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 095/3197

5 JUN 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 the response to U. S. EPA comments on the Mustard Gas Burial Ground (MGBG), Solid Waste Management Unit 01/12, Draft RCRA Facility Investigation (RFI) Report as enclosure (1). The permit required Certification Statement is provided as enclosure (2).

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

Encl:
(1) Response to U.S. EPA Comments on the Draft RFI MGBG Report
(2) Certification Statement

Copy to:
ADMINISTRATIVE RECORD ~~(w/o encl)~~
SOUTHNAVFACENGCOM (Code ES32) (w/o encl)
IDEM (Doug Griffin)
TTNUS (Tom Johnston) (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.

Jane Hausila
SIGNATURE

Environmental Protection Department Manager — 6/5/03
TITLE — DATE

RESPONSES TO U.S. EPA REGION 5 COMMENTS (DATED APRIL, 25 2003) AND ADDITIONAL COMMENTS (DATED MAY, 6 2003) ON THE RFI REPORT FOR SWMU 1 - MUSTARD GAS BURIAL GROUNDS REVISION 0 DATED DECEMBER 2002

NAVAL SURFACE WARFARE CENTER
CRANE, INDIANA
U.S. EPA ID NO. IN5170023498

GENERAL COMMENTS

Comment GC-1:
The nature and extent of groundwater contamination at the Mustard Gas Burial Ground (MGBG) does not appear to be fully or adequately evaluated. Until a more complete understanding of a variety of issues has been developed, it may be impossible to initiate corrective measures at the unit.

There are wide fluctuations in groundwater contamination levels in the central portion of the unit, where contamination levels are at their highest. For example, in monitoring well 01-02, 1,1,2,2-tetrachloroethane (PCA) was detected at 38,000 ug/l in 2001 and at 30 ug/l in 2002. Trichloroethene (TCE) in the same well was detected at 16,000 ug/l in 2001 and at 20 ug/l in 2002. As indicated on page 5-17, the wide variation in TCE concentrations "is consistent with historical concentration changes." On page 5-18, it is indicated that large contamination fluctuations have occurred in wells 01-02, 01-05, and 01-11. Although there is brief discussion about these fluctuations in Section 5 of the RCRA Facility Investigation Report for SWMU 01 - Mustard Gas Burial Ground (RFI Report), including a discussion of a potential dense non-aqueous phase liquid (DNAPL) source, it is clear that much is still unknown about what exactly is occurring in the area(s) where groundwater contamination is most elevated.

There is no discussion of the fact that, for those wells that are most contaminated with volatile organic compounds (VOCs) (i.e., wells 01-02, 01-05, 01-11, 01-12, 01-15, 01-19, 01-22, and 01-25, as depicted on Figures 5-6 and 5-7), the wells are screened within a relatively limited vertical area, according to Table 2-1. All wells are screened in the Upper Pennsylvanian aquifer between an elevation of 600 feet above mean sea level (amsl) and 655 feet amsl; this would be limited to between 623 feet amsl and 655 feet amsl without well 01-12. The entire screened interval in the Upper Pennsylvanian aquifer is between 510 feet amsl and 655 amsl. A hydrogeologic cross-section of the area covered by these wells, which has not been included in the RFI Report, would be useful in evaluating the center of the contaminated zone.

Revise the RFI Report to address these concerns about the hydrogeologic setting and the extent of VOC contamination in groundwater.

Response to Comment GC-1

The Navy disagrees that the nature and extent of contamination has not been fully or adequately evaluated. The RFI Report carefully identifies where a full delineation of contaminants to applicable screening criteria has or has not been achieved. The fact that some conservative screening levels are exceeded in a select number of locations does not translate to inadequate evaluation of the extent of contamination. The large VOC concentration fluctuations in the ground water VOC plume interior have no bearing on the extent of contamination and are not expected to impede the evaluation of potential remedial options. Despite the concentration fluctuations, the overall VOC concentrations in the plume interior can clearly be seen to be decreasing, as depicted in Figures 6-5 and 6-6 of the draft RFI report. In those few cases where full delineation of contaminants relative to conservative screening levels is incomplete, the report describes the consequence in terms of potential future action or puts the exceedances into context with the objectives of the investigation. In no case does an exceedance of a concentration limit suggest that proceeding to a CMS would be inappropriate.

The Navy also disagrees with the implication that it "*may be impossible to initiate corrective measures at the unit*". While the reviewer may disagree with specific issues, none of those issues identified in this comment preclude movement to the evaluation of potential corrective actions. The Navy has put forth the following as a suggested course of action (excerpted from MGBG draft RFI report Section 9.2 with emphasis added) to address the environmental issues at this SWMU:

> *"As part of a CMS, additional monitoring could be conducted to verify that the VOC plume is stable with regard to location and size. Because the plume appears to be static or even shrinking, monitoring could be infrequent. Concentrations, while expected to continue to decrease, are not expected to change rapidly over the next five years. A round of samples within the next two years to further evaluate the* ***large concentration fluctuations that were observed at select wells between 2001 and 2002 could be warranted****, depending on the needs of the CMS. The* ***large concentration fluctuations in the plume interior have no effect on estimating the ground water VOC contamination boundaries****.*
>
> *The array of possible corrective measures is expected to be limited. Low hydraulic conductivities observed at the site are expected to limit the utility of active remedies that require the pumping of liquids into or out of bedrock.* ***Corrective actions are expected to focus on the most concentrated portion of the VOC plume****, which is located at or near the PBA."*

With regard to TCE concentrations and depths of wells, the statement that "All wells are screened in the Upper Pennsylvanian aquifer between an elevation of 600 feet above mean sea level and 655 feet amsl " is incorrect. Table 2-1, provided in the draft RFI report, indicates that seven well screens are situated with a bottom screen depth less than 600 feet amsl in the Upper Pennsylvanian aquifer. The well placements were selected to be representative of the Upper Pennsylvanian aquifer associated with the MGBG. Please also refer to the response to Comment SC-2.

In addition to Figures 1-11 through 1-14 provided in the RFI Report, the Navy has generated a cross section using available well information found in Appendix A for wells 01-02, 01-05, 01-11, 01-12, 01-15, and 01-22. Available information for wells 01-19 and 01-25 has also been

incorporated; however, well construction sheets are not available for these two wells as identified in Appendix A of the draft RFI report. Figure callouts have been changed to render them consistent with changes in figure numbers (these changes are not identified in these responses to comments). The new figure is numbered Figure 1-15 and is included as Attachment 1 to these responses to comments.

It should also be noted that the stream channel to the north of the MGBG is a physical barrier to ground water migration beyond that channel. Very little VOC contamination was detected in that channel.

In summary, the following changes have been made in response to this comment:

- Figure 1-11 has been revised to include the location of cross-section D-D'.

- The second sentence of the fifth paragraph of Section 1.2.6, has been revised to read: *"Figure 1-11 shows the locations of geologic cross-sections presented in Figures 1-12, 1-13, 1-14, and 1-15 for cross-sections A-A', B-B', C-C', and D-D', respectively. When reviewing Figure 1-15, the reader must consider that the elevation of the boring for Well 01-12 is out of alignment with the other points in the D-D' cross-section and is topographically lower than the figure might suggest."*

The remaining figures and associated figure callouts in Section 1 have also been renumbered to accommodate the insertion of new Figure 1-15.

SPECIFIC COMMENTS

Comment SC-1:

Executive Summary. The last sentence on page ES-1 indicates that the Phase II RFI Work Plan was not approved by U.S. EPA Region 5 and, therefore, was never implemented. Clarify whether the Phase II RFI objectives and activities were integrated with those of the Quality Assurance Project Plan for the Mustard Gas Burial Ground Phase III RCRA Facility Investigation (Phase III RFI Work Plan). Also, since the Phase II RFI Work Plan was not approved or implemented, clarify why the present RFI activities are not considered to be the Phase II investigation, rather than the Phase III.

Response to Comment SC-1

The following text, explaining the situation surrounding the draft Phase II RFI Work Plan, has been inserted before the last paragraph of Section 1.3.3 of the draft Phase III RFI report:

> *"A draft Phase II RFI Work Plan was developed in 1991, but was neither finalized nor implemented due to lack of funds (USACEWES, 1991). When funds became available, a Phase III work plan was developed to expedite the RFI process, i.e. to avoid two cycles of QAPP, fieldwork, and reporting. The Navy and U.S. EPA agreed that enough investigative data had been collected to verify that a release had taken place at the SWMU and that a "release assessment" as described in the NSWC Crane RCRA Permit had already taken place based on investigative efforts conducted by the U.S. Army Corps of Engineers. Hence, Phase II had, in essence, already been completed.*
>
> *A Phase III RFI is a "Release Characterization," which is what was accomplished by the work described in this report in accordance with Crane's RCRA Permit. The Phase II Work Plan was reviewed and was used primarily for historical information about the site. Appropriate information from this document was utilized in preparation of the U.S. EPA-approved Phase III RFI QAPP."*

In addition, the following parenthetical phrase has been added to the end of the last sentence of the Executive Summary, SWMU 01 Description: *"(See Section 1.3.3 for details)"*.

Comment SC-2:

Section 1.2.7, Hydrogeology. The second paragraph of Section 1.2.7 (page 1-8) indicates that aquifers beneath the Naval Surface Warfare Center - Crane Division (NSWC Crane) facility are believed to be vertically isolated from each other by shale beds that act as aquitards. Groundwater recharge to underlying bedrock units occurs where aquifer units crop out at the ground surface, or through vertical downward migration through joint openings from overlying units. It is not clear whether these bedrock joint openings might also occur within the aquitard shale formations. If so, the joint openings would provide a mechanism for contaminant transport from the shallow aquifer to the deep aquifer, yet there are relatively few deep wells to prove or disprove whether this mechanism has occurred beneath the MGBG. Clarify whether contaminant transport has actively occurred via joint openings within the aquitard between the shallow and deep aquifers.

Response to Comment SC-2:

The paragraph in question was taken from "Geology and Hydrogeology of the Ammunition Burning Grounds, Crane Naval Weapons Support Center" (USACE WES, 1988) as a direct reference. It is expected that joint openings are present in units that comprise both aquifers and aquitards, and the potential exists for downward groundwater flow. However, none of the four lower Pennsylvanian wells installed and sampled at the site had significant ground water contamination. Only two of the lower Pennsylvanian wells detected organic contamination (heptachlor at 0.017 µg/L in well 01C01, and trichloroethene at 1 µg/L in well 01T03. These concentrations indicate that ground water contamination is not present in any appreciable concentrations in the deeper lower Pennsylvanian groundwater. Furthermore, as discussed in Section 1.2.7 the presence of a shale unit at 600 feet amsl and the observed vertical head difference of 115 feet observed between shallow and deep wells appears to indicate the presence of two discrete water-bearing units with an extremely limited hydraulic connection.

No changes have been made to the RFI report in response to this comment.

Comment SC-3:

Section 2.5.3, Monitoring Well Repair and Development. Bullet 3 on page 2-7 indicates that a hole was located near well 01-23, which was backfilled. Revise the RFI Report to provide more detail on the size, depth, and nature of this hole.

Response to Comment SC-3:

The hole in question may have been created by animals or possibly by erosion (in the Field Operation Leader's opinion, it was not an abandoned boring or a hole caused by collapse of the soil around the existing well). Regardless of the cause, the FOL felt it was warranted to plug the hole to prevent any possibility of problems in the scheduled fieldwork that was to follow. This was as much a safety concern as any other. A sentence has been added to the end of bullet 3 stating:

> *"The hole was approximately 6 to 8 inches in diameter, estimated at 3 to 4 feet deep, and was thought to have been created by animals or possibly by erosion."*

Comment SC-4:

Section 2.7.2, Soil Sampling. The second sentence of this section appears to be out of context, or there appears to be missing information. Revise this section to clarify the text provided.

Response to Comment SC-4:

The word "These" in the second sentence of Section 2.7.2 should be "Three." The sentence has been corrected to read:

> *"Three composite soil samples were collected from the bottom of the large anomaly excavation and one composite soil sample was collected from the bottom of the small anomaly excavation."*

Comment SC-5:

Section 2.7.2.1, Surface Soil Sampling. Boring 01SB09 was intended to be collected just west of the primary burial area (PBA), but "uncertainty" in siting the desired sampling location caused this boring to be installed just inside the western boundary of the PBA. According to Figure 5-1, there are no soil borings in the immediate western region outside the PBA. Revise the RFI Report to include further explanation of the "uncertainty" involved, as well as what impact (if any) this may have regarding overall site results.

Response to Comment SC-5:

The boundaries of both the 2-acre MGBG proper, and the 0.2-acre PBA, which is located within the MGBG, are approximate. The knowledge of those boundaries is expected to be no more precise than ±10 feet. This uncertainty combined with the precision with which soil borings can be located without surveying was considered adequate, otherwise the sampling plan would have required that the locations be surveyed prior to sampling. The following text has been inserted as the fifth sentence in Section 2.7.2.1:

> *" This is within the uncertainty associated with the location of the MGBG and PBA boundaries and with the siting of unsurveyed sampling locations. Therefore, this deviation had no adverse impact on the intended representativeness or spatial coverage of the soil sampling."*

Comment SC-6:

Section 2.7.3, Surface Water Sampling. Surface water sampling was limited, due to dry streambed locations during the 2001 and 2002 sampling events. In addition, up to five staff gauges were to be installed in 2002 and surveyed at the surface water locations. However, because of shallow depth and low flow rate of the streams, staff gauges were not installed and flow rates were estimated at the time of surface water sample collection. The methodology used to estimate the flow rate was not described or referenced in the text of the report or in Appendix B-7, Surface Water Sample Log Sheets. A Field Task Modification Request (FTMR) Form is included in Appendix B-10, documenting the decision not to install the staff gauges. However, there is no discussion regarding the overall impact (if any) this may have had. Revise the RFI Report to include any effects (if any) these may have had on surface water results. Also, provide a discussion regarding how the flow rate estimation was conducted.

Response to Comment SC-6:

The phrase "up to five staff gauges" includes zero gauges as a possible number of gauges to be installed. Staff gauges were not installed because water levels were very low and did not support a continuous stream of water in much of the streambeds. Despite this general lack of continuously flowing water, the FOL tried to provide "order of magnitude" observations that would help the reader understand sampling conditions at the time of sampling. Because contaminant dilution should be less at low flow rates than at high flow rates, the concentrations presented in the report are expected to be biased toward environmental protection. Regardless of any bias, the streambeds near this SWMU are frequently dry, and water can only be sampled when present and under the conditions exhibited at the time of sampling.

There is no overall impact of providing or not providing the information referenced in the comment. Therefore, and because this text has evidently created confusion, the RFI report has been revised to delete the last three sentences in the second paragraph of Section 2.7.3.

Comment SC-7:

Section 2.7.4, Sediment Sampling. Sediment sample 01SD01 is slightly northwest of the proposed sampling location, when comparing Figure 1-11 of the RFI Report to Figure 4-3 of the Phase III RFI Work Plan. This change in sample location is not noted in the RFI Report. Revise the RFI Report to include an explanation for this deviation in sample location and whether the resulting data would be expected to be of comparable quality and usability.

