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Southwest Division
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LOCATION: MCAS El Toro

FROM: Bong T. Kown for
D. J. Tedaldi, Ph.D., P.E., Project Manager

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RESPONSE TO COMMENTS
DRAFT PHASE II FEASIBILITY REPORT
OPERABLE UNIT 2A - SITE 24
MCAS EL TORO, CALIFORNIA

Originator: Herbert Levine, Hydrogeologist U.S. EPA **To:** Glenn Kistner, RPM U.S. EPA **Date:** 10 October 1996	**CLEAN II Program** **Contract No. N68-711-92-D-4670** **CTO-0073** **File Code: 0222**
GENERAL COMMENTS **In general I found this document to be unacceptable as an usable report to evaluate the effectiveness of the presented remedial alternatives. The interpretation of subsurface lithologies is simplistic and not appropriate for designing a remediation scheme. It is appropriate when constructing cross-sections to group lithologies based on grain size and estimated hydraulic properties. The inclusion of silty sand and clayey sand as coarse grained units in cross-section is misleading since these units clearly have different hydraulic properties than the other coarse grained units. There are more sophisticated techniques available for interpreting the subsurface than was presented here (see attachment).** **The ground water flow model as presented is not a useful tool for accomplishing the model objectives, since critical supporting documentation and data were not included. The supposition that the pumping test data (and pilot test data) and interpretation may be presented in a draft final document is incorrect. These data are required to be included in the draft document. The draft final document is intended to resolve and include response to comments raised with the draft document (see FFA). The pumping test data is critical to evaluating both the model and well locations.**	***RESPONSES TO GENERAL COMMENTS*** Subsurface lithologies illustrated in geologic cross sections have been modified as suggested to include fine-grained units consisting of silts and clays, intermediate-grained units that consist of silty sand and clayey sand, and coarse-grained units that consist of sand and gravel. Remedial design will be accomplished by following guidelines established by the U. S. EPA in their publication "Presumptive Response Strategy and Ex-situ Treatment Technologies for Contaminated Groundwater at CERCLA Sites." The guidance states that site characterization should be coordinated with response actions and both should be implemented in a step-by-step or phased approach. The Navy has contracted with CLEAN II to perform groundwater remediation pilot testing at Site 24. The pilot testing will include aquifer testing and analysis of soil, soil gas and groundwater samples. Evaluation of these data will provide the level of characterization necessary to begin remedial design. It is unfortunate that the aquifer test report had not been completed and reviewed prior to issuing the draft Site 24 FS, however, the Aquifer Test Report was issued November 26, 1996 and submitted for review. Hydraulic conductivity estimates from pumping test data with the best curve fits ranged from 4.3 to 15.3 feet per day. The value assigned to the shallow groundwater unit in the computer model (10 feet per day), falls within this range. The groundwater model is not purported to be a perfect representation of the groundwater system. It incorporates an extensive body of subsurface information and professional judgement and has been tested against water level data, TCE concentration data and the results of the CLEAN I model. Comparisons among the simulated responses to remedial alternatives over 10-year and 20-year periods are considered to be valid and useful for deciding on a remedy. Results from the groundwater flow model are intended to be used to evaluate the remedial alternatives on a conceptual level. For example, in concept, placing extraction wells at the leading edge of the TCE plume or

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	within the TCE hot spot are fundamentally different. The groundwater flow model is able to illustrate fundamental differences in the response of the TCE groundwater plume and provides data to compare each alternative (e.g., TCE mass reduction, time to reach MCL, etc.). The model treats each alternative evenly so they are evaluated using the same criteria.
A sensitivity analysis was not presented with the ground water model. As stated in the ASTM Standard Guide for Application of a Ground-Water Flow Model to a Site-Specific Problem, "The purpose of a sensitivity analysis is to quantify the uncertainty in the calibrated model caused by uncertainty in the estimates of aquifer parameters, stresses, and boundary conditions." Since a sensitivity analysis was not done (or presented) then the uncertainty of the flow and transport model predictions can not be evaluated (see Specific Comments to Appendix D).	CLEAN II agrees that sensitivity analyses are useful tools to quantify the uncertainty in calibrated models due to model parameters such as boundary conditions, stresses, and aquifer properties. Sensitivity analyses were performed for the CLEAN I model. Since the CLEAN II model was based on the CLEAN I model, the sensitivity analysis results are expected to be similar. For the CLEAN I model, changes in specific yield and hydraulic conductivity had the greatest effect on water levels and capture zones. Given the intensive groundwater extraction from the aquifer, this is expected. The results also show the model is sensitive to values for porosity and retardation. This is also expected. Model runs using low porosity values and with hydraulic conductivity held constant, show accelerated migration of TCE. Conversely, model runs using high values of retardation, have slower TCE migration. For the purpose of this FS, sensitivity analyses will not be completed. A determination will be made at the conclusion of the groundwater remediation pilot tests whether to go forward with remedial design using a numerical approach or an analytical approach. If the numerical approach is chosen, sensitivity analyses will be completed at that time.
The proposal for placing extraction wells at the 5 ppb TCE contour is a very simplistic approach. The Navy should develop alternatives which include placing extraction and injection wells screened in the appropriate geologic materials and TCE hot spots. The reported drawdown from the IDP (if built) is significant and will have a dramatic impact on water levels within this OU. The Draft Final OU-1 Interim Action Addendum predicts water level declines over the first ten years of operation which dramatically impact on this project. The Navy must include this while	In the draft FS, the Navy described an alternative that includes placing extraction wells in the TCE hot spot. In Section 4 of the draft FS, Alternative 11 was given a detailed evaluation. An additional alternative was added for in the draft final FS (Alternative 10b) that includes extraction from the TCE hot spot and discharge to the IDP for treatment. The locations of the extraction and injection wells including their screened intervals is addressed conceptually in the draft FS. Specific locations will be determined during the remedial design and pilot testing phase of the project. The Navy has proposed

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selecting and comparing remedial alternatives.	that remedial action be initiated using the U. S. EPA Presumptive Response Strategy. Using this strategy, investigative and remedial responses are combined. Pilot testing that has been contracted with CLEAN II includes a specific methodology for locating extraction and injection wells and an opportunity for review and approval by the BCT. Pilot test extraction wells will be located within the TCE hot spot, as discussed in the November 6, 1996 BCT meeting. Specific locations and well screened intervals will be selected based on evaluation of Phase I and II RI data and information gained from the pilot test work, such as CPT, HydroPunch groundwater analyses, soil sample analyses, and lithologic logging of well boreholes. Three pilot test extraction wells have been installed as of November 1997. CLEAN II agrees that the simulated drawdown from the IDP suggests a significant effect on water levels in the OU. The Navy has demonstrated through modeling of alternatives in the FS and through conducting additional groundwater remediation pilot testing that dewatering of the shallow groundwater unit will probably occur given planned extraction rates that exceed groundwater recharge.
I have repeatedly requested from the Navy data in an electronic format. The requested data included a site map, site 24 chemistry and water level data, and lithologic data. I was specifically interested in these data to attempt an alternative interpretation of geology and contaminant distribution. These data are supposed to be freely distributed and the reluctance to provide those data is very suspicious, especially since previously supplied pumping test data included viruses.	These data have been provided to the U.S. EPA. CLEAN II apologizes for the delay in sending them and the inadvertent inclusion of a virus on one of the disks. (As an aside, the anti-cmos virus, which had infected our own system and copied to one of the disks sent to the EPA, is not destructive.)
These deficiencies are critical components for a draft document. It is not appropriate, in my opinion, to address these in a draft final document. These issues must be resolved prior to issuing the draft final document. Therefore, I suggest that we either reject this document, or request that the next revision be submitted as a draft. The Navy may choose to separate the vadose zone and ground water and pursue a ROD for SVE	CLEAN II agrees that the U.S. EPA should have ample time to review the pilot test reports before a draft final FS can be issued. This has been done. The vadose zone was separated from the FS and submitted as suggested. CLEAN II believes that site characterization issues can be addressed during groundwater remediation pilot testing and remedial design as provided for in the U. S. EPA publication "Presumptive Response Strategy and Ex-situ

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while addressing these concerns for the ground water.	Treatment Technologies for Contaminated Groundwater at CERCLA Sites."
SPECIFIC COMMENTS	***RESPONSES TO SPECIFIC COMMENTS***
1. Section 1.4.4.2 Stratigraphy, page 1-18. EPA disagrees with the statement that the coarse grained and fined grained units are continuous and extensive. This is an artifact of including silty sand and clayey sand in the coarse grained units (Figures 1-7 and 1-8) and an oversimplification of the geology. Both of these lithologies have an expected hydraulic conductivity several orders of magnitude less than sand. This is likely an explanation for the observation of contaminant distribution and an important distinction for extraction well placement. These Figures point out the data gaps present for understanding occurrence of contaminated ground water and the knowledge needed to place extraction wells. (See attachment)	**RESPONSE 1**: The geologic cross-sections have been modified to help demonstrate aquifer heterogeneity to include fine-grained units consisting of silts and clays, intermediate-grained units consisting of silty sand and clayey sand, and coarse-grained units consisting of sand and gravel, as suggested. The aquifer stratification that is illustrated in cross-section B-B' shows a fairly homogeneous sand unit occupying the upper 40 feet of the shallow groundwater unit. However, lithologic logs are often several hundred feet apart. Additional sampling that has been, and will be conducted during the groundwater remediation pilot tests will probably show increased stratification of the sand unit with fine-grained and intermediate-grained units. These data will be incorporated into the conceptual model. CLEAN II agrees that lithology is a factor in controlling contaminant distribution. Other important factors are proximity to a source and the groundwater gradient. All of these factors will be considered before locating a remedial extraction well. Any data gaps that need to be filled prior to locating a remedial groundwater extraction well will be accomplished during groundwater remediation pilot testing and remedial design.
2. Section 1.4.5.1 Shallow Groundwater Unit, page 1-23. EPA disagrees with the first paragraph interpretation of heterogeneities. See above comment. The reference to Phase II pilot tests points out the inadequacy of this document. EPA can not review data which are not presented nor comment on reported summary data (hydraulic conductivity of 1 to 5 ft/day). Which sands were measured for porosity? What value is there in averaging these data? The average linear velocity has little credence and little value as calculated. There is no supporting documentation for	**RESPONSE 2**: Characterization of aquifer heterogeneities is being completed as stated in the above response. Additional data collected during groundwater remediation pilot testing and remedial design will be used to refine our interpretation of aquifer heterogeneities where lithologic logs are separated by several hundred feet. Aquifer test data have been evaluated from both pumping and monitoring wells. In the evaluations and conclusions section of the aquifer test report, the hydraulic conductivity range estimated for well 24EX1 was 6.6 to 10.1

