



DEPARTMENT OF THE NAVY
CRANE DIVISION
NAVAL SURFACE WARFARE CENTER
300 HIGHWAY 361
CRANE INDIANA 47522 500.

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NSWC CRANE
5090.3a

IN REPLY REFER TO
5090/S4.7.1
Ser RP3/4332
- 1 NOV 2004

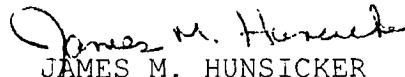
U.S. Environmental Protection Agency, Region V
Waste, Pesticides, & Toxics Division
Waste Management Branch
Corrective Action Section
77 West Jackson Blvd.
Chicago, IL 60604

Dear Mr. Ramanauskas:

Crane Division, Naval Surface Warfare Center submits the final report for the Mustard Gas Burial Ground, Solid Waste Management Unit (SWMU) 01, RCRA Facility Investigation (RFI). Enclosure (1) contains responses to comments as well as change pages with instructions. Enclosure (2) is the response to the general EPA comments concerning Ecological Risk Assessments (RA) affecting several SWMUs. The permit required Certification Statement is provided as enclosure (3).

If you require any further information, my point of contact is Mr. Thomas J. Brent, Code RP3-TB, at 812-854-6160, email thomas.brent@navy.mil.

Sincerely,


JAMES M. HUNSICKER

Manager, Environmental Protection
By direction of the Commanding Officer

Enclosures: 1. Final SWMU 01 RFI Report
2. Responses to General Ecological RA Comments
3. Certification Statement

Copy to:
ADMINISTRATIVE RECORD
SOUTHNAVFACENGCOM (Code ES31) (w/o encl)
IDEM (Doug Griffin)
TTNUS (Ralph Basinski) (w/o encl)

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

James M. Hussida
SIGNATURE

Manager, Environmental Protection
TITLE

11/1/04
DATE

RESPONSE TO ADDITIONAL COMMENT HHRA-SC-1-A (DATED 21 NOVEMBER, 2003) THAT WAS SUBMITTED BY PETER RAMANAUSKAS TO BILL GATES AND FORWARDED ON MONDAY, NOVEMBER 24, 2003 TO RALPH BASINSKI AND TOM JOHNSTON.

Comment HHRA-SC-1-A: The response does not adequately address the original comment. In NSW Crane's Response to Comments dated June 2003. The response to HHRA-GC-2 indicates that thallium detects in ground water were compared to background concentrations and the following text was inserted in the revised report on Page 7-31: "Thallium was detected in the ground water at concentrations exceeding the conservative screening levels established for COPC selection but was not selected as a COPC because study area concentrations did not exceed background concentrations." However, the text on Page 7-27 of the revised report states that "No chemicals were eliminated as COPCs for ground water on the basis of background because background concentrations or upgradient well data are currently not available for the site."

In addition, although there may be no background (upgradient) ground water samples for SWMU 1, a summary of groundwater analytical results should be provided. Provide further clarification to resolve this apparent discrepancy and provide a summary of the applicable groundwater analytical results.

Response to additional comment HHRA-SC-1-A.

The following changes have been made to the text in question and to Table 4-12 to resolve the identified discrepancy:

- The following sentence has been added to the 2nd paragraph in Section 4.2.4.
"Thallium was not selected as a COPC based on reanalysis of some samples (See Section 3.4.5)."
- The footnote associated with the double asterisk (**) in Table 4-12 has been changed to:
"Thallium was not detected in the GFAA reanalyses of select samples and was not selected as a COPC. See discussion in Section 3.4-5."
- The groundwater discussion in Section 7.5.2.5 (page 7-31) has been revised as follows:

"Thallium was originally detected in ground water at concentrations exceeding the screening levels established for COPC selection. Those results are provided here:

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

"However, those analyses were suspect because the thallium results were unusually uniform and the analytical technique used for analysis is known to

suffer occasionally from interferences. Therefore, the thallium was re-analyzed in select samples representing the ranges of concentrations and matrices of the original thallium analyses (See Section 3.4.5). The re-analyses indicated that the original thallium results were false positives and that thallium was not detectable in ground water. Thus, thallium was not selected as a COPC."

Regarding the request for a ground water data summary, Tables E-3-1 and E-3-2 of Appendix E contain a summary of all ground water data for sampling Rounds 1 and 2. In addition, Tables 4-3, 4-7, 4-12, and 4-17 in Section 4.0 of the report summarize ground water in various ways and for various purposes. No change was made in response to this portion of the comment.

SWMU 1 RESPONSES TO EPA COMMENTS DATED MARCH 19, 2004 AND RESPONSES TO COMMENTS ON OTHER ISSUES RELATED TO NSWC CRANE ECOLOGICAL RISK ASSESSMENTS

BACKGROUND

The Navy prepared ecological risk assessments (ERAs) for NSWC Crane SWMUs 1, 2, 3, 4, 5, 9, and 10 and submitted them to US EPA Region 5 for review. US EPA Region 5 reviewed the risk assessments and provided initial comments on several of the ERAs. The US EPA then provided further comments on the ERAs. These more recent comments were transmitted to the Navy via e-mail on March 19, 2004 by Peter Ramanauskas. The following statements were contained in the March 19, 2004 e-mail.

“Attached please find an electronic copy of our comments on Crane's ecological risk assessments. These comments were generated by looking at SWMU 3 as the example case, but apply to the eco risk assessments done at the other SWMUs (1, 2, 4, 5, 9, 10) and those assessments should be revisited to make any corrections needed. Some comments specific to certain SWMUs are provided at the end of the document.

I will presume that we will be getting on a conference call at some point after you have had a chance to review these comments. At that time, I would like to revisit the topic of PBT upper trophic level dose modeling at the SWMUs and the Navy's rationale for not modeling.”

US EPA's comments of March 19, 2004 consisted of 5 general comments, 29 comments specific to SWMU 3 (Jeep Trail / Little Sulphur Creek), and 2 comments specific to SWMU 2 (Dye Burial Grounds). These comments were discussed in a meeting and various conference calls with EPA Region 5. A list of the teleconferences is provided below:

- April 1, 2004 conference call with the Navy, EPA, and TtNUS
- June 9, 2004 technical meeting with the Navy, TtNUS, EPA, and IDEM.
- July 8, 2004 conference call with TtNUS and EPA
- July 15, 2004 conference call with TtNUS and EPA
- July 23, 2004 conference call with TtNUS and EPA
- September 9, 2004 conference call with the Navy, TtNUS, USEPA

During the course of the meeting and conference call various other issues were identified. Based on the teleconferences identified above, the Navy consolidated the original comments specific to SWMUs 2 and 3 from March 19 into a consolidated and renumbered set of comments. Added to these renumbered comments were additional issues that were raised during the teleconferences and during other communications among Navy and US EPA representatives. *These renumbered comments represent all outstanding US EPA comments concerning ERAs conducted to date at NSWC Crane, including the ERA for SWMU 1.* Table 1 depicts the renumbering of the original March 19 US EPA comments and it includes the additional issues that were raised in the teleconferences but were not included in the original March 19 US EPA comments.

The revised general responses to the March 19, 2004 comments and other issues that were raised by US EPA are provided in a separate document that was mailed to US EPA on August 16, 2004. That general responses document also includes a description of a revised ERA process that will be used for future ERAs but is not applicable to the SWMU 1 RFI. EPA's comments on the August 16, 2004 submittal were resolved in a conference call that was held among the Navy, TtNUS, and EPA Region 5 on September 9, 2004. This document reflects the resolution of all issues identified by EPA.

This Response to Comments (RTC) document addresses all unresolved March 19 comments and additional issues tabulated in Table 1. The comments are divided, below, into two sections – five General Comments and 26 Specific Comments. Each section of comments begins with the number 1. In several cases, the comments were subdivided (e.g., 1a, 1b, 1c, 1d, and 1e) to facilitate the generation and tracking of responses. Comments appear in **bold** text and responses appear in regular text. Text that

has been incorporated word for word into the revised SWMU 1 ERA is presented in italicized text. In addition, a revised section 8 (the ERA) for the SWMU 1 RFI report is being submitted separately with other RFI report change pages. *It will be necessary to have a copy of the revised Section 8.0 available when reviewing the responses below because several responses refer to the revised Section 8.0.*

GENERAL COMMENTS FROM EPA'S 3/19/04 E-MAIL

Comment 1a:

The use of alternate benchmarks for ecological risk needs to be based on a chronic no observed adverse effect level (NOAEL) threshold (see Section 1.3.1 of the 1997 ERA Guidance, EPA 540-R-97-006) for the most sensitive receptor likely to be exposed to contaminants at the site.

Response 1a:

The Navy agrees that screening levels for ERAs need to be based on NOAELs for the most sensitive receptor likely to be exposed to contaminants at the site for the purposes of chemicals of potential concern (COPC) selection. For that reason, only Region 5 Ecological Data Quality Levels (EDQLs) were used as the screening levels to select COPCs (i.e., see Section 4.3 of the SWMU 1 RFI report). The alternate benchmarks were only used in Step 3a to further evaluate the chemicals that were retained as COPCs for specific endpoints, not the most sensitive endpoint. For example, an alternate benchmark based on risks to plants was used to evaluate risks to plants in Step 3a. However, regardless of the risks to plants, that chemical was evaluated to determine risks to invertebrates (if toxicity data were available) and/or mammals/birds (if the chemical was bioaccumulative). Also, as agreed to in the July 23, 2004 and September 9, 2004 conference calls, alternate benchmarks based on lowest observable adverse effects levels (LOAELs) can be used in Step 3a as long as the effects of the benchmark are clearly discussed.

For the SWMU 1 ERA, the explanations of the alternate benchmarks are provided in the revised Sections 8.6.1.1 and 8.6.1.2 of the SWMU 1 RFI report.

Comment 1b:

A clarification statement must be made if the alternate benchmarks do not represent a chronic NOAEL for the most sensitive receptor or are being applied to flag serious (i.e., acute) ecological problems needing immediate action (e.g., interim measures) and the intended use is clear with respect to risk management.

Response 1b:

In many cases alternate benchmarks used to further evaluate potential risks from COPCs do not represent chronic NOAELs. As agreed to in the July 23, 2004 and September 9, 2004 conference calls, alternate benchmarks based on LOAELs can be used in Step 3a as long as the effects of the benchmark are clearly discussed.

For the SWMU 1 ERA, the explanations of the alternate benchmarks are provided in the revised Sections 8.6.1.1 and 8.6.1.2 of the SWMU 1 RFI report.

Comment 1c:

Any alternate benchmark needs to provide supporting information that it will be protective of the most sensitive receptor and explain how it will refine conservative assumptions (as stated in the Navy Policy for Conducting Ecological Risk Assessments).

Response 1c:

The Navy does not agree that alternate benchmarks need to be protective of the most sensitive receptor because alternate benchmarks are developed for particular receptor groups, which are not necessarily the most sensitive receptor group. The alternate benchmarks were only used in Step 3a to further evaluate potential risks to specific receptor groups (i.e., plants, invertebrates) from the chemicals that were retained as COPCs. See above response to comment 1b.

No changes were made to the SWMU 1 RFI report ERA based on this comment.

Comment 1d:

After reviewing the Navy Policy for Conducting Ecological Risk Assessments and revisiting the work plan for SWMU #3, no discussion is provided on developing an alternate benchmark that would deviate from a chronic no adverse effect level (NOAEL).

Response 1d:

Alternate benchmarks used in Step 3a were discussed in QAPPs and ERAs for the existing SWMUs (i.e., see Section 4.3 of the SWMU 1 RFI report). As agreed to in the July 23, 2004 and September 9, 2004 conference calls, alternate benchmarks based on LOAELs can be used in Step 3a as long as the effects of the benchmark are clearly discussed.

For the SWMU 1 ERA, the explanations of the alternate benchmarks are provided in the revised Sections 8.6.1.1 and 8.6.1.2 for the SWMU 1 RFI report.

Comment 1e:

For some chemicals, alternate benchmarks are appropriate when metal toxicity in surface water is controlled by water hardness and site water hardness is greater than 50 ppm. Likewise, sediment benchmarks that are developed using an equilibrium partitioning (EqP) equation (see footnote "s" in the Region 5, RCRA Ecological Screening Levels table) may be adjusted if site sediment data shows total organic carbon (TOC) is greater than one percent. Also a specific State water quality Criteria or Tier II value may be applied, as appropriate, for the site.

Response 1e:

The Navy agrees that hardness and TOC can be used to adjust alternate benchmarks, as appropriate, and also that Tier II values may be appropriate for sites.

It was not necessary to use hardness or TOC to adjust the screening values at SWMU 1. Also, it was not necessary to use Tier II values for the SWMU 1 ERA.

No changes were made to the SWMU 1 RFI report ERA based on this comment.

Comment 2:

Screening ecological risk benchmarks will be based on toxicity. *Therefore, background soil data will not be used as an alternate benchmark.* Specifically, the OSWER policy (Role of Background in the CERCLA Cleanup Program, April 26, 2002, OSWER 9285.6-07P) recommends that constituents that exceed risk-based screening concentrations be retained and addressed in the risk characterization. This OSWER policy is available at: <http://www.epa.gov/superfund/programs/risk/tooltrad.htm> and the above recommendation is found in the section on Consideration of Background in Risk Assessment.

Response 2:

The Navy agrees that site-specific background soil data is not be used as an alternate benchmark. The soil background data was used to select chemicals as COPCs as was presented in the approved QAPPs. However, as discussed in the June 9, 2004 technical meeting at Crane, the Navy agreed that background will not be used to select chemicals as COPCs in future ERAs at Crane. In future ERAs, chemicals that are detected at concentrations greater than the screening levels but below background will be qualitatively discussed as the first part of the Step 3a evaluation. During the July 23, 2004 conference call, it was agreed that for the reports that have already been completed, which used background to select COPCs, the Navy would just need to add a statement to the executive summary (ES) and the ERA to indicate that background was used to select the COPCs, however based on current EPA and Navy guidance, background will not be used to select COPCs in future ERAs.

