DEPARTMENT OF THE NAVY
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NSWC CRANE
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IN REPLY REFER TO:
5090/S4.7.1
Ser PRCR4/7097
23 MAR 2007

U.S. Environmental Protection Agency, Region V
Waste, Pesticides, & Toxics Division
Waste Management Branch, Corrective Action Section
77 West Jackson Blvd.
Chicago, IL 60604

Dear Mr. Ramanauskas:

Crane Division, Naval Surface Warfare Center submits responses to the U. S. EPA comments, dated June 9, 2006, on the Draft RCRA Facility Investigation Report (RFI) for Mine Fill A (MFA), Solid Waste Management Unit 12. The responses include extensive document revisions in order to present results of the sump sampling effort and the metals delineation at the Battery Dump Site. The submittal includes four parts, as follows:

Part 1: Responses to the June 9, 2006 comments
Part 2: Revised Section 3 text and tables
Part 3: Revised Section 5 text, tables, and figures
Part 4: Revised Appendix G tables

One copy of the responses to comments is presented as enclosure (1) for your review and approval. The permit required Certification Statement is provided as enclosure (2).

If you require any further information, my point of contact is Mr. Thomas J. Brent, Code PRCR4-TB, at 812-854-6160, email thomas.brent@navy.mil.

Sincerely,

J. M. Hunsicker
J. M. HUNSICKER
Environmental Site Mgr
By direction of the Commanding Officer

Enclosures: 1. Responses to Comments for the MFA RFI Report
2. Certification Statement

Copy to:
ADMINISTRATIVE RECORD
NAVFAC MW (Howard Hickey) (w/o encl)
IDEM (Doug Griffin)
TTNUS (Ralph Basinski) (w/o encl)

5090
Ser PRCR4/7097

23 March 2007

The letter SER PRCR4/7097 was for the submittal of the Draft RCRA Facility Investigation Report (RFI) for Mine Fill A, Solid Waste Management Unit 12 response to comments and change pages. The change pages were added to the draft report dated 1/30/06.

3/16/2007

NAVY RESPONSES TO U.S. EPA COMMENTS DATED JUNE 9, 2006 ON THE MINE FILL A (SWMU 12) DRAFT RFI REPORT

NAVY RESPONSES TO U.S. EPA COMMENTS DATED JUNE 9, 2006 ON THE MINE FILL A (SWMU 12) DRAFT RFI REPORT

United States Environmental Protection Agency (U.S. EPA) Region 5 comments, dated June 9, 2006, are shown in bold font. Navy responses to each comment are shown in regular font. Text changes to the RFI are shown in italic font enclosed in quotation marks in the response.

Comment 1:

The second paragraph of page ES-3 states that natural phytoremediation is playing a part in controlling and reducing the rate of contaminants reaching the base of the MFA ridge. Supplement this statement with evidence or present evidence in an appropriate section of the report.

Response: Although no data are available from SWMU 12 to demonstrate definitively whether vegetation on the hillsides of SWMU 12 is taking up energetic compounds, existing Section 6.1.3 (page 6-4) briefly presents the results of studies conducted at SWMU 13 regarding the uptake of energetic compounds by trees and shrubs. The similarity of SWMUs 12 and 13 in terms of topography, geology, weather, vegetation, and operations leads the Navy to believe the same process (phytoremediation) is occurring at SWMU 13 is also occurring at SWMU 12.

Sentence three of the second paragraph of page ES-3 has been changed as follows:

> *"Some of this groundwater seeps into the gullies on the side of the ridge. Based on evidence from NSWC Crane SWMU 13 and similarities to SWMU 12, some of the contaminated groundwater is taken up by trees and other vegetation and transpired."*

Section 6.1.3 has been replaced with a new Section 6.1.3 to explain this. That Section now reads as follows:

"6.1.3 <u>Plant Uptake</u>

Recent research by the United States Army Corps of Engineers (USACE) (May et al., 2003) suggests that plant uptake and phytoremediation may also be removing, degrading, and volatilizing RDX and TNT from the soils at NSWC Crane. During the NSWC Crane SWMU 13 RFI, vegetation samples were collected from trees and shrubs located on the northwest side of the ridge containing SWMU 13. This location was chosen because RDX-contaminated groundwater was considered most likely to be present and being taken up by plants. Results of the leaf analyses showed a relatively high frequency of detections of RDX, HMX, TNT, and degradation products in the 16 vegetation samples that were analyzed (TtNUS, 2005). Thus, the trees and vegetation on the northwest side of the ridge appear to be taking up groundwater and energetic compounds as groundwater discharges to the hillside. The energetic compounds may be photolytically degraded in the leaves while the leaves are still on the trees (see Section 6.1.4). Based on the similarity of SWMU 12 to SWMU 13 with regard to physiography and vegetation. these types of phytoremediation mechanisms are also believed to be actively operating at SWMU 12.

Leaves will probably carry some RDX and HMX back down to the ground during autumn and winter months. However, most of the leaves falling to the ground (i.e., leaf litter in the forest) will decay in place and the RDX and HMX will either biodegrade during decay or will be returned to the soil column, where it could recycle back up into the vegetation. No data are available to quantify RDX and HMX degradation rates in the leaf litter or the underlying soil."

Comment 2:

Referring to the third bullet on page ES-6, why is it unclear whether soils remaining after excavation were surface or subsurface soils? Wouldn't Interim Measure characterization samples tell you locations and depths of those soils which could not be excavated?

Response: The comment by the reviewer is correct. The IMR does specify the depths of soils that could not be excavated. The uncertainty in surface and subsurface soils actually is in the areas that were excavated and backfilled with bioremediated soil from different windrows that were mixed in the same hole. The reference to "explosives concentrations that could not be excavated" has been deleted.

The second bullet on page ES-6 has been revised as follows:

"For both risk assessments, the concentrations of some soil metals appear to be within naturally occurring concentration ranges, and it was not clear in some cases whether soils remaining after excavation were surface soils or subsurface soils. This is due in part because it is difficult to pinpoint the concentrations of explosives at precise depths in areas that were excavated and backfilled with bioremediated soil. Based on descriptions of the excavations it is believed that, with minor exceptions, all surface soils have explosives concentrations that are less than industrial or residential cleanup levels."

Comment 3:

Referring to the last two sentences of the second paragraph on page 1-3, do the reports indicate where these dumping locations were? Mention whether this RFI or previous studies focused on those areas?

Response: The last two sentences refer to historical practices at NSWC Crane. The information was obtained from Section 2.1.2, paragraph 6 of the Final RFI Phase I Environmental Monitoring Report (Halliburton NUS, 1997). These statements have been deleted because they apply to Crane as a whole.

The Phase I report indicates that during SWMU 12 reconnaissance, staining was noted on the ground around the paint locker (Building 196) located just south and west of Building 155. The stains were apparently the result of spilled liquids such as solvents used in Building 155 and near the paint locker (Building 196). Presumably, the solvents were dump between Building 155 and Building 196. Neither the RFI nor previous investigative studies have focused on this area.

Comment 4:

The text beginning in the middle of page 1-7 discusses existing conditions around buildings in MFA. Discussion of existing conditions around buildings 155, 3110 and 3111 is not presented although these are noted in the site history discussion of Section 1.2.2 as having demilitarization and documented contaminant releases take place. There is brief discussion of sampling around 'Structure 3110' and 'Structure 3037' on page 7-31. Present a summary of exactly which buildings were previously investigated and which buildings were investigated under this RFI. Discussion of existing conditions and/or sampling around these buildings or structures should be presented in an appropriate part of Section 1 or 5.

Response: The discussion beginning in the middle of Page 1-7 is related to SWMU 12 interim measure actions conducted at SWMU 12 during the period 1997 through 2000. In this time period, actions were only conducted and reported for Buildings 151, 152, 153/154, 157, 158/159, and 160, but not for Buildings 155, 3110, and 3111. More recently in the RFI, sampling has been conducted at Buildings 3110 and 3037 as discussed on Page 7-31.

Based on historical documentation, prior to the RFI, investigations were only conducted at Buildings 151, 152, 153/154, 157, 158/159, and 160. In the RFI, only Buildings 3110, and 3037 were investigated.

Existing contamination around Buildings 3110 and 3037 is discussed in Section 5..2.4 relative to soil boring samples 12SB04 to 12SB11. A new table was added to Section 1.0 to identify whether buildings and other structures at SWMU 12 were investigated during the RFI or during previous investigations.