Response to Comment SC-7:

As stated in the comment, the difference between planned and actual map coordinates for sampling location 01SD01 is slight. The text in Section 2.7.4 indicates that sediment samples were collected "... in a depositional area that had predominantly fine (clay and silt) particles present in the streambed or drainage ways." Accordingly, specific sample collection locations were field decisions made by experienced personnel – in this case with the objective of measuring chemical concentrations downstream of the confluence of the two branches shown in the figures but upstream of locations potentially affected by site operations. The representativeness and usability of the data from this sampling location was enhanced by this slight deviation from the QAPP. No changes have been made in response to this comment.

Comment SC-8:

Section 5.1, SURFACE SOIL, ROUND 1. The second paragraph in this section on page 5-3 indicates that the surface background soil sample was analyzed for a limited number of chemical constituents when compared to the on-site surface soil samples. The background soil sample was analyzed for thorium radioisotopes, pH, and cation exchange capacity (CEC) only. Generally, the accepted practice is to analyze the background samples for the identical parameters as the environmental samples. Revise the RFI Report to provide justification for not analyzing the samples for the same suite of parameters.

Response to Comment SC-8:

The Navy disagrees that "**Generally, the accepted practice is to analyze the background samples for the identical parameters as the environmental samples**". When the base-wide soil background study for NSWC Crane was being planned, the Navy was restricted by the U.S. EPA Region 5 to analyzing only metals, under the assumption that all organic chemical background concentrations would be assumed to equal zero. The second paragraph of Section 1.1 in Base-Wide Background Study for NSWC (TtNUS, January 2001) states, "*In a meeting with the U.S. EPA Region 5, the Navy, based on input from TtNUS, recommended analyzing background samples for polycyclic aromatic hydrocarbons and pesticides, and possibly volatile organic compounds and polychlorinated biphenyls, to use as verification that samples were collected from background populations. U.S. EPA Region 5 recommended, instead, that samples be analyzed for metals only. Accordingly, analyses for the U.S. EPA Contract*

Laboratory Program (CLP) Target Analytic List (TAL) metals, lithium, strontium, thorium, and tin were conducted in accordance with the standard U.S. EPA analytical methods."

Regarding the analyses conducted on background samples, the concentrations of 27 metals were reported in the NSWC Crane Base-Wide Background Soil Investigation report for 15 (not one, as stated in the comment) surface soil samples that correspond to the same surface soil group (Soil Group 3) found at the MGBG. A summary of those background concentrations can be found in Table F-6 (Appendix F) of the draft RFI report. These metal concentrations were used as the basis for background comparisons with concentrations of metals at the MGBG. However, the analytical technique used for thorium analyses during the MGBG Phase III RFI was alpha spectroscopy, and the analytical technique used for thorium analysis in the base-wide background investigation was inductively coupled plasma emission spectroscopy (ICPES). The resulting radiological and chemical concentrations are related through the specific activity of the radionuclide being analyzed. This fundamental physical relationship allows for conversion between radiological (e.g., pCi/g) and chemical (e.g., mg/kg) concentrations. The conversion between radiological and chemical thorium concentrations is described in detail in Section 3.4.1.3 of the draft RFI report. Comparisons to background concentrations are thoroughly discussed in Section 3.4.2 of the draft RFI report.

Soil boring 01SB21, located outside the MGBG, was used to demonstrate that the conversions between radiochemical and chemical concentrations are valid. Perhaps more specifically, any gross inconsistencies between radiological and chemical concentrations would have been cause for re-evaluating such conversions. No gross inconsistencies were noted. Indeed, the data from soil boring 01SB21 are consistent with soil data across the MGBG and with the chemical concentrations obtained during the NSWC Crane base-wide soil investigation. This is interpreted in Sections 5.1 and 5.2 (Metals) of the draft RFI report as representing a lack of contamination.

No changes have been made to the RFI Report to address this comment.

Comment SC-9:

Section 5.2, SUBSURFACE SOIL, ROUND 1, SVOCs. As indicated on pages 5-10 and 5-11, the highest levels of polynuclear aromatic hydrocarbons (PAHs) occur in soil boring 01SB20, particularly in the deepest sample of the boring. The report indicates that this "raises questions concerning how the deepest soil interval could be contaminated with PAHs from site activities in an area where intrusive activities are not known or suspected to have occurred." Further, there are no soil borings in the easterly, southerly, or westerly directions away from this boring. The report indicates that "there is no indication that sampling beyond the already sampled areas would better define the extent of a PAH-contaminated area." This conclusion does not appear to be accurate. Based on these factors, the nature and extent of PAH contamination in this area has yet to be determined. Revise the RFI Report to describe this issue in more detail.

Response to Comment SC-9:

Soil boring 01SB20 should be viewed in the proper context. This soil boring is beside a roadway (Highway-251) that supports industrial traffic. This is pointed out in Section 5.2, SVOCs. Oils (that would contain PAHs) are also believed to have been sprayed on the road to

suppress dust (Highway-251 is unpaved and covered with gravel). The detection limits reported for PAHs in soil and sediments ranged from 10 to 15 µg/kg. Virtually all PAH detections that exceed 15 µg/kg occurred at soil boring 01SB20 or the two sediment samples collected in the shallow ditch along Highway 251 (01SD07 and 01SD08). These sediment sampling locations are outside the MGBG proper and are also located adjacent to Highway-251. All of this evidence points to the source of the PAHs being the roadway or nearby debris piles and not the MGBG. Because of this and the fact that the PAH concentrations are generally near detection limits throughout the MGBG, these detections are not a significant concern and do not require additional investigation.

The following statement, which was not cited in this comment, is provided in the draft RFI report: "The PAH contamination is not bounded laterally or vertically in the strictest sense, but the few detections of PAHs are viewed to render these chemicals relatively insignificant as site contaminants." Therefore, the Navy does not agree with the comment **"This conclusion does not appear to be accurate"**; however, in response to the comment, the RFI Report has been revised to remove the last sentence in the SVOC summary paragraph.

Comment SC-10:

Section 5.3, GROUND WATER, ROUNDS 1 AND 2. As is indicated in the first paragraph on page 5-17, bounding of the TCE groundwater plume is not satisfied in the downgradient direction from boundary monitoring well 01-08. The RFI Report seems to indicate that this is not significant because of the reported undulations in the boundary plume and that some future monitoring results could be less than the 1.0 ug/L chemical of potential concern (COPC) screening level. This does not seem to be adequate rationale for discounting the presence of TCE above screening levels in this well, particularly given its downgradient location. Revise the RFI Report to address this concern.

Response to Comment SC-10:

An exceedance of screening levels does not automatically indicate that an unacceptable condition *does* exist, rather it indicates that an unacceptable condition *might* exist. The presence of TCE in ground water at concentrations greater than screening levels has not been discounted, nor is that implied in the cited discussion. However, the referenced draft RFI report text does put the exceedance into perspective. Given the scale of TCE exceedances elsewhere at this SWMU and the fluctuations noted at several well locations, the Navy believes that the exceedance falls well within the decision-making range for the risk manager. TCE was identified as a contaminant of potential concern, its concentration was great enough to yield an unacceptable risk, and this unacceptable risk has led to the conclusion that a Corrective Measures Study is warranted. The detection of TCE in well 01-08 is not expected to affect any remedy selection based on its location and concentration. In addition, the comment fails to mention that the commonly used cleanup goal of 5 µg/L is virtually the same concentration as the greatest measured TCE concentration (7 µg/L) in well 01-08. Also not noted in this comment is the conclusion of the draft RFI report that continued monitoring is likely to be warranted to monitor the movement, if any, of the plume.

The draft RFI report adequately addresses the significance of TCE concentrations in ground water at all locations associated with the MGBG investigation, and no change has been made in response to this comment.

Comment SC-11:

Section 5.3, GROUND WATER, ROUNDS 1 AND 2. As described on page 5-22, there appears to be a significant area of elevated metals contamination at and near monitoring well 01T02. It is noted that the highest concentrations of 10 of the 25 metals were detected in this well. The RFI Report indicates that samples from this well "display chemical characteristics that differ from the rest of the site." Given that it is in a downgradient direction from the primary study area, it is unclear why this is the case unless there is some local source for these anomalies, or there is a preferential flow pathway between the study area and well 01T02 that is not intercepted by a referenced, but unidentified, well located upgradient of 01T02. Revise the RFI Report to more fully discuss this issue, including the potential sources of the metals contamination at well 01T02 and any identified transport pathways for the metals contaminants from these potential sources.

Response to Comment SC-11:0

The discussion of this issue with data available to date is comprehensive. There are no identified metals source areas (and therefore also no transport pathways) near this well, and that is why it was originally selected as a good location for an upgradient well. In response to the comment, the Navy has modified the paragraph in question as follows:

> *"In summary, well 01T02 was originally not considered to be part of the MGBG study area (it was selected to be the upgradient well until water levels showed it to be downgradient). This is significant because samples from this particular well display chemical characteristics that differ from the rest of the site. For example, the maximum metal concentrations for 10 of the 25 metals (including three of the six ground water metal COPCs) were observed in this single well,* ***even though no readily identifiable sources of metals contamination are evident in this area****. The elevated metals concentrations may reflect the natural heterogeneity of the Pennsylvanian aquifer with regard to naturally occurring metals. While no source of metals contamination is readily identifiable, it is notable that this well is located adjacent to Highway 251. Some elevated metals concentrations observed in samples from well 01T02 are related to industrial metals (e.g., aluminum, iron, manganese, and nickel) that may have originated from vehicular traffic along this highway. Furthermore, while it is separated from the rest of the MGBG by at least one well that exhibits no detectable concentrations of VOCs, this well has VOC concentrations that are approximately equal to or less than the detection limits (Figure 5-4). One of the VOCs detected in well 01T02, toluene, is not a COPC and is not a significant site contaminant. Toluene is a component of gasoline, indicating that the roadway may be the source of this chemical. This chemical was detected in only three other widely separated wells at concentrations less than or equal to 2 µg/L, much less than its COPC screening level. In conclusion, samples collected from well 01T02 were not used to establish background (i.e., upgradient) concentrations because of the significantly different chemistry and the fact that this well is downgradient of the MGBG."*

Comment SC-12:

Section 6.3, Contaminant Transport Pathways. Section 6.3 does not consider all of the potential transport pathways, such as a groundwater-to-sediment pathway. Revise Section 6.3 and the conceptual site model accordingly.

Response to Comment SC-12:

All contaminant migration pathways were considered and all relevant pathways were discussed, regardless of how minor they are. Movement of contaminants to sediment via ground water is discussed briefly in Section 6.3.2, Migration of Ground Water Contaminants, and is represented in the second bullet of Section 6.3. The discussion in Section 6.3.2 indicates that contaminant migration to sediments from ground water is a minor migration pathway. The discussion of groundwater migration to sediment that is in the draft RFI report is commensurate with the level of importance of the ground water to sediment pathway. There is no need to revise the conceptual model, which already indicates that the groundwater migration pathway is a minor pathway for contaminant migration.

No changes have been made to the RFI report in response to this comment.

DATA QUALITY COMMENTS

GENERAL COMMENTS

Comment DQ-GC-1:

The data quality section provides mean quality control (QC) results in a few cases. The observed QC range is also reported in some cases. However, 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 applied 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 following text has been inserted into Section 3.3 immediately prior to the last sentence of the first paragraph:

> *"During data validation, individual QC results were evaluated. If individual QC results were acceptable, no validation flag was assigned to an analytical result, otherwise a flag indicating the type of QC deficiency was assigned to the result. The data quality review provided in this section, which was implemented after the data validation process was completed, is not designed to identify data that are acceptable or unacceptable according data QC criteria. Instead, it is designed to provide an overall quantitative measure of analytical performance not provided by data validation."*

A new second-to-last sentence has been inserted into paragraph 8 of Section 3.3, and the last sentence of that paragraph has been revised. The text now reads as follows:

> *"Unless otherwise specified, RPD values cited in the discussions below refer to individual RPDs of a single pair of original and duplicate samples. A value of zero for individual RPD values indicates perfect repeatability."*

Two new sentences have been added to paragraph 6 of Section 3.4. The text now reads as follows (new text is italicized):

> *"Unless otherwise specified, each percent R value cited in the discussions below refers to an individual percent R value. When appropriate, mean or average percent R values are also discussed.* Data qualifiers assigned during data validation because of non-compliant bias indicators are presented in Appendix E."

Outliers are discussed as appropriate. As an example, the following text has been excerpted from Section 3.4, Polycyclic Aromatic Hydrocarbons in Soil and Sediment, Round 1:

> *"Naphthalene had the lowest mean recovery, approximately 25 percent in all LCS, LCSD, MS, and MSD samples. The lowest naphthalene recovery was 2 percent in a single MS sample, and two different LCS samples yielded recoveries of only 7 percent. These data indicated an expected low bias for the latter four compounds, with naphthalene exhibiting a severe low bias."*

The text begins with a discussion of the mean percent R of naphthalene (i.e., 25) and then discusses recoveries for an individual outlier (i.e., 2 percent R). Note that the "2 percent R" is not identified as a mean recovery; it is discussed as an extreme value. No change has been made in response to this portion of the comment because it is believed that identification of outliers was thorough.

Comment DQ-GC-2:

It is unclear what the shaded cells in Tables 3-5, 3-6, 3-7 and 3-8 represent. The tables state that "shaded cells indicate that the maximum non-detect value exceeds the Risk-based target limit (RBTL) for at least one sample." However, the tables appear to be inconsistently shaded. For example, Table 3-7 indicates that 2-hexanone has a maximum non-detect value of 5,000 ug/L and a RBTL of 1,500 ug/L. However, the RBTL cell is not shaded. Revise the table to clarify what the shaded cells represent.

The original tables 3-5, 3-6, 3-7, and 3-8 were shaded to indicate where the nominal MDL exceeded the RBTLs. The tables have been revised so that the shading is consistent with the description in the cited text. The shading of Table 3-8 was not affected. Revised Tables 3-5, 3-6, and 3-7 are provided as Attachments 2, 3, and 4, respectively, to these responses to comments.

The associated text (following paragraph 2 of Section 3.3.2) has also been revised to maintain consistency with the tables and to point out that the nominal MDLs achieved RBTLs more frequently than the maximum observed MDLs. The revised text now reads as follows:

> *"To understand the impact of not having achieved RBTLs, it is important to understand the convention used for reporting non-detect values. Concentrations of organic analytes that were less than their MDLs were reported as the reporting limit (not the MDL) followed by a U qualifier. The reporting limits were generally less than typical laboratory reporting limits but greater than MDLs. This convention was used in response to the need to try to achieve the RBTLs. If a measured organic analyte concentration exceeded the MDL but was less than the reporting limit, the reported concentration was the measured concentration followed by a J qualifier. The J qualifier signified that the reported concentration had a high degree of uncertainty even though there was a high level of confidence that the analyte had been detected in the sample. Concentrations less than the MDLs for inorganics or MDAs for radiologicals were reported as the MDL (or MDA) with a U qualifier. Concentrations of organics, inorganics, or radiologicals that exceeded reporting limits were not qualified unless a data quality deficiency was identified. These reporting conventions are summarized below:*

Analyte Non-Detect Reporting

Measured Concentration	***Reported Concentration***	***Qualifier****
<MDL (MDA)	*MDL (inorganics)* *MDA (radiologicals)* *RL (organics)*	*U*
>MDL and <RL	*Measured concentration (organics)*	*J*
>MDL (MDA) and <RL	*Measured concentration (inorganics and radiologicals)*	*No qualifier*
>RL	*Measured concentration*	*No qualifier*

Tables 3-5 through 3-8 show the nominal MDLs and the minimum and maximum non-detect values for each analyte. The nominal MDLs represent MDLs as measured by the laboratory without any adjustments for sample-specific conditions such as moisture content or sample dilutions. Especially in cases where a dilution caused the maximum observed non-detect value to exceed the RBTL, the nominal MDL can be seen to be less than the RBTL. For example, 2-hexanone had a nominal MDL of 1.4 µg/L, but the maximum observed MDL was 5,000 µg/L. The significant elevation of the MDL was due to the dilution of at least one ground water sample that had a high concentration of at least one other target analyte."