The following text was added to the revised SWMU 1 RFI report to address this comment:

- *“Executive Summary, page ES-3, end of ERA section: “As presented in Tables 4-15 and 4-16, several chemicals were eliminated as COPCs because they were not detected at concentrations greater than background concentrations. For soil, these chemicals included antimony, arsenic, barium, cadmium, chromium, cobalt, lead, manganese, mercury, nickel, strontium, thallium, and thorium. For sediment, these chemicals included aluminum, antimony, arsenic, barium, beryllium, chromium, copper, iron lead, manganese, nickel, selenium, strontium, thallium, thorium, tin, and vanadium. Risks to these chemicals were not evaluated in the ERA, however, any risks would be within background risks and not related to site activities. Note that the use of background concentrations to select chemicals as COPCs was done in accordance with the approved QAPP for SWMU 1. However, based on current U.S. EPA and Navy guidance, background will not be used to select chemicals as COPCs for future ERAs at NSWC Crane.”*
- *Section 8.6.1.1, end of first paragraph: “As presented in Table 4-15 several chemicals were eliminated as COPCs because they were not detected at concentrations greater than background concentrations. For soil, these chemicals included antimony, arsenic, barium, cadmium, chromium, cobalt, lead, manganese, mercury, nickel, strontium, thallium, and thorium. Therefore, risks to these chemicals were not evaluated in the ERA, however, any risks would be within background risks and not related to site activities.”*
- *Section 8.6.1.2, end of first paragraph: “As presented in Table 4-16, several chemicals were eliminated as COPCs because they were not detected at concentrations greater than background concentrations. For sediment, these chemicals included aluminum, antimony, arsenic, barium, beryllium, chromium, copper, iron lead, manganese, nickel, selenium, strontium, thallium, thorium, tin, and vanadium. Risks to these chemicals were not evaluated in the ERA, however, any risks would be within background risks and not related to site activities.”*

Background soil data was discussed in Step 3a of the SWMU 1 ERA (Sections 8.6.1.1 and 8.6.1.2) to indicate that a chemical was retained as a COPC because it was detected at concentrations that exceeded the screening level and background concentrations. The background soil data was also discussed for a few chemicals to indicate that the screening levels were well below background concentrations or to show that the chemical concentrations in the site samples were only slightly greater than background. This was not done to indicate that there were no risks, only that there may be no site-related risks. The background data that was evaluated in the Step 3a discussions included the base wide soil background data set and upgradient sediment samples.

Comment 3a:

Supporting information is needed to justify how “Magnitude of criterion exceedance” and “Frequency of chemical detection” can be used to determine there is no need for further site evaluation and/or chemical toxicity is of no concern.

Response 3a:

The "magnitude of exceedence" and the "frequency of detection" were used to select chemicals as COPCs because even if a chemical was detected in one sample at a concentration that slightly exceeded a screening level it was still retained as a COPC. The "magnitude of exceedence" and the "frequency of detection" were used qualitatively to determine if it is likely that the chemical is causing a risk to ecological receptors. For example, if a chemical concentration in one sample is just slightly greater than a no effects level it unlikely that the chemical is causing significant risks. Also, if a chemical is detected at relatively low concentrations in 1 of 15 samples (and not detected in the other samples), it is also unlikely that the chemical is causing a significant risk. Therefore, these two factors are applied using professional judgment, in consideration of the following factors (as examples):

- Number of samples that had chemical concentrations that were greater than an EDQL (or other benchmark/toxicity data)
- Area represented by samples that had chemical concentrations that were greater than an EDQL (or other benchmark/toxicity data)
- Is the EDQL (or other benchmark/toxicity data) a no-effects level or a low-effects level
- Heterogeneity or uniformity of chemical concentrations across the site

During the September 9, 2004 conference call, it was agreed that the Navy would provide the rationale for using "magnitude of exceedence" and "frequency of detection" in the Step 3a evaluation, where appropriate, which could then be reviewed and commented on by EPA. However, frequency of detection alone would not be used to eliminate chemicals as COPCs. The context must be presented (FOD, area represented by samples, magnitude of exceedences, number of samples, etc.).

See the following sections of the revised SWMU 1 RFI report, Section 8.0, regarding the use of "magnitude of exceedence" and the "frequency of detection" in the Step 3a evaluation:

- Section 8.6.1.1 for isosafrole
- Section 8.6.1.2 for acenaphthene and isosafrole
- Section 8.6.2.2, next to last paragraph

Comment 3b:

If this is a procedure to address hot spots, the risk assessment will still need to delineate the area where the chemical concentration exceeds the chronic NOAEL for the most sensitive receptor.

Response 3b:

The procedure can be used to address hot spots, but it can also be used to show that the potential for risks are low, as discussed above. The Navy provides chemical tag maps that present the chemical concentrations at each sample location that exceed a screening level. For the SWMU 1 RFI report, the tag maps are provided in Section 5.0.

Therefore, no changes were made to the SWMU 1 RFI report ERA to address this comment.

Comment 4:

State what method(s) will be employed to determine metal bioavailability along with site specific field measurements that are being used (or reference a section of the report where this is discussed).

Response 4:

Various methods were used to evaluate metal bioavailability as part of SWMU 1 ERA as follows:

- In accordance with the new EPA Eco SSLs, the Eco SSLs for aluminum and iron are based on pH of the soil so if the soil pH is below a certain level, these metals are assumed to not be bioavailable and they will not be retained as COPCs. See Section 8.6.1.1 of the revised SWMU 1 RFI report ERA for the Step 3a evaluation of aluminum and iron.
- The form of the chemical that was used to conduct the toxicity tests that serve as the basis for the criteria may be discussed. For example, many of the toxicity tests used to develop screening levels for metals use highly bioavailable forms of the metal, such as metals salts, which in many cases are much more toxic than equivalent concentrations of the metals in field collected soils¹. See revised Section 8.6.1.1 (for copper, selenium, and zinc) and revised Section 8.6.2.2 (insectivorous receptors) of the SWMU 1 RFI report ERA for how bioavailability was qualitatively discussed in the SWMU 1 ERA.

Comment 5a:

Only the maximum concentration (see Section 1.2.2 and Step2 of the 1997 ERA Guidance, EPA 540-R-97-006) will be compared against the Region 5, RCRA ESLs to screen COPCs.

Response 5a:

Only the maximum concentrations were compared against the Region 5, RCRA EDQLs to select chemicals as COPCs in the SWMU 1 ERA (i.e., see Section 4.3 of the SWMU 1 RFI report) [note the ESLs will be used for screening in future ERAs].

No changes were made to the SWMU 1 RFI report ERA to address this comment.

Comment 5b:

If used, alternate benchmarks need to be based on a chronic NOAEL for the most sensitive receptor likely to be present.

Response 5b:

As agreed to in the July 23, 2004 and September 9, 2004 conference calls, alternate benchmarks based on LOAELs can be evaluated in Step 3a as long as the effects of the benchmark are clearly discussed.

The basis of the alternate benchmarks so their intended use with respect to risk management in the ERA is clear was provided in revised Sections 8.6.1.1 and 8.6.1.2 of the SWMU 1 RFI report ERA to address this comment.

Comment 5c:

Supporting information is needed to justify how an average concentration will apply to the most sensitive receptor likely. Average concentrations can be applied following Step 3a when a conceptual model, assessment endpoints, exposure areas and sampling frequency are clearly defined.

¹ Allen, Herbert E. 2002. Bioavailability of Metals in Terrestrial Ecosystems: Importance of Partitioning for Bioavailability to Invertebrates, Microbes, and Plants. Society of Environmental Toxicology and Chemistry.

Response 5c:

Average concentrations are only used in the SWMU 1 RFI report ERA for the food chain modeling (see revised Section 8.6). As discussed in the July 23, 2004 and September 9, 2004 conference calls, average concentrations can be used as long as it made clear how the average concentrations relates to the exposure area for the receptors that are being protected. When average concentrations are used, the conceptual model, assessment endpoints, exposure areas and sampling frequency will be clearly defined.

The following sentences were added to Section 8.6.2.2 (insectivorous receptors) to address this comment:

"The MGBG is relatively small (two acres). The American robin's home range while nesting is typically 0.5 to 2.0 acres, but robins forage over much larger areas during other seasons (U.S. EPA, 1993c). Similar circumstances for breeding versus non-breeding home ranges would exist for other insectivorous birds represented by the American robin. Average COPC concentrations are more realistic exposure point concentrations (EPCs) for birds than maximum concentrations because insectivorous birds are exposed to COPC concentrations throughout the SWMU, rather than a single location. Surface samples were collected at 21 soil borings scattered throughout the 2 acre SWMU so there is adequate spatial coverage within the exposure area of the robin making it appropriate to calculate an average concentration as the EPC."

GENERAL ISSUES FROM SPECIFIC COMMENTS IN EPA'S 3/19/04 E-MAIL, 6/19/04 MEETING, AND VARIOUS TELECONFERENCES

Comment 1:

For chemicals that are known to be persistent bio-accumulative toxic chemicals, an earthworm is not an adequately sensitive receptor.

Response 1:

The Navy agrees that for chemicals that are known to be persistent bio-accumulative toxic chemicals, an earthworm is likely not the most sensitive receptor, but the section of the SWMU 1 RFI report referenced by this comment was the Step 3a evaluation of risks to plants and invertebrates. The Step 3a evaluation of risks to wildlife was presented in a later section of the ERA and bioaccumulative chemicals are included in that evaluation.

Section 8.6 of the SWMU 1 ERA has been revised and now clearly presents the process followed when conducting the ERA to indicate that bioaccumulative chemicals in soil are evaluated both for risks to plants and invertebrates and also for risks to wildlife. See revised Section 8.6.2 of the SWMU 1 RFI report for the evaluation of bioaccumulative chemicals that were carried through the food chain model.

Comment 2:

The Dutch "Indicative Levels" shows that plant and animal life is seriously impaired (i.e., 50% of the species experience negative effects) and does not represent a screening benchmark (i.e., chronic NOAEL) as described in general comment number one.

Response 2:

As agreed to in the June 9, 2004 technical meeting, the Dutch numbers are not be used in the ERAs and all discussions related to the Dutch numbers are to be removed from the existing ERAs. The only exceptions would be in a few instances when the ecological basis of the numbers can be justified; the justification will be included in the ERA.

All references to the Dutch numbers were deleted from the SWMU 1 RFI report ERA.

Comment 3:

The Canadian Soil Quality Guidelines does not clearly state that a Residential/Parkland value is a chronic NOAEL intended to protect sensitive receptors (see general comment # 1).

Response 3:

Information regarding the toxicological bases for the Canadian Soil Quality Guideline (SQG) is now presented in Section 8.6.1.1 of the SWMU 1 RFI report ERA for copper, selenium, vanadium, and zinc (the only COPCs in soil that had Canadian SQGs).

Comment 4:

Concerns with the Canadian protocol include the following:

- a. **not intended to protect all wild plants and animals as noted in the land use definition "parkland is defined as a buffer zone between areas of residency and campground areas and excludes wild lands such as national or provincial parks"**

Response 4a:

The agricultural Canadian SQG indicates that the values must protect resident and transitory wildlife and native flora. The residential/parkland SQG indicates that like the agricultural land use, the values must ensure that the soil is capable of sustaining soil-dependent species and does not adversely affect wildlife from direct soil contact. Because the soil contact SQGs (based on protecting plants and invertebrates) are the same for the agricultural and residential/parkland land uses, they are designed to protect native flora. Regarding the protection of animals (i.e., mammals and birds), as indicated in response to Comment 4c in this attachment, the Navy is not using the Canadian SQG to evaluate animals.

No changes were made to the SWMU 1 RFI report ERA to address this comment.

b. the guideline uses a lowest observed effect concentration (LOEC) rather than a NOAEL. note, the "no potential effects range" (NPER) benchmark uses a LOEC

Response 4b:

The Canadian SQGs use various uncertainty factors to approximate no effects levels, or low levels of potential effects. As discussed above, the toxicological basis for the Canadian SQGs is now presented in the ERAs when they are used.

The toxicological basis for the Canadian SQGs was added to Section 8.6.1.1 of the SWMU 1 RFI report ERA for copper, selenium, vanadium, and zinc.

c. food web exposure to insectivores (e.g., shrew or robin) does not appear to be incorporated into the guideline. The Canadian soil value for naphthalene needs more documentation.

Response 4c:

Food web exposure to insectivores (e.g., shrew or robin) is not incorporated into the Canadian SQG, but the SQGs were not used by the Navy to evaluate risks to food chain receptors in the ERAs. The SQGs were only used to evaluate risks to plants and invertebrates.

Naphthalene was not a COPC in soil for the SWMU 1 ERA.

No changes were made to the SWMU 1 RFI report ERA to address this comment.

Comment 5:

The recently released U.S. EPA report, Ecological Soil Screening Level (Eco-SSL) for the following chemicals will replace the Region 5, RCRA ESL and needs to be used as the soil screening benchmark: aluminum, antimony, barium, beryllium, cadmium, cobalt, iron, lead, and dieldrin.

Response 5:

The Navy agrees to use the EPA Eco SSLs for selecting chemicals as COPCs in soil in future ERAs. The Eco SSLs are now discussed in Step 3a for the existing ERAs as agreed to in the July 23, 2004 conference call.

See revised Section 8.6.1.1 of the SWMU 1 RFI report ERA for the Step 3a evaluation of aluminum and iron using the EPA Eco SSLs. Eco SSLs have not been developed for any of the other chemicals that were retained as COPCs in the surface soil for SWMU 1.

Comment 6:

The ORNL benchmarks are not chronic NOAELs and do not represent the most sensitive receptor (see general comment # 1).

