

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

30 March 2007

Mr. Darren Newton
BRAC Environmental Coordinator
Base Realignment and Closure
7040 Trabuco Road
Irvine, California 92618

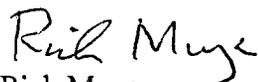
RE: Comments on the Draft Feasibility Study (FS) Report, Installation Restoration Program (IRP) Site 1, Former Explosive Ordnance Disposal (EOD) Training Range, Former Marine Corps Air Station (MCAS) El Toro, California

Mr. Newton:

The EPA has reviewed the subject document. This review has resulted in a significant number of comments on the draft document; however, we point out that many of the comments are repetitive as the information in question is presented in multiple sections of the report. EPA presents in the attachment our comments on the Draft FS Report.

If you should have any questions, please feel free to contact me at 415-972-3349.

Sincerely,



Rich Muza
Remedial Project Manager
Federal Facility and Site Cleanup Branch

cc Content Arnold, NFECSW SDIEGO
Jim Callian, NFECSW SDIEGO
Quang Than, DTSC
John Broderick, RWQCB
Bob Woodings, RAB Co-Chair
Marcia Rudolph, RAB Subcommittee Chair

received
4/9/07

COMMENTS ON THE DRAFT FS REPORT FOR IRP SITE 1, EOD TRAINING RANGE, FORMER MCAS EL TORO, CALIFORNIA

GENERAL COMMENTS

- 1. Section 4.5 and Tables 4-1, 4-2, & 4-3 --** The tables show the identification and screening of technology types and process options for munitions and explosives of concern (MEC)-impacted soil, naphthalene-impacted soil, and perchlorate-impacted groundwater. The discussion in the text does not clearly indicate why all technology types and process options included/discussed in the tables are not further discussed in the text of the FS Report (i.e., Section 5, Section 6, Appendix A, or Appendix G). According to the tables, the costs provided in the tables are estimates relative to the other process options provided; however, it is unclear what criteria/information was used to develop the cost estimates/comparisons as only a few of the process options are further assessed in Appendix G. It is recommended that Section 4.5 be revised to further describe the approach and to clarify the information utilized in the identification and screening of process options for the media of concern at IRP Site 1.
- 2. Section 5 --** Several alternatives require pre-design pilot studies to determine if the alternative can be implemented at the site. It is unclear if the remedial alternative would actually be selected prior to these pre-design pilot studies or if these studies would be conducted prior to any final remedy decisions. Based upon information provided in Appendix G, it does not appear that the pre-design pilot study costs have been accounted for with the associated alternatives. It is recommended that the FS be revised to clarify 1) how pre-design pilot studies will be handled and 2) what will happen if the pilot studies prove a specific/chosen alternative cannot be effectively implemented at the site.
- 3. Section 5 --** EPA's Directive on the "Use of Monitored Natural Attenuation (MNA) at Superfund, RCRA Corrective Action, and Underground Storage Tank Sites" (OSWER Directive 9200.4-17) as a groundwater remedy cites three lines of evidence that can be used to demonstrate that natural processes are acting to reduce concentrations of contaminants in groundwater with time. A "clear and meaningful trend" of declining concentrations is one of the lines of evidence for the demonstration of MNA; however, "decreasing concentrations should not be solely the result of plume migration". The decline in concentrations that is used to demonstrate MNA under the EPA Directive is done through a within-well comparison of concentrations over time. Based on information provided to date, MNA of perchlorate as per EPA's Directive on MNA has not been fully demonstrated at IRP Site 1. Many of the alternatives developed and evaluated for perchlorate-impacted groundwater include MNA as a process option. Therefore, it is recommended that further evaluation of MNA as per EPA's Directive on the "Use of Monitored Natural Attenuation (MNA) at Superfund, RCRA Corrective Action, and Underground Storage Tank Sites" be provided as an appendix and that this information be cited as appropriate with the text of the FS Report.
- 4. Appendix A --** The relationship of Appendix A to the main text of the FS Report is not clearly explained. It is recommended that the Executive Summary and Sections 1, 5, and 6 be revised to explain the relationship of Appendix A to the main report.