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averaging hydraulic conductivity nor for averaging porosity. What is the significance of an average linear velocity of 146 ft/yr? What are the implications of plume movement based on this number? (73 years to reach 2 mi., 108 years to reach 3 mi.).	feet/day; for well 24EX2 the range was 11.1 to 15.3 feet/day; and 4.3 to 5.8 feet /day for well 24IN1. These estimates are very close to the estimate of 10 feet/day used in the groundwater model. Supporting data for the porosity average is included in Section 1 of the aquifer test report. Five samples were analyzed from the saturated zone. The arithmetic and geometric means for the porosity samples are both about 0.22. The implications for plume movement are similar to those identified for simulated plume movement and sensitivity analyses stated in General Comments. Porosity, hydraulic conductivity, and hydraulic gradient all affect the rate of plume movement. Preferential flow may occur in units with higher hydraulic conductivity and in units with lower porosity (given hydraulic conductivity is constant). Increased hydraulic gradients (e.g., in response to pumping wells) will also increase the rate of plume movement. Each of these factors may affect plume movement at El Toro.
3. <u>Figure 1-9, Conceptual Model of VOC Source Area</u>. This Figure oversimplifies the distribution of VOC in the upper portion of the SGU. This Figure uses two dimensional data for contaminant distribution which is misleading. The data presented in Figures 1-7 and 1-8 shows that the contaminant concentrations vary dramatically. The three dimensional data distribution should be incorporated into the conceptual model.	**RESPONSE 3**: CLEAN II acknowledges that the conceptual model is a simplification of the TCE distribution in groundwater. The conceptual model has been modified to help illustrate the subsurface heterogeneities. Three dimensional characterization will be performed using a combination of Phase I, Phase II, and groundwater remediation pilot test data at the conclusion of the groundwater pilot testing.
4. <u>Section 1.4.6.2 Saturated Zone, Horizontal Characterization, page 1-37</u>. The interpretation of a homogeneous sandy unit is wrong and not appropriate for this report. The Navy should revise the cross-sections and then attempt an interpretation of contaminant distribution as a function of lithologies. As presented the Navy assumes similar behavior between sand and silty sands and clayey sands. EPA recommends using a third distinction for the cross-sections, an intermediate unit consisting of silty sands and clayey sands.	**RESPONSE 4**: The interpretation of a "fairly homogeneous sandy unit occupying the upper 40 feet of the shallow groundwater unit," is part of a summary of site conditions based on the findings of the draft Site 24 Remedial Investigation Report. The geologic cross-sections have been modified to help demonstrate aquifer heterogeneity to include fine-grained units consisting of silts and clays, intermediate-grained units consisting of silty sand and clayey sand, and coarse grained units consisting of sand and gravel, as suggested. The aquifer stratification that is illustrated in cross-section B-B' shows a fairly homogeneous sand unit occupying the upper 40 feet of the shallow

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	groundwater unit. However, lithologic logs are often several hundred feet apart. Additional sampling that has been, and will be conducted during the groundwater remediation pilot tests will probably show increased stratification of the sand unit with fine-grained and intermediate-grained units. These data will be incorporated into the conceptual model.
5. **Section 1.4.6.2 Saturated Zone, Vertical Characterization, page 1-38. The discussion of silt and clay layers separating sandy units is a significant observation. How were the hydraulic conductivity values measured? For discussion purposes it is reasonable to assume that the hydraulic conductivity of clays and silts in the SGU are not significantly different from hydraulic conductivities of silts and clays in the SGU. This might provide an explanation of the stratification reported for TCE measured in HCPT83. If the Navy still contends that the upper 40 feet of the SGU is homogeneous sands and is laterally extensive please provide an explanation for the contaminant stratification found in the CPT/HydroPunch data.**	**RESPONSE 5**: Fine-grained soil samples were analyzed for vertical hydraulic conductivity using ASTM Method D5084. Coarse-grained soil samples were analyzed using ASTM Method D2434. Silt and clay layers are found interbedded in the shallow groundwater unit. Contaminant stratification was noted in samples from HCPT83 and other HydroPunch locations. As discussed earlier, the homogeneous sand layer illustrated in cross-section B-B' is probably an artifact of lithologic logs separated by several hundred feet.
6. **Section 2.1.5.3 Cleanup to Background Level, page 2-8. RCRA is not necessarily an ARAR. This is dependent on how the groundwater treatment unit is defined. Why must background level or chemical concentrations be achieved? The reference to past U.S. EPA efforts to restore impacted aquifers to pristine levels should be expanded. One overriding conclusion presented in these site review reports (EPA, 1992a, 1992b) and subsequent ones (NRC, 1994) is that sites are not often characterized sufficiently to implement an effective remedy. This has important implications for El Toro. The general discussion (paragraph 2) on extraction and adsorption of contaminants should be expanded to discuss the impact of poorly placed extraction wells and the presence of DNAPLS. Though EPA does not mean to suggest that DNAPLs are present at El Toro, this has been an important factor in determining feasibility of pump and treat. The above mentioned**	**RESPONSE 6**: CLEAN II did not intend to suggest that background levels could be achieved. Instead we suggest that attaining background levels will not be technically and economically feasible. The discussion of past efforts to restore impacted aquifers has been expanded to describe problems such as inadequate site characterization, low hydraulic conductivity, aquifer heterogeneity, adsorptive capacity of the aquifer material, presence of DNAPL, and others. Many of these issues are being addressed in the groundwater remediation pilot tests. Some factors like aquifer heterogeneity and low hydraulic conductivity are site characteristics that must be addressed during remedial design.

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reports do discuss as limiting factors for cleanup an appropriate site characterization and site heterogeneities. These should be addressed in the FS for site 24.	
7. Section 2.3.2 Groundwater Volume and Associated Trichloroethene Mass, page 2-16. This estimate is based on an oversimplification of contaminant distribution and is likely wrong. As previously mentioned the distribution of TCE is highly stratified. Assuming that the upper 50 ft. of the SGU has a uniform contaminant distribution is wrong. The Navy should revise this section using measured concentration data.	**RESPONSE 7**: Measured concentration data were used. Data within contour intervals were averaged and the average concentration was used to calculate TCE mass within specific contour intervals in the top 50 feet of the shallow groundwater unit. For the bottom 50 feet, where data were sparse, the average concentration was assumed to be one order of magnitude lower. CLEAN II believes this is a reasonable estimate. An additional estimate will be prepared after compiling HydroPunch data collected during the groundwater remediation pilot tests.
8. Section 2.4.7 Screening of Technologies and Process Options, Figure 2-4 page 2-27. The data presented to the BCT indicated that air sparging did not work in the area where the pilot test was conducted. During BCT discussions the EPA has expressed reservations regarding this technique. Again, the EPA's position is that air sparging might be appropriate for shallow, homogeneous zones. This is clearly not the case at El Toro. Please change this technology, as well as in-well air stripping, to not applicable. Also, please change dual phase from potential to applicable.	**RESPONSE 8**: Air sparging and in-well air stripping have been changed to not applicable as suggested based on the inability to control the air sparging flow in the subsurface.
9. Section 2.4.7 Screening of Technologies and Process Options, Table 2-8, page 2-47. Comment # 8 applies here as well. Page 2-49. Please change ozone-enhanced air sparging to not applicable. Page 2-51, why is on station discharge limited to 6 months only? The irrigation does not necessarily need be for food crops as off-station.	**RESPONSE 9**: Ozone-enhanced air sparging has been changed to not applicable for the same reason stated above. Irrigation is concentrated during the summer and fall; so a 6-month duration was used because little irrigation is necessary during the winter and spring.
10. Section 3.4 Alternative 2A, page 3-7. Please discuss why VOCs are to be polished to non-detect.	**RESPONSE 10**: VOCs are polished to non-detect because the water is being reinjected into uncontaminated portions of the aquifer.
11. Section 3.5 Alternative 3, page 3-9. Please change process drawings to show treatment via IDP prior to VOC treatment.	**RESPONSE 11**: VOC treatment occurs at the IDP as the first step in treating the groundwater for potable use. DON feels that the figure is correct.

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12. Section 3.1 Effectiveness, page 3-9. If capture and treatment is provided by the IDP why is this alternative considered to have a low effectiveness?	**RESPONSE 12**: This comment refers to Alternative 3 which is no longer included in the draft final FS. Alternative 3 consisted of no action for soil and for the shallow groundwater unit and IDP for the principal aquifer. The effectiveness of this alternative was rated low because it did not address the source of contamination.
13. Section 3.5.4 Results of Screening Alternative. Comment # 12 applies here as well.	**RESPONSE 13**: Please see the response to Comment #12.
14. Section 3.10.2 Implementability, page 3-23. Please provide information supporting the claim that the public will not accept treated groundwater as a potable water supply. EPA and DoD routinely provide treated groundwater as a potable supply.	**RESPONSE 14**: DON did not state that the public would not accept treated groundwater but that there may be difficulties with public acceptance. Irvine Ranch Water District is considering contracting with a public relations firm to broach this subject with the public.
15. Section 4.2 Groundwater Modeling, page 4-4. EPA agrees with the approach of developing the model based on an existing regional model. However, it was our expectation that the model would be developed at a different scale for site 24. The resolution of site parameters such as lithology and associated hydraulic conductivities is too coarse for this project. Figure A-3-5 from the OU-1 FS indicates that the upper 40 ft will be dewatered in 10 years at well 22_DBMW47 at the downgradient end of the plume. This dewatering follows an exponential curve with significant water level declines in the first 2 years. For this reason dual phase extraction should be considered as an alternative.	**RESPONSE 15**: After completion of the groundwater remediation pilot tests a decision will be made whether to go forward using an analytical approach (as with the groundwater remediation pilot tests) or with a numerical approach. If the numerical approach is selected, the groundwater model can be adjusted, as necessary. Dual-phase or vacuum-enhanced groundwater extraction is part of Alternative 11 and is currently being pilot tested.
16. Section 4.4.2.1 Description, Shallow Groundwater Unit, page 4-20 and Figure 4-6. The problems associated with the groundwater model preclude the EPA from concurring with the extraction and injection scheme presented here. The Navy did not consider the implications of placing extraction and injection wells in the fine grained units. The modeling effort averaged the aquifer parameters so it is not possible to evaluate whether it is possible to	**RESPONSE 16**: The characterization of fine-grained, intermediate-grained, and coarse-grained units will be completed during groundwater remediation pilot testing and in the remedial design stage. A 3-D geologic model based on Phase II data could not address all design concerns as these data are not sufficient in quantity to develop a meaningful model. DON believes that too much interpretation of sparse data fields would be needed to create a meaningful 3-D geologic model.

