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MCAS EL TORO
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☐ APPROVAL

☒ OTHER

Gov't (Agency) Comments "Draft Operable Unit 1, Interim-Action Feasibility Study Report", Dtd 1 Sep 94 (EPA Region IX)

**ACTION REQUIRED**

☐ WORK AUTHORIZATION (R. Ward)

☐ OTHER

JAN 3

TITLE: AGENCY COMMENTS "DRAFT OPERABLE UNIT 1, INTERIM ACTION FEASIBILITY STUDY REPORT"

AUTHOR: BONNIE ARTHUR/EPA

DATE: 11/16/94

CATEGORY: 4.2

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***NOTE: *Location designator dictates further distribution to applicable RCMs.*

# MEMORANDUM

CH2M HILL

**TO:** Andy Piszkin/SWDIV
Joseph Joyce/SWDIV
Ginny Garelick/SWDIV
Bonnie Arthur/EPA
Juan Jimenez/CAL-EPA/DTSC
Larry Vitale/SARWQCB
Dante Tedaldi/Bechtel

**COPIES:** Davi Richards/CH2M HILL/CVO
Yueh Chuang/CH2M HILL/SDO
Hooshang Nezafati/CH2M HILL/SCO

**FROM:** John Dolegowski/CH2M HILL

**DATE:** 17 January 1995

**SUBJECT:** Summary of Issues for Discussion Based on Agency Comments

**PROJECT:** MCAS El Toro OU-1 Interim Action Feasibility Study (IAFS)

Attached is a summary of issues on the IAFS for discussion in the MCAS El Toro meeting in San Francisco on Wednesday, 18 January 1995.

UNITED STATES ENVIRONMENTAL PROTECTION AGENCY
REGION IX
75 Hawthorne Street
San Francisco, CA 94105-3901

November 16, 1994

Mr. Wayne Lee, Assistant Chief of Staff
Environment and Safety
MCAS El Toro
P.O. Box 95001
Santa Ana, CA 92709

CLE-001-01F145-F7-0004

Dear Mr. Lee:

EPA has reviewed the "Draft Operable Unit 1, Interim-Action Feasibility Study Report," prepared for Marine Corps Air Station, El Toro, California, dated September 1, 1994. Draft comments were hand delivered to the Navy on November 10, 1994, to facilitate the revision process. Please address the enclosed comments (Enclosure A and B). If you have any questions, I can be reached at (415) 744-2389.

Sincerely,

Bonnie Arthur
Remedial Project Manager
Federal Facilities Cleanup Office

Enclosures

cc: Mr. Juan Jimenez, DTSC
Mr. Larry Vitale, RWQCB
Mr. Joseph Joyce, SW DIV
Mr. Andy Piszkin, SW DIV
Mr. Dante Tedaldi, Bechtel

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OPTIONAL FORM 99 (7-90)
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| To Andy Piszkin | From Bonnie Arthur |
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# EPA COMMENTS ON MCAS EL TORO
# DRAFT OU 1 INTERIM-ACTION FEASIBILITY STUDY (FS) REPORT

## ENCLOSURE A

**GENERAL**

1) EPA concurs with the Navy's "interim action" approach because of the priority to expeditiously contain the volatile organic compound (VOC) contaminated shallow groundwater prior to the start-up of Orange County Water District's (OCWD) proposed Desalter project. We also agree with the selected alternative of onsite extraction and treatment using air stripping and vapor phase carbon, prior to piping to the OCWD treatment system and their delivery of potable water.

Prior to the selection of the final remedy in the basewide groundwater Record of Decision, however, a more thorough analysis and consideration of innovative technologies is necessary. Additionally, EPA is strongly supportive of removal of sources of groundwater and soil contamination, and agrees with the proposal to consider other source removal alternatives after further data is obtained in Phase II investigations.