7. **Section 3.1.4.3, Page 3-20** -- “The disturbed wetland and portions of the mulefat scrub and southern willow scrub may meet the definition of wetland based on the Army Corps of Engineers Wetlands Delineation Manual. Portions of the mulefat scrub and southern willow scrub may not be jurisdictional because they no longer occur in areas subject to wetland hydrology, and they were created in uplands.” It is unclear how the determination that portions of this habitat may not be jurisdictional was made. In addition, it is unclear how the potential disturbed wetland and portions of the mulefat scrub and southern willow scrub may affect the proposed remediation alternatives. It is recommended that the report be revised to provide documentation regarding if the disturbed wetland and portions of the mulefat scrub and southern willow scrub are jurisdictional wetlands or not. If the disturbed wetland and portions of the mulefat scrub and southern willow scrub are jurisdictional wetlands, it is recommended that the FS include a discussion regarding how this designation affects the proposed remediation alternatives.
8. **Section 3.3.3.1, Page 3-22** -- Soil sampling was conducted at the Northern and Southern EOD Training Ranges and the 3.3-acre area located in the southern portion of Site 1 during the Phase I Remedial Investigation (RI), the Verification of Perchlorate Study, the Environmental Base Survey, and Phase II RI. However, either soil sampling in the buffer zone and range perimeter was not conducted or this was not discussed in the text of the FS Report. It is recommended that information be provided regarding any soil sampling that occurred in the buffer zone and range perimeter; if soil sampling did not occur in these areas, it is recommended that a discussion regarding why these areas were not sampled be provided.
9. **Figure 3-13** -- Figure 3-13 provides sediment sampling locations but the location of the sediment sampling relative to Site 1 is unclear. It is recommended that Figure 3-13 be revised to clarify that the sediment sampling occurred in the ephemeral pond located on Site 1 and to show the location of the ephemeral pond relative to Site 1.
10. **Section 3.3.6, Page 3-49** -- The FS Report does not include a section to summarize the surface water contamination conclusions. In order to make Section 3.3.6 consistent with other sections of Section 3.3, it is recommended that the FS be revised to include a conclusion section regarding surface water contamination.
11. **Section 3.4.2, Page 3-59** -- “Twelve separate hydrogeologic zones (primarily within the bedrock) were identified at IRP Site 2 during a hydrogeologic investigation which included long-term aquifer tests; IRP Site 1 has hydrogeologic zones similar to those at IRP Site 2.” Based upon the information provided, it is unclear how Site 2 and Site 1 have similar hydrogeologic zones. It is recommended that the FS be revised to further clarify why the hydrogeologic zones at Sites 1 and 2 are considered similar.
12. **Section 3.6.1.1, Page 3-65** -- “VOCs, SVOCs, dioxins, explosives residues, TPH, and inorganic chemicals were detected in surface and subsurface soil at the site and thus were COPCs for those two media.” According to Section 3.3.3.1, “perchlorate was detected at low concentrations and at low frequencies in soil at the Northern and Southern EOD Training Ranges.” Based on the first statement, it can be deduced that perchlorate should also be a

COPC for soil. It is recommended that the FS provide additional information to clarify this apparent discrepancy.