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maintain pumping rates in the fine grained units and whether the fine grained units can accept the recharge. This has dramatic implications for aquifer flushing and contaminant plume capture. Attachment A to these comments is a three dimensional geologic model with TCE concentrations. Slices through the geologic model indicate that high concentrations of TCE are contained in the fine grained units. It is possible to use such a model of geology and contaminant distribution to refine the groundwater model and more logically place the extraction and injection wells. EPA recommends the Navy to consider this approach since the presented model and alternatives are not acceptable.	More spatial hydraulic conductivity data is needed in the aquifer extraction and injection areas. This type of data can only be obtained by drilling and aquifer testing, as is being accomplished in the groundwater remediation pilot testing. A 3-D geologic characterization will be conducted at the completion of pilot testing when additional design data are available.
17. <u>Section 4.4.6.2 Evaluation, Long-Term Effectiveness and Permanence, page 4-58</u>. While this alternative poses many positive actions; SVE, containment of the shallow plume, extraction wells placed in the shallow plume hot spots, and natural attenuation of the principle aquifer, there are significant problems with the ground water conceptual and numeric model to actually document the scheme proposed here. While EPA agrees in principle with this approach, changes to the ground water conceptual and numeric model are needed to evaluate effectiveness. Specifically, the conceptual model and numeric model needs to address the concerns mentioned in comments 1,2,3,4,5,7,15,16, & Attachment A). All data produced by the numeric model are considered suspect until these concerns are addressed.	**RESPONSE 17**: The conceptual model has been adjusted as suggested. A decision will be made at the completion of groundwater remediation pilot testing whether to go forward using an analytical approach or a numerical approach. If the numerical approach is selected, the groundwater model can be adjusted, as appropriate.
18. <u>Section 4.5.3 Long-Term Effectiveness and Permanence, page 4-64</u>. EPA agrees with the added benefit of removing mass from the vadose zone via SVE. EPA disagrees with the conclusion that the SGU dewaters after 17 years. As discussed in comment 15, the downgradient edge of the 500 ppb contour is significantly dewatered after 2 years, and after 10 years is dewatered by 40 ft.(see Figure A-3-5, OU-1 FS). This phenomenon must be included	**RESPONSE 18**: Dewatering will occur whenever groundwater extraction exceeds groundwater recharge. Since groundwater recharge is heavily dependent on precipitation, DON does not imply that dewatering after 17 years is a precise prediction. It is instead the result of extracting more groundwater than recharges the aquifer, based on the model estimates. In contrast, alternatives that reinject groundwater do not predict dewatering in the model simulations since groundwater extraction does not exceed recharge.

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in the evaluations of alternatives. The Navy must revise the numeric model prior to EPA agreeing that the extraction/reinjection scheme as proposed for any alternative is valid.	Sustainable pumping rates will be evaluated during groundwater remediation pilot testing and during remedial design The numerical model may be revised, if appropriate.
19. Section 5.0 Pilot testing, page 5-1. It is inappropriate for the Navy to propose including these pilot tests in a Draft Final document. According to the FFA, and discussion with the Navy during BCT meetings, the Draft Final document should address the comments made during the initial presentation in the Draft document and not require extensive comments from the agencies.	**RESPONSE 19**: Pilot test reports have now been submitted and reviewed. CLEAN II regrets the delay.
20. Section 6.3 Recommendations, page 6-4. EPA agrees that the presentation of remedial alternatives is conceptual, however the failure to include a representative conceptual model and limitations of the subsequent numeric model leaves significant doubt that appropriate alternatives have been evaluated. While it is true that many design details can be addressed during the remedial design phase, the presentations of alternatives here, including Alternative 11, does not include a realistic estimation of aquifer response to stresses (see comments for Appendix D). Therefore, EPA can not agree in concept to comparisons of cost and effectiveness.	**RESPONSE 20**: The conceptual model has been modified, as suggested. Further refinements will be made by incorporating data from the groundwater remediation pilot tests. The numerical model will be refined, as appropriate. A decision will be made as to whether to go forward with the numerical model after groundwater remediation pilot testing is complete.
21. Section 6.3.1 Soil Vapor Extraction, page 6-4. Agree.	**RESPONSE 21**: Noted.
22. Section 6.3.2 Horizontal Groundwater Extraction/Injection, page 6-4. Agree that a horizontal well could be beneficial and be simulated. EPA agrees with the suggestion that this technology be investigated, but not until the conceptual and numeric models are revised to incorporate EPA's comments.	**RESPONSE 22**: DON concurs.
23. Section 6.3.3 Air Sparging Using Ozone, page 6-5. EPA rejects the use of air sparging at EL Toro. The use of air sparging with ozone has not been demonstrated at any sites to be effective in destroying	**RESPONSE 23**: DON concurs. Air sparging has been reclassified as not applicable.

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TCE in ground water. The example provided (Kerfoot, 1996) can not demonstrate whether the induced air is being captured and if TCE is being destroyed.	
24. Section D1, Introduction, page D1-1. While a review of the model did not reveal any fatal flaws, sufficient information is missing to determine if the model actually meets the stated objectives. While the model might actually be modeling flow and response to stress, the Navy has not demonstrated that the aquifers beneath EL Toro are being modeled.	**RESPONSE 24**: The groundwater model will be refined, as appropriate if it is decided that future work will go forward using a numerical approach.
25. Section D1, Introduction, page D1-1. A model sensitivity analysis was not presented. As stated in the ASTM Standard Guide for Application of a Ground-Water Flow Model to a Site Specific Problem, "The purpose of a sensitivity analysis is to quantify the uncertainty in the calibrated model caused by uncertainty in the estimates of aquifer parameters, stresses, and boundary conditions." Since a sensitivity analysis was not done, then the uncertainty of the flow and transport model predictions can not be evaluated. EPA recommends conducting a sensitivity analysis when this model is revised.	**RESPONSE 25**: Please see response in general comments.
26. Section D1, Introduction, page D1-1. According to the text, the objective of the OU-2A modeling effort was to *"provide a tool for the evaluation of remedial alternatives for the trichlorethene (TCE) contamination of the shallow groundwater unit underneath Site 24 and TCE sources in this area (p. D1-1)"* yet a significant amount of effort also went into developing a tool which simulates the deep Principal aquifer, and many of the remedial scenarios also include addressing contamination present in the deep Principal aquifer. Please clarify whether the objectives of this modeling effort also included addressing contamination present in the deep Principal aquifer, or whether the efforts to that end are considered out of the	**RESPONSE 26**: Although this FS addresses Site 24, both the principal aquifer and the shallow groundwater unit were modeled. The reason for this is that actions taken in the shallow groundwater unit have an impact on the principal aquifer and vice versa. Therefore, in order to optimize the remedial actions being taken at OU-1 and OU-2A, it was necessary to model both areas together. Similar logic was used in the OU-1 IAFS. Both the shallow groundwater unit and principal aquifers were also modeled in the OU-1 IAFS.

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scope of the OU-2A Site 24 modeling effort presented in the August, 1996 FS Report.	
27. Section D2.2.2, Intermediate Zone, page D2-2. The text indicates that the intermediate zone average hydraulic conductivity measured from soil samples collected at Site 24 during the Phase II RI was 4.5 x 10^{-9} cm/sec and Figure D5-2 indicates that the value used in the OU-2A model for the intermediate unit hydraulic conductivity at Site 24 was 2.0 ft/day (7.1 x 10^{-4} cm/sec). Please clarify which of these values represent horizontal and/or vertical hydraulic conductivity and specify the ratio of anisotropy used in the model. Also, explain how the horizontal and vertical hydraulic conductivity values used in the model compare with values obtained from site tests or with values expected from geologic descriptions of the soil where hydraulic data was not available.	**RESPONSE 27**: Aquifer testing has not been performed in the intermediate zone, and detailed lithologic logs are not available. Hydraulic conductivity values used in the model represent horizontal hydraulic conductivity. The values from the tested soil samples represent vertical hydraulic conductivity. The sample indicated was selected from a fine-grained unit, knowing in advance that the hydraulic conductivity would be indicative of the low range present. Conversely, sand samples were analyzed to evaluate the high range. The anisotropy rate used in the OU-2A model is the same as for the OU-1 model. It varies between 10:1 and 100:1. The ratio of anisotropy was varied during the OU-1 model calibration to match empirical water level data. Aquifer testing has not been performed in the intermediate zone, and detailed lithologic logs are not available.
28. Section D2.4, Hydraulic Conductivity, page D2-3. The hydraulic conductivity distribution in the Principal Aquifer used in the OU-1 and OU-2A models is shown on Figure D2-3. Please discuss the basis for this hydraulic conductivity distribution.	**RESPONSE 28**: The OU-2A model uses the same hydraulic conductivity distribution as the OU-1 model. Additional analysis was not completed for this FS. The OU-1 model hydrogeologic properties are discussed in Appendix A of the IAFS report (pg. A4-4).
29. Section D2.4, Hydraulic Conductivity, page D2-3. Figure D2-5 shows that a hydraulic conductivity value of 10 ft/day was used to represent the Shallow Unit at Site 24 in the OU-2A model, and the text indicates that this value was based on the field measured hydraulic conductivity values shown on Figure D2-4. Neither the text nor the figure indicate how the value of 10 ft/day was derived from the field data. There are 15 OU-2A field obtained hydraulic conductivity values located within the gray zone representing 10 ft/day in the model on Figure D2-4, however, the geometric mean of these 15 values is 1 ft/day. Also, all of the field obtained values located in the northern half of the MCAS range from 0.01 to 1.1 ft/day, which is considerably lower than 10 ft/day. This apparent	**RESPONSE 29**: Hydraulic conductivity values in the shallow groundwater unit must be higher on average than 0.01 to 1 ft/day to allow TCE transport downgradient from Buildings 296 and 297. The distance from Building 296 to the leading edge of the TCE hot spot is over 3,000 feet. Empirical evidence also suggests that the aquifer retardation factor is very low. Adjusting the model to reflect spatial variability of these data would not account for the TCE transport that is empirically evident. Therefore, the model was calibrated to match empirical data.