There are a few difficulties with the presentation in the FS as noted below: a) a table with shallow and principal aquifer inorganic levels should be included in the report (RI table will suffice),

b) The FS should clarify the use of "containment" versus source area extraction for Alternatives 4a and 4b (onsite extraction wells). As cited below, there are inconsistencies in the text for the intent of this alternative: 1) "removal of contaminants directly at their source(s) in the southwestern portion of the station is being deferred" (pages ES-9, ES-11, 3-21, 4-1, 4-12, 7-26), 2) "a significant amount of contaminated groundwater will be captured by the shallow extraction wells close to the suspected source of TCE contamination (Page 5-17), 3) "...shallow extraction wells likely provide containment close to the suspected source areas, and significantly reduce overall concentration of contaminants within the Shallow Aquifer" (page 5-38), and 4) "The objective of the shallow extraction downgradient of the TCE contamination is to contain highly contaminated groundwater in the Shallow

Aquifer, close to the suspected source area" (page 5-7).

2) There are data gaps identified in the FS (for example, limited benzene data prevent a model run with benzene, page 5-3) and uncertainty associated with the use of models. After the Desalter wells are started up, model validity testing should be scheduled. At that time it will be essential to have additional data from further groundwater monitoring episodes.

3) It is stated several places in FS that data gaps (including groundwater "hot spot" definition) identified in Operable Unit 1 (OU 1) will be addressed by Operable Unit 2 (OU 2) investigations and reports. With the shift from CLEAN I to CLEAN II contractors, EPA is very concerned about coordination and planning for investigations (soil and groundwater) to address these data gaps. It is imperative that the OU-1 and OU-2 (CLEAN I and II) contractors coordinate closely to ensure that all contaminated groundwater is addressed at El Toro.

4) The Desalter is an offsite discharge alternative and should be included in Table 3-2. This list of discharge alternatives should not be marked N/A until the alternatives are evaluated. This discussion should evaluate each discharge alternative and the selected alternative must be protective of human health and the environment.

5) The discussion of hazardous waste classification is not consistent throughout the document. Please refer to the California Code of Regulations, Section 66261.20 (pages 6-27, 7-25).

6) Use consistent descriptions of aquifers, shallow and principal, throughout FS (i.e. pages ES-8, 5-10).

7) Extraction well locations are not clear on Figure 5-1. Please include a figure, of larger scale, for each alternative.

8) Alternatives 4 "a" and "b" should be more clearly delineated throughout the FS (Tables ES-1, 7-1).

9) Clarify throughout the FS that all cost discussions regarding the Desalter are preliminary since negotiations between the Navy and OCWD are ongoing.

10) Page 6-5; Units of expression should be consistent in the report; therefore, use either ppm or mg/L, ppb or µg/L.

**SPECIFIC**

1) Pages xi, xii; Correct the following items in the "Acronyms and Short Forms List:" a) add DON (Department of the Navy), MICR and b) $SO_3$ is incorrectly listed as sulfate.

2) Page ES-1; Clarify the content of each of the seven volumes. It appears that Volume 1 does not contain a summary of all documents.

3) Page ES-2; Provide further explanation for the interim action RI (starting with "a response action to the VOC contamination..."). For example, cite meetings with the regulatory agencies where consensus was obtained.

4) Page ES-2; Clarify which VOCS were detected in the "area identified during Phase I RI as having the highest detected levels of VOCs."

5) Page ES-2; The Desalter extraction/treatment system discussion should include that the pumping of the Desalter extraction wells will increase the vertical gradient.

6) Page ES-3; Figure ES-1 is incorrectly cited.

7) Page ES-6; Provide a summary of other VOCs (in addition to benzene and TCE) and inorganics. Refer to or include figures from RI with other compounds depicted.

8) Page ES-7; Clarify the difference between Maximum Contaminant Levels (MCLs) and Maximum Contaminant Levels Goals (MCLGs).

9) Pages ES-9, 4-1; In paragraph starting with "Removal of the contaminants...", clarify that there are two media involved (soil and groundwater).

10) Page ES-12; Please clarify the following two sentences which appear to be contradictory. "Desalter wells would reduce migration of TCE...within shallow aquifer-partially contain benzene-contaminated groundwater," and "desalter may significantly induce vertical migration of TCE...from high concentration zones in shallow aquifer into intermediate horizon and principal aquifer."

