

EQB's Comments  
Draft Environmental Remedial Investigation Work Plan  
Solid Waste Management Unit (SWMU) 4  
Former Naval Ammunition Support Detachment  
Vieques Island, Puerto Rico  
June 2004

## INTRODUCTION

TRC has reviewed and provides the attached comments to the Draft Environmental Remedial Investigation Work Plan, Solid Waste Management Unit (SWMU) 4, dated June 2004.

The RI Report presents the proposed environmental sampling activities as a part of an Environmental Remedial Investigation (RI) at a former Open Burn/Open Detonation (OB/OD) site identified as Solid Waste Management Unit (SWMU) 4 with the Former Naval Ammunition Support Detachment (NASD).

The SWMU 4 site was initially investigated as part of the Expanded Preliminary Assessment/Site Investigation (PA/SI) program in 2000 and the Initial Assessment Study (IAS) report in 1984.

The SWMU 4 Work Plan references procedures described in the Master Work Plan for the Former NASD (2001). TRC had not provided previously comments to the Master Work Plan for This review presents significant issues identified in the RI Report, as well as requests to clarify cited issues.

## GENERAL COMMENTS

1. The boundary of SWMU 4 must be extended to account for "kickouts" that may have fallen into the water. Since the travel distance of "kickouts" may be up to 3,000 feet in any direction, the SWMU 4 boundary should be delineated by extending the arc illustrated in Figure 1-2 and creating a complete circle. The scope of the RI must be adjusted to include assessment of the marine area.

**Navy Response:** The boundary of SWMU 4 does not include the marine environment. Any off-shore studies necessary will be completed after the terrestrial investigations have been completed. If off-shore investigation adjacent to SWMU 4 is deemed necessary in the future, the area can be studied as part of a larger off-shore effort or identified as a separate study area.

2. The risk assessment work plan was drafted as a generic plan that does not take into consideration information provided in other sections of the work plan or data collected during previous investigations. For example, a conceptual site model is provided in Section 3, but the human health risk assessment work plan states that a conceptual site model will be developed. The conceptual site model should be used in the decision-making process for determining the number, type and location of sampling for the RI. It is unclear that data collected during previous investigations has been used to identify data gaps for the risk assessment that should be addressed during the RI. A preliminary list of chemicals of potential concern should have been developed based on sampling

data collected to date and a preliminary understanding of the fate and transport mechanisms and pathways should be known as a result of this data. This information should be used to develop the scope and purpose of the RI investigation to collect data needed to adequately characterize the site and exposure pathways for risk assessment purposes. Please modify Section 5 to include data and information known about the site and discuss data gaps for the risk assessment. This discussion is necessary to ensure that the investigation provides data needed to move forward with the risk assessment.

**Navy Response:** To ensure consistent application of risk assessment protocol across Vieques, Section 5 has been deleted from the document and the HHRA approach in the Master Quality Assurance Project Plan referenced in Section 3.1. The PA/SI identified relatively few constituents detected that were associated with potential releases. However, because of information gathered during the geophysical investigation conducted as part of the MEC work (e.g., identification of exact locations of burn pits), additional evaluation of historical aerial photos for the area, and identification of several ephemeral streams, additional data collection is warranted as part of this RI. The proposed additional data collection effort is intended to sufficiently characterize the site and assess the potential risks to human health and the environment. Further, the proposed additional samples will be analyzed for a comprehensive suite of analytes; thus previous data screening results were not used to focus the list of analytes for RI analysis. Also, please refer to responses to comments from EPA on Sections 2 and 3 of this work plan.

#### PAGE-SPECIFIC COMMENTS

1. Page ES-III, Paragraph 1 - The preliminary results should be provided from the Munitions and Explosives of Concern remedial investigation (MEC RI). The text indicates that the MEC RI results indicate the need for additional environmental investigations at this site. Review of this information is needed to evaluate the scope of the proposed work.

**Navy Response:** The sentence to which the comment is referring inadvertently referred to the MEC RI results as indicating the need for additional environmental investigations, rather than the PA/SI results which is what was intended. The fourth sentence of the first paragraph has been revised to read: "Results from the PA/SI, as well as additional data collection and evaluation conducted since the PA/SI, indicate the need for additional environmental data collection in order to adequately assess the nature and extent of contamination at the site and potential risks posed, if any."

The results of the MEC RI report are included in Section 2.3.6 of the MEC RI, and are summarized in the Executive Summary, Page ES III, fourth paragraph.

A mistake was made in the Executive Summary, Page ES III, Paragraph 1, fourth sentence which called out the MEC RI as opposed to the PA/SI. The sentence will be edited to read: "Results from the PA/SI indicate a need for additional environmental investigations at the site."

Both the PA/SI and the MEC RI reports were reviewed during the proposed scope of work development.

2. Page ES-III, Paragraphs 3 and 4 - The text must be reviewed for consistency and revised as appropriate. Paragraph 3 states that the site is approximately 100 acres and Paragraph 4 states that 87 acres of the site were subjected to the geophysical survey. What is the status of the remaining 13 acres?

**Navy Response:** There is no inconsistency in the text. The site area is approximately 100 acres. The 100-acre area is an estimated area that may have been impacted by historical operations, findings from site surveys, and findings from investigations. The geophysical survey and subsurface investigation included an area of 87 acres. The geophysical survey determined the density of subsurface anomalies. During the geophysical survey there were areas that were not accessible to the geophysical equipment due to landscape restrictions such as ephemeral streams. The areas not covered by the geophysical survey (the 13 acres referred to above) are part of the SWMU 4 site but have not yet been investigated for MEC.

**Comment 2A:** Add text that says if necessary, additional area beyond the 87 acres will be evaluated in the future.

**Navy Response:** Executive Summary, a sentence was added to the end of the fourth paragraph that states: "If necessary, geophysical survey will be conducted beyond the original 87 acres in the future."

3. Page ES-III, Paragraph 5 - Given that Paragraph 3 indicates that thermal destruction of fuels took place at the site, the absence of petroleum carbon range analyses, like Volatile Petroleum Hydrocarbons (VPH) and Extractable Petroleum Hydrocarbons (EPH), appears to be a data gap. Although the results of the soil and groundwater data did not detect volatile organic compounds (VOCs) or semivolatile organic compounds (SVOCs) other than explosive related compounds, and thus indicates limited potential for the presence petroleum contamination, the results could reflect sampling bias. In other words, the locations of the anomalies detected during the geophysical investigation and ground-scarred areas identified from aerial photographs might not be consistent with areas where destruction of fuels took place. The description of site activities on Page 2-1, paragraph 3 does not specifically discuss the use of fuels in destruction processes, the means, methods, and locations for fuel destruction, and the volume and types of fuels used/destroyed. Additional information would be helpful to evaluate the value of, and suitable locations for, petroleum analysis of environmental media.

**Navy Response:** No additional information is available regarding the means, methods and locations of fuels used in the destruction process. It is reasonable to assume that they were used as part of the OB activities, utilizing the pits made for that purpose, which is why soil sampling is proposed for the pits. Because SWMU 4 is not a UST site, the samples will be analyzed for VOCs and SVOCs to account for potential contamination by petroleum constituents. No VPH or EPH analysis will be conducted at SWMU 4.

4. Page 2-1, Section 2.1, Paragraph 3 -
- a. Clarify the location of the "open burn area."
  - b. Clarify if the open burn area is separate and distinct from where open detonation was conducted.

- c. Clarify if open burning was conducted in pits.

**Navy Response:**

- a. A sentence has been added to Section 2.1, Paragraph 3, after the last sentence which states: "Two OB/OD pits were identified as burn pits (pits 2 and 12). The pits identified as demo pits consisted of pits 1, 3 through 11, and 13. Three OB/OD pits were identified as "potential" (pits 14 through 16)." Figure 2-11 of the Work Plan identifies all the pit locations. For investigative purposes all 16 of the OB/OD pits will be treated as if Open Burn and/or Open detonation activities occurred there.
- b. Please refer to Page Specific Comment Response to 4a above.
- c. Please refer to Page Specific Comment Response to 4a above.
5. Page 2-1, Section 2.1, Paragraph 3 - Clarify whether the method described for OB/OD was used in the 1940s or if this is a description of more recent methods for OB/OD. Please provide a description of past methods for igniting or detonating munitions and explosives. This information is useful to verify the appropriateness of the list of chemicals of potential concern.

**Navy Response:** Section 2.1 paragraph 3 is a description of the common method for initiating a burn; however, prior to the common use of electrical initiating devices, non-electrical methods may have been used. Propellants contain a subset of chemicals which are included in the analyte lists being sampled for. Other igniting materials potentially used may have included petroleum products (e.g., diesel fuel) composed of VOCs and SVOCs.

The third paragraph in Section 2.1 has been revised to read; "The material to be burned was placed in the open burn area and a squib or other detonator was placed in the waste material. The open burn was then initiated from a safe distance using electrical detonation. Propellants contain explosive and non-explosive materials and other common igniting fluids, such as diesel fuel, which comprise volatile and semi-volatile organic compounds for which analysis will be performed."

6. Page 2-2, Section 2.2.2, Paragraph 1 -
- a. Provide preliminary geologic cross-sections based on the available data.
- b. Provide available information regarding the hydraulic gradient of site groundwater and hydraulic conductivity, if available.

**Navy Response:**

- a. Geologic cross-sections will be generated at the completion of the RI and included in the RI Report.
- b. There are no historical hydraulic conductivity data. Slug testing will be performed during the next RI field event at SWMU 4, and the data will be included in the full RI Report. Another subsection (4.3.3.1), entitled Hydraulic Conductivity Testing, has been added to the RI Work Plan that includes the following text: "In-situ hydraulic conductivity tests will be performed on eight monitoring wells areally distributed at SWMU 4 using the slug test method to obtain estimates of the aquifer hydraulic conductivity, groundwater flow velocity, and potential well yield at the site. Each test will involve installing a pressure transducer in the well connected to a data logger programmed to measure water level during the test. After the initial water level is measured, a 1-

inch-diameter by 5-ft-long PVC slug will be lowered into the well. The rise and decline of the water level in the well will be observed until the approximate original water level elevation is achieved. The slug will then be quickly removed from the well, causing the water to drop rapidly. The data logger will measure and record the recovery of the water level in the well until the water level has reached the approximate pre-test groundwater elevation. The data will be analyzed using the methods described by Bouwer and Rice (1976) to develop an estimate of the hydraulic conductivity of the aquifer and its variability across the site."

In addition, at least two rounds of water level measurements will be collected during the next RI field event (one at approximate high tide and one at approximate low tide) in order to calculate the hydraulic gradient, which will then be included in the RI Report.

7. Page 2-2, Section 2.2.2, Paragraph 2 -
- a. Clarify where the drainage feature noted in the paragraph discharges.
  - b. Remove the cross-hatching from Figure 2-1. Figure 2-1 is cited as being illustrative of topography and drainage at SMWU 4, but the cross-hatching obscures the details of topography and drainage.
  - c. Note the location of the cited drainage feature on Figure 2-1 or another appropriately scaled figure. The drainage feature cited in the paragraph is not noted on Figure 2-1; however, the scale of the figure may not be appropriate for this level of detail.

**Navy Response:**

- a. The ephemeral streams are shown on revised Figure 2-2 in Attachment C. Section 2.2.2, Paragraph 2, fourth sentence has been edited to read: "However, during storm events, a portion of the local runoff is toward the drainage feature adjacent to the OB/OD pits at SWMU 4 that discharges to the Caribbean Sea along the beach shoreline. An additional ephemeral stream is located in the northern portion of the site which runs from the southeast to the northwest and discharges to the Laguna Boca Quebrada.
  - b. The cross-hatching has been removed from Figure 2-1. The revised figure is included as Attachment C.
  - c. The location of the ephemeral streams have been added to Figure 2-1. This revised figure is located in Attachment C.
8. Page 2-2, Section 2.3.1, Paragraph 1 - Include a figure showing the areas where the ecological survey was performed. Clarify in this section whether the habitat is suitable for threatened or endangered species found in this region.

**Navy Response:**

Figure 2-3 (Attachment C) illustrates the SWMU 4 and control areas surveyed by Geo-Marine in 2000. Reference to this figure has been added to the end of the first sentence of Section 2.3.1.

Section 2.3.1 (page 2-2) has been updated to include a tabulation of federally-listed species. The first paragraph of this section has been replaced with the following:

"An ecological survey was conducted at SWMU 4 to describe the site flora and fauna (Geo-Marine, 2000). Figure 2-3 identifies the areas surveyed (both site and control).