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difference between observed hydraulic conductivity values and modeled values could impact the predicted capture zone widths and flow rates and should be incorporated into the model. Please clarify how the value of 10 ft/day was derived from the field data, and also explain why the model hydraulic conductivity was not varied spatially across the MCAS based on the 28 field obtained values shown on Figure D2-4.	
30. <u>Section D4.3, Key Assumptions in the Transport Model, page D4-6</u>. The second listed assumption states that no biodegradation or chemical reactions are modeled. The reason given is that this creates a conservative result from the transport model. While it is true that the predicted contaminant distribution prior to remediation efforts would probably be larger, the effects of remedial pumping are likely exaggerated by these assumptions. The input file for MT3D shows that the factor describing both biological decay and adsorption reactions were set to zero in accordance with the statement in the text. The assumption of no decay is routine since there is insufficient data about the reactions resulting in the biodestruction of TCE to support a single input value. The assumption regarding adsorption is also reasonable given the uncertainties in accurately describing the governing reactions. However, these assumptions combine to create a situation where the resulting predictions are likely less reliable than if some attempt had been made to estimate one or the other of these components.	**RESPONSE 30**: Selection of a biological or adsorption factor will be done if it is decided to go forward with future project work using a numerical approach.
The third listed assumption indicates that a longitudinal dispersivity of 50 feet and a lateral dispersivity of zero feet were used in the transport model. The potential range of dispersivity and also the relative uncertainty in predicting the appropriate dispersivity is relatively high. However, it is generally considered to be affected by the scale of the problem. Anderson and Woessner	CLEAN II did not adjust the dispersivity values used in the OU-1 model. In Appendix A of the IAFS report (pg. A4-9) it is stated that dispersivity values were chosen based on general discussions in Neuman (1987), Cherry (1994), and model calibration efforts. Selection of dispersivity values is probably best determined based on the results of sensitivity analyses. If it is agreed that results of numerical simulations will be used to guide the remedial effort, the

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(1992) state *"dispersivity seems to increase with the size of the contaminant plume; i.e., dispersivity seemingly increases as the plume moves downgradient."* Also, Fetter (1993) suggests that while the potential range is rather large, the longitudinal dispersivity can be estimated to be about 0.1 of the flow length. Fetter also states that the few field studies available indicate a ratio of longitudinal to transverse dispersivity ranging from 6 to 20. Please explain why a relatively low longitudinal dispersivity of 50 feet and a zero lateral dispersivity of 0 feet was used to represent large plumes ranging from 2,000 to 10,000 feet in length. The values used could potentially affect the predicted distribution of contaminants and also the recovery well design layout.	dispersivity value may be modified.
31. <u>Section D5.2, Calibration Method, page D5-1</u>. Figure D5-1 presents the recharge distribution used in the OU-2A model with values ranging from 0.1 to 1.6 ft/yr. The text on page D2-2 indicates that it is assumed that 10 percent of rainfall will infiltrate to the groundwater, which, based on the calculations on page D3-4, is equal to 1.18 in/yr (0.1 ft/yr). Please explain what data or literature sources were used in developing the recharge zones (0.1, 0.3, 0.4, 1.0, 1.4, and 1.6 ft/yr) input into the model. Explain what the variable recharge zone shown on Figure D5-1 represents. Also, explain why the amount of deep percolation from direct precipitation input into the MODFLOW was twice as high as the estimated amount shown on Table D5-1.	**RESPONSE 31**: Larger values of infiltration were used near stream channels and foothills where runoff is concentrated. These values were selected during model calibration to modify the direction of groundwater flow in the shallow groundwater unit to better reflect Site 24 conditions.
32. <u>Section D5.3, Calibration Results, page D5-3</u>. The calibration results are briefly summarized on Table D5-2 and plotted on Figure D5-3. The lack of surface features shown on Figure D5-3 make it difficult to determine what area is represented by the figure. However, the contours indicate some areas where the model predicted groundwater elevation and flow direction differ significantly from the observed data. Most notably there is a 20	**RESPONSE 32**: Additional data will be provided if it is decided that future project work will be guided using a numerical approach.

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foot difference between 120 ft OU-2A model contour and the adjacent 140 foot observed contour. The 120 ft OU-2A model contour line also indicates a groundwater low area which is not seen in the observed data. Also, the flow directions indicated by the 150 ft to 180 ft contours vary between the observed and predicted values in some areas. Discuss the distribution of the 101 calibration points relative to the location of the existing shallow and deep contaminant plumes and the existing and simulated recovery and production wells. Explain whether all of the calibration points were located in the shallow unit, or whether some of them were located in the deep unit. **There is no discussion of vertical gradients in the modeling text. Discuss whether the groundwater flow within the model domain is predominately horizontal, and if not, describe the vertical gradients that were observed in the field. Discuss whether the model duplicates any vertical gradients that are present. Since the shallow and deep units are both represented by more than one layer, indicate the layers within these units that were designated for comparison with values observed in the field.**	
COMMENTS ON CONCLUSIONS AND RECOMMENDATIONS **SECTION D7** **The following comments are provided with respect to the review of the groundwater flow and contaminant transport modeling effort review. They are organized in the same order as the bulleted items provided on page D7-1 of the subject report.**	***RESPONSES TO COMMENTS ON CONCLUSIONS AND RECOMMENDATIONS*** **SECTION D7**
• **Soil vapor extraction likely does reduce remediation times.**	Agree.

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• **Any conclusions regarding the effectiveness of a remedial alternative on drawdown, on water levels in deeper units or on vertical gradients may be biased because hydraulic conductivities and recharge values may be overestimated.**	Hydraulic conductivity and recharge values are the product of model calibration. These assumptions can be checked using groundwater remediation pilot test data.
• **Injection in the upper units (layers 1 and 2) should increase downward gradients in the lower layers. This observation may be indicative of effects of other uncertainties on the model results.**	If injection is conducted in layer I without extraction, downward gradients are present as stated. Injection into layer two should impede vertical migration from layer 1. If extraction is combined with injection, the plume can be contained at its fringes and extracted from the center, which limits vertical migration. Simulated vertical migration is enhanced when pumping occurs across both layers of the shallow groundwater unit. This draws TCE into the lower half of the shallow groundwater unit, enhancing the effect of vertical gradients caused by agricultural or Irvine Desalter Project wells.
• **Pumping in the zone most highly affected is likely the best approach.**	DON concurs.
• **Alternative 11 is the most effective because of a large number of groundwater extraction wells combined with source input term reduction designed to reflect the use of SVE.**	DON concurs. For the draft final FS, an additional alternative, 10B, has been added. This alternative also extracts groundwater from the hot spot in the groundwater plume beneath Site 24 and discharges the groundwater to the IDP for treatment. Modeling shows that this alternative is also very effective in remediating the shallow aquifer at Site 24.
• **The estimate of exactly 38 years to reach MCL concentrations for TCE is likely unreliable. At best attempts to model contaminant migration scenarios provide approximate time scales and are most useful when comparing alternatives. It is risky to rely on models for precise estimates of cleanup time.**	The estimate of 38 years is an estimate to be used in relative comparison with other alternatives. CLEAN II does not mean to imply the model simulates precise predictions of clean-up time.

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Attachment A **EPA performed a geospatial analysis of the available geologic and contaminant data for Site 24, MCAS El Toro. This analysis was done using the EarthVision software developed by Dynamic Graphics, Inc. The result of this analysis is provided as a three dimensional solid model of both the geologic conditions at the site and the contaminant distribution. Our objectives were: to determine if the observed distribution is controlled by the subsurface lithology, develop plan view figures showing the geology and contaminant distribution at fixed intervals through the upper 40 feet of the SGU, and to evaluate the proposed extraction/injection wells based on the geologic model and the distribution of contaminants.**	
Solid Model Construction **Since the purpose of this task is to provide some input on the likely effects of subsurface lithology on TCE distribution several simplifying assumptions were made to focus the model construction activities. First is the placing specific lithologies based on general grain size. Fine grained deposits were defined as being predominately clay or silt. Coarse grained deposits were defined as being predominately sand or gravel. The geologic data used for this evaluation were taken from the Draft Phase II Remedial Investigation Report Operable Unit 2A Site 24, Marine Corps Air Station, El Toro, CA dated June 1996. The data from approximately 100 borings, including Cone Penetrometer (CPT) points, were reviewed and the lithologies grouped according to the fine grained and coarse grained definitions provided above. These data were then used to construct a geologic solid model of the area of Site 24 by starting at an elevation of approximately 75 feet above mean sea level (MSL) and building upward through the lithologic materials to approximately 300 feet MSL. This results in a fairly detailed geologic model ranging in thickness from 90 to 110 feet. An oblique view of the geologic model**	DON agrees that a 3-D geologic model will be helpful in selecting locations for groundwater extraction and injection wells. A 3-D representation will be completed using Phase I, Phase II, and groundwater remediation pilot test data at the conclusion on the groundwater pilot tests. DON does not believe that Phase I and Phase II RI data can be used by themselves to complete a meaningful 3-D model. The groundwater remediation pilot testing focuses its effort on the TCE hot spot. These data will be very valuable in completing the 3-D model.