11) Page ES-12; The text for Alternative 3 mentions the need for additional wells; however, Alternative 3 doesn't include these wells and this point is not clear in the description.

12) Page ES-13; Provide greater detail regarding irrigation

wells.

13) Page ES-13; Clarify "...downgradient of the northeastern VOC contamination zones."

14) Pages ES-14, 7-4, Tables ES-1/7-1, ES-2; It is not appropriate to use a numerical ranking system for alternatives because these factors are qualitative only. Additionally, a preliminary discussion of community and state acceptance should be added, with more detail provided throughout the process as more state/community input is obtained.

15) Page ES-15; Tables ES-1 and 7-1 are very useful summaries. Please revise the tables to reflect these comments. Additionally, the "Compliance with ARARs column" for Alternatives 4a and 4b is confusing and should more clearly define the distinctions between the alternatives.

16) Page 1-8, 1-49; Include vinyl chloride in the discussion of degradation products.

17) Page 1-12; Possibly change "unconsolidated" to "sometimes restricts groundwater flow" as discussed on page 1-13.

18) Page 1-12; Please correct grammar starting with "additional evidence comprises boring logs..."

19) Page 1-13; Provide rationale for the short timeframe for the pump tests.

20) Page 1-19; For ease of reading, consider aligning the numbers by the decimal point. This comment applies to all tables in this document.

21) Page 1-25; Under the CLP program, contract required detection limits (CRDLs) are applicable to inorganics only. Contract required quantification limits (CRQLs) should be used when referring to organic CLP analyses. Please make this correction in all other tables and throughout the text of the document also (pages 1-33, 1-40, and 1-41).

22) Page 1-48; Clarify that there is only a **potential** exposure source via drinking water. It is EPA's understanding that no one is currently drinking contaminated groundwater from El Toro.

23) Page 1-48; The third bullet item should be supported by the data. Although the model predictions used as part of Alternative 1 seem to partially fill this need, inspection of the model figures does not strongly support the notion of widespread migration. For example, after 20 years, not much

migration would appear to have occurred when considering the 5 µg/L contours.

24) Page 1-49, Section 1.7; Organization of the FS should be addressed up front.

25) Page 2-4; Please ensure that the risk assessment section is updated with respect to the changes currently in progress, if applicable.

26) Page 2-15; EPA's protocol for the classification system was not finalized and text should be revised to reflect this.

27) Page 2-17; The discussion regarding the feasibility of achieving background levels as remedial objectives is incomplete. First, the criteria for selecting the RCRA groundwater protection standards as relevant and appropriate is not substantiated. If the source is a RCRA regulated unit, it is likely that these standards would be applicable, rather than relevant and appropriate (this will also be addressed by ARARs comments from regional counsel). Second, the text does not adequately address the two conditions which must be demonstrated in order to establish concentration limits greater than background. The technically and economically infeasible condition is not adequately addressed and the 2nd condition is omitted.

28) Page 3-1; Provide greater detail regarding institutional controls.

29) Page 3-2; Please delete the example of the "plug-in" ROD as it is not applicable to this interim FS/ROD.

30) Page 3-3, Table 3-2, "Effectiveness" for the no action alternative; Revise to state that "natural processes of biodegradation are not expected to be effective and are extremely slow." There is no evidence to support the assertion that natural biodegradation of VOC is potentially effective at this site. In addition, some of the by-products of biodegradation (vinyl chloride) are more problematic than the original contaminants.

31) Page 3-7; Please add to Table 3-2 that air stripping, in addition to steam stripping, may also result in scaling of the column and packing.

32) Page 4-5; Please clarify how Alternative 2 would "interfere with the planned Irvine Desalter Project" (see page 4-17).

33) Page 4-5; The arrow emanating from the plumes on Figures 4-2, 4-3, 4-4 should be removed. It may be misleading since

it seems to suggest that the remedial action would cause the plume to move in a new direction.