- 13. Section 4.2.4.4, Page 4-5** -- The text references the implementation of alternatives G-3b, G-4a, G-4b, G-5, N-3, M-3, and M-4; however, these alternatives have not been introduced at this point in the FS Report. It is recommended that the text be revised to eliminate any references to information not yet presented in the FS Report.
- 14. Section 4.4.3, Page 4-9** -- It is unclear why soil is not included in the target zone for remedial action for perchlorate-impacted groundwater, since the discussion of fate and transport of perchlorate identifies perchlorate in soil as an on-going source for contamination of groundwater (ie., perchlorate dissolves in infiltrating precipitation and is dissolved when the groundwater table rises). If this is the case, removal of perchlorate-contaminated soil could reduce the potential for contamination of groundwater in the source area. It is recommended that this issue be further addressed and/or clarified in the FS Report.
- 15. Section 4.3.1, Page 4-7** -- Under the third bullet, an assumption for cost estimating purposes that “the entire Northern and Southern EOD Training Ranges would have 3 feet of soil removed and cleaned of all metallic objects” looks to be rather extreme verse the site conceptual model for MEC/MD at Site 1. What is the basis for this cost estimating assumption? It is recommended that supporting information for this assumption be further discussed in the FS.
- 16. Table 4-3** -- Under “Effectiveness” for “Natural Attenuation and Monitoring”, it is stated “..., an evaluation of the spatial distribution of perchlorate at IRP Sites 1 and 2 indicates that perchlorate concentrations decrease by an order of magnitude from the central source area at IRP Site 1 to the aquifer immediately upgradient of IRP Site 2.” EPA’s Directive on the use of MNA cites declining concentrations with time as one of the lines of evidence for the demonstration of MNA. However, this concept as applied here in the FS is explicitly questioned in the Directive. Groundwater plumes tend to show a decline in concentrations with downgradient flow due to the natural processes of advection and dispersion. The decline in concentrations that is used to demonstrate MNA under the EPA Directive is done through a within-well comparison of concentrations over time. Based on information provided to date, MNA of perchlorate as per EPA’s Directive on MNA has not been fully demonstrated at Site 1. Therefore, it is recommended that further evaluation of MNA as per EPA’s Directive on the “Use of MNA at Superfund, RCRA Corrective Action, and Underground Storage Tank Sites” be provided as an appendix and that this information be cited here in the FS Report.
- 17. Section 5.1.4, Page 5-3 & 5-4** -- An assumption for cost estimating purposes that “the entire Northern and Southern EOD Training Ranges would have 3 feet of soil removed and cleaned of all metallic objects” looks to be rather extreme verse the site conceptual model for MEC/MD at IRP Site 1. What is the basis for this cost estimating assumption? It is recommended that supporting information for this assumption be further discussed in the FS.

18. **Section 5.2.1, Page 5-4** – “Naturally occurring mechanisms including biodegradation would continue to act to reduce concentrations of naphthalene in soils.” EPA’s approaches on the use of MNA identify these “natural processes” as components of the MNA technology in subsurface environments. Therefore, it is recommended that either 1) the above statement be deleted from the text here or 2) that the text be revised to also mention that these mechanisms will not be monitored or evaluated under the no action alternative.
19. **Section 5.2.3, Page 5-9** -- Confirmation samples will be collected from the sidewalls and bottom of the excavation areas to confirm that naphthalene-impacted soil with concentrations greater than the California-modified PRG for industrial soil have been removed. “If the confirmation sampling results confirm that cleanup has been attained, the excavated areas would be backfilled.” What would occur if the confirmation sampling results did not confirm that the cleanup goal had been attained? It is recommended that the FS discuss this potential scenario including a discussion regarding any actions and costs that would be associated with this scenario.
20. **Section 5.3.1, Page 5-10** -- “Natural attenuation processes such as dilution and dispersion would be acting to reduce the concentrations of perchlorate in the groundwater.” EPA’s Directive on the use of MNA identifies these “natural processes” as components of the MNA technology and in other alternatives these processes are being claimed as the MNA components of the remedy. Therefore, it is recommended that the above statement be deleted from the text here as “no action” is meant to be no action.
21. **Section 5.3.2, Page 5-13** – “However, an evaluation of the spatial distribution of perchlorate at IRP Sites 1 and 2 indicates that perchlorate concentrations decrease by an order of magnitude from the central source area at IRP Site 1 to the aquifer immediately upgradient of IRP Site 2. This indicates that the natural attenuation processes such as dilution and dispersion are occurring to reduce perchlorate concentrations as it migrates from the central source area at IRP Site 1 to the Station boundary.” EPA’s Directive on the use of MNA cites declining concentrations with time as one of the lines of evidence for the demonstration of MNA. However, this concept as applied here in the FS is explicitly questioned in the Directive. Groundwater plumes tend to show a decline in concentrations with downgradient flow due to the natural processes of advection and dispersion as cited above. The decline in concentrations that is used to demonstrate MNA under the EPA Directive is done through a within-well comparison of concentrations over time. Based on information provided to date, MNA of perchlorate as per EPA’s Directive on MNA has not been fully demonstrated at Site 1. Therefore, it is recommended that further evaluation of MNA as per EPA’s Directive on the “Use of MNA at Superfund, RCRA Corrective Action, and Underground Storage Tank Sites” be provided as an appendix and that this information be cited here in the FS Report.
22. **Section 5.3.3.1, Page 5-15** – Have any estimates been made as to how many injections of a slow-release substrate would be anticipated in order to attain the TCG throughout the plume? The assumptions for cost estimates in Appendix G (Table G-5) allow for substrate injection every five years; what is this assumption based on? It is recommended that this issue be clarified.