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showing the alternating layers of coarse grained and fine grained deposits is attached.	
A three dimensional interpretation of TCE was constructed using data from monitoring wells and from HydroPunch sampling locations. These data were extracted from the Final Quarterly Groundwater Monitoring Report for MCAS, EL Toro, Ca dated June 27, 1996. In the case of the monitoring wells the reported TCE concentration was assigned to the vertical location corresponding to the center of the well screen. These data were entered into the EarthVision data base and a three dimensional model of the TCE distribution was constructed. The TCE data analysis was done independent of the geologic model so that the interpretation of vertical distribution would be based only on the actual vertical location of the sample. Any observed correlation between the projected distribution of TCE and the geologic model would then be a result of the natural correlation between the data sets. An oblique view of the three dimensional TCE plume is provided and shows the estimated extent of the 5 ppb TCE surface.	
<u>Lithologic Control of Contaminant Distribution</u> **Figures are presented which show horizontal slices depicting both geology and TCE distribution. These Figures are the result of slicing both of the three dimensional solid models at 5 foot intervals from the highest elevation of the water table to an elevation 40 feet below the lowest point of the water table. The Figures are provided in pairs. The first part of each pair shows the geology as fine grained and coarse grained deposits with no TCE information. The second part is a clear overlay showing the projected TCE concentrations down to 5 ppb along with geology only in areas outside the TCE plume. There are a total of 26 Figures attached as 13 pairs. These Figures illustrates the complexity of the distribution of the coarse and fine grained materials and distribution of TCE. Figures from elevations ranging from 120 MSL to 140 MSL show the TCE**	

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distribution separating into two apparently distinct plumes. In addition, the high concentration under buildings 297 and 296 shifts from underneath building 296 toward 297 as depth increases. This separation and shifting is apparently coincident with the occurrence of a large area of fine grained materials which develops with increasing depth. This observation suggests that there may have been two distinct sources in this area and that at depth there remains a separation in these contaminant masses. The other important observation from these figures is that the TCE concentrations seem to be highest in the fine grained materials and have not spread into the more permeable coarse grained material at these depths. This observation suggest the possibility that phase separate contaminants are responsible for the concentrations observed in 24CPT83 (3100 ppb) even though the levels typically expected from a phase separate source would be higher. Figures from 140 MSL to 180 MSL suggest that the contaminants occurring in shallow locations are in coarse grained materials and are spread over a larger area and are more diffuse. This may be indicative of a combination of lower residual concentrations likely present in the more permeable layers and the larger volume of mobile groundwater available to dilute and move the TCE contamination from its original location. It appears from this analysis that the lithology at the site is affecting the distribution of TCE, but the contaminants are not necessarily concentrating in the coarse grained deposits. A more detailed analysis of lithologic data may provide some additional guidance on the relative contribution of lithology and original source location and distribution of TCE. An example would be including a transitional lithologic group between coarse grained and fine grained. An intermediate textural group would likely highlight the lack of very fine grained materials such as clay and determine if the few clays present are influencing contaminant distribution. The occurrence of silty sands and clayey sands would be included in this intermediate textural group. This would also highlight the impact of these units included as coarse grained	

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deposits, but having significantly different hydraulic properties.	
Data Gaps **There is some bias included in this analysis by the distribution of the available data, the data collection method and the goals of the original data collection activities. The spatial analysis provided through EarthVision helps provide some input on where additional data would be helpful in achieving the most complete and appropriate level of understanding. A data gap identified from this analysis is the area between buildings 296 and 297. This is an area where the existing data suggest a separation at depth between tow coarse grained sediment zones and the location of a high TCE concentration at approximately 122 ft. MSL. The nature and completeness of this lithologic separation could have a dramatic effect on the effectiveness of the planned remediation. The observed TCE concentration at 122 ft. MSL also suggests the need for additional TCE data in the area at similar depths using a more repeatable data collection technique. Additional data at several locations at depths greater than 120 ft. MSL would be extremely helpful in confirming the location of the highest contamination and in completing the site conceptual model with respect to TCE migration.**	These data gaps are being addressed by the groundwater remediation pilot tests.
Extraction Well Layout **Review of the proposed extraction well layout for Alternative 11 does not suggest that the distribution of extraction wells is based on lithologic data interpretation. Given the variability in both the lithology of the subsurface and the distribution of TCE, a layout designed to maximize the effectiveness of each well would be appropriate. In addition, the design of the associated injection wells does not seem to take into account geologic variability. EPA recommends locating a focused number of extraction wells in areas known to be coarse grained and connected with the more highly contaminated zones. Similarly, the injection wells would be best located in areas most in need of further flushing action. This approach**	CLEAN II concurs that extraction and injection well locations should be carefully selected to maximize their efficiency. This is currently being done using a team-approach to complete the groundwater remediation pilot testing. The decision to go forward using a numerical approach or analytical approach will be made after the groundwater remediation pilot tests are completed.

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would likely result in fewer wells and a more focused remedial effort. This type of analysis would also require the use of a ground water flow model that is capable of a focused analysis in the area of Site 24. This could be accomplished with the existing MODFLOW model, but would require some grid modifications to provide the level of detail best suited to extraction system design.	

RESPONSE TO COMMENTS
DRAFT PHASE II FEASIBILITY STUDY -
OPERABLE UNIT 2A, SITE 24
MCAS EL TORO, CALIFORNIA

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GENERAL COMMENT **Overall, the document was well-written and well-organized. The ARARs discussion was particularly well-done - it was thorough, well-reasoned, and specifically tailored to the chemicals/locations/actions on site. In other words, it avoids the general pitfall of ARARs discussion which is to have a laundry list of the whole universe of ARARs, without a clear explanation of when these requirements would be ARARs.**	***RESPONSE TO GENERAL COMMENT*** Comment noted; the Department of the Navy (DON) and our contractor, CLEAN II, appreciate your thoughtful review.
SPECIFIC COMMENTS 1. **Page ii: Third full paragraph, last sentence - states that offstation, the maximum reported TCE concentration is 35 micrograms per liter. Somewhere in the document, I think it states 34 micrograms per liter.**	***RESPONSES TO SPECIFIC COMMENTS*** **RESPONSE 1**: Both of the values are incorrect and will be changed in the draft final FS. According to the Orange County Water District, the maximum TCE concentration (47.8 micrograms per liter) was encountered in well MCAS-7 on December 22, 1995.
2. **Page iv: Second bullet under Vadose Zone - states that vadose zone remediation will continue until the average VOC soil gas concentrations are below the threshold concentration capable of contaminating groundwater above the MCLs. Question: Where will this be measured and how?**	**RESPONSE 2**: Soil gas samples will be collected from the effluent flow from soil vapor extraction wells and submitted to a certified laboratory for analysis of VOCs. The results of the laboratory analysis will be compared to the VOC threshold concentrations to determine when SVE is no longer necessary to prevent the VOCs in soil from contaminating the shallow groundwater unit above the MCLs. The locations of the SVE wells will be determined during the remedial design phase.
3. **Page iv-v: Under remedial action objectives for groundwater, it doesn't make it clear that the groundwater in the shallow unit and in the principal aquifer will be cleaned up to MCLs and that groundwater which will be reinjected will be treated to nondetect levels.**	**RESPONSE 3**: The remedial action objectives for the principal aquifer are found in the OU-1 IAFS. The OU-1 remedial action objective for groundwater downgradient of the source areas is to reduce concentrations of VOCs in the area of concern in the shallow groundwater unit and the principal aquifer to federal or state cleanup levels (which in most cases are MCLs). The remedial action objectives for the shallow groundwater unit at OU-2A are addressed in the Site 24 FS and are as follows: • prevent use of groundwater containing VOCs above cleanup levels for domestic use;

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	• contain migration of VOCs above the cleanup levels in the shallow groundwater unit beyond the point of compliance; and • reduce concentrations of VOCs in the Site 24 shallow groundwater unit downgradient of the point of compliance to federal or state cleanup levels. The remedial action objectives for the shallow groundwater unit are designed to assure that groundwater passing the point of compliance is at or below the MCL. This does not necessarily mean that all groundwater in the shallow groundwater unit under the Site 24 waste management area will meet MCLs. VOCs in reinjected groundwater will be cleaned to non-detect levels prior to reinjection. For TCE this is 0.5 μg/L.
4. **Page vi: Third full paragraph, second sentence - states that alternative 6a and 10 will increase the mobility of TCE into deeper groundwater units. Why is this the case?**	**RESPONSE 4**: Remedial pumping dewatering occurs over the entire thickness of the shallow groundwater unit in Alternatives 6a and 10. This draws TCE into the lower half of the shallow groundwater unit and nearer the influence of vertical gradients developed by agricultural pumping. These mobilize TCE into deeper stratigraphic layers. This phenomenon is illustrated using groundwater modeling and is discussed in Section 4 and in Appendix D.
5. **Page 1-7: Section 1.3 - mentions for the first time (and I believe the last time) site 25 as part of OU-2A. Therefore, it is not clear to me whether Site 25 was evaluated and is considered part of OU-2A.**	**RESPONSE 5**: Site 25, the Major Drainages, is considered part of OU-2A. Site 25 was included in OU-2A because it was believed that the drainages might be contributing to the regional groundwater plume. The Phase II RI report for Site 25 was submitted as an addendum to the Site 24 RI in January 1997. The report was delayed due to lack of rainfall, which was needed for surface water sampling in the drainages. The RI investigation of OU-2A showed that Site 24, and not Site 25, was the source of the regional groundwater plume and Site 25 was approved for no action in the Record of Decision for the OU-2A and OU-3A No Action Sites. The site is only briefly discussed in the draft final FS report for Site 24 groundwater.

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6. Page 1-8: Second to the last sentence in full paragraph in Section 1.32 - It is not clear to me what we mean in the sentence that reads "The dividing line that separates OU-1 and Site 24 is approximated by the 5 μg/l TCE contour in the southwestern portion of the Station." Please clarify.	**RESPONSE 6**: The relationship of OU-1 and Site 24 is shown on Figure 1-4. The dividing line between the two areas has been modified. It is represented by a line drawn through monitoring wells 24NEW7, 22_DGMW47, 10_DGMW77, 18_PS8, and 18_PS3. The division also represents the point of compliance for the groundwater plume that originates from Site 24.
7. Page 2-5: Under remedial action objectives for groundwater - states as one of the objectives is to ensure the continued beneficial use of groundwater in the principal aquifer. It doesn't say how this will be accomplished.	**RESPONSE 7**: The second remedial action objective for Site 24 has been revised to clarify how the continued beneficial use of groundwater in the principal aquifer will be ensured by the Site 24 remedial actions. Please see the response to Comment 3 above.
8. Page 2-18: This section discusses institutional controls. The last sentence in the first paragraph states "[r]emedial alternatives are evaluated for soil that have the potential to contaminate groundwater above MCLs." What does this have to do with institutional controls? In the second paragraph in this section, it identifies long-term monitoring of groundwater conditions and allocation of an alternative water supply in the list of possible institutional controls. These two are not what we typically refer to as institutional controls. The groundwater monitoring may be necessary to determine whether institutional controls such as deed and access restrictions are still necessary. Provision of an alternative water supply may be part of a groundwater remedial action.	**RESPONSE 8**: The discussion of institutional controls has been expanded to address the types of deed and access restrictions that are anticipated to be required to minimize exposure to contaminated groundwater and to provide access for operation of the groundwater remediation system and monitoring the progress of remediation. The last sentence in the first paragraph has been deleted. A separate section has been added to the FS to discuss monitoring.
9. Page 4-17: Last paragraph evaluates whether alternative 1 (No Action) would comply with ARARs. ARARs are only triggered when a remedial action is taken. Therefore, an ARARs discussion is not necessary for a no action alternative. Please make this correction here and in other parts of the FS where ARARs is discussed for alternative 1.	**RESPONSE 9**: The text has been revised to note that an ARARs discussion is not appropriate for Alternative 1.

