRANE
CRANE, INDIANA

CONTRACT NO.	
3960	
OWNER NO.	
CTO 159	
APPROVED BY	DATE
DRAWING NO.	REV.
FIGURE 1-18	0

ATTACHMENT 1

SECTION 8.5 – SCIENTIFIC/MANAGEMENT DECISION POINT

8.5 SCIENTIFIC/MANAGEMENT DECISION POINT

The SERA includes the estimation of exposure levels and screening for ecological risks. The SERA is concluded by a Scientific/Management Decision Point (SMDP) at which point one of the following decisions is made (DON, 1999):

(1) Adequate information exists to conclude that ecological threats at a site are negligible; no further evaluations of ecological risks are necessary.

(2) Adequate information exists and there is a potential for adverse ecological effects. In this case, the decision can be to either conduct an interim cleanup (if cost-effective to do so) or continue to Step 3a.

Included in the decisions listed above is an evaluation of the adequacy of the available information on which the decisions are based. Questions are answered during this evaluation such as:

- Were adequate numbers of samples collected in the appropriate locations?
- Were the samples analyzed for the appropriate parameters with sufficient sensitivity?

This section of the ERA describes whether or not the collected data are adequate for making ecological risk decisions for SWMU 03. Section 5.0 of this report contains discussion of the nature and extent of contamination at SWMU 03, and Figures 1-3 and 1-8 show photographs and topography of the site, respectively.

The ABG is designated as SWMU 03/10. The OJT area is located adjacent to it and is considered an extension of the ABG. The OJT is no longer used as a treatment area; however, it is still used as an active vehicle route. From the ABG area, LSC runs to the southeast through the OJT area, and then southward to the NSWC Crane property boundary. The creek has been impacted by activities at the ABG and OJT. Open burning of explosives and explosive-contaminated materials took place at the ABG and two general areas at the Jeep Trail site. In one portion of the OJT, the Burn Area, empty bomb casings were burned, using black powder, to remove any explosive residues. In the second area, the Burn Pit, explosive-contaminated materials, including small munitions items and components, solvent-contaminated rags, and packaging materials, were burned using wood dunnage in a pit.

The exact size and location of the two OJT treatment areas is unknown. Reportedly open burning also took place along the length of the OJT. The area has not been used for munitions treatment since 1983 and has since been re-vegetated. The ABG treatment area is essentially devoid of vegetation in order to minimize fire hazards during open burning treatments. The areas along LSC, within the ABG, have been

seeded with grass to minimize erosion of soil into LSC. The OJT site is located in a gravel-covered area on the western side of the gravel access road (Jeep Trail 25). The OJT and the remainder of the LSC valley are surrounded by wooded areas along the hillsides to the east and west, with miscellaneous natural ground vegetation under the tree canopy and along the creek banks. Ground surface elevations at the OJT range from about 550 to 800 feet amsl. The surface elevation where LSC exits the southern boundary of the installation is approximately 500 feet amsl.

8.5.1 Surface Soils

Forty-eight surface soil (0 to 2 feet) samples were collected at SWMU 03. Samples were collected in and around the burn area and the burn pit in order to obtain sufficient spatial coverage for bounding the contaminated area(s) (see Figure 1-7). Therefore, the samples were collected in areas where the chemical contamination is expected to be the greatest.

Surface soil samples were analyzed for dioxins, VOCs, SVOCs, energetics, pesticides, PCBs, herbicides, and inorganics. Figures 5-1 and 5-2 are tag maps that show analytical data on site maps for the organic and inorganic chemicals, respectively. Table 4-1 presents the summary of positive analytical results for the soil samples and Table 4-20 is the ecological risk screening table for surface soils. Twenty-three dioxins/furans (including six dioxin/furan totals), six VOCs, 20 SVOCs, eight energetics, three herbicides, and 23 metals were detected in surface soil samples collected at the OJT. Of these, all individual dioxin/furans, two SVOCs, one energetic, and nine metals were retained as COPCs because their maximum detected concentrations exceeded the Region V EDQLs and background levels (for metals only). Additionally, all total dioxin/furans (including TEQ bird and TEQ human/mammal), six energetics, and one metal were retained as COPCs because an EDQL was not available for comparison. All detected bioaccumulative chemicals (U.S. EPA, 2000a) that exceeded the EDQL were retained as COPCs for food chain modeling.

Dioxin/furans were detected in surface soil samples (4 to 11 out of 11 samples), depending upon the dioxin compound. Although dioxin/furans were detected in the one sample collected within the ABG and two samples south of the ABG, the greatest detections of dioxin/furans in surface soil samples were found in samples surrounding the Burn Pit. EEQs for dioxins/furans ranged from 1.6 (1,2,3,4,6,7,8,9-OCDF) to 17,286 (1,2,3,4,6,7,8,9-OCDD). Concentrations of dioxins/furans decrease south of the Burn Pit, indicating the presence of these chemicals are likely attributable to former combustion activities at the OJT. SVOCs were detected in 1 to 13 of 45 samples seemingly co-occurring with dioxins/furans detections (i.e., surrounding the Burn Area and Burn Pit). Naphthalene had an EEQ of 1.3 while di-n-butyl phthalate had an EEQ of 30. The detections of PAHs were expected in these areas because PAHs are products of combustion. Detected phthalates (particularly di-n-butyl phthalate) could be indicative of disposal and burning of plastics. Energetics were detected in 1 of 48 to 9 of 47 samples in surface soils

at the OJT with the detections mostly in the surface soil samples surrounding the Burn Area and Burn Pit (03SS01, 03SS03, 03SS13, 03SS16, 03SS18, 03SS19, 03SS21, 03SS22, 03SS24, and 03SS26). 1,3,5-Trinitrobenzene had an EEQ of 29, while EEQs for other detected energetics could not be calculated due to a lack of EDQLs. Detections of energetics in close proximity to the Burn Pit and Burn Area and the lack of these chemicals detected in samples further south of the Burn Pit and Burn Area indicate that these chemicals are likely attributable to the former burning activities at OJT.

