FIRST FIVE-YEAR REVIEW REPORT FOR FRONTIER FERTILIZER SUPERFUND SITE YOLO COUNTY, CALIFORNIA

PREPARED BY

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Approved by: Kathleen Salyer **Date:** 9/26/12

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Executive Summary

This is the first Five-Year Review (FYR) of the Frontier Fertilizer Superfund Site (the Site) located in Davis, California. The purpose of this FYR is to review information to determine if the remedy is and will continue to be protective of human health and the environment. The triggering action for this FYR was the start of the remedial action on September 25, 2007.

The Site was initially developed in the 1950s and contained facilities that serviced the agricultural industry. The chemicals that present the most risks in the soil and groundwater at the Site are the pesticides: EDB (1,2-dibromoethane), DBCP (1,2-dibromo-3-chloropropane), DCP (1,2-dichloropropane), and TCP (1,2, 3-trichloropropane). Carbon tetrachloride also was used as a grain fumigant, and the source appears to be separate from the pesticides. The Site contains contaminated soil and a groundwater plume that extends in a northerly direction beyond the Remainder Parcel under residential housing. The nearest residence is approximately 600 feet north of the property boundary. The Site is currently zoned for commercial and light industrial development.

In September 2006, U. S. Environmental Protection Agency (EPA) selected the remedy for the Frontier Fertilizer Superfund Site to protect long-term human health and the environment. The major components of the selected remedy are in situ (in place) heating, groundwater pump-and-treat system using granular activated carbon (GAC), enhanced anaerobic biological treatment of the source area, institutional controls (ICs), and ground cover to minimize ecological receptor contact with contaminated surface soil.

The groundwater pump and treat system has been in operation since 1995. The in place heating or Electrical Resistive Heating (ERH) operations began February 23, 2011, and are expected to continue until October/November 2012. The other components of the remedy will be implemented upon completion of the ERH.

According to the data reviewed, the Site inspection, and the interviews, the groundwater remedy is functioning as intended by EPA's Record of Decision. The soil and vadose zone component of the remedy, ERH, is not complete, but data collected to date demonstrate that it is performing as intended. There have been no changes in the applicable or relevant and appropriate requirements that would affect the protectiveness of the remedy. The assumptions used in determining exposure pathways are considered to be health protective and reasonable in evaluating risk for this Site. There has been a change in the TCP toxicity value that may affect the long- term protectiveness. There have been no other changes in the toxicity factors or other contaminant characteristics that could affect the protectiveness of the remedy. There has been no change to the standardized risk assessment methodology that could affect the protectiveness of the remedy. There is no other information that calls into question the protectiveness of the remedy.

The remedy at the Frontier Fertilizer Superfund Site is currently protective of human health and the environment because all exposure pathways are being controlled. However, for the remedy to be protective in the long term, a restrictive covenant should be placed on the Frontier Fertilizer property (as identified in the ROD), options to optimize the groundwater remedy should be evaluated and the cleanup level for TCP should be re-evaluated to incorporate the newer TCP toxicity number.

Five-Year Review Summary Form

SITE IDENTIFICATION		
Site Name: Frontier Fertilizer		
EPA ID: CAD071530380		
Region: 9	**State:** CA	**City/County:** Davis/Yolo

SITE STATUS	
NPL Status: Listed 5/31/94	
Multiple OUs? OU 1 only	**Has the site achieved construction completion?** No; CC scheduled for FY 2014

REVIEW STATUS
Lead agency: EPA
Author name (Federal or State Project Manager): Bonnie Arthur, Remedial Project Manager, Region 9, U.S. EPA
Author affiliation: U.S. EPA
Review period: October 2007 – June 2012
Date of site inspection: June 4, 2012
Type of review: Statutory
Review number: First
Triggering action date: 9/25/07
Due date (five years after triggering action date): 9/25/12

Five-Year Review Summary Form (continued)

Issues/Recommendations				
OU(s) without Issues/Recommendations Identified in the Five-Year Review:				
NA				
Issues and Recommendations Identified in the Five-Year Review:				
OU(s): OU 1.	**Issue Category:** Institutional Controls			
	Issue: Potential difficulties in obtaining deed restriction from owners. Currently, EPA has control of Frontier Fertilizer and owners are not viable PRPs.			
	Recommendation: Involve management and attorney team early in process.			
Affect Current Protectiveness	**Affect Future Protectiveness**	**Implementing Party**	**Oversight Party**	**Milestone Date**
No	Yes	EPA, DTSC	EPA	12/2013

