RESPONSES TO AGENCY COMMENTS ON DRAFT TECHNICAL MEMORANDUM NO. 5: REMEDIAL ALTERNATIVES EVALUATION REPORT FOR THE NAVY EXCHANGE GAS STATION (SITE 3) NAVAL TRAINING CENTER (NTC), SAN DIEGO, CALIFORNIA CTO-0064

Comments from Martin Hausladen

Site 3 – Navy Exchange Gas Station
Naval Training Center, San Diego

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GENERAL COMMENTS

Comment 1. Section 1.3, pg. 1-4. Please include a figure showing posted concentrations and the extent of groundwater contamination. This would help the reader more easily understand the text.	**Response 1.** Figures with concentrations for both the vadose zone and groundwater contamination have been provided in the site assessment reports referenced in the RAE document. As a streamlined approach was used for development of this document, rather than reproducing each of these figures again for the RAE, one figure showing the areas impacted by free-phase hydrocarbons (the focus of remedial action) was included.
Comment 2. Section 1.3, pp. 1-7 through 1-9. This section is incomplete without a discussion of groundwater flow direction(s) at the site. The groundwater flow direction must be discussed to justify statements that contamination is not related to Site 3. Explain why high concentrations of combustible gas indicate a source. Discuss why it is not believed that floating product may have migrated to these areas.	**Response 2.** A groundwater flow direction map will be included in Section 1 of this document. Also, as indicated in the site assessment reports, the high concentrations of combustible gas identified at the bank property are believed to indicate a source separate from the NEX gas station because the location at which they were measured is upgradient of the source areas identified at the NEX gas station.
Comment 3. Section 1.3.6, pg. 1-9, bullet 1. Explain how the separate phase product was "observed to be distinctly different than that identified in MW-4 and MW-8," since slightly different soil conditions may result [in] product weathering differently. Discuss whether samples from MW-14 were submitted for fuel fingerprinting chromatography.	**Response 3.** Further information on the fuel-fingerprinting conducted at the site can be found in the site assessment reports, including physical descriptions of the product as visually observed. As reported in the site assessment report, samples from MW-14 were submitted for fuel-fingerprinting analysis.

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Comment 4. Section 2, p. 2-2. Neither of these "technologies" can be used alone, since it is not possible to dispose of soils off-site without previously having excavated the soil; similarly, some method of treatment or disposal is required for excavated soils. Excavation is a removal option, not a technology. If more than one process technology is necessary, also consider a soil treatment technology. Revise.	**Response 4.** The first sentence in Section 2 on page 2-2 will be revised to read as follows: "The remedial technology applicable to the waste-oil-contaminated soil consists of excavation and off-site landfill disposal. Treatment technologies are not expected to be applicable for the waste-oil-contaminated soil because of its limited extent." As a result of the identification of the remedial technology for the waste-oil-contaminated soil as "excavation and off-site landfill disposal," Sections 2.6 and 2.7 will be combined.
Comment 5. Additional information is necessary to evaluate whether the technologies are appropriate for Site 3. For example, the levels of TPH and BTEX compounds in soils and groundwater should be presented, so that technologies appropriate for the observed contamination can be selected. The type of soils at Site 3 should be discussed, and at least one cross-section depicting both lithology and contamination should be included. Discuss whether elevated levels of metals were detected (for example, were analyses for lead done and was lead detected?) because the presence of metals may dictate the technologies which are applicable. Each technology (or subsection of Section 2) should include a discussion of these site-specific "critical factors" to facilitate evaluation of whether the technology is appropriate for Site 3.	**Response 5.** This document was written following a "streamlined approach." As discussed in Section 2, page 2-1, remedial technologies and process options that were neither applicable nor effectively implementable based on site-specific information were not considered. The remedial technologies selected for discussion in the document were prescreened for their applicability to the site. These site-specific considerations (i.e., "critical factors"), rather than being discussed in Section 2, are addressed in the descriptions of the remedial alternatives presented in Section 3. Detailed discussions of site background conditions, including analytical results (which were considered during the RAE process), are provided in the site assessment reports referenced in the RAE document. A summary of the site assessment findings, focusing on areas where free-phase hydrocarbons were found, is presented in Section 1.
Comment 6. Section 2.3, pg. 2-6. Discuss limitations of product skimming. For example, product skimming would not be appropriate in MW-4 because the apparent product thickness is only 0.03 feet.	**Response 6.** The following sentence will be added at the end of paragraph 2 on page 2-6, Section 2.3, which discusses the limitations of product skimming: "Skimming is more effective in wells with large product thicknesses." Product skimming was proposed for MW-4 to prevent further accumulation of free product in this well. Moreover, operation of a passive skimmer in MW-4 would not add significant cost because operation of a passive skimmer is already being proposed for MW-8.