Of the 23 metals detected in surface soils, 10 metals were statistically determined to be greater than background concentrations and also exceeded the EDQL (or an EDQL was not available). As indicated in Section 3.4, chemicals detected at concentrations greater than the background concentrations indicate the possibility of a release in potentially isolated locations. Metals selected as COPCs are potentially associated with burned waste at the Burn Pit. The soil samples collected at the Burn Area were not analyzed for metals based on the operational history of the Burn Area. Detections of metals are highest in these areas and exceed the background surface soil concentrations to the greatest extent of samples collected at OJT. EEQs ranged from 1.3 for barium to 189,838 for lead. Metals concentrations in other areas across the OJT do not indicate a clear pattern of contamination. Because the surface soil samples appear to be well distributed in the area of the suspected disposal activities, and because potential ecological risks exist, the surface soils at SWMU 03 are further evaluated in Step 3a of the BERA.

8.5.2 Sediment/Surface Water

To assess the potential risks associated with migration of chemicals from ground water and soil to sediment and surface water, sediment and surface water samples were collected from locations along LSC.

Sediment

A total of fifteen shallow (0 to 6 inches) and 15 deep (6 to 12 inches) sediment samples were collected in LSC. Shallow sediment samples were analyzed for VOCs, SVOCs, energetics, pesticides, herbicides, and inorganics. Deep sediment samples were analyzed for VOCs, SVOCs, energetics, herbicides, and inorganics. Figures 5-7 and 5-8 are tag maps that show organic and inorganic analytical data on site maps. Tables 4-4 and 4-5 present the summary of positive organic and inorganic analytical results for the shallow and deep sediment samples, respectively. Tables 4-21 and 4-22 are the ecological risk screening tables for shallow and deep sediment samples, respectively.

Five VOCs, six SVOCs, four energetics, one pesticide, five herbicides, and 24 metals were detected in shallow sediment samples. Of these, three SVOCs, one energetic, one pesticide, and four metals were retained as COPCs because their maximum detected concentrations exceeded the EDQL and the

upgradient concentrations (for metals only). Additionally, three energetics and four metals were retained as COPCs because no EDQL was available for comparison and their maximum detected concentrations exceeded the background concentrations (for metals only). Six VOCs, seven SVOCs, five energetics, six herbicides, and 24 metals were detected in deep sediment samples. Of these, one SVOC, one herbicide, and four metals were retained as COPCs because their maximum detected concentrations exceeded the EDQL and the background concentrations (for metals only). Additionally, all five detected energetics and four metals were retained as COPCs because no EDQL was available for comparison and their maximum detected concentrations exceeded the upgradient concentrations (for metals only). All detected bioaccumulative chemicals (U.S. EPA, 2000a) that exceeded the EDQL were retained as COPCs for food chain modeling.

SVOCs were detected relatively infrequently in sediment samples (with a maximum frequency of detection of 3 out of 15 samples collected). Detections of SVOCs were found in samples downstream of the ABG and sporadically in other LSC samples, indicating no clear pattern of contamination. SVOC detections could be attributable to activities associated with the ABG or indicate deposition over time from past activities at the OJT. EEQs for the COPCs ranged from 3.7 for acenaphthene to 12 for diphenylamine. Methoxychlor was detected only once in shallow sediment sample 03SD18 with an EEQ of 4.7. This sample location is the second to farthest downstream sample collected. Methoxychlor was not detected in any other samples. Additionally, no other pesticides were detected in shallow sediment samples. Therefore, the presence of this pesticide is likely attributable to run-off of spot soil applications and not associated with former OJT activities. 2,4-D was retained as a COPC in both shallow and deep sediment samples with detection frequencies of 7 of 10 samples (shallow) and 5 of 12 samples (deep). The maximum EEQ for 2,4-D in shallow sediment samples was 3.5 with a similar EEQ in deep sediment samples of 4.8. 2,4-D was detected sporadically in LSC sediment samples indicating no clear pattern of contamination. Additionally, 2,4-D was detected in the upgradient sediment location, 03SD04. 2,4-D was detected in surface soil samples (although it was not retained as a COPC), indicating that there is a possibility that 2,4-D was deposited from surface water runoff washing soils into LSC. Due to the nature of herbicide usage and sparse spatial distributions, the herbicide detections possibly reflect topical applications rather than former ABG and/or OJT activities. Energetics were retained as COPCs in both shallow and deep sediments with maximum detection frequencies of 4 of 15 samples (shallow) and 5 of 15 samples (deep). 2,4-Dinitrotoluene had an EEQ of 15 in shallow sediment samples; EEQs could not be calculated for other detected energetics because EDQLs were not available. Concentrations of the energetics were detected primarily in samples collected within and downstream of the Burn Pit (03SD10, 03SD11, 03SD12, and 03SD13); although the maximum detection of 2,4-dinitrotoluene was found in 03SD06, collected within the ABG. The presence of energetics in the environment is an indication of contamination and the presence of these chemicals is likely attributable to deposition from the ABG and/or the OJT.