34) Page 4-12; Please provide the pumping rate for Alternative 2 as on page 4-17.

35) Page 4-12; The text here and elsewhere states that the pumping rate for the Desalter would be 8,000 ac-ft/yr. Because this expression of units is not commonly used in feasibility studies, please use gallons/minute or gallons/day.

36) Page 4-14; Provide further clarification and monitoring schedule/analytes for the "groundwater extracted from the downgradient end of the plume...used without treatment for agricultural purposes."

37) Page 4-19; Delete the following sentence pertaining to the disadvantages of the Navy's operation of an extraction and treatment system: "Although DON acts for Marine Corps...the absence of a local presence...make it more difficult to administer this alternative." Absence from a site is not an acceptable reason not to operate a treatment system. Many companies are required to operate a treatment system once their operations have stopped and they have moved out of an area.

38) Page 5-3; Please add the production rate used in the model calibration.

39) Page 5-3; The text cites that the available benzene plume data is insufficient to run the model for benzene. As mentioned in the general comments, after the Desalter wells are started up, further model validity testing should be scheduled. At that time it will be essential to have further data from groundwater monitoring.

40) Page 5-7; Provide the rationale for the 60-75 gpm rate.

41) Page 5-10; The aquifer terminology is confusing. What aquifer contains the 5 µg/L TCE concentration zone? Later in the paragraph a 50 µg/L TCE concentration zone is mentioned, but there is still no easily found definition of these terms. The FS should use only one system for description of contaminant zones.

42) Page 5-10; Please clarify whether the Desalter pumping results in an overall reduction or increase in contamination levels within the shallow aquifer.

43) Page 5-11, Figures 5-2a, 5-3; Please revise the titles of these figures. The current titles indicate that the figures

represent conditions within the shallow aquifer, but the figures show projected flow paths within the shallow and principal aquifers.

44) Pages 5-22 through 5-31; As Alternative 4 includes the shallow on-station wells, the FS should confirm the predictions related to extraction rates from these wells because there have been indications that 600 gpm may be unrealistic.

45) Page 5-34; Figure 5-8 is very difficult to interpret because in black and white there is almost no distinction between the flow lines and any of the other types of lines on the figure.

46) Page 5-38; It is unclear at this time whether the VOC migration in the northwest will be addressed by OU-2, as mentioned in the text. It is imperative that the OU-1 and OU-2 (CLEAN I and II) contractors coordinate closely to ensure that all contaminated groundwater is addressed at El Toro.

47) Page 6-1; Clarify which "relevant institutional issues" are not resolved. In general, more detail should be provided regarding institutional controls.

48) Page 6-4; Clarify whether institutional controls will be administered or enforced under the no action alternative; if institutional controls are included with Alternative 1, cost cannot be zero.

49) Page 6-6, 6-16; The statement that "VOCs are not expected to be removed by the RO System" may not be correct. Some reverse osmosis (RO) membranes can remove VOCs. The Navy should complete an evaluation of different RO membranes.

50) Page 6-15; Explain components of a Phase 1 archaeological survey.

51) Page 6-17; Radon discussion should include information regarding radon analyses/detections at any El Toro monitoring wells. Include rationale for assumption that the radon is naturally occurring.

52) Page 6-17, 6-41, 6-29; Clarify the following conflicting sentences: "...existing institutional controls by IRWD requiring a permit to drill a well continue in place" and "DON is currently investigating the need for additional institutional controls to prevent new, privately owned wells from accessing groundwater and inadvertently using it without treatment for domestic or other uses."

53) Page 6-18; Clarify the following sentence: "At the downgradient end of the TCE plume, a future response...would not be made technically more difficult by implementation of Alternative 3."

54) Page 6-19; Desalter discussion should include disadvantages of increasing the vertical gradients.

55) Page 6-20, Figure 5-1; The text for Alternative 4a cites Figure 5-1. Figure 5-1 depicts Alternative 4, not 4(a). Change Figure 5-1 "Alternative 4" title to Alternative 4 (a) and (b) on Figure 5-1. Also, provide a figure, with larger scale, for each alternative.