Response 6:

As presented in the response to general Comment No. 1, above, the ORNL benchmarks were not used as screening values to select chemicals as COPCs. The ORNL benchmarks were only used in Step 3a to further evaluate risks to plants and invertebrates. Therefore, they do not need to be chronic NOAELs or represent the most sensitive receptors. Also, as presented in the response to general Comment No. 1, the basis of the alternate benchmarks were presented in the ERA so that its intended use with respect to risk management is described.

During the September 9, 2004 conference call, it was agreed that alternate benchmarks, which are effects levels for plants and invertebrates could be used as NOAELs, for purposes of COPC screening, if they correspond to an effect of 20 percent or less on the receptor population. The basis for the benchmark would have to be clearly presented. This is based on the fact that the US EPA Ecological Soil Screening Levels for plants and invertebrates are based on geometric means of effects concentrations (EC_{20s} , EC_{10s} , and/or Maximum Acceptable Toxicant Concentrations. Chemical concentrations that are below these values will be eliminated as COPCs. Because a twenty percent reduction in growth or yield (for plants) and twenty percent reduction in growth, reproduction, or activity (for earthworms) were used as the threshold for significant effects for the ORNL benchmarks, chemical concentrations that are less than the ORNL benchmarks were eliminated as COPCs for that receptor.

The toxicological basis for the ORNL benchmarks was added to Section 8.6.1.1 of the SWMU 1 RFI report ERA for copper, selenium, vanadium, and zinc (the only COPCs in soil that had ORNL benchmarks).

Comment 7:

Eco-SSLs for several chemicals are in development and will replace the Region 5, RCRA ESL. When available the Eco-SSLs need to be used as the soil screening benchmark.

Response 7:

The Navy will use the Eco-SSLs for selecting chemicals as COPCs for future ERAs when they are available when the ERA is prepared.

No changes were made to the SWMU 1 RFI report ERA based on this comment.

Comment 8:

The chemical values in the report "Preliminary Remediation Goals (PRG) for Ecological Endpoints" (ORNL ES/ER/TM-162/R2 August 1997) are not intended to be used for screening, but are thresholds for significant adverse effects.

Response 8:

The Navy agrees that PRGs are not intended for screening, but as stated in the referenced PRG document, "PRGs are intended to correspond to minimal and acceptable levels of effects on the general ecological assessment endpoints as defined in the data quality objectives (DQO) process for ecological risk assessments on the Oak Ridge Reservation (Suter et al. 1994). In general, they correspond to small effects on individual organisms which would be expected to cause minimal effects on populations and communities." Therefore, concentrations below the PRGs are not expected to cause significant adverse effects.

No changes were made to the SWMU 1 RFI report ERA based on this comment.

Comment 9:

The “effects range – low” (ERL) value is not an alternate benchmark for a chronic NOAEL, but it is a higher toxicity gradient than the threshold effects level (TEL) used in the EPA Region 5 ESL table. The ERL is the lower 10th percentile concentration of sediment toxicity data and a value where toxicity can be expected. The TEL (not the ERL as stated in the report) is the concentration below which adverse effects are expected rarely.

Response 9:

The Navy agrees that the ER-L is not a chronic NOAEL, but neither is the TEL that is used in the EPA Region 5 ESL table. As cited in the Consensus-Based Sediment Quality Guidelines article by MacDonald et al., (2000), the ER-L “represents the chemical concentration below which adverse effects would rarely be expected.” This definition is similar to that as the TEL which “represent the concentration below which adverse effects are expected to occur only rarely” (MacDonald et al., 2000). Also, note that the TEC value (i.e., not toxic), which is used as the revised Region 5 RCRA ESL, incorporates the Ontario lowest effect level (LEL), TEL and ER-L values.

As indicated by EPA in the July 23, 2004 conference call, although the TEC is more of a LOAEL than a NOAEL, it is acceptable for screening because EPA is trying to protect benthic invertebrate communities, not populations. Therefore, the values can be greater than no-effects levels.

The toxicological basis of the TEL (for acenaphthene) and TEC (for heptachlor) are presented in revised Section 8.6.1.2 of the SWMU 1 RFI report ERA.

Comment 10:

Likewise, the “effects range – median” will represent the 50th percentile of sediment toxicity data and “upper effects threshold” values will be a concentration where adverse impacts would always be expected.

Response 10:

As presented in the consensus article (MacDonald et al., 2000); the ER-M “represents the chemical concentration above which adverse effects would frequently occur.” Therefore, the Navy does not agree that the ER-M is the chemical concentration above which adverse impacts would always occur. As discussed and agreed to by EPA in the June 9, 2004 technical meeting, the Navy will present one lower effects level and one higher effects level (such as the PEC) to show the range of the effects levels because the lower effects levels and higher effects levels provide probabilities of effect. The Navy will clearly present the basis of those values in the ERAs (where used) and how they were used in the ERA.

The toxicological basis of the PEL (for acenaphthene) and PEC (for heptachlor) are presented in revised Section 8.6.1.2 of the SWMU 1 RFI report ERA.

Comment 11: The screen is a pass-fail process.

Response 11:

The Navy agrees that the screen is a pass-fail process.

The section of the SWMU 1 RFI report that the comment references (Section 8.6.1.2) is not the screening step. The COPC screen was conducted in Section 4.3 of the SWMU 1 RFI, as indicated in the first sentence in Section 8.4 of the ERA.

No changes were made to the SWMU 1 RFI report ERA based on this comment.

Comment 12:

Sediment toxicity needs to be limited to freshwater species with reported chronic NOAELs. The LOEC and NOEC values for TNT, based on marine and estuarine organisms, are not acceptable as alternate benchmarks.

Response 12:

Although freshwater toxicity data/benchmarks are preferred for evaluating risks to organisms in freshwater, marine benchmarks are often used as surrogates for chemicals that do not have freshwater toxicity data/benchmarks. As stated by USEPA in the September 9, 2004 conference call, Chris Ingersoll from USGS indicated that although saltwater species are less sensitive to some chemicals than are freshwater species, it is acceptable to use saltwater sediment values for chemicals that do not have freshwater values. USEPA therefore agreed that saltwater values could be used as long as the uncertainties are discussed in the ERA.

This comment is not applicable to the SWMU 1 ERA. No saltwater sediment values were used for the SWMU 1 ERA.

No changes were made to the SWMU 1 RFI report ERA based on this comment.

The Navy agrees that the freshwater value cited in the text for TNT in Steevens et. al. (2002²) is not a valid value based on the information presented by USEPA during the September 9, 2004 conference call. See response to Comment No. 24 in this attachment for information regarding the toxicity of TNT to sediment organisms.

This comment is not applicable to the SWMU 1 ERA. TNT was not detected in the sediment at SWMU 1.

No changes were made to the SWMU 1 RFI report ERA based on this comment.

Comment 13:

The “probable effects concentration” (PEL) represents a level where adverse effects are frequently expected and is not an alternate benchmark for a chronic NOAEL.

Response 13:

As discussed in the June 9, 2004 technical meeting, for chemicals where the only toxicity data available is an AET or some other higher effects level, it was agreed to carry the chemical through the ERA but it would not be quantitatively evaluated. It was noted during the meeting that this approach was acceptable because usually if there is a problem at the site, it would be caused by other chemicals that have toxicity data.

No changes were made to the SWMU 1 RFI report ERA based on this comment.

² Steevens, Jeffrey A., B.M. Duke, G.R. Lotufo, and T.S. Bridges, 2002. “Toxicity of the Explosives 2,4,6-Trinitrotoluene, Hexahydro-1,3,5-Trinitro-1,3,5-Triazine, and Octahydro-1,3,5,7-Tetranitro-1,3,5,7-Tetrazocine in Sediments to *Chironomus tentans* and *Hyallela azteca*: Low-Dose Hormesis and High-Dose Mortality” in *Environmental Toxicology and Chemistry*. 21:7:1475-1482.

Comment 14:

The “effects range-low” (ER-L) for antimony represent the lower range of sediment toxicity (see specific comment #16) and the “effects range-median” (ER-M) is the median value of sediment toxicity. Neither the ER-L nor the ER-M is alternate benchmarks for a chronic NOAEL.

Response 14:

Navy agrees that neither the ER-L nor ER-M are chronic NOAELs, but neither is the TEL that is used in the EPA Region 5 ESL table. As indicated by EPA in the July 23, 2004 and September 9, 2004 conference calls, LOAELs are acceptable for screening benchmarks for sediment invertebrates because EPA is trying to protect benthic invertebrate communities, not populations. Therefore, the values can be greater than no-effects levels.

No changes were made to the SWMU 1 RFI report ERA based on this comment.

Comment 15:

The “apparent effect thresholds” (AETs) were not developed to evaluate ecological risk and they represent a level where adverse biological impacts are always expected and adverse impacts are also known to occur at levels below the AET.

Response 15:

The Navy agrees that the AET represents a level where adverse biological impacts are always expected and adverse impacts are also known to occur at levels below the AET.

No changes were made to the SWMU 1 RFI report ERA based on this comment.

Comment 16:

The lack of information on the toxicity (i.e., chronic NOAEL) of chemicals result in a decision to continue with the ecological risk assessment process, Steps 3 through 7 (see Section 2.5 of the 1997 ERA Guidance, EPA 540-R-97-006).

Response 16:

The Navy agrees to carry a chemical through the ERA if there is no toxicity data for that chemical, unless other factors in Step 3a (i.e., frequency of detection) are used to eliminate it from further evaluation. However, the Navy does not agree that chemicals without toxicity data need to be evaluated in Steps 3 through 7 of the ERA process. Steps 3 through 7 are the BERA and typically include the collection of site-specific biological data (i.e., toxicity tests, biological surveys, etc.). Therefore, a site should not proceed to a BERA just because a chemical is lacking toxicity data. Also, during the September 9, 2004 conference call, it was agreed that because the information contained in Step 3a is consistent with the information presented in other ERAs that USEPA has reviewed, the Navy can continue to conduct the further risk evaluation in Step 3a.

Toxicological data was lacking for isosafrole in the soil and sediment, and dichlorodifluoromethane in the sediment. However, these chemicals were not recommended for further evaluation after Step 3a based on other factors as discussed in Sections 8.6.1.1 and 8.6.1.2 for the SWMU 1 RFI report.

Although changes were made to Sections 8.6.1.1 and 8.6.1.2 based on other comments, no changes were made to the sections based on this comment.

Comment 17:

It was not clear that the Step 3a evaluation was designed to eliminate chemicals as COPCs for certain groups of receptors and that chemicals that are screened out for one receptor group would still be evaluated for other receptor groups.

Response 17:

The Navy agreed to add text to the beginning of the Step 3a evaluation to indicate that the evaluation will consist of screening out chemicals for the various receptor groups, starting with plants/invertebrates, aquatic receptors, and ending with wildlife.

Several pages of text were added to the beginning of Section 8.6 fo the SWMU 1 RFI report to explain the ERA process that was followed at the SWMU 1.

Comment 18:

The ERA should indicate the State designated water uses for the water bodies at Crane and if there are any threatened, endangered, or special concern species in the water bodies just off-site of Crane (i.e., outside the base boundaries)?

Response 18:

The SWMU 1 RFI report ERA presents the recognized water uses as regulated by the State of Indiana and determines whether there may be threatened, endangered, or special concern species in the water bodies just off-site of Crane (i.e., outside the base boundaries).

The following text was added to the end of the second paragraph in Section 8.2.1.2 of the SWMU 1 RFI report to address the comment regarding the state designated water uses:

"The Boggs Creek-Goldsberry Hollow waterbody segment designated state water uses are aquatic life support, fish consumption, and primary contact. This waterbody segment was not assessed as part of the 2004 Indiana Integrated Water Quality Monitoring and Assessment Report to determine if the waterbody was supporting those uses (IDEM, 2004). However, the Boggs Creek-Buzzard Run waterbody segment, located downstream of the Boggs Creek-Goldsberry Hollow waterbody segment is fully supporting the aquatic life support and primary contact water uses; it was not assessed for the fish consumption water use (IDEM, 2004)."

The following text was added to the end of the new third to last paragraph in Section 8.2.1.2 of the SWMU 1 RFI report, Threatened and Endangered Species, to address the comment regarding if there are any threatened, endangered, or special concern species in the water bodies just off-site of Crane (i.e., outside the base boundaries):

"As discussed above, Boggs Creek discharges off-site to the East Fork of the White River. River otters, a state endangered species, are being reintroduced to Indiana. The otters are expanding from their original release sites into other watersheds including the East Fork of the White River (IDFW, 2000). Also, the East Fork of the White River is the site for an ongoing study of lake sturgeon populations, another state endangered species (IDFW, 2000). Finally, spotted darters, a state endangered species, has been found in the East Fork of the White River (IDFW, 2000). Note that other threatened, endangered, or special concern species also may be present in the water bodies just off-site of Crane, as well."

See response to Comment No. 22 below for the revised Section 8.2.1.2, "Threatened and Endangered Species."

Comment 19:

If there is not a screening level for one of the receptors it may be possible to determine that the receptor is less sensitive to the chemical compared to a receptor for which a screening level was developed.

Response 19:

As discussed and suggested by US EPA in the June 9, 2004 technical meeting, if there is not a screening value for one of the receptors an attempt was made to indicate that other receptors are less (or more) sensitive than the receptors for which a screening level was developed. US EPA also stated during the September 9, 2004 conference call that they often only evaluate risks to wildlife in Step 3 because wildlife are often the most sensitive receptors for chemicals. If there are no unacceptable risks for the wildlife species then it is assumed that there are no unacceptable risks to plants or invertebrates. Therefore, a qualitative evaluation was conducted to evaluate risks to the receptor that does not have a screening level or other toxicity data established for a particular chemical, or if toxicity data is limited for a particular receptor.

In the SWMU 1 RFI report ERA, the evaluation was conducted for earthworms exposed to selenium in soil as added to Section 8.6.1.1.