Originator: Thelma Estrada, ORC **To:** Bonnie Arthur, RPM U.S. EPA **Date:** 15 October 1996	**CLEAN II Program** **Contract No. N68-711-92-D-4670** **CTO-0073** **File Code: 0222**
10. Page 4-31: Last sentence, first paragraph - mentions RWQCB General Groundwater Cleanup Permit. Later on, the FS makes it clear that this is not an ARAR because on-site remedial actions do not require a permit and because it appears this General Permit applies to TPH discharges. Nevertheless, the DON feels that it will comply with the substantive requirements of this General Permit. Please make it clear that these will be TBCs, not ARARs.	**RESPONSE 10**: The discussion of Alternative 2a, which contained this statement, has been deleted. However, the discussion of Alternative 9, which contains similar language, has been revised to clarify that the substantive requirements of the General Groundwater Cleanup Permit are TBCs for this action.
11. Page 4-37: First paragraph under "Overall Protection of HHE" - states that contaminated groundwater extracted from the aquifers is treated to meet prescribed discharge objectives and transferred to the Irvine Desalter Project for treatment. What are these "prescribed discharge objectives?"	**RESPONSE 11**: The discussion of Alternative 6a, which contained this statement, has been deleted. While Irvine Desalter Project (IDP) discharge objectives are not ARARs for the DON remedial actions, the discussion of Alternatives 10a and 10b, which contain similar language, have been revised to read "Contaminated groundwater extracted from the aquifers will be transferred to the Irvine Desalter Plant (IDP) and treated by the IDP to meet the IDP prescribed discharge objective of 0.5 μg/L." The prescribed discharge objective for TCE is presented in Table 3-11 of the Irvine Desalter Project Preliminary Design Report. DON recognizes the MCLs as the cleanup levels for its remedial actions, not the detection limit. Groundwater will not be treated prior to discharge to the IDP as stated in Comment 11. Treatment occurs at the IDP.
12. Page 4-49: First paragraph under "Compliance with ARARs" states that the time period required to meet the MCL for the shallow groundwater unit and principal aquifer is significant. Elsewhere in the FS (Table 6-1), I think we actually have a specific number of years. Why not say that here and in the other narrative parts of the FS?	**RESPONSE 12**: The text will be changed to reflect the results of groundwater modeling, that is, an estimate of the time required to meet MCLs in the principal aquifer. As noted in Response 3, the shallow aquifer will be remediated to assure that groundwater at the point of compliance is at or below the MCL. This does not necessarily mean that all groundwater in the shallow groundwater unit under the waste management area will meet MCLs.
13. Page 4-57: Last paragraph on this page - this section does not state that the cleanup of the principal aquifer will be accomplished through natural attenuation. I think it is important to state that under this alternative, it is projected that MCLs for the principal aquifer will be met by natural attenuation.	**RESPONSE 13**: Section 4.4.5.2 has been revised to clarify that remediation of the principal aquifer will be accomplished through natural attenuation.

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14. Page 4-63: Section 4.5.2 states that alternative 1 will violate the RCRA groundwater protection ARARs. Please see comment above regarding ARARs and no-action alternative.	**RESPONSE 14**: The FS has been revised to state that Alternative 1, as the no action alternative, does not trigger ARARs.
15. Page A2-4: Row which identifies ACLs as ARARs under CERCLA. The identification of ARARs is part of the procedure for Superfund compliance with requirements of other environmental and public health statutes when conducting remedial actions. The establishment of site-specific ACLs is provided for under RCRA (40 CFR 264.94), with CERCLA 121 (d) (2) (B) (ii) providing a set of three additional conditions limiting the use of ACLs at Superfund sites where MCLs would otherwise be applicable or relevant and appropriate. The 3 conditions identified here should just be listed as a footnote.	**RESPONSE 15**: Page A2-4 has been revised to clarify that CERCLA 121(d)(2)(B)(ii) provides three criteria limiting the use of alternate control limits at Superfund sites where MCLs would otherwise be applicable or relevant and appropriate. The three criteria are reformatted as bullets to allow them to remain on the same page as the rest of the text.
16. Page A2-7: Second row - states that only the primary standards for VOCs are State ARARs for this action. Are these State standards more stringent than the federal ones? Please make this clear.	**RESPONSE 16**: This statement has been revised to state that the state primary standards for VOCs are considered ARARs only if they are more stringent than the federal primary standards.
17. Page A2-8: First paragraph under State and Regional Water Quality Control Board - since this only describes the Board's authority to establish water quality objectives, this should be deleted since this is not the ARAR. Alternatively, under the column comments, the sentence "[s]substantive provisions are ARARs" should be revised to read" "Substantive provisions which establish beneficial uses and water quality objectives for ground and surface waters are ARARs."	**RESPONSE 17**: The sentence under the Comments heading has been modified as suggested.
18. Page A2-10: Please clarify what the following (in the last sentence of the second paragraph) means as applied to this site - ". . . located at the hydraulically downgradient unit of the waste management area that extends throughout the uppermost aquifer underlying the regulated unit . . ."	**RESPONSE 18**: The point of compliance for the OU-2A groundwater remediation is represented by a line drawn through monitoring wells 24NEW7, 22_DGMW47, 10_DGMW77, 18_PS8 and 18_PS3. This is the dividing line between the OU-1 and OU-2A remedial activities.

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19. **Page A2-17: First and second paragraphs refer to waste discharge requirements that implement the water quality plan. Since these waste discharge requirements are typically in permits, please clarify that the permits are not the ARAR but the substantive requirements in the permits. Also, delete reference to secondary MCLs which are not ARARs as well as the substantive portions of the General Permit which are also not ARARs for reasons cited above. Both may be identified as TBCs if DON agrees they should be TBCs.**	**RESPONSE 19**: The first paragraph will be modified to clarify that only the substantive portions of the permits are ARARs. The reference to secondary MCLs and to the General Groundwater Cleanup Permit have been deleted from the second paragraph. A discussion clarifying that the substantive portions of the General Groundwater Cleanup Permit are TBCs is found in Section A2.2.2.7.
20. **Page A4-1: Delete A4.1.1, A4.1.2, A4.1.3 as ARARs are not triggered by a no action alternative.**	**RESPONSE 20**: These subsections have been deleted in the draft final FS.
21. **Page A4-2: Delete last row as record keeping requirements are not substantive requirements.**	**RESPONSE 21**: The row containing record keeping requirements has been deleted from Table 4-1.
22. **Page A4-8-10: Delete these requirements that pertain to DOT requirements. These DOT requirements apply to offsite activities and are therefore not ARARs, although the facility has to comply with them in any transport of hazardous materials offsite.**	**RESPONSE 22**: DOT requirements have been deleted. However, Pretransport Requirements from 22CCR66262.30 - .33 have been added to the table for consistency with the Site 24 Vadose Zone Record of Decision.
23. **Page A4-14: First row refers to waste discharge requirements. Again, make clear that the requirement is not the permit but the substantive requirements of such a permit. Also, on this page, delete reference to alternative 1.**	**RESPONSE 23**: The draft final FS has been revised to clarify that the ARAR is not the permit but the substantive requirements of the permit are ARARs. The reference to Alternative 1 has been deleted.
24. **Page A4-15: The row where Res. 92-49 is discussed - the last sentence two sentences should be deleted or rewritten. First, the last sentence should be deleted completely as this part of the resolution does not establish any new requirement. In other words, whether the requirements of Chapter 15 and Res. 68-16 are ARARs depend not on this section of Res. 92-49 but on an independent analysis of Chapter 15 and 68-16, as applied to the site and remedial actions on that site. The second to the last sentence should be rewritten so that it quotes directly the language of Res. 92-49 III.G, which is the only substantive requirement of Res. 92-49 that may be an ARAR.**	**RESPONSE 24**: The last two sentences have been deleted.

RESPONSE TO COMMENTS
DRAFT PHASE II FEASIBILITY STUDY
FOR SITE 24, OPERABLE UNIT 2A
MCAS EL TORO, CALIFORNIA

Originator: Tayseer Mahmoud, RPM Cal EPA **To:** Joseph Joyce, BRAC Environmental Coordinator MCAS El Toro **Date:** 11 October 1996	**CLEAN II Program** **Contract No. N68-711-92-D-4670** **CTO-0073** **File Code: 0222**
GENERAL COMMENTS	***RESPONSES TO GENERAL COMMENTS***
1. An alternative should be added to the FS which includes only the active remediation of Site 24 and excludes OU-1.	**RESPONSE 1**: Alternative 11 is such an alternative. Alternative 11 includes active remediation of Site 24 and excludes any action on OU-1 with the exception of monitored natural attenuation in the principal aquifer. The monitoring costs are presented separately for the Site 24 shallow groundwater unit and the OU-1 principal aquifer.
2. An alternative should be added to the FS which includes active remediation on-site and in situ remediation (natural attenuation) in the principal aquifer because it is unclear whether or not Alternative 11 proposes no action or natural attenuation of the principal aquifer.	**RESPONSE 2**: The discussion of Alternative 11 in Section 4 has been modified to clarify that Alternative 11 includes monitored natural attenuation in the principal aquifer.
3. The data and analysis generated by the SVE, air sparging, and aquifer pump test pilot studies should be included in the final draft of the FS and appropriate review time should be allotted. Additionally, in the future there should be a consensus with the BCT regarding submittal dates for work plans and reports concerning pilot studies.	**RESPONSE 3**: Data and analysis from the SVE pilot test studies were included in the draft final FS for the vadose zone. Data and analysis from the air sparging and aquifer pump tests are included in Section 5 of the draft final FS for Site 24 groundwater. Details of the pilot tests are found in the Aquifer Test Report and Air Sparging Pilot Test Report.
SPECIFIC COMMENTS	***RESPONSES TO SPECIFIC COMMENTS***
1. <u>Executive Summary, Development of Remedial Alternatives, page v</u>: The text is unclear whether or not Alternative 11 proposes no action or natural attenuation of the principal aquifer. If Alternative 11 proposes no action for the principal aquifer then the cost for groundwater monitoring should not be included.	**RESPONSE 1**: The text will be clarified to state that natural attenuation is being used in Alternative 11 for OU-1. Cost estimates for groundwater monitoring in the shallow groundwater and principal aquifer will be presented separately in the draft final FS.
2. <u>Section 1.3.2 Relationship Between OU-2A and OU-1</u>: This title should be revised because this section contains information regarding OU-2B, OU-2C, and OU-3.	**RESPONSE 2**: The title has been revised on the draft final FS report.

