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April 8, 2005

U.S. Environmental Protection Agency  
Region II  
290 Broadway – 22<sup>nd</sup> Floor  
New York, New York 10007-1866

Attn: Mr. Adolph Everett, P.E.  
Chief, RCRA Programs Branch

Re: Contract N62470-95-D-6007  
Navy CLEAN, District III  
Contract Task Orders (CTO) 0033, 0268, and 0271  
U.S. Naval Station Roosevelt Roads (NSRR), Puerto Rico  
RCRA/HSWA Permit No. PR2170027203  
Navy Responses to EPA Comments Dated January 7, 2005 on the  
Draft Final CMS Final Report for TWFF, dated November 8, 2004; Draft CMS Final Report for  
SWMUs 54 and 55, dated October 28, 2004; and the Draft Steps 3b and 4 of the Baseline ERA,  
SWMU 9 – Area B, dated December 1, 2004

Dear Mr. Everett:

Baker Environmental, Inc. (Baker), on behalf of the Navy, is providing you with one copy of the Navy responses to EPA Comments dated January 7, 2005. These comments were on the Draft Final CMS Final Report for TWFF, dated November 8, 2004; the Draft CMS Final Report for SWMUs 54 and 55, dated October 28, 2004; and the Draft Steps 3b and 4 of the Baseline ERA, SWMU 9 – Area B, dated December 1, 2004.

These responses reflect the changes generated through the preliminary Navy responses and corresponding preliminary EPA comments and the decisions made during the March 17, 2005 conference call between EPA, BAH, Navy and Baker discussing the comments and responses on the Draft Final CMS Final Report for the TWFF.

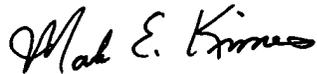
Upon EPA approval of the Navy response to EPA comments the Navy will modify the documents as outlined in the responses and submit Final documents for the sites covered in the EPA comments.

Mr. Adolph Everett, P.E.  
U.S. Environmental Protection Agency, Region II  
April 8, 2005  
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If you have questions regarding this submittal, please contact Mr. Kevin Cloe, P.E. at (757) 322-4736. Additional distribution has been made as indicated below.

Sincerely,

**BAKER ENVIRONMENTAL, INC.**



Mark E. Kimes, P.E.  
Activity Manager

MEK/lp  
Attachments

cc: Mr. Kevin R. Cloe, LANTDIV - Code EV23KC  
Ms. Lee Anne Rapp, LANTDIV – Code EV31LR (letter only)  
Ms. Madeline Rivera, NSRR  
Mr. Tim Gordon, US EPA Region II  
Ms. Kathy Rogovin, Booz Allen & Hamilton  
Mr. Carl Soderberg, US EPA Caribbean Office  
Mr. Carmelo Vazquez, PR EQB  
Mr. John Tomik, CH2M Hill Virginia Beach

**NAVY RESPONSES TO EPA COMMENTS DATED JANUARY 7, 2005 ON THE  
DRAFT FINAL CMS FINAL REPORT FOR TWFF (SWMU 7 & 8) DATED NOVEMBER 8, 2004;  
DRAFT CORRECTIVE MEASURES STUDY FINAL REPORT FOR SWMUs 54 AND 55 DATED  
OCTOBER 28, 2004; AND DRAFT STEPS 3b AND 4 OF THE BASELINE ECOLOGICAL RISK  
ASSESSMENT SWMU 9 DATED DECEMBER 1, 2004  
NAVAL ACTIVITY PUERTO RICO  
CEIBA, PUERTO RICO**

**EPA REGION II COMMENTS**

**Draft CMS Final Reports for Tow Way Fuel Farm (SWMUs 7 & 8) and SWMUs 54 & 55**

*Based on these reviews, EPA has determined that the Draft Final CMS reports for Tow Way Fuel Farm (SWMU 7 & 8) and SWMUs 54 & 55, as well as the final remedy proposals made in them, have significant outstanding issues that must be resolved before those CMS reports can be accepted and the proposed final remedy recommendations be considered sufficiently acceptable to proceed with public review and comment on them. EPA is concerned about certain unsupported assumptions, particularly with regard to the monitored natural attenuation (MNA) remedies proposed for the dissolved constituent plumes in the groundwater at both Tow Way Fuel Farm and SWMUs 54 and 55. Any MNA proposal must be consistent with EPA's 1999 Guidance (OSWER Directive 9200.4-17) on the usage of MNA at Superfund and RCRA sites. EPA has a number of other concerns, including:*

*a) incomplete analysis of the fate and transport of the dissolved contaminants in the groundwater, particularly at SWMU 55. EPA's concerns regarding fate and transport of the dissolved contaminants at SWMU 55 were previously discussed in our letters of February 24, 2004 and September 1, 2004 (regarding the Draft and Final TCE Plume Delineation and Source Investigation Reports), and also in the enclosed Technical Review;*

**Navy Response to EPA Comment a:**

While the Navy acknowledges that there is some uncertainty in the assumption that MNA is occurring at SWMU 55 in the area of the TCE plume, this assumption is certainly not unsupported. The presence of daughter compound cis-1,2 DCE at the site is proof positive that some degradation of TCE is occurring in the aquifer in its natural state. (See also response to BAH Specific Comment No. 4 to the EPA Comments dated February 24, 2004.) The Navy admits that the MNA alternative does need substantiation prior to implementation and is therefore, adding an MNA evaluation to the CMS alternatives. This evaluation will be performed prior to implementation of any alternative in which MNA is included. The MNA evaluation will address items in the OSWER Directive 9200.4-17 for the use of MNA at RCRA and Superfund Sites.

EPA's concerns for fate and transport of the TCE plume at SWMU 55 relate back to their concerns about adequate characterization of the TCE plume and its potential to reach the Ensenada Honda and the associated ecological concerns related to this potential. To alleviate these concerns, and to evaluate mass transport to the Ensenada Honda, a conservative value of mass flux of the dissolved TCE plume at SWMU 55 was estimated in response to BAH Specific Comment No. 4 for the SWMU 54/55 CMS (see below). It was shown that the screening level for surface water would not be exceeded at any point in the Ensenada Honda even if a complete pathway from the source area of the TCE plume to any location in the surface water were present. In addition, if the mass flux was kept constant as calculated, and there was no flushing of water in the Ensenada Honda with water from outside the Honda, and no degradation of TCE of any kind, the surface water screening value would not be exceeded until 118 years had gone by, and would take approximately 4,250 kg of TCE. (Calculations are provided below in response to BAH Specific Comment No. 4).

*b) the recommendation for continued usage and extensive expansion of the hydrocarbon recovery system at Tow Way Fuel Farm, utilizing only phased-separated hydrocarbon (PSH) "skimming". EPA recommends that consideration be given to implementing a recovery system involving not only "skimming", but also including some form of more aggressive multiphase recovery system, such as a dual-phase (PSH and water), i.e., a pumping well system, or even multiphase extraction (water, PSH, and vapor) system, i.e., vacuum enhanced recovery system. The usage of a dual phase or multiphase recovery system typically should significantly reduce the remedial time frame to achieve acceptable clean-up, by reducing the remaining PSH volume to a much greater extent and more rapidly than through the usage of an entirely passive recovery system, i.e., PSH "skimming". With "shimming" no hydraulic "draw-down" is created around individual recovery wells. Such "draw-down" enhances PSH movement towards the recovery well. The passive "skimming" system proposed in the CMS calls for 60 recovery wells. A dual-phase or multi phase system typically requires a much smaller number of wells due to each well having a much greater "zone of influence/capture". While EPA is aware of Navy concerns with the increased operation & maintenance (O & M) costs and NPDES or UIC permitting requirements for handling the volumes of groundwater recovered with a dual-phase or multi-phase recovery system, a shortened remediation time frame using a dual-phase or multi-phase recovery system could mitigate the costs associated with the O & M and permitting requirements, compared to an all "skimming" recovery system.*

**Navy Response to EPA Comment b:**

In order to demonstrate the effectiveness of the passive skimming system, the Navy proposes that the passive skimming alternative be fully implemented. Two years of data from a fully implemented passive skimming alternative will be collected and will be reported in an Engineering Evaluation Report (EER). The EER may also evaluate other technologies that may be more effective in the event that the passive skimming system is not removing the PSH in a timely manner.