Comment 20:

Need to develop list of chemicals that will be carried through the food chain model for herbivorous and invertivorous mammals and birds and carnivorous birds and mammals.

Response 20:

As discussed at the June 9, technical meeting, EPA indicated that the fox and hawk models do not need to be conducted at most sites unless there is a really a problem with bioaccumulative chemicals. Also, during the July 23, 2004 conference call, it was agreed that the chemicals that were carried through the food chain model in the ERAs conducted to date, which used the list of important bioaccumulative chemicals from EPA (2000), EPA/823/R-00/001 was acceptable for those ERAs and the food chain models would not need redone. The only chemicals not included in the food chain model for the SWMU 1 ERA were isosafrole, aluminum, iron, and vanadium, for reasons presented in Section 8.6.2. Based on the discussions during the September 9, 2004 conference call, US EPA confirmed that the chemicals that were carried through the food chain model for the existing ERAs were acceptable. The Navy agreed to include a brief discussion in the ERA indicating that if the chemical is not accumulating in the food item, then the exposure of the small mammal or bird consuming the food item to the chemical is likely to be low. For that reason, only bioaccumulative chemicals are included in the food chain model.

The following text was added to Section 8.6.2.1 for the SWMU 1 RFI report (after the first sentence) to address this comment:

"The primary reason for only including bioaccumulative chemicals in the food chain model is based on the assumption that although wildlife can be exposed to chemicals that do not accumulate in food items (i.e., plants, invertebrates) via direct ingestion of the media (i.e., soil), the exposure of the animal consuming that chemical will be low if the chemical is not accumulating in the food item."

Comment 21:

Chemicals with concentrations/doses greater than no-effects levels should be evaluated in Step 3a.

Response 21:

Step 3a includes an evaluation of all chemicals with concentrations/doses greater than no-effects levels, with the assumption that the Region 5 EDQLs represent no effects levels.

See Section 8.6 of the SWMU 1 RFI report ERA for the Step 3a evaluation. No additional chemicals were evaluated in Step 3a based on this comment because all chemicals that were retained a COPCs were evaluated in Step 3a.

Comment 22:

The ERA should present more qualitative information of the potential for exposure to threatened and endangered (T&E) reptiles at the site (as one reptile species was identified as a T&E species). For example, the ecological risk assessment should include information detailing the likelihood of the presence of reptilian receptors, the mechanisms through which these receptors may be impacted, and possible individual and/or population level impacts to these receptors. Otherwise, without qualification, the sentence, "...there are uncertainties in risks to reptiles because there is a lack of exposure factors for reptiles and a lack of reptile toxicity data for the detected chemicals" is open to interpretation. Revise the document as requested.

Response 22:

During the April 1, 2004 conference call, the Navy agreed to add qualitative information to both existing and future ERAs regarding the potential or likelihood that T&E reptiles (and other T&E species) are present based on the habitat such as the physical factors or site characteristics affecting exposure of reptiles (or other T&E species).

To address this comment, and other comments regarding T&E species, the following text was added to the SWMU 1 ERA:

The text in Section 8.2.1.2 was replaced with the following text: *"An Endangered Species Management Plan for NSWCrane was prepared in October 2000 (Comarco Systems, Inc., 2000). As part of this plan, the federal and state endangered and threatened species and species of special concern for the facility were identified. This was accomplished by the compilation of a large amount of information on species present at NSWCrane. Information included in the Endangered Species Management Plan (Comarco Systems, Inc., 2000) was obtained from studies and surveys conducted by the Navy and other agencies and groups (such as research institutions). A small subset of these studies include the Inventory of Neotropical Migratory Birds, Mist Net and Radiotelemetry Surveys for the Indiana bat, Bobcat Trapping, Rattlesnake Survey, Purdue University Wildlife Studies, and several fish surveys and bird counts. These studies and others that were used in compiling a list of endangered species present at NSWCrane are described in more detail in the Endangered Species Management Plan (Comarco Systems, Inc., 2000).*

Numerous wildlife species are present throughout NSWCrane. Of these species, some are listed as endangered and threatened species or species of special concern. NSWCrane occupies Daviess, Greene, Lawrence, and Martin counties in Indiana, although only a very small portion of NSWCrane is in Daviess, Greene, and Lawrence counties. The Fanshell pearly mussel, tubercled blossom, ring pink, and clubshell are listed as federally endangered species within Martin, Daviess and Lawrence counties. Additionally, the Northern riffleshell and rough pigtoe are listed as federally endangered species in Martin County. These invertebrate species are not likely to be present at SWMU 01 because they prefer medium to large rivers with moderate currents and gravel substrates as habitat. The preferred habitat that these species prefer is absent at NSWCrane. Additionally, none of these species was identified in Comarco Systems Inc., 2000 as observed at NSWCrane. The Indiana bat is listed as federally endangered in Greene, Lawrence, and Martin counties but not in Daviess County. Figure 8-2 presents capture locations from the misty net and radiotelemetry survey of the Indiana bat at NSWCrane (see Section 8.2.4.1, Carnivorous Birds and Mammals, for a discussion on the likelihood that the Indiana Bat is

present at SWMU 01). Only the bald eagle is listed as a federal threatened species in all four counties. The bald eagle is not likely to be present at SWMU 01 due to a lack of vast expanses of water (i.e., the preferred hunting habitat for the bald eagle) at this SWMU. There are no records of any other species at NSWC that are federally listed as endangered or threatened.

Ten species listed as endangered by the Indiana Department of Natural Resources have been recorded at NSWC and include the Indiana bat, bobcat, timber rattlesnake, bald eagle, osprey, loggerhead shrike, yellow crowned night heron, Virginia rail, king rail, and Henslow's sparrow (Comarco Systems Inc., 2000). No state-listed threatened species have been recorded at NSWC Crane. Bald eagles (as discussed above) and ospreys are not expected to occur at SWMU 01 due to the absence of preferred foraging habitat (large open waters). Similarly, the Virginia rail and king rail are found in marshes and mudflats, the Henslow's sparrow is found in damp fields, and the yellow crowned night heron is primarily a bird of swamps. These habitats are absent from SWMU 01. The loggerhead shrike prefers open fields with scattered trees, but is occasionally found in open woodlands. Thus, use of the site by the loggerhead shrike would be occasional at most. The prime timber rattlesnake habitat is forested land on higher dry ridges with a south or southwestern exposure. SWMU 01 is located on a high dry ridge, so it is possible that the timber rattlesnake is present at the SWMU. As discussed above, Boggs Creek discharges off-site to the East Fork of the White River. River otters, a state endangered species, are being reintroduced to Indiana. The otters are expanding from their original release sites into other watersheds including the East Fork of the White River (IDFW, 2000). Also, the East Fork of the White River is the site for an ongoing study of lake sturgeon populations, another state endangered species (IDFW, 2000). Finally, spotted darters, a state endangered species, has been found in the East Fork of the White River (IDFW, 2000). Note that other threatened, endangered, or special concern species also may be present in the water bodies just off-site of Crane, as well.

Some species that are listed as Federal species of concern in Comarco Systems, Inc. (2000) are also state endangered species (IDNR, 2002). These include the Northern Harrier (Davies County), American bittern (Greene County), and sedge wren (Lawrence County). These species are not endangered in Martin County, where the majority of NSWC Crane occupies and so it is unlikely that operations at NSWC Crane are affecting these species' populations significantly. See Section 8.7.1 for a discussion of the uncertainties associated with not quantitatively evaluating risks to these species in the ERA.

The Rare Animals of Indiana list (Indiana DNR, 2002) was reviewed to verify that no change in status of these species had occurred since October 2000. This list is much larger than that presented in Comarco Systems, Inc. (2000) and is not reiterated here. It was verified that the species listed above did not experience a change in status. Also, the County Distribution of Indiana's Federally Threatened, Endangered, Proposed, and Candidate Species list (USFWS, 2002) was reviewed to verify that no change in status of these species had occurred since October 2000."

The following text was added to the end of the last sentence in the second paragraph in Section 8.7.1 to the SWMU 1 RFI report: "(see below for a discussion of potential risks to the timber rattlesnake)"

- The following text was added to the end of Section 8.7.1 of the SWMU 1 RFI report (note that the third and fourth paragraphs from that section was deleted as they repeat the information presented in the fifth paragraph of the section): "As discussed in Section 8.2.1.2, several endangered and threatened species or species of special concern are present at NSWC Crane, and potentially may inhabit SWMU 01. Risks to these species were not specifically calculated so the uncertainties of not calculating risks to these species are presented here. As discussed above, risks to large carnivorous mammals and birds are expected to be negligible so risks to the bobcat, bald eagle, Northern harrier, and osprey are expected to be negligible, as are risks to carnivorous reptiles such as the timber rattlesnake. Loggerhead shrikes and the sedge wren consume mostly aboveground insects such as caterpillars, beetles, spiders, and flies, as opposed to the worms that are consumed by the American robin in the food-chain model. Because worms are in direct contact with exposure to the soil, it is expected that they would have greater levels of contaminants at SWMU 01 than aboveground insects; therefore, risks to the robin from consuming worms are expected to be greater than risks to the loggerhead shrike and sedge wren from consuming aboveground insects. Risks to the worm

eating American robin from chemicals in the surface soil and surface water were determined to be low; therefore, risks to the loggerhead shrike and sedge wren also are expected to be even lower than risks to robins. The American bittern is a marshland loving bird that feeds on fish, frogs, eels, insects, and water snakes. Because there is very little aquatic habitat present at SWMU 01, the presence of the American bittern is unlikely."

Comment 23:

Surface soil exposures and sub-surface soil exposures should be examined (if applicable) for receptors at the site. In order to examine these exposures, soil sampling depth classes need to be developed. U.S. EPA has suggested the 0 to 0.5 foot below ground surface (ft bgs) as being reflective of surface soils exposure pathways, and 0.5 to 2 foot bgs as reflective of subsurface soil exposure pathways, based on best professional judgment and experience with other sites in the region and across the nation.

U.S. EPA clearly understands that earthworms, plants, and burrowing wildlife will not necessary restrict foraging or burrowing activities to these specific depth classes; however, it should be realized that these receptors of concern are representative species that are used to estimate risk for all of the potential receptors residing at, or otherwise using, the site.

It should also be noted that this recommendation has been provided to assist in the design of future sampling events. That is, it is not necessary to revise the ecological risk assessment based on collection of a new data set.

However, future sampling activities should be designed to incorporate this approach, or sound rationale should be provided for the Navy's selection of 0 to 1 ft bgs and 0 to 2 ft bgs for examining various soil exposures for receptors at the Site.

The rationale should clearly state why the Navy feels it is not necessary to separate surface soil and sub-surface exposure pathways, and why it is appropriate to use two different soil sampling depth classes depending on the analytes being examined (e.g., 0 to 1 ft bgs for inorganic parameters and 0 to 2 ft bgs for dye parameters at SWMU 2.)

Response 23:

Generally at NSWC Crane surface soil samples are collected from a depth of 0 to 2 feet (excepting volatiles which are collected from a depth of 0.5 feet to 2 feet). Samples for each fraction are collected from the entire interval. In some cases historical information or the need for data to support a CMS may warrant collection of fractions from different depths.

The Navy does not agree that samples from two separate intervals within the top two feet need to be collected to evaluate ecological risk. Most ecological receptors will be exposed to contaminants in the top two feet of soil as they move through the soil column. In addition, Section 1.4.2.2 of the approved SWMU 1 quality assurance project plan (QAPP) indicates that the surface soil depth would be 0 to 2 feet below ground surface.

For future ERAs, surface soil intervals will be chosen on a site-specific basis and the rationale for the choice of the surface interval would be provided in the planning documents and in the ERA.

No changes were made to the SWMU 1 RFI report ERA based on this comment.

Comment 24:

The paper by Steevens et. al., 2002. does not provide specific chronic NOAEL or LOAEL data. Steevens et. al. showed that TNT had a LC₅₀ of 28.9 mg/kg with a 95% CI of 25.8 to 32.5 for survival of *Hyalella azteca* (an amphipod) which is a severe adverse effect. The alternate benchmark of 25 mg/kg for TNT is in the severe effects range and is misleading when presented as a refinement chronic NOAEL.

Response 24:

As was discussed during the September 9, 2004 conference call, the TNT values from Steevens et. al., 2002 do not appear valid because the TNT degraded quickly in the sample so the measured concentrations were much less than the nominal concentrations. Therefore, because nominal concentrations were used to calculate the LC₅₀ value, the calculated LC₅₀ is not appropriate and would be much lower using measured concentrations. The Navy agreed not to use the TNT values from Steevens et. al., 2002 for the reason discussed above.

Based on a conference call between TtNUS, US EPA Region 5, and the US Army Corps of Engineers (USACE) on October 6, 2004, Jeff Steevens from USACE indicated that NOECs and LOECs for nitroaromatic compounds were developed in a paper by Conder, et. al., 2004³. The study calculated NOECs and LOECs for nitroaromatic compounds and in order to convert the values from nmol/kg to mg/kg, an average molecular weight of 200 was used. The average molecular weight was based on the approximate average molecular weights of TNT, ANTs, and DNTs of 227, 197, and 167, respectively. Based on this study, the NOEC, LC50, and LOEC for survival of 112, 184 and 304 nmol/g, respectively, converted to 22.4, 36.8 and 60.8 mg/kg, respectively.

Note that TNT was not a COPC at SWMU 1 and no changes were made to the SWMU 1 RFI report ERA to address this comment.

Comment 25:

Other tests by Steevens et. al. resulted in *Chironomous tentans* (a midge) growth being greater when RDX and HMX was present at all test concentrations with respect to the control. The RDX concentration of 711.2 mg/kg did have a significant increase in growth which was incorrectly stated in the risk assessment. All of the Steevens et. al. LOEC and NOEC are not acceptable as alternate benchmarks.