HUMAN HEALTH RISK ASSESSMENT COMMENTS

GENERAL COMMENT

Comment HHRA-GC-1:

Section 1.4.2.2 of the Phase III RFI Work Plan lists thiodiglycol as a site-related chemical of concern. However, based upon the information provided in the RFI Report, it does not appear that soils (surface and subsurface) or groundwater were sampled for this constituent. If historical evidence indicates that thiodiglycol could be present at the site, then the RFI should evaluate the potential presence of this contaminant and determine the nature and extent of thiodiglycol contamination or sample to verify that thiodiglycol is not a concern at the site. Revise the RFI Report to address any potential data gaps associated with thiodiglycol.

Response to Comment HHRA-GC-1

Thiodiglycol was selected as a chemical of interest because it is a degradation product of bis(2-chloroethyl)sulfide (i.e., mustard gas). However, thiodiglycol also appears naturally in the environment; therefore, analysis for thiodiglycol was proposed only if mustard gas or one of the other two mustard gas degradation products was detected. None of those chemicals was detected in any media, so there was no need to analyze any samples for thiodiglycol. This condition for thiodiglycol analysis should have been footnoted in Tables 1-5, 4-2, 4-8 through 4-12, and 7-1 of the QAPP, but it was inadvertently omitted. To account for this omission, the following text has been added to the end of the paragraph in Section 3.3.1.3, Round 1 of the RFI report:

> *"Thiodiglycol occurs naturally in the environment and it occurs as a degradation product of mustard gas. Therefore, although not noted in the MGBG QAPP, analysis for thiodiglycol was proposed only if mustard gas or one of its other degradation products was detected. None of those chemicals was detected in any sample; therefore, no samples required analysis for thodiglycol."*

Comment HHRA-GC-2:

Constituents were selected as chemicals of potential concern (COPCs) if detected concentrations were greater than screening levels and also exceeded background concentrations. However, recently published U.S. EPA policy no longer supports excluding COPCs from the risk assessment based on a comparison to a background level (*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 2 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-GC-2:

The following qualitative discussion of constituents eliminated on the basis of comparisons to background concentrations has been added to Section 7.5.2.

> *"Qualitative Evaluation of Chemicals Eliminated as COPCs on the Basis of Background Comparisons*
>
> *"Aluminum, arsenic, chromium, iron, manganese, and thallium were detected in soils and/or sediments at concentrations exceeding the conservative screening levels established for COPC selection but were not selected as COPCs because study area concentrations did not exceed background concentrations. The following table provides a qualitative evaluation of the metals by comparing maximum detected concentrations to the U.S. EPA Region 9 PRGs for residential and industrial exposures.*

Parameter	*Maximum Surface Concentration (mg/kg)*	*Maximum Subsurface Concentration (mg/kg)*	*Maximum Sediment Concentration (mg/kg)*	*Region 9 Residential PRG (mg/kg)*	*Region 9 Industrial PRG (mg/kg)*	*Literature Backgroun d (mg/kg)*
Aluminum	*NA*	*NA*	*13,700*	*76,000*	*100,000*	*10,000 – 300,000*[1]
Arsenic	*10.9*	*20.2*	*31.1*	*0.39*	*1.6*	*0.1 – 97*[2]
Chromium	*NA*	*NA*	*45.1*	*210*[3]	*450*[3]	*1 – 2,000*[2]

Parameter	Maximum Surface Concentration (mg/kg)	Maximum Subsurface Concentration (mg/kg)	Maximum Sediment Concentration (mg/kg)	Region 9 Residential PRG (mg/kg)	Region 9 Industrial PRG (mg/kg)	Literature Background (mg/kg)
Iron	NA	NA	76,900	24,000	100,000	700 – 550,000(1)
Manganese	114	NA	1,640	1,800	20,000	100 – 4,000(1)
Thallium	0.69	0.75	7.1	5.2	68	0.1 -- 12

1 – Dragun, 1988. The Soil Chemistry of Hazardous Materials. Hazardous Material Control Research Institute, Silver Spring, Maryland.
2 – U.S. EPA Region 9 Preliminary Remedial Goal Table, October, 2002.
3 – The PRG presented for chromium assumes a 1:6 ratio of hexavalent chromium to trivalent chromium. The PRG for hexavalent chromium was used in the selection of COPCs.
NA - Not Applicable

"The PRGs presented for aluminum, iron, manganese, and thallium are based on the potential for non-carcinogenic health effects (the values are 10 times the COPC screening levels used in this HHRA). The maximum detected concentrations of aluminum and manganese are less than their respective residential and industrial PRGs. The maximum detected concentration of aluminum is one-fifth of the residential PRG and one-seventh of the industrial PRG. The maximum detected concentration of manganese is 90 percent of the residential PRG and one-twelve of the industrial PRG. The maximum detected concentrations of iron and thallium exceed their residential PRGs but are less than their industrial PRGs. The maximum detected concentration of iron is approximately 3 times its residential PRG and 75 percent of its industrial PRG. The PRG for iron is actually based a recommended daily intake for iron. Consequently, an exceedance of the PRG for iron is not a definitive indication of the potential for adverse non-cancer health effects. The maximum detected concentration of thallium slightly exceeds its residential PRG and is one-ninth of the industrial PRG. The PRGs presented for arsenic and chromium are based on the potential for cancer effects and represent the 1×10^{-6} (one-in-one-million) cancer risk level (these values are the COPC screening levels used in this HHRA). PRGs representing the 1×10^{-5} and 1×10^{-4} cancer risk levels would be 10 and 100 times the values, respectively, presented for the 1×10^{-6} cancer risk level. Consequently, the maximum detected concentrations of chromium and arsenic do not exceed the 1×10^{-6} and 1×10^{-4} cancer risk levels, respectively. Additionally, the concentrations of metals in soil and sediment are within the background ranges reported in literature.

"Cesium-137, lead-210, potassium-40, radium-226, and thorium-228 were detected in soils and/or sediments at concentrations exceeding the conservative screening levels established for COPC selection but were not selected as COPCs because study area concentrations did not exceed background concentrations. The following table provides a qualitative evaluation of the radionuclides by comparing maximum detected concentrations to the U.S. EPA SSLs for radionuclides in soil:

Parameter	Maximum Surface Concentration (pCi/g)	Maximum Subsurface Concentration (pCi/g)	Maximum Sediment Concentration (pCi/g)	SSL (pCi/g)	Literature Background (pCi/g) [1]	
					Surface Soil	Subsurface Soil
Cesium-137	0.09	NA	NA	0.061	0.49	0.28
Lead-210	0.52	0.65	NA	0.063	NA	NA
Potassium-40	9.94	9.23	NA	0.14	16	16
Radium-226	1.68	1.9	NA	0.013	1.5	1.5
Thorium-228	0.73	0.781	1.49	0.16	1.6	1.6

1 – Background Concentrations of Naturally Occurring Inorganic Chemicals and Selected Radionuclides in the Regional Gravel Aquifer and McNairy Formation at the Paducah Gaseous Diffusion Plant, Paducah, Kentucky. Risk Assessment Information System Internet site. http://risk.lsd.ornl.gov/rap_hp.shtml.

NA Not Applicable

"The PRGs presented for radionuclides are based on the potential for cancer effects and represent the 1 x 10^{-6} (one-in-one-million) cancer risk level (the values are the COPC screening levels used in this HHRA). PRGs representing the 1 x 10^{-5} and 1 x 10^{-4} cancer risk levels would be 10 and 100 times the values, respectively presented, for the 1 x 10^{-6} cancer risk level. The maximum detected concentrations of cesium-137 and thorium-228 do not exceed the 1 x 10^{-5} cancer risk level, and the maximum detected concentrations of lead-210 and potassium-40 do not exceed the 1 x 10^{-4} cancer risk level. The maximum detected concentrations of radium-226 slightly exceed the 1 x 10^{-4} cancer risk level. Additionally, with the exception of radium-226, the concentrations of radionuclides in soil and sediment are within the background ranges reported in literature. The maximum MGBG radium-226 concentration exceeds the literature background concentration by less than 7 percent; the literature background would also exceed the cancer risk level of 1 x 10^{-4}.

"Thallium was detected in the ground water at concentrations exceeding the conservative screening levels established for COPC selection but was not selected as a COPC because study area concentrations did not exceed background concentrations. The following table provides a qualitative risk evaluation of thallium by comparing the maximum detected concentrations to the U.S. EPA Region 9 PRGs for tap water and the Federal SDWA MCLs:

Parameter	Ground Water Concentration (µg/L)	Region 9 PRG (µg/L)	Federal MCL (µg/L)
Thallium (Total)	5.1	2.4	2
Thallium (Dissolved)	7.7	2.4	2

"The PRG for thallium is based on the potential for non-cancer effects. The maximum detected concentration of total thallium is twice the PRG, and the maximum detected concentration of dissolved thallium is three times the PRG."

SPECIFIC COMMENTS

Comment HHRA-SC-1:

Section 3.4.2, Background Comparisons. The RFI Report does not clearly indicate what specific background concentrations were used for comparison to site concentrations. For example, the RFI Report indicates that there are 67 soil samples, but not all samples were analyzed for all constituents. In addition, if statistical comparisons to background were made, the RFI should present a discussion of the statistical analysis that was conducted and the results of the test. In order to clarify what background concentrations were applied, revise the RFI Report to include a summary table for each medium and constituent of the background concentrations used in determining whether a constituent is a COPC. In addition, this table should also present the detection frequency for each constituent.

Response to Comment HHRA-SC-1:

Background comparisons were only conducted for metals, including the targeted radionuclides. This is explained in Section 3.4.2 of the draft RFI report. Section 3.4.2.1 of the draft RFI report states that the soil background data are summarized in Table 3-13 for gamma spectrometric concentrations and in Appendix F for chemical concentrations (refer to Appendix F Tables F-6, F-7, and F-8). These tables group the background data according to the three soil types encountered at the MGBG, and summary statistics are presented for each metal. These tables also provide frequencies of detection for each chemical. Multiple references are made throughout Section 3.4.2 to Appendix F of the draft RFI report, which is where the statistical approach to background comparisons is described. Appendix F includes a description of the statistical background comparison process, a presentation of the applicable mathematical equations, the results of the statistical calculations, and a summary of the background data used for those comparisons. It also includes hand-written example calculations.

To render individual background chemical concentrations more available to readers of this RFI report, Tables E-1 and E-2 of Appendix E have been revised to include the individual analyte results for each background samples. The revised tables also now include the soil group numbers for each soil sample. Revised Tables E-1 and E-2 are provided as Attachments 5 and 6 to these comment responses.

Comment HHRA-SC-2:

Section 3.4.2.1, Soil. Page 3-44 discusses comparison of site concentrations of thorium-230 (Th-230) to site background concentrations. However, background consisted of only one sample. One background sample does not provide sufficient data to determine the natural levels and natural variations of Th-230 in background soils at the site. The RFI Report does not and cannot provide justification that the one sample collected represents the minimum or the maximum concentration of the natural range of background concentrations. Based on the lack of sufficient data to determine whether or not the Th-230 concentrations are within background levels, at a minimum (including external radiation), the risks to Th-230 should be addressed quantitatively in the Uncertainty and Risk Characterization sections of the risk assessment. Revise the RFI Report to include a discussion of the risks to each of the receptors based on external exposure to Th-230 in the Uncertainties section of the risk assessment.

Response to Comment HHRA-SC-1.

There is no need to include Thorium-230 in the quantitative risk assessment because the detected thorium-230 concentrations are within normal background levels. While it is true that statistical background evaluations cannot be made with just one background value, a statistical comparison is not needed in this case. A calculation has been added to the end of Section 3.4.2.1 to demonstrate rather conclusively that the observed Thorium-230 concentrations represent only naturally occurring Thorium-230. The added calculation is provided as Attachment 7 to these responses. It is noteworthy that Additional U.S. EPA Comment 2 provided on May 6, 2003 concerning naturally occurring thorium concentrations in soil corroborates this calculation. In addition, please refer to the response to Comment SC-8.

Comment HHRA-SC-3:

Section 3.4.4, Additional Evaluation of Soil Arsenic Concentrations. This section discusses the arsenic levels in soil at the site. It is unclear whether a defensible statistical analysis was conducted. According to NSWC Crane, a statistical analysis of site arsenic concentrations to background indicated elevated levels of arsenic. Thus, a site attribution analysis using a box-and-whisker plot was conducted to compare the two data sets. The result of the interpretation of the plots was that arsenic levels at the site are a subset of natural background levels. Interpretation of box-and-whisker plots is subjective. However, based upon review of Figure 3-2, Evaluation of Surface Soil Arsenic Concentrations, it does appear that the site levels of arsenic are significantly elevated. Upon review of Figure 3-3, Evaluation of Subsurface Soil Arsenic Concentrations, there is concurrence that for Group 8 soils, arsenic is not present at levels significantly elevated from background. However, for Group 9 soils, no conclusions can be drawn as there is only one value for comparison. Even if Group 9 soils were compared to Group 8 soil background levels, arsenic is significantly higher in onsite locations than background. Based upon these conclusions, the RFI Report does not provide adequate justification for exclusion of arsenic as a COPC in both surface soil and Group 9 subsurface soil. Revise the RFI Report to include arsenic as a COPC in surface soil and Group 9 subsurface soil.

Response to Comment HHRA-SC-3:

The physical connection between soil concentrations and the soils they represent should not be overlooked. The reviewer argues that, based on Figure 3-2 of the draft RFI report, the MGBG surface soil arsenic concentrations are elevated compared to the background concentrations. By that argument, Figure 3-3, which shows relatively low arsenic concentrations, would demonstrate that the MGBG subsurface soils are cleaner than subsurface background soil. This, of course, is a theoretical impossibility. Instead, Figures 3-2 and 3-3 show that the soil arsenic distributions at the MGBG differ slightly from those represented by the background data. Indeed, one should not expect that data collected over many hundreds of acres during the base-wide background investigation will represent *exactly* the same distribution as data collected over just 2 acres (i.e., the MGBG investigation). On the other hand, the data collected over hundreds of acres could reasonably be expected to *include* data collected from a smaller area, and that is what was observed for both surface soil and subsurface soil Group 8. With that in mind, Figures 3-2 and 3-3 show arsenic concentrations for surface and subsurface soil Group 8 at NSWC Crane to be within background levels. The arsenic distributions in Figures 3-2 and 3-3, when considered in light of the geographic areas associated with the two different data sets, represent sub-populations of the overall base-wide background data.