Samples 03SD11 (deep) and 03SD15 (shallow) had the highest metals detections overall, although concentrations in other samples across the OJT also exceed the corresponding EDQLs. EEQs in shallow sediment samples ranged from 3.2 for zinc to 21 for lead. EEQs in deep sediment samples ranged from 6.7 for barium to 17 for copper. The maximum detections of metals in shallow sediment samples were found in several samples including those collected within the ABG and immediately downstream of the ABG (i.e., 03SD05 and 03SD06) and the Burn Pit (03SD11). The maximum concentrations of six COPCs in deep sediment samples (including aluminum, antimony, barium, copper, lead, and zinc) were found at location 03SD11; this location is located downstream of the Burn Area and Burn Pit. The presence of metals in these samples is most likely attributable to former ABG and/or OJT activities. However, the presence of metals in other OJT samples (including 03SD15 and 03SD16) could be attributable to OJT activities such as vehicular traffic, disposal and burning of wastes, etc. Because the sediment samples appear to be well distributed within LSC, and because potential ecological risks exist, shallow and deep sediment at SWMU 03 are further evaluated in Step 3a of the BERA.

Surface Water

A total of six low flow and 11 high flow surface water samples were collected in LSC. Twelve low flow surface water samples were originally proposed for collection; however, six sample locations were dry during the field event. Low-flow surface water samples were analyzed for VOCs, energetics, herbicides, total and dissolved metals, total suspended solids (TSS), and dissolved oxygen (DO). High-flow surface water samples were analyzed for VOCs, SVOCs, energetics, herbicides, total and dissolved metals, TSS, and DO. Figures 5-9 and 5-10 are tag maps that show organic and inorganic analytical data on site maps. Tables 4-6 and 4-7 present the summary of positive analytical results for the low flow and high flow surface water samples, respectively. Tables 4-23 and 4-24 are the ecological risk screening tables for low flow and high flow surface water samples, respectively.

Three VOCs, five energetics, one herbicide, and 17 metals were detected in low flow surface water samples. Of these, lead was retained as a COPC (total metals) because the maximum concentration exceeded the EDQL and the upgradient concentration. Additionally, one VOC, all five detected energetics, and iron (dissolved metals) were retained as COPCs because an EDQL was not available and the maximum concentration exceeded the upgradient concentration (iron only). Two VOCs, two SVOCs, five energetics, three herbicides, and 21 inorganics were detected in high flow surface water samples. Of these, one SVOC and four metals (total metals) were retained as COPCs because their maximum concentrations exceeded EDQLs and the maximum upgradient concentration (metals only). Additionally, all five detected energetics and 2,4-D were retained as COPCs because EDQLs were not

available for these chemicals. All detected bioaccumulative chemicals (U.S. EPA, 2000a) that exceeded the EDQL were retained as COPCs for food chain modeling.

Bromomethane was detected in half of the low flow surface water samples and not at all in high flow samples. Bromomethane was retained as a COPC because an EDQL is not available for comparison; however, VOCs are typically not detected in surface water samples due to their volatility. Bromomethane was detected in groundwater samples and may be the source of bromomethane in the low flow surface water samples. Energetics were detected frequently in both low flow and high flow surface water samples, particularly HMX and RDX. EEQs for the energetics could not be calculated as EDQLs for these chemicals are not available. Energetics were also detected in groundwater samples indicating their presence in surface water could be a result of contaminated groundwater from the ABG or activities associated with the OJT. Energetics were also detected in sediment. 2,4-D was detected only in two high flow surface water samples and not at all in low flow surface water, although 2,4-D was detected in other media as well. The two detections were relatively low (0.28 and 0.36 ug/L) and validated as "J" values or "estimated" and were found in samples 03SW09 and 03SW13. These samples are located in the middle of the LSC sampled area and 2,4-D was not detected in downstream samples. An EEQ for 2,4-D could not be calculated as an EDQL for this chemical is not available.

Lead was retained as a COPC in low flow total surface water samples with an EEQ of 15, but was not detected in the dissolved metals fraction. Lead was also detected in high flow total surface water samples with an EEQ of 219, although it was detected at levels below the upgradient samples in the high flow dissolved surface water samples. The maximum concentrations of lead did not co-occur at the same sample location indicating no clear pattern of contamination. Similarly to lead, cadmium, copper, and zinc were all selected as COPCs in high flow total surface water samples but were either below the upgradient concentration or below the EDQL in the dissolved metals fraction. EEQs for these chemical were 2, 3.7, and 2, respectively. Iron was retained as a COPC in low flow dissolved surface water samples because the maximum detected concentration exceeded the upgradient maximum detection. Additionally, all iron detections in low flow dissolved surface water samples exceeded the maximum upgradient detection. An EEQ could not be calculated for iron because an EDQL is not available. Surface water samples were co-located with sediment samples that appear to be well distributed within LSC. Because potential ecological risks exist, low flow and high flow surface water at SWMU 03 are further evaluated in Step 3a of the BERA.