Table 2-1A provides the federally listed species occurring or potentially occurring at former NASD Vieques. Biologists walked transects through the site and identified any federally protected species seen and noted the presence or absence of preferred habitat for these species. Survey results indicated that no endangered or threatened species were observed at this site and, as discussed below, no preferred habitat of any of these species is present at SWMU 4.

*Cobana negra* (*Stahlia monosperma*), the only federally listed threatened tree known to occur on former NASD Vieques, has been found between the boundary of black mangrove (*Avicennia germinans*) communities, salt flats and the upland communities at former NASD Vieques. This species is also known to occur in coastal forests of southeastern Puerto Rico. The preferred habitat for *Cobana negra* is not present at this site. *Chamaecrista glandulosa* var. *mirabilis*, a federally listed endangered tree, occurs in open areas with fine, white, highly permeable, and strongly acid sands, a habitat type which does not occur at the site. Some 10 to 12 individuals of *Calyptrotrichia thomasi* (federally listed endangered tree) are known to occur within the subtropical moist forest life zone on Monte Pirata, where the elevation is 300 meters. This subtropical moist forest life zone on Monte Pirata is not located at SWMU 4. *Goetzea elegans*, another federally listed endangered tree, has a very narrow ecological niche, and is restricted to ravines and ledges in semi-evergreen seasonal forests on limestone, of which only ravine habitats occur at this site. *Eugenia woodburyana* (federally listed endangered tree) is found in deciduous and semi-evergreen seasonal forests of the subtropical dry forest life zone. Though SWMU 4 occurs within the subtropical dry forest life zone, this species was not observed during the ecological survey.

Federally threatened and endangered sea turtles such as the green (*Chelonia mydas*), hawksbill (*Eretmochelys imbricata*), leatherback (*Dermochelys coriacea*), and loggerhead (*Caretta caretta*) sea turtles, and endangered marine mammals such as the West Indian manatee (*Trichechus manatus*), sperm whale (*Physeter macrocephalus*), fin whale (*Balaenoptera physalus*), and humpback whale (*Megaptera novaeangliae*) would not occur at this site because they require marine habitats.

Federally endangered marine birds such as the brown pelican (*Pelecanus occidentalis occidentalis*) and the roseate tern (*Sterna dougalli dougalli*) would not likely occur at this terrestrial site, but could occur in the nearby lagoons and coastal marine waters of the Caribbean Sea. During the ecological surveys, brown pelicans were observed flying over the adjacent marine habitat, but not at SWMU 4."

TABLE 2-1A  
 Federally Listed Species Occurring or Potentially Occurring at Former NASD Vieques

Scientific Name (Common Name)	Federal Status
<b>Plants</b>	
<i>Chamaecrista glandulosa</i> var. <i>mirabilis</i> (Herb)	Endangered
<i>Calyptanthus thomasi</i> (Tree)	Endangered
<i>Stahlia monosperma</i> (Cobana negra)	Threatened
<i>Goetzea elegans</i> (Beautiful Goetzea)	Endangered
<i>Eugenia woodburyana</i> (Evergreen tree)	Endangered
<b>Corals</b>	
<i>Acropora palmata</i>	Threatened
<i>Acropora cervicornis</i>	Threatened
<b>Reptiles and Amphibians</b>	
<i>Chelonia mydas</i> (Green sea turtle)	Threatened
<i>Dermochelys coriacea</i> (Leatherback sea turtle)	Endangered
<i>Eretmochelys imbricata</i> (Hawksbill sea turtle)	Endangered
<i>Caretta caretta</i> (Loggerhead sea turtle)	Threatened
<b>Birds</b>	
<i>Pelecanus occidentalis occidentalis</i> (Brown pelican)	Endangered
<i>Sterna dougalli dougalli</i> (Roseate tern)	Threatened
<b>Mammals</b>	
<i>Physeter macrocephalus</i> (Sperm whale)	Endangered
<i>Balaenoptera physalus</i> (Fin whale)	Endangered
<i>Megaptera novaeangliae</i> (Humpback whale)	Endangered
<i>Trichechus manatus</i> (West Indian manatee)	Endangered

9. Page 2-2, Section 2.3.1, Paragraph 3 - The last sentence states: "No evidence existed that the historical activities at this SWMU had an impact on wildlife or its habitat." Please provide a brief discussion of the investigation that demonstrated that no impacts occurred due to historical OB/OD. It seems likely that the opening burning or detonation of explosives had an impact on wildlife and habitat at the time OB/OD occurred.

**Navy Response:** This conclusion was extracted directly from the ecological survey report. The last sentence of this paragraph has been replaced with the following text:

**"The ecological survey (Geo-Marine, 2000) concluded that there was no existing evidence that the historical activities at SWMU 4 have had an impact on wildlife or their habitat. This conclusion was based upon the lack of observable impacts to vegetation (i.e., no plant stress based upon a comparison to a control site) and wildlife (based upon the species observed relative to those expected based upon geographic area and habitat)."**

10. Page 2-2 to 2-3, Section 2.3.2 - Provide additional details on areas used for OB/OD. Information whether specific areas were typically used to burn or detonate or whether the

locations of OB/OD pits were changed periodically is useful in determining if proposed sample locations are located within potential source areas.

**Navy Response:**

The following text has been added to Section 2.3.2 following the second paragraph:

"The OB/OD pits identified on Figure 2-2 were identified from aerial photography. The OB/OD pits shown on Figure 2-8 were identified during the MEC remedial investigation and are based on the field findings and aerial photography. No other areas investigated had the characteristics of OB/OD pits. The suspected OB/OD pits at SWMU 4 are characterized on the landscape by varying sizes of surface depressions. The pits are at various locations near the access road and range from approximately 500 ft<sup>2</sup> to 1,000 ft<sup>2</sup> in size. The depressions are typically shallow with relatively short berms encompassing all or portions of the limits of the depressions. The surfaces of some of the OB/OD pits had metal debris of variable size visible. The two pits identified as burn pits (pits 2 and 12 on Figure 2-8) had metal retaining cages fabricated from railroad track, angle iron, and metal pallets. The pits identified as demo pits (pits 1, 3 through 11, and 13 on Figure 2-8) were characterized by open, rounded, and bermed landscape depressions with MEC, munitions debris (MD), and non-MD present. The OB/OD pits identified as "potential" (pits 14 through 16 on Figure 2-8) had less prominent depressions and berms with fewer MEC, MD, and non-MD. Based on the historical aerial photos and field observations, it is evident that multiple locations were used for OB/OD operations."

11. Page 2-3, Section 2.3.4.1 - Provide the depth of the magnetic anomalies where soil samples were collected, as this information is useful for reviewing soil sample depths. Also, please indicate whether BIP was conducted at locations where soil samples were collected.

**Navy Response:** Section 2.3.4 Expanded PA/SI, the following paragraph has been added at the end of the Section. "The results of the geophysical survey found that the greatest density of magnetic anomalies were found in the vicinity of the OB/OD pits and decreased with distance away from them. There were 11,211 metallic anomalies identified during the geophysical survey, as shown in Figure 2-9. Of those 1,792 were MEC related. The percentage of metallic anomalies that were MEC was greater from 0-6 inches bgs than 7-12 inches bgs. Thirty three anomalies were investigated at depths greater than 12 inches bgs. Of those, 21 were non-ordnance related scrap (ORS), 10 were ORS, and there were two "no finds." No MEC items were found below a depth of 12 inches (CH2M HILL, March 2004 Draft MEC RI)."

Section 2.3.4.1 Soil Sampling Results, the following two paragraphs have been added at the beginning of the Section. "The PA/SI soil sampling points were chosen based on areas that were downslope of potential buried metal anomalies based on the magnetometer survey. The magnetic anomalies are too abundant and vary in depth, so and it is not possible to determine the depth of the anomalies near the soil sample locations.

Demilitarization under the MEC RI was accomplished primarily through consolidated demolition shots designed to render MEC/UXO items into ORS free of energetic material or explosive residue. A demolition pit 8' x 8' x 4' was constructed in Quadrant B-22 (see Figure 4-2 where soil sample location SS/SB-49 is located) to accommodate these operations. Twenty shots occurred over 5 days. No PA/SI soil samples were collected in quadrant B-22."

12. Page 2-3, Section 2.3.4.1, Paragraph 1 -

- a. Provide the rationale for the selection of the subsurface soil sample depths. The depth of sample collection should coincide with the highest contaminant concentrations based on field screening and observations.
- b. There is also a data gap for surface soil. Surface soil is characterized as 0 to 2 feet, yet no current data exists for soils from 6 inches to 2 feet below ground surface (bgs). The additional work planned for the site should include greater characterization of the surface soil interval.
- c. Clarify the depth to groundwater in the areas where borings were advanced and indicate how the depth to groundwater influenced sample collection depths.
- d. See prior comments about the potential data gap associated with the lack of petroleum carbon range data.

**Navy Response:**

- a. **The surface soil (0 - 6 inches) and the subsurface soil depth (4 - 6 ft) were the agreed upon sampling depth intervals in the Final PA/SI Work Plan. During the RI, the sampling depth will be consistent with the most recent subsurface soil sampling procedure agreed upon by the Technical Subcommittee (modified slightly to include a sample from the bottom of the pits, if distinguishable and if below 6 feet). The soil sampling procedure text in section 4.3.4 will be revised as follows, "At each location, a subsurface soil sample will be collected at a 2-ft interval within the 2 to 6 ft zone, based on where visual and/or PID screening suggests the presence of contamination. In the absence of visual or screening evidence of potential contamination, the subsurface soil sample will be collected from the 4 to 6-ft interval (or just above the water table or bedrock, if encountered before this depth). If the bottom of the pits are identified below 6 feet, an additional sample will be collected from the interval that coincides with the bottom of each pit. If bedrock is found deeper than 6 feet, and if soil contamination is suspected below 6 feet (and/or bottom of pits), based on visual and/or PID screening, an additional subsurface soil sample will be collected from the interval where the highest level of contamination is suspected. This information has been added after the fourth bullet in Section 4.3.4.**
- b. **The PA/SI surface soil samples were collected in accordance with the site-specific Work Plan (CH2M HILL, April 2000) which states that the surface soil samples will be collected from 0 - 6 inches. Since the Draft RI Work Plan was issued, the regulatory agencies for Vieques issued selection criteria guidance for surface soil samples specifically for Vieques. Based on the selection criteria, the majority of the SWMU 4 sampling area meets the selection criteria for collection of surface soil samples from 0 to 12 inches. That is, most of the area is not suitable for land crab habitat, and ecological receptors are potential receptors at the site. Further, no VOCs were detected in the surface or subsurface soil collected during the PA/SI. Therefore, the text of the Work Plan has been revised to identify a 0-to 12-inch depth for surface soil sample collection at locations away from the lagoon and ephemeral stream, and a 0-to-24-inch depth for surface soil sample collection at the locations immediately adjacent to the lagoon and within the ephemeral stream (if the stream is dry at the time of sampling).**
- c. **The depth to groundwater is not known at each boring location, and did not influence the sample depth collection because the subsurface soil samples were**

predetermined to be collected from the 4 – 6 ft depth interval (see Final PA/SI Work Plan). The borings conducted during the monitoring well installation have depths to groundwater between 7 and 28 ft, as stated in section 2.2.2. During the RI, subsurface soil sample collection will be conducted in accordance with the response to comment 12a above.

d. Please refer to response to Page Specific Comment 3.

13. Page 2-4, Paragraph 1 -

- a. Demonstrate how site conditions are consistent with the use of a PRG based on a DAF of 20.
- b. Clarify why the Navy divided the DAF PRGs by 10 for screening

**Navy Response:**

A site-specific SSL value will be calculated during the RI using the data collected during this sampling effort. However, following are specific responses to comments above.

- a. Data collected suggests that little site-related contamination is present and that leaching from site debris or soils is not occurring to a discernible degree, as the 16 subsurface soils and the groundwater samples collected from the existing 8 monitoring wells did not have munitions or metals reported in the scrap metal casing material (e.g., lead or zinc) related to site historical operations. Additional data proposed for collection in this work plan will also be evaluated to determine if current findings are consistent with past findings. Most of the burning activities occurred in the higher ground areas, where groundwater is approximately 28 feet deep. Some of the burning activities did occur in shallower aquifer areas nearer to the ephemeral stream located south of the pit area. None of the 8 wells contained site-related contaminants, indicating SSL values with a DAF=20 are adequately protective. The subsurface soil samples collected from the site in the 16 locations did not have any munitions related compounds or the metals from scrap metal debris above the leachability criteria. This may be due to absence of contamination, or to site-specific characteristics such as low solubility of the contaminants and/or soil characteristics.
- b. The DAF listed in Tables 2-1 and 2-2 and discussed in paragraph 1 is 1/10 of the SSL value at a DAF=20. These SSL values with a DAF=2 were inadvertently used in the draft work plan. It is worth noting that even at the DAF=2 based SSL value, no exceedences are noted in the Table 2 for the organic or inorganic chemicals expected from munitions related wastes. For the purpose of expediting this work plan, the same more conservative SSL values (i.e., DAF=2) will be retained. However, during the RI, site-specific SSLs will be calculated and used for screening against site data.

