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Subject: Responses to NASA Comments Pertaining to UST Cluster 2, NASA Crows
Landing Flight Facility

Hello Don,

Transmitted are responses dated 11 September 2002 to NASA comments dated 19 August 2002
pertaining to UST Cluster 2.

Please do not hesitate to contact me if you have questions pertaining to the responses.

Thank you very much.

V/R
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12 September 2002



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RESPONSE TO COMMENTS FROM THE NATIONAL AERONAUTICS SPACE ADMINISTRATION (NASA)
Subject: Interim Data Summary, UST Cluster 2 Soil Vapor Extraction Testing
NASA Crows Landing Flight Facility, Crows Landing, California (IT Corporation, July 2002)

Comment	Response
<p>Comments dated 19 August 2002 prepared by Don Chuck, NASA</p> <p>Subject: Transmittal, Interim Data Summary, UST Cluster 2 Soil Vapor Extraction Testing, NASA Crows Landing Flight Facility, Crows Landing, California</p>	
General Comments	
<p>The report does not explain why there was the need to perform the soil vapor extraction (SVE) testing at Cluster 2. The Corrective Action Plan (CAP) for Cluster 2 recommended bioventing/biosparging as the remedial alternative. SVE was added during the design phase to address volatile vapors at the site. As agreed to with the Regional Water Quality Control Board, once SVE concentrations reached 2500 ppmv, the system was to be operated in the biovent mode. Bioventing/biosparging was to continue until the remedial action goals were met. As noted in this report, when oxygen is supplied to the subsurface, bioremediation appears to take place (refer to graphs of O2 levels vs. time). This is why biovent/biosparge was recommended in the CAP. The Navy needs to explain why the system was shut down and the CAP disregarded.</p>	<p>The Navy proposes to utilize cost-effective and efficient treatment strategies wherever practicable. The <i>Final Corrective Action Plan, Underground Storage Tank Sites UST Cluster 1, Cluster 2, 109, and 117</i> (Tetra Tech, 30 June 1998)(CAP) specifically states that SVE is not warranted at UST Cluster 2 because it was assumed that there were low concentrations of volatile contaminants. SVE was included in the corrective action design for the site, a system was installed, and the SVE system operated for approximately 6 months (from January until June 2000), removing approximately 3,200 pounds of petroleum hydrocarbons. SVE performance evaluation testing was conducted at UST Cluster 2 to evaluate its continued effectiveness at treating petroleum hydrocarbon contaminated soil. Details of the testing and rationale are included in the <i>Soil Vapor Extraction Optimization for the Remediation of UST Cluster 1 and Site Verification Activities at Various Sites, Work Plan</i> (IT, 2001) (Work Plan) that was submitted to the members of the BRAC Cleanup Team, NASA, and Stanislaus County.</p> <p>Estimates in the design basis report indicated that the SVE system would only be required to operate for 2 months but the system was still effectively removing petroleum hydrocarbons after 6 months. The results from the system operation indicate that concentration of volatile contaminants may be higher than previously assumed and may result in spread of contamination if biosparging was operated in conjunction with bioventing (air injection), and the treatment system was shut off. It is not the Navy's intent to implement treatment operations that could potentially result in the spread of contaminants in the vadose zone and groundwater.</p>

Comment	Response
	<p>Following the shut down of the system, the Navy evaluated the soil and groundwater data and developed a plan to conduct additional testing. Because the SVE system was so effective at removing contamination it was determined that it may be more cost effective to continue SVE operation and additional testing was necessary to evaluate the long-term effectiveness. Analytical results from soil gas samples recovered from 2 wells at the start of the SVE performance testing indicated that the petroleum hydrocarbon concentrations were above 2500 ppmv (i.e. the soil vapor concentrations rebounded after the 6 months of SVE/biosparge system operation).</p>
<p>Based on comments below, it appears that the Navy and its contractors do not understand the difference between bioventing and biosparging from SVE and air sparging. While both techniques involve the movement of air through soil and groundwater, the remedial mechanisms and goals are different. More is discussed in the specific comments below.</p>	<p>There are many different ways to design systems for SVE, bioventing, biosparging, and air sparging and, although the goal of the design may be specific, (i.e. vapor recovery or enhancement of in situ bioremediation) the mechanisms are not exclusive. SVE and air sparge systems also provide oxygen to enhance in situ bioremediation, bioventing (operated in extraction mode) also recovers vapors, and biosparging also volatilizes contaminants. Optimization of the design and operation of the system for recovery or biodegradation is not necessarily done based on which alternative is feasible but on which alternative is more cost effective based on observed site conditions.</p>
<p>Nowhere is there any discussion of groundwater at the site. It should be noted that levels of total petroleum hydrocarbons (TPH) were found as high as 16,900 ug/l and benzene as high as 1230 ug/l.</p>	<p>The interim data summary presents the preliminary results from SVE performance evaluation testing and includes proposed locations for soil sampling to evaluate the system operation effectiveness and to evaluate the potential risk attributable to residual petroleum hydrocarbons in the soil. The interim data summary is not a closure report. The site closure report will include a discussion of the vadose zone and groundwater conditions at UST Cluster 2.</p> <p>Groundwater impact at UST Cluster 2 is being evaluated as part of the quarterly groundwater monitoring program and the recent and historical results are included in the quarterly reports. It should be noted that, although historical results indicated high concentrations of petroleum hydrocarbons in groundwater at UST Cluster 2, recent results indicate that concentrations are currently non-detect in most wells.</p>
<p>Finally, vapor concentrations should have been sampled for the various constituents to show which products are being removed.</p>	<p>As stated in the work plan, samples that were collected in SUMMA canisters and sent to an off-site laboratory were analyzed for petroleum hydrocarbons by EPA Method TO-3 and for VOCs by EPA Method TO-14-A. Individual VOCs were not detected in the system influent samples collected throughout the testing. Final laboratory results will be presented in the final report.</p>