56) Page 6-20, Section 6.4.1; Provide greater detail pertaining to the following: "Formalize arrangements for potentially required future response at the downgradient end of the plume."

57) Page 6-21; Include a discussion of the viability of maintaining or achieving a pumping rate of 60 gpm/well. The text should identify potential contingency planning or consequences of the wells not maintaining the predicted flow. Will the objectives of Alternative 4 be met if the flow is less than predicted? Given the apparent uncertainty in the well yield, it may be appropriate to use a range of flow rates in the evaluations rather than a single value.

58) Page 6-29; Clarify if additional options will be necessary if Phase II data indicate that higher TCE concentrations in the source area exist. Other technologies in addition to hydraulic source control may be appropriate if higher concentrations are found.

59) Page 6-34; It is not correct to state that "...if TCE is removed to its MCL concentration, then all other VOCs present will be at or below their respective MCLs," especially if benzene or other difficult-to-treat contaminants are present.

60) Page 6-39; Provide a definition of "FRP" (Table 6-5) and "8 inch WC" (Table 6-6). Tables 6-5 and 6-6 should include a list of the contaminants present and respective influent and effluent concentrations. Is there a typographical error in Table 6-5 for flow rate?

61) Page 7-2; The maximum detected TCE value is missing from the text in the 4th paragraph.

62) Page 7-5; For Alternative 3, indicate which aquifer would eventually be flushed. EPA does not concur with the statement for Alternative 3 that "theoretically...no wastes

would remain onsite, and therefore no residual risk would persist." Soil contamination in the vadose zone would be unaffected by the desalter system and therefore contamination would remain, even in a theoretical evaluation. See the discussion on pages 7-13 and 7-14 of the FS.

63) Page 7-5; For Alternative 1, consider changing text to "Does not actively reduce toxicity, mobility, or volume." This would eliminate the confusing combination of "...increase reduction..."

64) Page 7-5; Alternative 4a, Short-term Effectiveness. Replace the term "hyperbolic value" with asymptotic value. Also, indicate where within Section 5 the discussion of asymptotic values is found.

65) Page 7-9; Here and elsewhere in the report all large cost figures (greater than $10M) should be rounded to the nearest million dollars and smaller costs should be rounded to the nearest hundred thousand.

66) Page 7-17, Table ES-1, 7-1; The Table does not correspond with the text for Desalter-only (Alternative 3).

67) Page 7-19; The statement related to the preferential sorption of VOCs onto fine grained material.

68) Page 7-21; Arsenic is a carcinogenic metalloid.

69) Page 7-21, 7-29; Short term effectiveness. Mention that "...normal risks associated with construction would result..." Explain measures to compensate for risks, i.e. approved health and safety plan.

70) Page 7-22; Revise and clarify the sentence "...could require half again to twice as long..."

71) Page 7-30; Please correct the typographical error in the second to last sentence of the 4th paragraph. Alternative 3 is stated twice, but the comparison is between Alternative 3 and Alternative 4.

72) Table 7-2; The table indicates that retardation has moderate effect on the contaminant concentrations. However, no retardation factor was used in the modeling efforts. The intent should be clarified.

73) Page 7-35; The uncertainty section is helpful, however, some context should be provided. It should be stated that an uncertainty section is typically not included in FS. Delete the sentence "...no parameters have an unacceptably

high degree of uncertainty and that the uncertainty for most parameters is relatively small." The text and model do not support this conclusion. Please see General Comment #2 regarding model validity testing.

**APPENDIX A**

1) Section 3.2.3; Since the shallow aquifer is unconfined, please use the term specific yield, instead of the term storage coefficient.

