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RESPONSE TO FLORIDA DEPARTMENT OF ENVIRONMENTAL PROTECTION COMMENTS OF FEASIBILITY STUDY FOR SITE 45 BUILDING 603 MARCH 2010 NAS PENSACOLA FL
06/22/2010
TETRA TECH INC

NAVAL AIR STATION PENSACOLA

PENSACOLA, FLORIDA

FEASIBILITY STUUDY FOR SITE 45

(BUILDING 603 LEAD SITE)

RESPONSE TO FDEP COMMENTS DATED MARCH 5, 2010

Comments by the Florida Department of Environmental Protection (FDEP) are shown in bold font. Responses follow each comment and are shown in regular font. Changes to Feasibility Study text are italicized and enclosed in quotation marks.

Comment 1: On page 1-5, Section 1.2.3.3, last sentence, it says that the depth to the shallow surficial aquifer is approximately 13 feet bgs at Site 45. This is incorrect as the depth to the water table is approximately 4 feet bgs. The depth of the shallow surficial aquifer is being confused with the total depth of shallow monitoring wells that have screens that intersect the water table.

Response: Section 1.2.3.3 will be changed to: *"Groundwater in Escambia County occurs in three major aquifers: a shallow surficial aquifer, which is both artesian and non-artesian (the sand and gravel aquifer), and two deep artesian aquifers (the upper and lower limestones of the Floridian aquifer). Because the shallow surficial aquifer is partly unconfined and recharged principally by direct infiltration of rain, this aquifer is particularly susceptible to contamination from surface sources (EnSafe/Allen & Hoshall, 1996).*

Based on data from the Site 45 RI (TtNUS, 2009), the depth to water in the shallow monitoring wells (monitoring well screened from approximately 3 to 13 feet bgs) in the water table zone of the surficial aquifer ranged from 3.92 feet to 5.14 feet beneath the top of the well casings at Site 45 in December 2005. The depth of water in the deep monitoring wells (monitoring wells screened from approximately 40 to 50 feet bgs ranged from 3.93 to 4.86 feet beneath the top of the well casing. The shallow groundwater flow direction is generally toward the east and southeast, and the deep aquifer zone appears to be generally toward the south.

Assuming 4 feet bgs for the top of the aquifer from the water level measurements and a depth of 54 feet bgs from the soil borings, the groundwater investigation area for the surficial aquifer is estimated to be approximately 50 feet thick at Site 45.

Groundwater elevation data indicate an average hydraulic gradient of 0.0022 feet per foot (feet/foot) for the shallow surficial water table wells and the gradient for the deep aquifer zone is approximately 0.0021 feet/foot south using PEN-45-05 (2.22 ft) and PEN-45-13 (1.88 ft) approximately 166 ft apart. In December 2005, both upward and downward vertical gradients were measured at Site 45.

Slug test data were used to determine hydraulic conductivity, the geometric mean hydraulic conductivity for the shallow water table aquifer zone was estimated at 29.1 feet per day (ft/day) and the deep aquifer zone was estimated at 39.8 ft/day."

Comment 2: On page 1-7, Section 1.4.1, first paragraph, some of the groundwater chemicals of concern (COCs) have been inadvertently added to a discussion regarding chemicals detected in soil.

Response: The sentence will be changed to: *"Twelve of thirty-two surface soil samples collected between 0 and 0.5 foot had exceedances of one or more FDEP residential and/or industrial FDEP Soil Cleanup Target Levels (SCTLs) for arsenic, barium, lead, TPH and PAHs expressed as benzo(a)pyrene equivalents (FDEP, 2005b)."*

Comment 3: On page 1-8, Section *1*.4.2, second sentence, it says that Table A of Chapter 62-785, Florida Administrative Code, specifies chemicals that have secondary standards. This is incorrect. Table A of Chapter 62-785, F.A.C., contains groundwater cleanup target levels (GCTLs) calculated solely based on protection of human health for chemicals that either have GCTLs listed in Chapter 62-777, F.A.C., based on organoleptic considerations (example: cumene) or have secondary standards.