8.5.3 Summary

In summary, a SERA was performed for SWMU 03. Based on the results of the collected data, adequate information exists to determine that potential risks are possible to receptors from exposure to the selected

COPCs. Adequate numbers of samples were collected in areas where the contamination, if present, should be detected. The samples were analyzed for the appropriate parameters based on site history. Finally, based on the data quality review in Section 3.0, the data is of sufficient quality to proceed with the risk assessment. Therefore, the SERA is advancing to the Step 3a of the BERA – the refinement of the site-related COPCs.

REVIEW OF THE
HYDROGEOLOGIC FEASIBILITY OF USING NATURAL ATTENUATION AND PHYTOREMEDIATION AS REMEDIAL ALTERNATIVES FOR EXPLOSIVES AND TCE CONTAMINATED GROUNDWATER AT THE AMMUNITION BURNING GROUNDS
DATED AUGUST 2002

NAVAL SURFACE WARFARE CENTER - CRANE DIVISION
CRANE, INDIANA
EPA ID NO. IN5170023498

GENERAL COMMENTS

General Response: The comments in general reflect a lack of understanding of the unique groundwater conditions at Crane and the assumptions that drove this study. The absence of a figure showing the conceptual model probably added to this misunderstanding, although, the hydrogeology was explained in the test. The conceptual model is shown at the end of the end of the responses. The unique hydrogeologic conditions are that the contaminated groundwater returns to the surface before it exits the installation and that there is no vertical or lateral migration of contaminants out of the Little Sulfur Creek Valley. Solution features act as drains that control groundwater but the aquifer has diffuse and mixed groundwater flow as well. The biological degradation is occurring in these areas of lower hydraulic conductivity not in the solution features. Dilution and aeration are occurring in the areas of rapid transport For this study the down-gradient decline in chemical concentrations in the groundwater was more important than decline in individual wells. Individual wells are in a state of semi-equilibrium as natural attenuation removes contamination but up-gradient sources provide input of small amounts of contaminants. The uniqueness of this site is the reason a traditional Monitored Natural Attenuation (MNA) approach was not used. For typical natural attenuation studies the up-gradient sources have been removed. Most importantly, at the time of the initiation of this study the chemical data indicated that no concentrations of contaminates at levels of concern were exiting the installation. This was a joint effort with the EPA to demonstrate the attenuation factors that were removing the contaminants before ground and surface water exited the installation not at individual wells and for a proof of concept that enhanced phytoremediation may be a viable corrective measure. If data from more recent studies indicate that concentrations of concern are leaving the installation or that significant sources of contaminants, including soils, have not been removed, the natural attenuation approach should be re-evaluated in light of the new data. The 2001 Annual Groundwater Monitoring Report shows low concentrations of explosives at Spring A and B but does not show explosives at these concentrations exiting the installation.

Comment 1:

Throughout the *Hydrogeologic Feasibility of Using Natural Attenuation and Phytoremediation as Remedial Alternatives for Explosives and TCE Contaminated Groundwater at the Ammunition Burning Grounds* Report (Report), NSWC Crane indicates that monitored natural attenuation (MNA) is an appropriate and preferred remedial technology for the Ammunition Burning Grounds (ABG). For example, the Report states in the first paragraph on page vii in the Executive Summary that ABased on past and ongoing investigations the hydrogeologic

conditions at the ABG appear to meet all the needed criteria for making monitored natural attenuation the preferred remedial action for groundwater.@ In the discussion of the numerical modeling activities in Section 8, the Report states (Section 8.2 on page 28) that AThe conceptual model . . . forms the foundation for the premise that monitored natural attenuation along with phytoremediation (if needed) is the remedial action of choice.@ Finally, in the conclusions section of the Report (Section 9), NSWC Crane states in the fifth paragraph on page 31 that AAll of these results indicate that natural attenuation is occurring and is causing declining concentrations in explosives over time.@ NSWC Crane concludes the Report by stating that the U.S. EPA required three Alines of evidence@ have been met at the ABG (page 32). However, upon further review, it is not clear that the three lines of evidence have been met as stated in the Report. The concerns with this conclusion are presented in the following paragraphs.

The first U.S. EPA line of evidence requires that historical groundwater and/or soil data demonstrate a clear and meaningful trend of decreasing contaminant mass and/or concentrations over time. In support of this line of evidence, NSWC Crane presents plots of groundwater contaminant concentrations at individual wells over time. These data are presented in Report Figures 18 through 23 and in Table 5. The Report draws two conclusions from these data (refer to Section 4.10, page 14). First, the highest contaminant concentrations were observed in monitoring wells located in the area of the currently ABG while the lowest concentrations were observed in the area where Little Sulphur Creek exits the NSWC Crane facility. Second, most wells show a general decrease in contamination throughout the monitoring period with some wells showing seasonal variations in concentrations.

While the first conclusion is generally true, there are also exceptions to this conclusion. Although most of the highest concentrations were detected in the area of the ABG, several of the wells located within the vicinity of the ABG were non-detect for the various constituents. For example, well C03 is located in the very center of the ABG but was non-detect for the constituents plotted on the graphs [trichloroethylene (TCE), RDX, trinitrotoluene (TNT)]. In addition, wells C04 and C15, which are located along the perimeter of the ABG, were essentially non-detect for all three constituents (with the exception of a minor detection of TCE in well C04). As a result, while it is recognized that the contaminant concentrations at the ABG tend to be higher than the contaminant concentrations at Little Sulphur Creek, there is also a spatial variability of contaminant concentrations within and around the ABG itself. Thus, it is not entirely clear if the reduction in contaminant concentrations are the result of biological degradation or spatial variability of the contamination.