*c) EPA also has concerns that the recommended remedy for the contaminated soils at Tow Way Fuel Farm involves only institutional controls/land use restrictions. The CMS indicates that because the Navy plans to keep the fuel lines at Tow Way Fuel Farm in place, and moth-ball them until the future use of the fuel systems is determined, excavation of contaminated soils is not practical. However, the presence of an inactive, moth-balled system, that the Navy has no plans to utilize, and over which the Navy intends to relinquish control, should not represent an impediment that precludes aggressive remediation of the contaminated soils to provide a permanent remedy. EPA's policy is for a preference for a permanent remedy rather than a remedy based entirely on imposition of land use restrictions. Therefore, EPA recommends that the CMS be revised to include some excavation of the contaminated soils at Tow Way Fuel Farm. Excavation could significantly reduce the duration of time over which land use controls might be required. This is particularly true with regard to arsenic contamination in the soils at Tow Way, as concentrations of this contaminant is not expected to degrade over time. Otherwise land-use controls might be required in perpetuity, unless the arsenic and other contaminant levels are reduced via excavation or some other remedial measure, to levels fully protective of human health.*

**Navy Response to EPA Comment c:**

The Navy will include surface soil (0 – 2 ft bgs) arsenic and PAH removal/disposal to the preferred option. The text will be revised to state that the arsenic and PAHs above the CAOs will be excavated. Additionally, the conceptual layouts within the CMS will be modified to reflect the approximate areas to be excavated. The volumes from these areas will be included were appropriately throughout the CMS.

*d) MNA is proposed as part of the recommended remedy for groundwater at both Tow Way Fuel Farm and SWMUs 54 and 55; yet the effectiveness of MNA at these sites in a reasonable timeframe has not yet been demonstrated, as required pursuant to EPA's 1999 Guidance (OSWER Directive 9200.4-17) on the usage*

*of MNA at Superfund and RCRA sites. The 1999 MNA Guidance indicates that "...MNA will be an appropriate remediation method only where .....it will be capable of achieving site-specific remediation objectives within a timeframe that is reasonable compared to other alternatives." The 1999 Guidance also requires that "...the effectiveness of MNA in both the near-term and long-term timeframes should be demonstrated to EPA..." In addition, other remedial measures (such as enhanced bioremediation at SWMU 54 and injection of sodium permanganate at SWMU 55) to supplement or enhance MNA are recommended to be pilot tested to evaluate their effectiveness. Therefore, both CMS Reports should be revised to clearly describe what actions will be taken if:*

*1) based on the first two years of future groundwater monitoring results MNA is found to not be sufficiently effective in a reasonable timeframe, and/or*

*2) the bench and/or pilot scale tests of other remedial measures to supplement or enhance MNA (such as enhanced bioremediation at SWMU 54 and injection of sodium permanganate at SWMU 55) demonstrate that those other measures will not likely be effective.*

**Navy Response to EPA Comment d:**

As stated in response to EPA Comment a, an MNA evaluation will be performed prior to implementation of this alternative or any alternative in which it is included. In addition, text will be added to the SWMU 54/55 CMS to indicate the response of the Navy to ineffective pilot tests. See also response to SWMU 54/55 BAH General Comment No. 4.

The CMS report for the TWFF will be amended to evaluate the effectiveness of MNA in the EER after the first two years of operation. The evaluation will include an update of the expected timeframe to achieve CAOs. Any potential pilot tests to evaluate enhancement of MNA will be described in the EER. Additionally, any polishing techniques such as CleanOx will also be evaluated in the EER to enhance cleanup times at this point.

*e) In addition, all the recommended remedies for both Tow Way Fuel Farm and SWMUs 54 and 55 involve some institutional controls. However, the proposals for institutional controls are not sufficiently detailed to allow EPA to fully evaluate the adequacy of such controls. Also, the draft CMS reports do not describe how the land use and groundwater usage restrictions will be maintained and monitored following sale or transfer of those portions of the property where these SWMUs are located.*

**Navy Response to EPA Comment e:**

The Navy and EPA are currently negotiating a RCRA 7003 Order on Consent that is expected to include, among other things, requirements that institutional and/or engineering controls be maintained for any SWMUs and AOCs at the NAPR facility where clean-up levels based on unrestricted (i.e., residential) land-usage are not achieved. The RCRA 7003 Order on Consent is also expected to include requirements addressing responsibility for maintaining such institutional and/or engineering controls for a SWMU or AOC in the event of the sale or transfer of that portion of the NAPR facility to an entity other than the U.S. Navy. The Navy has indicated to EPA that it expects any entity acquiring a portion of the NAPR facility where clean-up levels based on unrestricted (i.e., residential) land-usage have not been achieved, will be required to enter into an "enforceable agreement" (such as an Administrative Order) with EPA. If the acquired parcel is subject to institutional and/or engineering controls, it would be the Navy's expectation that continued maintenance of those institutional and/or engineering controls would

be required under any “enforceable agreement” (such as an Administrative Order) between the acquiring entity and EPA.

*The above and other concerns are discussed more fully in the enclosed two Technical Reviews.*

**Navy Response to EPA Comment:**

See the responses to the comments provided in the two Technical Reviews below.

**Draft Work Plan for steps 3b and 4 of BERA for SWMU 9 Area B (Tanks 214 -215)**

*As you know, as part of our review of the Draft Work Plan for steps 3b and 4 of the BERA, EPA and our contractor, Booz Allen Hamilton, have reviewed and commented on several preliminary versions of this proposal, which were revised and submitted on behalf of the Navy by Baker Environmental, via Email. EPA has determined that the Draft Work Plan for steps 3b and 4 of the BERA submitted on behalf of the Navy by Baker Environmental's letter of December 1,2004 is acceptable. However, prior to implementation of the work, EPA requests that the Navy submit, for EPA's concurrence, a table and/or map giving the exact number and/or locations where samples will be collected for the *Leptocheirus plumulosus* toxicity tests described in Section 6.3.1.2 of the December 1,2004 Work Plan for steps 3b and 4 of the BERA.*

**Navy Response to EPA Comment:**

The exact number of sediment samples submitted for *Leptocheirus plumulosus* toxicity testing, as well as sampling locations, will be dictated by analytical data for sediment samples collected in accordance with Section 6.3.1.1 of the Draft Step 3b/4 document. As such, the requested information cannot be provided at this time. However, following review of the preliminary data, the proposed number of sediment samples and proposed sample locations will be provided to the USEPA for review and comment prior to implementation of sediment sampling activities for *Leptocheirus plumulosus* toxicity testing.

**BOOZ ALLEN & HAMILTON INC.  
TECHNICAL REVIEW OF THE NOVEMBER 2004 CORRECTIVE MEASURES STUDY FINAL  
REPORT (CMS FINAL REPORT) AND NAVY RESPONSE TO EPA JANUARY 30, 2004,  
COMMENTS ON THE NOVEMBER 2003 DRAFT CMS FINAL REPORT AT THE TOW WAY FUEL  
FARM**

***I EPA GENERAL COMMENTS***

- 1. The response is acceptable.*
- 2. The response is acceptable based on information presented in Tables 3-1 through 3-3.*
- 3. The response is acceptable.*
- 4. The November 2004 Corrective Measures Study Final Report (CMS Final Report) now provides additional information on estimated time frames for alternative implementation and achievement of corrective action objectives (CAOs). However, the estimated time frames are unsupported and appear to represent very general "ballpark" numbers. For example, the estimated time frames for contaminant concentration reduction via monitored natural attenuation (MNA) are presented in*

*Appendix B as either 10 years (if other groundwater treatment methods are used along with MNA) or 20 years (without additional treatment). The duration of required MNA activity is dependent on the ability of each initial active treatment component to remove source materials and treat groundwater. Consequently, a qualitative discussion to support the estimated time frames should be provided. The CMS Final Report should be revised to more accurately predict and fully justify estimated time frames for achieving CAOs for each medium within each alternative. It should be noted that, although each alternative will be evaluated as a whole with regard to projected time required for cleanup, the estimates will need to be determined on a media-specific basis (e.g., soil, groundwater, and phase separated hydrocarbon [PSH]).*

*Finally, Naval Activity Puerto Rico (NAPR) should review the Technical Implementability sections throughout Section 2 to ensure that the description of each alternative includes the estimated time frame for cleanup of each impacted medium (soil, groundwater, and PSH). Where appropriate, the report should indicate that contamination is expected to remain in place indefinitely.*