14. Page 2-4, Paragraph 5 -

- a. Clarify if the groundwater samples were collected consistent with Region II low stress (low flow) purging and sampling guidance.
- b. Provide the depth to groundwater in the areas sampled.

**Navy Response:**

- a. Groundwater samples were not collected consistent with Region II low stress (low flow) purging and sampling guidance. All the samples were collected using low flow rates which ranged from 227 ml/min to 3,409 ml/min, but did not meet the requirements specified in the Region II low stress (low flow) purging and sampling guidance. Existing wells (with the exception of MW04 that was destroyed by hurricane), as well as wells installed during the RI, will be sampled during the RI following the Region II low stress procedure, if possible.
- b. The following statement has been added to Section 2.3.4.2 Groundwater Sampling Results, Second paragraph: "Groundwater depths ranged from 7 to 28 ft bls in the SWMU 4 monitoring wells, but elevations varied by less than 1.5 feet."

15. Table 2-1 - Provide footnotes to this table explaining all PRG adjustments.

**Navy Response:** The footnote has been changed as follows in Table 2-1:  
"PRG - Preliminary Remediation Goal; the PRGs that are based on noncarcinogenic endpoints (as indicated by an "nc" on the PRG table) were divided by 10 to account for exposure to multiple non-carcinogenic constituents on the same target organ."

16. Table 2-1 - Please provide supporting documentation for the use of a dilution/attenuation factor (DAF) of 20, including calculations using site-specific hydraulic conductivity, hydraulic gradient, total organic carbon, etc. that show this value is protective for this site.

**Navy Response:** Data collected during the RI, and relevant historical data, will be used to determine the most appropriate DAF value to be used for site-specific leachability screening in the RI Report, and the justification will be included in the report. However, a more conservative SSL value based on a DAF of 2 was inadvertently used in the draft work plan, and it will be retained as a very conservative value in revised work plan to expedite the work plan review process. It should be noted that the screening using the DAF=2 conducted in the draft Work Plan did not identify contamination that is of leachability concern. Further, none of the wells contained contamination attributed to past OB/OD activities. The wells are located in the immediate vicinity of the pit areas, which are the primary sources of potential site contamination. Additional data collected as part of the RI will be used to calculate site-specific SSL values and verify previous findings of lack of leachability concerns at SWMU 4.

17. Table 2-2 - Provide footnotes to this table explaining all PRG adjustments

**Navy Response:** Please see response to comment 15.

18. Table 2-3 - Provide footnote to this table explaining PRG adjustment.

**Navy Response:** Please see response to comment 15.

19. Page 2-8, Paragraph 2 - See Comment to Page ES-III, Paragraphs 3 and 4 regarding the geophysical survey area.

**Navy Response:** Please refer to response to Page Specific Comment 2.

20. Page 2-8, Paragraph 5 - Clarify if the 1,792 MEC items includes both buried and un-buried items. Page 4-1, Paragraph 3 indicates that 1,300 buried MEC items were detected during the geophysical survey.

**Navy Response:**

Section 4, paragraph 3, first sentence has been revised to read:

"...the RI identified 1,792 buried MEC items and 123 surface MEC items at the site."

The 4<sup>th</sup> paragraph in Section 2.3.6 has been revised to read:

"One-hundred twenty-three surface MEC items were identified at SWMU 4 during the MEC remedial investigation. Of the 11,211 metallic anomalies removed from the

subsurface (below ground surface), a total of 1,792 (approximately 16 percent) were MEC items. Approximately 97 percent of the MEC items removed were 20mm projectiles or small arms items. One-thousand six-hundred eighty-one of the subsurface items were found from 0-6 inches below the ground surface and the remaining subsurface MEC were found from 7-12 inches below the ground surface. The types of MEC items removed are summarized in Table 2-4, and are illustrated on Figure 2-11."

21. Page 2-9, Table 2-4 - Provide the depths at which MEC items were found. Clarify what is meant by surface (i.e., clarify whether items were lying on the ground or below ground, and if below ground, how deep).

**Navy Response:** Please refer to the response to Page Specific Comment 20.

22. Figure 2-1 - Remove the cross-hatching from this figure. It obscures the topography and drainage in the area of interest.

**Navy Response:** Figure 2-1 has been edited as indicated and is included as Attachment C.

23. Figure 2-2 -
- a. It would seem that explanation is required to support using a 1967 aerial photograph to illustrate scars and stains observed in 1970.
  - b. Clarify if the arc illustrated on the figure is consistent with the "Area of Restricted Land use" illustrated on Figure 1-2. If so, then consider changing the label used to illustrate the arc on Figure 2-2 that says [sic] "3000' Ft. Arc Based on Radius from MW-01 in SWMU-04 Site"
  - c. Illustrate/label the drainage feature discussed on page 2-2, paragraph 2 (and elsewhere) in the text.
  - d. Label the SMWU boundary for clarity.
  - e. Clarify why samples were not collected in the trench identified on this figure. Also, clarify what the "SWMU 04" Feature Identifiers are referring to in the legend of the figure.

**Navy Response:**

- a. The 1967 aerial photo was used as a base map because of quality for representing the findings of analysis of various photos. A footnote has been added to Figure 2-2 that states: "1967 aerial photo is used as base map only."
- b. The arc on Figure 2-2 is consistent with the restricted land use boundary shown on Figure 1-2. The label has been changed on Figure 2-2 to read: "3000' Ft. Arc Based on Radius from MW-01 in SWMU-04 Site/Area of Restricted Land Use"
- c. Figure 2-2 has been edited to include the location of the ephemeral streams. See Attachment C.
- d. The SWMU 4 boundary is arbitrary at this stage. For the purposes of the RI, the SWMU area will be that defined by the extent of contamination found.

e. PA/SI soil sample locations were chosen based on magnetic anomalies identified at the site. No magnetic surveying was done in the trench; therefore no soil samples were collected there. Three soil borings will be collected in the location of this trench during this RI. The locations of these samples are shown in Figure 4-2 and 4-3 included in Attachment D. The "Feature Identifiers" are the designations given to the features identified during the aerial photograph analysis.

24. Page 2-3, Section 2.3.3 - According to EPA guidance (EPA, 1989), "...background samples are collected at or near the site in areas not influenced by site contamination, but in areas that do have the same basic characteristics as the medium of concern..." If the background comparison contemplated by the Navy for this site does not satisfy this and other applicable guidance, then additional background sampling may be required. Provide all documentation necessary to clearly demonstrate that this guidance is satisfied, or propose measures to ensure compliance with the guidance.

**Navy Response:** Section 2.3.3 refers to the background investigation that has already been conducted for west Vieques. The background soil data suggested that regardless of location and depth, background soil constituent concentrations are consistent across west Vieques.

Historical data indicate groundwater migration is northerly. In addition, the data from the eight wells surrounding the OB/OD pit area suggest the historical activities have had little to no effect on groundwater in the nearby groundwater. Although the two background wells proposed for the site are located more than 1,000 upgradient of the OB/OD pit area, they will be re-sited as far south as possible from the OB/OD pits, but within the same geologic setting. The actual locations will be identified upon field mobilization.

25. Figure 2-3 - Several of the previous sample locations (SB-12 to SB-16) are located in the vicinity of roadways away from OB/OD pits and where the MEC avoidance survey was conducted. Please clarify the rationale for selecting these sample locations.

**Navy Response:** The previous PA/SI sample locations (SB-12 to SB-16) were located near the roadways based on the results of the magnetometer survey. Proposed RI sampling locations are within the OB/OD pits.

26. Figures 2-3 and 2-4 -  
a. Add a legend notation indicating what the grid means.  
b. Label or indicate the drainage feature discussed on page 2-2, paragraph 3 (and elsewhere) in the text.

**Navy Response:**

a. Quadrants are used in MEC work to identify the area of work. Figures 2-6 through 2-14 and Figures 4-1 through 4-3 have been edited to include a note in the legend that states: "Quadrants are specified areas of 30 meters by 30 meters." Figures are included in Attachments C and D.

- b. The ephemeral streams shown on the NWI map have been labeled on Figures 2-1, 2-2, and 2-5 through 2-14 and Figures 4-1 through 4-3, 4-5, and 4-6. All figures are shown in Attachments C and D.

27. Figure 2-4 -

- a. Add a legend notation indicating that the dots represent anomalies from the geophysical survey.  
b. Add a legend notation indicating what the grid means.

**Navy Response:**

- a. The legend of Figure 2-7 has been edited to include a note stating: "Items listed below were found during the MEC avoidance geophysical survey conducted in April 2000." Refer to Attachment C.  
b. Please refer to the response to the Page Specific Comment 26a.

28. Figure 2-7 - Clarify the units of perchlorate. The legend notation for units says the following: "All concentrations are of total metals in µg/L unless noted otherwise." No notation is provided for the perchlorate concentration units.

**Navy Response:** The footnote of Figure 2-10 has been edited to read: "All metals shown are total metals unless stated otherwise. All concentrations shown are in µg/L." Please refer to Attachment C.

29. Figure 2-10 - Clarify what the numbers in red signify.

**Navy Response:** Figure 2-13 has been revised to make all numbers the same color; there is no need to differentiate these grids or values. Figure 2-13 is shown in Attachment C.

30. Page 3-1 to 3-2, Section 3.1 - Please list screening criteria in order of preference and separate the criteria into two sections based on protection of human health and ecological receptors. Please consult the following references prior to using values from Canada or the Netherlands: Jones, D.S. et al, 1997 and Suter, G.W. and Tsa C.L., 1996.

**Navy Response:** Please see the response to EPA Comment 23 for the screening criteria.

31. Page 3-1, Groundwater Bullets - Include MCLs as screening criteria to be consistent with the discussion of the identification of Contaminants of Potential Concern (COPCs) on page 5-2, Section 5.2.1.

**Navy Response:** MCLs will be added as screening criteria and are shown in the response to EPA Comment 23.

32. Page 3-1, Section 3.1, Soil Screening Criteria - Include EPA Eco-SSLs (EPA, 2003) in the list of screening criteria.

**Navy Response:** Please see the response to EPA Comment 23. The latest version of the EPA Eco-SSLs (2005) are included in the revised set of soil screening criteria that will be used in the ERA.

33. Page 3-1, Section 3.1, Migration to Groundwater - Provide supporting calculations for the use of a DAF of 20 for the Migration to Groundwater SSLs.

**Navy Response:** Please refer to response to comments 13 and 16 above. Though the intent was to use an SSL value based on a DAF=20, the draft work plan used DAF=2 based SSL values to screen the soil data for soil-to-groundwater leachability. During the RI, a site-specific DAF will be estimated using site hydrogeological parameters as input factors for the EPA guidance based SSL estimations.

34. Pages 3-2 and 3-3, Section 3.2 -

- a. Provide available analytical data that quantifies organic content of the soil (e.g., Total Organic Carbon [TOC]). This information will be useful in evaluating the fate and transport of contaminants (e.g., retardation, attenuation) at the site and the degree to which contaminants could leach to groundwater.
- b. Clarify if the locations of existing sampling were consistent with areas of known fuel destruction/use. Earlier descriptions of site activities noted the destruction of fuels at the site, yet no fuel constituents/residues were detected in the sampling. Fuel destruction may have been a minor component of activities conducted at the site. Alternatively, fuel destruction may have been conducted in areas different from the sample locations.
- c. Provide additional information concerning the depths of pits excavated at the site for material disposal/destruction and the typical depth to groundwater in these areas. This information may be helpful in targeting sampling depths and evaluating the proximity of contaminant release to groundwater.
- d. Provide information concerning the groundwater classification at this site, proximity to water supply wells and productive groundwater aquifers containing potable quality water, and potential for saltwater intrusion.
- e. Include a discussion of current and future land uses at the site and a description of the conceptual site model provided in Figure 3-2 clarifying the current understanding of the site and potential receptors.

**Navy Response:**

- a. TOC data were not collected during the PA/SI. TOC data will be collected during the RI as shown in the revised Tables in Attachment A. The TOC results will be used in the future dilution and attenuation factor estimations, and other chemical fate and transport behavior discussions.
- b. The previous soil sampling was done in the vicinity of the buried metal anomalies identified during the magnetometer survey. The areas where the destruction of fuels occurred was most likely in the OB/OD pits, which will be sampled during this RI as specified in the Work Plan, Section 4.3.4 Soil Sampling.