Response. The groundwater in the ABG is moving along preferential pathways with more rapid movement occurring in zones containing more fractures or solution features. It would be expected under these conditions for some wells in a highly contaminated area to show non-detects. Also, the reduction in concentrations in down-gradient wells is not just from biological degradation, but from dilution and naturally occurring phytoremediation. The unique groundwater conditions prohibit the ABG site from being analyzed as a traditional monitored natural attenuation site but the technical feasibility of other corrective actions makes MNA a viable alternative.

The second conclusion presented in the Report is less clear. Decreasing contaminant concentration trends in the individual monitoring wells are not evident from a visual inspection of the contaminant plots shown in Figures 18 through 23. In fact, from a visual perspective, the contaminant concentrations appear to be variable, but stable throughout the monitoring period. A lack of decreasing contaminant concentrations is also reflected in a statistical analysis of TCE and RDX in each of the monitoring wells/springs/creeks via the Mann-Kendall approach. Trend analysis via this approach indicates that no trends are present in the samples with the exception of two wells and one spring (C08P2 - increasing trend for TCE; C20 - decreasing trend for TCE; and Spring C - increasing trend for RDX). It is important to note that Spring C is located downgradient of the ABG, yet this spring exhibits a slightly increasing statistical trend in RDX concentrations over time. This increasing trend is also apparent through a visual inspection of the plot (Figure 23).

Response: The above is true. However, there is a decreasing trend in concentrations as you analyze wells from the active ABG area to the installation boundary. This study was based on the assumption that the contaminated soils in the upper portion of the Little Sulfur Creek Valley would be removed. In the results section it did not say that the trends analyses was for individual wells. It is this down-gradient decreasing trend analyses that has been used to support a natural attenuation approach. For individual wells to show decreasing trends the source of contamination has to be removed. At the ABG contaminated soils are acting as a source for contaminants in down-gradient wells. These wells are stable as far as trends although most recent concentrations are lower than initial concentrations. Again the unique geological conditions at this site make monitored natural attenuation attractive even though the traditional approach cannot be followed exactly

It should be noted that the Report does not present any isoconcentration (isopleth) maps which illustrate the current configurations of the contaminant plumes. Although future plume distribution maps are presented as part of the numerical modeling results in Section 8 (Figures 41 through 46), no maps are presented to show the current configurations of the plumes. More importantly, contaminant isoconcentration maps over time should be used to demonstrate a trend of decreasing contaminant mass and/or concentrations, as specified by the first U.S. EPA line of evidence.

Response: The EPA directive states thatB**Historical groundwater and /soil chemistry data that demonstrate a clear meaningful trend of declining contaminant mass and/or concentration at appropriate monitoring or sampling points. In cases where the source has been completely removed the above statement would refer to concentrations in individual wells, however in the case of the ABG, appropriate monitoring points was interpreted as a series of down-gradient wells. In traditional MNA studies the groundwater does not become surface water in a relatively short distance as it does in the Little Sulfur Creek Valley.**

In the absence of: 1) contaminant isoconcentration maps over time, 2) clear and evident trends of decreasing contaminant concentrations in the well graphs shown in Report Figures 18 through 23, and 3) any other visual or statistical methods which can be used to demonstrate plume stability or a loss of contaminant mass and/or concentrations over time, it is not clear that the first U.S. EPA line of evidence has been met.

Refer to above response.

The second U.S. EPA line of evidence requires the presentation of hydrogeologic or geochemical data which demonstrate indirectly the types of natural attenuation processes active at the site and the rate at which such processes will reduce contaminant concentrations to required levels. In support of this line of evidence, NSWC Crane provides the calculation of biological degradation rates for certain constituent species (e.g, TNT) in the soil as part of the phytoremediation column studies. There are no concerns with regard to the information presented as part of these studies. However, no biological degradation rates have been determined for contaminant species (e.g., TCE, RDX, HMX, TNT) in the groundwater. The calculation of biological degradation rates in the groundwater is especially critical for a demonstration of the appropriateness of MNA at the ABG considering the very rapid groundwater velocity characteristic of the underlying solution-enhanced limestone aquifer.

Response: The primary attenuation of contaminants in the solution cavities would be by dilution. The solution cavities are only a part of the aquifer system. Groundwater would be moving much slower through the fractured media and the alluvial material and would allow some biodegradation to occur.. Studies conducted by Indiana University show that there is solution, mixed, and diffuse flow in the Little Sulfur Creek Valley.

In addition, the U.S. EPA MNA Directive entitled *Use of Monitored Natural Attenuation at Superfund, RCRA Corrective Action, and Underground Storage Tank Sites*, OSWER Directive No. 9200.4-17P, April 1999, indicates that other characterization data may be used to quantify the rates of contaminant sorption, dilution, or volatilization. Although some information regarding contaminant sorption is presented for the site soils as part of the phytoremediation column studies (refer to Report Tables 6 and 8), no information is presented in this regard for the groundwater environment.

Response: The main reason that natural attenuation is being considered at this site is because the groundwater in Little Sulfur Creek valley returns to the surface and becomes surface water before it exits the installation. If contaminate concentrations in the water leaving the site are acceptable then the contaminates are being naturally attenuated. If contaminates are still crossing the boundary contaminant sources upgradient, including highly contaminated soils, would have to be removed before natural and/ or enhanced phytoremediation would be viable.