#### **Navy Response to EPA General Comment 4:**

The estimated time frames discussed in the November 2004 Corrective Measures Study Final Report (CMS Final Report) are expressed as engineering estimates. This is due partly because of the varied data collected during two previous pumping tests (Hydraulic Characteristics Evaluation, TO #9 and Draft Pilot Test to Evaluate Enhancement or Product Recover Report TWFF SWMU 7/8). These tests were inconclusive in determining the effective radius of influence due to the heterogeneity of the subsurface. As a result, it was determined that an engineering estimate would be as valuable as using widely varying data from the previous pump tests. Based upon trend analysis from recent monthly PSH data collected at the TWFF, the PSH has noticeably been reduced with no active PSH collection system. See the TWFF Quarterly Progress Report No. 31 and the upcoming TWFF Quarterly Progress Report No. 32. The data from the TWFF Quarterly Progress Report No 32 is provided as an attachment to these responses. This data includes a table of wells with positive detections of product split into two main areas (Forrestal Road and the UGW25 area) and the remaining wells throughout the site. Also provided are graphs of the product thickness from the wells from these three areas. This should not be overshadowed by the desire to hydraulically collect PSH. The PSH has not showed any movement to a compliance point, in fact the PSH has done the opposite. The only known mechanism at work to reduce the PSH plume is MNA and monthly well bailing performed under the interim corrective measures.

A qualitative discussion will be added to each alternative time estimate. The discussion will include why engineering estimates are used. It will be noted that before startup of any active system, a pump test will be performed to determine well numbering and spacing.

A time estimate has been included in each alternative per media of concern. The time estimate is the Technical Implementability sections throughout Section 2 of the CMS Final Report.

In order to demonstrate the effectiveness of the passive skimming system, the Navy proposes that the passive skimming alternative be fully implemented. Two years of data from a fully implemented passive skimming alternative will be collected and will be reported in an EER. The EER may also evaluate other technologies that may be more effective in the event that the passive skimming system is not removing the PSH in a timely manner.

## ***II BAH GENERAL COMMENTS***

- 1. The response is acceptable.*

2. *The response is acceptable.*
3. *The response is acceptable.*
4. *The report should be expanded to include more specific cleanup time frame estimates and complete documentation on the basis for such estimates. Refer to the discussion on EPA General Comment 4 above for further detail.*

**Navy Response to BAH General Comment 4:**

See Navy Response to EPA General Comment 4 (with the addition of an EER).

5. *The response is acceptable.*
6. *The response is acceptable.*
7. *The response is not acceptable. In addition to referencing the response to Specific Comment No.4, which has been found to be inadequate, the response does not provide a convincing demonstration that alternative remedial options, such as two- and three-phase extraction, would not significantly increase the removal rates for PSH. The response cites an 8-month period in which a multiphase extraction system was operated but in which only 20 gallons of PSH were removed to refute the results of the earlier Terra Vac study. However, no further explanation or analysis of this poor performance was provided. A more complete analysis and comparison of the Terra Vac and subsequent tests should be provided to evaluate the potential efficacy of multiphase extraction technologies.*

**Navy Response to BAH General Comment 7:**

After two years of operation of the passive skimming system option, an EER will be developed to evaluate the effectiveness of passive skimming. Other technologies may also be evaluated in the EER should the passive skimming system prove ineffective at removing the PSH.

8. *The response is not acceptable. The response indicates that the Resource Conservation and Recovery Act (RCRA) Part B Appendix B does not require a discussion of the distribution of PSH and contaminated groundwater relative to the site hydrogeology and the impact of that site hydrogeology, including the variability in hydraulic characteristics of subsurface materials, on the performance of remedial technologies. However, Section IV, A, 1 of Appendix B of the RCRA Part B Permit requires that the performance based on effectiveness of each remedial alternative be evaluated. Appendix B (pg. B-5) specifically requires that, "any specific waste or site characteristics which could potentially impede effectiveness shall be considered." The response has also referred to the Corrective Measures Site Investigation Report for cross sections of the site that identify subsurface materials and PSH thickness. However, the Corrective Measures Site Investigation Report does not provide a cross section through the principal area of PSH remediation. The information and analysis requested in the original comment is still required to fully evaluate the technologies that are under consideration for remediation of PSH and contaminated groundwater.*

**Navy Response to BAH General Comment 8:**

A cross-section of wells within the largest PSH plume, near UGW-25, will be added to facilitate evaluation of PSH and contaminated groundwater. The cross-section will include UGW-25, MTMW-03, UGW-03, and RW-1.

An EER will be developed after operating the passive skimming system for two years. If the skimming system proves to be ineffective, then the EER may include an appropriate discussion on hydrogeology and hydraulic characteristics of the PSH-impacted area.

9. *The response is acceptable.*
10. *The response is partially acceptable. The response is correct in stating that process options were screened during the CMS Task 1 to eliminate those that do not achieve the corrective measure objective within a reasonable time. However, as indicated in Section III.C. of Appendix B of the RCRA Part B Permit (pg. B-3), the Task 1 screening "focuses on eliminating those technologies which have severe limitations for a given set of wastes and site-specific conditions." Thus, it is still necessary in subsequent CMS tasks to evaluate and clearly demonstrate the efficacy of a screened technology, particularly as it will be applied in each specific remedial alternative.*

*The CMS Final Report has provided greater detail and analysis of the PSH skimming technology as intended for use in the remedial alternatives under consideration. These details include the use of 60 skimming wells and an assumed radius of influence of 25 feet. However, no analysis has been presented to demonstrate that PSH skimming applied in this manner will meet the CAO of reducing PSH thickness to 0.01 feet throughout the entire area affected by PSH. It is important to note that analysis presented in the CMS Task I report appears to indicate that such a design may not meet the CAO in a reasonable time period.*

**Navy Response to BAH General Comment 10:**

Passive skimming, as represented by skimming manufacturers, has the capability to remove the product to a sheen (0.01 feet PSH). As described in the CMS Task I Report, PSH skimming alone may not meet the CAO. Case histories show that removal of the residual PSH is difficult, but can be achieved given enough time. The reduction of residual PSH to 0.01 feet generally requires other mechanisms at work to speed the reduction. These mechanisms can be physical, chemical, and/or biological. In order to achieve the 0.01 feet PSH with skimming, MNA is expected to assist in removing/reducing the residual PSH to 0.01 feet. The combination of these two process options will meet the CAO of 0.01 feet.

An EER will be developed after operating the passive skimming system for two years. If the skimming system proves to be ineffective, then the EER may include discussion of other mechanisms to remediate the PSH to the CAO of 0.01 feet.

***III BAH SPECIFIC COMMENTS***

1. *The response is acceptable.*
2. *The response is acceptable.*
3. *The response is acceptable.*

4. *The response is acceptable.*
5. *The response is acceptable.*
6. *The response is acceptable.*
7. *The response is not acceptable. The response indicates that while process options are interchangeable, this is best reserved for the recommended alternative where the removal, substitution, or addition of a process option is more apparent. The response indicates that the Navy can "add, remove, or substitute in any alternative and not change the outcome if groundwater is not being produced." While the meaning of this response is not entirely clear, it is taken to mean that only options that do not produce groundwater can be considered for substitution. However, there should be no inherent limitation on options that produce groundwater. If such an option should provide significant improvement in outcome, particularly in reducing the time frame for remediation, it should be considered. It is also noted that the CMS Final Report provided no analysis of potential substitutions of technology options when evaluating the remedial alternative and selecting a recommended alternative.*

**Navy Response to BAH Specific Comment 7:**

In order to demonstrate the effectiveness of the passive skimming system, the Navy proposes that the passive skimming alternative be fully implemented. Two years of data from a fully implemented passive skimming alternative will be collected and will be reported in an EER. The EER may also evaluate other technologies that may be more effective in the event that the passive skimming system is not removing the PSH in a timely manner.

8. *The response is acceptable. Although the response does not fully address the concerns expressed in the original comment, the revisions to the CMS plan provide adequate analysis of the options involving the withdrawal, treatment, and disposal of contaminated groundwater.*

**Navy Response to BAH Specific Comment 8:**

Comment noted.