2) Section 4.2.2; The report does not adequately explain how the hydraulic conductivity data presented in Section 3 were used to define the hydraulic conductivity zones presented in Figures 4-4a, b, c. It would be helpful to present the hydraulic conductivity data on a map to facilitate the comparison of the hydraulic conductivity zones used in the model with the measured values. An example where differences in observed/modeled is MW 18BGM_MW14, near SE boundary. Observed K of 4.3 ft/day and modeled at 15 ft/day. Additionally, include a Figure similar to Figure 3-22 of the OU-1 RI Report to make the report more stand alone.

3) Section 4.2.5 (page 4-10); It would be helpful to expand the discussion on numerical dispersion to discuss the performance of CFEST in this respect based on past experience with the code.

4) Section 4.2.5 (page 4-12); The TOC (FOC) values as measured should be included and retardation should be calculated. Also, the discussion of the highest TCE concentration (1,000 ug/L instead of the observed maximum value of 2,000 ug/L) in the initial condition used in the model for the predictive simulations leaves some unanswered questions. Does the TCE distribution used as initial condition in the model provide the same total TCE mass as that estimated from the field observations? Does this mean that the discretization of the problem domain in the vicinity of the highest observed concentrations is too coarse?

5) Section 4.2.5 (page 4-13); The statement "Although variations in TCE concentrations...suggest that multiple sources of TCE may be present, the modeling approach assumes only one source of TCE contamination" needs further clarification. Does the one source included in the model provide the same TCE mass as the combined total of the individual sources? Some of the potential sources are located at substantial distances from each other. How does the omission of potential sources, e.g., the Magazine Road

Landfill source, affect the reliability of the model predictions? Additionally, a rigorous assessment of the potential of the presence of a "continuing" source, i.e. DNAPL, should be conducted (see guidance in Enclosure C). This DNAPL, if present, would serve as a continuing source for groundwater contamination via vapor phase and separate phase transport in addition to aqueous phase.

6) Section 5; Flow Model Calibration: Besides minimizing the RMS error between observed and simulated heads, it is equally important to match the ground water flow direction. The model in general matches the observed flow direction, but with two notable exceptions. The flow direction in the shallow aquifer at the base seems to be more to the west, while the interpreted flow direction is more to the northwest (compare Figure 5-1 with Figure 3-10). It would be instructive to include a Figure superimposing the two sets of contours to illustrate agreement, or disagreement in flow directions in critical parts, in terms of contaminant transport, of the simulation domain. How does this difference in flow direction affect contaminant transport predictions? The pumping center west of the base shown in the Fall 1992 data is not reproduced by the simulation (compare Figure 5-1b with Figure 3-11).

7) Section 5.1 (page 5-1); The definition of the RMS error should read "the RMS error is the square root of the average of the squared differences of..." instead of the "the RMS error is average of the squared differences of..."

8) Section 6; Solute Transport Model Calibration: It is recognized that it is practically impossible to meaningfully simulate the migration of contaminants over the past 50 years with no documented information about contaminant sources and limited information about ground water flow conditions during this period. However, there are two areas of disagreement between simulated and observed concentrations that merit further discussion. a) The simulated TCE plume is much wider than the observed plume. The report states that the lateral dispersivity used in the model calibration was equal to zero (page 6-3). This raises the question of why the simulated plume is so wide and calls for an assessment of the magnitude of lateral numerical dispersion in the model. It would be instructive to compare the simulated plume with particle tracks originating from the same sources as those used in the model calibration. The lateral extent of the simulated plume with the two methods should be about the same. If not, the difference might be attributable to lateral numerical dispersion. b) The calibration did not include any sources in the Magazine Road landfill area.

9) Section 6; It would be appropriate here to discuss the impact of using a steady-state flow field for calibrating the model over the last 50 years, in view of the fact that during this period there were significant changes in the direction of ground water flow, as suggested by the maps presented in Attachment 2.

10) Section 6.2 (page 6-2); The references to Figure 4-5 should be changed to references to Figure 4-4b. There is no Figure 4-7 in the report.

11) Section 7; Sensitivity Analysis: The sensitivity analysis presented in this section is focused on the model predictions, not the calibration. Therefore, this section should follow Section 8 which presents the model predictions for the base choice of input parameters.