- c. The suspected OB/OD pits at SWMU 4 are characterized on the landscape by varying sizes of surface depressions. The depressions range from approximately 500 square feet to 1,000 square feet in size. OB/OD pits were generally shallow and circular in nature with depressions approximately 20 feet diameter, surrounded by 2 foot berms at ground surface (CH2M HILL, March 2004 Draft MEC RI). Soil borings and subsurface soil sample collection will be conducted in a manner consistent with that developed by the Technical Subcommittee (see response to comment 12a).

The groundwater at the site ranges from approximately 7 to 28 ft bls in the SWMU 4 monitoring wells which are located in the vicinity of the OB/OD pits.

- d. The following information has been added to Section 2.2.2 Site-Specific Geology and Hydrogeology "A search of historical records regarding Vieques groundwater resources (i.e. USGS, ATSDR, Navy) indicates there is no official use designation of the Resolucion Valley aquifer. Groundwater sampling results during the 2000 PA/SI at SWMU 4 identified salinity values of around 9.4 ppt and TDS values of approximately 8900 mg/L. Historical records do indicate that the Resolucion Valley aquifer has high TDS and salinity, is not currently being used as a potable water source (since 1978, potable water has been supplied via pipeline from the main island of Puerto Rico), and was not a primary source of potable water prior to installation of the pipeline (most of the potable water was supplied by Esperanza Valley aquifer). According to the USGS Open-File Report 95-368 entitled Water Wells on Isla de Vieques, Puerto Rico (1995), there are no water wells located within approximately 2 miles of the SWMU 4 site."
- e. The following three subsections have been added to Section 3.2 Conceptual Site Model:

"3.2.1 Current and Future Site Use

3.2.1.1 Surrounding Land Use

Western Vieques is bounded by water on three sides: Vieques Sound to the north, Vieques Passage to the west, and the Caribbean Sea to the south. The east land-based border is controlled by the Puerto Rico Department of Natural Resources, the Puerto Rico Port Authority, and private landowners. The Vieques Municipal Airport property lies adjacent to the northeast portion of the site where the abutting property provides the runway approach clear zone. South of the airport is undeveloped land managed by the Puerto Rico Department of Natural Resources. Further south lays the area known as the "South La Hueca" parcel, an area inhabited by individual landowners with private homes, small pastures, and farms.

3.2.1.2 Existing Site Land Use

Little activity has occurred within the property boundaries of the former NASD since land transfer proceedings in 2001. Access to the SWMU 4 area is currently restricted by fences due to the presence of MEC/UXO. Access roads are gated and locked with signage indicating the potential danger associated with the area. A chain link fence encompasses a large portion of the 400-acre

buffer zone, including the shoreline to the south of the site. Vehicle access to the SWMU 4 area is limited to the main access road, which is gated, that originates at the paved road leading to Mt. Pirata.

Since access has been restricted, the site has been managed as a wildlife refuge by the DOI's Fish and Wildlife Service (FWS), Caribbean Division. Although access is restricted, there is evidence of trespassing, primarily in the form of crabbing equipment. Trespassers have also been seen on site rustling wild horses.

Currently the site is inactive and is located within fenced area of the former NASD, thus has no human receptor exposures other than potential trespassers.

### 3.2.1.3 Anticipated Site Land Use

The FWS is in process of preparing a Comprehensive Conservation Plan/Environmental Impact Statement (CCP/EIS) for Vieques National Wildlife Refuge that will provide long term guidance for the management and public use of these lands. It is anticipated that future land use scenarios for western Vieques including the SWMU 4 area will be addressed in that document. A preliminary land use plan for the SWMU 4 has been developed by FWS that includes an observation tower(s) and associated trails for nature observation and other recreational activities, including usage of beaches along the southern boundaries of the site.

For conservative evaluation, the future land use is assumed to include exposure to human receptor groups such as maintenance workers, construction workers, industrial workers, recreational visitors, and residential receptors. The exposure routes are assumed to include site soil and groundwater exposures through incidental ingestion, dermal contact and inhalation. The ecological receptors are assumed to include plants and animals within the SWMU 4 area. Additionally, surface runoff to the ephemeral stream and the lagoon will be considered, as appropriate, in the human health and ecological risk assessments.

The potential migration pathways, exposure points, and potential receptors were considered during development of the sampling and analysis protocol for SWMU 4 included in this Work Plan. The proposed sampling and analysis protocol is presented in Section 4. The preliminary CSM will be revised upon collection of data during the RI and included in the RI Report."

The Conceptual Site Model is shown as Figure 3-1 and a description of the CSM is included in Section 3.2 Conceptual Site Model, which includes a current understanding of the site and potential receptors.

### 35. Figure 3-2 -

- a. Include the construction worker as a potential human receptor for surface soil. The construction worker is exposed to surface as well as subsurface soil for all exposure pathways except for root uptake since the construction worker does not spend all their time in an excavation. EPA 2001 describes the Construction Worker as a short-

term receptor who is exposed to soil contaminants during the workday for the duration of a single construction project (typically a year or less). The activities for this receptor typically involve substantial on-site exposures to surface and subsurface soils. The construction worker is expected to have a very high soil ingestion rate. EPA assumes the Construction Worker to be exposed to contaminants via the following direct and indirect pathways: incidental soil ingestion, dermal absorption, inhalation of volatiles outdoors, and inhalation of fugitive dust.

- b. Replace the “?s” with “X” and evaluate a future residential land use scenario.
- c. Include the residential receptor as a potential human receptor for subsurface soil. Future residents could become exposed to subsurface soils through a variety of mechanisms, including excavations for residential building foundations.
- d. Given the scope and duration of ordnance-related activity at this site, a threat to public safety will remain due to the potential presence of energized materials. Physical hazards are also likely to be present due to exposed metals (e.g., cuts, scrapes).
- e. Clarify why an adult would not be exposed to surface water/sediment at this site, while a resident child would be exposed to these environmental media.
- f. Clarify why contamination may only be present in subsurface soil as a result of leaching. The report documents that munitions were encountered in subsurface soil and therefore may be a source of subsurface contamination.
- g. Clarify why construction workers will not be exposed to groundwater, which is present at 7 feet bgs in some portions of this site.

**Navy Response:**

- a. **Figure 3-2 has been revised to include a construction worker exposure scenario for SWMU 4, consistent with other site RIs completed for the west Vieques (former NASD) sites. The exposure routes and exposure assumptions are consistent with the other completed risk assessments to date, and includes surface soil exposure for the construction worker. Revised Figure 3-2 is included as Attachment C.**
- b. **Figure 3-2 has been revised as requested (Attachment C.). The future residential land use scenario will be evaluated for conservatism.**
- c. **The residential scenario has been included, consistent with other risk assessments completed for the west Vieques, and includes the subsurface soil exposure route.**
- d. **Comment noted. MEC removal activities are ongoing to address the safety concerns.**
- e. **Exposure to surface water/sediment would take place in a recreational manner. Therefore, Figure 3-2 has been revised to show recreational adult, child, and youth receptors for surface water/sediment (Attachment C).**
- f. **As stated in the response to comment 11, no MEC items were found below a depth of 12 inches (CH2M HILL, March 2004 Draft MEC RI).**
- g. **Based on the wells installed during PA/SI at SWMU 4, the majority of the site groundwater is approximately 28 ft bls. Only the wells located close to the edge of the site indicated groundwater presence at shallower depth. Direct exposure to groundwater during excavation or construction activities will be identified as a potentially complete exposure pathway in this work plan. During the RI, this pathway will be re-evaluated to determine if it is a potentially complete pathway.**

36. Page 4-1, Section 4 - The site investigation should include data collection for hydraulic conductivity and grain size, which will contribute to the evaluation of the fate and transport of contamination at the site.

**Navy Response:** Grain size analysis will be performed and slug testing will be conducted during the RI to collect data for hydraulic conductivity and fate and transport analysis. Please refer to the Navy's response to comment 6b for additional information.

37. Page 4-1, Paragraph 3 - See comment regarding Page 2-8, Paragraph 5 for clarification if the 1,792 MEC items includes both buried and un-buried items. Page 4-1, Paragraph 3 indicates that 1,300 buried MEC items were detected during the geophysical survey.

**Navy Response:** See response to comment 20.

38. Page 4-4, Section 4.3.1.3 - Clarify that surface and subsurface soil sampling will be conducted in areas where BIP methods are used to eliminate munitions.

**Navy Response:** Based on the geophysical and MEC removal activities that were conducted as part of the PA/SI, it is unlikely that any BIPs will be required during the upcoming MEC removal activities. However, should BIPs be required, surface soil sampling will be done at representative BIP locations. In other words, based on the type of items included in the BIPs, a surface soil sample will be collected at sufficient locations to account for all munitions items included in BIPs. Surface soil samples will be sufficient because data collected to date show that no MEC items have been found below 12 inches. The following has been added at the end of Section 4.3.1.3: "Based on the geophysical and MEC removal activities that were conducted as part of the PA/SI, it is unlikely that any BIPs will be required during the aforementioned removal activities. However, if BIPs are required, additional soil sampling will be conducted, as described in Section 4.3.4."

The following has been added as another bullet item in Section 4.3.4: "If BIPs are required, a surface soil sample will be collected at a sufficient number of BIP locations to account for all munitions items included in the BIPs."

39. Page 4-5, First Bullet - Clarify the distance between the two monitoring wells discussed in the bullet and OB/OD Pits 14, 15, and 16.

**Navy Response:** The proposed monitoring wells (MW-13, MW-14, and MW-15), as shown on Figure 4-1 in Attachment D, have been relocated to be immediately adjacent to pits 14, 15, and 16.

40. Page 4-5, Second Bullet - Provide the basis for installing monitoring well NDW04MW15 200 feet from the area targeted for monitoring. A location closer to the source area may be warranted.

**Navy Response:** The monitoring well will be placed within or adjacent to the OB/OD Pit 14, depending upon rig accessibility. The new proposed location (approximate) is shown on Figure 4-1 in Attachment D.

41. Page 4-5, Third Bullet – According to EPA guidance (EPA, 1989), “...background samples are collected at or near the site in areas not influenced by site contamination, but in areas that do have the same basic characteristics as the medium of concern...” Provide documentation that the areas selected for groundwater background sampling satisfy this and other applicable guidance.

**Navy Response:** Please see the response to comment 24.

42. Pages 4-5 and 4-6, Section 4.3.3 –
- a. Add VPH and EPH analyses to the suite of analysis for this site due to the history of past disposal/destruction of fuels.
  - b. Clarify if low stress (low flow) sampling will be conducted consistent with Region II guidance (GW Sampling SOP Final, March 16, 1998). Provide details of procedures that will be followed and equipment used (e.g., bladder pumps, flow-through cell, etc.)
  - c. For consistency, the list of analyses discussed in the text should be the same as that presented in Table 4-2.

**Navy Response:**

- a. Please refer to the response to the Page Specific Comment 3.
  - b. Yes, low flow sampling will be conducted in accordance with the EPA's "Low-Flow" guidance, if possible (i.e., well capacity is sufficient to permit adherence to the guidance). The text in section 4.3.3, second paragraph, third sentence has been revised as follows: "Afterward, the wells will be purged and sampled in accordance with EPA's 'Low-Flow' guidance document, if possible. The Low-Flow guidance document is found in the Master Work Plan as a SOP (CH2M HILL, January 2001)."
  - c. The text of section 4.3.3 has been revised to state: "The nine newly installed monitoring wells and seven existing wells (MW-04 destroyed) will be sampled for VOCs, SVOCs, pesticides, PCBs, total and dissolved metals, and explosives (including perchlorate), IC anions, and alkalinity,"
43. Page 4-6, Table 4-2 –
- a. The laboratories must use the most current Contract Laboratory Program (CLP) Statements of Work (SOWs) for semivolatile organic compounds (SVOCs), pesticides/polychlorinated biphenyls (PCBs), and metals as is being done for the volatile organic compound (VOC) method. Therefore, OLC02.1 must be changed to OLC03.2 for SVOCs and pesticides/PCBs and ILM04.0 must be changed to ILM05.3 for metals. It should be noted that the SVOC list in OLC03.2 contains additional compounds in comparison to OLC02.1.
  - b. It is unclear why the ion chromatograph anions and alkalinity analyses are proposed for groundwater. These are being used for surface water samples to determine

hardness to support ecological screening. The Conceptual Site Model presented in Figure 3-2 does not indicate ecological exposures associated with groundwater.