9. *The response is acceptable.*
10. *The response is acceptable. Nevertheless, excavation of contaminated soil should be reconsidered once the future use of the fuel systems are determined. Excavation of contaminated soil would be preferable if it could significantly reduce the duration over which land use controls (LUCs) would be required, particularly if all of the arsenic contamination could be removed, as this contaminant is not expected to degrade over time.*

**Navy Response to BAH Specific Comment 10:**

As stated in Navy Response to BAH Specific Comment 7, the Navy will add the surface soil (0 – 2 ft bgs) arsenic and PAH removal/disposal to the alternative.

11. *The response is acceptable. The revised CMS provides sufficient additional details regarding the extraction of groundwater in Alternative 3 to allow evaluation of the alternative.*

**Navy Response to BAH Specific Comment 11:**

Comment noted.

12. *The response is acceptable.*
13. *The response is not acceptable. The response indicates that, "unless you are remediating the recovered groundwater to drinking water standards, hydraulic control must be established at all times." However, the CMS Final Report (pg. 2-15) states that the Puerto Rico Environmental Quality Board (PREQB) Underground Injection Control (VIC) Division would expect that any re-injected water meet drinking water standards at a minimum. Thus, re-injected water quality should not be a constraint to injecting downgradient of the extraction wells.*

**Navy Response to BAH Specific Comment 13:**

The reference to the PREQB UIC Division requirements (pg. 2-15) will be removed from the CMS Final Report. An EER will be developed after two years of operating the passive skimming system alternative and reinjection may be evaluated should passive skimming prove to be ineffective.

14. *The response is acceptable.*
15. *The response is acceptable.*
16. *The response is acceptable.*
17. *Refer to BAH Specific Comment 19.*

**Navy Response to BAH Specific Comment 17:**

See Navy Response to BAH Specific Comment 19.

18. *The response is acceptable. Please refer to BAH Specific Comment 10.*

**Navy Response to BAH Specific Comment 18:**

Comment noted.

19. *As correctly noted in the Navy response, the revised Draft CMS Final Report is based on the alternatives developed in the Task 1 CMS. As also noted in the Navy response, process components may be added, substituted, or eliminated if it will improve the alternative. Nevertheless, throughout the responses, NAPR appears reluctant to consider even evaluating potential modifications to the existing alternatives in an attempt to achieve Tow Way Fuel Farm (TWFF) cleanup more expediently and/or permanently. However, we believe that this is the most appropriate time for such an evaluation, using detailed information in the revised draft report on alternative and process component strengths, weaknesses, effectiveness, and costs. In response to the Navy's request for more specific direction on potential modifications, we provide the following recommendations.*  
  
*Although it is understood that certain treatment components may have beneficial impacts on several media, a preliminary evaluation of information presented on Tables 3-1 through 3-3 suggest that other component combinations may be appropriate. According to Table 3-1, the most*

*favorable soil treatment appears to be accomplished under Alternatives 5 (land farming and biodegradation) and 2 (bioventing). According to Table 3-2, the most favorable groundwater treatment options are included in Alternatives 1 (MNA), 4 (MNA and air sparging), and 5 (MNA and electrochemical geo-oxidation [ECGO]). According to Table 3-3, the most favorable PSH treatment would be accomplished under Alternatives 1 and 4 (skimming) and 5 (CleanOx biological treatment). However, as indicated in the previous comments, the relative effectiveness of PSH skimming and dual or other multiphase extraction technologies have not been adequately resolved. Additionally, as discussed in previous BAH Specific Comment 21, excavation and disposal of contaminated soil could be the preferable alternative. A moth balled system that the Navy no longer has a use for should not be seen as an impediment to excavation. Excavation is preferable if it could significantly reduce the institutional controls that would be required, and the aggressive remediation of soil could remove all arsenic contamination, which will otherwise remain in perpetuity. Neither Landfarming nor bioventing will be effective for remediation of arsenic in soil. Similarly, some form of multiphase extraction may be preferable to PSH skimming.*

*Revise the report to consider this and other possible combinations of media-specific components from the options outlined above. NAPR should compare the resultant combinations to Alternative 1, specifically indicating whether the modifications would serve to improve or enhance the overall remedy. A separate table similar to Table 3-1 is recommended for documenting strengths and weakness of the modified corrective measures alternatives. Such conclusions should also be fully justified and documented in the text.*

**Navy Response to BAH Specific Comment 19:**

The Navy will include surface soil (0 – 2 ft bgs) arsenic and PAH removal/disposal to the preferred option. Additionally, in order to demonstrate the effectiveness of the passive skimming system, the Navy proposes that the passive skimming alternative be fully implemented. Two years of data from a fully implemented passive skimming alternative will be collected and will be reported in an EER. The EER may also evaluate other technologies that may be more effective in the event that the passive skimming system is not removing the PSH in a timely manner.

20. *The response is acceptable.*

21. *The response is acceptable. Please refer to BAH Specific Comment 10.*

**Navy Response to BAH Specific Comment 21:**

Comment noted. See Navy Response to BAH Specific Comment 10.

22. *All paragraphs of this response are acceptable.*

23. *The response is acceptable.*

24. *The response is acceptable.*

25. *The response is not acceptable. The response indicates that a ranking of 3 was given to alternative 4 because air sparging would increase the hydraulic gradient immediately around the well and potentially push contamination away from the well. However, the mounding that occurs at the initiation of air sparging is only a temporary phenomenon that dissipates quickly. The movement*

*on groundwater resulting from this temporary mounding should have no long-term impact on the remedy.*

**Navy Response to BAH Specific Comment 25:**

The comparative ranking in question is associated with Environmental Benefits. Alternative 1 was re-evaluated and lowered in line with the other groundwater alternatives in the original response to comments. Alternative 1 was ranked 3 and Alternative 4 was given a 4. Even though the mounding is a “temporary phenomenon”, the mounding does occur and may initially push the dissolved contaminants away from the sparging well thus increasing possible environmental risks. Alternative 1 does not increase any environmental risks. The dissolved plume is very small and contained under the PSH plume at its greatest thickness. Each alternative (1 and 4) uses skimming to remove the PSH first. In Alternative 4 sparging would proceed after PSH removal. Therefore, it is likely that the dissolved plume would have reached CAO or below levels before sparging is undertaken given the presence of favorable MNA parameters.

26. *The response is acceptable.*

27. *Despite NAPR's conclusion that the permit requires only limited scheduling detail (to include design, construction, and operations task), we repeat our request for presentation of MNA details on Figure 3-1. The schedule should indicate when locations for the MNA monitoring well network will be determined ( design phase), when the five new wells will be installed ( construction phase), and when semiannual sampling will begin (operations phase). In addition, Figure 3-1 should be modified to include additional detail presented in the Navy response. The engineering evaluation to be conducted after five years of operation should be specifically included as a line item on the schedule, and a footnote should be added stating the purpose of this evaluation. To clarify that the schedule also accounts for implementation of LUCs, the last three sentences in the Navy response should be inserted as another footnote on the figure. Finally, the figure may no longer present realistic projections for start and finish dates, given the fact that the CMS Final Report is not yet approved. If necessary, the figure should be revised to include more probable start and finish dates based on the current status of this project.*

**Navy Response to BAH Specific Comment 27:**

A footnote to the schedule will be added to include the last four sentences of the original response. The dates will be removed and replaced with days so there is no confusion on a possible start date. The start date will be determined after the CMS Final Report is approved. Figure 3-1 will be modified to identify when MNA monitoring well network will be determined (design phase), when new wells will be installed (construction phase), and when sampling will begin (operations phase).

28. *In response to concerns regarding the actual cost of implementing LUCs at the TWFF, NAPR contends that their original estimate of \$5,000 should be more than sufficient. Furthermore, NAPR notes that engineering control costs will be negligible (because the fence is already in place) and that costs for periodic inspections have been included in the estimate. However, this response is inconsistent with the dollar values presented in the Appendix B order of magnitude cost estimates, which now show an estimated cost of \$20,000 for implementation and maintenance of institutional controls. Additional discussion should be provided to explain why the LUC costs increased fourfold (when the response indicated that no increases were necessary), and to list the specific line items comprising the current estimated dollar value. Finally, the report should be revised to explain why costs for LUC implementation are expected to be the same for each of the five possible alternatives when different LUC programs would be implemented under*

*the various scenarios, particularly in association with Alternative 3.*

**Navy Response to BAH Specific Comment 28:**

The original comments were not adjusted to reflect the actual costs annotated in Appendix B. The LUC costs are fixed administrative costs associated with implementation of the LUCs. The maintenance of the institutional controls (periodic review) is covered in the O&M costs for each alternative. The previous two sentences will be added to the cost estimates as a footnote.