Numerous revisions have been made throughout Section 5.0 to incorporate discussions of the sump samples analyzed for explosives. Addition of new Section 5.1.3 is one of these changes. The remaining changes related to this comment response generally describe what can be seen by inspecting Figures 5-1, 5-24, 5-25, and 5-26. Most of the soil contamination around sumps is limited to shallow soils. Soil samples collected around sumps near Buildings 152, and 157 had the greatest degree of contamination. Only three sump water samples could be collected and all three had detectable levels of explosives. The highest sump water concentration (95 µg/L) was observed in a sump near Building 154. With one exception (16 mg/kg) sump sediment concentrations were in the range of non-detectable at 0.25 mg/kg to less then 8 mg/kg. The highest shallow groundwater contamination was observed along the eastern edge of the site. However, concentrations in considerable excess of the drinking water standard (0.61 µg/L) were detected to the west, as well. Overall, the greatest degree of contamination is associated with the central portion of the site from west to east.

These changes are included as an enclosure to this response document..

Comment 5:

Referring to the vein of contamination at MFA Battery mentioned in the last sentence of Section 1.2, present a discussion of how that metals and explosives impacted material may have been deposited there and what the source might.

Response: The following information has been added as the introductory paragraph in Section 1.2 under the header "BATTERY SITE INTERIM MEASURE".

"The Battery Site was discovered by a representative of the NSWC Crane Environmental Protection Department during the early 1990s. The Battery Site contains two areas: (1) Battery Area where batteries were dumped on the ground surface; and (2) Soil Area adjacent to the Battery Site where soil and construction debris was dumped in small mounds. When the batteries were discovered, they were recognizable as AA household type batteries. The origin of the batteries is unknown. However, based on their condition at the time of discovery and subsequent rate of degradation, they were probably placed at the site in the mid to late 1980s. The origin of this debris or the dates on which it was placed at the site is unknown. Due to its proximity to MFA, the mounded soil may have originated from within MFA, possibly from the installation of road culverts."

Comment 6:

There is a typo in Section 2.4.2: surrey.

Response: This typographical error has been corrected to read as *"survey"*.

Comment 7:

What is the source of the HHRA and ERA Criteria presented in Table 3-4? Values do not appear to match those presented in the project QAPP. For example, Appendix B of the February 2003 QAPP gives a human health RBTL for Aluminum in soils as 76,000 mg/kg while Table 3-4 lists the HHRA value at 8.3 mg/kg; Figure 5-1 shows Aluminum human health level at 8.3 mg/kg; Figure 5-2 shows

Nickel human health screening value at 14 mg/kg. Recheck all tables and figures to ensure the correct human health and ecological risk based screening values are presented. Tables listing such screening levels should be footnoted to identify the source of the value. State whether any corrections to screening levels will result in changes to report COPC selections and/or conclusions. Should figures require revision and resubmittal, consider identifying screening exceedances with color for easier identification.

Response: The sources of the HHRA criteria presented in Section 3 are United States (U.S.) Environmental Protection Agency (EPA) Region 9 PRGs, U.S. EPA Soil Screening Levels (SSLs) for Migration from Soil to Groundwater and Migration from Soil to Air, and Indiana Department of Environmental Management (IDEM) Default Closure Levels. The ERA criteria are primarily the Region 5 Ecological screening levels (ESLs). However, for soil, the USEPA Ecological Soil Screening Levels (Eco SSLs) were given preference over the Region 5 ESLs based on direction from EPA region 5. The USEPA Eco SSLs are more current than the ESLs. One reason that some criteria in the RFI report are different from criteria listed in the QAPP is that some values have changed in the 2 to 3 years since the QAPP was written. The criteria were updated in the RFI Report. Another reason is that the number of chemicals in the SSL lists has been considerably expanded since the QAPP was written. When the QAPP was written, the SSLs were obtained from Appendix A of the U.S. EPA 1996 Soil Screening Guidance. Since that time, many additional SSLs have been calculated by Tetra Tech NUS, Inc. using the calculation tool provided on the U.S. EPA Soil Screening Guidance Website (http://risk.lsd.ornl.gov/calc_start.htm).

Regarding the example discrepancies mentioned by the reviewer, in the 1996 SSL Guidance, no SSLs had been developed for aluminum and the SSL for Migration from Soil-to-Groundwater for nickel was 7 mg/kg. Today, using the Soil Screening Guidance Website, the SSL for Migration from Soil to Groundwater for aluminum is 8.3 mg/kg and the value for nickel is 14 mg/kg. The criteria used in the RFI report represent the most current values at the time the risk assessments were performed.

As requested by the reviewer, the criteria in the tables in Section 3, the COPC selection tables in Sections 7 and 8, and the criteria on the figures have been rechecked. All values were found to be correct and up-to-date, with the following exceptions:

1. The ERA criterion for vanadium in surface soil was 1.59 mg/kg in Tables 3-4 through 3-6 but has been corrected to be 7.8 mg/kg in those tables.

2. The ERA criterion for aluminum in surface water, incorrectly listed in Table 3-14 (now Table 3-22) as 3.6 µg/L, was corrected to be 87 µg/L.

3. On Tables 3-18 (now Table 3-26) through 3-20 (now Table 3-28), 3-27 (now Table 3-35), and 3-28 (now Table 3-36), the RDX ERA criterion of 3070 µg/L was corrected to be 190 µg/L.

4. In Table 3-39 (now Table 3-47), the bis(2-ethylhexyl)phthalate ERA criterion of NA was corrected to be 182 µg/kg.

None of the changes in the Section 3.0 tables resulted in a change to the COPC status of any chemical nor did the corrections require any changes to figures.

Comment 8:

There appear to be a couple of typos on page 4-3: '08SW/SD04' (should this be 12SW/SD04?) and 'drainageway G' (should this be drainageway H?).

Response: The following corrections have been made to sample location callouts in Section 4:

Section 4.3, p. 4-3, paragraph 1, last sentence: "*08SW/SD04*" should be "*12SW/SD04*".

Section 4.3, p. 4-3, paragraph 2, eighth sentence: "*drainageway G*" should be "*drainageway H*".
Page 4-4, paragraph 1, last sentence: "*12SW/SD18, and 12SW/SD20*" should be "*12SW/SD19, and 12SW/SD21*".

Comment 9:

The second to the last sentence of the first paragraph on page 4-10 should be supplemented with supporting evidence that all shallow groundwater is discharging to the gullies or changed to better agree with the second sentence on page 4-13.

Response: The last sentence of the first paragraph on page 4-10 is incorrect. In Section 4.6, p. 4-10, paragraph 1, line 5: The two sentences beginning with "*All shallow groundwater ...* "have been changed to: "*Based on the site hydrology (see Section 6.0 and Figure 6-1), most shallow groundwater in the Puz and Pmz is flowing laterally toward the gullies with a minor vertical downward component of flow to the Plz.*" and "*The hydraulic gradients in the Puz and Pmz steepen as the slide slopes of the ridge are approached.*"

Comment 10:

The second and last paragraphs of page 4-12 mention the crop lines of the Pmz and Mgd aquifers. These are not shown on Figures 4-11 or 4-12. What is the elevation of the stream relative to the crop line of the Glen Dean Limestone?

Response: There are fewer wells drilled down into the Pmz, Plz, and Mgd water-bearing zones than the Puz zone. Hence, it is difficult to project a well-defined top and elevations for the lower water-bearing units. The Plz zone rests directly on the top of the Mgd zone and are consequently in direct hydraulic communication, so these two zones can be lumped together as one aquifer.

In general, the Pmz zone is about 50 feet thick. The top of this unit is at approximately 670 feet msl. The bottom of the unit lies at about 615 to 625 feet msl. Based on this information, the Pmz intersects the unnamed tributary streams and gullies above the 620-ft ground surface elevation contours, in the middle portions of the ridges. A footnote will be added to Figure 4-11 which reads:

"The Pmz zone is about 50 feet thick. The top of this unit is at approximately 670 feet msl. The bottom of the unit lies at about 615 to 625 feet msl. Based on this information, the Pmz intersects the unnamed tributary streams and gullies above the 620-ft ground surface elevation contours, in the middle portions of the ridges."