Issues/Recommendations				
OU(s) without Issues/Recommendations Identified in the Five-Year Review:				
NA				
Issues and Recommendations Identified in the Five-Year Review:				
OU(s): OU 1	**Issue Category:** Remedy Performance			
	Issue: The toxicity of TCP has changed so the current TCP cleanup value may not be protective for future benefical use of groundwater.			
	Recommendation: Evaluate the impact of the lower toxicity number on the current TCP cleanup level.			
Affect Current Protectiveness	**Affect Future Protectiveness**	**Implementing Party**	**Oversight Party**	**Milestone Date**
No	Yes	EPA	EPA	12/2013

Issues/Recommendations				
OU(s) without Issues/Recommendations Identified in the Five-Year Review:				
NA				
Issues and Recommendations Identified in the Five-Year Review:				
OU(s): OU 1	**Issue Category:** Remedy Performance			
	Issue: Groundwater extraction system capture zone may not include all contaminated groundwater.			
	Recommendation: Evaluate options to optimize groundwater remedy.			
Affect Current Protectiveness	**Affect Future Protectiveness**	**Implementing Party**	**Oversight Party**	**Milestone Date**
No	Yes	EPA	EPA	12/2013

Sitewide Protectiveness Statement (if applicable)	
Protectiveness Determination:	**Addendum Due Date (if applicable):**
Short-term Protective	**N/A**
Protectiveness Statement: The remedy at the Frontier Fertilizer Superfund Site is currently protective of human health and the environment because all exposure pathways are being controlled. However, for the remedy to be protective in the long term, the restrictive covenant should be placed on the Frontier Fertilizer property, options to optimize groundwater remedy should be evaluated, and the cleanup level for TCP needs to be re-evaluated to incorporate the newer TCP toxicity number.	

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List of Acronyms and Abbreviations

APN	Assessor's Parcel Number
AQMD	Air Quality Management District
ARAR	applicable or relevant and appropriate requirement
BACT	best available control technology
bgs	below ground surface
CCl4	carbon tetrachloride
CCR	California Code of Regulations
CERCLA	Comprehensive Environmental Response, Compensation, and Liability Act
CERCLIS	Comprehensive Environmental Response, Compensation, and Liability Information System
CFR	Code of Federal Regulations
COC	chemical of concern
CPT	cone penetrometer test
DBCP	1,2-dibromo-3-chloropropane
DCP	1,2-dichloropropane (dichloropropane)
DTSC	Department of Toxic Substances Control [California]
EDB	1,2-dibromoethane (ethylene dibromide)
EPA	U.S. Environmental Protection Agency
ERH	electrical resistance heating
FFSOG	Frontier Fertilizer Superfund Oversight Group
ft/d	feet per day
FYR	Five-Year Review
GAC	granular activated carbon
gpm	gallons per minute
GWTS	groundwater treatment system
HAP	hazardous air pollutant
HHRA	human health risk assessment
HQ	Hazard quotient
IC	institutional control
IRIS	[EPA] Integrated Risk Information System
kg	kilograms
kW	kilowatt
LUC	land use covenant, land use control
MCL	maximum contaminant level
mg/L	milligrams per liter
NAPL	non-aqueous phase liquids
NCP	National [Oil and Hazardous Substances Pollution] Contingency Plan
NPL	National Priorities List
OEHHA	Office of Environmental Health Hazards Assessment
OU	operable unit
PHG	Public Health Goal
ppb	parts per billion
ppm	parts per million
PRG	[EPA Region 9 screening-level] preliminary remediation goal

RAO	remedial action objective
RA	remedial action
RCRA	Resource Conservation and Recovery Act
RI	Remedial Investigation
ROD	Record of Decision
RPM	Remedial Project Manager
RWQCB	Regional Water Quality Control Board
Site	Frontier Fertilizer Superfund Site, Davis, California
STLC	Soluble Threshold Limit Concentration
TCP	1,2,3-trichloropropane (trichloropropane)
TDS	total dissolved solids
TTLC	Total Threshold Limit Concentration
ug/kg	micrograms per kilogram
ug/L	micrograms per liter
USACE	U.S. Army Corps of Engineers
U.S.C.	United States Code
VOC	volatile organic compound
WDR	Waste Discharge Requirement
WQO	water quality objective

First Five-Year Review Report

for

Frontier Fertilizer Superfund Site

1. Introduction

The purpose of a Five-Year Review (FYR) is to evaluate the implementation and performance of a remedy to determine if the remedy will continue to be protective of human health and the environment. The methods, findings, and conclusions of FYRs are documented in Five-Year Review Reports. In addition, FYR Reports identify issues found during the review, if any, and document recommendations to address them.