Response: The 1st paragraph of Section 1.4.2 will be changed to: *"Table 1-3 summarizes the locations of groundwater samples with exceedances of one or more GCTLs. Groundwater samples collected from six of the ten shallow monitoring wells sampled during the Site 45 RI contained iron at concentrations exceeding its secondary MCL under Chapter 62-550, F.A.C., and GCTL under Chapter 62-785, F.A.C but not its NAS Pensacola background value of 1,708 µg/L (Ensafe/Allen & Hoshall, 1994).*

The groundwater samples collected from each of the four deep monitoring wells also contained iron at concentrations exceeding its MCL under Chapter 62-550, F.A.C., and GCTL under Chapter 62-785, F.A.C. Three of the four groundwater samples from the deep monitoring wells contained iron at concentration exceeding its NAS Pensacola background value.

However, the concentrations of iron detected in the groundwater samples collected from the shallow and deep monitoring wells are below its Health-Based USEPA Region 9 Tap Water PRG [and current Regional Screening Level (RSL) Table Tap Water April 2009] of 26,000 µg/L."

Comment 4: On page 1-8, Section 1.4.2, the terms "background concentration" and "reference concentration" are both used in the same paragraph. If the terms mean the same thing, one term should be chosen and referred to throughout the document for consistency and clarity sake. If there are differences between "background concentration" and "reference concentration", the differences should be explained.

Response: The term "background concentration" will be used throughout the document for consistency and clarity sake.

Comment 5: One page 1-11, second paragraph from the top of the page, first sentence, please revise the sentence to read correctly per my comment (3) above.

Response: The sentence will be changed to: *"Also aluminum, iron, and manganese were detected at concentrations that exceeded their secondary MCLs under Chapter 62-550, F.A.C. and GCTLs under Chapter 62-785, F.A.C. they were detected at concentrations significantly less than their respective Health-Based USEPA Region 9 Tap Water PRGs [and current Regional Screening Level (RSL) Table Tap Water April 2009] ."*

Comment 6: On page 2-6, Section 2.2.1, second paragraph, it discusses the use of the 95% upper confidence level (UCL) of the mean. Please identify this as a technique for calculating exposure point concentrations for a specified area to which a receptor could be exposed and that the technique requires apportionment of the risks of like-acting chemicals per Chapter 62-780, F.A.C.

Response: The paragraphs will be changed to: *"In applying the cleanup goals during remediation, site-wide concentrations would need to be decreased to equal to or less than site-wide average concentrations or 95 percent (%) upper confidence limits (UCLs) as specified under Chapter 62-780, F.A.C. A sufficient number of surface soil samples (minimum 10) would be collected during confirmatory sampling in the areas where action is taken to demonstrate that after implementation of the chosen remedial action, site-wide concentrations would meet these cleanup goals.*

Using this approach, the surface soil contaminant concentrations, or average soil contaminant concentrations calculated based on the 95% UCL are compared to their direct exposure CTLs or alternative direct exposure soil CTLs that are established pursuant to paragraph 62-780.650(1)(d), F.A.C. If more than one contaminant is present in the surface soil in the unsaturated zone at the site, the soil CTLs for all contaminants detected in surface soil samples at the site shall be apportioned based on their like-acting health affect."

Comment 7: On page 2-9, Section 2.4.2, it describes how the volume of contaminated groundwater was estimated. I found the description somewhat confusing. A figure depicting graphically how the volume was calculated would be appreciated. Please note that the volume calculated in this section is extremely important in deriving costs for any remedy that actively treats groundwater.