Consider also that there were 15 surface soil data values in the base-wide background data set, but there were 20 MGBG surface soil values. The 33 percent greater number of MGBG values yields a significant likelihood that the greater maximum value would appear in the MGBG data set. This is what was observed. This situation is more pronounced for Soil Group 8, which had an even greater disparity between the number of data values in the background and site data sets. Soil Group 9 appears to exhibit the same pattern, although the single background value for this Soil Group precludes such a conclusion. Soil Group 9 will be discussed further, below.

Consider that soil contamination is the augmentation of naturally occurring soil chemical concentrations. If the observed MGBG surface soil data represent arsenic contamination, Figure 3-2 suggests that the arsenic selectively contaminated only the background surface soils of lesser arsenic concentration. The result is a compressed, but slightly elevated, data distribution with a maximum value approximately the same as the maximum background value. This would be a most remarkable situation but it is unquestionably outside the realm of plausibility. Furthermore, the rather uniform spatial distribution of arsenic concentrations across the MGBG corroborates this interpretation. All of this is explained in the draft RFI report discussions (Section 3.4.4) on arsenic concentrations.

Only four Soil Group 9 samples were collected from MGBG soil borings 01SB01 through 01SB20. Each of those samples was collected from a depth of 6 to 10 feet, and the four sample locations are well separated. The arsenic concentrations in the 2- to 6-foot depth of the same borings range from 3.4 to 4.7 mg/kg, clearly representing no contamination. The box plots do show that the Soil Group 9 MGBG sample results are elevated relative to the single background concentration. However, arsenic concentrations of two of the four MGBG samples were comparable to the arsenic concentration of the single Soil Group 9 background sample and the Soil Group 8 samples. This leaves just two locations at the deepest sampled soil interval that could be contaminated with arsenic. Even if this would represent contamination, the concentrations and limited spatial extent of the contamination would not warrant continued investigation. Rather than include arsenic as a COPC when the evidence is very strong that it is not a site contaminant, the following additional discussion has been inserted into Section 7.6.1 (it is now the third paragraph under ***"Chemicals Potentially Attributable to Background"***):

"Arsenic in subsurface soil (Section 3.4.4 and Tables 4-10 and 4-11) was also eliminated from the quantitative risk assessment on the basis of background comparisons. Because the background and site data sets for subsurface soil are relatively small, especially for Soil Group 9 samples, there is more uncertainty associated with the elimination of arsenic as a COPC in subsurface soil than in surface soil. To more fully characterize the effects of omitting arsenic from the quantitative risk assessment, risks for the only receptor evaluated for exposure to combined surface/subsurface soil, the construction worker, were recalculated with arsenic included. The results of the recalculations were as follow: the total HI for the construction worker (RME) increased from 0.28 to 0.37 and the ILCR increased from 4.2×10^{-9} to 5.8×10^{-7}. The HI and ILCR are less than U.S. EPA benchmarks and therefore, the effects of omitting arsenic in subsurface soil from the quantitative risk assessment are likely to be minimal. Even if the maximum detected concentration in subsurface soil (20.2 mg/kg) was used to calculate risks, the total ILCR (1.4×10^{-6}) would only slightly exceed the lower limit of the U.S. EPA's risk management range, 1.0×10^{-6}. Therefore, eliminating arsenic as a COPC was justifiable."

Comment HHRA-SC-4:

Section 3.4.7, Additional Thorium-230 Evaluation for Soil. This section discusses the justification for exclusion of Th-230 as a site contaminant. While it is agreed that Th-230 is probably not above background levels, this is not based on the results of the statistical analysis but rather the historical records, spacial distribution and upgradient concentrations. It appears that the Wilcoxon Rank Sum (WRS) test was applied for comparing the site concentrations to background. However, with the WRS test and other nonparametric tests, more than one sample is required for there to be any validity to the results of the statistical test. The WRS test was conducted using only one background sample, rendering the results of little to no use. In addition, the RFI Report does not address the level of Type I and Type II uncertainties that were applied, how the statistic test was determined, nor does it discuss the power of the test. Revise the RFI Report to discuss the validity of the test, uncertainties and the power of the test.

Response to Comment HHRA-SC-4:

Section 3.4.7 of the draft RFI report establishes that the thorium-230 background comparison was not statistical. In this case there was no need for statistical comparisons and the discussion in the draft RFI report is viewed to be adequate. The WRS test for thorium (except thorium-230) and other metals whose concentrations were compared statistically to background concentrations used more than one background value for those comparisons. This is indicated in Tables F-6, F-7, and F-8, where the denominators of the fractions in the "Frequency of Detection" column are greater than unity. Note that statistical comparisons were not used for Soil Group 9 and the associated discussions in the draft RFI report are viewed to be adequate. Appendix F describes the Type I error rate as 0.05 (or 5 percent significance) and describes the background comparison process in detail. Please refer to the discussion in Section 3.4.7 of the draft RFI report and also please refer to the response to Additional EPA Comment 6. No change has been made in response to this comment. However Type II error rates have been calculated and are presented as Attachment 8 to these responses to comments.

Retrospective power calculations are thought by some statisticians not to be informative. Because of their controversial nature, these tables have not been included in the RFI report.

Comment HHRA-SC-5:

Section 4.1, Summary of Detected Chemicals. The third paragraph on page 4-1 indicates that table entries containing a validation flag of "R" or "UR" should be viewed with caution. Section D.1.1 of the Phase III RFI Work Plan clearly states that rejected data ("R" and/or "UR" qualified data) will not be used in the risk assessment. Clarify the statement "viewed with caution" and revise the text to state that rejected data ("R" and/or "UR" qualified data) will not be used in the risk assessment. Also, clarify if any rejected data was used in the risk assessment.

Response to Comment HHRA-SC-5:

Rejected data were not used in the risk assessments. Section 3.1 states in the "definition" of each validation flag that data with UR or R validation flags are considered to be unusable. Nevertheless, sentences one and two of the third paragraph of Section 4.1 have been joined to clarify the meaning of the phrase "viewed with caution." The text now reads:

> *"Table entries containing a validation flag of R or UR represent chemicals that may or may not actually be present in the sample; analytical problems were severe enough to cause those values to be rejected for quantitative use. Data qualified in this manner are not used in the quantitative risk assessment."*

Comment HHRA-SC-6:

Section 4.0, Selection of Chemicals of Potential Concern. Table 4-6, involving screening criteria used in the selection of human health COPCs for soil/sediment, and Table 4-7, involving screening criteria used in the selection of human health COPCs for groundwater, show that 2000 U.S. EPA Region 9 tap water Preliminary Remediation Goals (PRGs) were used for screening criteria. However, U.S. EPA Region 9 has subsequently updated the U.S. EPA Region 9 PRG database (October 2002) and several of the PRGs have been modified to reflect changes in toxicity criteria. In addition, the industrial scenario PRGs have also been modified to incorporate a higher soil ingestion rate. This affects several of the PRGs listed in Table 4-6 and Table 4-7, including 1,1-dichloroethene (1,1-DCE), chloroform, tetrachloroethene, toluene, trans-1,2-dichloroethene, trichloroethene, 4-nitrophenol, cobalt, copper, and mercury. Since the date on the RFI Report is December 2002, the revised PRGs should have been incorporated. Revise the RFI Report to reflect the 2002 PRGs, or provide adequate justification as to why 2002 PRGs were not used and the influence the dated PRGs have had on COPC selection and the resultant estimation of risk and hazard.

Response to Comment HHRA-SC-6:

The Region 9 2002 PRGs were published after the risk assessment for CTO 158 was completed and before the Draft RFI report was issued. If the risk assessment were revised to reflect the changes in the Region 9 PRGs, 1,1-DCE would be eliminated as a COPC for ground

water, and cobalt would be added as COPC for ground water. No changes would occur for the other constituents listed in the above comment. Even though the 2002 PRGs were not available at the time the risk assessment was completed, the most current toxicological data were used in the risk assessment calculations. For example, the current (May 2003) reference doses (RfDs) and cancer slope factors (CSFs) for 1,1-DCE and TCE were used in the risk assessment. In regard to cobalt, risks to the most sensitive receptor, the future child resident, have been recalculated to evaluate the effect of omitting cobalt from the risk assessment. The results of the recalculation indicated that the Hazard Quotient for cobalt was less than unity (0.6) and the total Hazard Index for this receptor did not change. Therefore, the results and conclusions of the risk assessment are not affected by the omission of cobalt. Based on the above discussion, the risks calculated for the MGBG would not change if the 2002 PRGs were used for COPC selection.

No changes have been made in response to this comment.

Comment HHRA-SC-7:

Section 4.0, Selection of Chemicals of Potential Concern. Table 4-8, Occurrence, Distribution, and Selection of Chemicals of Potential Concern - Direct Contact with Surface Soil, Round 1, lists the maximum concentration of thallium as 2.8 mg/kg. However, Section 3.4.5 of the RFI Report (pages 3-48 and 3-49) discusses the fact that the Round 1 thallium sample data were false positives and presents a discussion of the re-analysis and confirmation sampling to verify this. Based upon the re-analyses of the samples, it was concluded that the original thallium results were artificially elevated and that the thallium results were within background concentrations. Table 3-14, Thallium Re-analysis Results, lists the re-analysis concentration for thallium as 0.13 mg/kg. Based on this, it appears that the risk assessment and selection of COPCs should have been conducted using the revised thallium data. Clarify which data were appropriate for use in determining whether thallium is a COPC. Revise all tables and discussions, as appropriate.

Response to Comment HHRA-SC-7:

The values shown in Tables 3-14, 4-8, and 4-9 are correct. As discussed in Section 3.4.5 and as shown in Table 3-14, the value of 0.13 mg/kg was determined from the re-analysis of Sample 01SS030002. For completeness, results of the initial analyses and the re-analyses were presented in Tables 4-8 and 4-9. To clarify this situation, the following explanation has been inserted after the second full paragraph of Section 4.2.2:

> *"As indicated in the footnote to Table 4-8, thallium was eliminated as a COPC because re-analyses of the samples with the greatest reported thallium concentrations (e.g., 2.8 mg/kg in Sample 01SS030002) resulted in thallium concentrations much less than the initial analyses (0.13 mg/kg in Sample 01SS030002). The results of the re-analysis indicated that concentrations of thallium at the site were within background levels. Therefore, thallium was eliminated as a COPC."*

Comment HHRA-SC-8:

Section 4.0, Selection of Chemicals of Potential Concern. Table 4-9, Occurrence, Distribution, and Selection of Chemicals of Potential Concern -Migration From Surface Soil, Round 1, lists the rationale for contaminant detection or selection as "NTX" for aluminum, arsenic, cobalt and manganese. The footnote defines "NTX" as no toxicity information. This is misleading as toxicity criteria for each of these constituents does exist. Revise the footnote for clarity indicating there is no screening level criteria but that toxicity values exist, or remove the reference of "NTX" for these constituents.

Response to Comment HHRA-SC-8:

> *"NTX" has been changed to "NS" in Tables 4-9 and 4-11 and has been defined as: "Soil Screening Levels have not been determined for these constituents."*

Comment HHRA-SC-9:

Section 4.0, Selection of Chemicals of Potential Concern. Table 4-9, Occurrence, Distribution, and Selection of Chemicals of Potential Concern -Migration From Surface Soil, Round 1, lists the U.S. EPA Generic Soil Screening Level (SSL) for Migration to Groundwater for Th-230 and Uranium-235 (U-235) as 3.3 pCi/g and 0.039 pCi/g, respectively. These values could not be verified in the reference "Soil Screening Guidance: Technical Background Document". Verify the values and reference(s) for the SSLs for Th-230 and U-235.

Response to Comment HHRA-SC-9:

The SSLs shown in Table 4-9 are correct. The value for Thorium-230 is 0.3 pCi/g (the reviewer apparently looked at the wrong line in the table) and the value for Uranium-235+D is 0.039 pCi/L. The derivation and calculation of these SSLs are provided in Appendix G-1 (Calculations of Risk-Based Concentrations and SSLs for Radionuclides) of the draft RFI report.

No changes have been made in response to this comment.

Comment HHRA-SC-10:

Section 4.0, Selection of Chemicals of Potential Concern. Table 4-12, Occurrence, Distribution, and Selection of Chemicals of Potential Concern for Groundwater, identifies 1,1-DCE as a COPC, based upon comparison to the 2000 U.S. EPA Region 9 tap water PRG of 0.046 µg/l. However, U.S. EPA has since determined that the carcinogenic data are insufficient for assessment of the carcinogenicity of 1,1-DCE through the oral route. The oral slope factor for 1,1-DCE has thus been withdrawn from the IRIS database. The 2002 PRG table has subsequently recalculated the tap water PRG based upon the oral reference dose, and lists a PRG of 340 N µg/l. It is recommended that the RFI Report be revised to reflect the most recent toxicological data for 1,1-DCE and apply the 2002 tap water PRG.

Response to Comment HHRA-SC-10:

See response to Comment HHRA-SC-6.

Comment HHRA-SC-11:

Section 4.0, Selection of Chemicals of Potential Concern. Table 4-12, Occurrence, Distribution, and Selection of Chemicals of Potential Concern for Groundwater, discounts cobalt as being a COPC. However, if 2002 tap water PRGs had been used for screening, this constituent would have been selected as a COPC. Table 4-12 lists a PRG for cobalt of 220 µg/l (based on Target Health Quotient (THQ) of 0.1), based upon the 2000 PRGs, while the 2002 PRG table provides a PRG of 730 µg/l (based on THQ of 1.0). Further, Section 5.0, Nature and Extent of Contamination, states that one-tenth of the risk-based criterion (PRG) for noncarcinogens will be used for screening COPCs. Therefore, in accordance with the 2002 PRGs and the methodology outlined in Section 5 of the RFI Report, the screening value for cobalt (based on a THQ of 0.1) should be 73 µg/l. The maximum detected concentration for cobalt (total metals) is 126 µg/l, which exceeds the appropriate screening value of 73 µg/l. Revise the RFI Report to reflect the 2002 tap water PRG for cobalt (730 µg/l based on THQ of 1.0, or 73 µg/l based on THQ of 0.1), and include cobalt as a COPC. In addition, revise all subsequent calculations and discussions.

Response to Comment HHRA-SC-11:

See response to Comment HHRA-SC-6.

Comment HHRA-SC-12:

Section 5.1, Surface Soil, Round 1- VOCs. Page 5-5, first paragraph, states that 2-butanone is less toxic than methylene chloride and was not selected as a COPC, thus 2-butanone is not addressed further in the RFI Report. The relative toxicity of 2-butanone to methylene chloride is not relevant in determining whether 2-butanone is a COPC. Clarify the RFI Report text, as it appears that 2-butanone was not selected as a COPC solely since it is less toxic than methylene chloride.