Comment	Response
Specific Comments	
<p>COMMENT 1 Par. 2, 3rd Sent., Pg. 1</p> <p>The tanks were connected by underground piping to a truck <i>and</i> a railcar offloading facility to the north.</p>	<p>Comment noted.</p>
<p>COMMENT 2 Par. 2, Last Sent., Pg. 1</p> <p>The sentence should also state that when tank operations ceased in 1965, they were filled with water. The tanks remained filled with water until their removal in 1994.</p>	<p>Comment noted.</p>
<p>COMMENT 3 Par. 3, 6th Sent., Pg. 1</p> <p>The system was run using SVE to remove any volatile hydrocarbon vapors in the soil. The use of SVE was an addition made during the design phase. The CAP selected bioventing/biosparging as the remedy for Cluster 2. Biosparging has very little effect, if any, in removing volatile hydrocarbons. The biosparging reference should be removed from this sentence.</p>	<p>Although the goal of operating the system in biosparge mode was to enhance in situ biodegradation, the mechanism of aerating the groundwater resulted in the volatilization of petroleum hydrocarbons, which were recovered by the SVE system. The SVE system was added to the design and operated to capture volatile petroleum hydrocarbons, including those generated by biosparging, to ensure the spread of contamination was minimized during startup of the system.</p>
<p>COMMENT 4 Par. 4, 7th Sent., Pg. 1-2</p> <p>The sentence notes that petroleum vapor concentrations decreased significantly. The sentence does not state whether these levels reached the 2500 ppmv level at which the system was to be switched to the biovent mode to address the heavier hydrocarbons. This requirement was spelled out in the <u>UST Cluster 2 Design Basis Report, Revised Definitive Design</u>, Tetra Tech, 4/9/99. See Attachment 1 for reference. The flow chart was added at the request of the Regional Water Quality Control Board and agreed to by the Navy. The flow chart provided a decision basis that both parties could agree to as to when to switch from the SVE mode to the biovent mode.</p> <p>The Navy needs to explain why the system is not being operated in biovent mode.</p>	<p>The design basis report is not a decision document, but provides supporting information to detail how the CAP will be implemented. The CAP does not include any reference to soil gas concentrations that will be used to guide system operation or soil gas cleanup levels. The design basis report does not provide any data supporting the use of 2500 ppmv as a concentration to guide system operation (i.e. estimated vapor emission rates from ground surface to meet air emission requirements). The flow chart included as Attachment 1 does not allow for collection of soil samples following SVE operation to determine if soil remediation goals have been met and to determine if bioventing is necessary.</p> <p>Table 6 in Attachment 2 of the Interim Report provides the soil gas concentration following the first quarter of system operation. The charts in Attachment 3 of the Interim Report provide the TVPH concentration from each well during the performance evaluation testing. The TVPH concentrations in both wells CL2-BV-01 and CL2-BV-02 were above 2500 ppmv at the start of the performance evaluation testing and are below 2500 ppmv after testing. Soil samples will be collected to evaluate the effectiveness of the SVE system operation and determine additional requirements for site closure.</p>