**Navy Response:**

- a. The laboratory contractor will be instructed to use the most recent CLP methods for the individual analytical fractions. SVOC, VOC, Pesticides/PCBs will use SOM01.1. The metals will use method ILM05.3. Revised Table 4-2 is included in Attachment A.
  - b. The anion and alkalinity analyses proposed for groundwater and surface water are being incorporated to supply data to assist with the SSL criteria determination for the site (Tables 4-2 and 4-4, respectively). Hardness has been added to the surface water analyte list, but will only be analyzed if the sampled surface water is freshwater (salinity less than one part per thousand) based upon field measurements of salinity when the surface water samples are collected. Revised Tables are included in Attachment A.
44. Page 4-6, Paragraph 1 - Clarify that temperature, pH, dissolved oxygen and conductivity readings will be collected using a sonde within a flow through cell.

**Navy Response:** The field parameters will be collected in accordance with the Master Work Plan SOPs. A sonde within a flow through cell is not listed in the SOPs as a required piece of equipment. However, normally a sonde within a flow through cell is used during the groundwater sampling events. Parameters to be collected during groundwater sampling are listed in Section 4.3.3 Groundwater Sampling and Analysis, Page 4-6, first paragraph.

45. Page 4-6, Section 4.3.4, Paragraph 1 - Collect deeper surface soil samples in those areas where the expanded PA/SI samples indicated potential contamination at 0 to 6 inches, unless historical data indicates that contamination is restricted to the 0 to 6 inch bgs interval.

**Navy Response:** Please refer to response to Page Specific Comment 12b. The Navy does not intend to collect additional, deeper surface soil samples at the previous PA/SI surface soil sampling locations. The RI soil sampling locations address the possible source areas more appropriately because the locations were selected based on more comprehensive information than was available during the PA/SI.

46. Pages 4-6 and 4-7, Section 4.3.4 - Provide the rationale for the selection of the location of the samples to be collected at the northwest of the site. For example, it would be helpful to know if the samples will be collected in areas where signs of surface runoff are visible or if such features have been observed at the site.

**Navy Response:** The soil boring locations shown adjacent to the lagoon in Figure 4-2 are approximate. The actual locations will be based on field observations made upon mobilization. Further, if there are multiple obvious discharge locations from surface runoff observed by the field staff, additional samples will be collected during the field effort. The following has been added after the first sentence of the second bullet on page 4-7: "The locations of the borings are intended to coincide with locations where overland runoff from

the site likely enters the wetland area. Therefore, the exact locations and exact numbers of samples will be selected in the field. Field personnel will look for overland runoff features, such as ephemeral streams, small rivulets, topographically low and sloped areas, and deltas in the lagoon, to select the actual soil boring locations."

47. Section 4.3.4 - Clarify which figure shows the location of the soil boring to be completed in the drainage feature to the southwest of OB/OD Pit 12.

**Navy Response:** Figure 4-1 through 4-4, and 4-6 have been revised to add the sample IDs for the proposed sampling locations and are shown in Attachment D.

Three surface soil samples, SS-43 through SS-45, are proposed to be collected in the ephemeral stream adjacent to the OB/OD pits, and three surface soil samples, SS-50 through SS-53 are proposed in the northern-most ephemeral stream. If water is present at the time of collection, surface water samples will be collected and the soil samples will be collected from the top 6 inches of material and designated sediment samples. If the ephemeral stream is dry during collection, the samples will be collected from the top 24 inches of material and designated surface soil samples. The text of section 4.3.4, fourth bullet, has been revised as follows, "Three soil borings (SS-43 through 45) will be completed in the ephemeral stream to the south-southwest of OB/OD Pit #12, and four soil borings (SS-50 through 53) will be completed in the ephemeral stream to the north of the site to assess if there is contamination in the stream resulting from surface water runoff . The location of the soil borings are shown on Figures 4-2 and 4-3. The proposed locations on the figures are approximate and the actual placement of the sample locations (upstream for background, adjacent to runoff from site, and mouth of stream near outlet to the sea or lagoon) will be chosen based on field observations such as surface water runoff channels, depositional environments, and wetland vegetation. If the sample location is dry during collection, the depth of the surface soil sample will be 0 - 2 ft. If the sample location is wet during collection, the depth of the sediment sample will be 0 - 6 inches. The samples will be analyzed for the full TCL/TAL analyte list, explosives, and perchlorate."

48. Page 4-6, Section 4.3.4, 1<sup>st</sup> bullet - The text states that the full TCL/TAL analyte list will be performed for soil samples. However, Table 4-3 does not include cyanide which is part of this list. Clarification is needed whether cyanide analysis is needed in soil samples, or other matrices as well, for this investigation.

**Navy Response:** The full TCL/TAL metals list will include cyanide. The text and table in this section have been revised to reflect this.

49. Page 4-6, First Bullet -
- a. Collect additional soil from the 0.5 to 2 foot interval to fully characterize the surface soil interval.
  - b. Clarify if soil samples will be screened for the presence of VOCs using a jar headspace procedure.
  - c.

**Navy Response:**

- a. Since the Draft Work Plan was issued, the regulatory agencies for Vieques issued selection criteria guidance for surface soil samples specifically for Vieques. Based

on the selection criteria, the majority of the SWMU 4 sampling area meets the selection criteria for collection of surface soil samples from 0 to 12 inches. That is, most of the area is not suitable for land crab habitat, and ecological receptors are potential receptors at the site. Further, no VOCs were detected in the surface or subsurface soil collected during the PA/SI. Therefore, the text of the Work Plan has been revised to identify a 0-to-12-inch depth for surface soil sample collection at locations away from the lagoon and ephemeral stream, and a 0-to-24-inch depth for surface soil sample collection at the locations immediately adjacent to the lagoon and within the ephemeral stream (if the stream is dry at the time of sampling).

- b. The text of this section has been revised to reflect the most recent subsurface soil sampling procedure agreed upon by the Technical Subcommittee (modified slightly to include a sample from the bottom of the pits, if distinguishable and if below 6 feet). Another paragraph has been inserted after the four bullets in this section which describes the subsurface soil sampling procedures. The text has been revised as follows, "At each location, a subsurface soil sample will be collected at a 2-ft interval within the 2 to 6 ft zone, based on where visual and/or PID screening suggests the presence of contamination. In the absence of visual or screening evidence of potential contamination, the subsurface soil sample will be collected from the 4 to 6-ft interval (or just above the water table or bedrock, if encountered before this depth). If the bottom of the pits are identified below 6 feet, an additional sample will be collected from the interval that coincides with the bottom of each pit. If bedrock is found deeper than 6 feet, and if soil contamination is suspected below 6 feet (and/or bottom of pits), based on visual and/or PID screening, an additional subsurface soil sample will be collected from the interval where the highest level of contamination is suspected. The PID readings will be taken directly from the split spoons or direct-push liners upon opening them"

50. Page 4-7, First Bullet -

- a. Provide the rationale for sampling subsurface soil at the 4 to 6 foot depth interval. According to the Conceptual Site Model (Section 3.2), groundwater occurs at depths ranging from 7 to 28 feet bgs. Subsurface soil samples may need to be collected from depths other than 4 to 6 feet bgs (i.e., the capillary fringe, highest field screening measurement, visual staining, etc.).
- b. Clarify if a field screening procedure will be used to select samples with observable contamination. Select samples would then be submitted for laboratory analysis.
- c. Add VPH/EPH analyses due to the history of past disposal/destruction of fuels.

Navy Response:

- a. Please refer to the response to Page Specific Comment 49b.
- b. Please refer to the response to Page Specific Comment 49b.
- c. Please refer to the response to Page Specific Comment 3. Because TPH is a composite of various hydrocarbons and there is no EPA-promulgated risk-based screening criteria for TPH, environmental media samples will be analyzed for petroleum-related constituents (e.g., VOCs, PAHs) for which risk-based screening

criteria are available and for which quantitative risk assessments can be performed, rather than analyzed for TPH.

51. Page 4-7, Third Bullet -

- a. Clarify why only one sample will be collected from the drainage feature.
- b. Describe the rationale/procedure for selecting the sample location in the drainage feature.
- c. Identify from what depth the drainage feature soil sample will be collected.

**Navy Response:**

- a. Please refer to the response to the Page Specific Comment 47.
- b. Please refer to the response to the Page Specific Comments 46 and 47.
- c. Please refer to the response to the Page Specific Comment 47.

52. Page 4-7, Table 4-3 -

- a. As previously discussed, add VPH/EPH analyses due to the history of past disposal/destruction of fuels.
- b. Include analysis of TOC. This information will be useful in evaluating the fate and transport of contaminants (e.g., retardation, attenuation) at the site and the degree to which contaminants could leach to groundwater.
- c. Distinguish the number of surface soil samples and subsurface soil samples separately.
- d. Include pH and total organic carbon content (by Lloyd Kahn method) for surface and subsurface soil samples.

**Navy Response:**

- a. Please refer to the response to Page Specific Comments 3 and 50c.
- b. TOC has been added to the list of analyses for soil samples. Revised Table 4-3 is shown in Attachment A.
- c. Table 4-3 has been edited to include separate columns for surface soil and subsurface soil samples to be collected. Revised Table 4-3 is shown in Attachment A.
- d. pH and TOC have been added to the list of analyses for soil samples. Revised Table 4-3 is shown in Attachment A.

53. Page 4-7, Section 4.3.4, Table 4-3 - The laboratories must use the most current CLP SOWs for VOCs, SVOCs, pesticides/PCBs, and metals. Therefore, OLM04.2 must be changed to OLM04.3 for VOCs, SVOCs, and pesticides/PCBs and ILM04.0 must be changed to ILM05.3 for metals.

**Navy Response:** The laboratory contractor will be instructed to use the most recent CLP methods for the individual analytical fractions. SVOC, VOC, Pesticides/PCBs will use SOM01.1. The metals will use method ILM05.3. Revised Table 4-3 is shown in Attachment A.

54. Page 4-8, Section 4.3.5 - The rationale for each surface water sample location should be presented.

**Navy Response:** Regarding the lagoon samples, the lagoon has been labeled in Figure 4-3 as shown in Attachment D. The sample symbols designate them as surface water/sediment (see legend). Similar to the soil sample locations around the lagoon, the surface water/sediment sample locations shown in the lagoon are approximate. As stated in the response to comment 46, the soil sample number and locations adjacent to the lagoon will be selected in the field, based on visual observations of potential preferable runoff pathways. A similar logic will be used to select the surface water/sediment sampling locations in the lagoon. Preference will be given to where ephemeral streams, if identified, discharge to the lagoon. This rationale has been added to Section 4.3.5.

55. Page 4-8, Section 4.3.5, Paragraph 3 - According to EPA guidance (EPA, 1989), "...background samples are collected at or near the site in areas not influenced by site contamination, but in areas that do have the same basic characteristics as the medium of concern..." Provide supporting information that the areas selected for surface water background sampling satisfy this and other applicable guidance.

**Navy Response:** Laguna Arenas, where the surface water and sediment samples were collected that are proposed as background for the lagoon samples to be collected during the SWMU 4 RI, is the closest lagoon environment that is outside the potential influence of the historical OB/OD activities at the site.

56. Page 4-9, Table 4-4 - The laboratories must use the most current CLP SOWs for SVOCs and metals as is being done for the VOC and pesticide/PCB methods. In addition, the method currently cited for SVOCs is a low-medium concentration method. As is done for the other parameters, the low-level CLP SOW (OLC03.2) must be used and not OLM04.2. This method would also yield quantitation limits consistent with those cited in Appendix F for SVOCs.

**Navy Response:** The laboratory contractor will be instructed to use the most current promulgated low concentration CLP analytical methods as defined by USEPA for each matrix type. The analytical methods to be used for analysis of samples are outlined in the revised Table 4-4 in Attachment A.

57. Page 4-9, Section 4.3.6, Table 4-5 - The laboratories must use the most current CLP SOWs for VOCs, SVOCs, pesticides/PCBs, and metals. Therefore, OLM04.2 must be changed to OLM04.3 for VOCs, SVOCs, and pesticides/PCBs and ILM04.0 must be changed to ILM05.3 for metals.

**Navy Response:** The laboratory contractor will be instructed to use the most recent CLP methods for the individual analytical fractions. The method will be SOM01.1 for VOCs, SVOCs, and pesticides/PCBs analysis. CLP method ILM05.3 for metals analysis. Methods that will be used are outlined in the revised Table 4-5 in Attachment A.

58. Table 4-5 - Please include total organic carbon content for sediment samples, as this information may be needed to establish applicable ecological sediment screening criteria.

