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NSWC CRANE
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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 095/3113

3 APR 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 enclosures (1) through (5) for the Final RCRA Facility Investigation (RFI) Report for the Dye Burial Grounds (DBG), Solid Waste Management Unit 02/11. Two copies of the enclosures (1) through (5) are furnished. The permit required Certification Statement is provided as enclosure (6).

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

Sincerely,

James M. Hunsicker

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

Encl:
(1) Volume 1 of 2 of the DBG RFI Report
(2) Appendix H.5
(3) Appendix G
(4) Replacement Cover Page and Binder Spine
(5) Response to Comments
(6) Certification Statement

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

COMMENTS ON THE RFI REPORT FOR SWMU 2 - DYE BURIAL GROUNDS REVISION 0 - DATED JUNE 2002 NAVAL SURFACE WARFARE CENTER CRANE, INDIANA

GENERAL COMMENTS

Comment GC-1:

The RCRA Facility Investigation (RFI) report for Solid Waste Management Unit (SWMU) 2 - Dye Burial Grounds does not provide a detailed discussion on the nature and extent of contamination at SWMU 2. The RFI report simply summarizes the analytical data per media and indicates that no apparent pattern with regard to contamination was noted. The RFI report does not provide sufficient explanation regarding the extent of contamination or whether the contamination is considered to be adequately defined. Examples are provided in the Specific Comments below. Revise the RFI report to include additional detail (if available) about the extent of contamination.

Response: For clarification, some changes were made to further support the assertion that little contamination exists at SWMU 2. The following text replaces the last paragraph of Section 4.1, Metals:

"Beryllium, calcium, copper, and magnesium were the only surface soil metals with data sets that were determined to be statistically greater than background concentrations. As noted above calcium and magnesium are essential nutrients and are not discussed any further. Beryllium was detected in three surface soil samples (02SS190001, 02SB100002, and 02SS090002) at concentrations ranging from 0.56 to 0.85 mg/kg but this metal was not detected in subsurface soil (See Section 4.2). Samples 02SS09002 and 02SS100002 were collected within 50 feet of each other at approximately the same concentration; otherwise there is no pattern of contamination. Because of its sparse spatial distribution, the history of SWMU 2 disposals, and tightly distributed beryllium concentrations in surface soil, this metal does not appear to be site related contamination. The corresponding background data set had just one sample out of 15 samples that had a beryllium detection (0.49 mg/kg). This is viewed to be the primary reason why the site data appear to be greater than background concentrations. The SWMU 2 beryllium surface soil concentrations are within a factor of two of this concentration and appear to represent a background population local to SWMU 2 rather than site contamination. If the observed beryllium concentrations are actually site related contamination, the scarcity of detections and the limited range of concentrations do not warrant further investigation.

"The observed copper concentrations in surface soil (8 to 11.8 mg/kg) fall well within the range of NSWC Crane basewide background concentrations (5.4 to 17.1 mg/kg). The copper concentration distribution for SWMU 2 samples is tighter than for the background samples and this appears to be the reason that SWMU 2 copper concentrations were classified as exceeding background concentrations. Similar to beryllium, this is viewed to be a consequence of the site samples

representing a geographically smaller area than the background samples. Although Figure 4-1 shows some copper concentrations in surface soil exceed its ecological data quality level used for selecting COPCs, so do copper background concentrations.

"Based on the above observations, neither copper nor beryllium is viewed to be a site contaminant in surface soil and there is no need to discuss the spatial distribution of these chemicals further. To be conservative, however, these metals are considered for COPC selection in Sections 6.0 and 7.0 to preclude the possibility of overlooking any risk associated with their existence at SMWU 02.

The following paragraph has been inserted before the second paragraph of Section 4.2, Metals:

"Key differences between subsurface Soil Groups 8 and 9 appear to have caused different outcomes of the statistical background comparisons. As explained in Section 4.0, background comparisons are conducted independently for each soil group. The NSWC Crane basewide background data set for Soil Group 8 has nine samples (27 metal results in each sample). None of the SWMU 2 Soil Group 8 metals was identified as being greater than these background concentrations. By contrast, the background data set for Soil Group 9 has just one concentration value for each of 27 metals. As expected by random chance alone, several of the of SWMU 2 Soil Group 9 metal concentration, were greater than the single background concentration. When this occurred, the metal was identified as being in excess of background concentrations. The dearth of background data for Soil Group 9 appears to be the reason for Soil Group 9 samples at SWMU 2 appearing to have elevated concentrations of metals. Exceedances of the single background concentrations for Soil Group 9 samples are shown on Figure 4-1

The following paragraph has been inserted at the end of Section 4.2, Metals:

"Because of the similarity of surface and subsurface soil metal concentrations and considering the statistical artifact caused by having only a single Soil Group 9 background value, the subsurface soil metal concentrations do not appear to be site related contamination. The site history and the lack of spatial metal concentration patterns suggesting a release of metals further support this assertion. There is no need to discuss the extent of these metal concentrations further for these reasons. To be conservative, however, these metals are considered for COPC selection in Sections 6.0 and 7.0 to preclude the possibility of overlooking any risk associated with their existence at SWMU 2."

The first paragraph of Section 4.3, Metals in the Upper Pennsylvanian Aquifer has been revised as follows:

"Arsenic, barium, calcium, cobalt, iron, manganese, magnesium, selenium, sodium, and zinc were detected in the Upper Pennsylvanian samples 02GW0101 and 02GWC12P301; however, of these metals, only the concentrations of selenium and sodium were in excess of upgradient concentrations. Cadmium, cobalt, nickel, and potassium were only detected in sample 02GWC12P301, and of these metals, the concentrations of cadmium and cobalt were in excess of upgradient sample concentrations in well 02C12P3 only. Selenium and zinc were detected in both

of these wells and were in excess of upgradient concentrations in both wells (02-01 and 02C12P3). Both samples were collected in the northeastern quadrant of the site. These metals were also detected in surface and subsurface soil samples at SWMU 2 although the evidence indicated that these metals do not represent site related contamination (see Section 4.2). Calcium, magnesium, potassium, and sodium are considered to be essential nutrients and therefore do not warrant further discussion. Also of note, aluminum, antimony, beryllium, chromium, copper, lead, mercury, silver, thallium, tin, and vanadium were not detected in these samples collected within the Upper Pennsylvanian aquifer."

The following text has been added to the end of Section 4.3, Metals...Lower Pennsylvanian Aquifer, sentence 4:

"...although the evidence indicates that these metals do not represent site related contamination (see Sections 4.1)."

Paragraph 1 of Section 4.3, "Metals in the Lower Pennsylvanian Aquifer" has been revised to read as follows:

"Arsenic, barium, calcium, iron, manganese, magnesium, nickel, selenium, sodium, and zinc were detected in downgradient wells in samples 02GW0201, 02GW0701, 02GW0801, and 02GWC11P301; however, only the concentrations of arsenic and nickel in these samples were in excess of upgradient concentrations. Aluminum, beryllium, copper and lead were detected only in sample 02GWC11P301 and only the concentrations of aluminum, beryllium, and lead in this sample were in excess of background concentrations. Calcium, magnesium, potassium, and sodium are considered to be essential nutrients and will not be discussed any further. Cadmium and cobalt were detected in samples 02GWC11P301 and 02GWC12P301, cadmium was also detected in sample 02GW0801, and cobalt was also detected in sample 02GW0201. Of all of these detections the greatest concentrations were generally associated with sample 02GWC11P301. All of these detected metals were also detected in surface and subsurface soils at SWMU 2 although the evidence indicates that these metals do not represent site related contamination (See Section 4.2). Also of note, antimony, chromium, mercury, silver, thallium, tin, and vanadium were not detected in these samples collected from within the Lower Pennsylvanian Aquifer."

The following text has been inserted as a new sixth sentence in the second paragraph of Section 4.3, Metals...Lower Pennsylvanian Aquifer, sentence five:

"As described in Section 5.4.2 of the approved Work Plan, historical data showed that inorganic chemicals were found in most wells at SWMU 2.

The following text has been inserted after the second paragraph of Section 4.3, Metals...Lower Pennsylvanian Aquifer:

"During planning for this Phase III RFI there was some uncertainty in linking the presence of inorganics in ground water to activities at SWMU 2 based on historical ground water data. One

reason for this was that anomalously low pH levels were observed in some wells that exhibited elevated inorganic concentrations (i.e., above the risk-based screening criteria). Low pH (acidic conditions) in sandstone is most likely a natural phenomenon and responsible for the elevated concentrations of inorganics. In addition, the distribution of metals within the aquifers is not necessarily coincident with the proximity of the wells to the dye burial trenches, thereby supporting the suspicion that elevated concentrations of inorganics are naturally occurring. While the historical data quality was unverified the results obtained during this Phase III investigation are consistent with the historical data.

"Visual inspection reveals that the metals concentrations obtained during this investigation typically fall within the ranges of the historical data. Some example concentrations ranges are shown below:

- *Cobalt historical ground water concentrations in Upper and Lower Pennsylvanian wells ranged from 6 to 697 µg/L whereas cobalt concentrations in this investigation ranged from 1.5 to 445 µg/L.*
- *Iron historical ground water concentrations in Upper and Lower Pennsylvanian wells ranged from 10 to 121,000 µg/L whereas iron concentrations in this investigation ranged from 465 to 1,810 µg/L.*
- *Manganese historical ground water concentrations in Upper and Lower Pennsylvanian wells ranged from 5 to 30,100 µg/L whereas manganese concentrations in this investigation ranged from 25.3 to 3,790 µg/L.*
- *Zinc historical ground water concentrations in Upper and Lower Pennsylvanian wells ranged from 5 to 1,950 µg/L whereas zinc concentrations in this investigation ranged from 10.5 to 2,280 µg/L.*

"Some of the greatest metal concentrations recorded in the historical data are associated with wells that are upgradient or cross-gradient to the Interim Measures cap and SWMU 2. One of the most remarkable examples is well 02C22P3, which is located cross-gradient approximately 1,500 feet to the southeast of SWMU 2. This well had 30,100 µg/L dissolved manganese in 1991 and there are no existing or former SMWUs upgradient of this well. While the quality of the historical data could not be verified, widespread data quality errors in metals analyses would be uncommon and the consistency of the historical data with current data demonstrate that the metals concentrations observed for this Phase III investigation are not unusual in the SWMU 2 area. Historical data are summarized as temporal trends in Figures 4-3 through 4-8. All results are plotted, including non-detect values, if present. To avoid plotting series of non-detects, only trends for those metals that had a reasonable number of detections are plotted. The historical decreasing concentration trends evident in Figures 4-3 to 4-8 are unexplained. The most recently collected data are consistent with the most recent historical trend data.

"If well 02-05 were to be excluded from consideration as a background well, as originally planned, additional exceedances of upgradient contamination would be detected because the concentrations in the remaining upgradient well (02C10P3) are less than those in well 02-05. The

impact on human health risk of excluding well 02-05 as an upgradient well is discussed in Section 6.1. The impact on evaluating the nature and extent of contamination while excluding well 02-05 would be the need to identify more locations that are cross-gradient and downgradient of the sole upgradient well (02C10P3) that have metal concentrations greater than that upgradient well. However, the available evidence suggests that, while metal concentrations downgradient of the Interim Measures cap have been detected, the metals do not appear to originate as a result of SWMU 2 operations."