Originator: Tayseer Mahmoud, RPM Cal EPA **To:** Joseph Joyce, BRAC Environmental Coordinator MCAS El Toro **Date:** 11 October 1996	**CLEAN II Program** **Contract No. N68-711-92-D-4670** **CTO-0073** **File Code: 0222**
3. Section 1.4.4.2, Stratigraphy, Figure 1-7: Cross-Section B-B' on this figure should show a 1000 ppb contour.	**RESPONSE 3**: The cross-section illustrates individual groundwater sample results at each sample location. Both HydroPunch and monitoring well results are used. These data combine discrete sample results (over a 1-foot interval) with monitoring well results that represent an average over the interval of the well screen. The TCE contours in groundwater adequately demonstrate the vertical extent of groundwater contamination beneath Site 24. Additional data collected during the groundwater remediation pilot test may provide enough data to accurately draw a 1,000 μg/L contour; however, DON feels that with the present data, the extent of TCE contamination is best represented by the 500 μg/L contour.
4. Section 1.4.6.2, Saturated Zone, page 1-28: The text states that during the Phase II RI the horizontal characterization of VOCs were completed in groundwater. DTSC disagrees with this conclusion. Further horizontal delineation of VOCs in groundwater is needed down-gradient of Building 296. Also, further vertical delineation is needed in the area of 09_DGMW45. These data could be collected through pilot studies during the design phase.	**RESPONSE 4**: The Phase II RI was approved with the understanding that additional monitoring wells would be installed downgradient of Building 296 during the groundwater remediation pilot test field work. This work is currently being performed. As part of the groundwater remediation pilot test activities, 2 monitoring wells have been installed inside Building 296, 2 monitoring wells have been installed downgradient of Building 296, and three monitoring wells have been installed downgradient of Building 297.
5. Section 1.4.6.2, Saturated Zone, page 1-38: Regarding 24HCPT83, did the geologic material from which TCE was detected at 3100 ppb differs from the geologic material 16 feet deeper where the TCE was detected 26 ppb?	**RESPONSE 5**: Both samples were taken in sandy silts based upon interpretation of CPT data. The upper and lower samples are separated by a relatively thick silt section.
6. Section 1.4.7.3, Chemical Persistence, page 1-45: Although DTSC agrees that chemical and biological degradation of TCE is a minor component contributing to mass reduction, the rationale as to why the comparison of a field measured concentration to the regulatory concentration of TCE is used as an indicator of chemical and biological degradation should be provided.	**RESPONSE 6**: The statement on Page 1-45 was first made that chemical and biological degradation of TCE is relatively slow. The field-measured concentration was then compared to the MCL to suggest that the TCE hot spot is not a likely candidate for monitored natural attenuation without first removing TCE mass to the degree feasible. The second bullet on Page 1-45 will be modified to read, "TCE in the shallow groundwater was reported as high as 3,100 μg/L," and the rationale statement described above will be included.

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7. **Section 2.1, Development of Remedial Action Objectives: The National Contingency Plan (NCP) states that the "point of departure for excess cancer risk is 1E-06 and that risks estimated to fall in the range of 1E-06 up to 1E-04 should be managed on a case-by-case basis. The language in this section seems to state risks between 1E-06 and 1E-04 are always acceptable. Please change this section to conform with the NCP.**	**RESPONSE 7**: Section 2.1 has been revised to state that the remedial goals should be consistent with an excess cancer risk in the range of 10^{-6} or less.
8. **Section 2.1.4, Remedial Action Objectives, page 2-5: The fourth bullet under the Groundwater heading, as written, is not an RAO for Site 24. It is suggested to delete the fourth bullet and then modify the second bullet to include the fourth bullet.**	**RESPONSE 8**: The remedial action objectives have been revised as suggested. The fourth objective has been deleted since remedial action objectives (RAOs) for the principal aquifer are not appropriate in the OU-2A FS and because OU-1 RAOs are already presented in the OU-1 IAFS. The remedial action objectives have been reworded as follows: • prevent use of groundwater containing VOCs above cleanup levels for domestic use; • prevent migration of VOCs above cleanup levels in the shallow groundwater unit beyond the point of compliance; and • reduce concentrations of VOCs in the Site 24 shallow groundwater unit downgradient of the point of compliance to federal or state cleanup levels.
9. **Section 2.1.5.3, Cleanup to Background Level, Page 2-9: Please provide further explanation as to the intended meaning of the last sentence in this section.**	**RESPONSE 9**: This sentence refers to the fact that when a technology such as pump-and-treat is used to remediate groundwater, a point is reached where continued system operation does not result in a significant increase in the amount of mass removed (i.e., the curve showing mass removed over time becomes asymptotic). At this point, it becomes technically and economically infeasible to continue the groundwater remediation using pump-and-treat technology.
10. **Section 2.4, Identification and Screening of Technology Types and Process Options, Table 2-8: Given the available information received at the BCT meetings Process Options - Oxygen**	**RESPONSE 10**: CLEAN II concurs that given the available information that has been shared with the BCT to date has demonstrated that the implementation of air sparging is too fraught with difficulties to be considered

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enhancement and air sparging should be identified as Not Applicable. As shown from the preliminary information generated from the pilot study, air sparging is not a feasible technology, therefore oxygen enhancement is not either. Furthermore, the known lithologies underlying Site 24 indicate clay and silt layers throughout the area similar to the lithologies where the air sparing pilot study took place.	potentially applicable. Air sparging and oxygen enhancement will be identified as Not Applicable in the draft final FS.
11. <u>Section 3.2, Alternative Screening Methodology, Table 3-1</u>: This table should state "yes" in the column Retained for Evaluation for Alternative 2a because further evaluation of this alternative was provided in the document.	**RESPONSE 11**: While this was true in the draft FS, Alternative 2a is not retained for evaluation in the draft final FS because this alternative does not include SVE, the selected remedy for remediation of the vadose zone. Alternative 9, which is hydraulically equivalent to Alternative 2a, includes SVE and is retained for evaluation.
12. <u>Section 4.2, Groundwater Modeling, Page 4-4</u>: Model input parameters resulting from the aquifer pump pilot study is not substantiated. Please include the field data and analyses from the aquifer pump tests in the draft final.	**RESPONSE 12**: The aquifer test results are summarized in Section 5 of the draft final FS. Details of the aquifer testing are found in the Aquifer Test Report.
13. <u>Section 4.3.1, In Situ Soil Vapor Extraction Description, Page 4-6</u>: This section cannot be reviewed with regard to the SVE well field design until the field data generated from the SVE pilot study is submitted to the agencies.	**RESPONSE 13**: The SVE pilot test report was submitted to the agencies as part of the draft final FS for the Site 24 vadose zone.
14. <u>Section 4.4, Individual Evaluation of Remedial Alternatives, Figures 4-4 and 4-5</u>: Show the location of Culver Drive on these figures to give the reviewer a better feel of where the model predicts the plumes to reach.	**RESPONSE 14**: Culver Drive will be included on the figures that illustrate TCE in the principal aquifer. It is outside the map boundaries for the shallow groundwater unit and intermediate zone.
15. <u>Section 4.4.2.1, Description of Shallow Groundwater Unit & Principal Aquifer, Figures 4-6 and 4-7</u>: The presentation of the extraction and injection well fields are considered conceptual. It is assumed that there will be changes in the design phase. Also, as	**RESPONSE 15**: CLEAN II concurs that the well fields are considered conceptual and that there will be changes in the remedial design phase. Data collected during the groundwater remediation pilot test will assist in designing the actual field.

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shown on the figures, it is difficult to evaluate the locations of the wells because the map scales are too small.	
16. <u>Section 4.4.3.2, Long-Term Effectiveness and Performance for Alter. 6a, Page 4-38 & Section 4.4.5.2, Long-Term Effectiveness and Performance for Alter. 10, Page 4-50</u>: According to the model, shallow groundwater unit will be dewatered in approximately 17 years. This would cause downward hydraulic gradients to develop and mobilize TCE into deeper units. The BCT should discuss, at the design stage, the possibility of partial groundwater reinjection to flush the aquifer. Also, SVE treatment after the aquifer is dewatered.	**RESPONSE 16**: Comment noted.
17. <u>Section 4.4.6.2, Evaluation of Alternative 11 for Compliance with ARARs</u>: Alternative 11 does not have an active component for remediation of the principal aquifer. This subsection should discuss compliance with ARARs for the principal aquifer.	**RESPONSE 17**: Remediation of the principal aquifer will employ monitored natural attenuation as described in the OU-1 IAFS. The OU-1 IAFS established MCLs (or RBCs in the absence of MCLs) as cleanup goals for the principal aquifer. Modeling of Alternative 11 shows that MCLs will be achieved in approximately 31 years. Alternative 11 will thus comply with the chemical-specific ARARs for the principal aquifer. Additional discussion of compliance with ARARs in the principal aquifer is found in the OU-1 IAFS.
18. <u>Section 4.5.2, Compliance with ARARs, Page 4-63</u>: Reference to Alternative 61 is a typographical error. The correct reference is 6a. Also, the 1st sentence suggests that alternatives 2a, 6a, 9, 10, and 11 generally comply with their respective ARARs. See comment #17 above regarding Alternative 11.	**RESPONSE 18**: The reference to Alternative 6a has been removed since this alternative is no longer included in the FS. Alternative 11 also complies with the ARARs for Site 24 as discussed in the response to Comment 17.
19. <u>Section 5, Pilot Testing</u>: Please provide the SVE, air sparging, and groundwater extraction/injection pilot test reports for the testing conducted at Site 24 during Phase II RI/FS.	**RESPONSE 19**: The SVE pilot test report was included in the draft final FS for Site 24 vadose zone. The aquifer testing and air sparging pilot test reports are summarized in Section 5 of the draft final FS report for Site 24. Details of these pilot tests are found in the Aquifer Test Report and Air Sparging Pilot Test Report.