The upper surface of the Plz lies at about 605 ft msl and the Glen Dean Limestone should not extend deeper than about 580 ft msl. The Plz/Mgd zone intersects the ground surface between ground surface elevations of 580 and 605 ft msl, along the lower portions of the ridge, but above the elevation of Turkey Creek. A footnote will be added to Figure 4-12 which reads:

"The upper surface of the Plz lies at about 605 ft msl and the Glen Dean Limestone should not extend deeper than about 580 ft msl. The Plz/Mgd zone intersects the ground surface between ground surface elevations of 580 and 605 ft msl, along the lower portions of the ridge, but above the elevation of Turkey Creek."

Comment 11:

Should the symbol used for 'final bioremediated concentrations' on page 5-9 be 'Cc'? This is what is presented in the equations on page 5-10.

Response: Yes, the symbol for "bioremediated concentrations" in Section 5.2, page 5-9, last paragraph, sixth sentence, should be C_c and has been changed to "C_c".

Comment 12:

Referring to the mass computations presented on page 5-10, is depth to bedrock information available for the bioremediated areas of the MFA? Can a better estimate of explosives mass remaining be done by calculating impacted soil volume remaining above bedrock and using the initial characterization sample results from the interim measure?

Response: Depths to bedrock are not available in all locations. Initial characterization data indicate the explosives concentrations prior to excavation. If the ICS results indicated an unacceptable level of explosives contamination the soils were excavated, so unless the initial characterization concentrations were already acceptable, the initial characterization data no longer reflect concentrations of explosives in soils around the buildings. More recent explosives data for soils indicate that explosives are present in some of the soils around sumps. Therefore, the text following the calculation has been supplemented by adding the following text (referring to the External Sump/Drainage Investigation, or ES/DI) to the end of the paragraph located immediately after the calculation:

"When the additional detections of explosives in soil and perched groundwater near sumps are considered, it is understandable that the SMWU 12 ridge top could be considered a continuing explosives contamination source for groundwater. Based on available data, the explosives of most significance are RDX, HMX, 2,4,6-tirinitrotoluene, and the primary degradation products of these chemicals (MNX, DMX, TNX, 2-amino-4,6-dinitrotoluene, and 4-amino-2,6-dinitrotioluene). More discussion on soil explosives contamination identified during the ES/DI is provided in later subsections. The ES/DI data indicate that relatively high explosives concentrations are present near certain ES/DI sampling locations on the east side of the SWMU (see Figure 5-1). Based on these recent data, the extent of contamination, though not bounded in all directions, appears to represent small quantities of contaminated soil compared to the previous excavations. With the additional detections of explosives, it is evident that the excavations did not address all contaminant sources. Finding all contaminant sources may not be possible but it is believed, based on site history and available data, that most significant sources have been identified. Therefore, it is reasonable to consider the SMWU 12 ridge to be a mosaic of sparsely distributed residual explosives contamination in soil, most of which has been delineated on a relatively large scale. The explosive-related chemicals detected most frequently and in the highest concentrations were RDX, HMX, 2,4,6-dinitrotoluene, and the degradation products of these chemicals (MNX, DNX, TNX, 2-amino-4,6-dinitrotoluene, and 4-amino-2,6-dinitrotoluene). More discussion on soil explosives contamination identified during the ES/DI is provided in later subsections."

Comment 13:

Referring to the second sentence of the second paragraph on page 5-10, can the excavation depth range be presented here along with the average depths?

Response: Table 1-1 lists the depths of grid cells that were not excavated to achieve explosives concentrations less than industrial screening values but the depths of excavations are not known in all locations. That is why an average depth was estimated in the second sentence of the paragraph in question to be "...about 3 or 4 feet bgs, on average". A depth of 3 to 4 feet bgs represents a best estimate of average excavation depth. In Section 5.2.1, page 5-10, second paragraph, third-to-last sentence has been divided into two sentences to incorporate a direct reference to Table 1-1 as follows:

"However, some areas could not be excavated to achieve explosives concentrations less than industrial cleanup levels (See Table 1-1). Because bedrock is shallow in several places, contaminants may have moved directly to bedrock as adsorbed or dissolved species."

Comment 14:

Referring to the first full sentence on page 5-12, isn't 12SS150002 located at MFA Battery and not MFA Proper?

Response: Yes, soil sample 12SS150002 is located at the MFA Battery site and not in the MFA proper. The reference to "MFA proper" has been changed to "MFA Battery Site". In addition, "then" has been changed to "than" in the second sentence of the middle paragraph on page 5-12 of Section 5.2.2.

Comment 15:

The second sentence of Section 5.2.3 states that relatively few chlorinated VOC results were rejected. Looking at Section 3 and Table H-2, it doesn't appear that any chlorinated VOC results were rejected.

Response: The first phrase of Section 5.2.3, paragraph 1, sentence 2 has been deleted to accurately reflect that no chlorinated results were rejected. The sentence is now as follows:

"The rejections were generally for chemicals that are part of the analytical VOC fraction but are not of particular interest for SWMU 12 (See Section 3.0 and Table H-2)."

In addition, the word "chlorinated," has been deleted from the first sentence of the second paragraph on page 5-13 Section 5.2.3.

Comment 16:

Referring to the first paragraph of Section 5.2.4, present a brief summary of any metals issues from the bioremediation effort, regardless of leachability potential.

Response: Recently collected metals data were used to delineate metals contamination at the MFA Battery Site. Incorporation of these data resulted in a significant revision of Section 5.2.4. The new Section 5.2.4 text, revised tables associated with that text, and revised figures 5-4 through 5-12 are provided as enclosures to this comment response document. To address this comment, the first sentence of Section 5.2.4 on page 5-13 was deleted. The text after the semicolon in the third sentence of the first paragraph of Section 5.2.4 was also deleted. The following text was inserted before the last sentence of the first paragraph of Section 5.2.4 on page 5-13:

"The bioremediation program at SWMU 12 focused on the 8 RCRA metals (arsenic, barium, cadmium, chromium, lead, mercury, selenium, and silver) plus aluminum. These metals were analyzed in Initial Characterization and Post-Excavation samples. They were not analyzed in the bioremediated compost which was backfilled into the excavated areas of SWMU 12. The data presented in the IMR indicated that only concentrations of arsenic exceeded residential and/or industrial criteria for the protection of human health (TolTest, 2001, 2002, 2005). An analysis of potential risks for the historical metals is presented in this report in the Human Health and Ecological Risk Assessments (Sections 7 and 8, respectively). The human health risk assessment, for example, indicated that risks from exposure to arsenic and aluminum in the historical soil samples were acceptable. An important uncertainty factor regarding the historical metals is that the concentrations of metals in the bioremediated compost are not known. This is mitigated by the fact that the highest concentrations of aluminum and arsenic detected in the historical samples were used to determine the exposure concentrations used in the risk assessments."

The affected paragraph is paragraph 3 of new Section 5.2.4.

To better set up the incorporation of the latest round of metals data, additional changes were made to the beginning of Section 5.2. The changes include a revision of the second paragraph of this section as follows (altered text is in italics font):

"The analyses conducted during this RFI are documented in Section 2.0 and summarized in Table 2-3. Data summary tables are presented in Sections 1.0 and 3.0 of this report. The Section 1.0 tables represent the bioremediation effort; Section 3.0 Tables 3-1 through 3-7***3*** reflect the RFI effort. *The RFI effort included collection of samples for the ES/DI and delineation of metals contamination at the Battery Site.* A complete data set of all samples collected and analyzed for the bioremediation effort is available in the IMRs (MK, 1999 and TolTest, 2002). A complete data set for the RFI is presented in Appendix G tables (G-1 through G-*8*)."

The second half of paragraph 3 and the first part of paragraph 4 of Section 5.1.1. were also rewritten as follows (changed text is in italic font):

"...Samples collected from locations 12SB01 through 12SB11 were placed into the MFA group; samples from locations 12SB12 through 12SB2*4 and locations 12SB25 through 12SB39* were placed into the Battery Site group. *Surface and subsurface soil samples from locations 12SB021 through 12SB24 and all soil samples from locations 12SB25 through 12SB39 were collected during the first round of Battery Site metals contamination delineation.* Both the MFA and Battery Site areas include soils from the background Soil Groups 3 and 8. *Samples collected for the ES/DI (from locations 12SB40 through 12SB71) were analyzed for explosives only and all explosives detections were assumed to represent site-related contamination. Soil samples were collected from borings 12SB72 through 12SB85 in October 2006 to supplement the original metals delineation at the Battery Site...*"

Statistical comparisons between background and SWMU 12 RFI metals concentrations *were generally not conducted for this investigation, but simple comparisons were made between background soil upper tolerance limits (UTLs) and site concentrations. This is explained further in Section 5.2.4.* References are made in the following text to maximum concentrations and in certain cases, average concentrations for particular metals in soil samples.