- 23. Section 5.3.3.1, Page 5-16** – The timing of remedies selection is such that the TCE issues at Site 2 could be addressed through remedy selection/implementation prior to the selection of a remedy at Site 1. Therefore, there may not be a concern with regards to the TCE at Site 2 and the PRB with in-situ bioremediation described here. Furthermore, mention of VOC contamination at Site 2 here in the FS Report for Site 1 can be confusing to readers as no background information on the VOC contamination is provided. It is recommended that either 1) this issue be deleted from the text or 2) background information on the VOC contamination in groundwater at Site 2 be included in Section 3 of the FS Report.
- 24. Section 5.3.3.2, Page 5-19** – Are there any State regulatory issues with the injection of potentially contaminated water with these amendments into the ground water at Site 1? Would this work be considered as Class V wells under the Underground Injection Control (UIC) Program? It is recommended that these questions be addressed here.
- 25. Section 5.3.3.2, Page 5-19** – The timing of remedies selection is such that the TCE issues at Site 2 could be addressed through remedy selection/implementation prior to the selection of a remedy at Site 1. Therefore, there may not be a concern with regards to the TCE at Site 2 and recirculation system with in-situ bioremediation described here. Furthermore, mention of VOC contamination at Site 2 here in the FS Report for Site 1 can be confusing to readers as no background information on the VOC contamination is provided. It is recommended that either 1) this issue be deleted from the text or 2) background information on the VOC contamination in groundwater at Site 2 be included in Section 3 of the FS Report.
- 26. Section 5.3.4.1, Page 5-20** – Have any estimates been made as to how many injections of a slow-release substrate would be anticipated in order to control the source area? The assumptions for cost estimates in Appendix G (Table G-9) allow for substrate injection every five years; what is this assumption based on? It is recommended that this issue be clarified.
- 27. Section 5.3.4.2, Page 5-27** – Have any estimates been made as to how many injections of a slow-release substrate would be anticipated in order to control the source area? The assumptions for cost estimates in Appendix G (Table G-11) do not indicate substrate injection more than once; what is this assumption based on? It is recommended that this issue be clarified.
- 28. Section 5.3.5.2, Page 5-28** – Have any estimates been made as to how many injections of a slow-release substrate would be anticipated in order to attain the TCG throughout the plume? The assumptions for cost estimates in Appendix G (Table G-13) allow for substrate injection every five year; what is this assumption based on? It is recommended that this issue be clarified.
- 29. Section 5.3.5.3, Page 5-28** – Based on the data presented on Figure 5-8, MNA would also be a necessary component of this remedy for the alluvial groundwater present to some extent downgradient of the proposed location of the intermediate PRB. Levels of perchlorate in excess of the TCG are present in this area based on the data in Figure 5-8. It is recommended that this issue be addressed here.