29. *Refer to EPA General Comment 4 for additional recommendations with regard to estimated time frames for cleanup via MNA.*

**Navy Response to BAH Specific Comment 29:**

See Navy Response to EPA General Comment 4.

30. *The response is acceptable.*

31. *The response is acceptable.*

32. *Although operation and maintenance (O&M) labor hours have been reduced in some cases, this comment does not appear to have been consistently applied across all treatment components. For example, O&M labor hours for the extraction well process option still includes a total of 32 hours per week. This level of effort and that projected for several other process options still seem excessive. Additional information on how these estimates were derived, and details on what will be accomplished with these labor hours, would provide support for NAPR's current estimates. Revise the Appendix B cost estimates appropriately, adding footnotes to include the requested information where appropriate.*

**Navy Response to BAH Specific Comment 32:**

Labor hours may seem excessive at first glance, but past experience in Puerto Rico has proven these costs to be consistent and relevant to the activities to be performed under the O&M costs. Keep in mind that the labor hours are associated with 27 groundwater recovery wells and a complete treatment system which includes complicated components. Operation labor costs include pump adjustments, wellhead adjustments, reporting, product removal from holding tanks, treatment system checks, vacuum system checks, periodic discharge sampling, and conveyance piping checks. Maintenance labor costs include removing pumps periodically and removing any biofouling, removing conveyance piping clogs, periodic maintenance on compressor, periodic maintenance on product tanks, periodic maintenance on treatment system, and periodic maintenance on vacuum system. The last two sentences will be added as a footnote.

33. *The response with regard to cost calculation corrections is acceptable. Refer to Specific Comment 34 for discussion of soil disposal costs.*

**Navy Response to BAH Specific Comment 33:**

Comment noted. See Navy Response to BAH Specific Comment 34.

34. *According to the response to comments 33 and 34, the estimated cost for soil disposal of \$180 per ton is a direct quote from Clean Harbors, and is higher than usual because soil will be barged*

*off of the island for disposal. However, the current estimate in Appendix B for soil disposal under Alternative 3 cites a cost quote of \$96 per ton using a different vendor (Environmental Management Specialists). The report should be revised to describe the basis for the current cost estimate for soil disposal. In addition, the Draft CMS Final Report should be revised to explain why disposal costs are no longer included for treated soil excavated and treated ex-situ under Alternatives 4 and 5.*

**Navy Response to BAH Specific Comment 34:**

The original response did not reflect a more recent quote from Environmental Management Specialists (EMS). It was assumed that there was no facility in Puerto Rico that could accept the contaminated soils. However, upon further investigation, EMS was able to verify that the contaminated soils could be placed in a permitted landfill in Puerto Rico and the Navy was given a quote to reflect this revision. The basis of cost for the disposition of soil under the excavation and disposal cost estimate for TWFF includes only the landfill costs to accept the soil for disposition. This is a line item in the cost estimate and is annotated with the EMS quote as a reference. Treated soil excavated and treated ex-situ under Alternative 4 and 5 will be used as clean backfill, therefore no disposal costs are associated with these two alternatives.

35. *The response is acceptable with regard to cost estimate titles. Refer to Specific Comment 34 for discussion of soil disposal costs.*

**Navy Response to BAH Specific Comment 35:**

Comment noted. See Navy Response to BAH Specific Comment 34.

36. *The response is acceptable.*
37. *Provide a specific Web page reference for supporting cost estimate documentation on the Remediation Technologies Development Forum (RTDF) Web site.*

*The original comment expressed concerns that O&M costs were inadvertently omitted from the ECGO cost estimates in Appendix B. However, NAPR indicates that the lump sum costs identified as line item "ECGO Process" include such costs. Because it is a proprietary system, capital and O&M costs have not been broken down in detail. However, the vendor will supply equipment and specialized laborers for installation and operation of the treatment system. Nevertheless, it is assumed that costs not directly associated with equipment and labor (e.g., electric and utilities) will be borne by NAPR without going through the vendor and should be added to the O&M portion of the ECGO estimates. Revise the report and cost estimates accordingly.*

**Navy Response to BAH Specific Comment 37:**

The RTDF website address to support the cost estimate for ECGO is <http://www.rtdf.org/PUBLIC/SEDIMENT/MINUTES/091200/sep12-2k.htm>. The cost estimate will be revised to reflect the utilities requirements.

**BOOZ ALLEN & HAMILTON INC.**  
**TECHNICAL REVIEW OF THE DRAFT CORRECTIVE MEASURES STUDY**  
**FINAL REPORT FOR SWMUS 54 AND 55**

***I GENERAL COMMENTS***

1. *A technical review has been conducted of the Draft Corrective Measures Study Final Report for SWMUs 54 and 55 (Draft CMS Report) for Naval Activity Puerto Rico (NAPR) in Ceiba, Puerto Rico. The review indicates that while the Draft CMS Report provides detailed analyses of a variety of remedial alternatives for SWMU 54 and SWMU 55, a number of technical concerns remain. Many of these technical concerns focus on the analysis of the fate and transport of contaminants at SWMU 55, including the effectiveness of natural attenuation as a potential remedy at that SWMU. A number of other technical concerns with the analysis of specific technologies have also been noted. These concerns are documented in the following Specific Comments and should be addressed before the analysis and recommendations of the CMS Report can be accepted.*

**Navy Response to BAH General Comment 1:**

Comment Noted.

2. *The introduction of the Draft CMS Report for SWMUs 54 and 55 indicates that transfer of property or parcels of property from NAPR to other entities will require transfer of the EPA Part B Permit and states that EPA will be involved in that transfer. The Draft CMS Report does not address how NAPR will ensure that the proposed corrective action objectives (CAOs) remain appropriate when the site is transferred. The CMS Report should include a discussion of how NAPR will ensure that the CAOs will remain appropriate once the site is transferred, considering the land use assumptions upon which they are currently based.*

**Navy Response to BAH General Comment 2:**

At the present time a 7003 Order is being developed between the USEPA and the Navy. This order will establish procedures and guidelines for transfer of property of the former NSRR to other parties. Appropriate language regarding the applicability of established CAOs to any new land use will likely be included in this document. Because the development of this Order is ongoing, this issue is currently out of the scope of this CMS report.

3. *The Draft CMS Report recommends institutional controls as part of the final remedy for SWMUs 54 and 55. However, the institutional controls have not been adequately defined or evaluated in the Draft CMS Report. As part of the technical evaluation and justification for the selected remedy, the CMS Report should be revised to identify the specific institutional controls that will be utilized, the potential routes of exposure to contaminated media, and the means by which the controls will effectively block each potential exposure route. In addition, the CMS Report should indicate how the institutional controls will be maintained after property transfer.*

**Navy Response to BAH General Comment 3:**

The following text will be added into the CMS Final Report:

The Navy and EPA are currently negotiating a RCRA 7003 Order on Consent that is expected to include, among other things, requirements that institutional and/or engineering controls be maintained for any SWMUs and AOCs at the NAPR facility where clean-up levels based on unrestricted (i.e., residential) land-usage are not achieved. The RCRA 7003 Order on Consent is also expected to include requirements addressing responsibility for maintaining such institutional and/or engineering controls for a SWMU or AOC in the event of the sale or transfer of that portion of the NAPR facility to an entity other than the U.S. Navy. The Navy has indicated to EPA that it expects any entity acquiring a portion of the NAPR facility where clean-up levels based on unrestricted (i.e., residential) land-usage have not been achieved, will be required to enter into an “enforceable agreement” (such as an Administrative Order) with EPA. If the acquired parcel is subject to institutional and/or engineering controls, it would be the Navy’s expectation that continued maintenance of those institutional and/or engineering controls would be required under any “enforceable agreement” (such as an Administrative Order) between the acquiring entity and EPA.