**Navy Response:** Table 4-5 has been edited to include Total Organic Carbon as a sampling parameter (Attachment A).

59. Tables 4-4 and 4-5 - Analyses for petroleum carbon ranges (e.g., VPH and EPH) should be included given the sites history of fuel destruction.

**Navy Response:** Please refer to the response to Page Specific Comments 3 and 50c.

60. Page 4-10, Section 4.5.1 - The text implies that laboratory method detection limits (MDLs) will be compared to the screening criteria. It should be noted that the quantitation limits should be compared to the screening criteria and not the MDLs. The MDL is a statistically derived number and is not an accurate measurement of the lowest concentration the laboratory can reliably detect.

**Navy Response:** The issues concerning accuracy and precision at the "MDL" level are understood. The "MDL" value demonstrates a minimum concentration of an analyte that can be identified, measured, and reported with 99% confidence that the analyte concentration is greater than zero but Type I and II errors will occur at this level of quantitation. The CLP analytical methods use a pre-determined CRDL but in addition the laboratory will derive an IDL that is based upon sample mass, dilution factors, and moisture content. Like the "MDL", the IDL has similar issues of Type I and II errors. The risk assessor will use one half the CRDL value in deriving the statistical calculations when the concentration of the target is non-detect while recognizing that the laboratory's IDL can be a lower value.

61. Figure 4-1 -
- a. Label the proposed well locations with the proposed well identifiers.
  - b. Clearly label/identify the drainage feature and mangrove swamp.

**Navy Response:**

- a. Please refer to response to EPA comment 35. The figure has been revised with well identifiers (Attachment D).
  - b. The ephemeral streams within SWMU 4 have been identified and the Laguna Boca Quebrada has been labeled on Figure 4-1 as shown in Attachment D.
62. Figure 4-2 - Clearly label/identify the drainage feature and mangrove swamp.

**Navy Response:** Figure 4-2 has been edited to include the ephemeral streams and Laguna Boca Quebrada. Figure shown in Attachment D.

63. Figure 4-2 - Clarify the relationship between the proposed soil sample locations and the ground scar identified in Figure 2-2 as PI-01. Also, aerial photograph (Figure 2-2) depicts a road extending due north from the center of SWMU 4. This road does not appear on the figures in this work plan. The Work Plan should discuss the history of this road and summarize activities that may have occurred on it. The Work Plan should also clarify whether this road provided access to OB/OD areas within SWMU-04. The Work Plan should clarify what activities have been conducted to investigate potential OB/OD along

this road. If no such activities have been conducted, the Work Plan should propose activities to investigate potential OB/OD.

**Navy Response:** Four surface soil and subsurface soil boring locations have been added to the RI Work Plan. The PI-01, PI-02, PI-03 and PI-04 sampling locations are shown in Figure 4-2 (Attachment D). Each SS/SB location will be collected in the approximate center of each ground scar/probable stain. To clarify the rationale, a fifth bullet has been added to text of section 4.3.4 which states, "Four soil borings will be completed in PI-01, PI-02, PI-03 and PI-04 to assess if there is contamination in these photo identified areas. Each SS/SB location will be collected in the approximate center of each ground scar/probable stain. The samples will be analyzed for the full TCL/TAL analyte list, explosives and perchlorate, and the other parameters listed in Table 4-3."

After reviewing the historical aerials, the road is present in the 1967 aerial but there is no indication of OB/OD activity along the roadside. The road does not appear on the 1999 aerial due to vegetation growth. Based on the geophysical investigation, there is no evidence of OB/OD activities along the roadside.

64. Figure 4-3 - Please clarify why sediment sampling is not proposed for the western shore area. Although the topographic figure is difficult to read, it appears that the topography slopes down toward the west. Sampling in this area would be useful for determining if surface runoff has occurred in areas of the beach unaffected by tidal action.

**Navy Response:** Surface water and sediment samples will be collected in the lagoon in accordance with the response to comment 54. Additionally, soil samples (or surface water and sediment samples) will be collected in the ephemeral streams located on the site in accordance with the response to comment 47. The topographic information identified from the topographic map and based on the site visit conducted by the Technical Subcommittee in May 2005 suggests surface runoff from the site flows primarily toward the ephemeral stream south of the pit area and toward the lagoon in the northwest (likely via the other significant ephemeral stream at the site). No sampling of the sea will be conducted during the RI, as discussed in response to EPA comment 8.

65. Page 5-1, Section 5.2, Paragraph 1 - Clarify how the RAGS Volume II, Environmental Evaluation Manual, will be used in the human health risk assessment (HHRA).

**Navy Response:** Section 5 has been deleted, as the recent update to the Master Quality Assurance Project Plan (not yet submitted for regulatory review) includes a detailed description of the risk assessment methodology and also lists the guidance documents used in the risk assessment. A draft human health risk assessment protocol section of the Master Quality Assurance Project Plan.

66. Page 5-2, Section 5.2, Paragraph 2 - Please note in the text that a preliminary conceptual site model has been developed for this site and is presented in Figure 3-2. Please revise this paragraph to discuss the preliminary CSM and the current understanding of the site.

**Navy Response:** Section 5 will be deleted from the document and the HHRA approach in the Master Quality Assurance Project Plan will be referenced in Section 3.1. Additional

information regarding the SWMU 4 land use has been added to Section 3; the response to the Page Specific Comment 34e describes this.

67. Page 5-2, Section 5.2.1, Paragraph 1 - The first sentence states that "Existing analytical data from SWMU 4 will be evaluated for a quantitative risk assessment..." Other sections of the report indicate that the data collected from the remedial investigation will be included in the risk assessment. Please clarify this here as well.

**Navy Response:** Section 5 will be deleted from the document and the HHRA approach in the Master Quality Assurance Project Plan will be referenced. All applicable site data (historical and newly gathered) will be utilized for a comprehensive understanding of nature and extent and potential risks.

68. Page 5-2, Section 5.2.2, Paragraph 1 - Please discuss available land use data and sampling data from the PA/SI in conjunction with the preliminary conceptual site model provided in Figure 3-2 in this section. Please identify data gaps that will be addressed in the RI. If additional land use data or information on receptors will be obtained during the RI, please discuss in this section.

**Navy Response:** The available land use information is included in the revised text for CSM in Section 3.0, as included in responses to comments 34e and 35 above. Section 5 will be deleted from the document and the HHRA approach in the Master Quality Assurance Project Plan will be referenced.

69. Page 5-3, Section 5.2.2, Paragraph 2 - Please clarify the third sentence of this paragraph.

**Navy Response:** Section 5 will be deleted from the document and the HHRA approach in the Master Quality Assurance Project Plan will be referenced.

70. Page 5-3, Section 5.2.2, Paragraph 3 - Please clarify whether the various recreational scenarios will be evaluated separately in the risk assessment or will be evaluated to develop exposure parameters for a general recreational exposure scenario.

**Navy Response:** Please refer to the response to Comment 35e. The more conservatively protective scenario of the two, a recreational visitor (versus a trespasser scenario) comprising adult, youth, and child receptors will be included in SWMU 4 risk assessment. The exposure factors used for intake estimations for the exposure scenarios will be evaluated consistent with other site risk assessments conducted for this portion of the island and described in the HHRA protocol. As noted above, Section 5 will be deleted from the document.

71. Page 5-3, Section 5.2.2, Paragraph 5 - Please clarify what is meant by "appropriate representative exposure pathways." Typically, complete exposure pathways are evaluated for each scenario in the risk assessment. Also, EPA RAGS Part D guidance requires that all exposure pathways considered but excluded from evaluation be identified and an explanation given as to why the pathway will not be evaluated in the risk assessment. Please ensure that the conceptual site model submitted in accordance with this EPA guidance includes this information.

**Navy Response:** The most conservative complete pathways for each potential scenario will be quantitatively evaluated, while the less conservative pathways will be evaluated qualitatively. For example, the most conservative of the recreational use scenarios (such as hunting or fishing) will be quantitatively evaluated and the less conservative recreational scenario (such as wildlife photographers) will be evaluated qualitatively. This approach is described in the HHRA protocol to be added to the Master Quality Assurance Project Plan. As noted above, Section 5 will be deleted from the document.

72. Page 5-3, Section 5.2.2, Paragraph 6 - Please provide a reference for the EPA guidance that will be used in developing values representing the 95% upper confidence limit of the mean for each contaminant.

**Navy Response:** The risk assessment procedures followed are detailed in the HHRA protocol added to the Master Quality Assurance Project Plan. The EPCs will be estimated using EPA's ProUCL tool referenced below. "EPA, 2004a. ProUCL, to calculate the exposure point concentration (EPC), ProUCL, Version 3.0. Prepared by Lockheed Martin Environmental Services). April 2004."

73. Page 5-3, Section 5.2.2, Paragraph 7 - PREQB does not support the evaluation of a 0.5-acre portion of the site for risk assessment purposes. PREQB requests that each area impacted by contamination is adequately defined and characterized and exposure point concentrations representing the 95% upper confidence limit of the mean or the maximum for each area impacted by contamination (whichever is lower) are used to evaluate exposure to each receptor. Please note that "relevant data" should only include that data for each area impacted by contamination.

**Navy Response:** The proposed approach for the EPC estimation is in accordance with EPA risk assessment guidance using ProUCL tool, as indicated above in response to comment 72. As noted above, Section 5 has been deleted from the Work Plan, as a more detailed HHRA approach section is included in the Master Quality Assurance Project Plan. Only relevant data, based on area of contamination, will be used for site EPC estimation. The area of contamination will determine the size of the site that is used in the EPC estimation.

74. Page 5-4, Section 5.2.2, Paragraph 3 - Please clarify why only soils within the uppermost 6 feet will be evaluated for direct exposure during excavation. Please define the depths associated with surface and subsurface soil.

**Navy Response:** Please see the responses to comments 12a and 12b for the surface soil and subsurface soil sampling depths. Subsurface soil to a maximum depth of 6 feet will be evaluated for direct exposure, which is consistent with EPA Region II policy, and consistent with other risk assessments conducted for Vieques. Soil deeper than 6 feet are unlikely to be encountered during construction activities.

75. Page 5-4, Section 5.2.2, Paragraph 4 - The initial understanding of the fate and transport of all contaminants identified based on previous investigations at this should be provided here. If the data from the PA/SI is insufficient to determine preliminary fate and

transport mechanisms and pathways for this site, please identify this data gap and discuss what data will be collected during the RI to address this data gap. This comment applies to Section 5.3.1.1 also. Please do not dismiss exposure pathways from quantitative consideration in the risk assessment until the RI data is collected and evaluated. For example, the inhalation of volatiles in ambient air volatilizing from soil exposure pathway should not be excluded from quantitative evaluation based solely on data collected during the PA/SI. The lack of volatiles in surface soil is based only on samples collected from 0 to 6 inches below ground surface (bgs). Deeper samples may indicate the presence of volatiles associated with historic releases or confirm the lack thereof. Please note that volatilization from soil occurs in subsurface as well as surface soil. Therefore, subsurface soil should be evaluated as a source for volatiles to ambient air for all receptors in accordance with EPA guidance (EPA, 1996 and 2001a).

**Navy Response:** The understanding of the fate and transport of constituents was used to develop the sampling rationale proposed for the RI, both in the draft RI Report and the revisions to be made based on the response to comments and additional evaluation of existing data. Response to a number of EPA and EQB comments detail this rationale. In addition, as noted in the response to comment 35, the CSM has been revised to include all reasonable exposure pathways and receptors. Further, data collected during the RI will be used to revise the CSM, as appropriate. Revised Figure 3-2 is included as Attachment C.

76. Page 5-4, Section 5.2.3 - Please update this section to reflect current EPA guidance on the hierarchy for toxicity values to be used for the human health risk assessment (EPA, 2003b).

**Navy Response:** Section 5 will be deleted from the document and the HHRA approach in the Master Quality Assurance Project Plan will be referenced. Current EPA guidance is included in the HHRA approach in Attachment I.

77. Page 5-5 to Page 5-6, Section 5.3.1.1 - A summary of previous habitat surveys or site walks for the purpose of evaluating habitat or wildlife should be provided here. Section 2.3.1 references a wildlife survey that was conducted at this site. Please use information from that survey to identify a preliminary list of species and habitats and data gaps for the ecological risk screening/assessment that should be addressed during the field investigation for the RI. EPA soil screening values for ecological receptors should be used for screening purposes prior to using EPA Region 4 guidance values. EQB requests the use of freshwater sediment screening criteria provided in MacDonald et al, 2000 as the tier 1 reference and Jones, D.S., et al, 1997 as a tier 2 reference.