Finally, the method used most often to demonstrate the second line of evidence is the measurement of geochemical indicator parameters (including various electron acceptors and metabolic byproducts) and the graphical presentation of their distribution within the groundwater in the area of the contaminant plumes. The Report indicates in Sections 4.4 and 4.7 that many of

these geochemical indicator parameters (e.g., dissolved oxygen [DO], pH, specific conductance, temperature, turbidity, oxidation-reduction potential [ORP], alkalinity [carbonate, bicarbonate, and hydroxide], carbon dioxide, ferrous iron, hydrogen sulfide, nitrate, nitrite, and water level) were measured during the field investigation activities. However, none of this information was included in the Report. These data should be presented both in tabular format, and as isoconcentration (isopleth) maps for the various parameters of interest, especially for the electron acceptors and metabolic byproducts (e.g., DO, ORP, carbon dioxide, ferrous iron, hydrogen sulfide, nitrate, and nitrite) so graphical presentations of the groundwater affected by biological degradation are available. Furthermore, if any additional electron acceptor/metabolic byproducts were measured and not reported (e.g., sulfate, ethane, ethene, chloride, and methane), these data should be presented as well.

Response:At the time this report was being prepared the data showed that contaminants of concern were not crossing the installation boundary. If subsequent data indicate that contaminants are crossing the boundary at higher concentrations the feasibility of using natural attenuation would have to be addressed. The data was addressed in enough detail to insure that contaminants of concern were breaking down, but because the groundwater becomes surface water before it discharges there was no need to look at the groundwater at each well as in a traditional MNA study.

In the absence of: 1) biological degradation rates for the contaminant species in the groundwater, 2) characterization data which can be used to quantify the rates of contaminant sorption, dilution, or volatilization potential of contaminants in the groundwater, and 3) a tabular and graphical presentation of the distribution of geochemical indicator parameters within the groundwater in the area of the contaminant plumes, it is not clear that the second U.S. EPA line of evidence has been met.

Response: See above response.

The third U.S. EPA line of evidence requires data from field or microcosm studies which directly demonstrate the occurrence of a particular natural attenuation process at the site and its ability to degrade the contaminants of concern. The phytoremediation and microbial mineralization studies (Report Sections 5 through 7) for the soils at the ABG address this line of evidence and there are no concerns with regard to the information presented as part of these studies. However, it should be noted that no microbial studies have been conducted for the groundwater environment at the ABG.

Response: The unique conditions at ABG are such that the groundwater becomes surface water before it exits the installation.

In summary, given the concerns with the various activities described above for the ABG, it does not appear that the necessary lines of evidence as outlined in the U.S. EPA MNA Directive have been met. If NSWC Crane still intends to pursue MNA as a viable remedial alternative for the ABG, additional information will need to be presented to fulfill the requirement for multiple distinct but converging lines of evidence, especially with regard to the groundwater beneath the ABG.

Response: With the unique hydrogeologic conditions at ABG the groundwater becomes surface water and can be evaluated easily to see if standards are being met. If standards are not being met and contamination is moving across the installation boundary natural attenuation is not a viable option till up-gradient contaminant sources are removed.

Comment 2:

The Report indicates in Section 3 (Hydrogeology) that groundwater in the vicinity of the ABG flows through the Big Clifty/Beech Creek Aquifer, which consists primarily of a solution-enhanced limestone unit. The Report also indicates that pump tests conducted in the Beech Creek Limestone yielded transmissivity values ranging from 0.28 to 5.79 meters^2/day. In addition, dye tracer tests conducted in the Big Clifty/Beech Creek Aquifer resulted in an effective conductivity value of 286 meters/hour (Report page 9). Although the average groundwater flow velocity is not provided in the Report, these very high conductivity and transmissivity values indicate that the groundwater flow rate is likely very rapid in the aquifer. In light of the presumed very high groundwater flow rates, it is not clear how NSWC Crane believes that the aquifer is suitable for MNA. According to the U.S. EPA MNA Directive (page 18), MNA is only appropriate in aquifers where Athe contaminant plumes are no longer increasing in extent, or are shrinking.@ Given the advective flow rate of the limestone aquifer beneath the ABG, it is highly unlikely that attenuation mechanisms (e.g., sorption, dispersion, dilution, biological degradation, etc.) could act at sufficient rates to stabilize a contaminant plume and prevent the offsite advective transport of contamination. This is even reflected in the NSWC Crane document entitled *Resource Conservation and Recovery Act Facility Investigation Report for SWMU 03 - Old Jeep Trail/Little Sulphur Creek* (dated November 2002), where it is stated on page 6-15 that AThe flow rate through the karsts conduits is so quick that there is no time for microbial biodegradation to occur.@ Furthermore, an extremely rapid flow rate would also not allow for the implementation of contingency remedies as required by the U.S. EPA MNA Directive (page 24 in the Directive). Given these considerations, NSWC Crane should justify the text in the third paragraph on page 9 of the Report where it is stated AThe hydrogeology at the ABG appears to be well suited for natural attenuation to be occurring.@

Response: As noted in the report the aquifer flow system is not all conduit flow but has diffusive and mixed flow as well. The conduit flow in the cavernous limestone near the center of the valley acts as a drain that controls groundwater flow down the valley. The areas where the conduits are located are limited and in many places the flow is very slow through fractures and alluvium.