It is noted that cobalt and zinc in ground water were not originally identified as exceeding upgradient concentrations. While those metals did not exceed upgradient concentrations based on a simple Wilcoxon rank sum statistical test, the concentrations were great enough to warrant their inclusion on Figure 4-2. They were inadvertently omitted from the figure but have been added and flagged on Figure 4-2 as exceeding the upgradient concentration. The revised Figure 4-2 and new Figures 4-3 through 4-9 are provided in Attachment 1 to this response document. Additionally, the original Figure 4-3 has been renumbered to Figure 4-10 to account for additional figures that have been developed in this response document.

The first paragraph of Section 4.4 Subsection Metals has been revised as follows:

"Aluminum, arsenic, barium, calcium, iron, magnesium, manganese, and sodium were the only metals detected in this surface water sample. Concentrations of aluminum (523 µg/L), arsenic (0.41 µg/L), barium (78 µg/L), calcium (49,700 µg/L), iron (874 µg/L), magnesium (11,700µg/L), and sodium (11,500 µg/L) were in excess of concentrations found in the upgradient samples. Three of the detected metals (calcium, magnesium, and sodium) are considered to be essential nutrients and will not be discussed any further."

The following text was inserted at the end of Section 4.4 Subsection <u>Metals</u>:

"With no significant soil or ground water contamination, the source of elevated surface water metal concentrations cannot be identified. The results for dissolved aluminum and iron were much less than the results for total aluminum and iron, respectively, which indicates that those two metals are present primarily in particulate form. The results for dissolved and total metals were otherwise in agreement, indicating that most metals are present in dissolved form in the seep water. The metals with elevated concentrations in the surface water, excluding essential nutrients, do not consistently have elevated concentrations in the Upper or Lower Pennsylvanian ground water. For example, aluminum was detected in just one ground water sample, yet the aluminum concentration in the seep water was elevated. The lack of data for other seeps confounds the determination concerning whether the seep concentrations represent contamination. However, because there was little if any soil or ground water contamination at SWMU 2, there is no apparent site-related source of surface water contamination and these metals in seep water are not discussed further in the context of SWMU 2 contamination. The effect of the upgradient concentration exceedances on human and ecological risks are evaluated further in Sections 6.0 and 7.0."

The first paragraph of Section 6.5.2.3, Noncarcinogenic Risks – CTE has been revised as follows:

"Cumulative HIs for the construction worker, adult recreational user, and adolescent trespasser under the CTE scenario are less than unity (1), indicating that no toxic effects are anticipated for these receptors under the CTE exposure conditions. Cumulative HIs for the CTE for future adult and child residents are 1.8 and 3.9, respectively. The HI calculated for nickel (ingestion route of exposure) in ground water exceeds 1 for the future child resident."

Comment GC-2:
The RFI report concludes in several sections that elevated constituent concentrations are not related to SWMU 2 disposal activities. For example, Section 4.2, Subsurface Soil (third paragraph on page 4-4), indicates that "even though 10 of the detected metals are present at concentrations in excess of the respective background data sets, there is no evidence to suggest that these metals are related to disposal activities at SWMU 2." Additionally, Section 4.3, Groundwater, indicates that low pH and elevated metals concentrations in well 02C11P3 (the most downgradient well) are not related to SWMU 2 disposal activities. However, several of these concentrations exceed the screening levels (e.g., Ecological Data Quality Levels, Maximum Contaminant Levels, Region 9 Tap Water Goals, Indiana Department of Environmental Management criteria, etc.) and should be addressed. It is unclear whether Naval Surface Warfare Center, Crane Division (NSWC Crane) intends to address this contamination under future activities at SWMU 2, under separate investigation, or not at all. Revise the RFI report to provide a discussion regarding how these areas will be addressed.

Response: As stated in response to General Comment 1, above, additional text has been added to the RFI report Sections 4.1 and 4.2 to clarify that the apparent elevated metal concentrations in subsurface soil are essentially a "fluke" that is derived from having only a single background concentration for each metal for Soil Group 9. The best way to understand this "fluke" concept is to imagine the following scenario. First, a sample from a background population is analyzed for a metal. Then another sample from the same population is analyzed for the same metal and the results are compared. There is a 50 percent chance that the concentration of the metal in the second sample will exceed the concentration of metal in the first sample. Should more and more samples be collected and analyzed for that metal, the chance of exceeding the metal concentration in the first sample for one of the subsequent samples increases rapidly. On average, when only one sample is collected after the first sample, half of the metal concentrations in this one sample are expected to exceed the corresponding concentrations from the first sample. This is the scenario that arose for Soil Group 9 samples, a sample group for which only a single background constituent value exists. The scenario is similar for ground water when only one upgradient ground water sample exists and multiple downgradient samples are compared to that one upgradient sample.

Concentrations of naturally occurring chemicals such as metals that are within background concentrations are not considered to be contamination even if a concentration exceeds a screening level.

In response to General Comment 1, additional text has also been added to Section 4.3 to address this concern associated with the extent of ground water "contamination." Please see the response to General Comment 1 for clarification of the apparent elevated metal concentrations in ground water.

With regard to action to be taken in response to the elevated risks estimated for SWMU 2, the Executive Summary states that the institution of land use controls to prevent disturbance of the cap is recommended. At this time, there is no schedule regarding additional control actions, however, a Corrective Measures Study is planned for SWMU 2. As part of the Corrective Measures Study, remedial alternatives will be evaluated for this SWMU.

The following text has been added after the last sentence of Section 1.2.5:

"This investigation was undertaken with the expectation that the cap would remain undisturbed for the foreseeable future and that land use controls to prevent future disturbances would be instituted at a future date."

SPECIFIC COMMENTS

Comment SC-1:

Section 1.4.5.2. states that the boundaries of the Upper Pennsylvanian aquifer are identified where the ground slopes downward and exposes the unit in outcrops. Are these outcrops clearly visible on all sides of the unit ensuring a good unit boundary?

The third full paragraph of Section 1.4.5.2. on page 1-6 notes that a hydraulic trough associated with the Golconda/Haney aquifer is identified and attributed to a structural trough previously identified by U.S. ACE. This seems to imply that the dye burial ground trenches intercept the Golconda/Haney aquifer. Is this the case?

Response: The text implied that outcrops exist on the sides of the ridges which is not the case. The text has been modified to reflect this knowledge. The fourth sentence in the first paragraph of Section 1.4.5.2 has been modified as follows:

"This aquifer exists under the SWMU 2 cap area and extends to the north, south, and west; and is terminated on the sides of the ridge where the ground surface intersects the unit."

The third sentence in the second paragraph of Section 1.4.5.2 has been modified as follows:

"The boundary of the Upper Pennsylvanian aquifer is identified where the ground surface slopes downward, intersecting the unit."

The last sentence in the second paragraph of Section 1.4.5.2 has been modified as follows:

"Upper Pennsylvania ground water does not appear to discharge to the surface, because no visible seeps exist where the Upper Pennsylvanian aquifer would be expected to terminate along the slopes of the hills bordering the site."

The Dye Burial Ground trenches do not intersect the Golcany/Haney Aquifer and no implication was intended. The Dye Burial Ground trenches are located within the shallow fill at depths less than 10 feet beneath the ground surface, whereas the Golcany/Haney Aquifer is located within the Golcany/Haney Formation at a depth that is greater than 75 feet beneath the ground surface. The Geologic cross sections shown as existing Figures 1-6, 1-7, and 1-8 show depict these units in greater detail.

No changes to the report have been made in response to Golcany/Haney Aquifer portion of this comment.

Comment SC-2:

Section 2.5.1, Soil Sampling. Table 5-8 of the Work Plan for RCRA Facility Investigation, Corrective Measures Study, and Risk Assessment at SWMU 2 - Dye Burial Grounds (Work Plan) indicates that additional soil samples may be collected at additional locations and/or

depths if contamination is detected in the soils. It does not appear that additional surface or subsurface soil samples were collected. Revise the RFI report to include a discussion regarding whether any additional samples were collected and the rationale supporting this decision.

Response: For clarification, the following text has been added to the end of Section 2.5.1:

"Field conditions did not indicate a need for the collection of additional samples beyond those that were designated in the approved SWMU 2 Work Plan because no staining associated with dyes was observed during soil sampling."

For further clarification, the following text has been added to the end of Section 4.6:

"The approved SWMU 2 Work Plan, Table 5-8, indicates that additional soil samples could be collected at locations and/or depths other than the planned locations and depths if contamination was detects in the soils. The lack of evidence for significant metals contamination at SWMU 2 indicated that additional soil sampling was not warranted."

Comment SC-3:
Section 2.5.2, Groundwater Sampling. Section 5.5.2.2 of the Work Plan indicates that groundwater sampling will be conducted in a two phased approach. The first round includes the sampling of eight existing monitoring wells. The Work Plan indicates that "...if detected inorganic concentrations exceed upgradient concentrations, the second round of ground water sampling will be conducted to evaluate the nature and extent of groundwater contamination." Table 4-4 of the RFI report indicates that the detected concentrations of several inorganic constituents exceeded the upgradient concentrations (as defined by sample 02GWC10P301). However, it does not appear that a second round of groundwater sampling was conducted. Revise the RFI report to include an explanation as to why two phases of groundwater sampling were not conducted, as proposed in the Work Plan, and whether the extent of groundwater contamination is considered fully defined.

Response: For clarification, the following text replaces the last paragraph of Section 4.6:

"The lack of dye detections in ground water samples demonstrates that dyes are not migrating from soils at SWMU 2 into the ground water. Section 5.5.2.2 of the approved Work Plan indicates that a second round of ground water sampling would be conducted to evaluate the nature and extent of ground water contamination if detected inorganic concentrations exceed upgradient concentrations. While some SWMU 2 ground water metals were detected at concentrations greater than upgradient concentrations, the number of such occurrences, the concentration levels observed, and the lack of spatial patterns with such detections are evidence that ground water is not contaminated with metals as a result of SWMU 2 operations. Therefore, the presence of metals in downgradient wells cannot be attributed to SWMU 2 operations and the need to collect additional ground water samples does not exist. The cessation of further sampling is supported by the historical data. Although the quality of the historical data is unverified, the historical data and

the most recently collected data are consistent, and indicate that elevated metals concentrations are not related to SWMU 2 activities.

"With these observations in mind, no significant ground water contamination is considered to have been identified at SWMU 2. The metals in ground water are of interest because their concentrations vary widely from well to well. Metals are naturally present in ground water and naturally occurring fluctuations in metal concentration can be expected. The ground water metals' concentrations are apparently not related to disposal activities at SWMU 2. Because the ground water between the Dye Burial Grounds and well 02C11P3 has not been adversely affected by dyes or dye-related constituents, there is no reason to associate the low pH value and elevated metals concentrations observed in 02C11P3 with the SWMU 2 activities. Coal was observed in only one boring at the Dye Burial Grounds (location 02C13); however, coal seams are present in the Lower Pennsylvanian rock strata at other locations of NSWC Crane, including the Rockeye and the Pest Control Sites (see Section 4.3). It is hypothesized that the low pH and elevated metal concentrations found in the ground water sample from well 02C11P3 are caused by the contact of ground water with oxidized pyritic rock that is in close proximity to well 02C11P3.