Comment 17:

The last full paragraph on page 5-14 discusses metals data presentation for the Battery Site. Why were samples originally proposed for 0 to 2 foot depths taken at only 0 to 6 inches? The last sentence is speculative and should be deleted. The actual sample depths should be reflected on the figure(s) so as not to be misleading.

Response: Samples originally proposed for collection from the 0-2 foot bgs interval were not literally collected from that interval because, during excavation, the soil depths within the surface soils were mixed. Consequently, the soils in the 0- to 6-inch interval were judged to be as equally representative of the 0- to 2- foot interval as an actual 0- to 2-foot sample. The last full paragraph of Section 5.2.4 on page 5-14 has been revised to more clearly indicate this by replacing the last sentence of that paragraph with the following text:

"During excavation, the soil depths within the 0- to 2- foot surface interval were mixed. Consequently, the soils in the 0- to 6-inch interval were judged to be as equally representative of the 0- to 2- foot interval as an actual 0- to 2-foot sample."

The affected paragraph is paragraph 11 of new Section 5.2.4 which is provided as an enclosure to this response document.

Comment 18:

The first two sentences on page 5-16 are unclear. Should the second sentence read 'is not delineated'?

Response: Yes, the word "not" is missing from the sentence. Because addition of new soil metals data required a significant revision of Section 5.2.4, the sentence in question and the paragraph it was in have been deleted. Please see new Section 5.2.4 provided as an enclosure to this response document.

Comment 19:

The third and fourth sentences on page 5-17 state that seeps were identified, but not sampled during Round 2. If this is correct, then fix all report text which states that no seeps were found. If seeps were identified, they should be mapped for future monitoring.

Response: As stated in Section 2.5.2, no seeps were found during the RFI. The reference to seeps being present but not sampled is incorrect and has been deleted. Specifically, the third full sentence in the last paragraph before Section 5.3.1 (corresponding to former page 5-17 third and fourth sentences) has been deleted and the existing fourth and fifth sentences have been combined as follows:

"As yet unidentified seeps are expected to exist based on the geology and hydrogeology, therefore, the observed surface water and sediment concentrations are most likely representative of groundwater discharge as well as surface runoff."

New Section 5.3 and the first subsection therein, 5.3.1, are provided as an enclosure to this response document.

Comment 20:

The first sentence of Section 5.3.2 gives the impression that 12SW/SD03 was the only sediment sample collected for the RFI. Additionally, this sentence states that no other surface water samples were analyzed for SVOC. However, the fourth sentence states that there were no SVOC detections in SWMU 12 downgradient surface water samples. The fifth sentence gives the impression that SVOC analysis was performed on more than just location 12SW/SD03.

Response: Three sediment samples were collected for the RFI and analyzed for SVOCs. To clarify this, the first sentence of Section 5.3.2 has been replaced by the following two sentences:

"SVOCs were analyzed in Round 1 and Round 2 surface water samples collected from location 12SW/SD03; no other surface water samples were collected. A sediment sample was collected from each of three locations (12SW/SD03, 12SW/SD07, and 12SW/SD09), and these samples were analyzed for SVOCs."

In addition, the "240 µg/kg" in the existing seventh sentence of Section 5.3.2 has been corrected to "*340 µg/kg.*"

Comment 21:

Referring to the last paragraph on page 5-20, there appears to be a typo in the fourth sentence: 'his surface water'. This same sentence mentions the outfall from a settling basin. Additional information should be provided on this settling basin. Is this part of the wastewater treatment system mentioned on pg 1-5? Has it been further investigated as part of recent sump investigations conducted at this SWMU? Do other such basins exist? What is the current

condition of this basin? Is it NPDES permitted? What were the processes discharging to this basin that would elevate metals concentrations? Previously it is stated that only Aluminum is site related. This is apparently not the case. There is a typo in the fifth sentence: 'basis'.

Response: "his" has been changed to "this" in the fourth sentence of the last paragraph of Section 5.3.3.1 on Page 5-20. In addition, "basis" has been corrected to "basin" in the fifth sentence of the same paragraph.

The last paragraph originally on Page 5-20 has been revised to incorporate further information on metals delineation and is provided as an enclosure to this response document.

Regarding the concrete basin, there is little available history. Verbal communications have led to conflicting indications concerning whether the basin was ever used. Photographs of the basin clearly show horizontal water level lines at various positions between the top rim and bottom of the basin. The most pronounced line appears to be within two feet of the basin bottom but one line appears to be within two feet of the basin rim. An influent pipe to the basin projects into the volume of the basin over top of a pronounced stain on the sloping side wall that is evidence of discharges from the pipe into the basin. These observations lead to the conclusion that the basin has contained large volumes of water, possibly on more than one occasion. The size of the basin is large enough that it does not appear precipitation could be responsible for all of the water level lines. The basin is not known nor does it appear to be or to have been part of the Building 151 wastewater system mentioned on page 1-5 of this RFI report. Samples were collected from soil borings 12SB08, 12SB09, 12SB10, and 12SB11 located around the perimeter of the basin in 2004 but no samples were collected during the ES/DI. No other such basins exist at SWMU 12. The basin is not NPDES permitted. No information could be found concerning the processes that discharged to the basin and, as stated earlier, there is little information at all concerning its use. Regarding use of aluminum at SWMU 12, text in other portions of Section 5.0 [e.g., in Section 5.4.1 (new Section 5.5.2), paragraph 11, "Aluminum -...."] mentions aluminum as being a metal whose use was known at SWMU 12. No text could be found, however, that says aluminum is the only metal used at SWMU 12. Instead, mention is made in the last paragraph before Section 5.4.2 that "Finding low levels of industrial metals such as aluminum, chromium, copper, iron, lead, and zinc as contaminants in groundwater in an industrial area might be expected; detection of elevated concentrations of beryllium, cobalt, mercury, selenium, thallium, and tin is unusual. Therefore, the metals contamination appears to be site-related, but sources of the contamination have not been identified."

Regarding uses of aluminum at SWMU 12, please also refer to the response to comment 36.

The third paragraph of Section 5.3.3.1 has been modified to describe what is known about the basin. Please see response to Comment 22.

Comment 22:

The seventh and ninth full sentences on page 5-21 are unclear.

Response: The third paragraph of Section 5.3.3.1, which contains these seventh and ninth sentences, has been revised extensively. The revised text follows:

"Similar logic applied to other locations and parameters yields the following conclusions. Surface water at sampling location 12SW/SD35 is contaminated with metals relative to any measure (e.g., upgradient concentrations or SVs). This is evident because this location appears at the top of the rankings in Table 5-1 for every metal except manganese. In several cases, the concentrations of metals at this location were orders of magnitude greater than the next highest concentrations. This location, sampled only in Round 2, appears to be an outfall from the settling basin numbered 3037 in Figure 5-2, but multiple conversations with NSWC Crane facilities managers could not confirm this. By one account the basin may never have been used. It is currently empty and does not show staining from a water level as might be expected if it had once contained water The outfall was sampled directly, before any dilution of the

effluent took place. Locations downgradient of this location also would be expected to exhibit elevated metals concentrations. Location 12SW/SD02, which is within 100 feet of location 12SW/SD35, consistently appeared in the upper half and even the upper fourth of the concentration distributions in Table 5-1. If location 12SW/SD02 represented only background concentrations, some of the results would be expected to fall in the lower half of the concentrations distributions by chance alone. The distribution of 12SWSD02 data indicates that concentrations at this location are comparable to upgradient concentrations even though they are in the upper half of upgradient concentrations. If location 12SW/SD35 is ignored, nearby locations 12SW/SD34 and 12SW/SD36 were frequently the locations of the highest or nearly highest concentrations. Because these locations are nearby 12SW/SD35, if they are contaminated, they should exhibit contaminants similar to those detected at 121SW/SD35. Instead, where as they generally fall in the top fourth of the metal rankings, the metals concentrations at these two locations generally lie within the range of upgradient metal concentrations and are much more consistent with metal concentrations in other SWMU 12 samples. Based on these observations, it is reasonable to conclude that contamination from 12SW/SD35 is bounded in the downgradient direction by metals concentrations representing the upper end of the upgradient concentration distributions. If any metals contamination is present at locations near to 12SW/SD35 it is not clearly discernible from the available data."