Comment 3:

Report Section 5.2 indicates that one soil sample was collected by personnel from the U.S. EPA Ecosystems Research Division for microbial mineralization analyses, determination of bulk density, percent organic matter, percent sand/silt/clay, cation exchange capacity, etc. Additional discussion should be provided to clarify why only one soil sample was collected and how this one sample is believed to be representative of the soils from the areas where phytoremediation is being considered.

Response: The soil sample was collected as a representative sample from the Little Sulfur Creek Valley to provide data that showed attenuation should be occurring. Since groundwater at the boundary was essentially clean during the time of this study, the EPA was trying to develop a proof of concept that attenuation was being accomplished by plants. I think they accomplished this goal.

Comment 4:

The Report presents a discussion of the TNT adsorption isotherm (Freundlich isotherm) in Section 5.8.2, and provides the values for the partition coefficient (0.00274 l/mg), volume of soil in the column (7.0 kg), and concentration of the TNT solution (10 mg/L). However, the Report does not indicate the value of the empirical constant (1/n) used to derive the sorbed contaminant concentration of 191.9 mg (although it appears to be around 1.0). Provide this value and the source of the value in the Report.

Response: Because the data plotted as Cw = KfCw were linear as shown by the regression coefficient (R2 = 0.9722) at concentrations up to 20 mg/L (actually up to 50 mg/L), it was assumed that n = 1 of which gave a partition coefficient of 0.00274 mg/L. Thus, the empirical value of n =1 was used to calculate the concentration of 191.9 mg.

Comment 5:

Section 8 of the Report presents the results of the numerical modeling study conducted for the groundwater beneath the ABG. Several concerns were identified with this section of the Report and are discussed in the following paragraphs.

Section 8.2 indicates that a conceptual model based on the site hydrological and chemical data was developed before the numerical modeling was conducted. However, this conceptual model was not presented in the Report. Since the conceptual model forms the basis for the development of the numerical model, and since the conceptual model Aforms the foundation for the premise that monitored natural attenuation along with phytoremediation (if needed) is the remedial action of choice@ (fourth paragraph on page 28 of the Report), this model should be included in the Report.

Response: Many of the comments reflect the fact that the unique hydrogeologic conditions at the ABG were not understood by the reviewers . A figure showing the conceptual model is at the end of the responses.

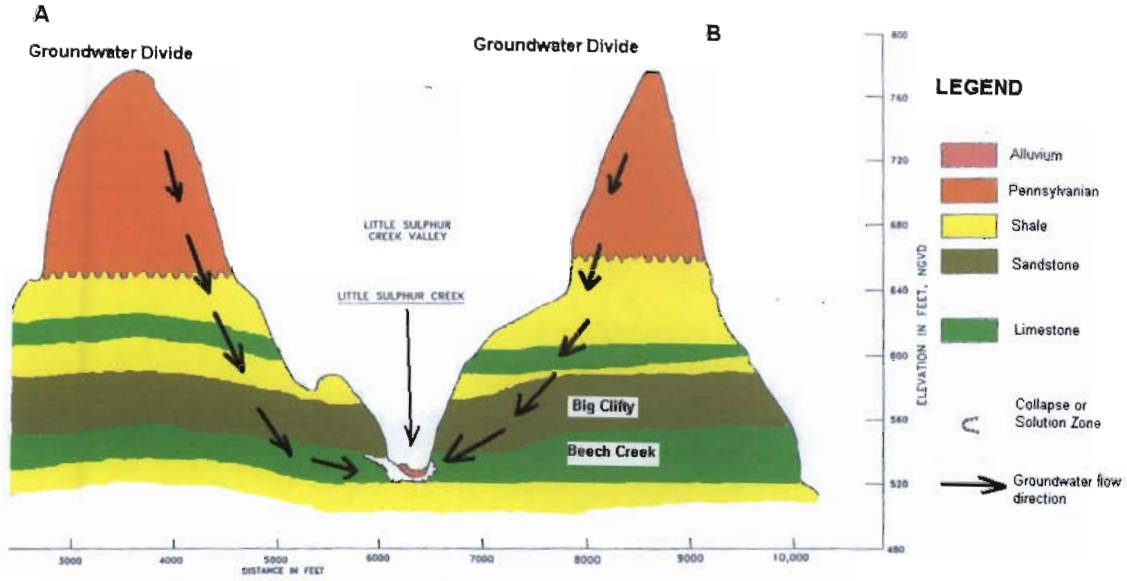
The numerical model input parameters are listed in Table 11 and discussed in Section 8.3 of the Report. Information presented in this table for the MODFLOW routine includes the horizontal and vertical conductivity values and the drain conductance values for the three model layers. However, no information is presented regarding the initial boundary conditions and default parameters for the model (e.g., constant head - constant flux boundaries, sources and sinks, recharge values, solver packages, etc.), discussion of the calibration process, and results of

sensitivity analyses, etc. All input and decision criteria should be presented in the Report. In addition, although predictions of future TCE, TNT, and RDX distributions are discussed in Section 8.4, there is no discussion of how the model results compare and calibrate with the field-derived data. It is also assumed that all calibrations were conducted with FY 1999 and FY 2000 data (per the text discussion on page 14). The Report should indicate whether more recent groundwater elevation data were available, and if so, why these data were not used in the calibration process.