- 30. Section 5.3.6, Page 5-31** – What is the basis for the claim that 92 extraction wells would be necessary in order to effectively implement this alternative? It is recommended that further supporting information be provided here as well as in Appendix F.
- 31. Section 5.3.7, Page 5-32** -- “It is estimated that Alternative G-5 would take the shortest time (approximately 50 years) to reduce perchlorate concentrations to less than the TCG along the entire extent of IRP Site 1 perchlorate plume.” According to Section 5.3.5.4, Alternative G-5 would take approximately 15 years to reduce the perchlorate concentrations to less than the target cleanup goal (TCG) for the entire Site 1 perchlorate plume. It is recommended that this discrepancy be addressed.
- 32. Section 6.2.1.2, Page 6-5** -- This alternative does not appear to be protective of ecological receptors because fencing and signs will not protect wildlife and birds from hazards at the site. It is recommended that the text be revised to state that this alternative is not protective of ecological receptors.
- 33. Section 6.2.2.2, Page 6-7** – “Naturally occurring mechanisms including biodegradation would continue to act to reduce concentrations of naphthalene in soils.” EPA’s approaches on the use of MNA identify these “natural processes” as components of the MNA technology in subsurface environments. Therefore, it is recommended that either 1) the above statement be deleted from the text here or 2) that the text be revised to also mention that these mechanisms will not be monitored or evaluated under the no action alternative.
- 34. Section 6.2.2.2, Page 6-7** -- This alternative does not appear to be protective of ecological receptors because fencing and signs will not protect wildlife and birds from hazards at the site. It is recommended that the text be revised to state that this alternative is not protective of ecological receptors.
- 35. Section 6.2.2.3, Page 6-11** -- The paragraph on “Overall Protection of Human Health and the Environment” only discusses human health and does not discuss whether this alternative is protective of ecological receptors. It is recommended that the text be revised to include a discussion of the protectiveness of this alternative for ecological receptors.
- 36. Section 6.2.3.1, Page 6-12** – “Natural processes such as dilution and dispersion would be the only processes acting to reduce perchlorate concentrations in groundwater.” EPA’s Directive on the use of MNA identifies these “natural processes” as components of the MNA technology and in other alternatives these processes are being claimed as the MNA components of the remedy. Therefore, it is recommended that the above statement be deleted from the text here as well as under “Long-Term Effectiveness and Permanence” and “Reduction of Toxicity, Mobility, or Volume through Treatment” on this page. “No action” is meant to be no action.
- 37. Section 6.2.3.2, Page 6-13** – What mechanisms (ie., natural processes) are occurring in the subsurface for MNA? EPA’s Directive on the “Use of MNA at Superfund, RCRA Corrective Action, and Underground Storage Tank Sites” requires that the mechanisms at

work be defined in evaluating alternatives claiming MNA as a remedy component. It is recommended that this issue be further addressed in the FS.

38. **Section 6.2.3.3, Page 6-15** – The timing of remedies selection is such that the TCE issues at Site 2 could be addressed through remedy selection/implementation prior to the selection of a remedy at Site 1. Therefore, there may not be a concern with regards to the TCE at Site 2 and the PRB with in-situ bioremediation described here under “overall protection of human-health and the environment” and “long-term effectiveness and permanence”. Furthermore, mention of VOC contamination at Site 2 here in the FS Report for Site 1 can be confusing to readers as no background information on the VOC contamination is provided. It is recommended that either 1) this issue be deleted from the text or 2) background information on the VOC contamination in groundwater at Site 2 be included in Section 3 of the FS Report.
39. **Section 6.2.3.4, Page 6-17** – Are there any State regulatory issues with the injection of potentially contaminated water with these amendments into the ground water at Site 1? Would this work be considered as Class V wells under the UIC Program? It is recommended that these questions be addressed here.
40. **Section 6.2.3.4, Page 6-17 & 6-18** -- The timing of remedies selection is such that the TCE issues at Site 2 could be addressed through remedy selection/implementation prior to the selection of a remedy at Site 1. Therefore, there may not be a concern with regards to the TCE at Site 2 and the recirculation system with in-situ bioremediation described here under “overall protection of human-health and the environment” and “long-term effectiveness and permanence”. Furthermore, mention of VOC contamination at Site 2 here in the FS Report for Site 1 can be confusing to readers as no background information on the VOC contamination is provided. It is recommended that either 1) this issue be deleted from the text or 2) background information on the VOC contamination in groundwater at Site 2 be included in Section 3 of the FS Report.
41. **Section 6.2.3.8, Page 6-28** -- What is the basis for the claim that 92 extraction wells would be necessary in order to effectively implement this alternative? It is recommended that further supporting information be provided here as well as in Appendix F.
42. **Section 6.2.3.9, Page 6-29** -- What is the basis for the claim that 92 extraction wells would be necessary in order to effectively implement this alternative? It is recommended that further supporting information be provided here as well as in Appendix F.
43. **Section 6.3.2.3, Page 6-36** -- “Naturally occurring mechanisms including biodegradation would continue to act to reduce concentrations of naphthalene in soils.” EPA’s approaches on the use of MNA identify these “natural processes” as components of the MNA technology in subsurface environments. Therefore, it is recommended that either 1) the above statement be deleted from the text here or 2) that the text be revised to also mention that these mechanisms will not be monitored or evaluated under the no action alternative.