Comment	Response
<p>COMMENT 5 Par. 4, Last Sent., Pg. 2</p> <p>The sentence states that the effectiveness of the SVE system could not be evaluated because the biosparge system was in operation. It should be noted the biosparging does not generally generate as much vapor as air sparging does. Biosparging is operated at lower flowrates and pressures than air sparging. The remedial mechanisms are different. Biosparging primarily adds oxygen and/or nutrients to microbes to induce/increase bioremediation. Air sparging on the other hand, injects air at high flowrates to strip contaminants out of the water and carry the vapors to the vadose zone for removal by SVE.</p> <p>Reviewing the graph in Figure 6, it appears that SVE is effective in reducing soil vapor. Additionally, the hydrocarbon removal rate does not appear to be much different than what is shown in the Cumulative Mass Removed/Removal Rate graph in Attachment 3 of the report. One could conclude that since the rate is about the same when the biosparge system is on compared to the rate when SVE is operated alone, most of the mass is coming from the vadose zone and not the groundwater.</p> <p>Based on the above discussion, the last sentence of the paragraph should be struck.</p>	<p>A common misconception about biosparging is that biosparge systems are operated at lower flowrates and pressures than air sparge systems. Lowering the flowrate of air injected into the subsurface only reduces the distribution (i.e. radius of influence) not the effectiveness of the air at stripping contaminants from the groundwater. Biosparge system, such as the one design and built for UST Cluster 2, include timers to control the amount of time that air is injected. In biosparge mode, air is injected into the groundwater until the dissolved oxygen concentrations are high enough to support biodegradation. The air injection is then cycled off until the dissolved oxygen concentrations decrease to the level where biodegradation is inhibited. Air sparging systems are generally designed for continuous air injection or for pulsed operation with longer air injection times. The mass of contaminants volatilized in biosparge mode is lower than in air sparge mode only because of the difference in the amount of time air is injected.</p> <p>Considering the petroleum hydrocarbon concentrations in groundwater at the start of the system operation, it is likely that most (but not all) of the mass recovered by the SVE system was from the vadose zone and not groundwater. The effectiveness of the SVE system could not be evaluated independently from the biosparge system during the system operation because of dilution of air in the vadose from air injected into groundwater for biosparging.</p>
<p>COMMENT 6 Par. 5, 2nd Sent., Pg. 2</p> <p>Data evaluation included "remediation time frames." No discussion of time frames appears in this report.</p>	<p>The data from the SVE testing was evaluated to determine petroleum hydrocarbon removal rates and changes in removal rates over time and with respect to vapor concentrations. These results are included in the interim report. Removal rates relate directly to remediation time frames. Additional information relating to time to complete remediation will be obtained after the soil samples are collected and analyzed. A thorough evaluation of remediation time frames will be included in the final SVE performance evaluation testing report.</p>
<p>COMMENT 7 Par. 6, 3rd Sent., Pg. 2</p> <p>The sentence states that air was bled into the SVE system to allow the blower to operate within its acceptable range. Was there any effects to be seen in well vacuum? At what point in the operation was additional air added? Had the vacuum in the wells stabilized before bleed air was supplied?</p>	<p>The work plan provides detailed information on system operations during the SVE performance evaluation testing, including when bleed air is introduced and adjusted. In general, the SVE system operates on bleed air initially until the operating temperature for proper contaminant destruction is reached. Process air from the wells is then introduced and the bleed air rate is adjusted until the desired flowrates and vacuums from the extraction wells are established.</p>

Comment	Response
<p>COMMENT 8 Par. 7, 3rd Sent., Pg. 2</p> <p>SUMMA canisters were used to collect samples monthly. Were samples analyzed for individual constituents or just TVPH? If they were not, why not? Such information would have been useful in evaluating the effectiveness of the SVE and show what contaminants were being removed from the vadose zone.</p>	<p>As stated in the work plan, samples that were collected in SUMMA canisters and sent to an off-site laboratory were analyzed for petroleum hydrocarbons by EPA Method TO-3 and for VOCs by EPA Method TO-14-A. Final laboratory results will be presented in the final report.</p>
<p>COMMENT 9 Par. 8, 2nd Sent., Pg. 2</p> <p>For well CL2-BV-02, the graph for the PID reading shows not decrease.</p>	<p>The PID readings from CL2-BV-02 showed a decrease in concentrations of light end petroleum hydrocarbons throughout the performance evaluation testing as shown in the chart in Attachment 3. The light end petroleum hydrocarbons (measured by PID) decreased from initial concentrations of approximately 700 ppmv to approximately 300 ppmv. The scale of the chart (a result of the relatively high initial petroleum hydrocarbon concentrations measured by FID) makes the decrease in PID readings difficult to see.</p>
<p>COMMENT 10 Par. 10, Pg. 3</p> <p>The oxygen data do appear to indicate that bioremediation does occur when adequate oxygen is supplied. This is the reason that the CAP selected bioventing for soils and biosparging for the groundwater. Since it appears that bioremediation is effective at the site, the Navy needs to explain why the system is not being operated as agreed to in the CAP. This would also allow this portion of the base to be transferred to the County.</p>	<p>Cost estimates provided in the CAP indicate that it was assumed that 2 years of bioventing would be required to remediate the soil at UST Cluster 2. No reasoning is provided for the estimate. Soil sampling and analysis to verify when remediation goals were achieved are not included in the estimate. Although bioventing is effective, it may not be cost effective or the fastest remedy for the site based on recent data from system operation at startup and SVE testing. SVE was added during the design phase presumably to accomplish mass removal from the vadose zone to reduce remediation time frames and to minimize the spread of contamination. Approximately 5600 pounds of petroleum hydrocarbons were removed by SVE to date (from January 2000 through 2002), which would take several years to remediate by bioventing (biodegradation rates of 6 mg/kg·day measured during predesign pilot testing). The SVE testing and soil sampling is being conducted to evaluate methods of further expediting site remediation to transfer the “remediated” property to the County.</p>
<p>COMMENT 11 Par. 11, 1st Sent., Pg. 3</p> <p>The recommended remediation for Cluster 2 is bioventing/biosparging, not SVE/sparge as stated (see pages 6-6 and 6-7 of <u>the Final Corrective Action Plan, Underground Storage Tank Sites UST Cluster 1, Cluster 2, 109, and 117, Tetra Tech, 6/30/98</u>).</p>	<p>The sentence in the interim report refers to how the system was operated from January to June 2000, not to the recommended alternative proposed in the CAP.</p>