"Even with the biased soil and ground water sampling strategy that was used in this investigation, dye contamination was detected in just seven out of 23 subsurface soil samples located near to the Interim Measures cap, and the concentrations that were detected were less than 12 mg/kg (most of the detections were less than 6 mg/kg). During cap installation soil that was visibly contaminated with dyes was excavated and placed under the cap. No dyes were detected in ground water and there are no COPC screening levels available for the two dyes (Acid Yellow 23 and Acid Orange 10) that were detected in subsurface soil only. The potential for dye migration into ground water was the primary consideration during planning for this project. These data indicate that SWMU 2 has had little impact on environmental media.

"Despite the lack of evidence for metals contamination in soils and ground water at SWMU 2, metals exceeding the upgradient or background concentrations and COPC screening levels were conservatively carried into the risk assessment to preclude the possibility of not evaluating potentially harmful chemicals in those media. Well 02-05 was interpreted to be an upgradient well for this investigation, although only well 02C10P3 was originally identified as the single upgradient well. The exclusion of well 02-05 as an upgradient well was also considered in the human health risk assessment uncertainty analysis (see Section 6.0)."

Comment SC-4:

<u>Section 2.5.4, Sediment Sampling.</u> The RFI report indicates that sediment samples were collected from the locations proposed in the Work Plan. However, Figure 4-3 of the RFI report shows sample location 02SWSD05 further south than the sample location proposed in Figure 5-19 of the Work Plan. 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: Sample locations were approximated in the field by pacing and locating them in relationship to site structures. Each sample location was marked after sample collection, and subsequently the sample location was surveyed. It is not anticipated that the shifting of sample location 02SWSD05 invalidated the results, since the results would still be reflective of downstream contaminant concentrations, which was the original intent of the sample. For clarification, the following text has been added after the second sentence in the first paragraph of Section 2.5.4:

"Sample location 02SWSD05 was located approximately 500 feet further south than originally indicated in the approved SWMU 2 Work Plan. All sample locations were determined by pacing and locating in the field in relation to facility structures. The shifting of this sample location still meets the original objective, because the sample provides data that are reflective of downstream contaminant concentrations, which was the original intent of this sample..."

Comment SC-5:
<u>Section 4.0, Nature and Extent of Contamination.</u> This section indicates that historical analytical results for SWMU 2 were not considered in the nature and extent discussion because of the questionable quality of the data. If the quality of the data is in question, potentially resulting in unusable data, the number of samples collected during this Phase III investigation may be insufficient to characterize the nature and extent of contamination at SWMU 2. Revise the RFI report to include a more detailed discussion of the historical analytical results for SWMU 2 and the applicability of the previous data in determining the nature and extent of contamination at this SWMU.

Response: The term "questionable" has been replaced with the term *"unverifiable"* in the fourth paragraph of Section 4.0. It should be noted that, while there was limited data by which to evaluate the quality of the historical data, the data were sufficient for planning purposes.

Instead of reiterating the lengthy discussions of historical data quality and usability covered in the approved SWMU 2 Work Plan, the text at the end of Section 1.3 has been revised to direct the reader to the approved SWMU 2 Work Plan as follows:

"Based on past investigations of ground water and observations made during installation of the Interim Measures multilayered cap, the military dyes were identified as contaminants of primary interest for this investigation. The past investigations provided no quantitative chemical information on dye concentrations at SWMU 2; however visual observations during the installation of the multilayered cap did reveal the presence of dyes in soil. Soil stained with dyes was excavated and placed under the cap. Magnesium is the only metal identified in historical records as having been disposed at SWMU 2, however there was some uncertainty concerning whether or not other metals could have been disposed at SMWU 2. Sampling indicated that only dissolved metals concentrations were observed in the ground water. Although dissolved metals were detected in ground water at concentrations suspected to represent local background conditions they were conservatively retained for further investigation because of the uncertainty

associated with their disposal. Only dyes and metals were identified as requiring further investigation as part of this Phase III RFI.

"The historical ground water data are summarized in Section 5.0 of the approved Work Plan for this project and the historical metals data are provided in Section 4.0 of this RFI report. As stated in Section 5.5.2.1 of the approved Work Plan, the sampling undertaken in this investigation was designed to be biased toward those locations most likely to be contaminated with dyes if dye contamination persisted at SMWU 2.

"Analytical methods for quantification of the dyes in aqueous and solid environmental media were developed, validated, and approved for used by U.S. EPA Region 5 prior to undertaking this Phase III investigation. Dyes disposed at SWMU 2 did not contain metals."

The degree to which the nature and extent of contamination has been established is addressed in response to other comments. In particular, please refer to the responses to General Comments GC-1 and GC-2.

Comment SC-6:
Section 4.1, Surface Soil. It appears as if the extent of surface soil contamination has not been adequately defined. Aluminum, arsenic, iron and manganese were detected above U.S. EPA Region 9 residential preliminary remediation goals (PRGs) in nearly all surface soil samples. In addition, there appears to be no apparent trend in contamination. Therefore, the horizontal extent of contamination in surface soils may not be fully defined. Revise the RFI report to include a discussion regarding whether the extent of surface soil contamination is considered adequately defined.

Response: Aluminum, arsenic, iron, and manganese were detected at concentrations exceeding their respective COPC screening levels, however it should be noted that the COPC screening levels are one-tenth of the Region 9 PRGs for the non-carcinogenic metals aluminum, iron, and manganese. In actuality, the iron concentration exceeded the Region 9 PRG in just one sample (02SS110001) and the manganese concentration was equal to the Region 9 PRG in just one sample (02SS160001). For all the other surface soil samples, the concentrations were less than Region 9 PRGs for these three metals. In addition, the lack of concentration trends is consistent with the lack of contamination when concentrations are not significantly elevated relative to background concentrations.

U.S. EPA Region 9 Residential Preliminary Remediation Goals are provided in Table 6-1 of the RFI report. Tables 6-4 and 6-5 of that RFI report provide data concerning the status of individual metals relative to screening levels and background concentrations. Tables 6-4 and 6-5 show that none of the metals quantified in surface soils at SWMU 2 exceeded both the screening levels and background concentrations. Therefore, it is appropriate to conclude that no metal contamination of interest exists in surface soils. However, the RFI does present a discussion of metals in surface soils because, the metals that exceeded background concentrations were considered when selecting COPCs.

Please refer to the responses to General Comments GC-1 and GC-2 for a discussion of the text that has been added to address metal contamination at SMWU 2.

Comment SC-7:
Section 4.2, Subsurface Soil. It appears that the extent of subsurface soil contamination also has not been adequately defined. Arsenic and iron were detected above U.S. EPA Region 9 PRGs in nearly all subsurface soil samples. In addition, three detections of aluminum and two detections of manganese were also above these PRGs. There appears to be no trend of decreasing constituent concentrations in the sample locations furthest from the edge of the interim cap. Therefore, the horizontal extent of contamination in subsurface soils may not be fully defined. Revise the RFI report to include a discussion regarding whether the extent of subsurface soil contamination is considered adequately defined.

Response: Few of the detected subsurface metals concentrations exceeded both the COPC screening level and the background concentrations. For example, iron concentrations in subsurface soil samples did not exceed the Region 9 iron PRG although at least one iron concentration exceeded the COPC screening level which is one-tenth the Region 9 PRG. Iron was selected as a COPC because it exceeded both the COPC screening level and the background concentration. However, the iron concentrations in subsurface soil that were identified as exceeding background concentrations were associated with Soil Group 9, which has only one background iron value. If the same data are compared to Soil Group 8, which also represents subsurface soil at SWMU 2, the maximum site iron concentration is approximately half of the maximum background value.

The lack of a horizontal concentration trend in metal samples that were taken away from the multilayered cap at SMWU 2 is an indication that the metals with concentrations greater than COPC screening levels or greater than background concentrations are not site related contamination. Please refer to the response to General Comment GC-2 regarding the extent of subsurface soil contamination.

To further define the extent of dye contamination in subsurface soil, the following additional text has been added to the end of the second paragraph of Section 4.2 Subsection Dyes:

"The detection of dyes in these soils near the northwestern section of the Interim Measures cap indicates that subsurface soil dye contamination exists at SMWU 2 outside the multilayered cap. Dye detections are bounded on three sides at the northwestern edge of the cap. The topographically downgradient direction in this area is unbounded with respect to dye detections; however, the concentrations of dyes are low. Dye detections in the other two sample collection areas are completely bounded by the cap and by non-detects. The extent of dye contamination in subsurface soil at SMWU 2 is minimal. The impacts of dyes on human health and ecology are evaluated in Sections 6.0 and 7.0, respectively. Dye contamination does not require further investigation because the detections were low and infrequent, and were nearly completely bounded in all directions by non-detects."

Comment SC-8: TJ

<u>Section 4.3, Groundwater.</u> This section indicates that both monitoring wells 02C10P3 and 02-05 were used as upgradient monitoring wells. However, Section 5.5.2.2 of the Work Plan indicates that monitoring well 02C10P3 would be used as the upgradient monitoring well, and monitoring well 02-05 would be used to collect investigative groundwater samples. The use of monitoring well 02-05 as an upgradient well may not be appropriate. This monitoring well is located within the approximated boundaries of the SWMU area. Monitoring well 02C10P3 represents a more appropriate upgradient groundwater sample location, due to its location outside of the SWMU boundaries. Revise the RFI report to denote sample 02GWC10P301 as the only upgradient groundwater sample for SWMU 2, and revise any resulting assumptions accordingly.

Response: The Navy disagrees that well 02C10P3 is the only appropriate upgradient well. The following text has been added as a new second paragraph in Section 4.3 for justification to include well 02-05 as an upgradient well:

"Well 02C10P3 was the only well originally designated in the approved Work Plan to be the upgradient well for this SMWU 2 investigation. Synoptic water level measurements confirmed that well 02-05 was also hydraulically upgradient of the SMWU 2 Interim Measures multilayered cap. While well 02-05 is located within the approximate SMWU 2 boundary, it is appropriate to note that the SWMU 2 boundary is a somewhat arbitrary perimeter. Dye burials at SMWU 2 occurred downgradient of the well 02-05 location (see Figure 4-2). Of the sampled ground water monitoring wells that are upgradient of the Interim Measures multilayered cap, well 02-05 is the closest well. Thus, well 02-05 is viewed to represent upgradient conditions at a location that is closest to the multilayered capped area without being affected by potential sources of contamination associated with dye burials. Where appropriate, any differences associated with excluding, as opposed to including, well 02-05 as an upgradient well are discussed."

The following text has been inserted after Section 4.0, paragraph 3, sentence 2:

"The rationale for this deviation from the approved Work Plan is explained in Section 4.3."