Response: Section 2.4.2 will be changed to: "*The locations of FDEP GCTL exceedances are presented on Figure 1-5 and the estimated plumes are presented on Figure 2-3. The three areas consist of: Area G1 is where lead exceeds its primary MCL and is approximately 5,000 square feet; Area G2 is where vanadium exceeds its GCTL and is approximately 500 square feet; Area G3 is where mercury exceeds its primary MCL and is approximately 500 square feet.*

The site lithology that was presented in previous reports (EnSafe/Allen & Hoshall, 1996) for Site 45 and general vicinity indicate the surficial aquifer sediments consist primarily of sand, with varying but relatively insignificant amounts of silt, silty clay, and shell material. The depth of the low-permeability marine clay confining unit at Site 45 was determined during the Site 45 RI (TtNUS, 2009) by the response to drilling resistance with a geosonic rig. The low-permeability marine clay was estimated to range from approximately 53 to 55 ft bgs. Shallow monitoring wells at Site 45 are typically screened from approximately 3 to 13 feet bgs and the deep wells from approximately 42 to 52 feet bgs. Monitoring wells were not installed in an intermediate depth between the two previously discussed zones at Site 45.

The depth to water at Site 45 was found during the Site 45 RI (TtNUS, 2009) to ranges from approximately 3.92 feet to 5.14 feet for the shallow monitoring wells and approximately 3.93 to 4.86 feet for the deep monitoring wells. Assuming 4 feet bgs for the top of the aquifer from the water level measurements and a depth of 54 feet bgs from the soil borings, the Site 45 groundwater investigation zone is estimated to be approximately 50 feet. Based on these assumptions, it is assumed that 1/3 of the surficial aquifer thickness or an approximate 17 feet thick zone is contaminated by the COCs at each of the three plumes.

At Area G1, lead was detected at concentrations exceeding its primary MCL under Chapter 62-550, F.A.C. but not its natural attenuation default concentration in groundwater samples collected from shallow monitoring wells PEN-45-04S and 18GS02S (hydraulically downgradient well). Lead was not detected at concentrations exceeding its primary MCL in groundwater samples collected from deep monitoring wells PEN-45-05 and PEN-45-11. This suggests that the plume is stable and limited to the area defined by shallow monitoring wells PEN-45-04S and 18GS02S. Area S1 (Figure 2-1) is potentially the source of the plume.

Based on a plume area that is approximately 5,000 square feet and 17 feet thick the volume of lead contaminated groundwater at Area G1 is estimated to be approximately 190,740 gallons. Assuming the entire plume has an average concentration of 59.5 µg/L lead, there is approximately 0.09 pounds of lead in the plume.

At Area G2, vanadium was detected at a concentration that exceeded its health based GCTL under Chapter 62-777, F.A.C. but not its natural attenuation default concentration in the groundwater sample collected from deep monitoring well PEN-45-07D. Vanadium was not detected at a concentration that exceeded its GCTL in the groundwater sample collected from shallow monitoring well PEN-45-06 (PEN-45-06 is clustered with PEN-45-07D) and the shallow and deep monitoring well cluster (PEN-45-08 and PEN-45-09) located hydraulically downgradient from monitoring well PEN-45-07D (Figure 2-3). This suggests that the plume is stable and limited to the area defined by deep monitoring well PEN-45-07D. A source area for vanadium was not identified in the Site 45 RI.

Based on a plume area that is approximately 500 square feet and 17 feet thick the volume of vanadium contaminated groundwater at Area G2 is estimated to be approximately 19,074 gallons. Assuming the entire plume has an average concentration of 73.1 µg/L vanadium, there is approximately 0.01 pounds of vanadium in the plume.

At Area G3, mercury was detected at a concentration that exceeded its primary MCL under Chapter 62-550, F.A.C. but not its natural attenuation default concentration in the groundwater sample collected from shallow monitoring 18GS04S (Figure 2-3). Monitoring wells have not been installed hydraulically downgradient of shallow monitoring 18GS04S. A source area for vanadium was not identified in the Site 45 RI and mercury was not detected in groundwater samples collected from shallow and deep monitoring wells (PEN-45-12 and PEN-45-13) located hydraulically upgradient of monitoring well 18GS04.