Response to Comment HHRA-SC-12:

The first paragraph on page 5-5 has been rewritten as follows:

> *"2-butanone, carbon disulfide, and toluene were not selected as COPCs because their maximum detected concentrations were less than the risk-based screening concentrations, and these constituents are not addressed further in the report (note that carbon disulfide and toluene were detected at concentrations close to their respective detection limits). Methylene chloride was the only VOC selected as a COPC in surface soil, and its extent is unbounded." This chemical is a common laboratory contaminant."*

Comment HHRA-SC-13:

Section 5.1, Surface Soil, Round 1- Metals. Page 5-7, first paragraph, states that essential nutrients are not discussed any further. While Risk Assessment Guidance for Superfund (RAGS, U.S. EPA 1989) does state that essential nutrients do not need to be considered in the quantitative risk assessment, RAGS also states that "prior to eliminating such chemicals from the risk assessment, they must be shown to be present at levels that are not associated with adverse health effects." Typically, upper intake levels (ULs), as derived by the United States Department of Agriculture (USDA) Food Safety and Inspection Service and the National Academy of Science Institute of Medicine, Food and Nutrition Board recommended daily allowances (RDAs) are used to evaluate essential nutrient toxicity. Revise the RFI Report to include an adequate discussion regarding the elimination of essential nutrients.

Response to Comment HHRA-SC-13:

The following expanded discussion of essential nutrients has been inserted as the second paragraph of Section 4.2.1 under "**Essential Nutrients and Chemicals without Toxicity Criteria**":

> *"Sodium was detected in groundwater at a maximum concentration of 117 mg/L and an average concentration of 41.6 mg/L. Assuming that adults ingest 2 liters of water per day and children ingest 1.5 liters per day, this corresponds to a maximum daily intake of 234 mg/day for adults and 175.5 mg/day for children. These intake rates are below the recommended daily allowances (RDAs) for sodium-sensitive adults (500 mg/day) and for children (225-300 mg/day). Therefore, the concentrations of sodium in groundwater at MGBG would not be expected to cause adverse health effects. The EPA (USEPA, April 2002)*

recommends that "the sodium concentration in drinking water not exceed a range of 30 to 60 mg/L because of possible adverse effects on taste at higher concentrations." The EPA requires Public Water Systems that exceed 20 mg/L to notify local and State public health officials. The EPA guidance was developed for those individuals restricted to a total sodium intake of 500 mg/day and should not be extrapolated to the entire population (USEPA, April 2002). Based on EPA recommendations, the concentrations of sodium detected in groundwater at the MGBG could potentially affect sensitive individuals. However, the concentrations are more likely to affect taste and render the groundwater undrinkable. Therefore, based on taste considerations, it is unlikely that groundwater at the site would be used as a source of potable water, thereby minimizing potential health effects.

"The maximum detected concentration of calcium in groundwater at the MGBG was 344 mg/L, which corresponds to a maximum daily intake of 688 mg/day (assuming that a person drinks two liters of water per day). This intake rate is below the recommended daily allowance (RDA) for calcium (1,000 mg/day); therefore, the concentrations of calcium in groundwater at MGBG would not be expected to cause adverse health effects.

"The maximum detected concentration of potassium in groundwater at the MGBG was 15.5 mg/L, which corresponds to a maximum daily intake of 31 mg/day (assuming that a person drinks two liters of water per day). This intake rate is well below the recommended daily allowance (RDA) for potassium (2,000 mg/day); therefore, the concentrations of potassium in groundwater at MGBG would not be expected to cause adverse health effects.

"The maximum detected concentration of magnesium in groundwater at the MGBG was 250 mg/L, and the average concentration was 71.5 mg/L. These correspond to a maximum daily intake of 500 mg/day and an average intake of 143 mg/day (assuming that a person drinks two liters of water per day). The maximum intake rate slightly exceeds the range of recommended daily allowances (RDAs) for magnesium, 310 mg/day for women to 400 mg/day for men. The maximum intake rate exceeds the RDAs in only 1 of 37 groundwater samples. Note that the RDA is not an indicator of adverse health effects but an estimated safe and adequate daily dietary intake expected to satisfy the needs of 50 percent of the people in a given age group. Based on this discussion and the fact that the groundwater at the MGBG is likely not potable because of sodium levels, the concentrations of magnesium in groundwater at MGBG would not be expected to cause adverse health effects.

"An evaluation of essential nutrient levels in soil and sediment samples collected at MGBG indicates that maximum daily intakes for these media would be significantly less than RDA values."

Comment HHRA-SC-14:

Section 5.1, Surface Soil, Round 1- Radionuclides. Page 5-7, last paragraph, states that all radionuclide concentrations in surface soils were within background concentrations, and that no radionuclides were selected as COPCs. However, Table 4-9, Occurrence, Distribution, and Selection of Potential Chemicals of Concern - Migration from Surface Soil (page 2 of 2), identifies Th-230 as a COPC based on potential migration to groundwater from surface soil. Correct this apparent contradiction and revise the RFI Report accordingly. In addition, modify all subsequent discussions and calculations, as warranted.

Response to Comment HHRA-SC-14:

As discussed in Sections 3.4.7 and 4.2.2, Thorium-230 was eliminated as a COPC on the basis of background comparisons. The bolding has been removed from Thorium-230 in Table 4-9, and the following footnote has been added to Tables 4-8, 4-9, 4-10, and 4-11:

> *"The rationale for the elimination of Thorium-230 on the basis of background comparisons in presented in Section 3.4.7."*

Comment HHRA-SC-15:

Section 7.3.3, Exposure Point Concentrations. This section discusses the approach taken to determine the exposure point concentrations (EPCs). The text indicates that for data sets with fewer than ten samples, the EPC will be defined as the maximum detected concentration; while for data sets with greater than ten samples, conventional statistical methods would be applied in determining the 95-percent upper confidence limit (UCL), to be used as the EPC. Upon reviewing Tables 3.1 through 3.3 of Appendix G, it appears that for surface soil and subsurface soil, sufficient samples were available to determine the distribution of the available data set using the Shapiro-Wilk test and the 95% UCL for use as the EPC. For groundwater, the maximum detected concentration was used as the EPC. Clarify how the EPCs for all media were determined. In addition, Section D.2.3, Exposure Point Concentrations, of the Phase III RFI Work Plan indicates that detailed sample calculations and the general methodology for the statistical evaluation for determining the distribution and UCL for each data set will be provided in the RFI Report. The RFI Report does not appear to contain this information. Revise the RFI Report to include detailed sample calculations and the general methodology for the statistical evaluation for determining the distribution and UCL for each data set.

Response to Comment HHRA-SC-15:

Sample statistical calculations have been added to Appendix G-3a and are provided as Attachment 9 to these responses to EPA comments. The following reference to the sample calculations has been added to the end of the second paragraph in Section 7.3.3:

> *"Example calculations for the distribution of the data sets and UCLs are provided in Appendix G-3."*

Regarding the EPCs, a detailed explanation of the EPC determination for the media evaluated in the risk assessment is provided in the bulleted list at the end of Section 7.3.3.

Comment HHRA-SC-16:

Section 7.3.4.2, Dermal Contact with Soil. This section discusses the rationale for selecting the skin surface areas (SAs) and soil adherence factors (AFs) for each of the receptors. It is noted that more recent sources for the SAs and AFs were used in the risk assessment and that this represents a deviation from the values presented in Table D-3 of the Phase III RFI Work Plan. While the values for SA and AF as presented in the risk assessment are acceptable, the text should be revised to note the deviation from the Phase III RFI Work Plan.

Response to Comment HHRA-SC-16:

The following sentence has been added after the first sentence in the second paragraph of Section 7.3.4.2:

> *"Note that the skin surface areas (and other dermal exposure factors) used in the risk assessment represent recent changes in U.S. EPA dermal guidance and may differ from the values specified in the QAPP (Tetra Tech NUS, Inc., 2001b)."*

Comment HHRA-SC-17:

Section 7.3.4.4, Dermal Contact with Ground Water. Page 7-16 presents an equation which was used to assess exposures resulting from dermal contact with water, which is applicable for organics. This equation includes an FA term which is defined as the "chemical specific fraction absorbed." However, a "chemical specific fraction absorbed" quotient is not included in the equation provided on page D-31 of the Phase III RFI Work Plan. Verify that the equation as applied for the risk assessment is correct, and revise the RFI Report to discuss this deviation from the Phase III RFI Work Plan. In addition, modify any subsequent calculations, as warranted.

Response to Comment HHRA-SC-17:

The equation used to evaluate dermal exposure to water (including the FA term) is an EPA update to risk assessment methodology and is presented in the new dermal guidance (RAGS-Part E). This change is addressed by the response to Comment HHRA-SC-16.

Comment HHRA-SC-18:

Section 7.3.4.6, Inhalation of Volatiles in Ground Water. Page 7-17 presents the Foster and Chrostowski (1987) equation for determining the mass transfer coefficient (K). However, there appears to be a discrepancy in the numerator between the equation as presented in the Phase III RFI Work Plan and in the RFI Report. Verify that the equation as presented and applied in the RFI Report is correct. Modify any calculations as warranted. In addition, provide a copy of the referenced Foster and Chrostowski (1987) paper, as an Appendix to the RFI Report.

Response to Comment HHRA-SC-18:

The following sentence has been added to the end of the first paragraph of Section 7.3.4.6 under "Exposure of Workers to Volatiles in a Construction/utility Trench" and an Appendix G-5 has been added to the RFI report (Attachment 10 to these responses to comments):

> *The equations and calculations of the Foster and Chrostowski shower model in the risk assessment are correct. There was an error in the equation presented in Section D.2.4.7 (Appendix D) of the QAPP. No changes have been made in response to this comment. A copy of the Foster and Chrostowski model has been provided in Appendix G-5.*

Comment HHRA-SC-19:

Section 7.5, Risk Characterization. The RFI Report indicates that if the screening level risk is below a target risk of 1 x 10^{-4}, then the risk is acceptable. U.S. EPA generally considers risk-based approaches to be protective if they achieve a risk which falls within the 10^{-4} and 10^{-6} range. However, U.S. EPA's preference is for risk-based approaches that are at the more protective end of the risk range. A target risk level of 1 x 10^{-6} should be used as the point of departure in the discussion of site risks. Revise the text of the RFI Report to specifically identify and discuss those risks (chemicals and exposure routes) that exceed a target risk of 1 x 10^{-6}. For estimates of risk which fall within the risk range of 10^{-4} and 10^{-6} , U.S. EPA will make a judgment on an acceptable level of risk which may be allowed to remain *in situ*. Although the facility may make suggestions regarding remedial levels, U.S. EPA will make site-by-site determinations based on the level of conservatism and degree of uncertainty inherent in the quantitative and qualitative assessments of risk.

Response to Comment HHRA-SC-19:

The requested information is provided in Table 7-11 of the draft RFI report. Additionally, Tables 7-9 and 7-10 have been revised to include this information and are provided in Attachment 11 to these responses to comments; however, according to the project decision rules, human health risks less than 1X10^{-4} 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-20:

Appendix G-1, Calculations of Risk-Based Screening Concentrations and SSLs for Radionuclides. This appendix provides the output files from the U.S. EPA Soil Screening Guidance for Radionuclides Model. For each of the radionuclides, it appears that the model default parameters were used for determination of the SSLs. Revise the RFI Report to discuss the effect of applying the default values to the NSWC Crane site. This discussion should be included in the uncertainty section of the risk assessment and address the potential for over/under-estimation of the SSLs based solely upon default values.

Response to Comment HHRA-SC-20:

Uncertainties associated with the use of default exposure factors are presented in Section 7.6.2, and a discussion of limitations associated with the use of the SSLs is included in Appendix G-1. As indicated in Section 7.6.2, the U.S. EPA specifies the use of the 95th percentile for most parameters. Therefore, the selected values for the RME receptor represented an upper bound of the observed or expected habits of the majority of the population. A discussion of the uncertainties associated with some modeling parameters used in the SSL calculations (e.g., soil porosity or soil bulk density) could be added to the uncertainty discussion. However, because all of the radionuclides for which SSLs were developed were eliminated as COPCs on the basis of background comparisons, this additional discussion would not add value to the RFI report.

No change has been made to the RFI report in response to this comment.

Comment HHRA-SC-21:

Appendix G-1, Calculations of Risk-Based Screening Concentrations and SSLS for Radionuclides. The adult-only intake rate for soil ingestion was set as 50 mg/kg. However, the soil ingestion rate for adults should be consistent with the soil ingestion rate applied throughout the risk assessment and to be consistent with U.S. EPA's Exposure Factors Handbook (1997), Supplemental Guidance for Developing Soil Screening Levels for Superfund Sites (2001), and the Region 9 PRGs. Revise the SSL model inputs to reflect an adult-only soil ingestion rate of 100 mg/day. Revise all SSL calculations and all subsequent calculations and determinations, as necessary.

Response to Comment HHRA-SC-21:

The adult-only SSLs were not used in the risk assessment. The Adult-only SSls are automatically calculated and printed from the U.S. EPA website with the residential age-adjusted SSLs, also obtiained from the EPA web site. Because the adult-only values were not used, it is not necessary to revise any tables or calculations in the risk assessment. No change has been made to the RFI report in response to this comment.

MINOR COMMENTS

Comment HHRA-MC-1:

Section 4.0, Selection of Chemicals of Potential Concern. Tables 4-8 through 4-11 do not show the exact background values used for screening and only identify whether concentrations are or are not above background. Revise the tables to include the background concentrations used for screening.

Response to Comment HHRA-MC-1:

Please refer to the response to Comment HHRA-SC-1.

Comment HHRA-MC-2:

Section 4.0, Selection of Chemicals of Potential Concern. Table 4-8, Page 2, indicates that the concentration of Th-230 is above background, however this contradicts Section 3.4.7 which indicates that the concentration of Th-230 is below background. Revise the table to include a footnote referencing Section 3.4.7, clarifying why Th-230 is considered below background concentrations.

Response to Comment HHRA-MC-2:

Table 4-8 has been revised to indicate that the Thorium-230 concentration is less than background, and the following footnote has been added to Tables 4-8, 4-9, 4-10, and 4-11:

"The rationale for the elimination of Thorium-230 on the basis of comparisons to background concentrations is presented in Section 3.4.7."

ECOLOGICAL RISK ASSESSMENT COMMENTS

GENERAL COMMENTS

Comment ERA-GC-1:

The methodology presented combines several aspects of a screening-level risk assessment (SERA) with methods that are more appropriately conducted during a baseline ecological risk assessment (BERA). Furthermore, the objectives of the SERA have not been clearly established, and the scientific management decision point (SMDP) that is recommended to be presented at the end of the SERA in both the 1997 U.S. EPA guidance entitled *Ecological Risk Assessment Guidance for Superfund: Process for Designing and Conducting Ecological Risk Assessments (EPA/540/R-97/006)* and the process outlined in Figure 8-1, Navy Tiered Approach, has not been clearly presented. Revise the RFI Report to include a clear presentation of the SMDP that culminates Steps 1 and 2 of the SERA as is outlined in the U.S. EPA guidance referenced above. In addition, given the data gaps and issues associated with the sampling methodology, selection of analytical parameters, selection of assessment endpoints and receptor species which are discussed in the following specific comments, the conclusions of the SERA must be reviewed and revised as appropriate.