Comment 23:

The last paragraph on page 5-21 discusses sediment metals concentrations and states that exceptional metals are within two times SV and/or maximum upgradient sediment concentration. The conclusion that is derived from this is that sediment contamination downgradient of 12SW/SD35 does not extend as far as 12SW/SD02. This is unclear – 'within two times SV and/or maximum upgradient sediment concentration' is still above screening levels/upgradient and is not delineated.

Response: The number of site sediment values is about four times the number of upgradient values. This factor alone is enough to cause exceedances of upgradient concentrations in the downgradient samples even if the downgradient samples represent the same population as the upgradient samples. To bring this point out, the fourth paragraph of Section 5.3.3.1, has been changed to have the following text inserted as new third, fourth, fifth, and sixth sentences:

"The number of downgradient samples is about four times the number of upgradient samples. This uneven sample distribution between upgradient and downgradient sample numbers favors obtaining the maximum observed concentration in the downgradient sample set. When this is taken into account along with the relatively slight exceedances of SVs or upgradient concentrations for these few exceptional metals, it becomes evident that the observed exceedances of upgradient concentrations in downgradient samples is at least partly an artifact of the sampling design. A factor that supports this assertion is the lack of physical connection between the sediment samples of greatest metal concentration and the lack of spatial patterns to suggest that observed SV or upgradient concentration exceedances are the result of site operations."

Comment 24:

The last paragraph of Section 5.3.3.1 states that the origin of the elevated surface water ammonia concentrations is unknown. What about the backfilled compost being a source?

Response: The last six sentences of the last paragraph of Section 5.3.3.1 have been replaced with the following:

"This is one of the most downgradient of gully sample locations. Section 5.3.3.2 describes complete bounding of ammonia concentrations by non-detectable results as the most downgradient of all surface

water sampling locations, including TCMS locations. Ammonia would most likely have originated with the soil compost which contained large quantities of chicken manure."

The Navy agrees that backfilled compost was the most likely source of ammonia. Section 7.2 of the IMR Report (MK 2000) stated that elevated levels of airborne ammonia from chicken manure results in the need for full face air purifying respirators during initial windrow preparation and the first five to seven days of the windrow cycle.

Comment 25:

The last sentence of the first paragraph of Section 5.4 refers to well 12MWT25I – is this a typo?

The affected sentence has been removed from the first paragraph of Section 5.4. The original Section 5.4 now has been revised and now becomes Section 5.5 in the revised Section 5 which is included as an enclosure to this response document.

Comment 26:

Referring to the groundwater metals discussion beginning on page 5-27, in numerous instances it is stated that metals appear to be site related, but operationally related sources are unknown. Text on page 7-9 states that barium, chromium, and lead were listed as potential hazardous wastes at SWMU 12 in the Phase I RFI (Halliburton NUS, 1992) because of their presence in grit blast residue (barium and lead) and paint wastes (chromium). These are then operationally related. Can any of these operations be associated with the high levels of metals in the settling basin (12SW/SD35)? Can high level of multiple metals be associated with bomb casing materials, parts, and/or painting operations? The discussion for vanadium does not refer to upgradient concentrations as was done for other metals.

Response: The grit blasting occurred in Bldg 155, which is located on the other side of the SWMU from sampling location 12SW/SD35, so the elevated metal concentrations do not appear to be related to grit blasting. The same can be said for a connection to the settling basin.

No change was made in response to this portion of the comment.

Regarding the association of high metal concentrations with bomb casing materials, parts, and/or painting operations, no connection has been made to date.

Regarding the vanadium discussion, the following text has been inserted as the third sentence of the vanadium discussion:

"Vanadium was not detected in upgradient Puz wells in either sampling round."

Comment 27:

The first sentence of the nitrate plus nitrite discussion on page 5-31 states that the concentrations were significantly less than the 1,000 µg/L SV. However, levels presented in subsequent sentences all exceed this level (e.g. 12MWT07 – 4.1 mg/L; 12MWT32 – 6.1 mg/L, etc.). The last partial sentence on this page states that it is not clear that these chemicals are site related. This contradicts what is presented on page 5-22 ("The detection of elevated nitrate concentrations is consistent with finding explosives in surface water and it is consistent with SWMU 12 history.") and the first sentence of Section 6.2.1 ("MFA was used for the preparation of nitrate...").

Response: The first sentence of the nitrate plus nitrite discussion (now the second to last paragraph of new Section 5.5.2) has been deleted to correct this confusion. The callout of Figure 5-37 has been moved to the existing second sentence of nitrate plus nitrite discussion which becomes the first sentence after this deletion. The next to last sentence in the paragraph regarding the nitrate discussion has been replaced by the following two sentences.

"*The chicken manure used in the composting operation, and which is present in the replaced bioremediated soil, contains nitrogen compounds. The nitrogen compounds are the most likely sources of* NO_3 *and* NO_2*.*"

In addition, the phase "the preparation of nitrate and" has been removed from the first sentence of Section 6.2.1.

Comment 28:

The last paragraph of section 5.4.1 contains a typo: '12SW/SD325'.

Response: The "12SW/SD325" in the last paragraph of former Section 5.4.1 (now Section 5.5.2) has been changed to "*12SW/SD35.*"

Comment 29:

Section 5.4.2 does not go into discussion of Plz/Mgd metals. How do those metals levels compare with Puz wells?

Response: The Section in question is a description of Puz and Pmz chemical concentrations A discussion of chemical concentrations for the Plz and Mgd wells is provided in the section following that section (now Section 5.5.3). Nevertheless, to answer the question, the metal concentrations of Plz/Mgd wells were generally within the range of metal concentrations of Puz and Pmz wells. To explain this in more detail, the following text has been inserted in place of the first sentence of the last paragraph of the Plz/Mgd discussion:

"Metals concentrations in the Plz/Mgd wells were generally greatest in the upgradient well (12MWT43). Plz/Mgd upgradient well 12MWT43 had the following chemical concentrations in excess of maximum shallow well (Puz/Pmz) concentrations: antimony (3.5 µg/L and 3.5 µg/L in Rounds 1 and 2, respectively), barium (1360 and 1950 µg/L in Rounds 1 and 2, respectively), chromium (78.9 µg/L in Round 2) and vanadium (58.5 µg/L in Round 2). The chromium (28.4 µg/L in Round 1) and vanadium (39.9 µg/L in Round 1) concentrations were less than the maximum shallow well concentrations. The maximum shallow well concentrations for these four metals were: 3.2 µg/L for antimony (sample 12GWT3101-F), 214 µg/L for barium (sample 12GWT4802), 47.9 µg/L for chromium (sample 12GWT4802), and 49.4 µg/L for vanadium (sample 12GWT4801). In general, metal concentrations in the Plz/Mgd wells were within the range of metal concentrations observed for the shallower wells."

Comment 30:

The last paragraph on page 5-33 states the groundwater concentrations of several metals were not presented. In the second sentence of this last paragraph, list which metals are not presented because of no exceedances of SV, slight exceedances of SV, and those bounded by downgradient wells with concentrations less than the SV.

Response: The following sentence has been inserted to replace the existing second sentence of paragraph 4 in Section 5.4.3 on former page 5-33 (now Section 5.5.4):

"These metals have no human health SVs (calcium, magnesium potassium, and sodium), the metal concentrations did not exceed the human health SV in any sample (copper, tin), the number of exceedances was small compared to the number of results generated (antimony, barium, mercury, selenium, zinc), all exceedances were within a factor of three of the SV (antimony), or the exceedances were bounded by wells with concentrations less than SVs in the lateral or vertical downgradient direction (antimony in wells 12MWT31 and 12MWT32; mercury in wells 12MWT06, 12MWT11, 12MWT12, and 12MWT17; and zinc in well 12MWT07)."

Comment 31:

Referring to the last bullet on page 5-35, are the metals present in the "contaminated vein" at the Battery Site the same as what is elevated at MFA Proper?

Response: The metals in the "contaminated vein" at the Battery Site are different than the metal concentrations in the MFA proper. In general, metal concentrations are similar to background concentrations in the MFA proper whereas metal contamination is evident at the Soil Area located within the Battery Site. If metal concentrations in the MFA proper appear to exceed typical background concentrations, the exceedances are minor and may represent localized variations in background concentrations. This is a very different situation than in the Battery Site where metal concentrations are well above what could be considered to be background concentrations.