Based on a plume area that is approximately 500 square feet and 17 feet thick the volume of mercury contaminated groundwater at Area G3 is estimated to be approximately 19,074 gallons. Assuming the entire plume has an average concentration of 6.6 µg/L mercury, there is approximately 0.001 pounds of mercury in the plume.

Groundwater volume calculations are provided in Appendix B."

Comment 8: On page 3-6, Section 3.2.3, subsection on Cost, same comment as (1) above.

Response: The sentence will be changed to: *"Moreover, because the depth of the water table is approximately 4 feet bgs, dewatering would not be required under dry weather conditions."*

Comment 9: On page 4-15, Component 1, fourth sentence, please replace the word "in-situ" with the word "ex-situ". This will conform with what is written in Component 3.

Response: The sentence will be changed to: *"The data obtained for lead obtained via XRF would be correlated with fixed-base laboratory for additional confidence in the extent of soil requiring ex-situ treatment."*

Comment 10: On page 4-19, Section 4.3.1.2, subsection on Long-Term Effectiveness and Permanence, please change "surface water" to "groundwater".

Response: The sentence will be changed to: *"Alternative GW-1 would have no long-term effectiveness and permanence because contaminated groundwater would remain on site."*

Comment 11: Why has the active treatment component for groundwater been limited to in-situ treatment? There are other groundwater treatment options available that could have been evaluated in the FS. Please note that monitoring groundwater for the natural attenuation of metals like lead (Pb), mercury (Hg) and vanadium (V) could be a very expensive option if natural attenuation processes are very slight and no appreciable difference is detected between monitoring events. It may be advisable to estimate timeframes for remediating groundwater via natural attenuation and active treatment in order to better calculate which remedy is truly the most cost effective option.

Response: The Navy has conducted, for the past several years, focused Feasibility Studies that include the remedial technologies that are most appropriate for the site conditions, would likely be conducted in a reasonable time period and are cost effective. The other remedial options that were screened for Site 45 (Please refer to Tables 3-1 and 3-2 of the FS) could have been evaluated in more detailed but were not considered because they were not applicable for the site conditions presented in Section 1.0 of the FS, could be conducted in a reasonable time period and were not considered cost effective.

Additionally, in December, 1999, EnSafe, Inc. prepared a Final Technical Memorandum for Evaluation for MNA for Site 38, Buildings 71 and 604 at Naval Air Station (NAS), Pensacola, Florida. The MNA study found that measurements of dissolved oxygen, oxidation reduction potential, hydrogen, iron and sulfate and sulfide supported reductive dechlorination of chlorinated solvents and anaerobic conditions that support the sorption of lead to the aquifer sediments.

Other evidence of MNA at NAS Pensacola for inorganics includes the long-term monitoring data obtained from Operable Unit (OU) 4, Site 15 Pesticide Rinsate Disposal Area. At this site concentrations of arsenic have decreased through time based on long-term monitoring results. The evidence for MNA is documented by laboratory analytical results that have been obtained through a long-term quarterly monitoring program that has been conducted since 2001. For example arsenic has decreased in the groundwater samples from monitoring well 15GR03R from 150 μg/L in January 2004 to less than 5 μg/L in March 2006. It is possible that the arsenic removal occurred under anaerobic conditions because sulfate-reducing bacteria is present and produce sulfides at sufficient concentrations to result in the precipitation of arsenopyrite (FeAsS) or co precipitate with iron. The decrease in arsenic concentrations may also occur by other natural attenuation mechanisms including advection, dilution, and dispersion.

Also, there have been several studies conducted at NAS Pensacola to obtain data to evaluate treatability of petroleum related constituents using oxygen enriching technologies at various sites

across Naval Air Station (NAS) Pensacola. The preponderance of data from these studies suggest that the shallow groundwater across NAS Pensacola is typically under reducing (anaerobic) conditions that range from limited to strongly favorable for reductive dechlorination of chlorinated solvents and reducing conditions that potentially result in the sorption and immobilization of some inorganics.