Response 25:

As was discussed during the September 9, 2004 conference call, EPA indicated that they may consider the RDX and HMX toxicity values for survival because they were based on measured concentrations but the Navy should try to locate other lines of evidence. The following additional of evidence were located regarding the toxicity of HMX and RDX to aquatic organisms which indicate the HMX and RDX do not appear very toxic to aquatic organisms:

- One study cited in Talmage et al., 1999 indicated that a sediment pore-water concentration at the limit of HMX solubility would not be acutely toxic to the three organisms that were tested (a midge, isopod, and amphipod).

³ Conder, J.M., T.W. La Point, J.A. Steevens, and G.R. Lotufo. 2004. Recommendations for the Assessment of TNT Toxicity in Sediment. Environmental Toxicology and Chemistry. Vol. 23, No. 1. pp. 141-149.

- One study cited in Talmage et al., 1999 indicated that a sediment pore-water concentration of 15 mg/L of RDX would not be acutely toxic to the three organisms that were tested (a midge, isopod, and amphipod).

Based on the maximum detected concentration of HMX in a SWMU 1 sediment sample (0.422 mg/kg) and the very high NOEC value for survival of 146 mg/kg in Steevens et. al., risks to sediment invertebrates were viewed to be acceptable so HMX was eliminated as a COPC for risks to sediment invertebrates.

References to the toxicity values as they relate to growth of the test organisms were removed from the SWMU 1 ERA, but the references to the NOEC for survival was retained.

Comment 26:

The sediment quality benchmarks presented by Talmage (Talmage et. al. 1999. *Reviews of Environmental Contamination and Toxicology*, vol. 161, pages 1-156) needs to be presented as alternate benchmarks: TNT = 0.09 mg/kg, RDX = 0.01 mg/kg and HMX = 0.005 mg/kg.

Response 26:

Talmage et al., 1999⁴ indicated that the secondary chronic value (SCV) of 0.33 mg/L (which was used to calculate the sediment quality benchmark (SQB) using equilibrium) is overly conservative and a value of >3.3 mg/L is a more realistic interim value until additional toxicity tests are performed. If the more realistic value is used, the SQB increases from 0.005 mg/kg to 0.05 mg/kg, which is still low compared to the empirical data. Therefore, the Navy believes that the empirical data cited in Comments Nos. 24 and 25 in this attachment above, are more appropriate for use in determining if a chemical needs to be retained as a COPC after Step 3a of the ERA.

The Talmage et al., values were not added to the SWMU 1 RFI report ERA.

⁴ Talmage, Sylvia S., Dennis M. Opresko, Christopher J. Maxwell, Christopher J.E. Welsh, F. Michael Cretella, Patricia H. Reno, and F. Bernard Daniel, 1999. "Nitroaromatic Munition Compounds: Environmental Effects and Screening Values." *Rev. Environment. Contam. Toxicol.* 161:1-156

TABLE 1
CROSSWALK TABLE RELATING MARCH 19, 2004 COMMENTS FROM
US EPA AND GENERAL ISSUES TO CONSOLIDATED AND RENUMBERED COMMENTS

Original Comment Number from March 19, 2004 E-Mail	Consolidated Comment Number for General Comments	Consolidated Comment Number for Specific Comments/Other Issues
General Comments		
1	1a,1b,1c,1d,1e	
2	2	
3	3a,3b	
4	4	
5	5a,5b,5c	
Specific Comments for SWMU 3		
1		2
2		1,2
3	1a, 5a	
4	5a	1,2,6
5	5a	2,3,4
6	5a	2,5,6
7	5a	2,5,6
8	5a	2,5,6
9		2,3,4,7
10	5a	1,2,3,4,6,7,8
11		5
12	5a	2,5,8
13	5a	1,2,4,8
14	5a	2,6,7,8
15	5a	2,4,6,7,8
16		9,14
17	Not applicable ⁽¹⁾	
18		11
19		12,24
20	Not applicable ⁽¹⁾	
21	Not applicable ⁽¹⁾	
22		10,13,16
23	5a	9,10,15
24		15
25		9,10
26		9
27		9
28		16
29		9
Specific Comments for SWMU 2		
1		22
2		23
Other Issues		
Not applicable ⁽²⁾		17,18,19,20,21,24,25,26

1 - The comment was specific for a chemical that was not detected at SWMU 1. No general issue was identified for the comment.

2 - The specific comments in this row are based on other issues that were discussed with US EPA and were not specifically identified in the March 19, 2004 e-mail from US EPA.

Enclosure (2)
Responses to General Ecological
Risk Assessment Comments

**GENERAL RESPONSES TO
US EPA COMMENTS DATED MARCH 19, 2004 AND COMMENTS ON OTHER ISSUES
RELATED TO NSWC CRANE ECOLOGICAL RISK ASSESSMENTS FOR
SWMUS 1, 2, 3, 4, 5, 9, AND 10**

BACKGROUND

The Navy prepared ecological risk assessments (ERAs) for NSWC Crane SWMUs 1, 2, 3, 4, 5, 9, and 10 and submitted them to US EPA region 5 for review. US EPA Region 5 reviewed the risk assessments and provided initial comments on several of the ERAs. The US EPA then provided further comments on the ERAs. These more recent comments were transmitted to the Navy via e-mail on March 19, 2004 by Peter Ramanauskas. The following statements were contained in the March 19, 2004 e-mail.

"Attached please find an electronic copy of our comments on Crane's ecological risk assessments. These comments were generated by looking at SWMU 3 as the example case, but apply to the eco risk assessments done at the other SWMUs (1, 2, 4, 5, 9, 10) and those assessments should be revisited to make any corrections needed. Some comments specific to certain SWMUs are provided at the end of the document.

I will presume that we will be getting on a conference call at some point after you have had a chance to review these comments. At that time, I would like to revisit the topic of PBT upper trophic level dose modeling at the SWMUs and the Navy's rationale for not modeling."

US EPA's comments of March 19, 2004 consisted of 5 general comments, 29 comments which were specific to SWMU 3 (Jeep Trail / Little Sulphur Creek), and 2 comments that were specific to SWMU 2 (Dye Burial Grounds). As noted above, the comments on SWMU 3 were intended to serve as a guide for revisiting ERAs for the other SWMUs. US EPA's comments and Navy responses to the comments have been reviewed with US EPA in several telephone conferences and a meeting at NSWC Crane on June 9, 2004. In addition various documents have been exchanged between US EPA and the Navy regarding various related issues.

This document addresses all US EPA comments that have been received to date by the Navy. It is organized as follows:

- Responses to General Comments from EPA's 3/19/04 E-Mail: This group of comments contains responses to the five general EPA comments dated March 19, 2004 as the comments may pertain to all of the SWMUs. If the comment addressed multiple topics the Navy subdivided the comments into "a", "b", etc. for separation of issues for ease of response.
- Responses to General Issue Comments from EPA's 3/19/04 E-Mail and Meetings: This group of issues contains responses to the 29 comments specific to SWMU 3 and the 2 comments specific to SWMU 2 dated March 19, 2004 as the comments may pertain to all of the SWMUs. Because many of the 29 comments were repetitive, the comments for SWMUs 2 and 3 were summarized into 18 general comments that could apply to the ERAs conducted at the other SWMUs. These general comments are listed as Comments 1 through 16 (SWMU 3 comments) and Comments 22 and 23 (SWMU 2 comments). In addition, Comments 17 through 21, and Comments 24 through 26, summarize comments on additional issues that US EPA raised during the following conference calls and/or technical meeting.

- o April 1, 2004 conference call with the Navy, EPA, and TtNUS
- o June 9, 2004 technical meeting with the Navy, TtNUS, EPA, and IDEM.
- o July 8, 2004 conference call with TtNUS and EPA
- o July 15, 2004 conference call with TtNUS and EPA
- o July 23, 2004 conference call with TtNUS and EPA
- o September 9, 2004 conference call with the Navy, TtNUS, USEPA

During the course of communications between US EPA and the Navy, flow charts were developed to succinctly identify and depict the logic involved when moving from each point in the ERA to each subsequent step. These figures reflect a slightly revised ERA strategy that EPA and the Navy agreed would apply to future ERAs, but not to ERAs that have already been submitted to US EPA for review. Figures 1 (soils), 2 (sediment), and 3 (surface water) illustrate the general ecological risk assessment process that will be followed for the future ERAs.

Each ecological risk assessment (SWMUs 1, 2, 3, 4, 5, 9, and 10) will be reviewed using this document as the basis for the review. The results of the review for each SWMU will be documented in separate comment responses documents. In the case of SWMUs 2 and 3 responses will also be provided for the specific comments for each SWMU that were provided in the 3/19/04 US EPA e-mail.

GENERAL COMMENTS FROM US EPA'S 3/19/04 E-MAIL

1a. Comment: The use of alternate benchmarks for ecological risk needs to be based on a chronic no observed adverse effect level (NOAEL) threshold (see Section 1.3.1 of the 1997 ERA Guidance, EPA 540-R-97-006) for the most sensitive receptor likely to be exposed to contaminants at the site.

Response: The Navy agrees that screening levels for ecological risk assessment (ERA) need to be based on NOAELs for the most sensitive receptor likely to be exposed to contaminants at the site for the purposes of chemicals of potential concern (COPC) selection. For that reason, only Region 5 Ecological Data Quality Levels (EDQLs) were used as the screening levels to select COPCs (i.e., see Section 4.3 of the SWMU 3 RFI report). The alternate benchmarks were only used in Step 3a to further evaluate the chemicals that were retained as COPCs for specific endpoints, not the most sensitive endpoint. For example, an alternate benchmark based on risks to plants was used to evaluate risks to plants in Step 3a. However, regardless of the risks to plants, that chemical was evaluated to determine risks to invertebrates (if toxicity data were available) and/or mammals/birds (if the chemical was bioaccumulative). Also, as agreed to in the July 23, 2004 and September 9, 2004 conference calls, alternate benchmarks based on lowest observable adverse effects levels (LOAELs) can be evaluated in Step 3a as long as the effects of the benchmark are clearly discussed.

No changes were made to the existing ERAs to address this comment.

1b. Comment: A clarification statement must be made if the alternate benchmarks do not represent a chronic NOAEL for the most sensitive receptor or are being applied to flag serious (i.e., acute) ecological problems needing immediate action (e.g., interim measures) and the intended use is clear with respect to risk management.

Response: In many cases alternate benchmarks used to further evaluate potential risks from COPCs do not represent chronic NOAELs. As agreed to in the July 23, 2004 and September 9, 2004 conference calls, alternate benchmarks based on lowest observable adverse effects levels (LOAELs) can be evaluated in Step 3a as long as the effects of the benchmark are clearly discussed. The Navy agrees to explain the basis of the alternate benchmarks so their intended use with respect to risk management in the ERA is clear.

1c. Comment: Any alternate benchmark needs to provide supporting information that it will be protective of the most sensitive receptor and explain how it will refine conservative assumptions (as stated in the Navy Policy for Conducting Ecological Risk Assessments).

Response: The Navy does not agree that alternate benchmarks need to be protective of the most sensitive receptor because alternate benchmarks are developed for particular receptor groups, which are not necessarily the most sensitive receptor group. The alternate benchmarks were only used in Step 3a to further evaluate potential risks to specific receptor groups (i.e., plants, invertebrates) from the chemicals that were retained as COPCs. See above response to comment 1b.

No changes will be made to the existing ERAs to address this comment.

1d. Comment: After reviewing the Navy Policy for Conducting Ecological Risk Assessments and revisiting the work plan for SWMU #3, no discussion is provided on developing an alternate benchmark that would deviate from a chronic no adverse effect level (NOAEL).

Response: Alternate benchmarks used in Step 3a were discussed in QAPPs and ERAs for the existing SWMUs (i.e., see Section D.4.1 of the approved QAPP for SWMU 3 and Appendix H.3 of the SWMU 3 RFI report). The text does not specifically indicate which benchmark deviates from a chronic NOAEL however; therefore, as presented in response to General Question No. 2 above, the effects that the alternate benchmarks represent will be clearly presented in the text of the ERAs.

1e. Comment: For some chemicals, alternate benchmarks are appropriate when metal toxicity in surface water is controlled by water hardness and site water hardness is greater than 50 ppm. Likewise, sediment benchmarks that are developed using an equilibrium partitioning (EqP) equation (see footnote "s" in the Region 5, RCRA Ecological Screening Levels table) may be adjusted if site sediment data shows total organic carbon (TOC) is greater than one percent. Also a specific State water quality Criteria or Tier II value may be applied, as appropriate, for the site.

Response: The Navy agrees that hardness and TOC can be used to adjust alternate benchmarks, as appropriate, and also that Tier II values may be appropriate for sites. Hardness and TOC have been used in the Step 3a evaluation in some of the ERAs, as needed, and they will be used in future ERAs to adjust the screening levels if the water hardness is greater than 50 ppm and/or the TOC in the sediment is greater than 1%. In cases where alternate screening values are calculated (metal toxicity based on water hardness, adjusting sediment benchmarks to account for site specific-TOC, etc.) details on the basis for the adjustment will be provided. Tier II values also have been and will be used in some of the ERAs at Crane.

2. Comment: Screening ecological risk benchmarks will be based on toxicity. *Therefore, background soil data will not be used as an alternate benchmark.* Specifically, the OSWER policy (Role of Background in the CERCLA Cleanup Program, April 26, 2002, OSWER 9285.6-07P) recommends that constituents that exceed risk-based screening concentrations be retained and addressed in the risk characterization. This OSWER policy is available at: <http://www.epa.gov/superfund/programs/risk/tooltrad.htm> and the above recommendation is found in the section on Consideration of Background in Risk Assessment.