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Comment 7. Section 2.4, pg. 2-8. Discuss potential problems with air sparging. For example, air sparging tends to move separate phase product into soil, unless the air injection well is surrounded by SVE extraction wells. This effect is undesirable.	**Response 7.** Potential problems of air sparging are discussed on page 2-8, Section 2.4, paragraph 2. Although air sparging has the potential to move free-phase hydrocarbons floating on groundwater into the vadose zone, the hydrocarbons can then be recovered by a vapor extraction system. Full recovery of injected air is inherently a critical design objective, and has been discussed in the last sentence of page 2-8, Section 2.4, paragraph 2. The following sentence will be added at the end of paragraph 2: "Air sparging wells and vapor extraction wells must also be placed appropriately to assure the recovery of injected air."
Comment 8. Section 3.3.1.1, pg. 3-4, Section 3.3.2.1, pg. 3-10, and Section 3.3.3.1. In situ bioremediation, as described in these sections will NOT work for the vadose zone (unless the infiltration gallery extends over the entire extent of contaminated soil). The description provided in these sections might work to remediate groundwater and saturated soil. Material induced into the infiltration gallery will travel vertically and will not spread out horizontally to any useful degree. For in situ bioremediation of vadose zone soils to work, all soil to be bioremediated must be moist and supplied with nutrients. One way of accomplishing this might be to install a closely spaced grid of perforated pipes and continually reinject treated groundwater with the addition of nutrients and bacteria as necessary. Groundwater would have to be recovered using downgradient extraction wells and/or french drains and treated to remove excess nutrients, TPH, and BTEX compounds. This method would also have the additional benefit of flushing contaminants from the soil. Note also that bioremediation is ineffective for large hydrocarbon molecules found in waste or lubricating oils. Revise these sections as necessary.	**Response 8.** Heavy-end hydrocarbon vadose-zone contamination exists at or near the water table in a localized area around MW-8. The infiltration gallery is an access area for loading biological factors into the soil. As the infiltration gallery is loaded, biological factors will flow to the water table and then, in addition to traveling vertically, will extend preferentially along the water table where oxygen contents are higher. Furthermore, soils in the area of the infiltration gallery, consisting of silty and clayey sands, would promote lateral flow of the biological factors in the vadose zone. Therefore, this system should be effective as proposed. Biotreatability studies will determine the degree of biodegradability of the heavy-end hydrocarbons, and these studies are proposed as a part of the remedial alternatives (page 3-9, Section 3.3.1.2, paragraph 5). Moreover, the proposed focus of remediation is on the free-phase hydrocarbons found at the site (with a cleanup goal of removing free-phase hydrocarbons detected in MW-4 and MW-8) and not remediation of adsorbed-phase hydrocarbons in soil or dissolved-phase hydrocarbons in groundwater.