44. **Section 6.3.2.3, Page 6-36** -- "Similar to Alternative 1, biodegradation would be the only process acting to reduce naphthalene concentrations in the soil for Alternative N-2." EPA's approaches on the use of MNA identify these "natural processes" as components of the MNA technology in subsurface environments. Therefore, it is recommended that either 1) the above statement be deleted from the text here or 2) that the text be revised to also mention that these mechanisms will not be monitored or evaluated under Alternative 2.
45. **Section 6.3.2.4, Page 6-36** -- "There is an uncertainty as to whether natural attenuation processes including biodegradation in soils would appreciably reduce naphthalene concentrations in reasonable amount of time." EPA's approaches on the use of MNA identify these "natural processes" as components of the MNA technology in subsurface environments. Therefore, it is recommended that either 1) the above statement be deleted from the text here or 2) that the text be revised to also mention that these mechanisms will not be monitored or evaluated under the no action alternative.
46. **Section 6.3.3.3, Page 6-40 & Table 6-3** -- The timing of remedies selection is such that the TCE issues at Site 2 could be addressed through remedy selection/implementation prior to the selection of a remedy at Site 1. Therefore, there may not be a concern with regards to the TCE at Site 2 and the PRB or recirculation system with in-situ bioremediation described here. Furthermore, mention of VOC contamination at Site 2 here in the FS Report for IRP Site 1 can be confusing to readers as no background information on the VOC contamination is provided. It is recommended that either 1) this issue be deleted from the text or 2) background information on the VOC contamination in groundwater at Site 2 be included in Section 3 of the FS Report.
47. **Section 6.3.3.3, Page 6-40 & Table 6-3** -- "Alternative G-3b...; therefore, it is expected to provide better long-term effectiveness than Alternative G-3a." This statement implies that Alternative G-3b should be rated higher for the "long-term effectiveness" criteria than Alternative G-3a; however, the ratings on Table 6-3 are "fair" for both Alternatives G-3a and G-3b. It is recommended that this issue be addressed.
48. **Appendix A, Section 3.5, Page A-13** -- "Figures 6 and 7 present conceptual designs for Options GM-5a and GM-5b of Alternative GM-5." Figure 6 is the only figure presented for Alternative GM-5 and this figure does not provide a conceptual design for the options as stated in the cited text. It is recommended that this issue be addressed.
49. **Appendix A, Sections 5.2.15.2.1.3, & 5.2.1.4, Pages A-27 & A-28** -- "Natural processes such as dilution and dispersion would be the only processes acting to reduce perchlorate concentrations in groundwater." EPA's Directive on the use of MNA identifies these "natural processes" as components of the MNA technology and in other alternatives these processes are being claimed as the MNA components of the remedy. Therefore, it is recommended that the above statement be deleted from the text here as well as under "Long-Term Effectiveness and Permanence" and "Reduction of Toxicity, Mobility, or Volume through Treatment" on this page. "No action" is meant to be no action.