**Navy Response:** To ensure consistent application of the risk assessment protocol across Vieques, Section 5 has been deleted from the document and the ERA approach in the Master Quality Assurance Project Plan (draft included as Attachment H) is referenced in Section 3.1.

The habitat and wildlife species survey data presented in Section 2.3.1 for the upland habitats is sufficient for evaluation in the RI. However, there is no site specific ecological survey information for the estuarine wetland located to the northwest of SWMU 4. Thus, an ecological survey will be conducted in this adjacent lagoon (Laguna Boca Quebrada), as well as the lagoon proposed for background sampling of surface water and sediment (Laguna

Arenas). Section 4 of the RI Work Plan has been updated with the following text which outlines the ecological survey techniques to be used to identify habitat types, associated plants and animals, and occurrence of threatened or endangered species.

### **“SWMU 4 Lagoon Ecological Survey**

An ecological survey is proposed for the lagoon habitats within the northwestern boundary of SWMU 4, which is located in the southwestern corner of Vieques. The limits of the SWMU 4 boundary incorporate the estuarine Laguna Boca Quebrada, which will be the subject study area. Laguna Arenas, an estuary located further to the north, will serve as the reference site. The purpose of the ecological survey is to provide a qualitative inventory of habitats, fish, benthos, and wildlife species, including protected species that may occur within these lagoons and mangrove fringe communities.

### **Vegetative Communities**

The initial task will be to map the vegetative communities of the lagoon habitats. Recent aerial photos in digital format will be used to map the vegetation communities within the vicinity of the lagoons. Upon completion of the aerial mapping, the communities will be ground-truthed to verify aerial signatures and community types. During this survey, a species list will be developed of the dominant vegetative species found within the mapped communities. The deliverable for this task will be a scaled map of the existing vegetation communities associated with Laguna Boca Quebrada and Laguna Arenas and adjacent habitat, as well as a species list of the dominant plant species present on both areas. This map will be used to direct the other surveys described below to target specific habitats. Vegetation data collected from Laguna Boca Quebrada will be qualitatively compared to the reference area, Laguna Arenas, to determine if there are any obvious differences.

### **Terrestrial Wildlife**

Qualitative bird surveys will be performed along wandering transects and fixed monitoring points at selected locations within the lagoon habitats. Transect and fixed point locations will be defined at the site, but will be located to allow a single observer the ability to view from varying vantage points all of the open water and shoreline habitats directly associated with the lagoons. Transect observations will be conducted for specified durations (e.g., 1 hour) in both the early morning and late evening periods when peak bird activity is expected. At the fixed monitoring points, observations will also be made for specified periods of time (e.g., 10 minutes). All avian species observed will be enumerated, along with descriptions of location observed, habitat type, and behavior. It is anticipated that these monitoring techniques will be conducted at least three times at each lagoon area during a 1-week period.

Other wildlife (i.e., mammals, reptiles, amphibians, land crabs) will also be surveyed to document wildlife use of the lagoon areas and adjacent habitats, including the mangrove fringe and transitional upland areas. These surveys will entail a qualitative description of the observed and expected wildlife species that may be encountered in the mapped habitats. These lagoons are expected to be very difficult to access due to dense vegetation in the surrounding habitats. Wandering transects will be used during visual surveys through the mangrove and adjacent habitats, including visual surveys from canoes, to identify expected wildlife species. Wildlife

signs such as scat, tracks, and burrows will be noted. Land crab colonies in the upland transitional areas will be identified if present.

Wildlife information collected from Laguna Boca Quebrada will be qualitatively compared to the reference area, Laguna Arenas, to determine if there are any obvious differences.

## **Fish and Invertebrates**

Fish will be captured to identify and characterize the fish community within the lagoons. Fish will be caught using a variety of techniques to determine which method produces the best catch. Shallow depths in the lagoons and soft substrates are expected to limit access to some extent. Hyper saline conditions often encountered in these lagoons are expected to limit diversity. Fish species caught will be identified and measured, and live released in the lagoon, if possible. Fish species not immediately identified will be kept and preserved on ice or isopropyl alcohol for later identification by local experts if needed. In order to maximize catch efficiency, fish will be caught using cast nets, seines, and gill nets of varying mesh size to target as many species as possible. Seines and gill nets will be used in locations where tidal flow is expected. Cast nets will be used in both shallow and deep areas of the lagoons.

Marine invertebrate organisms will be collected and identified to determine the general community composition within each of the lagoons. Benthic organisms will be surveyed using dip nets and visual inspection of the various potential habitat types, including soft mud sediments, hard structures such as limestone rock or outcrops, and mangrove roots. Organisms will be field identified and released live, however, some specimens may be retained (live or preserved) for more accurate identification in the laboratory.

Fish and invertebrate species information collected from Laguna Boca Quebrada will be qualitatively compared to the reference area, Laguna Arenas, to determine if there are any obvious differences.

## **Protected Species**

Protected species may be present within the habitats near the coastal lagoons. Of specific interest is the threatened plant species, *Cóbana negra* (*Stahlia monosperma*), which is often associated with coastal shrub habitats. Based on the mapped community results, specific habitats will be surveyed for the presence of endangered and threatened species that may occur within the lagoons and adjacent habitats. Wandering transects will be used during visual surveys through the mangrove and adjacent habitats, including visual surveys from canoes, to identify the presence of protected species. The locations of any protected species will be shown on aerial photo-based maps based on GPS coordinates and visual observation of sightings within the representative habitats."

**For screening values, please see the response to EPA Comment 23.**

78. Page 5-7 to Page 5-8, Section 5.3.3.1 - Ecotoxicity criteria represent acute exposure should be converted to LOAELs for comparison to NOAEL-based hazard quotients. Also, considering this site is in Region 2, please use guidance appropriate for this region.

**Navy Response: To ensure consistent application of the risk assessment protocol across Vieques, Section 5 has been deleted from the document and the ERA approach in the Master**

Quality Assurance Project Plan (draft included as Attachment F) is referenced in Section 3.1. All comparison criteria used in the ERA will be based upon chronic (not acute) exposures although both LOAEL- and NOAEL-based chronic criteria will be considered. All applicable ERA guidance (see response to EPA Comment 23) will be considered during the conduct of the ERA.

79. Page 5-8, Section 5.3.4 - If this site requires a baseline ecological risk assessment, a supplement to this work plan should be submitted for agency review and approval that provides information on the proposed studies and approaches that will be used. The information provided in this section currently only provides a brief outline of steps involved in conducting a baseline ecological risk assessment.

**Navy Response:** To ensure consistent application of the risk assessment protocol across Vieques, Section 5 has been deleted from the document and the ERA approach in the Master Quality Project Plan (draft included as Attachment F) is referenced in Section 3.1. If the site proceeds beyond Step 3 of the ERA process, a Step 4 work plan will be prepared and submitted for regulatory review.

80. Page 5-9, Section 5.3.6 - Please include a statement that proposed field study work plans and sampling plans will be provided for agency review and approval prior to implementation.

**Navy Response:** To ensure consistent application of the risk assessment protocol across Vieques, Section 5 has been deleted from the document and the ERA approach in the Master Quality Project Plan (draft included as Attachment F) is referenced in Section 3.1. The following statement will be added to Section 1, paragraph 5 following the first sentence that begins "This Work Plan provides....":

"Any additional field study work plans and sampling plans (e.g., Step 4 ERA documents) that may be required based upon the results of this RI and the subsequent risk assessments will be provided for agency review and approval prior to implementation."

81. Page 5-9, Section 5.4 - The text should clarify the basis for selecting 10E-04 as the cancer risk level above which cleanup is required.

**Navy Response:** Section 5 will be deleted from the document and the HHRA approach in the Master Quality Assurance Project Plan will be referenced in Section 3.1. The comment is addressed as follows in the Master HHRA approach:  
"Generally, remedial actions are not warranted at sites with risks within 10<sup>-6</sup> to 10<sup>-4</sup> range, or HI less than 1.0 (EPA, April 1991)."

This statement is based on the following reference:  
EPA 1991. "Role of the Baseline Risk Assessment in Superfund Remedy Selection Decisions." Office of Solid Waste management and Emergency response, Washington D.C. OSWER DIRECTIVE 9355.0-30, April 22, 1991.

82. Page 5-9, Section 5.4.2 - The text should be revised to indicate that the development of RGOs will comply with Region 2 guidance.

**Navy Response:** If RGOs are necessary to be developed following the RI, they will be developed according to EPA Region 2 guidance. However, as noted above, Section 5 will be deleted.

83. Table 5-1 - Please note that limited information is available in the risk assessment work plan to allow a full review of the proposed exposure parameter values presented in Tables 5-1, 5-2 and 5-3. Additional comments and requested changes may be provided once the exposure scenarios are described.

**Navy Response:** The HHRA approach and exposure assumptions are included in detail in the Master Quality Assurance Project Plan, along with a more detailed description for receptor behavior that leads to the determination of exposure factor for use in intake estimations. The revised work plan will remove Section 5 and associated Table 5-1. Table 1 of the HHRA Approach section includes the exposure factors that have been in use for sites on west Vieques and will be applied to other future sites at Vieques, including SWMU 4. Also, an interim deliverable of the RAGS Part D Table 4s, 5s and 6s will be provided for review by the agencies for SWMU 4 as well as other sites. A consistent approach to the exposure factors us for the default exposure scenarios will be used.

- The ingestion rate for a utility worker should be 330 mg/day to be consistent with current EPA guidance (2001a). The ingestion rate for a maintenance worker (outside worker) should be 100 mg/day to be consistent with current EPA guidance (2001a).

**Navy Response:** This change is included in Table 1 of the HHRA Approach section in Master Quality Assurance Project Plan.

- The use of a faction ingested (FI) less than 1 for a maintenance worker or utility worker is not consistent with current EPA guidance. The daily ingestion rate considers ingestion from all sources and should be used without modification to represent the contact rate for these receptors.

**Navy Response:** An FI term may not be used for SWMU 4, as the site is large enough in areas to engage a worker for longer periods of time such as a typical work-day of 8 hr. Relevance of the FI term will be discussed during the interim review of the RAGS Part D exposure factors tables, as stated above.

- Based on the exposure factors presented, it appears that child and adult exposure will be combined to evaluate 30 years of exposure to a resident for carcinogens, but risks will be presented separately for a child and an adult for noncarcinogens. The use of age-adjusted exposure factors (not rates – please modify parameter names to age-adjusted inhalation and ingestion factors) is acceptable, but the risks associated with exposure to noncarcinogens should also be presented as a combined child/adult Hazard Index (HI). The exposure duration for an adult should be reduced to 24 years and the overall HI to a residential receptor representing 30 years of exposure should be presented for noncarcinogens. If the Navy wishes to evaluate a child receptor separately from an adult receptor, then this approach should be used for carcinogens as well as noncarcinogens, and an age-adjusted exposure factor would not be used

and the adult exposure duration for noncarcinogens would remain 30 years. This comment applies to Tables 5-2 and 5-3 also.

**Navy Response:** The risks and HI to residential receptors will be consistent with what has been implemented as part of the RI reports completed for other west Vieques sites. The interim review of the exposure factors, equations and toxicity criteria will be provided to EPA and EQB as part of the RAGS Part D table review. Additionally, as requested by PREQB, the risk and HI summary table will include a total risk and HI value for an adult and child combined.

- The PEF for a utility worker should be developed using current EPA guidance (EPA 2001a). Also, the default PEF assumes that the area impacted by contamination is 0.5 acres. Prior to using this value to evaluate the inhalation of particulates exposure pathway, please confirm that the size of the area impacted by contamination at the site is consistent with this default value. If not, a site-specific value should be calculated in accordance with the EPA guidance.

**Navy Response:** A site-specific PEF value for workers will be estimated for SMWU 4.

- Notes h through j indicate that the soil loading calculations used to calculate adherence factors are provided in Appendix G, which was not included in the hardcopy or electronic version of the work plan provided to PREQB. However, please use adherence factors from current EPA guidance (EPA, 2001b) unless additional supporting documentation is provided on the equations used, and which demonstrates the selection of a central tendency AF for a high-end activity or a high-end AF for a central tendency (i.e., typical) activity, as EPA describes in their guidance. Absent this site-specific information, please use the following recommended AFs provided in Section 3.2.2.3 of the EPA guidance: a commercial/industrial worker - 0.2; adult resident - 0.07; child resident - 0.20. Since the commercial/industrial worker uses the median AF for a utility worker, this value should be used for the utility worker as well.

**Navy Response:** Table 1 in the HHRA approach in the Master Quality Assurance Project Plan includes the exposure factors and the footnotes for the factors selected for dermal pathway. The AF values are also included in Table 1 of the HHRA protocol in the Master QAPP, and these are consistent with the risk assessments conducted for other sites within west Vieques.