A new second sentence has been added to the third paragraph of Section 4.3 as follows:

"Table 4-5 presents historical data for select inorganics, including metals, in the Upper and Lower Pennsylvanian aquifers"

The following third paragraph has been added to Section 6.6.1 Subsection Chemicals Potentially Attributable to Background:

"Monitoring wells 02GW0501 and 02GWC10P301 were used as background wells in the selection of COPCs. The work plan had indicated that only monitoring well 02GWC10P301 would be used to establish background conditions in ground water and monitoring well

02GW0501 would be used to characterize ground water conditions within SWMU 2. Although monitoring well 02GW0501 is located within the approximate SWMU 2 boundary, it is located outside and hydraulically upgradient of the landfill cap. Consequently, as discussed in Section 4.3, it is believed that ground water samples from 02GW0501 are representative of background conditions. If 02GW0501 had been included in the database for SWMU 2 then manganese and iron would also have been retained as COPCs for ground water from the lower Pennsylvania Aquifer in addition to the COPCs previously identified. HIs for exposures to ground water by hypothetical child and adult residents under the RME scenario would be 30 and 8.7, respectively. Aluminum (HQ = 2.2), cadmium (HQ = 3.2), cobalt (HQ = 2.1), iron (HQ = 1.1), manganese (HQ = 16), and nickel (HQ = 4.2) are the major contributors to the HI for the child resident under the RME scenario. Manganese (HQ = 4.6) and nickel (HQ = 1.2) are the major contributors to the HI for adult resident under the RME scenario. Under the CTE scenario, HIs for exposures to ground water by hypothetical child and adult residents would be 8.9 and 4.1, respectively. Manganese (HQ = 4.6) and nickel (HQ = 1.2) are the major contributors to the HI for the child resident under the CTE scenario. Manganese (HQ = 2.1) is the major contributor to the HI for adult resident under the CTE scenario. Since manganese and iron are noncarcinogens, the ILCRs presented in Section 6.5.2 for hypothetical residential exposures to ground water would not change."

Comment SC-9:

<u>Section 4.3, Groundwater.</u> It appears that the extent of groundwater contamination may not be adequately defined. Most of the maximum concentrations of constituents in groundwater were detected at the most downgradient sample location, 02C11P3. The RFI report indicates that these levels are not likely attributable to SWMU 2 disposal activities. However, even if the data from this well are not considered in the groundwater nature and extent discussion, several metals detections in the remaining wells still exceed the background and screening levels. In addition, there appears to be no apparent trend in decreasing contamination in the samples collected further downgradient within the SWMU. Revise the RFI report to include a discussion regarding whether the extent of groundwater contamination is considered adequately defined as a result of these other constituent exceedances.

Response: One reason why the observed concentrations are not viewed to represent site contamination is the observation of no decreasing trend in metal concentrations or dye concentrations that is presented in this comment. Concentrations that represent background concentrations should show no trend related to site activities but concentration variability will be observed with respect to both well location and time. Additional text has been added to Section 4.3 to expand on the discussion of the ground water chemicals. Please see the response to General Comment GC-1 for the additional text.

Comment SC-10:

<u>Sections 4.4, Surface Water, and 4.5, Sediment.</u> These sections indicate that the upgradient surface water and sediment samples were collected in Little Sulphur Creek, upgradient of the main treatment area in SWMU 3. However, a figure showing these locations (Little

Sulphur Creek and SWMU 3) is not included in the RFI report. Revise the RFI report to include a figure showing the locations of these upgradient surface water and sediment samples.

Referring to Section 4.4 on page 4-8, why was dye analysis not conducted on surface water seep sample? What aquifer is associated with this seep?

Response: Figure 4-9 has been added to identify the locations of upgradient samples used to establish whether SWMU 2 site samples were contaminated.

To complement the addition of Figure 4-9, the following reference to Figure 4-9 has been added at the end of the second paragraph in Section 4.4:

"These locations are shown in Figure 4-9."

To complement the addition of Figure 4-9, the following reference to Figure 4-9 has been added at the end of the third paragraph in Section 4.5:

"These locations are shown in Figure 4-9."

With regard to dye analyses on the seep sample, sample 02SW0701 was the seep sample and it was analyzed for dyes. A new second, Subsection entitled "Dyes" has been added into Section 4.4 as follows:

"**Dyes**

"No dyes were detected in the single available seep sample."

The following text has been added before the existing sixth sentence in the first paragraph of Section 2.5.4 Sediment Sampling identifying the seep as representative of the Golconda/Haney aquifer:

"Local geology interpretations and the elevation of the sampled seep relative to groundwater elevations indicate that the seep is associated with the Golconda/Haney aquifer."

Comment SC-11:
Section 4.6. The third paragraph states that only beryllium and cadmium were detected in excess of human health criteria in MW02C11P3. However, the information presented in Figure 4-2 for this well also identifies arsenic and nickel as detected above human health screening levels.

Response: Section 4.6 has been revised to include aluminum, arsenic, cobalt, and nickel, and zinc as metals whose concentrations exceeded background concentrations and human health screening

criteria. The third and fourth sentences in the third paragraph of Section 4.6 have been revised as follows:

"In this well, eight metals (aluminum, arsenic, beryllium, cadmium, cobalt, lead, nickel, and zinc) were detected in excess of background and human health criteria. This was the only Lower Pennsylvanian well in which both aluminum and beryllium were detected."

Figure 4-2 (See Attachment 1) has been revised to show where these same metals are elevated relative to upgradient concentrations.

Comment SC-12:
Section 5.1, Classes of Chemicals Disposed or Detected at SWMU 2. This section indicates that elevated concentrations of inorganics in groundwater are suspected of being naturally occurring. However, the RFI report does not provide documentation to support this suspicion. Supporting documentation should be provided which includes upgradient, as well as downgradient, monitoring well data to show that elevated inorganic concentrations are found site-wide and in the region, and that these levels may be naturally-occurring.

Response: : Pennsylvanian sandstones, siltstones, and shales in the Illinois Basin (geological structural basin) are typically associated with coal seams and resulted from the deposition of sediment in swamp, deltaic, and estuarine paleoenvironments. Iron, sulfur, and trace metals can accumulate as sulfide minerals (e.g., pyrite, marcasite, iron monosulfide) in these types of sedimentary environments, which are highly reducing. When lithified, these types of sediments form shale, siltstone, and sandstone. These are the types of rocks that are now present near the ground surface at SWMU 2. The exposure of these rocks and sulfide minerals to oxygen allows the sulfide minerals to gradually oxidize, thereby releasing iron, acidity, and trace metals into the groundwater. The oxygen can enter the ground as gaseous oxygen or as oxygen dissolved in rainwater that infiltrates the ground surface. Gaseous oxygen can also enter the ground relatively easily through a well casing. The oxidation of sulfide minerals in the rock directly adjacent to monitoring well 02C11P3, or any of the other Pennsylvanian monitoring wells, could account for low pH measurements and elevated metal concentrations.

Well 02C11P3 is located downgradient of SWMU 2 and is separated from the main burial area by three monitoring wells (02-02, 02-07, and 02-08) that had pH values above 5.22, and much lower concentrations of cobalt, copper, iron, lead, manganese, nickel, and zinc than did the groundwater sample collected from 02C11P3. Therefore, the metal concentrations found in 02C11P3 appear to be a very localized condition, and definitely not the result of a plume emanating from SWMU 2. A more plausible explanation of the metals observed in well 02C11P3 is the localized oxidation of sulfide minerals contained in the sandstone adjacent to the well (i.e., a natural source).

A comparison has been made between the total metal concentrations found in the recent sample collected from 02C11P3 and historical dissolved metals data collected from 13 wells that are considered to be upgradient or sidegradient of the cap area of SWMU 2 and are screened in Pennsylvanian rock units. The concentration of copper found in 02C11P3 during the RFI was

21.5 µg/L. Historical data exceeded this value one or more times in 9 of the 13 upgradient and sidegradient wells. The concentration of iron found in 02C11P3 during the RFI was 3,350 µg/L. Historical data exceeded this value one or more times in 6 of the 13 upgradient and sidegradient wells. The concentration of manganese found in 02C11P3 during the RFI was 1,720 µg/L. Historical data exceeded this value one or more times in 6 of the 13 upgradient and sidegradient wells. The elevated levels of aluminum, cobalt, nickel, and zinc detected in the sample from well 02C11P3 during the RFI, however, have not been exceeded previously in upgradient or sidegradient monitoring wells. Because well 02C11P3 is separated from the cap area of SWMU 2 by three wells that have much lower concentrations of these metals, the higher levels of metals found in well 02C11P3 are attributed to the local sandstone and shale rather than the landfill material.

Additional information has been provided in the response to General Comment GC-1. Various comment responses throughout this response document have resulted in extensive modifications in Section 4.3 to provide additional information on background levels of dissolved metals in groundwater at the site, as discussed in the response to General Comment GC-1.

In addition, the first paragraph of Section 5.1 has been revised as follows:

"The concentrations of several metals (aluminum, arsenic, beryllium, cadmium, cobalt, nickel, and zinc) in ground water collected from monitoring wells screened in Pennsylvanian rock are greater than screening levels and were determined to be statistically greater than background concentrations. However, two facts suggest that the elevated metal concentrations found in the wells are not the result of migration from buried wastes contained in SWMU 2. First, well 02C11P3 contained the greatest concentrations of these metals. However, this well is located the farthest downgradient and three other monitoring wells (02-02, 02-07, and 02-08) with relatively low concentrations of the metals in question are located between SWMU 2 and well 02C11P3. It is extremely doubtful that contaminated ground water migrating from the disposal area could have impacted well 02C11P3 without affecting the other three wells. Thus, the spatial distribution of metal concentrations does not support a migration-from–the-burial-grounds hypothesis. Secondly, the concentrations of iron, manganese, and copper found in well 02C11P3 during the RFI are less than concentrations historically detected in six or more out of thirteen wells that are located upgradient or side-gradient of SWMU 2. Thus, the levels of metals found in well 02C11P3 may appear at first to be elevated, but are not when one considers the levels historically detected in wells that are upgradient or side-gradient of the burial site. The most plausible explanation for the elevated metals concentrations that are found sporadically around the site is that naturally-occurring sulfide minerals contained in the Pennsylvanian shale and sandstone are oxidizing and locally affecting the metal concentrations in the groundwater. However, for the purpose of this RFI and to be conservative, the metals determined to be above background in Section 4.0 (using recent data from background wells 02-05 and 02C10P3, not historical data) and above screening levels have been retained as COPCs and have been evaluated for risk in Sections 6.0 and 7.0."

HUMAN HEALTH RISK ASSESSMENT COMMENTS

Comment HHRA-1:

Executive Summary (Page ES-3). It is stated in the third bullet point of this section that lifetime incremental cancer risks for human receptors were estimated to be within the range of 10^{-6} to 10^{-4}, and are therefore considered to be acceptable. From the Administrative Authority's perspective, acceptability of residual or target risk values which fall within the National Contingency Plan (NCP) risk range of 10^{-6} to 10^{-4} is based on the consideration of the inherent degree of conservatism and level of associated uncertainty in the quantitative point estimates of risk, and must be approved by U.S. EPA Region 5 on a case by case basis. Therefore, it is the decision of U.S. EPA Region 5 to determine whether risks to receptors at SWMU 2 that fall within the NCP risk range are acceptable. Replace statements in the RFI report regarding the acceptability of risks that fall within the NCP risk range with something similar to "risk range for which remedial actions are not usually performed."

Response: The Navy acknowledges that the U.S. EPA Region 5 retains the right to determine whether risks to receptors at SWMU 2 that fall within the NCP risk range are acceptable. This decision can be made by the U.S. EPA by approval or disapproval of statements contained within the RFI. The statements within the existing Executive Summary are designed to provide guidance with regard to further action (i.e., corrective measure study, further remedial action, etc.). If the proposed statement "risk range for which remedial actions are not usually performed" replaces the existing text, then it would be inconclusive as to whether or not further action is recommended. Therefore, no changes have been made to the document in response to this comment.