Therefore, based on the known favorable site conditions MNA was appropriately selected as an alternative in the FS because the shallow groundwater across NAS Pensacola is typically under reducing conditions that are favorable for reductive dechlorination of chlorinated solvents and reducing conditions that result in the sorption and immobilization of some inorganics.

We concur with the FDEP that the timeframe for each remedial technology should be included to assist in the evaluation and selection of an options that is protective of human health and the environment based on the projected site use, and is implementable, timely and cost effective. However, at NAS Pensacola, it appears that each site has some variation in the presence of limited to strong anaerobic conditions to slightly mild aerobic conditions. Because of this variation, estimates in the rate of decline are likely to be inaccurate and would best be evaluated by a monitoring program that is coupled with a contingency plan.

NAVAL AIR STATION PENSACOLA

PENSACOLA, FLORIDA

FEASIBILITY STUUDY FOR SITE 45

(BUILDING 603 LEAD SITE)

RESPONSE TO EPA COMMENTS DATED FEBRUARY 24, 2010

Comments by the U.S. Environmental Protection Agency are shown in bold font. Responses follow each comment and are shown in regular font.

Comment: EPA has reviewed the above referenced document. We do not understand your retention of natural attenuation (section 3.3.2.2) as an acceptable groundwater remedial alternative. Please justify your recommendation concerning this alternative. Also, keep in mind that this site is 40+ years old.

For more guidance on monitored natural attenuation, please refer to the following.

<u>Things to consider before you consider MNA</u>

MNA is a frequently used method of treatment (or avoidance of treatment). The frequency of its use has caused the Agency to take a more critical look at its efficacy. It is the intention of the Agency that MNA not become a fall back approach to the remediation of recalcitrant contaminants. The Agency is in favor of MNA at only those sites where it is appropriate. And MNA is appropriate as a remedial approach only where it can be demonstrated that its use will achieve the remedial objectives within a reasonable time frame and will likely meet the appropriate ARARS.

Moreover, the efficacy of MNA must be demonstrated before it is selected as a remedy. Three types of site-specific information may be required:

1. Historical ground water and/or soil chemistry data demonstrates a trend of declining contaminant concentration.

2. Hydrogeologic and geochemical data that demonstrate natural attenuation processes and rates.

3. Field or microcosm studies.

Be apprised, that unless #1 is of sufficient quality and duration, #2 is generally required.

Also, these requirements generate three obviously valid questions concerning what constitutes a trend. I will attempt to address these questions. The first question is: What sort of historical ground water and/or soil chemistry data can be used needed to demonstrate a trend of declining contaminant concentration?

Answer: There are two rates of decline, the rate of decline in a single well over time, and the rate of decline along a flow path in ground water.

The rate of decline in a well over time determines how long a plume will last. The rate of decline in a well along the flow path will determine how far the plume will extend.

The second question is: How much historical ground water and/or soil chemistry data is needed to demonstrate a trend of declining contaminant concentration over time in well?

Answer: Sites with at least ten years of monitoring data showing at least a ten fold reduction in concentration of the contaminants have a reasonable chance to demonstrate a declining trend.

The third question is: Which sites can be demonstrated to achieve remedial objectives <u>within a reasonable time frame?</u>

Answer: Depends on the attenuation required to reach the goal, and how long we are willing to wait.

Response to general comment: The Navy acknowledges that monitored natural attenuation (MNA) is not considered a "presumptive" or "default" remedy but is one of the options that should be evaluated with other applicable remedies. As such, MNA was considered an appropriate alternative to be included in the FS for Site 45 as it has been approved in Record of Decisions (RODs) for Sites 11, 12, 25, 26, 27 and 30.

The concentrations of contaminants and small plumes at Sites 11, 12, 25, 26, 27 and 30 are similar to Site 45 in that although the contamination is present at concentrations greater than EPA MCLs and FDEP groundwater cleanup target levels (GCTLs) the detected concentrations are relatively low and do not present an unacceptable threat to human health or the environment under the groundwater use restrictions that will be implemented as part of the selected remedy.