The U.S. Environmental Protection Agency (EPA) prepares FYRs pursuant to the Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA) Section 121 and the National [Oil and Hazardous Substances Pollution] Contingency Plan (NCP). CERCLA 121 states:

"If the President selects a remedial action that results in any hazardous substances, pollutants, or contaminants remaining at the site, the President shall review such remedial action no less often than each five years after the initiation of such remedial action to assure that human health and the environment are being protected by the remedial action being implemented. In addition, if upon such review it is the judgment of the President that action is appropriate at such site in accordance with section [104] or [106], the President shall take or require such action. The President shall report to the Congress a list of facilities for which such review is required, the results of all such reviews, and any actions taken as a result of such reviews."

EPA interpreted this requirement further in the NCP, 40 Code of Federal Regulations (CFR) Section 300.430(f)(4)(ii), which states:

"If a remedial action is selected that results in hazardous substances, pollutants, or contaminants remaining at the site above levels that allow for unlimited use and unrestricted exposure, the lead agency shall review such actions no less often than every five years after the initiation of the selected remedial action."

EPA conducted the FYR and prepared this report regarding the remedy implemented at the Frontier Fertilizer Superfund Site located in the City of Davis, Yolo County, California. The EPA is the lead agency for developing and implementing the remedy for the Site. The Department of Toxic Substances Control (DTSC) and the Regional Water Quality Control Board (RWQCB) support agencies representing the state of California have reviewed all supporting documentation and provided input to EPA during the FYR process.

This is the first FYR for the Frontier Fertilizer Superfund Site. The triggering action for this statutory review is the on-site construction start date of the remedial action. The FYR is required because hazardous substances, pollutants, or contaminants remain at the Site above levels that allow for unlimited use and unrestricted exposure.

2. Site Chronology

Significant events for the Frontier Fertilizer Superfund Site are listed in Table 1.

Table 1
Chronology of Site Events

Event	Date
Site was discovered by Yolo County Public Health after an employee's dog died of pesticide poisoning after contact with disposal basin.	1983
Potentially responsible party excavation and landfarm (aeration) of 1,100 cubic yards of soil from the disposal basin area. State of California installed initial groundwater pump-and-treat system.	1985 1993
NPL listing	5/31/94
EPA installed larger groundwater pump-and-treat system.	1995
Remedial Investigation/Feasibility Study complete	6/1/06
Record of Decision (ROD) signature	9/28/06
Remedial design start	1/09/07
Remedial Design complete	9/30/09
Superfund State Contracts:	9/11/2007 & 9/12/2007
Remedial Action start	9/25/07
Construction start date	9/2009

3. Background

3.1. Physical Characteristics

The Frontier Fertilizer Superfund Site is located in the City of Davis, California (Yolo County) (Figure 1) and includes a triangular 11.43-acre parcel, Assessor Parcel Number (APN) 071-412-031 owned by Pine Tree Properties and a 7-acre undeveloped parcel north of the Site that is part of a 10.98-acre parcel, APN 071-411-07, known as the "Remainder Parcel." The parcels contain contaminated soil and a groundwater plume that extends in a northerly direction. Contaminated groundwater extends beyond the Remainder Parcel under residential housing (Figure 2).