Comment HHRA-2:

Section 1.2.4, SWMU 2 Operations. It is stated that additional waste disposal trenches were discovered during historical site investigations. However, information is not provided which indicates the location or extent of these trenches. Revise this section of the human health risk assessment (HHRA) to include additional information about the location and geographical extent of waste disposal trenches at SWMU 2.

Response: The SWMU 2 historical documents discuss three disposal trenches. From the time that the geophysical surveys were conducted at the site in January 1991 until the initiation of the construction of the interim-measures cap in 1996, more trenches were discovered at SWMU 2. During this time period (e.g., 1991 until 1996), these disposal trenches were also referred to as the "waste areas." The locations of the waste areas are presented in Figure 5-2 of the approved Work Plan.

For clarification, Figure 1-14 has been modified to show the location of the Disposal Trenches/Waste Areas.

For additional clarification, the last paragraph of Section 1.2.4 has been revised to include a third sentence as follows:

"Geophysical surveys were conducted at the site in January 1991 to delineate the boundaries of the disposal activities. The results of the survey indicated that there are approximately 17 unidentified anomalies located at the site that may be attributable to site operations and may contain dye-contaminated material. Historically, these disposal activity areas have been referred to as either disposal trenches or waste areas."

Comment HHRA-3:
Section 1.4.6, Demography and Land Use. It is stated that none of the areas immediately adjacent to the NSWC Crane facility are zoned. No state or local planning exists in the vicinity of the facility, but municipal zoning exists in the region. Since the surrounding communities are stated to be in a period of transition, it is feasible that community growth may occur in the vicinity of the facility. Since the future use of adjacent land is not known, is subject to change, and is not currently zoned, land use planning and risk evaluation for potential receptors should be conservative and, as such, focused on residential land use and associated adult and child populations. Revise the Uncertainty Analysis, Section 6.6, to include a discussion regarding the uncertainty of future land use at or near SWMU 2, and reference this discussion in Section 1.4.6.

Response: There is no uncertainty regarding future land use because the Navy owns the land in and around SWMU 2. (SWMU 2 is located at a distance of approximately, 2,760 feet from the eastern NSWC Crane boundary.)

Because of the distance of SWMU 2 from the NSWC Crane boundary and the installation of the SWMU 2 multilayer cap, SWMU 2 will not have any impact on land usage external to NSWC Crane. The existing text of the second paragraph in Section 6.3.1.3 Exposure Routes, notes that "Exposure to contaminated soil at SWMU 2 is unlikely under current and future land use because the multilayered cap system has covered all soils that were visibly contaminated with dyes and all of those contaminated soils outside the cap have been placed underneath the cap. As described in Section 4.2, the extent of residual dye contamination in SMWU 02 soil is confined to subsurface soils in small areas and is of low concentration (i.e., <12 mg/kg)."

For further clarification, a new fourth sentence has been added to the second paragraph of Section 1.4.6 as follows:

"This separation distance of approximately 2,760 feet from the nearest eastern NSWC Crane property boundary and the multilayered cap will preclude any off-site impacts."

Comment HHRA-4:
Section 6.2.1, Data Usability. It is stated in the first paragraph on this page that "fixed-based analytical results" were used in the quantitative risk evaluation. It is not clear what is meant by "fixed-based analytical results." Provide additional discussion to clarify this statement.

Response: This statement refers to results generated in a laboratory that is not mobile. The text has been changed to read:

"Only target analyte data generated in a fixed location laboratory were used in the quantitative risk assessment."

Comment HHRA-5:
Section 6.2.2.1, COPC Screening Levels. It is stated that groundwater in the vicinity of the NSWC Crane facility is not used as a potable drinking water source. It is further stated that Lake Greenwood is used as a drinking water supply for the facility. However, regional off-site drinking water sources are not discussed. Revise the HHRA to provide information regarding drinking water sources for off-site populations in the vicinity of the NSWC Crane facility, including aquifer and surface water bodies, especially if the latter may receive recharge from site-impacted groundwater.

Response: This section presents the screening criteria that were used to select COPCs and is not the appropriate place to include a detailed discussion on off-site drinking water sources.

Section 1.4 contains a discussion of the geology and hydrogeology of NSWC Crane and SWMU 2. Because of the ground water flow pattern and the distance of SWMU 2 from the nearest eastern NSWC Crane boundary (approximately, 2,760 feet to the west of NSWC Crane boundary), off-site drinking water sources would not be expected to receive recharge from site impacted ground water.

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

Comment HHRA-6:
Section 6.2.2, Selection of Chemicals of Potential Concern. 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: A qualitative discussion which identifies constituents that exceed risk-based screening levels but were eliminated from the risk assessment based on comparison to site-specific background levels has been added to the RFI Report as a new Section 6.5.3 (see Attachment 2).

Comment HHRA-7:
Section 6.2.2.2, Lead as a COPC. Contrary to what is stated in the text, the screening levels for lead in soil (e.g., the Region 9 PRG) do represent risk-based screening levels. They are calculated on the basis of not exceeding a 10 microgram per deciliter (ug/dL) blood-lead concentration, which represents the level above which adverse health effects are known to occur. Revise the HHRA to correct this error.

Response: The Navy disagrees that the soil screening levels for lead represent risk-based concentrations. The text in this section does not state that there is a PRG for lead. The text in Section 6.2.2.2 states "There are no risk-based concentrations for this chemical since U.S. EPA has not derived toxicity values for lead." The 400 mg/kg screening level for residential exposures to lead by children was first published in EPA's Guidance on Residential Lead-Based Paint, Lead Contaminated Dust, and Lead Contaminated Soil, which is cited in the text.

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

Comment HHRA-8:
Section 6.3.1, General Conceptual Site Model. The reference in this section to "unacceptable" risk (and to acceptable risk and the U.S. EPA acceptable risk range anywhere in the risk assessment) contradicts U.S. EPA's Policy on Risk Characterization. Characterizations of permissible risk levels should be reserved for the conclusions of the RFI. Further the statement that unacceptable risks do not necessarily occur from any exposure seems to ignore the concept of a threshold toxicological response, and that it is possible to have exposure with no adverse effect. Revise the HHRA by removing statements regarding the acceptability of risk or hazard.

Response: For further clarification on this item, please see the response to Human Health Risk Assessment Comment 1 regarding comparisons to EPA's acceptable risk range. The reference to "unacceptable" risk in Section 6.3.1 occurs in the introduction to this section. The statement in question reads as follows: "An exposure, however long in duration, does not necessarily result in an 'unacceptable' health or environmental risk, although risks generally increase with increased frequency and/or duration of exposure." This statement is a generalized discussion of the relationship between exposure and risk and is correct in the context in which it is presented.

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

Comment HHRA-9:
Section 6.3.1.3, Exposure Routes, Soil. The discussion of the cap here and in other places in the RFI seems to contradict the text in the introduction that states the potential risks are estimated based on the assumption that no actions are taken to control contaminant releases. Revise the RFI to clarify whether the cap was considered as a contaminant release control during the HHRA.

Response: Beginning with the third sentence of the first paragraph in Section 6.0, the text has been changed to the following:

"As discussed in Section 1.2.5, an interim measures cap has been installed at SWMU 2 to minimize potential threats to human health and the environment by the mitigation of the migration of contaminants to ground water. The cap will be part of the final corrective measures at the site. Therefore, the cap was considered as a contaminant release control in the HHRA."

Comment HHRA-10:
Section 6.3.1.3, Exposure Routes, Ground Water. It is stated that direct exposure to groundwater at SWMU 2 is not expected to occur, but adequate justification is not provided to support this assumption. Additional information should be provided which discusses the known uses of groundwater, both inside facility boundaries and in the surrounding region; any known groundwater uses downgradient of SWMU 2; the depth to groundwater; and the potential for direct contact of construction worker receptors to groundwater.

Response: Please see the response to Human Health Risk Assessment Comment HHRA-5 regarding ground water usage at NSWC Crane and SWMU 2. The following text was added after the third sentence in the first bulleted item of Section 6.3.1.4:

"As presented in Table 1-1, depth to ground water at SWMU 2 is 20 feet or deeper, consequently it is very unlikely that a construction worker would be exposed to ground water even during excavation activities at SWMU 2."

However, it should be noted that even though direct contact exposure to ground water is not expected to occur at SWMU 2 the direct contact exposure pathway was evaluated for the hypothetical on-site residents in the HHRA.

Comment HHRA-11:
Section 6.3.1.4, Potential Receptors. A Recreational Child Receptor is not included in the list of potential receptors. Potential future uses for the recreational adult receptor include hiking, biking or hunting that may occur if the site were closed and developed into a state park. It is reasonable to assume that a recreational child receptor would also take part in some or all of these activities if SWMU 2 were developed into a park. Revise the HHRA to

include a recreational child receptor, or to provide adequate justification for excluding this potential receptor.

Response: The human health risk assessment was prepared following the EPA approved Work Plan. Child recreational users were not identified as a potential receptor group in the approved Work Plan. In addition, no COPCs were identified for surface soil at SWMU 2; consequently the only media evaluated for adult recreational users were sediment and surface water. It is very unlikely that a young child (ages 0 to 6) would have significant exposures to these media at this site.

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

Comment HHRA-12:
Section 6.4.1, Toxicity Criteria. It is stated in this section that toxicity values have been verified by the U.S. EPA RfD and Carcinogenic Risk Assessment Verification Endeavor (CRAVE) work groups. However, the CRAVE workgroups were discontinued in 1995. Values posted on the U.S. EPA Integrated Risk Information System (IRIS) database since then represent a consensus opinion of U.S. EPA health scientists representing the Program Offices and the Office of Research and Development. Revise this section of the HHRA to reflect this information.

Response: The Navy agrees. The reference to the CRAVE workgroup has been removed from the second paragraph of Section 6.4.1.

Comment HHRA-13:
Section 6.7, Summary and Conclusions. It is stated that because a cap exists at the site, land use control will prohibit future development of the site. However, one of the conclusions of the investigation, as listed in the Executive Summary, is that a land use control plan *should be developed and implemented.* It is not clear whether land use controls have been implemented at SWMU 2, what those controls consist of, what exposures they are designed to protect against, and how the land use limits will be or are being enforced. Revise the discussion in Section 6.7 to clarify the description and implementation schedule for any land use controls at SWMU 2.

Response: The results of the RFI have indicated the need for land use controls. The details of the land use controls (i.e., the implementation schedule) have not been established at this time.

The following sentence has been added to the end of the third paragraph of Section 6.7:

"A land use control program is not currently in place at NSWC Crane."

Comment HHRA-14:
Table 6-14, Summary of Exposure Assumptions. Exposure parameters are not provided for the ingestion of groundwater scenario for hypothetical future on-site residential receptors

within Table 6-14, although it is stated in Section 6.3.1.3 (Exposure Routes) that exposure routes for groundwater include ingestion and dermal contact. It does appear that lifetime incremental cancer risk and hazard index values were calculated for ingestion of groundwater, since these values are presented in Tables 6-18 and 6-19. Revise Table 6-14 to include exposure parameters used to calculate risk and hazard for residential receptors via ingestion of groundwater.