4. *The Draft CMS Report presents a series of remedial alternatives, many of which require further evaluation, such as bench and/or pilot scale studies, before they can be determined to be effective and implementable. However, these alternatives are being evaluated and compared to other alternatives as if they would be effective. Under such an approach, it is possible that an alternative could be selected that subsequently would be ineffective. Most of the proposed alternatives include institutional controls and monitored natural attenuation (MNA). It is not clear whether it is NAPR's intention to proceed with only the institutional control and MNA components of an alternative if the third technological component of that alternative is found to be ineffective, or to reevaluate the remaining remedial alternatives and select and implement another alternative. The CMS Report should clearly indicate how NAPR will proceed if bench and/or pilot scale tests demonstrate that the selected remedial alternative will not likely be effective.*

#### **Navy Response to BAH General Comment 4:**

The text will be revised to reflect the recommendation by BAH. The second ranked alternative will be evaluated if the primary technology (i.e., the pilot test) proves unfavorable.

## ***II SPECIFIC COMMENTS***

### ***2.0 Task I - CAO Development and Determination of Corrective Measure Alternatives***

#### ***2.4 Risk Assessments***

##### ***2.4.1 Human Health Risk Assessments - SWMU 54 & SWMU 55***

##### ***2.4.1.3 Exposure Assessment and Methodology for Development of CAOs***

1. *The text (page 2-15) and Appendix B both indicate that the results of the Johnson and Ettinger (J&E) indoor air modeling are included in Appendix B. Appendix B currently contains the description of site-specific parameters, but does not include the printouts of the J & E spreadsheet results. Appendix B should be revised to include the model worksheet printouts for each groundwater chemical of potential concern (COPC) evaluated considering the groundwater volatilization to indoor air exposure pathway at SWMU 54.*

#### **Navy Response to BAH Specific Comment 1:**

This oversight will be corrected in the next submittal. The appendix will include the output of the J&E model for each COPC.

2. *The text (page 2-16) indicates that the construction workers' exposure to groundwater is evaluated at SWMU 54, but does not mention whether this evaluation occurs at SWMU 55. The Final Task I CMS Report includes an evaluation for this potential exposure pathway at Tow Way Fuel Farm (SWMU 55), as groundwater is relatively shallow in this area. Additionally, Tables C-11 through C-14 present the CAOs developed for this exposure pathway for both SWMUs 54 and 55. The text should be revised to indicate that the construction workers' exposure to groundwater is also evaluated at SWMU 55.*

*Additionally, Table 2-23 presents the groundwater CAOs for the construction worker at SWMU 55; however, some of the values presented are not consistent with what has been developed (as presented in Table C-14), but appear to have been adopted from the Final Task I CMS Report. For example, Table 2-23 indicates the construction worker CAO for cis-1,2-dichloroethene is 6.0E+4 ug/L, but on Table C-14, the actual CAO developed is 7.6E +4 ug/L. This inconsistency is only present for two COPCs (cis-1,2-dichloroethene and tetrachloroethene). While the differences are nominal, the inconsistencies should be corrected so that the final approved CAOs are clearly documented and consistent throughout the CMS Report.*

#### **Navy Response to BAH Specific Comment 2:**

The text on page 2-16 will be corrected to include SWMU 55 in the evaluation of potential construction worker exposure to groundwater contaminants.

The values in Appendix C are correct and Table 2-23 will be corrected to reflect the two changes as noted in the comment.

#### ***2.4.1.5 Quantitative CAOs***

3. *Table 2-23 presents the CAOs for COPCs in groundwater for SWMU 55. Based on Table 2-8, 1,2-dichloroethane was selected as a COPC but no CAO appears to have been developed for this contaminant based on what is presented in Table 2-23. NAPR should provide justification for excluding the development of a CAO for 1,2-dichloroethane, or revise the CMS and Table 2-23 to include a CAO for this contaminant.*

#### **Navy Response to BAH Specific Comment 3:**

Table 2-23 will be revised to add the CAO for 1,2-dichloroethane. The comment correctly notes that it was identified as a COPC for SWMU 55.

#### ***2.4.3 Screening Level Ecological Risk Assessment - SWMU 55***

4. *When discussing the Screening Level Ecological Risk Assessment for SWMU 55 reported in the Final CMS Task 1 Report, the Draft CMS Report (pg. 2-29) indicates that an ecological CAO of 200 ug/L was established for trichloroethylene (TCE) in groundwater. The Draft CMS Report further indicates that, "it was noted that TCE was not detected in the groundwater sample collected from a monitoring well located within the estimated travel path of the TCE plume, nor was it detected in downgradient surface water and sediment collected from the Ensenada Honda." The Draft CMS Report subsequently indicates that, "it was concluded that this VOC is not migrating with groundwater to the Ensenada Honda at ecologically important concentrations."*

*During the review of the January 21, 2004 Draft TCE Plume Delineation & Source Investigation Report Tow Way Fuel Farm Report and the subsequent reviews of the Navy's Preliminary (6/23/04) and Final (8/11/04) Response to Comments (RTC) of the subsequent response, concerns have been expressed about the characterization of the contaminant plume at SWMU 55. In particular, concerns have been expressed regarding the failure to fully characterize the plume within bedrock. It was acknowledged that such a plume characterization would be difficult but was not necessary unless the ecological CAOs ultimately established indicate that a potential ecological impact in the nearby Ensenada Honda might exist.*

*However, with an ecological CAO for TCE established at 200 ug/L, it is not possible to conclude with any certainty that contaminated groundwater is not discharging to the nearby Ensenada Honda at concentrations above this CAO. While it is agreed that the likely impact on Ensenada Honda is likely to be small, it appears necessary to address these potential risks in a more direct fashion. One approach may be to increase the CAO based on an analysis of dilution of any potential discharge into this large surface water body using tidal flushing and dilution calculations.*

#### **Navy Response to BAH Specific Comment 4:**

It is the Navy's informed opinion that no contaminant mass is reaching the Ensenada Honda based on: 1) characterization of the contaminant plume during two completely site-specific and independent investigations (Baker, 2001 and 2004); and 2) characterization of Ensenada Honda surface water and sediment quality downgradient from SWMU 55 (Baker, 2003). However, because of USEPA's continued concern regarding characterization of the plume, two mass balance calculations were performed to investigate potential impacts to the Ensenada Honda. The mass balance calculations are described below and will be presented in the Final CMS Final Report:

- 1) In this calculation, the mass flux of TCE through a vertical cross-section of aquifer at SWMU 55 was assumed to reach the base of the Ensenada Honda at some location with the same mass flux as is seen at the site. Very conservative assumptions were made for estimating both the concentration and the cross-sectional area values. In Figure 2-13 of the CMS a cross-section of the aquifer perpendicular to groundwater flow is seen (B-B'). Superimposed on this cross-section are contours depicting the TCE concentrations. These concentrations were the maximum observed at the site. A rectangular area represented by 280 feet in the horizontal direction and 20 feet in the vertical direction was used to calculate mass flux through this cross-section. This is approximately 88 percent larger than the area of the outside contour on this figure. A concentration in the cross-section of 2,000 ug/L was used to represent the concentration crossing this entire area of the cross-section, even though this concentration is higher than was seen during the last investigation (maximum was 1,800 ug/L), and certainly would not be found over this entire area. Using a groundwater flow velocity of 113 ft/day (the maximum given in the site hydrogeology section 2.1.2.2 of the CMS), a mass flux through this cross-section can be calculated to be 98.2 g/day as shown below [mass flux (M/T) = concentration (M/L<sup>3</sup>) \* cross-sectional area (L<sup>2</sup>) \* groundwater flow velocity (L/T)].

$$\text{Mass Flux} = 2000 \text{ ug/L} * 5600 \text{ ft}^2 * 113 \text{ ft/year} * 28.317 \text{ L/ft}^3 * 1 \times 10^{-6} \text{ g/ug} * 1\text{yr}/365 \text{ days}$$

$$\underline{\text{Mass Flux} = 98.2 \text{ g/day}}$$

If the same cross-sectional area is assumed at a hypothetical discharge point at the base of the Ensenada Honda, with a water column above it of 1 foot, the associated volume receiving this mass is 5,600 ft<sup>3</sup>. (It should be noted that this assumes that there is NO degradation, retardation, dilution, or dispersion along the flow path, and that the mass flux into the Honda remains exactly the same

as in the source area of the plume. All of these are unlikely, resulting in an extremely conservative calculation.)