Response: The Navy agrees that site-specific background soil data should not be used as an alternate benchmark. The soil background data was used to select chemicals as COPCs as was presented in the approved QAPPs. However, as discussed in the June 9, 2004 technical meeting at Crane, the Navy agreed that background will not be used to select chemicals as COPCs in future ERAs at Crane. In future ERAs, chemicals that were detected at concentrations greater than the screening levels but below background will be qualitatively discussed as the first part of the Step 3a evaluation. During the July 23, 2004 conference call, it was agreed that for the reports that have already been completed which used background to select COPCs, the Navy would just need to add a statement to the executive summary (ES) and the ERA to indicate that background was used to select the COPCs, however based on current US EPA and Navy guidance, background will not be used to select COPCs in future ERAs.

Background soil data was discussed in Step 3a to indicate that a chemical was retained as a COPC because it was detected at concentrations that exceeded the screening level and background concentrations. The background soil data was also discussed for a few chemicals to indicate that the screening levels were well below background concentrations or to show that the

chemical concentrations in the site samples were only slightly greater than background. This was not done to indicate that there were no risks, only that there may be no site-related risks. The background data that will be evaluated in the Step 3a discussions will include the base wide soil background data set and upgradient surface water and sediment samples.

3a. Comment: Supporting information is needed to justify how "Magnitude of criterion exceedance" and "Frequency of chemical detection" can be used to determine there is no need for further site evaluation and/or chemical toxicity is of no concern.

Response: The "magnitude of exceedance" and the "frequency of detection" were used to select chemicals as COPCs because even if a chemical was detected in one sample at a concentration that slightly exceeded a screening level it was still retained as a COPC. The "magnitude of exceedance" and the "frequency of detection" were used qualitatively to determine if it is likely that the chemical is causing a risk to ecological receptors. For example, if a chemical concentration in one sample is just slightly greater than a no effects level it is unlikely that the chemical is causing significant risks. Also, if a chemical is detected at relatively low concentrations in 1 of 15 samples (and not detected in the other samples), it is also unlikely that the chemical is causing a significant risk. Therefore, these two factors are applied using professional judgment, in consideration of the following factors (as examples):

- Number of samples that had chemical concentrations that were greater than an EDQL (or other benchmark/toxicity data)
- Area represented by samples that had chemical concentrations that were greater than an EDQL (or other benchmark/toxicity data)
- Is the EDQL (or other benchmark/toxicity data) a no-effects level or a low-effects level
- Chemical concentrations compared to detection limit
- Heterogeneity of chemicals across the site

During the September 9, 2004 conference call, it was agreed that the Navy would provide the rationale for using "magnitude of exceedance" and "frequency of detection" in the Step 3a evaluation, where appropriate, which could then be reviewed and commented on by US EPA. However, frequency of detection alone would not be used to eliminate chemicals as COPCs. The context must be presented (FOD, area represented by samples, magnitude of exceedances, number of samples, etc.).

3b. Comment: If this is a procedure to address hot spots, the risk assessment will still need to delineate the area where the chemical concentration exceeds the chronic NOAEL for the most sensitive receptor.

Response: The procedure can be used to address hot spots, but it can also be used to show that the potential for risks are low, as discussed above. The Navy provides chemical tag maps that present the chemical concentrations at each sample location that exceed a screening level.

No changes were made to the existing ERAs to address this comment.

4. Comment: State what method(s) will be employed to determine metal bioavailability along with site specific field measurements that are being used (or reference a section of the report where this is discussed).

Response: Various methods were and will be used to evaluate metal bioavailability as part of ERAs for Crane as follows:

- In accordance with the new US EPA Eco SSLs, the Eco SSLs for aluminum and iron are based on pH of the soil so if the soil pH is below a certain level, these metals are assumed to not be bioavailable and they will not be retained as COPCs.
- The new US EPA Eco SSL guidance document has a matrix to qualitatively determine the bioavailability of metals based on the soil pH and TOC. This matrix will be used to evaluate qualitatively evaluate bioavailability of the metals
- The hardness of surface water is used to adjust the water quality criteria for select metals using US EPA equations.
- At sites where sediment samples are analyzed for acid volatile sulfides/simultaneously extracted metals (AVS/SEM), the AVS/SEM can be used to evaluate the bioavailability of some metals in sediment. If the concentration of AVS is greater than the concentration of SEM than the metals that are included in the SEM analysis are not considered to be bioavailable.
- The form of the chemical that was used to conduct the toxicity tests that serve as the basis for the criteria may be discussed. For example, many of the toxicity tests used to develop screening levels for metals use highly bioavailable forms of the metal, such as metal salts, which in many cases are much more toxic than equivalent concentrations of the metals in field collected soils¹.

The methods described above will be used in a quantitative and/or qualitative manner using professional judgment to determine if it is likely that the chemical concentrations in the media being evaluated have a high likelihood of causing risks.

5a. Comment: Only the maximum concentration (see Section 1.2.2 and Step2 of the 1997 ERA Guidance, EPA 540-R-97-006) will be compared against the Region 5, RCRA ESLs to screen COPCs.

Response: Only the maximum concentrations were compared against the Region 5, RCRA EDQLs to select chemicals as COPCs in the existing ERAs [note the ESLs will be used for screening in future ERAs] (i.e., see Section 4.3 of the SWMU 3 RFI report).

No changes will be made to the existing ERAs to address this comment.

5b. Comment: If used, alternate benchmarks need to be based on a chronic NOAEL for the most sensitive receptor likely to be present.

Response: As agreed to in the July 23, 2004 and September 9, 2004 conference calls, alternate benchmarks based on LOAELs can be evaluated in Step 3a as long as the effects of the benchmark are clearly discussed. The Navy agrees to explain the basis of the alternate benchmarks so their intended use with respect to risk management in the ERA is clear.

5c. Comment: Supporting information is needed to justify how an average concentration will apply to the most sensitive receptor likely. Average concentrations can

¹ Allen, Herbert E. 2002. Bioavailability of Metals in Terrestrial Ecosystems: Importance of Partitioning for Bioavailability to Invertebrates, Microbes, and Plants. Society of Environmental Toxicology and Chemistry.

be applied following Step 3a when a conceptual model, assessment endpoints, exposure areas and sampling frequency are clearly defined.

Response: Average concentrations were used in Step 3a for a few chemicals. As discussed in the July 23, 2004 and September 9, 2004 conference calls, average concentrations can be used as long as it is made clear how the average concentrations relate to the exposure area for the receptors that are being protected. When average concentrations are used, the conceptual model, assessment endpoints, exposure areas and sampling frequency will be clearly defined.

GENERAL ISSUES FROM US EPA'S 3/19/04 E-MAIL AND MEETINGS

1. **Comment: For chemicals that are known to be persistent bio-accumulative toxic chemicals, an earthworm is not an adequately sensitive receptor.**

Response: The Navy agrees that for chemicals that are known to be persistent bio-accumulative toxic chemicals, an earthworm is likely not the most sensitive receptor, but the section of the report referenced by this comment was the Step 3a evaluation of risks to plants and invertebrates. The Step 3a evaluation of risks to wildlife was presented in a later section of the ERA and bioaccumulative chemicals are included in that evaluation.

2. **Comment: The Dutch "Indicative Levels" shows that plant and animal life is seriously impaired (i.e., 50% of the species experience negative effects) and does not represent a screening benchmark (i.e., chronic NOAEL) as described in general comment number one.**

Response: As agreed to in the June 9, 2004 technical meeting, the Dutch numbers will not be used in the ERAs and all discussions related to the Dutch numbers will be removed from the existing ERAs. The only exceptions would be in a few instances when the ecological basis of the numbers can be justified; the justification will be included in the ERA.

3. **Comment: The Canadian Soil Quality Guidelines does not clearly state that a Residential/Parkland value is a chronic NOAEL intended to protect sensitive receptors (see general comment # 1).**

Response: The toxicological basis for the Canadian SQGs will be presented in the ERAs when they are used.

4. **Concerns with the Canadian protocol include the following:**
 - a. **not intended to protect all wild plants and animals as noted in the land use definition "parkland is defined as a buffer zone between areas of residency and campground areas and excludes wild lands such as national or provincial parks"**

Response: The agricultural Canadian SQG indicates that the values must protect resident and transitory wildlife and native flora. The residential/parkland SQG indicates that like the agricultural land use, the values must ensure that the soil is capable of sustaining soil-dependent species and does not adversely affect wildlife from direct soil contact. Because the soil contact SQGs (based on protecting plants and invertebrates) are the same for the agricultural and residential/parkland land uses, they are designed to protect native flora. Regarding the protection of animals (i.e., mammals and birds), as indicated in response to Comment 4c, the Navy is not using the Canadian SQG to evaluate animals.

- b. **the guideline uses a lowest observed effect concentration (LOEC) rather than a NOAEL. note, the "no potential effects range" (NPER) benchmark uses a LOEC**

Response: The Canadian SQGs use various uncertainty factors to approximate no effects levels, or low levels of potential effects. As discussed above, the toxicological basis for the Canadian SQGs will be presented in the ERAs when they are used.

c. **food web exposure to insectivores (e.g., shrew or robin) does not appear to be incorporated into the guideline. The Canadian soil value for naphthalene needs more documentation.**

Response: Food web exposure to insectivores (i.e., shrew or robin) is not incorporated into the Canadian SQG, but the SQGs were not used by the Navy to evaluate risks to food chain receptors in the ERAs. The SQGs were only used to evaluate risks to plants and invertebrates.

5. **Comment: The recently released U.S. EPA report, Ecological Soil Screening Level (Eco-SSL) for the following chemicals will replace the Region 5, RCRA ESL and needs to be used as the soil screening benchmark: aluminum, antimony, barium, beryllium, cadmium, cobalt, iron, lead, and dieldrin.**

Response: The Navy agrees to use the US EPA Eco SSLs selecting chemicals as COPCs in soil in future ERAs. The Eco SSLs will be discussed in Step 3a for the existing ERAs as agreed to in the July 23, 2004 conference call.

6 **Comment: The ORNL benchmarks are not chronic NOAELs and do not represent the most sensitive receptor (see general comment # 1).**

Response: As presented in the response to comment No. 1, the ORNL benchmarks were not used as screening values to select chemicals as COPCs. The ORNL benchmarks were only used in Step 3a to further evaluate risks to plants and invertebrates. Therefore, they do not need to be chronic NOAELs or represent the most sensitive receptors. Also, as presented in the response to comment No. 1, the basis of the alternate benchmarks will be presented in the ERA so that its intended use with respect to risk management is described.

During the September 9, 2004 conference call, it was agreed that alternate benchmarks, which are effects levels for plants and invertebrates could be used as NOAELs, for purposes of COPC screening, if they correspond to an effect of 20 percent or less on the receptor population. The basis for the benchmark would have to be clearly presented. This is based on the fact that the US EPA Ecological Soil Screening Levels for plants and invertebrates are based on geometric means of effects concentrations (EC)_{20S}, EC_{10S}, and/or Maximum Acceptable Toxicant Concentrations. Chemical concentrations that are below these values will be eliminated as COPCs. Because a 20 percent reduction in growth or yield (for plants) and 20 percent reduction in growth, reproduction, or activity (for earthworms), were used as the threshold for significant effects for the ORNL benchmarks, chemical concentrations that are less than the ORNL benchmarks will be eliminated as COPCs for that receptor.

7 **Comment: Eco-SSLs for several chemicals are in development and will replace the Region 5, RCRA ESL. When available the Eco-SSLs need to be used as the soil screening benchmark.**

Response: The Navy will use the Eco-SSLs for selecting chemicals as COPCs for future ERAs when they are available and when the ERA is prepared.

8 **Comment: The chemical values in the report "Preliminary Remediation Goals (PRG) for Ecological Endpoints" (ORNL ES/ER/TM-162/R2 August 1997) are not intended to be used for screening, but are thresholds for significant adverse effects.**

Response: The Navy agrees that PRGs are not intended for screening, but as stated in the referenced PRG document, "PRGs are intended to correspond to minimal and acceptable levels of effects on the general ecological assessment endpoints as defined in the data quality objectives (DQO) process for ecological risk assessments on the Oak Ridge Reservation (Suter et al. 1994). In general, they correspond to small effects on individual organisms which would be expected to cause minimal effects on populations and communities." Therefore, concentrations below the PRGs are not expected to cause significant adverse effects.

9 Comment: The "effects range – low" (ERL) value is not an alternate benchmark for a chronic NOAEL, but it is a higher toxicity gradient than the threshold effects level (TEL) used in the EPA Region 5 ESL table. The ERL is the lower 10th percentile concentration of sediment toxicity data and a value where toxicity can be expected. The TEL (not the ERL as stated in the report) is the concentration below which adverse effects are expected rarely.

Response: The Navy agrees that the ER-L is not a chronic NOAEL, but neither is the TEL that is used in the US EPA Region 5 ESL table. As cited in the Consensus-Based Sediment Quality Guidelines article by MacDonald et al., (2000), the ER-L "represents the chemical concentration below which adverse effects would rarely be expected." This definition is similar to that as the TEL which "represent the concentration below which adverse effects are expected to occur only rarely" (MacDonald et al., 2000). Also, note that the TEC value (i.e., not toxic), which is used as the revised Region 5 RCRA ESL, incorporates the Ontario lowest effect level (LEL), TEL and ER-L values.

As indicated by US EPA in the July 23, 2004 conference call, although the TEC is more of a LOAEL than a NOAEL, it is acceptable for screening because US EPA is trying to protect benthic invertebrate communities, not populations. Therefore, the values can be greater than no-effects levels. The Navy will clearly present the basis of those values in the ERAs (where used) and how they were used in the ERA.

No changes were made to the existing ERA to address this comment.

10 Comment: Likewise, the "effects range – median" will represent the 50th percentile of sediment toxicity data and "upper effects threshold" values will be a concentration where adverse impacts would always be expected.