No change has been made in response to this comment.

Comment 32:

The discussion of contaminant mobility, attenuation, and persistence presented in Section 6.1 should include a discussion of the photolysis of RDX in water under natural sunlight conditions (see ATSDR RDX Toxicity Profile Section 5.3.2.2). Section 6.1.3 (or the Contaminant Migration section on page 6-7) should discuss the potential for explosives contaminant migration from annual autumnally discarded foliage from tree leaves (and other sampled vegetation). The conceptual site model should be modified as needed based on that evaluation.

Response: In response to the first sentence of this comment, new "Section 6.1.4 Biotic Degradation" has been added at the end of Section 6.1 (just prior to Section 6.2) which discusses photolysis and hydrolysis of organic COCs, including RDX. The new Section 6.1.4 is provided below:

"6.1.4 Abiotic Degradation

Organic chemicals can degrade abiotically. One means of abiotic degradation is hydrolysis, where the compound reacts with water to form two or more new compounds. "At neutral or acidic pH values, RDX does not hydrolyze to an appreciable extent in freshwater or seawater (Talmage et al., 1999)." Reported hydrolysis half-lives of 170 days to several years indicate that hydrolysis is not a significant degradation process for RDX in natural water (Sikka et al., 1980; Spanggord et al., 1980a). Hydrolysis of other organic contaminants at SWMU 12 is not known to be significant.

Photolysis can be a primary abiotic degradation mechanism in translucent surface water (e.g., ponds, creeks, drainage ditches, and streams). Photolysis is the decomposition of a compound into simpler units when the parent compound absorbs radiation (e.g., sunlight). Photolytic degradation rates are typically slowed by high turbidity and increasing depth of water. RDX absorbs ultraviolet light with wavelengths between 240 and 350 nm (Etnier, 1986) and undergoes rapid photolysis in water (Sikka et al., 1980; Spanggord et al., 1980b). Spanggord and others (1980b) measured half-lives for RDX of 13, 14, and 9 days in distilled water, Holsten River water (Tennessee), and pond water, respectively. The photolytic degradation rates of RDX in the three types of water were much higher than the degradation rates of

HMX (Spanggord et al., 1980b). This was attributed to the fact that RDX has greater molar absorptivity. Nitrite, nitrate, and formaldehyde were identified as photolytic transformation products of RDX and HMX.

Just and Schnoor (2004) determined that RDX was photodegraded in reed canary grass leaves exposed to simulated sunlight. The primary degradation products were nitrous oxide and 4-nitro-2,4-diazabutanal. This is the first time that 4-nitro-2,4-diazabutanal has been measured in plant tissues following phytotransformation of RDX. These compounds, along with nitrite and formaldehyde, were also detected in aqueous RDX systems exposed to the same simulated sunlight. Results showed that the initial products of RDX photodegradation in translucent plant tissues were similar to products formed from aqueous photolysis of RDX. The detection of similar RDX degradation products in both aqueous and plant-based systems suggests that RDX may be initially transformed by similar mechanisms in both systems. Direct photolysis of RDX via ultraviolet irradiation passing into the leaves is hypothesized by Just and Schnoor (2004) to be responsible for the observed transformations. In addition, membrane-bound "trap chlorophyll" in the chloroplasts may shuttle electrons to RDX as an indirect photolysis transformation mechanism.

TNT is another energetic compound that is susceptible to photolytic degradation. In laboratory studies, TNT photolyzed rapidly in natural water, with half-lives of 0.5-22 hours. In field studies, TNT declined within a short distance of discharge points. Because photolytic degradation decreases with the intensity of the irradiating light, this type of degradation is least likely or least rapid when dissolved in turbid water or in water bodies covered by tree canopy. At NSWC Crane many of the drainage channels are tree-covered. Hence, photolysis is expected to be retarded, except in areas where drainage channels receive ample sunlight.

Photolysis is not believed to be a potentially significant degradation mechanism for the other site-related organic contaminants."

As noted in the second and third sentences of this comment, the Navy agrees that leaves will probably carry some RDX back down to the ground during autumn and winter months. However, most of the leaves falling to the ground (i.e., leaf litter in the forest) will decay in place and the RDX will either biodegrade during decay or will be returned to the soil column, where it could recycle back up into the vegetation. Section 6.1.3 has been revised, as follows, to include this additional aspect of phytoremediation:

"6.1.3 <u>Plant Uptake</u>

"Recent research by the United States Army Corps of Engineers (USACE) (May et al., 2003) suggests that plant uptake and phytoremediation is removing, degrading, and volatilizing RDX and TNT from the soils at NSWC Crane SWMU 12. During the SWMU 13 RFI, vegetation samples were collected from trees and shrubs located on the northwest side of the ridge containing SWMU 13. This location was chosen because RDX-contaminated groundwater was considered most likely to be present and being taken up by plants. Results of the leaf analyses showed a relatively high frequency of detections of RDX, HMX, TNT, and degradation products in the 16 vegetation samples that were analyzed (TtNUS, 2005). Thus, the trees and vegetation on the northwest side of the ridge appear to be taking up groundwater and energetic compounds as groundwater discharges to the hillside. The energetic compounds may be photolytically degraded in the leaves while the leaves are still on the trees (see Section 6.1.4). Based on the similarity of SWMU 12 to SWMU 13 with regard to physiography and vegetation, these types of phytoremediation mechanisms are also believed to be actively operating at SWMU 12.

Leaves will probably carry some RDX and HMX back down to the ground during autumn and winter months. However, most of the leaves falling to the ground (i.e., leaf litter in the forest) will decay in place and the RDX and HMX will either biodegrade during decay or will be returned to the soil column, where it could recycle back up into the vegetation. No data are available to quantify RDX and HMX degradation rates in the leaf litter or the underlying soil."

Comment 33:

Section 6.2.1 discusses the large amounts of explosives collected in sumps at MFA. This should be supplemented with information being currently collected/evaluated when it becomes available. The last sentence of the first paragraph of this section states that the past discharges drained directly to surface drainage channels. Discuss where these sumps drain to currently.

Response: The locations of all sumps, downspouts, storm drains, and other drain lines at SWMU 12 are not well known. It is believed that most of these currently drain or did drain to the southwest side of the SWMU, where gullies and the unnamed western tributary carried the surface and storm waters off-site toward Turkey Creek. Descriptions, data, and information concerning the sumps have been added to the RFI. These descriptions are scattered throughout the report. For example, in Section 5.0 there are several text changes that identify newly detected explosives contamination at select sumps. This is shown in Figure 5-1. In Section 6.0, a similar situation exists. In summary, the sump sampling identified that some of the sumps contained explosives at concentrations of significance as shown in Figures 5-1, and 5-24 and 5-25. The presence of explosives in these locations indicates that they could be continuing sources of groundwater contamination. The primary difference in fate and transport between sump contaminants and the same chemical in other media is that the sump contaminants can only migrate beyond the sumps if the sumps leak or overflow. The drainage point for the sumps is not known for at least some of the sumps. This is still undergoing evaluation. However, leaked contamination from the sumps would be detected in surrounding soils and groundwater. Soils and groundwater across the site have been sampled, especially in those locations where contamination is judged to have been most likely to be released.

Comment 34:

The fifth bullet on page 6-13 states that metals appear to be leaching directly from the bedrock (natural source). Why then would upgradient wells in the same formations contain lower concentrations? The same type of bedrock and groundwater quality conditions exist, correct?

Response: Many of the metals detected in SWMU 12 groundwater are significantly above background concentrations. Thus, it is difficult to attribute the high concentrations detected in SWMU 12 wells to natural leaching processes. However there is an explanation why this can occur, especially at sites like SWMU 12 that are situated on a ridge top. The explanation is that recharge from precipitation will, over time, accumulate metals and other chemicals (e.g., silica) from the overburden soil and bedrock matrices as it flows through these matrices. The upgradient wells at SWMU 12 represent the locations where recharge has had the least contact time with soil or bedrock, hence they would be expected to have lower metal concentrations for this reason alone. Nevertheless, the eleventh bullet in Section 6.2.5 has been revised to read:

- *"Concentrations of several metals (e.g., aluminum, iron, manganese, cobalt, lead, mercury, nickel, and zinc) are elevated in the uppermost groundwater monitoring zone. The only metal directly attributable to site operations is aluminum; the source(s) of the other metals in the shallow groundwater are unclear."*

Comment 35:

The second bullet of Section 7.2.2.2 states that chemicals with detection limits above SVs and not selected as COPCs because of non detects in all samples, will be discussed in the uncertainty analysis section; however, there does not appear to be such a discussion in Section 7.6.1.