The concentration (mass/volume) in this water would be 619 ug/L after one day of discharge and no dilution or flushing ( $98.2 \text{ g/day} / 5600 \text{ ft}^3 * 0.035315 \text{ ft}^3/\text{L} * 1 \times 10^6 \text{ ug/g} = 619 \text{ ug/L}$ ). If a dilution factor of 10 were assumed (Buchman, 1999, Coastal Protection and Restoration Division of NOAA) the concentration of TCE in this small volume would not exceed 61.9 ug/L, or be less than the surface water screening value for TCE (200 ug/L from Table 2-26 in the CMS) during any given day. Again, note the many extremely conservative assumptions used in these calculations.

- 2) The second calculation assumes that the water in the Ensenada Honda is completely mixed but stays in the confines of the Honda, that is, there is no water entering the Honda or leaving it. It also assumes again that there is no degradation or volatilization, i.e., no mass is lost due to any mechanism within the Ensenada Honda itself. The question is posed: how long would it take the concentration in the Ensenada Honda to reach the surface water screening value given a constant mass flux of 98.2 g/day. A cursory measurement of Figure 2-1 in the CMS shows that the aerial extent of the Honda is approximately 7,500 feet by 10,000 feet. If an average depth of 10 feet is assumed throughout the Honda (maximum depth is assumed to be 44 feet at the entrance passage as shown in Public Works Drawing No. 5289, but experience by site personnel indicates that the rest of the Ensenada Honda is fairly shallow), the calculated volume is  $7.5 \times 10^8 \text{ ft}^3$ . If concentration is defined as some mass in a volume, and the mass flux multiplied by some time yields the mass, then the concentration is defined as:

$$C(\text{screening level}) = \text{mass flux} * \text{time} / \text{volume}$$

The equation can be rearranged to find the time to reach that concentration or:

$$\text{Time} = C * \text{volume} / \text{mass flux}$$

Plugging in the numbers yields:

$$\text{Time} = 200 \text{ ug/L} * 7.5 \times 10^8 \text{ ft}^3 * 28.317 \text{ L/ft}^3 / 98.2 \text{ g/day} / 1 \times 10^6 \text{ ug/g}$$

$$\text{Time} = 43,254 \text{ days or } 118.5 \text{ years}$$

This is the time it would take to degrade the entire Ensenada Honda to a concentration of 200 ug/L of TCE. It would also take approximately 4,250 kg of TCE source material to accomplish this.

Given these two calculations, it appears that the ecological risk to the Honda due to TCE discharge of a hypothetical plume reaching this surface water body is extremely small, and that further ecological corrective action objectives should not be developed in this CMS.

Baker. 2003. Final Corrective Measures Study Task 1 Report, Tow Way Fuel farm, Naval Station Roosevelt Roads, Ceiba, Puerto Rico. Coraopolis, Pennsylvania. April 22, 2003.

Buchman, M.F. 1999. NOAA Screening Quick Reference Tables. NOAA HAZMAT Report 99-1. National Oceanic and Atmospheric Administration, Seattle, WA. 12 pp.

5. *The Screening Level Ecological Risk Assessment described in the Draft CMS Report (pg. 2-29) has concluded that the establishment of CAOs is not necessary for eight chlorinated solvent constituents detected in the SWMU 55 area in addition to TCE. This conclusion was based, in large*

*part, on the low concentrations of these constituents, which did not exceed the surface water screening values. While currently detected concentrations of these additional VOC constituents do not appear to pose a significant ecological risk to the Ensenada Honda, the failure to establish quantitative CAOs may become problematic in the future, particularly if the concentration of these constituents should increase in the future. It is important to note that several of the remedial options under consideration may generate increased concentrations of these additional chlorinated VOC constituents. Consequently, it would appear necessary to retain those constituents that may be generated under the various remedial alternatives as COPCs. It would also appear prudent to establish CAOs for these constituents.*

#### **Navy Response to BAH Specific Comment 5:**

Given the calculations done above in response to Specific Comment No. 4, it is highly unlikely that any VOC concentrations, whether of parent compounds currently present or daughter products resulting from implementation of recommended alternatives would pose a significant ecological risk to the Ensenada Honda. Therefore, it is the Navy's opinion that development of CAOs for additional chlorinated VOC constituents is not warranted.

#### ***2.6.2 Preliminary Screening of Alternatives***

##### ***2.6.2.2 Waste Characteristics***

6. *When discussing the characteristics of the wastes at SWMUs 54 and 55, the Draft CMS Report (pg. 2-38) indicates that the two constituents that must be addressed (benzene and TCE) are "both found only in a dissolved aqueous phase, and are not likely present as non-aqueous phase liquids (NAPLs)." While no NAPLs have been detected, the duration and concentration of the releases of these constituents strongly suggest that there may be some limited residual NAPL acting as a continual source in the release areas. The presence of limited, residual NAPL will likely influence the relative effectiveness of several of the remedial alternatives under consideration at these sites (see Specific Comment No. 16). Consequently, it is important that the CMS Report acknowledge the potential presence of residual NAPL in the source areas.*

#### **Navy Response to BAH Specific Comment 6:**

The Navy will acknowledge that there may be residual NAPL present at both SWMU 54 and SWMU 55 and state this in the text. However, the CMS will still focus on addressing the dissolved phase groundwater plumes, but lend some advantages to those alternatives that would treat any residual NAPL at the site. No NAPL investigations will be proposed prior to implementation of the alternatives as the Navy has already performed two investigations at SWMU 55 focused on detecting DNAPL, and the soil samples at SWMU 54 in the area of the benzene plume did not indicate any residual NAPL present.

#### ***3.0 Task II - Evaluation of the Corrective Measures Alternatives***

##### ***3.2 SWMU 54 & 55 - Alternative 2***

7. *Alternative 2 consists of institutional controls and monitored natural attenuation. The Draft CMS Report indicates that an MNA evaluation would need to be performed at SWMU 54 prior to implementation of this alternative. However, the need to perform a similar evaluation at SWMU 55 has not been clearly acknowledged. Although some data are available to identify and evaluate MNA processes at SWMU 55, the data and analysis currently available are not sufficient to meet EPA requirements for the selection of an MNA remedy. A more complete MNA evaluation is necessary before an MNA remedy could be selected for SWMU 55 and should be included in this*

*alternative.*

**Navy Response to BAH Specific Comment 7:**

An MNA evaluation for SWMU 55 will be added to the alternative.

***3.2.1 Technical***

***3.2.1.1 Implementability***

8. *The Draft CMS Report (pg. 3-5) indicates that, "the expected time of implementation of MNA is short." However, the report provides no basis for this conclusion. The modeling of the MNA processes presented in the Draft CMS Report assumed constant strength sources and, consequently, could not predict remediation time frames. Unless further justification can be provided to support the statement that, "the expected time of implementation of MNA is short," the CMS Report should be revised to indicate that the expected time of implementation of an MNA alternative is unknown.*

**Navy Response to BAH Specific Comment 8:**

The expected time of implementation of MNA is that time needed to implement the alternative, not the expected time of beneficial results. During the natural attenuation evaluation, site-specific degradation rates will be evaluated in order to enable a more accurate prediction of the expected time of beneficial results.

9. *The BIOCHLOR modeling presented for SWMU 55 in the Draft CMS Report indicates that the TCE plume should migrate beyond the SWMU boundaries into Ensenada Honda within approximately 5 years at detectable concentrations. The Draft CMS Report (pg. 3-6) indicates that, "however, current knowledge of the plume indicates that the plume has not reached the Ensenada Honda and that concentrations decrease to non-detect after 240 feet." Based on these monitoring data, the Draft CMS Report concludes that, "other abiotic mechanisms may be at work in the aquifer to keep" the concentrations low."*

*The Draft CMS Report provides no data supporting other, abiotic mechanisms that might keep contaminant concentrations low. Moreover, the Draft CMS Report does not acknowledge the uncertainties associated with the plume characterization and monitoring network (see Specific Comment No.4). The CMS Report should fully acknowledge these uncertainties and adjust the analyses and conclusions related to the fate of the SWMU 55 plume in this and other remedial alternatives accordingly.*

**Navy Response to BAH Specific Comment 9:**

An MNA evaluation done prior to implementation of SWMU 55 alternatives (see response to Comment No. 7) will determine if other mechanisms are at work in the aquifer to keep concentrations low.