Response: As presented in the consensus article (MacDonald et al., 2000); the ER-M "represents the chemical concentration above which adverse effects would frequently occur." Therefore, the Navy does not agree that the ER-M is the chemical concentration above which adverse impacts would always occur. As discussed and agreed to by US EPA in the June 9, 2004 technical meeting, the Navy will present one lower effects level and one higher effects level (such as the PEC) to show the range of the effects levels because the lower effects levels and higher effects levels provide probabilities of effect. The Navy will clearly present the basis of those values in the ERAs (where used) and how they were used in the ERA.

11 Comment: The screen is a pass-fail process.

Response: The Navy agrees that the screen is a pass-fail process. However, the section of the SWMU 3 RFI report that the comment references (Section 8.6.1.2) is not the screening step. The

COPC screens were conducted in earlier sections of the RFI reports (i.e., Section 4.3 for SWMU 3).

12 Comment: Sediment toxicity needs to be limited to freshwater species with reported chronic NOAELs. The LOEC and NOEC values for TNT, based on marine and estuarine organisms, are not acceptable as alternate benchmarks.

Response: Although freshwater toxicity data/benchmarks are preferred for evaluating risks to organisms in freshwater, marine benchmarks are often used as surrogates for chemicals that do not have freshwater toxicity data/benchmarks. As stated by US EPA in the September 9, 2004 conference call, Chris Ingersoll from USGS indicated that although saltwater species are less sensitive to some chemicals than are freshwater species, it is acceptable to use saltwater sediment values for chemicals that do not have freshwater values. US EPA therefore agreed that saltwater values could be used as long as the uncertainties are discussed in the ERA. The Navy agrees that the freshwater value cited in the text for TNT in Steevens et. al. (2002)² is not a valid value based on the information presented by US EPA during the September 9, 2004 conference call. See response to Comment No. 24 for information regarding the toxicity of TNT to sediment organisms.

13 Comment: The “probable effects concentration” (PEL) represents a level where adverse effects are frequently expected and is not an alternate benchmark for a chronic NOAEL.

Response: As discussed in the June 9, 2004 technical meeting, for chemicals where the only toxicity data available is an AET or some other higher effects level, it was agreed to carry the chemical through the ERA but it would not be quantitatively evaluated. It was noted during the meeting that this approach was acceptable because usually if there is a problem at the site, it would be caused by other chemicals that have toxicity data.

14 Comment: The “effects range-low” (ER-L) for antimony represent the lower range of sediment toxicity (see specific comment #16) and the “effects range-median” (ER-M) is the median value of sediment toxicity. Neither the ER-L nor the ER-M is alternate benchmarks for a chronic NOAEL.

Response: Navy agrees that neither the ER-L nor ER-M are chronic NOAELs, but neither is the TEL that is used in the US EPA Region 5 ESL table. As indicated by US EPA in the July 23, 2004 and September 9, 2004 conference calls, LOAELs are acceptable for screening benchmarks for sediment invertebrates because US EPA is trying to protect benthic invertebrate communities, not populations. Therefore, the values can be greater than no-effects levels. No changes will be made to the existing ERAs to address this comment.

15 Comment: The “apparent effect thresholds” (AETs) were not developed to evaluate ecological risk and they represent a level where adverse biological impacts are always expected and adverse impacts are also known to occur at levels below the AET.

² Steevens, Jeffrey A., B.M. Duke, G.R. Lotufo, and T.S. Bridges, 2002. “Toxicity of the Explosives 2,4,6-Trinitrotoluene, Hexahydro-1,3,5-Trinitro-1,3,5-Triazine, and Octahydro-1,3,5,7-Tetranitro-1,3,5,7-Tetrazocine in Sediments to *Chironomus tentans* and *Hyallela azteca*: Low-Dose Hormesis and High-Dose Mortality” in Environmental Toxicology and Chemistry. 21:7:1475-1482.

Response: The Navy agrees that the AET represents a level where adverse biological impacts are always expected and adverse impacts are also known to occur at levels below the AET. No changes will be made to the existing ERA to address this comment.

16 Comment: The lack of information on the toxicity (i.e., chronic NOAEL) of chemicals result in a decision to continue with the ecological risk assessment process, Steps 3 through 7 (see Section 2.5 of the 1997 ERA Guidance, EPA 540-R-97-006).

Response: The Navy agrees to carry a chemical through the ERA if there is no toxicity data for that chemical, unless other factors in Step 3a (i.e., frequency of detection) are used to eliminate it from further evaluation. However, the Navy does not agree that chemicals without toxicity data need to be evaluated in Steps 3 through 7 of the ERA process. Steps 3 through 7 are the BERA and typically include the collection of site-specific biological data (i.e., toxicity tests, biological surveys, etc.). Therefore, a site should not proceed to a BERA just because a chemical is lacking toxicity data. During the September 9, 2004 conference call, it was agreed that the information contained in Step 3a is consistent with the information presented in other ERAs that US EPA has reviewed and the Navy can continue to conduct the further risk evaluation in Step 3a.

17 Comment: It was not clear that the Step 3a evaluation was designed to eliminate chemicals as COPCs for certain groups of receptors and that chemicals that are screened out for one receptor group would still be evaluated for other receptor groups.

Response: The Navy agreed to add text to the beginning of the Step 3a evaluation to indicate the evaluation will consist of screening out chemicals for the various receptor groups, starting with plants/invertebrates, aquatic receptors, and ending with wildlife. The text will reference the flow charts (see attached) that were prepared to present the ERA process for evaluating chemicals in soil, sediment, and surface water.

18 Comment: The ERA should indicate the State designated water uses for the water bodies at Crane and if there are any threatened, endangered, or special concern species in the water bodies just off-site of Crane (i.e., outside the base boundaries)?

Response: The ERAs will present the recognized water uses as regulated by the State of Indiana and will determine if there may be threatened, endangered, or special concern species in the water bodies just off-site of Crane (i.e., outside the base boundaries).

19 Comment: If there is not a screening level for one of the receptors it may be possible to determine that the receptor is less sensitive to the chemical compared to a receptor for which a screening level was developed.

Response: As discussed and suggested by US EPA in the June 9, 2004 technical meeting, if there is not a screening value for one of the receptors an attempt will be made to indicate that other receptors are less (or more) sensitive than the receptors for which a screening level was developed. US EPA also stated during the September 9, 2004 conference call that they often only evaluate risks to wildlife in Step 3 because they are often the most sensitive receptors for many chemicals. If there are no unacceptable risks for the wildlife species then it is assumed that there are no unacceptable risks to plants or invertebrates. Therefore, a qualitative evaluation can be conducted to evaluate risks to the receptor that does not have a screening level or other toxicity data established for a particular chemical, or if toxicity data is limited for a particular receptor. This information may not be available for many chemicals but where it is, it can be used. It would typically be used for classes of chemicals such as PCBs, PAHs, etc.

20 Comment: Need to develop list of chemicals that will be carried through the food chain model for herbivorous and invertivorous mammals and birds and carnivorous birds and mammals.

Response: As discussed at the June 9, technical meeting, US EPA indicated that the fox and hawk models do not need to be conducted at most sites unless there is really a problem with bioaccumulative chemicals. Also, during the July 23, 2004 conference call, it was agreed that the chemicals that were carried through the food chain model in the ERAs conducted to date, which used the list of important bioaccumulative chemicals from US EPA (2000), EPA/823/R-00/001 was acceptable for those ERAs and the food chain models would not need redone. Phthalates were not included in the food chain modeling because they were not included on the list of important bioaccumulative chemicals in US EPA (2000). It was agreed that for future ERAs, TtNUS would generate a list of chemicals that would be carried through the food chain model for small mammals and birds and a separate list that would be used for higher trophic level carnivores such as hawks and foxes. At that time, phthalates could be included in that list for future ERAs. Based on the discussions during the September 9, 2004 conference call, US EPA confirmed that the chemicals that were carried through the food chain model for the existing ERAs were acceptable. The Navy will include a brief discussion in the ERA indicating that if the chemical is not accumulating in the food item, then the exposure of the small mammal or bird consuming the food item to the chemical is likely to be low. For that reason, only bioaccumulative chemicals are included in the food chain model.

21 Comment: Chemicals with concentrations/doses greater than no-effects levels should be evaluated in Step 3a.

Response: Step 3a will include an evaluation of all chemicals with concentrations/doses greater than no-effects levels.

22 Comment: The ERA should present more qualitative information of the potential for exposure to threatened and endangered (T&E) reptiles at the site (as one reptile species was identified as a T&E species). For example, the ecological risk assessment should include information detailing the likelihood of the presence of reptilian receptors, the mechanisms through which these receptors may be impacted, and possible individual and/or population level impacts to these receptors. Otherwise, without qualification, the sentence, "...there are uncertainties in risks to reptiles because there is a lack of exposure factors for reptiles and a lack of reptile toxicity data for the detected chemicals" is open to interpretation. Revise the document as requested.

Response: During the April 1, 2004 conference call, the Navy agreed to add qualitative information to both existing and future ERAs regarding the potential or likelihood that T&E reptiles (and other T&E species) are present based on the habitat such as the physical factors or site characteristics affecting exposure of reptiles (or other T&E species).

23 Comment: Surface soil exposures and sub-surface soil exposures should be examined (if applicable) for receptors at the site. In order to examine these exposures, soil sampling depth classes need to be developed. U.S. EPA has suggested the 0 to 0.5 foot below ground surface (ft bgs) as being reflective of surface soils exposure pathways, and 0.5 to 2 foot bgs as reflective of subsurface soil exposure pathways, based on best professional judgment and experience with other sites in the region and across the nation.

U.S. EPA clearly understands that earthworms, plants, and burrowing wildlife will not necessarily restrict foraging or burrowing activities to these specific depth classes; however, it should be realized that these receptors of concern are representative species that are used to estimate risk for all of the potential receptors residing at, or otherwise using, the site.

It should also be noted that this recommendation has been provided to assist in the design of future sampling events. That is, it is not necessary to revise the ecological risk assessment based on collection of a new data set.

However, future sampling activities should be designed to incorporate this approach, or sound rationale should be provided for the Navy's selection of 0 to 1 ft bgs and 0 to 2 ft bgs for examining various soil exposures for receptors at the Site.

The rationale should clearly state why the Navy feels it is not necessary to separate surface soil and sub-surface exposure pathways, and why it is appropriate to use two different soil sampling depth classes depending on the analytes being examined (e.g., 0 to 1 ft bgs for inorganic parameters and 0 to 2 ft bgs for dye parameters at SWMU 2.)

Response: Generally at NSWC Crane surface soil samples are collected from a depth of 0 to 2 feet (excepting volatiles which are collected from a depth of 0.5 feet to 2 feet). Samples for each fraction are collected from the entire interval. In some cases historical information or the need for data to support a CMS may warrant collection of fractions from different depths.

The Navy does not agree that samples from two separate intervals within the top two feet need to be collected to evaluate ecological risk. Most ecological receptors will be exposed to contaminants in the top two feet of soil as they move through the soil column.

For future ERAs, surface soil intervals will be chosen on a site-specific basis and the rationale for the choice of the surface interval will be provided in the planning documents and in the ERA.

24 Comment: The paper by Steevens et. al., 2002. does not provide specific chronic NOAEL or LOAEL data. Steevens et. al. showed that TNT had a LC₅₀ of 28.9 mg/kg with a 95% CI of 25.8 to 32.5 for survival of *Hyalella azteca* (an amphipod) which is a severe adverse effect. The alternate benchmark of 25 mg/kg for TNT is in the severe effects range and is misleading when presented as a refinement chronic NOAEL.

Response: As was discussed during the September 9, 2004 conference call, the TNT values from Steevens et. al., 2002 do not appear valid because the TNT degraded quickly in the sample so the measured concentrations were much less than the nominal concentrations. Therefore, because nominal concentrations were used to calculate the LC₅₀ value, the calculated LC₅₀ is not appropriate and would be much lower using measured concentrations. The Navy agreed not to use the TNT values from Steevens et. al., 2002 for the reason discussed above.

Based on a conference call between TtNUS, US EPA Region 5, and the US Army Corps of Engineers (USACE) on October 6, 2004, Jeff Steevens from USACE indicated that NOECs and LOECs for nitroaromatic compounds were developed in a paper by Conder, et. al., 2004³. The study calculated NOECs and LOECs for nitroaromatic compounds and in order to convert the values from nmol/kg to mg/kg, an average molecular weight of 200 was used. The average

³ Conder, J.M., T.W. La Point, J.A. Steevens, and G.R. Lotufo. 2004. Recommendations for the Assessment of TNT Toxicity in Sediment. Environmental Toxicology and Chemistry. Vol. 23, No. 1. pp. 141-149.

molecular weight was based on the approximate average molecular weights of TNT, ANTs, and DNTs of 227, 197, and 167, respectively. Based on this study, the NOEC, LC50, and LOEC for survival of 112, 184 and 304 nmol/g, respectively, converted to 22.4, 36.8 and 60.8 mg/kg, respectively.

25 Comment: Other tests by Steevens et. al. resulted in *Chironomous tenans* (a midge) growth being greater when RDX and HMX was present at all test concentrations with respect to the control. The RDX concentration of 711.2 mg/kg did have a significant increase in growth which was incorrectly stated in the risk assessment. All of the Steevens et. al. LOEC and NOEC are not acceptable as alternate benchmarks.

Response: As was discussed during the September 9, 2004 conference call, EPA indicated that they may consider the RDX and HMX toxicity values for survival because they were based on measured concentrations but the Navy should try to locate other lines of evidence. The following additional of evidence were located regarding the toxicity of HMX and RDX to aquatic organisms which indicate the HMX and RDX do not appear very toxic to aquatic organisms:

- One study cited in Talmage et al., 1999 indicated that a sediment pore-water concentration at the limit of HMX solubility would not be acutely toxic to the three organisms that were tested (a midge, isopod, and amphipod).
- One study cited in Talmage et al., 1999 indicated that a sediment pore-water concentration of 15 mg/L of RDX would not be acutely toxic to the three organisms that were tested (a midge, isopod, and amphipod).