Response to Comment ERA-GC-1:

In accordance with U.S. EPA and Navy Ecological Risk Assessment Policy, an SMDP can be made after Step 2 of the ecological risk assessment to determine the need for additional evaluation of the data. However, it is very rare that a site can exit the ERA process after only the screening steps because the chemical concentrations will almost always be greater than the screening levels. Therefore, the first step of the BERA (the Step 3a re-evaluation) is usually conducted immediately after the SERA and included in the same report as the SERA to expedite the ERA process. The second paragraph in Section 1.4.3 of the U.S. EPA-approved QAPP (May, 2001) states that the SERA will consist of the first two of eight steps required by the U.S. EPA guidance (1997; 1998) and Step 3a (the first step of the BERA) and the Navy Policy for Conducting Ecological Risk Assessments (1999). Step 3a is included directly after Step 2 and consists of refining the list of COPCs that were retained following Steps 1 and 2. Steps 3b through 7 are conducted if warranted, while Step 8 is incorporated throughout the ERA process. This information is presented in Section 8.1 of the RFI report.

An SMDP was prepared for this draft RFI report based on comments from the U.S. EPA concerning other NSWC Crane RFI reports, and it was included in this draft RFI report as Section 8.5. The Navy believes that the SMDP includes sufficient information required to make the determination to proceed with the risk assessment.

No change has been made in response to this comment.

Comment ERA-GC-2:

The screening approach includes a comparison to "alternative benchmarks" (Section 8.6.1) and presents the alternative benchmarks in Appendix H.4. The alternative benchmarks are ultimately used in the Step 3a refinement process in order to provide justification for eliminating COPCs that were found to be above Region 5 Environmental Data Quality Levels (EDQLs) and site background. That is those COPCs which had an ecological effects quotient (EEQ) greater than 1.0. In the event that a particular COPC concentration was less than the alternative benchmark, then dose-modeling to evaluate upper trophic level birds and mammals was not performed. Specific alternative benchmarks for each COPC identified in Tables 8-1 and 8-2 are discussed in Sections 8.6.1.1 and 8.6.1.2. The text indicates that a comparison to EDQLs and alternative benchmarks includes assessment of terrestrial birds and mammals. However, in general, a review of the alternative benchmarks indicates that they are most often associated with the protection of invertebrates or plants and not associated with upper trophic level mammals. Revise the RFI Report to address this issue.

Response to Comment ERA-GC-2:

The Navy agrees that the alternative benchmarks are associated with the protection of invertebrates and plants and are not associated with upper trophic level mammals. However, it is not clear where the text indicates that the comparison to alternative benchmarks includes the assessment of terrestrial birds and mammals. The third sentence in the first paragraph of Section 8.6.1 notes that the following subsections discuss whether a contaminant that was retained as a COPC is retained as a COC based on risks to soil invertebrates, terrestrial vegetation, and/or benthic invertebrates. The only mention of upper trophic level mammals is the last sentence in Section 8.6.1, which indicates that COCs retained based on risks to upper trophic level receptors are then further evaluated through food-chain modeling. (The references to Section 8.5.1.1, 8.5.1.2, and 8.5.2 in the last sentence of this section have been changed to 8.6.1.1, 8.6.1.2, and 8.6.2). Because the referenced paragraph may be confusing, the second to last sentence in the first paragraph in Section 8.6.1 has been revised as follows, and the last sentence has been deleted:

> *"The following subsections discuss whether chemicals that were initially retained as COPCs are further retained as final Chemicals of Concern (COCs) for soil invertebrates and terrestrial vegetation (Section 8.6.1.1) and benthic invertebrates (Section 8.6.1.2)."*

SPECIFIC COMMENTS

Comment ERA-SC-1:

Section 4.0, Selection of Chemicals of Potential Concern. Section 4.3 discusses the selection of chemicals of potential concern for ecological risk (Page 4-11, first paragraph). Constituents were selected as COPCs if maximum detected concentrations were greater than screening levels and also exceeded background concentrations (inorganics and radionuclides). However, U.S. EPA policy no longer supports excluding COPCs from the risk assessment based on a comparison to established background. (Refer to the May 1, 2002 OSWER guidance, *Role of Background in CERCLA Cleanup Program (OSWER 9285.6-07P)* and *The Role of Screening Level Risk Assessment and Refining Contaminants of Concern in Baseline Ecological Risk Assessments dated January 24, 2001*). Naturally-occurring analytes present at concentrations that exceed risk-based criteria should be included in the quantitative estimates of risk and hazard. Risk and hazard levels attributable to background concentrations should be discussed in the risk characterization. Revise the RFI Report accordingly.

Response to Comment ERA-SC-1:

The process for selecting ecological COPCs, as described in the U.S. EPA-approved RFI QAPP, was followed. The QAPP allows for eliminating inorganic chemicals (more specifically, metals) for consideration as chemicals of potential ecological concern based on a comparison of their site concentrations to background concentrations. Therefore, those chemicals were not included in the quantitative estimates of risks and hazards. However, the following discussion of chemicals eliminated due to background comparisons has been included as the second paragraph in Section 8.7.4, Risk Characterization:

> *"Background comparisons were used in the selection of COPCs for inorganics and radionuclides in environmental media. Only chemicals with detected concentrations greater than the background concentrations and that also exceeded the screening levels were retained as COPCs in surface soil and sediment. Tables 4-15 and 4-16 indicate the chemicals that were not retained as COPCs in surface soil and sediment, respectively, because the site concentrations did not exceed the background concentrations. There may be non-site-related risks associated with some of those chemicals because many of them were detected at concentrations that exceeded their respective EDQLs. However, in accordance with the EPA-approved RFI QAPP, these risks were not quantified as part of this ERA."*

Comment ERA-SC-2:

Section 8.2.1, Environmental Setting. The RFI Report provides a discussion of the habitat types and species occurring at the base and in the vicinity of the MGBG. However, no species distribution maps or land coverage maps involving habitat types have been included in the RFI Report. Maps should be included to help visualize the site from an ecological perspective. In addition, the RFI Report states (last paragraph on page 8-3) that the bird population includes a number of state or federal threatened, endangered, or species of special concern whose home ranges could include the site. Also, the RFI Report further states that the Indiana bat, a federally endangered species, is known to forage at the NSWC Crane facility. Distribution or range maps should be provided for these species since they are of special concern. Revise the RFI Report to include range maps and/or species distributions, as well as habitat coverage map(s).

Response to Comment ERA-SC-2:

NSWC Crane does not have species distribution maps or land coverage maps involving habitat types for NSWC Crane or the MGBG. Also, NSWC Crane does not have distribution or range maps for State or federal threatened or endangered species or species of special concern, with the exception of a map generated as part of a mist net and radiotelemetry survey conducted at NSWC Crane. That map shows Indiana bat capture locations and has been included as Figure 8-2 of the MGBG RFI report (Attachment 12, herein). Subsequent figure titles and figure call-outs were adjusted for the addition of Figure 8-2 (adjustments to figure callouts are not shown in these responses to comments). In lieu of species distribution and land coverage maps, the following sentence has been added to the third paragraph in Section 8.2.1.2 of the report:

> *"Figures 1-3, 1-4, 1-7, and 1-19 are site photographs that depict the habitats located at the MGBG."*

Additionally, the following text has been added as the last subsection in Section 8.2.1.2 to provide more information regarding the potential for the existence of the threatened or endangered species at SWMU 01:

> *"<u>Threatened and Endangered Species</u>*
>
> *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 and threatened species and species of special concern for the facility were identified. This was accomplished by the compilation of a large amount of information on species present at NSWC Crane. Information included in the Endangered Species Management Plan was obtained from studies and surveys conducted by the Navy and other agencies and groups (such as research institutions).*
> *Numerous species of wildlife, including some federal and State threatened and endangered species, were located throughout NSWC Crane including those mentioned in Section 8.2.1.1. Figure 8-2 presents capture locations from the mist net and radiotelemetry survey of the Indiana bat at NSWC Crane. The bald eagle is listed as a federal threatened species; however, its presence at the MGBG is unlikely due to a lack of vast expanses of water (i.e., the preferred hunting habitat for the bald eagle) at this SMWU. "*

Comment ERA-SC-3:

Section 8.2.1.2, Site-Specific Environmental Setting. The last paragraph of page 8-4 discusses Boggs Creek and states that Boggs Creek basin drains roughly 70 percent of NWSC Crane. It is unclear from the RFI Report if Boggs Creek is directly impacted by the MGBG through groundwater seeping into surface water. Revise the RFI Report to discuss any possible surface water impacts from groundwater seeps, with a focus on Boggs Creek.

Response to Comment ERA-SC-3:

The following text has been inserted at the end of Section 8.2.3.3:

> *"As mentioned in Section 8.2.3.2, it is possible that contaminants in ground water could discharge into surface water drainage channels. Some very limited evidence of this was found in sediment sampling of shallow drainage channels near to the MGBG and is discussed in Sections 5.3, 5.4, and 6.3.2 of the draft RFI report. Section 6.3.2 indicates that there is no reason to believe that a ground water to surface water pathway exists. In addition, it is unlikely that a complete exposure pathway exists between the MGBG site and potential aquatic receptors due to the absence of permanent aquatic habitat. Boggs Creek, which is located 1.2 miles downstream of the MGBG, receives runoff from 70 percent of Crane, including the MGBG. However, low contaminant concentrations observed in MGBG drainage channel sediments, the limited volume of contaminated ground water near the MGBG, and the expected volatilization of organic chemicals from surface water in MGBG drainage channels suggest that no significant or even measurable concentrations of contaminants attributable to the MGBG could be found in Boggs Creek. The limited amount of contamination detected in any sediments would not be enough to create an unacceptable exposure condition, even if the sediment could be transported to Boggs Creek without further dilution. This is also true for surface water. The data presented on Figure 5-10 indicate that no significant contamination attributable to the MGBG is leaving the MGBG area in surface water or sediment. The MGBG contaminated ground water plume is far enough (more than a mile) from Boggs Creek as to not pose any exposure threat to Boggs Creek."*

Comment ERA-SC-4:

Section 8.2.3, Potential Sources of Contamination and Associated Exposure Pathways. The first paragraph in this section (page 8-7) states that "surface water samples were collected but were analyzed for VOCs only based on detections in Round 1 groundwater samples." This statement seems to imply that only VOCs were detected in Round 1 groundwater samples. However, the discussion in Section 5.3 indicates that in addition to VOCs, eight semi-volatile organic compounds (SVOCs), four energetic compounds, one pesticide and 24 inorganic compounds were detected in Round 1 groundwater samples. Revise the RFI Report to clarify the text. In addition, since surface water samples were only analyzed for VOCs, it is not known if additional hazardous constituents are present in surface water at concentrations which exceed risk-based levels. This represents a data gap which must be addressed in the RFI Report. Revise the RFI Report to discuss the lack of investigation of

SVOCs, energetic compounds, pesticides and inorganics in surface water at the MGBG as a data gap, or provide additional rationale for not sampling surface water for analytical parameters other than VOCs.

Response to Comment ERA-SC-4:

The data from Round 1 sampling at the MGBG was discussed with U.S. EPA Region 5 prior to implementing the Round 2 sampling. The media to be sampled and the analytes to be measured in Round 2 were presented in those discussions. A technical memorandum dated March 13, 2002 and outlining the Round 1 preliminary results was submitted to U.S. EPA Region 5 as the focal point for those discussions. Table 4 of the Round 2 sampling plan, also developed with the knowledge of U.S. EPA Region 5 indicated that the surface water samples (if collected) would only be analyzed for VOCs and field parameters, including parameters useful to support the evaluation of natural attenuation as a potential remedial action.

Despite the situation described above, the following discussion has been added as the fourth paragraph under Section 8.7.2:

> *"No surface water resources exist at the MGBG site except in times of heavy rain events. Proposed surface water samples were not collected during the Round 1 sampling event because stream beds and smaller drainage channels were dry at the time of sampling. However, surface water samples were collected during Round 2 where water was present in intermittent pools at the time of sample collection. Round 2 sampling was conducted during an unusually wet month. As indicated in Section 5.0 of this RFI report, the analyses selected for 2002 samples were based on the results of the 2001 sampling and the need to fill data gaps for the RFI. Because the contaminants of primary interest were VOCs in ground water, surface water samples were analyzed only for VOCs, in accordance with the EPA-approved RFI QAPP. It was believed that analysis of VOCs in surface water samples would satisfy the potential ground water to surface water migration pathway. This is unlikely to represent a significant data gap in ecological risk evaluation of surface water because of habitat considerations. Fish are not likely to be present in the intermittent, shallow pools where surface water samples were collected, and risks to aquatic invertebrates are better characterized through the evaluation of sediment data at this site because of the intermittent nature of the surface water. Based on the above, the surface water and sediment data adequately characterizes exposure conditions associated with surface water at SWMU 01."*

Comment ERA-SC-5:

Section 8.2.3.3, Surface Water/Sediment. The third paragraph on page 8-9 states that surface water and sediment were evaluated in both ditches as a conservative measure. However, Figure 8-2, the Conceptual Site Model (CSM) does not indicate that surface water is an exposure medium. According to Figure 8-2, receptors may be exposed to contaminants in sediments and in soils. Revise the RFI Report to correct this apparent discrepancy.

Response to Comment ERA-SC-5:

The Conceptual Site Model (CSM) has been changed to add surface water as an exposure medium. Also, the figure number for the CSM has been changed to Figure 8-3 to reflect the addition of the Indiana bat trap location map as Figure 8-2. The revised Figure 8-3 is included as Attachment 13 to these responses to comments.

Comment ERA-SC-6:

Section 8.2.4.1, Assessment Endpoints. The last paragraph of page 8-11 states that large carnivorous mammals and birds were not evaluated in the SERA because the greatest exposure to site contaminants was expected to occur to small mammals and birds that ingest invertebrates, fish, or plants. The RFI Report further states that large carnivores forage over areas hundreds of acres in size and that the MGBG represents only a fraction of the area(s) where these large carnivores potentially hunt and feed. Although compounds which are well known to greatly biomagnify were not selected as COPCs, and although large carnivores have large roaming areas, large carnivores are still susceptible to site conditions. Dermal contact with surface soil or sediment, as well as ingestion of any contaminated species that may forage at MGBG, remain factors. The SERA should include a conservative examination of a representative for each functional feeding guild that may potentially use the site. As such, upper trophic level species (i.e., large carnivorous mammals) should be examined during the SERA using conservative assumptions. As outlined in the U.S. EPA guidance entitled *Ecological Risk Assessment Guidance for Superfund: Process for Designing and Conducting Ecological Risk Assessments (EPA/540/R-97/006),* the SERA should use conservative exposure parameters including: a 100 % area use factor, 100 % bioavailability, minimum body weight, maximum ingestion rate, the most sensitive life stage and 100% of the diet consists of the most contaminated dietary component. Revise the RFI Report to evaluate large carnivorous mammals and birds using conservative assumptions, or provide further discussion regarding the decision not to evaluate large carnivorous mammals and birds.