Response: The exposure assumptions for the ingestion of groundwater by hypothetical on-site residents are presented at the end of Table 6-14. Therefore, there is no need to revised Table 6-14.

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

ECOLOGICAL RISK ASSESSMENT COMMENTS

Comment ERA-1:

The RFI report states that Step 3A is the first step of the baseline risk assessment (BERA) process, and is used to refine the list of COPCs from the screening-level risk assessment (SERA). While the refinement of COPCs after the SERA is acceptable, the scientific management decision point (SMDP), that is recommended to be presented at the completion of the SERA in both the 1997 U.S. EPA ERA guidance and the Navy's ERA method (see Figure 7-1), has not been clearly presented.

The presentation of the SMDP should be a decision based on the results of Steps 1 and 2, and it should be indicated whether data are adequate for the decision made. Ecological effects quotient (EEQ) results should be presented in the context of the ecosystem to document whether there are any data gaps. It is understood that some of this information is provided in Section 7.0 and in other sections of the report, and it is not intended that this information be resubmitted for the SMDP. However, the information provided throughout the document should be integrated and presented in the context of an SMDP, to support the decision made for the SMDP in the context of ecological risk. Revise the RFI report to include a clear presentation of the SMDP at the completion of EPA Steps 1 and 2 of the SERA based on information provided in the SERA, before progressing to Step 3A.

Response: The RFI has been revised to include the SMDP as a new Section 7.5 (Scientific/Management Decision Point) presented after Steps 1 and 2 of the SERA and prior to Step 3A of the BERA.

Attachment 3 to this comment response document presents the new Section 7.5 (Scientific/Management Decision Point).

Comment ERA-2:

A number of threatened and endangered (T&E) bird species, and bird species of special concern, are listed as potentially occurring at SWMU 2. However, no discussion or examination of the potential of exposure to these species is provided in Section 7.0. Special consideration must be given to these species, and measurement and assessment endpoints selected for examining potential exposure to these species should focus on the individual, not the population. Revise the RFI report to provide a discussion of all T&E species and species of special concern that may potentially occur at the site. If complete information cannot be provided to verify that these species are absent at the site (e.g., critical habitat surveys, T&E species surveys), then these T&E species and species of special concern should be included in the SERA.

Response: The following discussion of the T&E species has been added to the end of Section 7.7.1 in the uncertainty analysis section of the RFI report:

"There are also uncertainties for potential risks to protected species (i.e., endangered, threatened, or species of special concern) at the site because risks to those species were not specifically evaluated in the ERA. Risks to these species were considered, however, using surrogate receptor species. An Endangered Species Management Plan for NSWC, Crane was prepared in October 2000 (Comarco Systems, Inc. 2000). As part of this plan, the federal and state endangered, threatened, and species of special concern for the facility were identified as described in Section 1.4.7 of this report. Several birds, two mammals, and one reptile are listed species that are present at NSWC Crane. Of the mammals, the risks to the Indiana bat were concluded to be negligible because none of the COPCs in the sediment and surface water were considered to be bioaccumulative; therefore, food chain modeling was not conducted for this species. Risks to the bobcat from contaminants at SWMU 2 also are expected to be negligible because of the general absence of bioaccumulative chemicals detected in the surface soil at the site (only copper) and the large home range of the bobcat versus the small size of the site. Of the birds, there is a potential that some of them may be present in the area around SMWU 2, because of the open grass area at the site and/or the wooded area surrounding the SWMU. However, based on the most conservative food chain model (maximum exposure parameters and the NOAEL as the TRV), adverse risks to herbivorous and carnivorous (insectivorous) birds were not expected. Therefore, no risks to the listed birds from contaminants at SWMU 2 would be expected."

Comment ERA-3:

<u>Section 7.2.6, Conceptual Site Model.</u> This section indicates that surface soil will be investigated to examine ecological exposures at the site, but it appears that subsurface soil will not be examined. Page 4-7 of the Work Plan states that surface soil investigation for ecological receptors will focus on the zero to 2 ft bgs interval. However, the soil intervals typically used to evaluate ecological exposures is zero to 0.5 ft bgs for surface soil and 0.5 to 2 ft bgs for subsurface soil. The 0.5 to 2 feet bgs exposure zone is typically considered the maximum depth that mammals will burrow. Depending on the nature of contamination and distribution, a composite of data from the zero to 2 feet bgs interval may underestimate risk through extrapolation of a chemical concentration across the entire sampling column, or could overestimate risk for one of the two sampling intervals. Revise this section and subsequent sections that rely on the soil data to reflect the zero to 0.5 feet bgs and 0.5 to 2 feet bgs exposure zones. If data are lacking for these two intervals, provide a detailed discussion of this information as a data gap and discuss in the uncertainty section.

Response: The surface soil samples comply with the definition of surface soil in the approved Work Plan. For clarification, the following discussion has been added as the second to last paragraph in Section 7.7.2:

"Surface soil was collected from the 0' to 2' bgs depth interval. These samples were divided into two aliquots. Samples to be analyzed for dye parameters were collected from the 0' to 2' interval and samples for inorganic parameters were collected from the 0' to 1' interval. Background surface soil data were collected from 0' to 1' bgs depth interval as a compromise depth for all NSWC Crane projects for which a variety of surface soil depths may be used. There is uncertainty in this approach depending on the source of contamination, how it was disposed at the site (i.e.,

buried), and the subsequent degradation of the buried materials because the two different depth intervals represent slightly different soil populations. However, the uncertainty was not viewed to be unacceptably large given all of the other uncertainties associated with environmental investigations."

Comment ERA-4:
Section 7.4, Ecological Screening. It is stated that maximum concentrations of inorganic contaminants that do not exceed background concentrations will not be retained as COPCs. Page 7-12 of the document indicates that site concentrations of constituents that are statistically above background concentrations are retained as COPCs, which is supported by the Work Plan. Therefore, it is unclear what process is being used for determining COPCs based on background comparisons (statistical comparisons or maximum detected investigative samples compared to background data). Revise the document to clarify the background comparison process and resulting COPC selection process. It should also be documented that all stakeholders agree that the background data set is considered representative (e.g., the regional background data values used for sediment in 7.5.1.2 would not normally be considered as representative).

Response: As indicated in Section 7.4, contaminants whose maximum concentrations do not exceed the background concentrations are not retained as COPCs. Section 4, (Nature and Extent of Contamination) briefly discusses the process by which background determinations were made in order to be utilized in the COPC selection. The reader is also referred to Appendices F.1 (surface soil), F.3 (surface water), and F.4 (sediment) for a detailed description of the statistics that were used in the background determinations. Because a Basewide Soil Background Study (TtNUS, January 2001) has been completed, the surface soil data set collected at SWMU 2 was compared to the basewide background surface soil data set by use of the Wilcoxon-Rank Sum test. Basewide background surface water and sediment data is not available, therefore, upgradient/reference surface water and sediment samples were collected at SWMU 2. Because only one surface water sample was collected, sample concentrations were compared to the maximum upgradient sample concentrations. The Wilcoxon Rank-Sum test was used to compare four background sediment samples to the seven SWMU 2 sediment samples.

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

Comment ERA-5:
Section 7.5, Step 3A - Refinement of the Screening. The first bullet on page 7-13 states that the magnitude of criterion exceedance will be used as a line of evidence to determine the need for further evaluation of the site. It is stated on page 7-11 that an EEQ of greater than 1.0 is considered indicative of potential risk, but does not necessarily indicate that an effect will occur. While this information is correct, the EEQs exceeding 1.0 should be presented to show the spatial distribution of exceedances in order to determine if the potential for risk is widespread across the site, contained to specific locations, non-existent, or altogether uncertain.

Care must be taken in this approach in that confidence in the EEQs is directly related to the confidence in the exposure concentrations and no observed adverse effect levels (NOAELs) used to calculate the EEQ exceedances. Therefore, the magnitude of criterion exceedance should not be solely used as a line of evidence to determine the need for further investigation. Rather, the spatial distribution of EEQs and uncertainties in the EEQ calculation process (e.g., confidence in the NOAELs used, confidence in chemical concentrations), should be examined in conjunction with the magnitude of exeedance. Revise the RFI report to incorporate these changes and include this information.

Response: The magnitude of criterion exceedance was not used solely as a line of evidence to determine the need for further investigation but rather was considered in conjunction with other bulleted items listed in Section 7.4 (Ecological Screening). However, a discussion of the spatial distribution of chemicals will be included as part of the SMDP. To recognize uncertainties associated with the EEQ calculation, a new sixth paragraph has been added to Section 7.7.3 (Ecological Effects Data) as follows:

"As discussed in Section 7.3.2, EEQs of greater than 1.0 were considered to be indicative of potential risk. However, such values do not necessarily indicate that an effect will occur but only that ecological effects are possible because a lower threshold has been exceeded. There are uncertainties in the calculated EEQs based on inherent uncertainties associated with the screening values and their derivation and the NOAELs (see above). The confidence in the EEQs is therefore directly related to the confidence in the exposure concentrations and NOAELs that are used to calculate the EEQ exceedances."

Comment ERA-6:
<u>Section 7.5, Step 3A - Refinement of the Screening.</u> The second bullet on page 7-13 states that frequency of detection will be used as a line of evidence to determine if further examination of the site is necessary. However, caution should be taken in using the frequency of detection as a line of evidence. The nature and extent of contamination at the site should be completely characterized, which should be reflected in the SMDP at the end of the SERA. If the nature and extent has been adequately determined, then frequency of detection may be used to refine the screening process. However, the spatial examination of EEQ exceedances should be used in conjunction with the evaluation of the frequency of detection to determine the need for further examination of the site. Revise the RFI report to include these considerations.

Response: The bulleted material in Section 7.5 presents the items that are evaluated as part of the Step 3A refinement; it does not present the actual evaluation of the data. The frequency of detection is one parameter that is evaluated in the Step 3A refinement. However, for this site, it was determined that detections were frequent enough that this evaluation was inappropriate to eliminate certain chemicals from being COPCs. See attached SMDP for a discussion of the contamination at the site.

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

Comment ERA-7:

<u>Section 7.5, Step 3A - Refinement of the Screening.</u> The third bullet on page 7-13 indicates that many contaminants, such as metals, are typically not considered to be bioavailable, and this is taken into consideration when examining the potential for exposure to ecological receptors at the site. However, no examination of site-specific conditions is provided in the document, therefore bioavailablity of contaminants at the site remains unknown. In addition, as recommended in the U.S. EPA Guidance for Conducting Ecological Risk Assessment (EPA, 1997) (EPA ERA Guidance), in the absence of site-specific information, 100% bioavailability should be assumed for the SERA. Revise the RFI report to use 100% bioavailability in evaluating ecological receptors during the SERA.

Response: The SERA does assume that the chemicals are 100 percent bioavailable. It is not until the Step 3A refinement (the first step of the BERA) that bioavailability less than 100 percent was considered. Bioavailability was used as a qualitative measure only and was not the sole basis for whether a chemical was retained as a COC after the Step 3A. For example, surface water samples were analyzed for total metals and dissolved metals because the dissolved fraction is considered most bioavailable to aquatic receptors such as fish (U.S. EPA, May 1992).