Additionally, in December, 1999, EnSafe, Inc. prepared a Final Technical Memorandum for Evaluation for MNA for Site 38, Buildings 71 and 604 at Naval Air Station (NAS), Pensacola, Florida. The Technical Memorandum described the natural attenuation study that was performed as part of a Feasibility Study (FS) for Site 38 (Buildings 71 and 604). Buildings 71 and 604 are located approximately 550 feet east of Site 45. The MNA study found that measurements of dissolved oxygen, oxidation reduction potential, hydrogen, iron and sulfate and sulfide supported reductive dechlorination of chlorinated solvents and lead. MNA was included in the FS for Site 38 and has also been included as the selected remedy in the Proposed Plan for chlorinated solvents and lead in Site 38 groundwater.

Also, several studies have been conducted at various sites across Naval Air Station (NAS) Pensacola to obtain MNA data and to evaluate treatability of petroleum related constituents using oxygen enriching technologies. The preponderance of evidence for MNA from these studies suggest that the shallow groundwater across NAS Pensacola is typically under reducing (anaerobic) conditions that range from limited to strongly favorable for reductive dechlorination of chlorinated solvents and reducing conditions that potentially result in the sorption and immobilization of some inorganics.

However, it should be noted that while both anaerobic and aerobic respiration have been successfully demonstrated for petroleum, biodegradation of petroleum by aerobic mechanisms is more rapid than anaerobic reduction (ASTM, 1998). Because of the length of time required to achieve groundwater cleanup target levels under the typical aquifer conditions at NAS Pensacola, treatability studies were conducted to document that the mildly anaerobic or aerobic conditions could be enhanced using oxygen enriching technologies to accelerate the degradation of petroleum related constituents in groundwater. A summary of the results of for the MNA and treatability evaluations is provided in Table 1.

Therefore, based on the known favorable site conditions MNA was appropriately selected as an alternative in the FS because the shallow groundwater across NAS Pensacola is typically under reducing conditions that are favorable for reductive dechlorination of chlorinated solvents and reducing conditions that result in the sorption and immobilization of some inorganics.

Response to 1st question/comment: There are three methods that are commonly used to evaluate the rate of decline and determine that natural attenuation is an active process including:

- Evaluating the rate of decline by using monitoring data to construct a linear trend for log concentrations values as a function of distance from the contamination source.
- Establish the first order degradation rate and apply that to the site to derive a time to reach MCLs.
- Conduct a statistical analysis of monitoring data with the Mann-Kendall at an 80% confidence level to determine whether or not a trend is present (increasing, no–trend or decreasing). A minimum of 4 quarterly sampling events would be conducted. The slope of the trend could be evaluated using Sen's slope estimator method to evaluate the rate of increase or decrease.

It is recommended for Site 45 that the natural attenuation remedy include conducting four quarterly sampling events and evaluating the data using the Mann-Kendall test.

Adequate proof of the existence of transformation processes for organic chemical can be determined using chemical analysis and evaluation of the chemical characteristic of the aquifer for natural attenuation. Several such evaluations have been conducted at NAS Pensacola and are provided in Table 1.

It should be noted that several factors can distort observed concentration profiles including: (1) assumption of steady-state conditions where none exist, (2) fluctuation in source strength with time, (3) the assumption of a linear relationship between the dispersive mass flux and the concentration gradient when none exits, (4) the assumption of heterogeneous flow and transport (5) placement of monitoring wells off of the plume centerline (6) dilution effects due to screen length, and (7) non-uniform degradation rate distribution.