Response to Comment ERA-SC-6:

As indicated during discussions between the Navy (TtNUS) and U.S. EPA (TechLaw), the usefulness of the food-chain modeling for large carnivorous birds and mammals represented by the hawk and fox is very limited because of the high amount of uncertainty involved in predicting small mammal tissue concentrations and because of the large home ranges of hawks and foxes compared to the size of the SWMU. Based on previous discussions between the Navy (TtNUS) and U.S. EPA (TechLaw), the following paragraph has been added to the end of Section 8.7.1

to discuss the uncertainties associated with not conducting food-chain modeling for the upper trophic level receptors (i.e., large carnivorous mammals):

> *"Food-chain modeling was not conducted for large carnivorous mammals and birds for several reasons including the uncertainty of estimating contaminant uptake into the diet source (small mammal tissue) and the large home range for carnivorous wildlife. Six chemicals were detected in the surface soil at concentrations that exceeded EDQLs; Isosafrole, 2,4-D, and four metals. Of these, three of the inorganics (copper, selenium, and zinc) are considered important bioaccumulative chemicals (U.S. EPA, February 2000). Herbicide detections such as 2,4-D are typical of spot applications rather than burial activities associated with SWMU 01. Although some herbicides are typically bioaccumulative, 2,4-D does not have a high potential for accumulating in animal tissue based on its high water solubility, as presented in Table 6-1. Also, the low detection frequency and relatively low concentration does not warrant concern for carnivorous mammals and birds. Isosafrale also has a high water solubility, so its bioaccumulation in animal tissue is expected to be low. Also, it exceeded the EDQL in only 1 of 24 soil samples. Finally, metals typically do not biomagnify in terrestrial systems (Newman, 1998). Therefore, although some chemicals detected at SWMU 01 may accumulate in the tissue of small mammals, risks to carnivorous birds and mammals are expected to be much lower than the risks to small herbivorous or insectivorous mammals and birds. This is because carnivorous birds and mammals are expected to obtain only a small portion of their food from SWMU 01 [boundaries of SWMU 01 are approximately 2 acres and home ranges of the red fox and red-tailed hawk are 193 acres and 370 acres, respectively (U.S. EPA, 1993)]. The food-chain EEQs assumed that the small herbivorous or insectivorous mammals and birds at SWMU 01 obtain all of their food from the site."*

Comment ERA-SC-7:

Section 8.2.4.3, Selection of Receptor Species. The second full paragraph on page 8-13 indicates that "The selection of species used to represent the receptor groups ... was based on considerations of their preferred habitat, body size, sensitivity, home range, abundance, commercial or sport utilization, legal status, and functional role. The short-tailed shrew, an insectivorous mammal, was chosen for the food-chain modeling. However, since the federally endangered Indiana bat is known to forage at NSWC Crane site, and is a specie of special concern, it is unclear why this specie was not for the food-chain modeling, based upon the selection criteria outlined in the RFI Report. Revise the food-chain modeling to incorporate the Indiana bat or provide adequate discussion regarding the decision not to use this specie for modeling purposes.

Response to Comment ERA-SC-7:

Food-chain modeling was not conducted using the Indiana bat as a surrogate species for reasons discussed in following text which has been added to Section 8.2.4.1:

> *"Although the federally endangered Indiana bat has been recorded at NSWC Crane, Indiana bats have not been captured near SWMU 01 in either of two multi-night field surveys in which bats were collected at various locations using mist nets (Whitaker 1996, BHE 1999). Indiana bats (especially females and juveniles) forage primarily in riparian and floodplain forests. These habitats are absent from SWMU 01. Male Indiana bats also forage primarily in riparian and floodplain forests but are known to occasionally forage in upland forests and over old fields (USFWS, 1999). Thus, while the presence of Indiana bats at SWMU 01 cannot be ruled out, the site does not provide preferred habitat for this species, and they have not been captured in either of two studies conducted near SWMU 01. Therefore, because of the probable absence of the species at SWMU 01, the Indiana bat was not selected as a representative species in the food chain modeling."*

The following references have been added to the RFI report:

BHE Environmental, Inc. 1999. Mist net radiotelemetry surveys for the Indian bat at the Crane Division, Naval Surface Warfare Center, Indiana. Cincinnati, Indiana.

U.S. Fish and Wildlife Service (USFWS). 1999. Indiana bat (Myotis sodalis) revised recovery plan, agency draft. Prepared by the Indiana Bat Recovery Team for Region 3 U.S. Fish and Wildlife Service, Ft. Snelling, Minnesota. March.

Whitaker, J.O. 1996. Survey of bats near burning and detonation areas along Sulfur, Turkey, and Boggs Creeks at Naval Surface Warfare Center, Crane Division, Martin County, Indiana. Report to RUST Environmental & Infrastructure, Inc., Cincinnati, Ohio. June.

Comment ERA-SC-8:

Section 8.3.1, Screening Levels. The third bullet on page 8-15 states that "Calcium, magnesium, potassium and sodium were not retained as COPCs." According to Table 4-15, these four constituents were not selected as COPCs because they were considered "nontoxic" (NT). As outlined in the U.S. EPA Bulletin entitled *The Role of Screening Level Risk Assessment and Refining Contaminants of Concern in Baseline Ecological Risk Assessments dated January 24, 2001,* a number of chemicals that may be site related function as nutrients in organisms such as calcium, iron, magnesium, sodium and potassium. The guidance goes on to state that prior to eliminating these chemicals from further assessment, additional information regarding the following must be presented: 1) the suite of chemicals relevant to the range of ecological receptors considered at the site; 2) the potential for toxic effects resulting from site concentrations relative to the toxicological benchmarks for nutrients; 3) whether contaminant interactions may result in a nutrient deficiency for organisms of concern; 4) whether the nutrient deficiency level and toxicity benchmark are similar in magnitude; and an evaluation of the potential for the nutrient to bioaccumulate, bioconcentrate, and/or biomagnify. Revise the RFI Report to address this issue.

Response to Comment ERA-SC-8:

After a review of current literature, the Navy is not aware of any screening values to evaluate risks to ecological receptors from calcium, magnesium, potassium, and/or sodium in various media. Also, the Navy is not aware of information available to address the four points in the comment for these chemicals. These four metals are typically not carried through an ecological risk assessment as COPCs because they are essential nutrients and non-toxic at normally encountered concentrations. A discussion of these metals as essential nutrients is presented in Section 4.3.1 of the draft RFI report. No change has been made to the RFI report in response to this comment.

Comment ERA-SC-9:

Section 8.4, Ecological Screening. The second paragraph in this section (page 8-16) states that surface soil samples were collected from the 0 to 2 feet bgs depth interval. However, the surface soil interval used to evaluate ecological exposures is typically considered to be within the 0 to 0.5 feet bgs. The 0.5 to 2 feet bgs exposure zone is typically considered as the subsurface matrix, which is the assumed maximum depth that mammals will burrow. The combination of data from the 0-2 feet bgs may underestimate the risk by extrapolating a chemical concentration across the entire sampling column. Revise the RFI Report to reflect the 0 to 0.5 feet bgs and the 0.5 to 2 feet bgs exposure zones. If data are lacking, then provide a detailed discussion of this information as a data gap.

Response to Comment ERA-SC-9:

The surface soil samples comply with the definition of surface soil as stated in Section 4.4.1 of the approved May 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. The fourth paragraph of Section 8.7.2 further clarifies why surface soils were taken from a depth of 0 to 2 feet instead of 0 to 0.5 feet.

No changes have been made to the RFI report in response to this comment.

Comment ERA-SC-10:

Section 8.4, Ecological Screening. The last paragraph on page 8-16 states that four inorganics (copper, selenium, vanadium and zinc) were retained as COPCs because they were detected at concentrations statistically exceeding site background. Table 4-15 indicates that arsenic and thallium concentrations detected at the MGBG did not exceed background concentrations. However, Table 4-8 indicates that both of these constituents did exceed background. Revise the tables and/or the text of the RFI Report to correct this discrepancy.

Response to Comment ERA-SC-10:

Table 4-8 has been changed to reflect that detected concentrations of both arsenic and thallium did not exceed background concentrations. The highlighted "Yes" under the "Site Above Background" column has been removed and replaced with "No." The triple asterisk (***) under the "Rationale for Contaminant Deletion or Selection" column has been removed and replaced with BKG[11] ;however, the text associated with the footnote will remain as follows:

> *"Reevaluation demonstrated that this chemical does not exceed background concentrations. See Section 3.4.4 (arsenic) and Section 3.4.5 (thallium)."*

Comment ERA-SC-11:

Section 8.6, Step 3a-COPC Refinement. This section discusses Step 3a of the Navy's Tiered Approach outlined in Figure 8-1. This step is similar to the first step of the BERA as described in the 1997 U.S. EPA guidance, *Ecological Risk Assessment Guidance for Superfund: Process for Designing and Conducting Ecological Risk Assessments (EPA/540/R-97/006)*. The RFI Report states that Step 3a is conducted after the completion of the ecological screening using Region 5 EDQLs to determine COPCs for the ecological risk assessment. The text goes on to indicate that the Step 3a refinement screening process includes an evaluation the following criteria: an examination of the maximum detected concentration and the average detected media concentration and that these concentrations are compared to benchmark values that present the average risk at the MGBG; an examination of the magnitude of criterion exceedance; frequency of chemical detection; contaminant bioavailability; available habitat; and food chain modeling. However, this approach follows neither the 1997 U.S. EPA ERA guidance, nor the Navy Tiered Approach. Both Figure 8-1 and the U.S. EPA guidance indicate that exposure estimates and risk calculations are completed as part of the SERA prior to the refinement of COPCs. The 1997 and 2001 U.S. EPA ERA guidances specifically state that the SERA does not provide definitive estimates of actual risk, generate cleanup goals, and is not usually based on site-specific assumptions. Therefore, the Step 3a refinement of COPCs should only occur as part of a BERA. Revise the RFI Report to eliminate the refinement of the screening process and conduct Steps 1 and 2 in accordance with the 1997 U.S. EPA ERA

guidance, using conservative estimates for screening and exposure modeling in order to determine potential risk to ecological receptors.

Response to Comment ERA-SC-11:

The Navy disagrees that the ERA approach did not follow the 1997 U.S. EPA guidance and the Navy's Ecological Risk Assessment Tiered Approach. Both documents were followed in estimating exposure and calculating risks by the comparing all maximum detected concentrations to the Region 5 EDQLs. Steps 1 and 2 of the ERA, therefore, have been conducted using conservative estimates and exposure modeling to determine the potential risks to ecological receptors. Definitive estimates of actual risk and site-specific assumptions are not included as part of Steps 1 and 2 of the ERA process (i.e., SERA). Finally, as explained in Section 8.1, Step 3a is the first step of the baseline ecological risk assessment (BERA) and consists of refining the list of COPCs that were retained following Steps 1 and 2. The Step 3a refinement as conducted in the RFI has long been identified by the U.S. EPA and the Navy as pertinent and acceptable for inclusion in an RFI after the SERA. Therefore, no changes have been made to the RFI report in response to this comment.

Comment ERA-SC-12:

Section 8.6.2.1, Methodology. The first paragraph in this section states that chemicals evaluated in the terrestrial food-chain model were limited to those identified by the U.S. EPA as bioaccumulative. However, this approach is unclear. The U.S. EPA does provide a list of priority chemicals that are considered persistent, bioaccumulative, or toxic (PBTs), but does not necessarily consider a COPC not to bioaccumulate, in the absence of site-specific data. Therefore, unless site-specific data exist to indicate certain COPCs are not bioaccumulative under specific conditions, then these COPCs should be included in food chain modeling. For the SERA, the most conservative bioaccumulation value derived from the literature should be used to estimate COPC uptake in food chain modeling. Revise the RFI Report to include these changes.

Response to Comment ERA-SC-12:

The first two sentences in the first paragraph of Section 8.6.2 (Terrestrial Food-Chain Modeling) have been replaced with the following text:

> *"The alternate benchmark values provided in Section 8.6.1 are not designed to evaluate risks to wildlife ingestion of soil, sediment, surface water, plants, invertebrates, and fish. Therefore, a terrestrial wildlife intake model was used to estimate the exposure of terrestrial receptors to the COPCs. The food-chain modeling was conducted only for chemicals identified by U.S. EPA in the following publication as important bioaccumulative chemicals: Bioaccumulation Testing and Interpretation for the Purpose of Sediment Quality Assessment, Status and Needs. EPA 823-R-00-001, Office of Water, Office of Solid Waste. EPA 823-R-00-001, February, 2000. The only chemicals that were retained as COPCs but were not carried through the food-chain model were isosafrole, aluminum, iron, and vanadium. No bioaccumulation data have been identified for isosafrole, and based on the high water solubility in Table 6-1, it is unlikely that this chemical would be bioaccumulative. The three metals listed above are not considered to be bioaccumulative under typical site conditions and there is*

nothing to suggest that conditions at the site would make these metals bioaccumulative in ecological receptors."

Also, the 90th percentile bioaccumulation factors were used for the conservative food-chain models based on recommendations in the ORNL documents (see references listed below) where these factors were obtained.

Sample, B.E., J.J. Beauchamp, R.A. Efroymson, G.W., Suter II, and T.L. Ashwood. 1998. Development and Validation of Bioaccumulation Models for Earthworms. Oak Ridge National Laboratory. ES/ER/TM-220.
June.

ORNL (Oak Ridge National Laboratory). 1998. Empirical Model for the Uptake of Inorganic Chemicals from Soil by Plants. BJC/OR-133. September.

Comment ERA-SC-13:

Section 8.6.2.1, Methodology. The last paragraph on page 8-31 indicates that, for mammalian species, the NOAEL (or LOAEL) from the test species was adjusted to a NOAEL (or LOAEL) for the representative species using a body-weight scaling equation from Sample et al. (1996) and Sample and Arenal (1999). The equation presented uses a metabolic scaling factor of 0.25. However, the 1999 publication by Sample and Arenal entitled Allometric Models for Interspecies Extrapolation of Wildlife Toxicity Data (Bull Environ Contam Toxicol 62: 653-663) indicates that the use of the metabolic scaling factor may not be appropriate for toxicity/body weight extrapolation factors. As such, it is recommended that the toxicity/body weight equation be calculated without the use of the scaling factor. Alternatively, provide additional information to justify the use of the scaling factor. In addition, provide a table which presents mammal toxicity reference values (TRVs) which have been calculated using a scaling factor and calculated without a scaling factor to allow for a comparison of the two methods.

Response to Comment ERA-SC-13:

The scaling factor of 0.25 was not actually used to adjust the NOAELs and LOAELs in the ERA. It was removed from the calculations based on previous U.S. EPA comments concerning risk assessments for other SWMUs at NSWC Crane, but it was inadvertently left as part of the equation in the text. The equation in the text has been corrected by removing the scaling factor from the equation. The revised equation is now presented in the text as follows:

$$NOAEL_W = NOAEL_t * (bwt/bww)$$

Where:

$NOAEL_W$ = *NOAEL for the representative wildlife species*
$NOAEL_t$ = *NOAEL for the test species*
bwt = Body weight of the test species
bww = Body weight of the representative wildlife species

Comment ERA-SC-14:

Section 8.7, Uncertainty Analysis. There is no discussion regarding the uncertainty introduced into the SERA by the sampling methodology used. For example, no surface water samples were collected during Round 1 due to the absence of surface water, however surface water samples were collected in Round 2 following a heavy rain event. Samples were analyzed for VOCs only and, according to the RFI Report, no VOCs were detected. A review of the data indicates that constituents including SVOCs, metals energetics and a herbicide, were detected in groundwater, soil or sediment samples collected from the MGBG. Therefore, it is unclear if the surface water sampling event adequately represented site conditions. Revise the RFI Report to include a discussion to support that the surface water sample results are truly representative of surface water conditions at the MGBG.