Preliminary indications are that the first step of TCE reductive dechlorination is occurring, as shown by the presence of cis 1,2 DCE at the site. Further reduction does not appear to be occurring, but that doesn't mean that it is not happening, or that there is no other mechanism working to keep concentrations low. Given that two full-scale plume characterization field events have occurred at this site, it may be that it is not possible to accurately predict with certainty what is causing the plume concentration to be non-detect past 240 ft.

10. *One of the requirements of the EPA's Office of Solid Waste and Emergency Response (OSWER)*

*Directive 9200.4-17 (1999) regarding the use of MNA at RCRA sites is that the site must be capable of being adequately monitored. For this reason, the application of MNA in fractured rock environments is frequently problematic. As indicated previously (see Specific Comments No.4), the difficulty of monitoring this site has been acknowledged. Before MNA can be selected as the remedial alternative for the SWMU 55 plume, the difficulties and uncertainties regarding downgradient monitoring of this plume must be addressed.*

**Navy Response to BAH Specific Comment 10:**

As shown in response to Specific Comment No. 4, the risks posed by this site are not significant if the known site concentrations eventually reach the Ensenada Honda. Even given this low risk, every reasonable precaution and measure will be taken during the design phase and implementation phase to ensure that the plume is adequately monitored.

Additional text will be added to the CMS stating that the monitoring network emplaced for the MNA implementation will be closely evaluated during the initial two years of monitoring, due to the difficulty and uncertainty associated with monitoring in fractured rock environments. Should any concentrations detected in the monitoring well network be found to be atypical and not consistent with the site conceptual model, additional wells may be installed to refine the site conceptual model and reduce the uncertainty of the existing monitoring network. Periodic evaluation of the site conceptual model will be done during the entire term of MNA as well, with the effect of also reducing uncertainty in monitoring of the fractured rock environment.

***3.4 SWMU 54 & 55 – Alternative 4***

***3.4.1 Technical***

***3.4.1.1 Performance***

11. *The discussion of Alternative 4, which includes the injection of strong oxidants into the subsurface, does not include a recognition that this technology is the most likely of those considered to destroy residual NAPL in the subsurface. Because there is a strong probability that some residual NAPL is present in each of the sources areas (see Specific Comment No.6), this advantage of the technology included in Alternative 4 should be recognized in the CMS Report.*

**Navy Response to BAH Specific Comment 11:**

See response to Specific Comment No. 6.

***3.4.1.2 Reliability***

12. *Alternative 4 includes the injection of oxidants into the benzene and TCE plumes at SWMUs 54 and 55 combined with MNA. MNA is intended to address any contaminants remaining after the completion of the in-situ oxidation. However, the Draft CMS Report does not acknowledge the potential impact of the injection of strong oxidants on microbial populations and the subsequent impact on the biodegradation of contaminants. If MNA is to be relied upon to complete the remediation, the potential impacts of injecting strong oxidants into the subsurface on microbial populations and the aquifer's redox conditions should be fully evaluated in the CMS.*

#### **Navy Response to BAH Specific Comment 12:**

The issue of the effect of strong oxidants on the microbial populations in situ has been a topic of great concern in the technical community. At the present time, conflicting evidence regarding the effect of oxidation on the microbial community is being presented. Marley, et al. (2003) presented evidence that reductive dechlorination increased in-situ following oxidation treatment by sodium persulfate and potassium permanganate. Dennis, et al., (2004) presented evidence that the microbial population shifted after in-situ chemical oxidation was performed, but that the total biomass remained approximately the same. The effects of oxidation on an aquifer's redox conditions can be evaluated following a pilot test. In most cases, the effects are temporary, and it is likely that the aquifer's original redox conditions will return following degradation of the oxidant in the subsurface.

Marley, M.C., et al., (2003). 'Enhanced Reductive Dechlorination Resulting from a Chemical Oxidation Pilot Test,' Proceedings of the Seventh International In-Situ and On-Site Bioremediation Symposium, Orlando, Florida, Battelle Press.

Dennis, P., et al., (2004). 'Impacts of Permanganate on Microbial Population, Diversity, and Dechlorinating Activity,' presented at the Fourth International Remediation of Chlorinated and Recalcitrant Compounds Battelle Conference, Monterey, California.

#### ***4.0 SWMU 54 Task III - Justification and Recommendation of the Corrective Measure(s)***

#### ***4.2 Recommendation of the Preferred Corrective Measure***

13. *The Draft CMS Report has recommended Alternative 3 for the benzene plume in SWMU 54. However, no clear alternative has been recommended for the TCE plume at SWMU 54. It appears that only institutional controls are being recommended for the TCE plume. However, an alternative employing institutional controls only has not been formally included in the CMS. Consequently, no analysis of this alternative and relative comparison with other alternatives has been provided. The Draft CMS Report (pg. 4-3) indicates that, "if institutional controls are not sufficient for the TCE plume, it is recommended that MNA be added to this corrective measure for the TCE plume." However, it is not clear what basis will be used to decide if institutional controls are sufficient. The CMS Report should provide an analysis of implementing only institutional controls for the TCE plume in SWMU 54. Based on this analysis, the CMS Report should make a clear recommendation regarding the corrective measures for the TCE plume in SWMU 54.*

#### **Navy Response to BAH Specific Comment 13:**

This section will be rewritten to state that MNA will be implemented for the TCE plume at SWMU 54.

#### ***5.0 SWMU 55 Task III - Justification and Recommendation of the Corrective Measure(s)***

#### ***5.1 Comparison of Alternatives***

#### ***5.1.1 Comparison of Alternatives on Technical Merits***

14. *Alternative 2, which includes MNA as the primary remedial approach, has been given the highest ranking on technical merit. However, given the uncertainties regarding the natural attenuation of the TCE plume at SWMU 55, including the limited evidence supporting an environment conducive to reductive dechlorination (see Specific Comment No. 7), it does not appear appropriate to give the highest technical ranking to Alternative 2. Unless adequate justification for this ranking is provided, a more realistic ranking should be assigned to Alternate 2.*

#### **Navy Response to BAH Specific Comment 14:**

A lower rank for technical merit will be assigned to the MNA alternative, based on the uncertainty of the ability for this alternative to be successful. However, it should be noted that all of the other alternatives are ranked on the basis that they will be effective to the best of their ability, regardless of any uncertainty associated with them. Therefore, it seems unfair to treat the MNA alternative differently, that is, with the added assumption of this uncertainty.

#### ***5.1.3 Comparison of Alternatives for Environmental Benefits***

15. *The Draft CMS Report indicates that Alternative 3 was ranked slightly less than Alternative 2. Alternative 3 includes bioaugmentation and MNA, while Alternative 2 includes only MNA. The Draft CMS Report appears to indicate that at least part of the reason for ranking Alternative 3 slightly less than Alternative 2 was because Alternative 3 may cause the formation of vinyl chloride. It is not clear why this distinction is being made since vinyl chloride is a daughter product of TCE that will likely result from biodegradation occurring under either natural conditions or the enhanced conditions induced by bioaugmentation. Unless this distinction can be adequately justified, it should be removed from the comparison of these two alternatives.*

#### **Navy Response to BAH Specific Comment 15:**

The Navy will acknowledge that vinyl chloride may be present at SWMU 55 at some undetected location or that it is not being produced from DCE under the natural aqueous environment that is currently present. Text will be added to the CMS stating that if it is being produced under natural conditions that it is unlikely to migrate in the groundwater because aerobic conditions in areas outside the plume would cause it to oxidize. However, under the bioaugmentation alternative, it may migrate due to the presence of anaerobic conditions that will be induced and sustained in this alternative. This justification should provide a clear basis for the distinction between Alternative 2 and 3.

#### ***5.2 Recommendation of the Preferred Corrective Measure***

16. *When identifying the preferred alternative between Alternative 3 (Bioaugmentation) and Alternative 4 (In-Situ Oxidation), the Draft CMS Report (pg. 5-3) indicates that the only differences between these alternatives is "a slightly lower rank for constructability of Alternative 4 and a slightly higher risk due to formation of vinyl chloride in Alternative 3." While Alternative 4 was ultimately selected, the comparison between these two alternatives should include the consideration that the injection of a strong oxidant into the source area at SWMU 55 will be much more likely to destroy any residual DNAPL remaining as source material (see Specific Comments Nos. 6 and 11).*

#### **Navy Response to BAH Specific Comment 16:**

See response to Specific Comment Nos. 6 and 11.