Response: This discussion was inadvertently omitted from the report. The following discussion has been added to the end of Section 7.6.1.

"Chemicals with Detection Limits Greater than Screening Concentrations That Were not Selected as COPCs

This section discusses the uncertainty associated with chemicals which were not selected as COPCs for human health or which were not detected in any media at SWMU 12 but had detection limits in some samples that exceeded human health screening concentrations for direct contact but were not quantitatively evaluated in the human health risk assessment. Detection limits for the following non-COPC or non-detected chemicals exceeded risk-based human health screening levels in some samples:

- *SOIL – 2,4-dinitrotoluene, 2,6-dinitrotoluene, kepone, n-nitrosodiethylamine, n-nitrosodimethylamine, n-nitroso-di-n-butylamine, and n-nitroso-di-n-propylamine, n-nitrosomethylethylamine*

- *GROUNDWATER – none*

- *SURFACE WATER – 1,2,4-trichlorobenzene, 1,4-dichlorobenzene, 3,3'-dichlorobenzidine, 3,3'-dimethylbenzidine, bis(2-chloroethyl)ether, hexachlorobenzene, hexachlorobutadiene, kepone, n-nitrosodiethylamine, n-nitrosodimethylamine, n-nitroso-di-n-butylamine, n-nitroso-di-n-propylamine, n-nitrosomethylethylamine, and n-nitrosopyrrolidine*

- *SEDIMENT – kepone, n-nitrosodiethylamine, n-nitrosodimethylamine, n-nitroso-di-n-butylamine, n-nitroso-di-n-propylamine, and n-nitrosomethylethylamine*

Detection limits for the above listed chemicals exceeded risk-based screening levels for residential soil and or tap water. With the exception of 2,4-dinitrotoluene and 2,6-dinitrotoluene in soil, none of these chemicals are associated with past activities at MFA nor were they identified as historical contaminants at the site in the Phase I Report (Halliburton, 1992) or in the IMR. Based on site history and the fact that these chemicals (except 2,4-dinitrotoluene and 2,6-dinitrotoluene) have not been positively detected in any samples or media at the site, it is reasonable to conclude that they are not present at the site and that risks have not been underestimated by omitting them from the quantitative risk assessment.

The elevated detection limits for 2,4-dinitrotoluene and 2,6-dinitrotoluene occurred in two Initial Characterization Samples (ICS) collected in November 1997 (See Table 7-5). These samples were collected from Grids 27 and 28 located near Building 153 and contained high levels of RDX, HMX, and TNT. As indicated in the IMR, these grids were not excavated because the soil was left in place to support a steam line. Of the 442 historical soil samples evaluated in this report, the detection limits for 2,4-dinitrotoluene and 2,6-dinitrotoluene exceeded residential (but not industrial) screening levels only in these two samples (2,4-dinitrotoluene was positively detected in 1 of 442 samples and 2,6-dinitrotoluene was detected in 3 of 442 samples). Consequently, it is unlikely that risks across the site have been significantly underestimated by the omission of these compounds from the quantitative risk assessment. Exposure to the elevated detection limits in Grids 27 and 28 would result in HIs greater than unity (1) for the hypothetical future child resident only. HIs for full time occupational workers and future construction workers would be acceptable if exposed to the elevated detection limits for 2,4-dinitrotoluene and 2,6-dinitrotoluene".

Comment 36:

The sixth and eight sentences of the last paragraph on page 7-9 contradict each other. Sentence six presents an operationally related source. Referring to the last sentence of this paragraph, what is the correlation between samples with high turbidity and high metals detections in the SWMU 12 groundwater data? Present an analysis of this.

Response: Agreed. There is a discrepancy between these sentences. Sentences six, seven, and eight of the last full paragraph of Section 7.2.3.1 has been revised to show that operationally related sources of

barium, cadmium, chromium, and lead were identified in RCRA Facility Investigation Phase I Environmental Monitoring Report (Halliburton NUS, 1992) as follows:

"However, barium, chromium, and lead are listed as potential hazardous wastes at SWMU 12 in the Phase I RFI (Halliburton NUS, 1992) because of their presence in grit blast residue (barium, chromium, and lead) and paint wastes (chromium and lead). Section 5.4.1 of this report discusses in detail the occurrence and distribution of metals in groundwater at MFA. As discussed in Section 5.4.1, the presence of arsenic, cobalt, manganese, and nickel in groundwater appear to be site related, but an operationally related source of these metals is unknown".

A discussion and analysis of the effects of turbidity on groundwater and surface water sample results is provided in Sections 7.2.3.6 and 7.2.3.7 of the report. Additional detail and analysis is provided in Section 5.5. There appears to be a clear relationship between turbidity in the samples and elevated metal concentrations. The following is an excerpt from the discussion in Section 7.2.3.6, with a reference to Section 5.5 added:

"Elevated concentrations of some metals in groundwater appear to be the result of particulate matter (turbidity) in the samples (see Section 5.5). The turbidity readings in some samples were greater than 300 NTU, with the readings in several samples (12MWT14 and 12MWT39) being 1,000 NTU or more. The concentration of aluminum detected in unfiltered sample 12GWT3901 was 12,200 µg/L, but aluminum was not detected in the associated filtered sample (12GWT3901-F) collected at the same time and location. At the same location, arsenic was detected at a concentration of 14.9 µg/L in the unfiltered sample, but the concentration in the filtered sample was 1.9 µg/L".

Comment 37:

The fourth sentence of Section 7.2.3.3 states that the IMR indicated that explosives, metals, and VOCs were COCs for SWMU 12. Was this based on previous studies? If so, can that information be used to help identify potential metals sources?

Response: The information in the IMR was based on the RCRA Facility Investigation Phase I Environmental Monitoring Reports (Halliburton NUS, August 1992). Table 5-7 of the Halliburton report lists potential hazardous wastes at MFA and sources. The table indicates that cadmium, chromium, lead, and barium were constituents of grit blast residue and that chromium and lead were constituents of paint waste. No detailed information was provided regarding amounts and disposal of the wastes. The report also indicated that aluminum powder was used in the production of bombs at MFA.

A new table was developed to identify whether individual buildings or structures have been investigated as part of this RFI or previously. The following sentence has been added to the end of Section 1.2.2:

"Table 1-3 identifies which buildings and structures were investigated as part of this RFI and which were investigated previously"

Comment 38:

The last paragraph of Section 7.2.3.4 contains the following contradictory sentences: "However, barium, chromium, and lead are listed as potential hazardous wastes at SWMU 12 in the Phase I RFI (Halliburton NUS, 1992) because of their presence in grit blast residue (barium and lead) and paint wastes (chromium)." and "As discussed in Section 5.4.1, the presence of arsenic, barium, cadmium, chromium, cobalt, lead, manganese, nickel, thallium, and vanadium in groundwater appear to be site related, but an operationally related source of these metals is unknown."

Response: See Response to Comment 36

Comment 39:

The first paragraph on page 7-24 discusses historical waste generation and management practices. Note whether all of these releases were investigated during historical investigations (i.e. previous to this RFI) and what the outcomes/recommendations of those investigations were. This paragraph also mentions and unlined pond. What is the current status of this pond? Is this either 'Structure 3110' or 'Structure 3037'? Is it under investigation as part of the current sump sampling taking place at this SWMU?

Response: The information in this paragraph (second paragraph heading of "Site Sources of Environmental Contamination" in Section 7.3.1) was obtained from Section 2.12 of the RCRA Facility Investigation Phase I Environmental Monitoring Report (Halliburton NUS, 1992) which described the general history and conditions at NSWC Crane. The information in this paragraph, with the exception of the last sentence, was not specific to SWMU 12 and was inadvertently included in the report. The paragraph has been removed from the report and the following sentence has been added to the previous paragraph *"The major sources of contamination at SWMU 12 are considered to be from washdown operations prior to 1980 and from the exhaust ventilation system."*

Comment 40:

The second full paragraph on page 7-26 states that explosives are present within the vein of contamination at the Battery Site. Is there an explanation for how this vein of contamination might have originated in its present location?

Response: The contamination at this location is thought to be the result of historical waste dumping at the Battery Site.