Response to 2nd question/comment: Ten years of data collection to justify MNA is a burdensome and not a cost effective requirement, and a justification of the 10 year requirement cannot be found based on a review of USEPA and Office of Solid Waste and Emergency Response (OSWER) directives. As stated in the response to the 1st question, conducting a minimum of 4 quarterly sampling events and evaluating the data using the Mann-Kendall test is recommended for the chemicals of concern (COCs) at Site 45. Additionally, a contingency plan should be developed should MNA not meet the decision requirements and clean up levels for the COCs

Response to 3rd question/comment: In regards to the timeframe for remedial actions, OSWER directive 9200.4-17P states that the USEPA recognizes that the determination of what timeframe is "reasonable" for attaining remediation objectives is a site-specific determination and should be reasonable when compared to other remedies which could be achieved through active restoration. This comparison is made in the FS.

- Alternative GW-1: No Action, duration not applicable because no remedial action will be implemented

- Alternative GW-2: LUCs and Monitored Natural Attenuation; anticipated to be 5 years with the rate determined by conducting natural attenuation monitoring and evaluating the data using the Mann-Kendall Test and Sen's slope estimate.
- Alternative GW-3: In-situ Groundwater Treatment and LUCs with Monitoring; is estimated to be 3 years, based on with the first injection being conducted after conducting a treatability test and plume delineation at each area, the second injections would be conducted 1 year later (if necessary) based on 4 quarters of monitoring, and one year of post active remediation monitoring (four quarterly sampling events).

Table 1 Summary of MNA and Treatability Evaluations			
Site	**Contaminants**	**Site Summary**	**Evidence of MNA**
Site 38 Buildings 71 and 604	Tetrachloroethene (PCE) and Lead	Measurements of dissolved oxygen, oxidation reduction potential, hydrogen, iron and sulfate and sulfide support reductive dechlorination of chlorinated solvents and lead.	Limited to strong evidence of MNA documented by field and laboratory analytical results.
OU 4, Site 15 Pesticide Rinsate Disposal Area	Pesticides (dieldrin) and arsenic	Concentrations of arsenic have decreased through time based on long-term monitoring results	**Sulfate-reducing bacteria is present and produce sulfides at sufficient concentrations to result in the precipitation of arsenopyrite (FeAsS) or co precipitate with iron.**
OU 1	benzene, chlorobenzene, vinyl chloride, nickel, naphthalene, xylenes, 1,1,2,2-tetrachloroethane, aluminum, cadmium, chromium, iron and manganese.	Natural attenuation data collected at OU 1 did not provide widespread evidence for reductive dechlorination, but the presence of vinyl chloride suggests that that reductive dechlorination of source materials already occurred.	Evidence of reductive dechlorination is based on laboratory analytical results. The presence of degradation products including vinyl chloride requires anaerobic conditions. Vinyl chloride degraded by aerobic conditions, not anaerobic.
UST Site 14	Petroleum related constituents related to diesel fuel marine (DFM) and various vehicle fuels	Quarterly monitoring results indicated that MNA would not be completely effective in reducing petroleum related constituents to GCTLs in accordance with the 5-year monitoring plan. A Treatability Study was conducted for the injection of Oxygen Release Compound®	Limited anaerobic to mild aerobic MNA conditions documented by field and laboratory analytical results. Treatability Study indicated that enhanced aerobic conditions would accelerate the degradation of the petroleum related constituents.

Table 1 Summary of MNA and Treatability Evaluations			
Site	**Contaminants**	**Site Summary**	**Evidence of MNA**
		(ORC) to enhance biodegradation.	GCTLs not exceeded following the ORC injection.
UST Site 17	Petroleum related constituents related to DFM	Quarterly monitoring results indicated that MNA would not be completely effective in reducing petroleum related constituents to GCTLs in accordance with the 5-year monitoring plan. A Treatability Study was conducted for the injection of ORC to enhance biodegradation.	Moderately reducing to slightly oxidizing conditions was documented by field and laboratory analytical results. Post-injection results indicated that the original plume was treated but exceedance of GCTLs occurs outside the ORC injection area.
UST Site 19	Petroleum related constituent, benzene		
UST Site 22, IR site 21	Petroleum related constituents related aviation gasoline		