Note that references to the toxicity values as they relate to growth of the test organisms were removed from the existing ERAs, but the references to the toxicity values as they relate to survival of the test organisms were retained.

26 Comment: The sediment quality benchmarks presented by Talmage (Talmage et. al. 1999. *Reviews of Environmental Contamination and Toxicology*, vol. 161, pages 1-156) needs to presented as alternate benchmarks: TNT = 0.09 mg/kg, RDX = 0.01 mg/kg and HMX = 0.005 mg/kg.

Response: Talmage et al., 1999⁴ indicated that the secondary chronic value (SCV) of 0.33 mg/L (which was used to calculate the sediment quality benchmark (SQB) using equilibrium) is overly conservative and a value of >3.3 mg/L is a more realistic interim value until additional toxicity tests are performed. If the more realistic value is used, the SQB increases from 0.005 mg/kg to 0.05 mg/kg, which is still low compared to the empirical data. Therefore, the Navy believes that the empirical data cited in Comments Nos. 24 and 25 above, are more appropriate for use in determining if a chemical needs to be retained as a COPC after Step 3a of the ERA.

The Talmage et al., values were not added to the existing ERAs.

⁴ Talmage, Sylvia S., Dennis M. Opresko, Christopher J. Maxwell, Christopher J.E. Welsh, F. Michael Cretella, Patricia H. Reno, and F. Bernard Daniel, 1999. "Nitroaromatic Munition Compounds: Environmental Effects and Screening Values." *Rev. Environment. Contam. Toxicol.* 161:1-156.

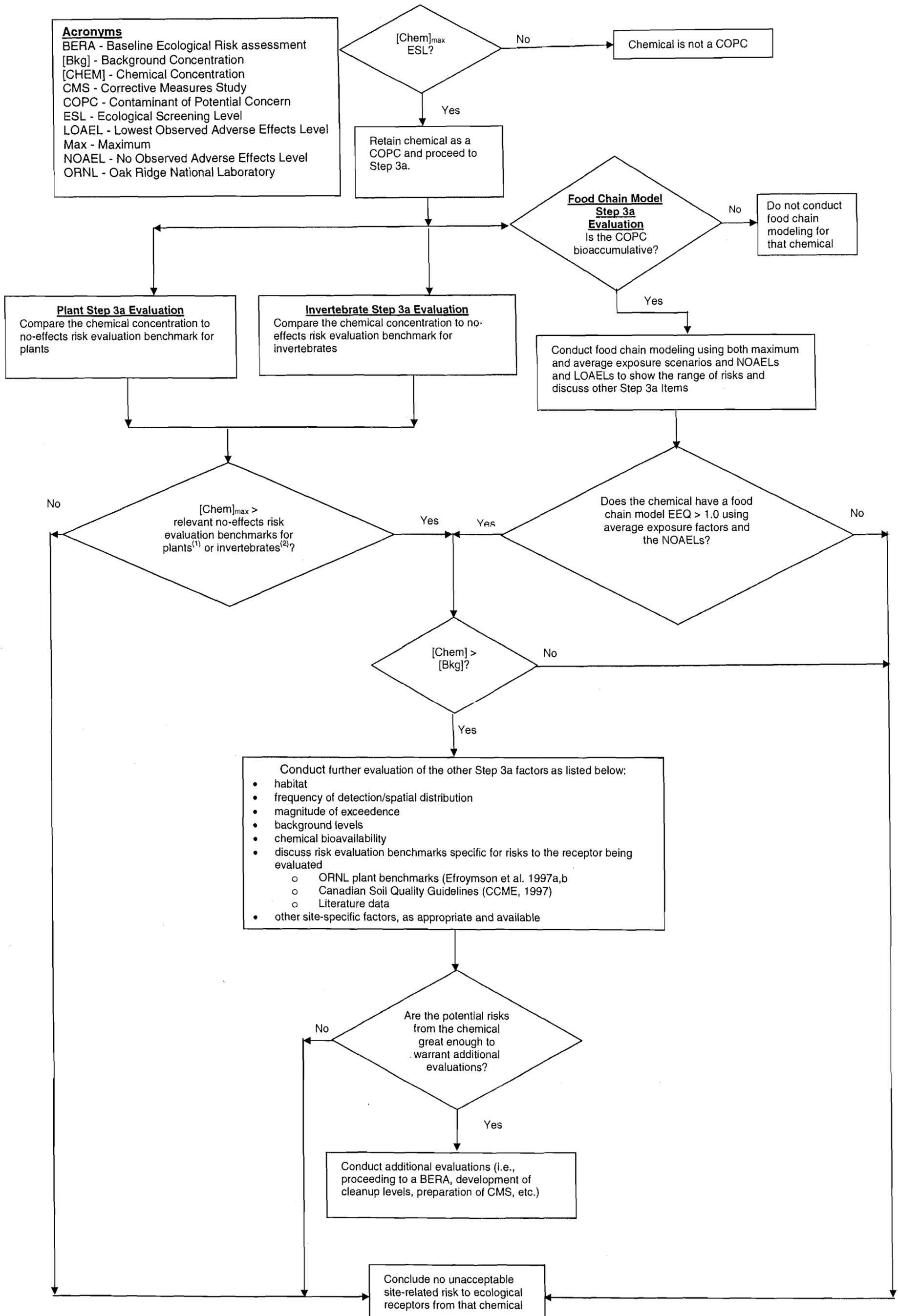


FIGURE 1

GENERAL ERA PROCESS FOR EVALUATION OF RISKS TO CHEMICALS IN SURFACE SOIL AT NSW CRANE, INDIANA
 NSW CRANE, CRANE, INDIANA

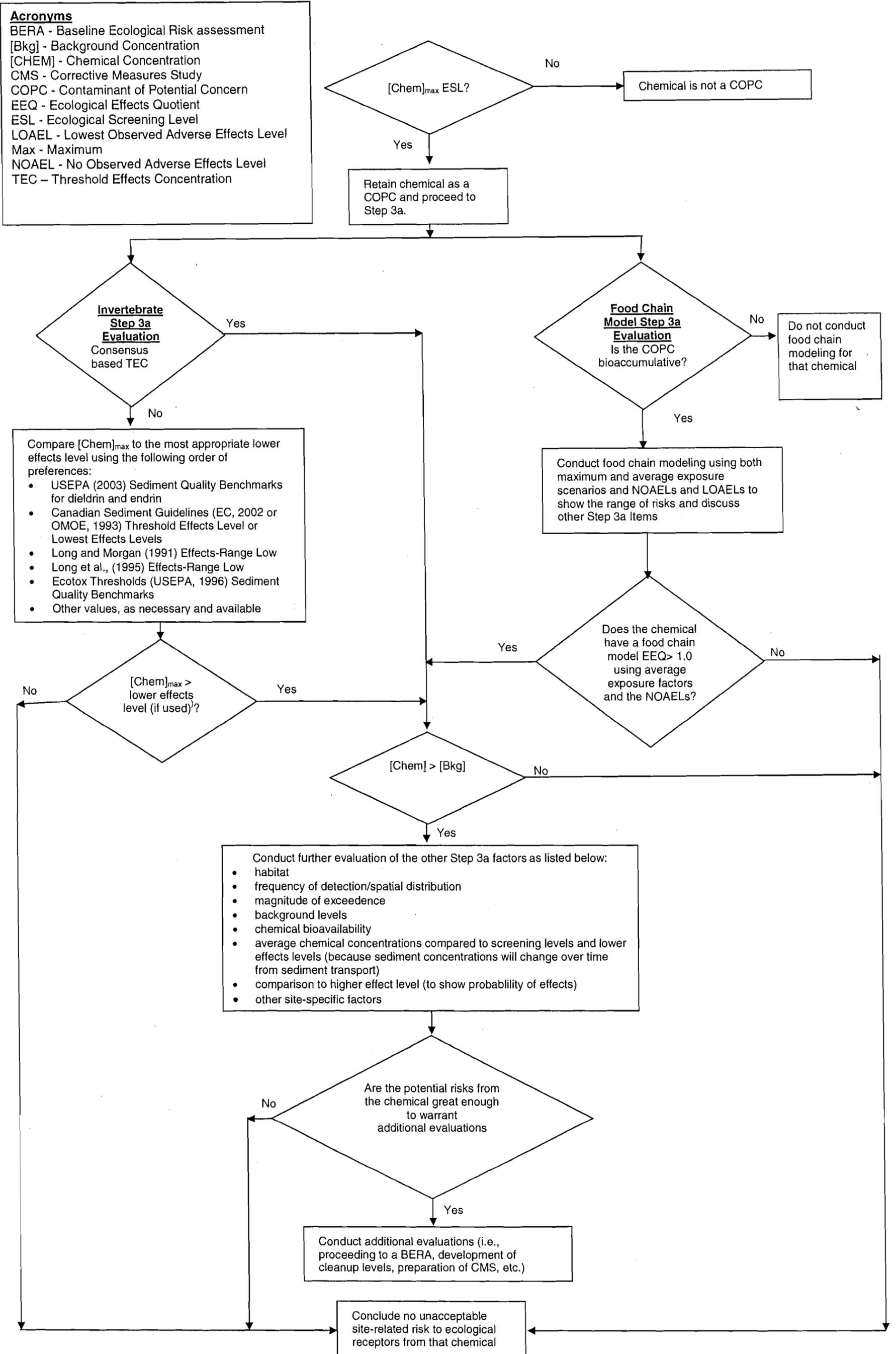


FIGURE 2

GENERAL ERA PROCESS FOR EVALUATION OF RISKS TO CHEMICALS IN SEDIMENT AT NSW CRANE, INDIANA
 NSW CRANE, CRANE, INDIANA

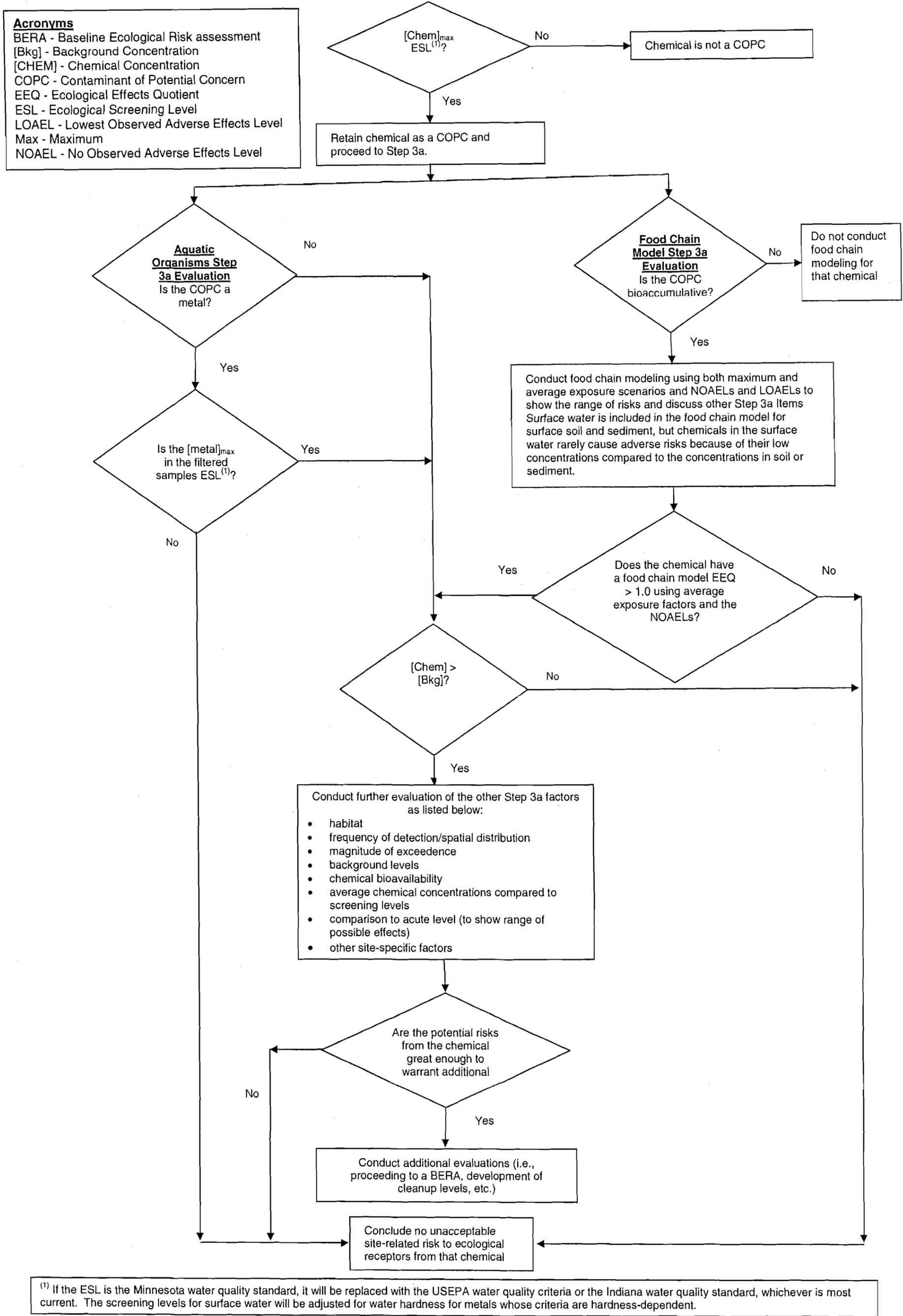


FIGURE 3

GENERAL ERA PROCESS FOR EVALUATION OF RISKS TO CHEMICALS IN SURFACE WATER AT NSWC CRANE, INDIANA
 NSWC CRANE, CRANE, INDIANA

5090
Ser RP3/4332

1 Nov 2004

The letter Ser RP3/4332 was for the Final
RFI Report for the Mustard Gas Burial
Ground SWMU 01. Updated pages added to
report dated 1/14/03.