Comment	Response
<p>COMMENT 12 Graph of Vacuum vs. Time for Observation Wells</p> <p>This graph does not provide much useful data for evaluating SVE influence on observation wells. To provide information on observation well response, the following minimum information should be provided:</p> <ul style="list-style-type: none"> • Distance from vent well to observation wells • Initial pressure readings • Pressure (vacuum) vs. time in each observation well compared to vacuum vs. time in vent well • A radius of influence should be calculated 	<p>Observation wells were not being monitored to determine the radius of influence from extraction at individual wells. Individual well testing was conducted during previous pilot testing and prior to the initial system startup to determine the radius of influence at each well. Observation wells were monitored during performance evaluation testing to evaluate if specific areas within the treatment area were showing some influence (greater than 0.1 inch water column vacuum) from the extraction well network. The chart provides the vacuum measured at each well at UST Cluster 2 during the performance testing and indicates that only 1 well within the vadose zone plume boundary, well CL2-MW-05, which is screened entirely below the water table, showed no influence during the SVE testing.</p>
<p>COMMENT 13 Sample Point Table, Pg. 3, and map</p> <p>The location of point three does not appear useful. The nearby previous samples were ND (CL2-MW-05) or have no concentrations (SB2-2A). A better location would be near CL2-MW-02A (TPH-E: 2700 mg/kg @ 26 ft. and 2900 mg/kg @ 35 ft.).</p> <p>For all the points, the rationale should include the reason for the depths chosen. Will the field geologist have some flexibility in choosing the final sample depths? For example, if the sample depth is listed at 22 ft. and staining is seen at 26 ft. will the sample be collected at 26 ft?</p> <p>Again, in the sampling rationale provided on the sampling forms, it must be noted that SVE was not the chosen remedy for the vadose zone at Cluster 2, it was bioventing. SVE was added to remove any volatiles that were in the vadose zone, bioventing was to induce bioremediation of heavier hydrocarbons such as jet fuel.</p>	<p>Sample location 3 was specifically located approximately 15 feet downgradient of monitoring well CL2-MP-02A, where high petroleum hydrocarbon concentrations were found in groundwater at the historic groundwater surface. Since the groundwater levels are lower than historic levels it is assumed that contaminants may have been trapped in the soil. Samples will be collected at the depth of the historic groundwater surface to determine if contamination remains in soil. Sample location 2 is approximately 15 feet northwest of CL2-MW-02 to verify petroleum hydrocarbon concentrations near that previous sample location.</p> <p>The rationale for sample depths is included in the sampling forms, "below the tank excavation and at the historic water level." Samples will be collected from the depths indicated on the sampling form regardless of observations made during soil boring to allow for collection of consistent data. Changes in soil color and/or moisture content are not always good indicators of contamination and may bias results if used to guide verification sampling. Additional samples may be collected if observations made during sample collection warrant additional investigation.</p> <p>The purpose of the investigation, as stated in the sampling form, is to evaluate the effectiveness of the SVE performance evaluation testing and to evaluate post-treatment concentrations to determine environmental risk. The remedy proposed in the CAP does not impact the specifically defined data quality objectives for this investigation that affect how the sample will be collected and analyzed, or how the data will be evaluated.</p>

Transmittal

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