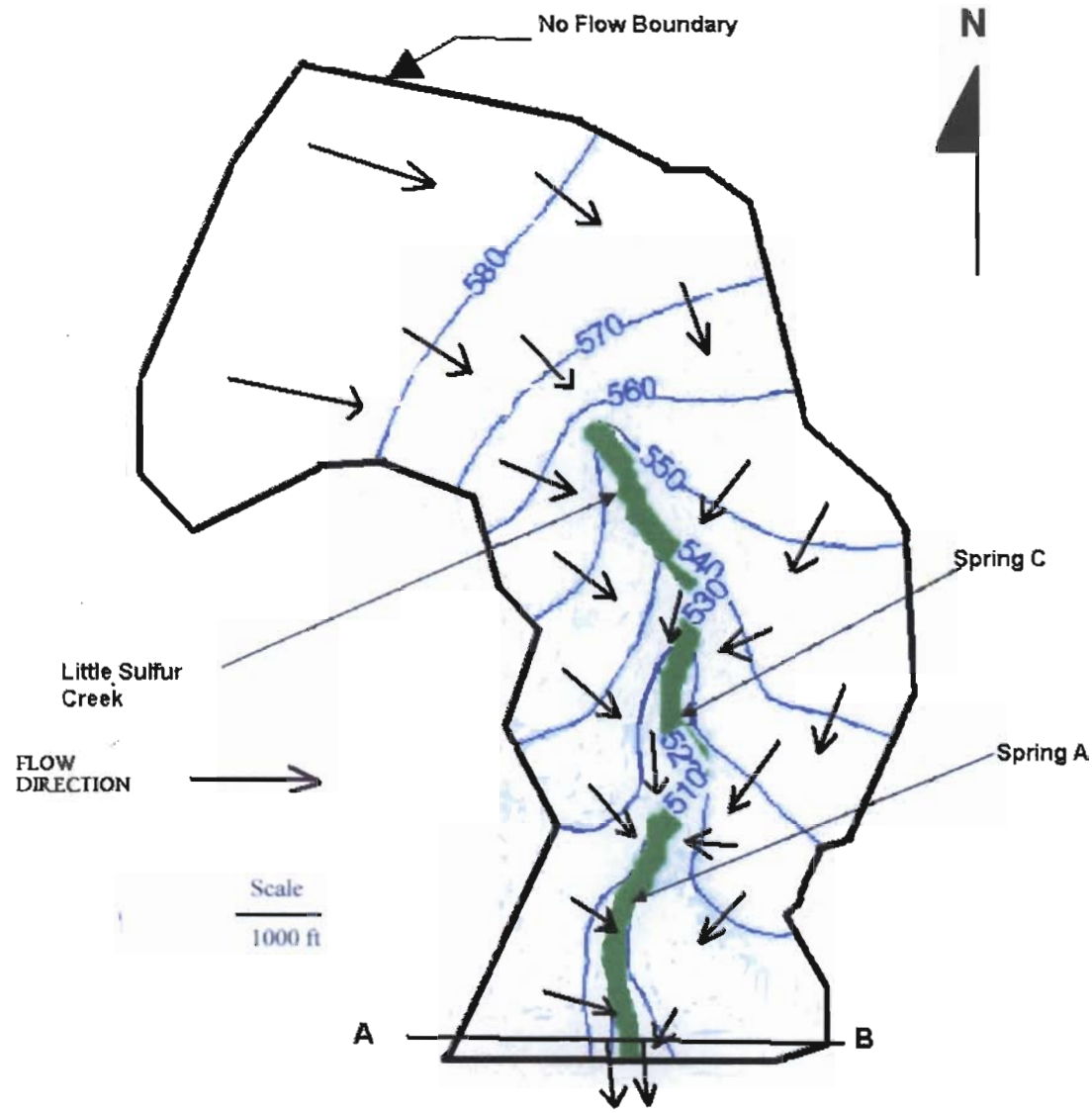
Response: Initial conditions of the groundwater model were derived from the local site data. Constant head boundaries were placed along the northern, western, and eastern boundaries of the groundwater model. These water levels on the boundaries were derived from wells along model boundaries, or extrapolated from well data. The hydraulic conductivity values, both vertical and horizontal, for the different formations were taken initially from another modeling study at Crane (Haitjema and Kelson, 1994). Drain conductivities were empirically estimated from Haitjema and Kelson (1994), however, the model did not prove very sensitive to this parameter. The solver used for the model was the preconditioned conjugate gradient (PCG2) solver. Discussions of comparisons between simulated and actual data are included for hydraulic heads (Figure 40), which showd good agreement. Figures 41,42, and 43 show a 57 year run, which simulates the period 1940s to 2002. These figures show that the model is capable of simulating the TCE, TNT, and RDX plumes. Calibration was performed to the 1999 to 2000 data, which would be expected to be representative of later periods (such as 2002), since the system likely had reached a steady state flow condition.

Finally, the Report provides a discussion of some of the fate and transport input values for the MT3D routine in Section 8.3 (last paragraph on page 29 of the Report) but does not discuss the source of these values. In particular, it is noted that the values provided in the text are not the same values derived from the soil column studies. Revise the Report to provide the source for these values.

Response: The source of the rate and decay constants for TNT and RDX are Figure 25 and 34 of the report, as well as standard constants for TCE taken from another modeling study (HLA, 1996).



Conceptual Model For Little Sulfur Creek Valley---Cross Section A-B



Conceptual Model For Little Sulfur Creek Valley--Plan View