- Please provide supporting documentation for the development of the site-specific skin surface area values. Please note that the moderate temperatures and climate should be considered in evaluating exposed skin surface area. It should be assumed that receptors wear shorts and shirts and, therefore, where the arms are exposed. Legs and arm surface areas should be used rather than lower legs and forearms. Also, calculations should include EPA's dermal guidance also provides recommended skin surface area values for a reasonable maximum exposure (RME) exposure scenario. Unless supporting documentation is provided justifying the use of the values proposed, please use the following EPA-recommended values: Adult Maintenance, Utility and Industrial Worker - 3,300 cm<sup>2</sup>; Residential Adult - 5,700 cm<sup>2</sup>; and Resident Child - 2,800 cm<sup>2</sup>. Note that for recreational receptors, it should be assumed that the receptors only wear shorts and no

shirt. Therefore, please develop site-specific values assuming exposure to face, hands, arms, legs and feet (residents only).

**Navy Response:** Table 1 in the HHRA approach in the Master Quality Assurance Project Plan includes the skin surface area (SA) estimates and the footnotes for the factors selected for the dermal pathway. These values are consistent with the risk assessments conducted for other sites within west Vieques and the same will be used for the SWMU 4 risk assessment for the applicable receptors. A set of preliminary list of exposure factors will be provided for agency review in RAGS Part D format and interim review and input will be incorporated in the draft RI report HHRA. Table 1 is shown in HHRA protocol in the Master QAPP.

- The exposure factors for a Recreational Adult should be presented in this table, since this exposure scenario is being evaluated for future land use.

**Navy Response:** The adult receptor will be included. Please refer to responses to comments 34 and 35.

- Please clarify why the table indicates that there is no exposure time for residential receptors, yet the not says that 4 hours is assumed for residential dermal contact.

**Navy Response:** As indicated above, the exposure factors table included in the Work Plan will be removed, and the exposure factors for SWMU 4 will be consistent with other assumptions used for other sites where risk assessments have been completed. Table 1 from the HHRA approach in the Master Quality Assurance Project Plan includes the exposure factors that have been in use at other sites where a risk assessment has been completed..

- It does not seem reasonable to combine 4 hours of exposure per day with only 50 days a year exposure for recreational receptors. Exposure to a monolayer of soil on the skin does not stop at the point a receptor is no longer on-site. Rather, exposure stops when the skin is washed. Therefore, to ensure that the exposure scenario represents a reasonable maximum exposure, please assume that the event duration is 8 hours for all receptors.

**Navy Response:** Exposure assumptions for recreational receptors will be consistent with assumptions used for other recreational scenarios completed for the RI sites, and as defined in the HHRA approach of the Master Quality Assurance Project Plan.

- The exposure frequency for a recreational youth) should be 50 days per year to be consistent with a recreational child.

**Navy Response:** As indicated in response to the comment above, exposure assumptions for recreational receptors will be consistent with assumptions used for other recreational scenarios completed for the RI sites.

- Please use current guidance in developing exposure parameter values. Note a indicates that a 1991 exposure factors reference is being used in developing values; however, the 1997 reference is listed in Section 5.2. This comment applies to Table 5-2 also.

**Navy Response:** Table 1 of the HHRA approach in the Master Quality Assurance Project Plan includes the exposure factors proposed for use in future RI reports. These proposed values are consistent with the values used in previous RI reports. As applicable, the latest available guidance will be used in identifying the exposure factors for various scenarios.

- Please correct the presentation of the equations in Notes o, p and q.

**Navy Response:** As noted above, Section 5 will be deleted. The exposure factors and the equations will be presented in Tables 4s for review by EPA and EQB, prior to using them in the risk assessment during SWMU 4 RI.

84. Table 5-2 - Please revise the incidental ingestion rate for a child recreational receptor to be consistent with EPA guidance (1989) for a swimming scenario (i.e., 50 ml/hour). Please revise the skin surface area values to take into account that clothing is not a barrier to water exposure. Therefore, for the recreational receptors, it should be assumed that the entire body is exposed to surface water unless site conditions preclude swimming. The skin surface area values for the remaining receptors should include the face, arms, hands, legs and feet (for residents).
- a. If a swimming scenario is appropriate, the event duration should be 4 hours for exposure to surface water to be consistent with EPA guidance (1989).
  - b. The exposure frequency for sediment and soil should be consistent with Table 5-1 (i.e., 50 days per year). Please clarify why the number of days a receptor would be on-site varies from 45 to 50 days for recreational receptors.
  - c. Please use adherence factors appropriate for each receptor and activity. A construction worker AF is not appropriate for a recreational user, especially a child, as shown in EPA's current guidance for evaluation dermal exposure (2001b). The AF for a child playing in wet soil is 3.327. Several higher values are also available for children playing in mud - 20.601 (geometric mean) and 230.663 (95<sup>th</sup> percentile). The use of 3.327 is appropriate as it represents the 95<sup>th</sup> percentile value for a central tendency activity. The same approach should be used for developing appropriate AFs for recreational users for wet soil/sediment, based on likely activities.

**Navy Response:** As noted above, Section 5, and Table 5-2, have been deleted from revised work plan. Please refer to Table 1 in the HHRA approach in the Master Quality Assurance Project Plan. Further, as previously indicated, an interim deliverable with exposure factors will be provided for review by EB and EPA, in accordance with RAGS Part D guidance, and agreed upon changes will be incorporated into draft HHRA as part of the RI report.

85. Table 5-3 - Please verify the units for the Exposure time provided in the table and in note e. The table states 0.007 hours/day, which translates to 0.4 minutes per day or 25 seconds. Note e indicates this value is in events/day. If the units are in events/day, then the units for the exposure frequency should be events/year.

**Navy Response:** As noted above, Section 5 and Table 5-3 have been deleted from the revised work plan. Please refer to Table 1 in the HHRA approach in the Master Quality Assurance Project Plan. Further, as previously indicated, an interim deliverable with exposure factors will be provided for review by EQB and EPA, in accordance with RAGS Part D guidance, and agreed upon changes will be incorporated into draft HHRA as part of the RI report.

86. Appendix A, Table 2 - Please use Residential PRGs to screen subsurface soil for the future residential exposure scenario. As shown in this table, the industrial screening criteria for noncarcinogenic compounds are generally over ten times higher than the residential screening criteria, especially for metals. The use of industrial PRGs results in screening individual noncarcinogenic compounds at a hazard quotient greater than 1 for soils greater than 2 feet below grade.

**Navy Response:** The approach proposed for subsurface soil risk evaluation is consistent with what was consistently implemented at other sites, which is in accordance with EPA Region II policy. In the past EPA Region 2 has indicated that their policy is to evaluate subsurface soils for industrial scenario, which would involve screening against industrial criteria and estimating risks to industrial and construction workers. This has been consistently applied to all the sites where a risk assessment has been completed to date.

87. Appendix F - The following issues were noted with the tables presented in Appendix F which compare laboratory reporting limits to screening criteria.
- a. MDLs were presented in this table in addition to the quantitation limits but cannot be used to compare to screening criteria, as discussed in comment #6 above.

**Navy Response:** Please see response to comment 60.

- b. Section 3.1 of the document states that Region IX Residential Soil PRGs will be used as screening criteria for soil samples in addition to Region IX Industrial Soil PRGs. However, Appendix F only presents the Industrial PRGs which are generally higher than the Residential PRGs. Therefore, it is unclear whether the laboratory reporting limits will be able to meet the Residential PRGs, when required. The table should be revised to present both sets of screening criteria.

**Navy Response:** The tables have been revised to include both residential and industrial PRG values.

- c. Section 3.3 of the document states that MCLs will be used as groundwater ARARs for the site. Section 3.1 states that the Region IX Tap Water PRGs will be used as screening criteria for groundwater. The table only summarized Region IX Tap Water PRGs for groundwater screening criteria. In general, this is acceptable since most Region IX PRGs are lower than MCLs. However, there are a few MCLs which are lower than the Region IX PRGs and should therefore be presented or one case where there is an MCL but no Region IX PRG and should therefore be presented. These are as follows: 1,1,1-trichloroethane, 1,1-dichloroethene, styrene, and beryllium (MCLs lower than Region IX PRGs) and total chromium (MCL exists but Region IX PRG does not exist).

**Navy Response:** Section 3.3 has been removed from the work plan, but both MCLs and PRGs will be used to screen groundwater data collected at SWMU 4.

- d. Screening criteria were not presented for groundwater for cis-1,2-dichloroethene, trans-1,2-dichloroethene, trichloroethene, and gamma-BHC although there are Region IX Tap Water PRGs and MCLs for these compounds.

**Navy Response:** If detected, these constituents will be screened against both PRGs and MCLs. The revised tables in the HHRA approach in the Master Quality Assurance Project Plan includes criteria for all the chemicals for which there is a PRG value in Region 9 Tables and/or an MCL.

- e. The parameter headers should list the low-level methods for (OLC03.2) for surface water and groundwater for VOCs and pesticides/PCBs.

**Navy Response:** Please see responses to comments 43 and 56.

- f. The surface water criteria listed on the table are from 2002. However, according to the website listed in Section 3.3 of the document for locating surface water ARARs, these were updated in 2003. The most recent screening criteria must be used.

**Navy Response:** The latest criteria available at the time the RI Report is prepared will be utilized for data evaluation.

- g. The screening criterion for 1,2-dibromoethane in groundwater must be changed to 0.000764 µg/L (not 0.00).

**Navy Response:** The latest criteria available at the time the RI Report is prepared will be utilized for data evaluation.

- h. The screening criterion for aldrin in groundwater must be changed to 0.004 µg/L (not 0.00).

**Navy Response:** The latest criteria available at the time the RI Report is prepared will be utilized for data evaluation.

- i. The screening criterion for dieldrin in groundwater must be changed to 0.0042 µg/L (not 0.00).

**Navy Response:** The latest criteria available at the time the RI Report is prepared will be utilized for data evaluation.

- j. It is unclear why the screening criterion for total PCBs in soil is different than the screening criterion for the individual PCB Aroclors in soil. According to the Region IX PRGs, these numbers should be equivalent.

**Navy Response:** The error has been corrected in the revised SWMU 4 work plan.

- k. The units for the metals quantitation limits in soil must be changed to mg/kg (not µg/kg).

**Navy Response:** The error has been corrected in the revised SWMU 4 work plan.

- i. It is unclear where the screening criterion for mercury in soils (0.00051 mg/kg) comes from. The Region IX Industrial PRG is 31 mg/kg and the Region IX Residential PRG is 2.3 mg/kg.

**Navy Response:** The table has been revised to include the latest criteria for mercury.

- m. Several of the metals quantitation limits could be lowered and subsequently able to achieve screening criteria if the ICP/MS option of the CLP SOW ILM05.3 was utilized. This should be considered in order to meet the stated screening criteria.

**Navy Response:** The laboratory contractor will use CLP SOW ILM05.3 as appropriate for the majority of the analytes in the metal fraction but will incorporate ICP/MS to meet the project remedial goal for thallium in a soil matrix and the MCL for water matrix.

- n. There are many screening criteria for each matrix which will not be met based on a review of Appendix F (quantitation limits versus the screening criteria). If this will adversely impact the risk assessment, this needs to be readdressed and use of other methods may be required to achieve the screening criteria for critical contaminants of concern. Other methods could include SW-846 methods modified to utilize selective ion monitoring for VOCs and SVOCs and lower concentration standards and reduced final extract volumes for pesticides and PCBs.

**Navy Response:** The contractor laboratory will be instructed to use approved methodologies such as CLP SOW SOM01.1 which incorporates techniques such as Selective Ion Monitoring (SIM) as well as other analytical procedures in an attempt to achieve the screening limits based upon the current laboratory state of the art technologies. A co-operative effort between the project team and contractor laboratory will be made to try and reach these specific levels of quantitation. Appendix F has been updated to include the compounds and reporting limits of the CLP SOW SOM01.1 and is shown in Attachment G.

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- EPA 1996. *Soil Screening Guidance: User's Guide*. US Environmental Protection Agency, Office of Solid Waste and Emergency Response. Washington, D.C. EPA/540/R-96/018. April.
- EPA 2001a. *Supplemental Guidance for Developing Soil Screening Levels for Superfund Sites*. Peer Review Draft. US Environmental Protection Agency, Office of Solid Waste and Emergency Response. Washington, D.C. OSWER 9355.4-24. March.
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- EPA 2002. *Handbook on the Management of Ordnance and Explosives at Closed, Transferring, and Transferred Ranges and Other Sites, Interim Final*. US Environmental Protection Agency. February.
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