- 50. Appendix A, Section 5.2.2, Page A-29** – What mechanisms (ie., natural processes) are occurring in the subsurface for MNA? EPA's Directive on the "Use of MNA at Superfund, RCRA Corrective Action, and Underground Storage Tank Sites" requires that the mechanisms at work be defined in evaluating alternatives claiming MNA as a remedy component. It is recommended that this issue be further addressed in the FS.
- 51. Appendix A, Section 5.2.3, Pages A-30 & A-31** – Have any estimates been made as to how many injections of a slow-release substrate would be anticipated in order to attain MCLs throughout the plume? No assumptions or cost estimates for the alternatives here are provided in the FS Report. It is recommended that these issues be clarified.
- 52. Appendix A, Sections 5.2.3.1 & 5.2.3.3, Page A-31** – The timing of remedies selection is such that the TCE issues at Site 2 could be addressed through remedy selection/implementation prior to the selection of a remedy at Site 1. Therefore, there may not be a concern with regards to the TCE at Site 2 and the PRB with in-situ bioremediation described here under "overall protection of human-health and the environment" and "long-term effectiveness and permanence". Furthermore, mention of VOC contamination at Site 2 here in the FS Report for Site 1 can be confusing to readers as no background information on the VOC contamination is provided. It is recommended that either 1) this issue be deleted from the text or 2) background information on the VOC contamination in groundwater at Site 2 be included in Section 3 of the FS Report.
- 53. Appendix A, Section 5.2.4, Page A-33** – Are there any State regulatory issues with the injection of potentially contaminated water with these amendments into the ground water at Site 1? Would this work be considered as Class V wells under the UIC Program? It is recommended that these questions be addressed here.
- 54. Appendix A, Section 5.2.4.1 & 5.2.4.3, Pages A-33 & A-34** – The timing of remedies selection is such that the TCE issues at Site 2 could be addressed through remedy selection/implementation prior to the selection of a remedy at Site 1. Therefore, there may not be a concern with regards to the TCE at Site 2 and the recirculation system with in-situ bioremediation described here under "overall protection of human-health and the environment" and "long-term effectiveness and permanence". Furthermore, mention of VOC contamination at Site 2 here in the FS Report for Site 1 can be confusing to readers as no background information on the VOC contamination is provided. It is recommended that either 1) this issue be deleted from the text or 2) background information on the VOC contamination in groundwater at Site 2 be included in Section 3 of the FS Report.
- 55. Appendix A, Section 5.2.5.6, Page A-37** – Have any estimates been made as to how many injections of a slow-release substrate would be anticipated in order to control the source area? No assumptions or cost estimates for the alternatives here are provided in the FS Report. It is recommended that these issues be clarified.
- 56. Appendix A, Section 5.2.6, Page A-38** – Have any estimates been made as to how many injections of an electron donor would be anticipated in order to control the source area? No

assumptions or cost estimates for the alternatives here are provided in the FS Report. It is recommended that these issues be clarified.

57. **Appendix A, Section 5.2.7, Page A-40** – Have any estimates been made as to how many injections would be anticipated in order to attain reduction of the source area as well as the downgradient (ie., proposed intermediate PRB) concentrations? No assumptions or cost estimates for the alternatives here are provided in the FS Report. It is recommended that these issues be clarified.
58. **Appendix A, Section 5.2.8.5, Page A-44** -- What is the basis for the claim that 176 extraction wells would be necessary in order to effectively implement this alternative? No discussion or figures are provided in the FS Report for the modeling performed. It is recommended that further supporting information be provided here as well as in Appendix F.
59. **Appendix A, Section 5.2.9.5, Page A-46** -- What is the basis for the claim that 176 extraction wells would be necessary in order to effectively implement this alternative? No discussion or figures are provided in the FS Report for the modeling performed. It is recommended that further supporting information be provided here as well as in Appendix F.
60. **Appendix A, Section 5.3.3, Page A-55 & Table 2** -- The timing of remedies selection is such that the TCE issues at Site 2 could be addressed through remedy selection/implementation prior to the selection of a remedy at Site 1. Therefore, there may not be a concern with regards to the TCE at Site 2 and the PRB or recirculation system with in-situ bioremediation described here. Furthermore, mention of VOC contamination at Site 2 here in the FS Report for Site 1 can be confusing to readers as no background information on the VOC contamination is provided. It is recommended that either 1) this issue be deleted from the text or 2) background information on the VOC contamination in groundwater at Site 2 be included in Section 3 of the FS Report.
61. **Appendix F, Figures F2-2 through F2-4** -- Figures F2-2 through F2-4 provide the horizontal hydraulic conductivity (feet/day) distribution in layer 1 (alluvium), layer 2 (weathered bedrock), and layer 3 (bedrock). However, the boundary of Site 1 is not clearly defined in these figures. It is recommended that Figures F2-2 through F2-4 be revised to include the boundary of Site 1.
62. **Appendix F, Section F3.2, Page F3-2** -- It is unclear why the assumption that there is no active or continuing source of perchlorate to groundwater was made, since the discussion of fate and transport of perchlorate identifies perchlorate in soil as an on-going source for contamination of groundwater (ie., perchlorate dissolves in infiltrating precipitation and is dissolved when the groundwater table rises). If this is the case, removal of perchlorate-contaminated soil could reduce the potential for contamination of groundwater in the source area. It is recommended that this issue be further addressed and/or clarified in the FS Report.
63. **Appendix F, General** – No discussion or figures are provided here for the modeling performed for the “Groundwater Feasibility Study Evaluation Based on the Proposed MCL

of Perchlorate of 6 ug/l" as covered in Appendix A of the FS Report. It is recommended that this omission be addressed.