No changes were made in response to this comment.

Comment 41:

The first bullet on page 7-31 discusses sampling at 'Structure 3110' and 'Structure 3037'. Discussion of sampling around these areas should also be presented in Section 1 or Section 5. The second bullet on this page summarizes the exposure units evaluated for this SWMU. What are their respective acreages?

Response: The samples discussed in this bullet (designated as SWMU 12 Proper samples) are the SWMU 12 RFI samples discussed on pages 13 and 14 of Section 5 (Section 5.2.4). These samples were analyzed for explosives and metals (one sample was analyzed for VOCs and SVOCs). No explosives, VOCs, or SVOCs were detected in the samples. The metal sampling results are presented in Tables 3-4, 3-6, 3-8, and 3-10 and discussed in Section 5.2.4. The results are also presented in the COPC selection Tables 7-1 through 7-4.

The areas provided below were based on calculations from figures included in the Interim Measures Report for SWMU 12 and professional judgment. Professional judgment was used to estimate boundaries that encompassed the excavated areas in a way that the encompassed area would have a simple rectangular shape. These areas have been included in the second bullet on Page 7-31, in Section 7..3.3.

- *SWMU 12 Proper – Approximately 55 acres*
- *Building 151 – Approximately 0.69 acres.*
- *Building 152 – Approximately 0.69 acres.*

- *Buildings 153/154 – Approximately 2.3 acres*
- *Building 157 – Approximately 0.8 acres*
- *Buildings 158/159 – Approximately 1.1 acres*
- *Battery Site – Approximately 0.4 acres*

Comment 42:

The 'Example Calculation – RDX at Building 153/154' section on page 7-34 mentioned a 'preliminary risk evaluation'. Include a reference citation for that evaluation.

Response: The "preliminary risk evaluation" was performed by the Tetra Tech human health risk assessor with the intention of reducing the number of calculations and size of the report. Risks for hypothetical future on-site residents were calculated for Buildings 151 and 160 (which did not require remediation) and were found to be acceptable and were less than risks for the other building areas that were evaluated in the risk assessment. The third sentence in the first paragraph under "Example Calculation" on page 7-34 has been revised as follows:

"Risks were not quantitatively evaluated for Buildings 151 and 160 because explosives concentrations in the ICSs were less than cleanup goals (and remediation was not required) and because a preliminary risk evaluation performed by the Tetra Tech NUS human health risk assessor indicated that residential risks for explosives from these areas would meet U.S. EPA benchmarks."

Comment 43:

Referring to the discussion presented in Section 7.5.2.1, clarify the use of target organ HIs versus cumulative HIs. In some cases only cumulative HI is discussed as for Puz groundwater. For multiple contaminants that express their threshold toxic effect on the same target organ or by the same mechanism of action, the additive hazard quotients should not exceed a level of 1.0. Does the 'cumulative HI' as presented in the RFI report merely add all target organ HIs as an extra measure of conservativeness?

Response: Yes, the cumulative HI is a sum of individual non-cancer risks (i.e., hazard quotients) for each COPC. However, if risk thus calculated is unacceptable, individual target organ effects are then evaluated. A discussion of cumulative HIs vs. target organ HIs is provided in Sections 7.5.1.1, 7.5.2.1, and subsequent sections of the report, as necessary.

No changes were made in response to this comment.

Comment 44:

Is the third sentence of bullet 3 on page 7-53 correct as written ('calculated risks would not be greatly affected by not eliminating')?

Response: This sentence (third sentence in Bullet 3 in Section 7.5.2.2) is correct but rather clumsily written. It has been revised as follows:

"A cursory examination of the background and upgradient concentrations and site concentrations presented in the COPC selection tables (Tables 7-1 to 7-19) indicates that in most cases (except for PlzMgd groundwater), the calculated risks would not be greatly affected by including metals which have concentrations within background levels in the quantitative risk assessment."

Comment 45:

Referring to the fourth sentence of Section 6.1, further explain how COPCs discussed in this section are representative of all other site related contaminants not discussed. Explanation of why COPCs not discussed are not ecological or human health risk drivers would be useful.

Response: The third and fourth sentences in the first paragraph of Section 6.1 are incorrect. All human health related and ecological COPCs for SWMU 12 are identified in Sections 7 and 8. The mobility, biodegradation characteristics, and/or extent of these COPCs are listed in Table 6-1 and discussed in various levels of detail in Section 6. In order to correct the text, the first paragraph in Section 6.1 will be changed to read:

"COPCs present at SWMU 12 belong to four primary groups: energetic compounds, PAHs, metals, and inorganic nitrogen compounds. VOCs are virtually absent at SWMU 12, so the potential for contaminants to volatilize is very low to non-existent. The primary physical, chemical, and biological factors that affect the mobility, migration, biodegradation, and persistence of the SWMU 12 COPCs are solubility, adsorption/desorption, dilution, dispersion, biodegradation, photolysis, and plant uptake. These processes are presented and discussed in this section."

Comment 46:

The last sentence of Section 7.3.4.4 states that the same exposure times, frequencies, and durations used to assess dermal exposure to water were used to estimate intakes for ingestion of water. Provide clarification of this sentence as the values for those parameters presented in Tables 7-22 and 7-23 appear to be different between different receptors. Provide similar clarification for the "same exposure frequency and duration" statement made in Section 7.3.4.2.

Response to Comment 46:

The exposure times, frequencies, and durations are different for different receptors. The sentences in Sections 7.3.4.2 and 7.3.4.4 have been revised as follows:

<u>Section 7.3.4.2</u>
"The same exposure frequencies and durations used in the estimation of dermal intakes were used to estimate exposure via incidental ingestion for each respective receptor."

<u>Section 7.3.4.4</u>
"The same exposure times, frequencies, and durations used to assess dermal exposure to water were used to estimate intakes for ingestion of water for each respective receptor."

Comment 47:

The EPC for groundwater receptors is stated as being the arithmetic average of the wells in the highly concentrated area of the plume. It does not seem that a "highly concentrated area" is determined for each of the COCs individually when calculating the EPC. Why wouldn't a separate evaluation for EPC be done for the most highly concentrated area of metals (or other COPCs) in groundwater similar to what is done for explosives?

Response: In the risk assessment for SWMU 12, a separate evaluation of the highly concentrated area of the plume was performed for each individual COPC and EPCs were calculated on this basis. As explained in the report, the most contaminated areas for explosives and for most metals coincided. A separate area was used for arsenic in the Puz because the most highly contaminated area differed from the other metals. In some cases (e.g., in the PlzMgd) maximum concentrations were used as the EPCs.

No changes were made in response to this comment.

Comment 48:

Referring to page 3-9, it would be interesting to hear whether Laucks would have anticipated results for the compounds hexachlorophene and pentachlorophenol using 8270C instead. While their recoveries obtained analyzing them as herbicides do seem variable, they're still running better than what can often be obtained using 8270C.

Response: Comment noted. The detection limits achieved for hexachlorophene and pentachlorophenol were unquestionably less using the herbicide analytical method than they would have been if SW-846 Method 8270C had been used. Because these compounds are not contaminants of major importance for SWMU 12 the erratic analytical performance was not considered to be problematic. It is also possible that the unusually poor analytical performance observed for SWMU 12 was an aberration and the performance would not be as variable the next time these compounds are analyzed by Laucks using the herbicide method.

ADDITIONAL NOTES

1. New Table 1-3 is provided with this response to comments as Enclosure 1 to address Comment 37.

2. Revised Section 3 text and tables are provided with this response to comments as Enclosure 2 to assist in cross-referencing made in the revised Section 5 and because Section 3 table numbers and data summaries have changed since the draft RFI was issued. In particular, Section 3 tables now summarize the External Sump/Drainage Investigation data (Tables 3-11, 3-19, 3-51, 3-53, and 3-55) for chemicals detected at least one time in surface soil, subsurface soil, sump water, sediment, and overburden groundwater, respectively, and metals delineation data.

3. An entire revised Section 5.0 is provided with this response to comments as Enclosure 3. Tag maps (Figures 5-1, 5-4 through 5-12, 5-24, 5-25, and 5-26) showing explosives concentrations measured during the External Sump/Drainage Investigation (ES/DI) are provided with this comment response document in Enclosure 4. Other figures in Section 5 have been renumbered as necessary to prevent conflicts with these figure numbers.

4. Revised Appendix G is provided as Enclosure 4 with this response to comment document.