12) Section 7.1.2 (page 7-3); The discussion of the sensitivity analysis for the specific yield is confusing. Since the principal aquifer is confined, the use of the term specific yield for this aquifer (layers 3, 4 and 5) is inappropriate.

13) Section 8.1 (page 8-1); Does the term "...time interval..." in the sentence "a 91-day time interval was used in these simulations" mean "time step", or does it mean something else?

14) Section 8.3.1 (page 8-7); In the sentence "The Desalter extraction wells are..." the reference to Figure 8-9 should be changed to Figure 8-5.

15) Sections 6, 7, and 8; The Principal Aquifer is represented in the model by 3 layers (layers 3, 4 and 5). However, all the contaminant transport simulation results presented in Sections 6, 7 and 8 are described as contaminant distributions in the Principal Aquifer. Are these average (geometric mean) concentrations of the concentrations in layers 3, 4 and 5? What is the vertical distribution of contaminants in the Principal Aquifer predicted by the model? Are there any field data to establish the vertical extent of contamination in the Principal Aquifer?

16) Section 9; Model Uncertainty and Limitations: The discussion of the model limitations should address the potential impact of numerical lateral dispersion on the simulated contaminant distribution. The simulation results (Figure 6.1) suggest that the lateral numerical dispersion may affect the model results. This would affect both the lateral extent of the simulated plumes and the their peak concentrations.

17) Section 9.3; What is the uncertainty arising from hydrologic conditions (wet vs. dry years) and their impact on aquifer recharge. An evaluation of all past WDR ground water level maps in conjunction with hydrologic data for the same period could provide insight into any relationship between the temporal and spatial distribution of recharge and changes in ground water flow direction.

18) Section 9.4; The discussion of uncertainty in calculated concentrations should address ongoing contamination sources.

19) Section 9.5; The recommendations on improvements to the model should include an evaluation of other potential contamination sources, including potential presence of DNAPL.

20) References; The list of references is incomplete. For example, it does not include the references Cherry (1994) and Neuman (1987) cited in page 4-10.

**APPENDIX B**

Please see Enclosure B.

**APPENDIX C**

1) Table C-5; It is not clear what the Removal (%) column refers to. Provide clarification of basis for removal calculation.

**APPENDIX D**

1) Page D-3; Radon measurements should be added to the Phase II groundwater studies.

2) Page D-7; Add the complete reference with date and source of publication for the article by Ford et al.

3) Table D-6; The footnote is not linked to the correct entry in the body of the table.

**APPENDIX E**

1) Tables E-1, E-2, and E-3; The additions to the construction costs, represented as 5 to 20% multipliers, seem a bit on the high side in total; however, since these factors are applied uniformly this fact should not affect the cost comparisons between alternatives. In most cases, engineering design under CLEAN I and CLEAN II cannot exceed 7 percent of the capital cost.

2) Table E-1, E-2, and E-3; Any mechanical system that

operates for a period of 40 years will undoubtedly require frequent repair of major components periodically during this period and probably may need complete replacement of most major components at least several times during this long period of performance. These additional non-annual O&M costs are absent from the estimate basis and these items will probably represent a significant cost when viewed as part of the present worth analysis.

3) Tables E-1, E-2, and E-3; As noted earlier, all large cost figures (greater than $10M) should be rounded to the nearest million dollars and smaller costs should be rounded to the nearest hundred thousand. There is no reason to believe that a greater level of accuracy exists for these estimates.

**APPENDIX F**

1) Page F-16; provide an explanation of Field's hydraulic calculator.

**APPENDIX H**

1) Page H-3; Does V represent the total cell volume or the pore volume?

2) Page H-7; The computer model assumed no retardation, i.e., retardation factor equal to unity. Why was a retardation factor of 2 used for these calculations? The calculations are highly sensitive to the retardation factor and therefore a range of values should have been used as part of a sensitivity analysis, rather than a single value.

3) Page H-9; Third sentence of the first paragraph. Clarify the statement "...based strictly on soloing the mass balance equations..." It appears to be an error.