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20. Section 6.1, Results of Remedial Alternatives Evaluation, Page 6-2: The text states "Alternative 11 also facilitates natural attenuation of TCE in the principal aquifer in OU-1" but in Figure 3-1 it states "no action" for Alternative 11. No action does not equate to natural attenuation, although the terms are used interchangeable throughout the FS. The usage of these terms should be clarified and corrected as appropriate.	**RESPONSE 20**: Figure 3-1 has been modified to show that natural attenuation, not no action, is being considered for Alternative 11. Also, the text of the FS has been revised throughout to clarify the difference between no action and natural attenuation.
21. Section 6.2, Results of the Draft OU-1 IAFS: Reference to off-station TCE highest concentration of 34 μg/L is not accurate. OCWD data reflects higher numbers up to 47.8 μg/L. Please make the corrections.	**RESPONSE 21**: The highest off-Station concentration of TCE was incorrectly shown as 34 μg/L in the Executive Summary, in Section 6.2, and in Appendix A. The concentration has been corrected to 47.8 μg/L in all three places.
22. Section 6.3.2, Horizontal Groundwater Extraction/Injection, Page 6-4. DTSC agrees that a horizontal groundwater extraction/injection well may be a viable remedial technology, however, further information is needed before a pilot study is initiated. Information related to cost may be the determining factor as to the appropriateness of this alternative. This information can be compiled before initiating any field activities. Information should include, but not be limited to, comparative cost of vertical wells to horizontal well(s), additional piezometers needed to measure the influence of the horizontal well(s), and approach to capture zone analysis. The Navy may want to check with personnel associated with Sacramento Army Depot, where horizontal wells were successfully installed.	**RESPONSE 22**: At this time DON does not plan to perform a pilot study of a horizontal groundwater extraction/injection well.
23. Section 63.3, Air Sparging Using Ozone, Page 6-5: Given the preliminary results form the air sparging pilot studies, DTSC does not agree that a pilot study which involves air sparging using ozone should be conducted. Air sparging test results, as reported at the BCT meetings, showed that this remedial technology is not	**RESPONSE 23**: Given the available information that has been shared with the BCT, air sparging has been changed from a Potentially Applicable technology to Not Applicable. As such, no further pilot testing is planned.

Originator: Tayseer Mahmoud, RPM Cal EPA **To:** Joseph Joyce, BRAC Environmental Coordinator MCAS El Toro **Date:** 11 October 1996	**CLEAN II Program** **Contract No. N68-711-92-D-4670** **CTO-0073** **File Code: 0222**
appropriate at Site 24, therefore it is reasonable to conclude that air sparging with ozone is also not appropriate for this site.	
24. <u>Appendix A, Table A2-3, Chemical-Specific ARARs</u>: Some chemicals in this table did not have risk base concentrations (RBCs). The following information on three chemicals might be useful:	**RESPONSE 24**: These data will be incorporated into the document.
a. <u>Dichlorodifluoromethane</u>: This compound is also known as Freon 12. As of August 1996, U.S. EPA Region IX gives residential Preliminary Remediation Goals (PRG) of 94 mg/kg in soil and 390 μg/L in water. These are based on an oral reference does (RfD_o) of 0.2 mg/kg-day and an inhalation reference does (RfD_i) of 0.057 mg/kg-day.	**RESPONSE 24(a)**: The PRG of 390 μg/L has been added to Table A2-3 as the risk-based concentration for dichlorodifluoromethane.
b. <u>2-Butanone</u>: This compound is also known as methyl ethyl ketone. As of August 1996, U.S. EPA Region IX gives residential PRGs of 7,100 mg/kg in soil and 1,900 μg/L in water. These are based on an RfD_o of 0.6 mg/kg-day and an RfD, of 0.6 mg/kg-day.	**RESPONSE 24(b)**: The PRG of 1,900 μg/L has been added to Table A2-3 as the risk-based concentration for 2-butanone.
c. <u>2-Hexanone</u>: This compound is also known as methyl-n-butyl ketone. No PRGs or reference doses are published for this chemical. However, n-hexane is metabolized in mammals first to 2-hexanone then to the neurotoxic 2, 5-hexanedi-one. Therefore, n-hexane is an adequate surrogate compound. As of August 1996, U.S. EPA Region IX gives residential PRGs for n-hexane of 110 mg/kg in soil and 350 μg/L in water. The PRG in soil is the saturating concentration, while the PRG for tap water is based on an RfD_o of 0.06 mg/kg-day and an RfD, of 0.057 mg/kg-day. **Table 4-1 in the Draft Final Risk Assessment gives the same RfD_o and RfD_i for dichlorodifluoromethane and 2-butanone,**	**RESPONSE 24(c)**: The PRG of 350 μg/L has been added to Table A2-3 as the risk-based concentration for 2-Hexanone.

Originator: Tayseer Mahmoud, RPM Cal EPA **To:** Joseph Joyce, BRAC Environmental Coordinator MCAS El Toro **Date:** 11 October 1996	**CLEAN II Program** **Contract No. N68-711-92-D-4670** **CTO-0073** **File Code: 0222**
but his table shows no values for 2-hexanone. Risk-based concentrations for chemicals of potential concern are not shown in the human health risk assessment. PRGs are risk-based concentrations which do not contain any site-specific information.	
25. <u>Appendix A, Section A3.1.1, ARARs, Floodplains, Page A3-8</u>: The paragraph discussed the ARAR relevancy of Section 66264.18(b), CCR, Title 22. Although the concentration of TCE in groundwater may not be classified as hazardous waste when managed, OU-2A addresses a situation where a pollutant is being remediated to prevent environmental degradation as is the purpose of the RCRA regulation. Discharging of contaminated groundwater to surface or injection would not be allowed if the groundwater was hazardous. Also, for this non-hazardous groundwater, the contaminated groundwater should be handled like hazardous waste. This is why 66264.18(b) would be relevant. That section requires proper construction.	**RESPONSE 25**: Groundwater will not be discharged to the surface. Groundwater that is reinjected into the shallow groundwater unit and principal aquifer will be treated to remove VOCs to a concentration less than the laboratory detection limit (0.5 μg/L).
26. <u>Appendix A, Section A4.2.1.1, ARARs, Page A4-21</u>: Reference to 22 CCR 66364.193 is a typographical error. The correct reference is 22 CCR 66264.193. Section 66264.193(c) requires leak detection if the unit cannot be inspected visually. The leak detection for underground piping can be placed in the annual of the double-walled pipe.	**RESPONSE 26**: The typographical error in Section A4.2.1.1 has been corrected as suggested.
27. <u>Appendix E, Table E2.3, Page E-4</u>: A footnote text is not provided for footnote letter (c) shown in the table. Also, the number of SVE samples calculated may not be accurate. Please explain how you arrived at the number.	**RESPONSE 27**: This comment refers to the Site 24 vadose zone FS, not the Site 24 FS for groundwater. Footnote letter (c) has been removed from the draft final Vadose Zone FS. Appendix E of the draft final Vadose Zone FS assumed that 48 SVE wells would be used for remediation at Site 24. The number of samples was based on testing one-third of the SVE wells monthly for 21 months. Section E2.2.1

Originator: Tayseer Mahmoud, RPM Cal EPA **To:** Joseph Joyce, BRAC Environmental Coordinator MCAS El Toro **Date:** 11 October 1996	**CLEAN II Program** **Contract No. N68-711-92-D-4670** **CTO-0073** **File Code: 0222**
	of the draft final FS for the Site 24 Vadose Zone was revised to explain the basis for the number of samples.

RESPONSE TO COMMENTS
DRAFT PHASE II FEASIBILITY STUDY
FOR SITE 24, OPERABLE UNIT 2A
MCAS EL TORO, CALIFORNIA

Originator: Lawrence Vitale CRWQCB **To:** Tayseer Mahmoud, RPM Cal EPA **Date:** 8 October 1996	**CLEAN II Program** **Contract No. N68-711-92-D-4670** **CTO-0073** **File Code: 0222**
GENERAL COMMENTS **Executive Summary, Page iii, Nature and Extent of Contamination: The 4th paragraph, last sentence states, "Off-station, the maximum reported TCE concentration is 35 micrograms per liter. However, TCE in the principal aquifer has been detected at levels near 50 micrograms per liter in various other wells; please explain these findings.**	***RESPONSES TO GENERAL COMMENTS*** This number will be corrected throughout the text to reflect maximum groundwater TCE contamination levels of 47.8 micrograms per liter.
Executive Summary, Page iv, Remedial Action Objectives: The second objective states, "minimize the off-station migration of VOC - contaminated groundwater in the shallow groundwater unit." Please define "minimize". We recommend control of off-station migration such that the contamination is contained and/or reduced through natural attenuation or treatment. The goal should be no migration beyond the established plume boundary.	The remedial action objectives have been reworded as follows: • prevent use of groundwater containing VOCs above cleanup levels for domestic use; • prevent migration of VOCs above cleanup levels in the shallow groundwater unit beyond the point of compliance; and • reduce concentrations of VOCs in the Site 24 shallow groundwater unit downgradient of the point of compliance to federal or state cleanup levels.
Section 2 - Identification and Screening of Technologies, Table 2-8, Page 2-47: The first option, on page 2-47, Natural Attenuation, states no action to implement and no direct cost. However, natural attenuation would incur costs to measure/evaluate if natural attenuation is effective. In addition, natural attenuation may require the additional installation of monitoring wells in strategic locations to aid in demonstrating its effectiveness.	The table has been corrected to note that there will be costs associated with monitoring the effectiveness of the natural attenuation option.
Section 6 - Conclusions and Recommendations, Page 6-1: The second paragraph states, "the natural attenuation alternative requires implementation of a detailed groundwater monitoring plan to monitor the progress of remediation". In addition to monitoring natural attenuation progress, the alternative should also include a contingency plan to address the possibility that natural attenuation may not be progressing satisfactorily and active intervention may be necessary.	DON agrees that a contingency plan is necessary for the case where natural attenuation does not prove effective in remediating the principal aquifer. This plan is provided in the OU-1 IAFS.