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Comment 9. Section 3.3.1.2, pg. 3-8. Based on information presented in this technical memorandum, skimming would only be effective in MW-8, because the apparent thickness of product in MW-4 (0.03 feet) is already less than most skimmers can achieve. If there is additional product thickness information for these wells, it should be presented. Explain why skimming was believed to be effective for MW-4 and revise this section as necessary.	**Response 9.** A skimmer was proposed for MW-4 to prevent further accumulation, in this well, of free-phase hydrocarbons present in the area of MW-4. This skimmer would be applied, as needed, if free-phase hydrocarbons accumulate in the well as a result of remedial activities performed for this area (e.g., sparging). Should the apparent thickness of product in this well be increased during remediation, skimming is believed to be applicable for MW-4 based on the results of previous skimming efforts at this location and the limited amount of free-phase hydrocarbons that currently exists in this well. Please also refer to the response to comment 6.
Comment 10. Section 3.3.2.1, pp. 3-10 and 3-12. As noted in comment 7, air sparging is likely to drive the separate phase product into the soil. In order to control the potential spread of contamination, SVE collection wells must surround the air injection wells and have sufficient capacity to collect all of the sparged air. It is not likely to be effective to have a horizontal extraction well on only one side of the air sparging injection wells. Revise this section.	**Response 10.** Because of the multitude of CAD symbols that had to be placed on the figure for a small area of the site, symbols were spaced farther apart for clarity and to avoid clutter. Figure 3-2 will be revised such that the sparge wells will be located directly in the center of the vadose-zone extraction wells. This figure is a schematic that shows approximate well locations for conceptual design purposes only. If Alternative 2 were to be implemented, design specifications would be formulated based on known site conditions and/or pilot test results.
Comment 11. Section 3.3.4.1, pg. 3-21, paragraph 2, sentence 1. The "relative compaction" of the soil has absolutely nothing to do with whether shoring or sloping is required. Sand could be "compact" but because of the properties of sand, the excavation would collapse. The necessity for shoring and sloping is dictated by OSHA and the California Uniform Building Code. Revise. Note that confined space entry procedures would be required if anyone will enter the excavation.	**Response 11.** Based on OSHA requirements, no shoring or sloping of the excavation walls is believed to be necessary because no workers will enter the excavation, which is relatively shallow. The necessity for sloping/shoring, for the sole purposes of completing the excavation, will be determined during design based on an evaluation of soil type, soil moisture content, soil compaction, and the proximity of the excavation to building foundations and/or underground utilities. As mentioned above, it was assumed that workers would not enter the excavation. Such activities, if for some reason required, would be addressed in the health and safety plan.

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Comment 12. Section 3.3.4.1, pg. 3-21, paragraph 2, last sentence. Surface run-on and runoff control would be required if the excavation is conducted between November and May, when most rainfall occurs in California, since it is impossible to guarantee that it will not rain. Revise.	**Response 12.** The last sentence of paragraph 2 in Section 3.3.4.1 on page 3-21 will be revised to read as follows: "For cost-estimation purposes, it was assumed that the excavation would be conducted in the dry season; if the excavation is conducted in the rainy season, then surface run-on and runoff control measures would be implemented."
Comment 13. Section 3.4.1, pg. 3-30, first sentence. Alternative 2 is likely to actually result in the migration of free-phase hydrocarbons off-site unless the air sparging/SVE extraction plan is modified. Monitor well 4 is very close to Nimitz Boulevard. As currently proposed, it is likely that the separate phase layer would be forced into soils and spread under Nimitz Boulevard. Revise this sentence.	**Response 13.** The first sentence on page 3-30 of Section 3.4.1 is accurate based on the modifications to Figure 3-2 proposed in the response to comment 10. Figure 3-2 will be revised to better show that sparge wells will be proximate to extraction wells, minimizing the potential for off-site migration of free-phase hydrocarbons.
Comment 14. Section 3.4.1, page 3-30, first paragraph, sentences 3 and 4. As noted in comment 8, the proposed infiltration/ bioremediation would only be effective in the saturated zone, and would not be effective in the vadose zone. Revise these sentences.	**Response 14.** Heavy-end hydrocarbons in the vadose zone are localized and located at or near the water table. The inoculation can be delivered effectively by the mechanism described in the text. Additional discussion is presented in response to comment 8.
Comment 15. Section 3.5, pg. 3-31, sentence 2. Alternative 2 does not address remediation of heavy-end hydrocarbons in the vadose zone (see comment 8), and further, is likely to actually result in the spread of hydrocarbons and the migration of hydrocarbons into soil beneath Nimitz Boulevard (see comments 7, 10, and 12). Revise this sentence.	**Response 15.** Alternative 2 would address both light- and heavy-end hydrocarbons in the vadose zone. Discussions are provided in the responses to comments 8, 10, and 14.