64. Appendix F, Section F3, Page F3-1 – “An effective porosity of 0.10 was used throughout the domain...” In Section F2.2 it was noted that the storage coefficients in the transient flow calibration were 0.2 for layer 1 and 7×10^{-5} for layers 2 and 3. Under unconfined aquifer settings (ie., layer 1), the storage coefficient (ie., specific yield) is considered equivalent to the effective porosity. However, in the modeling performed here the values of these aquifer parameters were not consistent. Why were different storativity values (ie., 0.2 and 0.1) used in the flow and transport modeling efforts? What impacts could this have on the results of the various simulations? It is recommended that this issue be clarified.

65. Appendix F, Section F3.2, Page F3-2 -- “Permeable reactive barriers are sufficient to reduce perchlorate concentrations to below 24.4 $\mu\text{g/l}$.” “Perchlorate degradation is assumed to be rapid based on results of the treatability study performed at Site 1. It is assumed that the direct injection of electron donors at the source area would achieve the required reduction in the ORP to affect the rapid anaerobic biodegradation observed in the treatability study. As a result, the perchlorate in the source area will be reduced to the extent that it longer migrates at concentrations greater than 24.4 $\mu\text{g/l}$.” The basis for these assumptions has not been provided in the FS Report. It is recommended that additional justification regarding why these assumptions would be considered valid be included here.

66. Appendix F, Section F3.2, Page F3-3 -- It is unclear why the model assumes that groundwater monitoring results indicate that “there is no longer an active, continuing source of perchlorate in the soil.” The text on page 3-54 of the FS Report states that “the effect of these sources (ie., residual pockets of perchlorate in soil) was observed during groundwater sampling conducted in June 2005 following the rise in water levels across the entire site in response to significant rainfall events. During this sampling, perchlorate concentrations increased in the majority of the monitoring wells in the central portion of Site 1 compared to concentrations observed during pre-rainfall sampling events.” It appears that the model does not incorporate this increase in perchlorate concentrations and that higher water levels at times of elevated precipitation could result in a continuing source of perchlorate to groundwater. It is recommended that this issue be further addressed and/or clarified in the FS Report.

67. Appendix F, Section F3.2, Page F3-3 – “...rapid reduction of perchlorate concentrations below 24.4 ug/l is assumed to result upon interaction of groundwater with PRB or electron donor.” The basis for this assumption has not been provided in the FS Report. It is recommended that additional justification regarding why this assumption would be considered valid be included here.

68. Appendix F, Section F4.4, Page F4-2 – The extraction alternatives claim that the use of 86 wells in the source area is necessary to effectively implement this alternative. Is this scenario technically feasible in the area of concern? What spacing between extraction wells was used in the evaluations? It is recommended that this issue be further addressed in the FS Report.

- 69. Appendix F, Figures F4-1 through F4-7 --** Figures F4-1 through F4-7 provide the computed perchlorate concentrations based on the various alternatives. However, the boundary of Site 1 is not clearly defined in the figures. It is recommended that Figures F4-1 through F4-7 be revised to include the boundary of Site 1.
- 70. Appendix G, Tables G-4 and G-8 --** It is unclear why there are no costs for substrate injection during calendar year 1 or 2. Substrate is provided as a periodic costs and it appears that the cost for the initial substrate injection is not included. It is recommended that this discrepancy be addressed.
- 71. Appendix G, Table G-7 –** Under “Operation and Maintenance of Groundwater Recirculation System”, no details are given for how the “volume of substrate (molasses) required for 1 year of operation” would be applied to the cost estimates. It is recommended that this issue be addressed.
- 72. Appendix G, Table G-11 –** No indication is given as to whether any estimates have been made as to how many injections of a slow-release substrate would be anticipated in order to control the source area. The assumptions for costs do not indicate substrate injection more than once. It is recommended that this issue be addressed.
- 73. Appendix G, Table G-13 –** No indication is given as to whether any estimates have been made as to how many injections of a slow-release substrate would be anticipated in order to control the source area. The assumptions for costs do not indicate substrate injection more than once. It is recommended that this issue be addressed.