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

Comment ERA-8:

<u>Section 7.5, Step 3A - Refinement of the Screening.</u> The fourth bullet on page 7-13 indicates that the extent of habitat will be used to determine if additional evaluation is required for ecological receptors at the site. However, habitat considerations should be reviewed prior to conducting a SERA (as presented in Appendix H.6, Ecological Assessment Checklist). Since it was determined that habitat conditions at the site could support ecological receptors, then the SERA should be conducted. Once the SERA is conducted, habitat considerations should be considered during the risk assessment process during the BERA (e.g., site use factor). Revise the RFI report to remove the use of qualitative habitat evaluation for the consideration of additional site evaluation in examining ecological exposures during the SERA.

Response: The SERA does not include a consideration of habitat quality in the determination for additional site evaluation. Rather, habitat evaluations/area use factors were not considered until the Step 3A refinement (the first step of the BERA) as suggested.

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

Comment ERA-9:

<u>Section 7.5.2, Terrestrial Food Chain Modeling.</u> It is stated that COPCs that are not considered bioaccumulative by U.S. EPA were not placed in the food chain model for examination of ecological exposures at the site. 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 those 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: The food chain modeling was only conducted for chemicals that are considered to be important bioaccumulative chemicals by U.S. EPA per 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 first paragraph of Section 7.6.2 (Terrestrial Food Chain Modeling) has been modified to include a discussion of the COPCs that were excluded in the food chain model and reason(s) for their excluded as follows:

"The above-mentioned alternate benchmark values are not designed to evaluate risks to wildlife ingestion of soil, sediment, surface water, plants, invertebrates, and fish. Therefore, a terrestrial wildlife intake model is used to estimate the exposure of terrestrial receptors to the COPCs. However, COPCs that U.S. EPA does not consider to be bioaccumulative are not placed in the terrestrial food chain model (U.S. EPA, February 2000). Food chain modeling for the raccoon, kingfisher, and bat was not performed because none of the COPCs in the sediment (barium and manganese) and surface water (aluminum and iron) were considered to be bioaccumulative; therefore, food chain modeling is not appropriate for these chemicals."

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. June. ES/ER/TM-220.

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

ORNL (Oak Ridge National Laboratory). 1998. Biota Sediment Accumulation Factors for Invertebrates: Review and recommendations for the Oak Ridge Reservation. BJC/OR-112. August.

DATA QUALITY COMMENTS

GENERAL COMMENT

Comment GC-1:
The data quality section provides mean or averaged quality control (QC) results. The observed QC range is also reported in some cases. However, when no outliers are discussed it is unclear if all individual associated QC results were acceptable. Clarify if 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. (e.g., Section 3.3.2 page 9 of 26, metals in groundwater and surface water.)

Response: The DQR is designed to provide an overall quantitative view of the data quality that is in contrast to the data validation, which provides only alphabetic qualifier flags for individual results. However, for clarification, additional text has been added to identify the extreme values for cases where they were not previously identified. In particular:

The second paragraph of Section 3.3.2, Dyes in Soil and Sediment has been replaced with the following text:

"The mean recoveries of surrogate compounds anthracene and benzanthrone were low at 47. percent and 58.1 percent, respectively, across all soil samples and related QC samples (61 results), excluding samples 02SD010006 and 02SD050006, which had zero percent recoveries. This indicates a general moderate low bias for soils and sediments. Occasional extreme values are not unusual for this many results. Sample 02SS050002 had one surrogate recovery below 10 percent indicating a potentially extremely low bias for target analytes. Sample 02SD020006-D had two surrogate recoveries below 10 percent and the original sample 02SD020006 had one surrogate recovery at 10 percent indicating a potentially extremely low bias for target analytes in these samples. Samples 02SD010006 and 02SD050006 had zero percent recoveries for the surrogates, indicating that the laboratory may have forgotten to spike those samples with the surrogate compounds. This assertion is made because it is unusual not to recovery any surrogate compound from a sample, especially when samples of similar matrix generally exhibit acceptable recoveries of the same surrogate compounds, as was observed in this investigation. Omission of surrogates from these samples could not be verified so the potential for an extremely low bias still must be viewed to exist for samples 02SD010006 and 02SD050006. The matrix spike and matrix spike duplicate for sample 02SS200002 had recoveries for the surrogate anthracene that were less than 10 percent (2.7 percent and 2.3 percent). However because the original sample (02SS200002) and its duplicate (02SS200002-D) had acceptable recoveries, the extremely low bias was ascribed to the matrix spike and its duplicate and the results for sample 02SS200002 were not qualified."

The second paragraph of Section 3.3.2, Dyes in Ground Water and Surface Water has been replaced with the following text:

"The mean recoveries of surrogate compounds anthracene and benzanthrone were 50.9 percent and 87.7 percent, respectively, across all aqueous samples and related QC samples (25 results). Sample 02GWC11P301 had an anthracene surrogate recovery of 3.9 percent, indicating a potentially extremely low bias for target analytes in this sample. However, anthracene recoveries in all other samples ranged from 41 percent to 66 percent, indicating that this extreme low result is not the norm. The anthracene surrogate recoveries indicate a moderate low bias with the potential for an extremely low bias for sample 02GWC11P301. The matrix spike and matrix spike duplicate for dyes in ground water yielded target analyte recoveries that ranged 78 and 95 percent, indicating excellent performance for those compounds and supporting the assertion that the 3.9 percent recovery of anthracene in sample 02GWC11P301 is an anomaly. The benzanthrone recoveries do not indicate any significant bias with recoveries across all samples ranging from 78 to 98 percent."

The first paragraph of Section 3.3.2, Metals in Ground Water and Surface Water has been replaced with the following text:

"The LCS and mean MS percent recoveries were within the expected ranges across all ground water and surface water SDGs except for iron, selenium, and tin. The lone LCS recovery for selenium was 126.0 percent indicating a potential slight high bias. The iron and tin mean MS percent recoveries were 73.7 percent and 74.8 percent, respectively. The minimum iron and tin MS recoveries were 58.0 percent and 56.3 percent, respectively; otherwise recoveries for these metals were greater than 89 percent. The mean percent recoveries for iron and tin on the whole are barely outside the expected recovery limits of 100 percent ± 25 percent, so no adverse impact to data quality is expected."

With regard to the use of individual QC results during data validation, yes, individual QC results are used to qualify results for environmental samples. The validation is carried out in accord with the data validation guidelines that are cited in Section 3.1 as the basis of data validation. No changes were made in response to this portion of this comment.

SPECIFIC COMMENTS

Comment SC-1:

Section 3.3.1, Precision. The precision criteria used to assess data was ±50% for solids and ±30% for aqueous solutions. However, Tables 3-1, 3-3 and 3-5 of the Quality Assurance Project Plan (QAPP) indicate that QC relative percent difference (RPD) limits for metals is 35% for the solid matrix and 20% for aqueous solutions. For dyes, the RPD limits are 35% for the solid matrix and 20-53% for aqueous solutions (depending on the compound). In addition, Table 3-5 lists aqueous RPD criteria as 20% for total suspended solids (TSS) and sulfate, and 11% for chloride and total organic carbon (TOC). Solid matrix RPD criteria for TOC was 30%. Clarify why the limits of ±50% for solids and ±30% for aqueous solutions were used when it appears that the approved QAPP limits should have been used for data assessment. In addition, it is recommended that qualification of the affected data be re-evaluated using QAPP RPD limits.

Response: The data quality review and the data validation are separate processes with different goals. The data validation process uses the QC limits cited in the approved Work Plan for the qualification of individual results. The end result of data validation is the assignment of alphabetic validation flags (e.g., U, J, R, UJ, and UR) to every result that is found to be sufficiently noncompliant with the validation criteria. The data quality review (DQR) is designed to provide a more quantitative and global measure of precision and bias than can be gleaned from the alphabetic data validation flags. In effect, the DQR is designed to address some shortcomings of the data validation process. One shortcoming is that data qualifiers are assigned to individual data values based on the performance of a limited number of QC indicators. This tends to inflate the importance of individual QC indicators because no allowance is made for the natural variability of these indicators. For example, the natural variability of QC indicators might yield an apparent deficiency in one sample but no deficiency in another sample whereas the same QC indicator is acceptable when judged across all samples. The DQR thus allows a data user to interpret analytical performance for a type of sample matrix rather than for individual samples. The second shortcoming of data validation is that the alphabetic qualifier flags assigned to analytical results carry no quantitative information regarding quantification of the magnitude (and in some cases, the direction) of any data quality deficiencies. For example, a J flag on one data point could indicate an apparent low bias whereas a J flag on another result could indicate an apparent high bias. The degree of bias and the direction of bias can not be indicated with a simple J qualifier. In contrast, the DQR summarizes in a quantitative manner the precision and bias indicators so the data user can obtain a quantitative understanding of the analytical performance.

The fact that many different, analyte-specific, precision criteria are used for data validation is to some extent what makes the use of a single precision criterion (e.g., RPD = 30) for each matrix useful when summarizing analytical performance. The "30" and "50" percent RPD values used in the DQR for water and solid matrices, respectively, are simply used as a single point of reference for evaluating the analytical performance. These criteria were not the basis for data validation and they do not signify acceptability. A statement to this effect is made in the fifth paragraph of Section 3.3.1. Because sampling error is generally considered to be the greatest source of error for

decision making and it frequently exceeds 50 percent for soils, it is believed that the 50 percent point of reference used in the DQR is appropriate. A similar argument can be made for the 30 percent for water samples.

No change was made in response to this comment.

Comment SC-2:
Section 3.3.1, Precision. This section indicates that Solvent Yellow 3 exhibited an RPD of 154.1 % and that "one other value exceeded 30%." However, it is not clear what the "other value" was nor which compound exhibited this RPD. Clarify which compound exceeded 30% and the extent of the exceedance.

Response: The first paragraph in Section 3.3.1, "Dyes in Soil and Sediment" was revised to read as follows:

"RPDs for the spiked compounds ranged from 1.5 percent to 154.1 percent across all spiked analytes in *MS/MSD pairs. Solvent yellow 3 exhibited the 154.1 percent RPD, and one other value for this compound (39.9 percent) exceeded 30 percent; otherwise, all RPD values across all spike compounds were less than 18 percent, indicating performance that is generally within expectations."*

Comment SC-3:
Section 3.3.2, Accuracy. This section indicates that Solvent Yellow 3 recoveries in the matrix spike (MS) and laboratory control sample (LCS) were biased low. In explaining how this low bias effects other analytes, this section provides a list of dyes present in the spiking solution. However, Solvent Yellow 3 is not listed as being present. Furthermore, it is unclear how the dyes included in the spiking solution were chosen since accuracy recovery limits for all dyes are included in the QAPP. Clarify if Solvent Yellow 3 was included in the spiking solution. It is also recommended that further clarification be provided for the apparent QAPP and RFI accuracy assessment differences.

Response: Solvent Yellow 3 was indeed in the spiking solution. The text is inaccurate because it states that Solvent Red 1 rather than Solvent Yellow 3 was included in the spiking solution. The fifth sentence in the first paragraph in Section 3.3.2 Subsection Dyes in Soil and Sediment has been revised to read as follows:

"By design, only a representative number of target compounds (Acid Orange 10, Acid Yellow 73, Disperse Violet 1, and Solvent Yellow 3) were spiked into the samples subjected to dye analyses, and there are 20 dye target compounds."