Response to Comment ERA-SC-14:

See the response to Comment ERA-SC-4 for the discussion to be added in Section 8.7.2.

Comment ERA-SC-15:

Section 8.7.5, Uncertainty Analysis. There is no discussion regarding the selection of COPCs, especially regarding essential nutrients. In addition, during the COPC selection process, COPCs were selected if maximum detected concentrations of constituents were greater than screening levels and also exceeded background concentrations (for inorganics and radionuclides). However, it should be noted that the U.S. EPA policy no longer supports excluding COPCs from the risk assessment based on a comparison to established background. Revise the RFI Report to include a discussion of any uncertainty involved in the selection of COPCs with respect to ecological risk.

Response to Comment ERA-SC-15:

See the response to comment ERA-SC-8 for a discussion regarding essential nutrients. Also see the response to comment ERA-SC-1 for a discussion to be added in Section 8.7.4 in regard to uncertainties associated with using background comparisons in the COPC selection process.

Comment ERA-SC-16:

Section 8.8, Ecological Risk Summary and Conclusions. The text states (page 8-41) that surface soil COPCs at the MGBG site appear to pose negligible or minor potential risk to terrestrial ecological receptors, and no chemicals were retained as surface soil COCs after the Step 3a refinement process. However, the third paragraph on page 8-35 indicates that under conservative assumptions, food chain EEQs exceeded 1.0 for the American Robin for zinc (EEQ of 12.0) and equaled 1.0 for selenium. Under average exposure scenario, the EEQ for zinc was 2.3. This indicates that risk is indeed present at the site. Revise the RFI Report to provide a discussion which indicates where HQ exceedances occurred for the robin within the MGBG. In addition, as outlined in Specific Comment No. 7 (of the Ecological Risk Assessment Comments), it is not clear why a more sensitive species was not selected for food-chain modeling. The use of a different receptor species may also result in the identification of risk at the MGBG. The RFI Report must be revised to address this issue and the conclusions modified accordingly.

Response to Comment ERA-SC-16:

Insectivorous birds represented by the robin will typically obtain their food from an area much larger than the area represented by the location of the maximum detection. Therefore, the average concentration represents a more realistic estimate of exposure for insectivorous birds than the maximum concentration. Furthermore, it would be unlikely that any insectivorous bird would obtain its food *exclusively* from SWMU 1, which is only 2 acres in size. In addition, the zinc EEQ of 2.3 is based on use of the NOAEL as a TRV, while the zinc EEQ based on the average scenario and using the LOAEL as TRV was 0.25. The use of a NOAEL as a TRV estimates a point below which effects are unlikely, and above which effects are uncertain. LOAELs, when used as TRVs, estimate points above which effects are likely, and below which effects are uncertain. LOAELs used as TRVs in this ERA reflect the most sensitive species and the most sensitive appropriate endpoints available, and therefore a measure of conservativeness is retained. An evaluation of risk posed by zinc (or any chemical) to upper level receptors should consider the NOAEL-based EEQ as well as the LOAEL-based EEQ, especially in determining if a site needs further study. For these reasons, and because the food chain model incorporates other conservative assumptions (e.g., 100 percent chemical bioavailability), zinc does not appear to pose significant potential risk to insectivorous birds represented by the robin.

It is not clear which species would be more sensitive to the detected chemicals than the American robin and short-tail shrew. It is implied from the comment that the Indiana bat may be a more sensitive species, but the primary reason for the endangered status of the Indiana bat is loss of habitat and human disturbance in caves (where it hibernates), not sensitivity to chemicals. The robin and shrew are better surrogates for exposure of chemicals in soil because they consume earthworms, versus the bat which consumes flying insects. Site-related chemical concentrations in earthworms, which are in direct contact with soil, are expected to be greater than in flying insects, most of which are not in direct contact with soil (or at least less than are earthworms). Also, robins and shrews have smaller home ranges than bats. Therefore, robins and shrews will be more exposed to site-related contaminants than bats.

No changes have been made to the RFI report in response to this comment.

MINOR COMMENTS

Comment ERA-MC-1:

Section 4.0, Selection of Chemicals of Potential Concern. Tables 4-15 and 4-16 do not indicate the exact background values used for screening COPCs, and only identify whether concentrations are or are not above background concentrations. Revise the tables to include the background concentrations used for screening.

Response to Comment ERA-MC-1:

Please refer to the response to Comment HHRA-SC-1.

Comment ERA-MC-2:

Section 8.6.1, Terrestrial Plants, Terrestrial and Aquatic Invertebrates, and Fish. The last paragraph on page 8-22 states that "COPCs are retained as final Chemicals of Concern (COCs) for soil invertebrates and terrestrial vegetation (Section 8.5.1.1) and benthic invertebrates (Section 8.5.1.2). COCs retained based on risk to upper level receptors via the food chain are discussed in Section 8.5.2." However, the references to other sections are incorrect. The correct references should actually be Section 8.6.1.1, Section 8.6.1.2 and Section 8.6.2 respectively. Revise the RFI Report to correct these discrepancies.

Response to Comment ERA-MC-2:

Section 8.6.2 has been revised as follows to correct the section references:

> *"...The following subsections discuss whether COPCs are retained as final Chemicals of Concern (COCs) for soil invertebrates and terrestrial vegetation (Section 8.6.1.1) and benthic invertebrates (Section 8.6.1.2). COCs retained based on risk to upper level receptors via the food chain are discussed in Section 8.6.2."*

Comment ERA-MC-3:

Section 8.6.2, Terrestrial Food-Chain Modeling. It is stated that Section 8.5.2.1 describes the food-chain model methodology, while Section 8.5.2.2 presents and discusses the results of the food-chain modeling for the surrogate species. However, Section 8.6.2.1 describes the food-chain model methodology and Section 8.6.2.2 discusses the results of the food-chain modeling for the surrogate species. Revise the RFI Report to reference the correct sections.

Response to Comment ERA-MC-3:

Section 8.6.2 has been revised as follows to correct the section references in Section 8.6.2.:

> *"Section 8.6.2.1 describes the food-chain model methodology, while Section 8.6.2.2 presents and discusses the results of the food-chain modeling for the surrogate species."*

Comment ERA-MC-4:

Section 8.2.1.2, Site-Specific Environmental Setting. The second paragraph of this section refers to Figure 1-8 of the Phase III RFI Work Plan when discussing Boggs Creek. However, Figure 1-2 of the RFI Report is identical. The RFI Report should reference figures already existing in the RFI Report. Revise the RFI Report accordingly.

Response to Comment ERA-MC-4:

The first sentence of the second paragraph in Section 8.2.1.2 has been revised as follows to reference Figure 1-2 of the RFI report:

> "Runoff from the MGBG drains into the two drainage channels/unnamed tributaries of Goldsberry Hollow, which drains west-southwest about 1.2 miles before entering Boggs Creek (See Figure 1-2)."

Additional Comments from U.S. EPA Region 5 Received on May 6, 2003 via Mr. Bill Gates

Additional U.S. EPA Comment 1:

Ground water samples in Rounds 1 and 2 may have been analyzed without filtering, which could have greatly reduced the concentrations since alpha particles are easily absorbed by overlying particulates. Paragraph 3 on page 3-17 seems to indicate that turbid water was used to make gross alpha measurements.

Response to Additional U.S. EPA Comment 1:

Because the primary purpose of this investigation was to collect data in support of a human health risk assessments, unfiltered ground water samples were analyzed. The sampling protocol required purging the well until the ground water turbidity was less than 5 nephelometric turbidity units (NTUs) or until the turbidity stabilized, then a sample of the ground water could be collected. Most (75 percent) of the 38 samples analyzed for gross alpha in Rounds 1 and 2 met the 5 NTU criterion. This level of turbidity would generally not be considered to be "turbid."

As stated in the paragraph 3 on page 3-17 of the draft RFI report, the greater turbidity of sample 01GW2302 may have contributed to the gross alpha analytical imprecision for this sample. The elevated turbidity (9.1 NTU), which indicates a comparatively elevated concentration of suspended matter, could have led to self-absorption of the alpha particles as indicated by the reviewer, but it may also have carried with it a greater concentration of alpha emitting radionuclides adsorbed to the suspended matter, thus causing the gross alpha result to be artificially elevated. Self-absorption may have resulted in the observed degree of imprecision, but the actual cause of the imprecision is unknown. Determining the cause is unnecessary because the degree of imprecision was acceptable. It is notable that the analytical method for gross alpha measurements limits the mass of suspended matter that may be deposited onto the gross alpha planchet, thus limiting the effects of self-absorption caused by the suspended matter.

No change has been made in response to this comment.

Additional U.S. EPA Comment 2:

Analytical results of the background data for SWMU 01 (Table 3-13) are reported in mg/kg units instead of radiation units (pCi/g). This makes a judgment on levels, almost universally found in radiation units, impossible without conversions for each radionuclide separately.

Response to Additional U.S. EPA Comment 2:

The Table 3-13 heading for the column labeled "Metal (mg/kg)" is in error. The label should read "Metal (pCi/g)" and has been changed accordingly.

Additional U.S. EPA Comment 3:

When concentrations in mg/kg are converted to picocuries per gram (pCi/g), using the data of Table 3-13, the numerical values are substantially, orders of magnitude, out of line with what would be expected for background soils. (e.g., 0.21 mg/kg of Th-230 converts to 4240 pCi/g. Something on the order of 1 pCi/g would be expected for normal background). This data impacts on judgments made for radioactive materials in the discussion. This data should be checked.

Response to Additional U.S. EPA Comment 3:

The heading for the first column of Table 3-13 [labeled "Metal (mg/kg)]" is incorrect. The heading has been corrected to read "Metal (pCi/g)." With this correction, the radioactivity concentrations of thorium and other radionuclides are as expected.

Additional U.S. EPA Comment 4:

Analytical results of the background data for SWMU 01 (Table 3-13) show a concentration for europium-155 based on positive detections. The presence of this relatively short lived radionuclide (4.96 years) in soil samples is exceptionally anomalous and should have been investigated further.

Response to Additional U.S. EPA Comment 4:

The Navy agrees that detecting europium-155 is an anomalous situation. Europium-155 exhibits low gamma ray emission energy (86.54 and 105.31 keV) and low yield when analyzed by gamma spectroscopy. The low energy and yield result in large uncertainties associated with the analytical results. In effect, peaks at energies similar to the europium-155 peak energies can be identified as europium-155. To be conservative, the laboratory reported europium-155 values as being detected even if when a peak at just one energy for this radionuclide was detected. In response to the reviewer's concern, the europium-155 results have been qualified by creating a new Section 3.4.13 in the RFI report containing the following text:

> "Europium-155 exhibits low gamma ray emission energy (86.54 and 105.31 keV) and low yield when analyzed by gamma spectroscopy. The low energy and yield result in large uncertainties associated with the analytical results and confound the identification of this radionuclide. In effect, non-europium-155 peaks at emission energies similar to the europium-155 peak energies can be mistaken for europium-155. To be conservative, the laboratory reported europium-155 values as being detected if just one emission peak for this radionuclide was detected. Because the half-life of europium-155 is short (approximately 5 years), this radionuclide is probably not present in the MGBG samples. Despite this potential artifact, europium-155 results were not eliminated from the database because of the general concern associated with radionuclides. In addition, MGBG gamma spectrometry results were generated by the same laboratory that generated the background gamma spectrometry data. When conducting comparisons of site and background gamma spectrometry data, this common factor tends to cancel the effects of the analytical artifacts described above."

Additional U.S. EPA Comment 5:

It would have been useful for the U.S. EPA Region 9 Preliminary Remediation Goal Table, as referenced in Table 4 - 6 and 4 -7, to have been included as an appendix.

Response to Additional U.S. EPA Comment 5:

The Region 9 PRGs applied to this investigation were obtained from the requested U.S. EPA Region 9 PRG Table. The practice for NSWC Crane investigations has been not to provide complete U.S. EPA PRG tables because many of the chemicals in the U.S. EPA tables are not applicable to the individual investigations. The same is true for this investigation. If the table were to be included, this argument could be extended to require the inclusion of many more U.S. EPA tables and even guidance and requirements documents. This would be contrary to the current efforts under way by the government and private sector to limit the use of paper. It is believed to be sufficient that the source references for data are provided and that the applicable data have been extracted from those source documents. No change has been made in response to this comment.

Additional U.S. EPA Comment 6:

The text in paragraph 1 on page 7-5 seems to indicate that thorium nitrate in illuminant material will degrade in contact with soil and moisture. Contact and moisture will not accelerate the radioactive decay of thorium. In fact, nothing changes the decay rate. Thorium will radioactively decay with a half-life equal to the estimated age of the universe, about 14 billion years, so it will essentially be a permanent part of the soil matrix.

Response to Additional U.S. EPA Comment 6:

The text in question was not intended to suggest that the decay of radioactive material could be accelerated or altered in any way through normal physical or chemical means. Rather, the text is a recounting (from historical documents) of the intent of the waste disposal of the small amounts of chemical wastes. To eliminate potential misunderstanding, the text in question has been revised to read as follows:

> *"The thorium nitrate and illuminant material containing thorium or thorium compounds was buried as waste from a research and development effort related to pyrotechnic devices. Also buried were some small amounts (a few ounces each) of unspecified chemical wastes documented to have comprised some 90 small quantities of aged laboratory chemicals. This latter disposal was designed to encourage decomposition of the small amounts of chemical wastes by effecting close contact with soil and moisture."*

Additional U.S. EPA Comment 7:

It is unclear why many of the gross alpha and gross beta data in table E-3-2 are labeled NA.

Response to Additional U.S. EPA Comment 7:

Filtered samples were not analyzed for gross alpha radiation or gross beta radiation, so those results in Table E-3-2 exhibit the entry "NA." This was in accordance with the U.S. EPA-approved MGBG QAPP. A list of samples and associated analyses (by analytical fraction) is presented in Table 3-2, and a more detailed list is presented in Table 2-1 showing the analyses conducted on each sample. The footnote at the bottom of Table E-3-2 indicates that "NA" means "Not analyzed."

No change has been made to the RFI report in response to this comment.

Additional Technical Changes

ATC-1:

The following definitions on page 3-3 of the draft RFI report have been revised as shown to indicate that they apply only to organic chemicals (the changed text is shown in bold):

BU - Indicates that an **organic** chemical was detected in this sample as well as the associated laboratory method blank but has been qualified non-detected as a result of laboratory blank contamination (i.e., concentration was less than the blank action level).

BJ - Indicates that an **organic** chemical was detected in this sample as well as the associated method blank, and is considered estimated because the concentration is in excess of the blank action level.

ATC-2:

The following reference has been inserted immediately following "The value of kG, H_2O is 0.833 (cm/s)" in Section 7.3.4.6, page 7-20:

"(U.S. EPA, April 1988)"

ATC-3:

The first sentence of the second paragraphs of Section 7.5.2.3 has been changed to read as follows:

"The cumulative HI for the future construction worker is 58."

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.

SIGNATURE

Environmental Protection Department Manager
TITLE

6/5/03
DATE