Dye analytical method development was being done in parallel to approved Work Plan development. Consequently, matrix spike recovery limits were provided for all dye target analytes in the QAPP. The actual group of dye spiking compounds, however, was limited to a representative list of compounds because of the potential for chromatographic interference of one

compound with another. This strategy is explained in Section 8.2, Matrix Spike of the QAPP. Dye target analytes elute over a chromatographic retention time range of approximately 5 to 35 minutes. The spiking compounds (with chromatographic retention times ranging from approximately 9 to 20 minutes) were selected to represent a cross-section of target analyte chromatographic retention times and chemical characteristics.

Comment SC-4:

Table 3-5, Observed Minimum and Maximum Reporting Limits Versus Risk-Based Soil Target Levels and Soils and Sediment EDQLs. This table indicates that reporting limit (RL) values exceeding risk-based target levels are highlighted. However, it appears that not all RL values exceeding risk based target levels are highlighted. For example, Solvent Yellow 14 lists the observed minimum, maximum and target laboratory RL as 10.6 mg/kg. The risk-based soil target level is 3.23 mg/kg, but the RL values are not highlighted. In addition, it appears that the silver observed maximum RL of 0.69 mg/kg and the target laboratory RL of 1.0 mg/kg are incorrectly highlighted since the risk-based soil target level is 2 mg/kg. Revise the table to ensure that it is correctly highlighted, or provide further clarification as to what the highlighted sections represent.

Response: For clarification, Table 3-5 has been revised as follows:

- The Solvent Yellow 14 Observed Min and Max RLs and the Target Laboratory RL have been highlighted. The observed Max RL and the Target Laboratory RL for silver remain highlighted because they exceed the sediment RBTL.

- The appropriate columns have been shaded for Solvent Yellow 14. The silver observed maximum RL and target laboratory RL are correctly highlighted because they are greater than the risk-based sediment target level. No change was made to the silver data highlighting.

- The sixth column of Table 3-5 has been retitled to "Risk-based Sediment Target Levels." Additionally, the Table 3-5 has been included as Attachment 4 to this response to comments document.

- The risk-based soil target level for Solvent Orange 3 has been updated from "124" to "*129.*" The risk-based soil target level for Solvent Red 1 has been updated from "INS" to "--."

Comment SC-5:

Table 3-7, Qualification Rates for Aqueous Analytical Data. It appears that some of the qualification rates provided in Table 3-7 do not correspond with data provided in Tables E.2-1, E.2-2 and E.3. For example, Table 3-7 indicates that the qualification rates for tin were 8% J and 92% UJ. However, Tables E.2-1, E.2-2 and E.3 indicate that 100% of the tin samples were qualified as UJ. In addition, Table 3-7 indicates that all aqueous data for Solvent Green 3 were qualified as UJ. However, Table E.2-1 indicates that some samples

were qualified as U. Clarify these discrepancies and revise the tables as necessary to ensure that consistent information is presented.

Response: Interpretation of the original Table 3-7 format is not intuitive and was not discussed in the RFI text. Each row of original Table 3-7 should be interpreted as the percentage of data associated with a particular qualifier code (e.g., P) that have been qualified as indicated (e.g., J or UJ).

Table 3-7 has been re-organized to present the data in a different, more intuitive, manner and is included as Attachment 5 to these responses to comments. The updated Table 3-7 presents, for a given qualifier, the percentage of data qualified as indicated for a particular reason. This essentially reverses of the original format.

The following specific example presents how updated Table 3-7 should be interpreted: For selenium, 100% of the "J" and "UJ" qualified data were qualified because of a LCS/LCSD non-compliance. Please notice that Table 3-7 does not incorporate "U" qualified data because data that were "U" qualified are non-detect data.

Comment SC-6:
Table 3-8, Qualification Rates for Soil Analytical Data. It appears that some of the qualification rates provided in Table 3-8 do not correspond with data provided in Appendix E Tables E.1-1, E.1-2, E.4 and E.5. For example, Section 3.3.3 and Table 3-8 indicate that all undetected Solvent Yellow 3 were qualified UR. However, the qualification information provided in the Appendix E Tables shows that Solvent Yellow 3 soils/sediment data were qualified as U, UJ or UR. In addition, data qualification percentages presented in Table 3-8 for Solvent Yellow 33 are unclear. Table 3-8 indicates that 100% of Solvent Yellow 33 data were qualified UJ due to LCS/LCSD non compliance, but also shows that 100% of the data were qualified U due to "other." However, Tables E.1-1, E.1-2, E.4 and E.5 contain both U and UJ qualified data. Clarify these apparent discrepancies and revise the tables as necessary to ensure that consistent information is presented.

Response: Similar to Table 3-7 (See Specific Comment SC-5), interpretation of the original Table3-8 format is not intuitive and was not discussed in the RFI text. Accordingly, Table 3-7 has been re-organized to present the data in a different manner per Specific Comment SC-5.

The following specific example presents how the updated Table 3-8 (Attachment 6 to these responses to comments) should be interpreted: For 2-aminoanthraquinone 3.7 percent of the "UJ" qualified data were qualified because of surrogate recovery non-compliance and other reasons; 96.3 percent of the "UJ" qualified data were qualified because of surrogate recovery non-compliance; 100 percent of the "UR" qualified data were qualified because of surrogate recovery non-compliance; and 7.1 percent of the "U" qualified data were qualified because of other. Please notice that Table 3-8 does not incorporate "U" qualified data because data that were "U" qualifier are non-detect data.

The following first sentence of the sixth paragraph in Section 3.3.3 has been deleted. The text in the last paragraph of Section 3.3.3 has been updated as follows:

"All dye results for samples 02SD010006, 02SD020006-D, 02SD050006, and 02SS050002 were rejected due to surrogate recoveries of less than 10 percent."

In addition, the following text has been added to the end of Section 4.1, Subsection Dyes:

"Despite the rejection of dye results form sample 02SS05000s, no other surface soil samples contained detectable concentrations of dyes. Therefore, there is no expectation that dye contamination in surface soil was undetected as a consequence of analytical problems."

In addition, the following text has been added to the end of Section 4.5, Subsection Dyes:

"Despite the rejection of dye results associated with samples 02SD010006 and 02SD050006, no other sediment, ground water, or surface soil samples contained detectable concentrations of dyes. Therefore, there is no expectation that dye contamination in sediment was undetected as a consequence of analytical problems."

The holding time exceedance for mercury has been removed from Table 3-8. A new row has been added to Table 3-8 for cation exchange capacity holding time exceedance as parameter "Cation Exchange Capacity."

MINOR COMMENT

Comment MC-1:

<u>Executive Summary, Field and Analytical Program for SWMU 2.</u> This paragraph states that "Surface water samples were also analyzed for total and dissolved metals, hardness, and total dissolved solids (TSS)..." To avoid confusion, total dissolved solids (TSS) should be changed to read total suspended solids (TSS).

Response: The text of the third sentence in first paragraph of the Executive Summary Subsection Field and Analytical Program for SWMU 2 has been revised to correct this typographical error as follows:

"Surface water samples were also analyzed for total and dissolved metals, hardness, and total suspended solids (TSS) and sediment samples were also analyzed for total organic carbon (TOC) to assist in assessing the potential risks for ecological receptors"

ADDITIONAL MODFICATIONS TO THE RFI REPORT

1. Various minor non-technical text changes, reference changes, grammar changes, etc. have been made to the RFI.

2. The second paragraph of Section 4.6 has been updated as follows:

   "Metals were detected in all sampled media. In general, the majority of the detected metals were present at concentrations comparable to or less than background, except in subsurface soil. In subsurface soil samples, the majority of the detected metals were present at concentrations in excess of background. Most of the background exceedances are attributable to having only a single background concentration value for each of the metals (Soil Group 9). When the results are compared to background data for the other subsurface soil group present at SMWU 2 (Soil Group 8), the SWMU 2 metal concentrations in subsurface soil appear to be similar to background concentrations."

3. The following change has made to the ERA based on comments by TechLaw on the RFI report for SWMUs 4, 5, 9, and 10:

   The results of the food chain modeling were recalculated by removing the body weight scaling factor of 0.25 to adjust NOAELs and LOAELs based on test species to surrogate species. The new Tables 7-4 and 7-5 and new Appendix H.5 are attached to the end of this response to comment document (Attachment 7 and 8, respectively).

4. In Response to Comment GC-1, two CPOCs that were previously eliminated based upon background (cobalt and zinc) were retained. This impacted the Human Health Risk Assessment as follows:

- The third and fourth sentences in the first paragraph of Section 6.2.3 (Selection of Chemicals of Potential Concern) Subsection Ground Water Lower Pennsylvanian Aquifer text have been modified as follows to include cobalt and zinc:

  "...Aluminum, arsenic, beryllium, cadmium, cobalt, nickel, and zinc were detected at maximum concentrations that exceeded the risk-based COPC screening levels; they were retained as COPCs. The maximum detected concentrations of iron and manganese exceeded the screening criteria but were within background levels; therefore, these chemicals were not retained as COPCs for ground water in the Lower Pennsylvanian aquifer."

- The first and second sentences in the second paragraph of Section 6.5.2.1 (Noncarcinogenic Risks — RME) have been modified as follows to include cobalt and zinc:

"Cumulative HIs for the future adult and child residents are 3.8 and 13, respectively. These elevated risks result from exposure to aluminum (child HI = 2.2), cadmium (child HI = 3.2), cobalt (HI = 2.1), and nickel (adult HI = 1.2, child HI = 4.2) in ground water, primarily by ingestion..."

- The fifth, sixth, and eighth paragraphs of Section 6.7 (Summary and Conclusions) have been modified as follows to include cobalt and zinc:

  "The list of COPCs for SWMU 2 includes the following:

  - *... Ground water in Lower Pennsylvanian aquifer - aluminum, arsenic, beryllium, cadmium, cobalt, nickel, and zinc...*

  "...which were below levels of concern. The infrequent, low concentration occurrences of dyes were insufficient to warrant additional investigation of soils...

  "The elevated HIs were attributable to exposure to aluminum, cadmium, cobalt, and nickel in ground water, primarily by ingestion. The HIs calculated for residential exposure to ground water are subject to the following sources of uncertainty:"

- Section 6 Tables 6-9, 6-15, 6-16, 6-17, 6-18, 6-19, and 6-20 have been modified to include cobalt and zinc.

- Appendix G (Health Risk Assessment Calculations) Tables 2.6, 3.2, 5.1, 6.1, 7.11, 7.12, 7.13, 7.14, 8.11, 8.12, 8.13, 8.14, 8.15, 8.16, 9.7, 9.8, 9.9, and 9.10 have been modified to include cobalt and zinc (see Attachment 9).

5. Additionally, the Executive Summary has been updated to include information as provided in this response to comment document.

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Ser 095/3113

03 APR 2003

The letter Ser 095/3113 was for the submittal of the Final RFI Report for the DBG. The pages have been incorporated into the previously submitted Report dated 07/10/02 (Ser 095/2232).

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

James M. Hunsicker

SIGNATURE

Environmental Protection Department Manager 04/02/03

TITLE DATE