Figure 1. Location Map for the Frontier Fertilizer Superfund Site

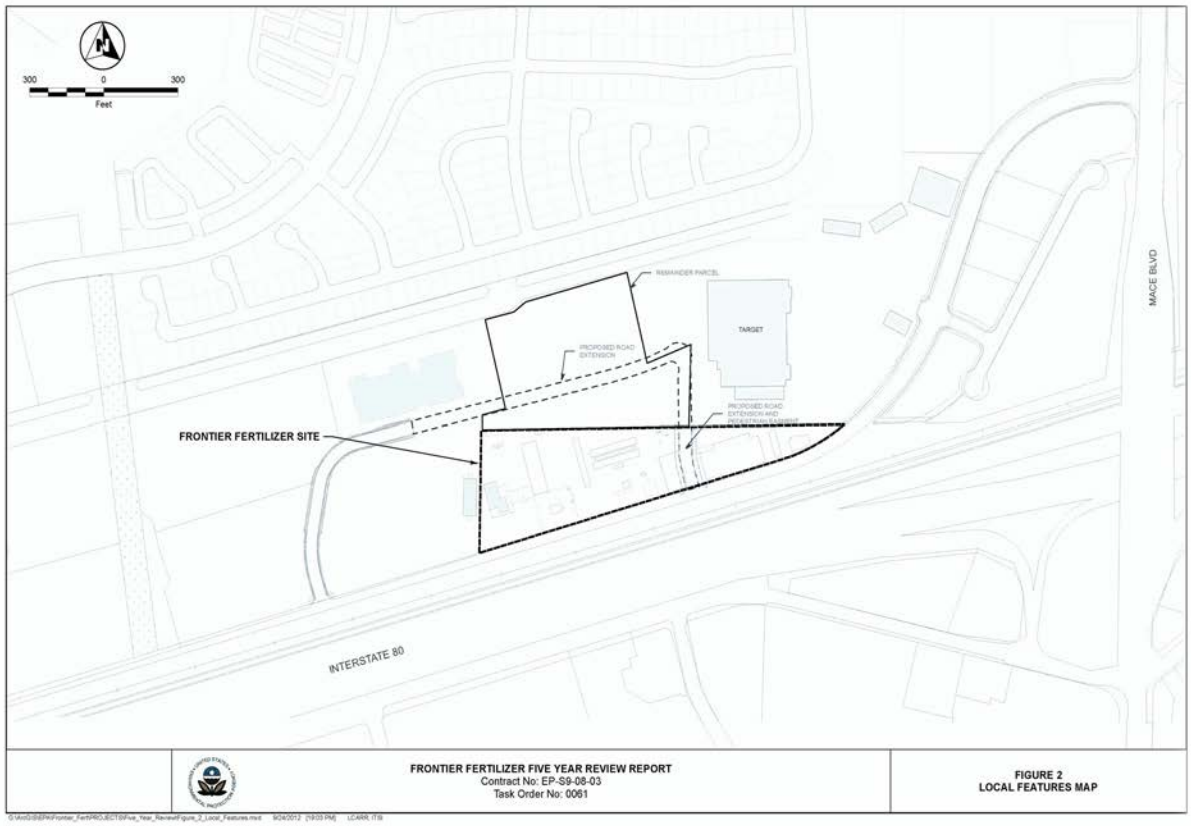

Figure 2. Local Features of the Frontier Fertilizer Superfund Site

3.2. Hydrogeology

The Site is underlain by Quaternary alluvium to depths exceeding 300 feet below ground surface (bgs). Below this depth, semi-consolidated units of clay and occasional sand/gravel extend to below 2,000 feet bgs. The alluvium deposits represent heterogeneous mixtures of gravel, sand, silt, and clay generated by the changing flowpath of Putah Creek over the past geologic epoch. Fine-grained materials from ancient floodplains predominate in the upper 100 feet, interrupted by discontinuous sand stringers that can be up to 10 feet thick. Data do not indicate that continuous aquifers or aquitards exist in the top 100 feet, which include the S-1 and S-2 aquifer zones. In these zones, sandy materials tend to be encountered interbedded with clays and silts that act to restrict the movement of groundwater. Significant variations in aquifer vertical and horizontal conductivities are typical across the S-1 and S-2 zones. Between 100 and 300 feet bgs, the subsurface is somewhat more stratified, with permeable sand units displaying greater continuity. Municipal and agricultural wells historically have utilized this depth interval, though recently the City has constructed wells in the deeper semi-consolidated units.

Four general water-bearing zones have been designated—from shallowest to deepest—as the S-1, S-2, A-1, and A-2 zones. Site monitoring wells are screened in the S-1, S-2, and A-1 zones and active extraction wells are constructed to extract groundwater from the S-1 and S-2 zones. The S-1 zone extends

to a depth of about 60 feet bgs and the S-2 zone has been designated at a depth of about 60 to 90 feet bgs. The measured horizontal hydraulic gradient across the Site indicates a flow direction to the north/northeast for the S-1 and S-2 groundwater zones. Typically, groundwater potentiometric head, i.e. depth to groundwater measured in monitoring wells, in the S-1 and S-2 are at an annual low of approximately 30 feet bgs in late summer. Potentiometric head are at an annual high at approximately 10 feet bgs in late winter at the end of the rainy season. Shallow groundwater levels vary with extraction rates, with available water in the zones, and with hydraulic conductivity between extraction wells and monitored wells.

The A-1 zone occurs at a depth interval of about 90 to 140 feet bgs. It appears to be dipping slightly to the south. The A-1 zone also appears to be laterally continuous throughout the area and, reportedly, throughout most of the region. Local agricultural wells reportedly draw from the A-1 and the deeper A-2 zone. This aquifer has a much higher hydraulic conductivity (estimated as high as 100 feet per day [ft/d]) than either of the shallower zones. The measured horizontal hydraulic gradient indicates a flow direction to the south/southeast in the A-1 zone. Similar to the S-1 and S2 zones, potentiometric head are at an annual low at approximately 30 feet bgs in late summer, which follows approximately 3 months of irrigation pumping. As in the S-1 and S-2 zones, potentiometric head in the A-1 zone is at an annual high at approximately 10 feet bgs in late winter, which is toward the end of the rainy season and following recovery from irrigation pumping. Seasonal fluctuations in the potentiometric head are largest in the A-1 zone because it is used as a source of irrigation water for nearby agricultural fields.

A 25- to 30-foot-thick clay layer, designated as the A-1/A-2 aquitard, underlies the A-1 aquifer and appears to separate it from the A-2 aquifer. This aquitard has been investigated at the Site by four soil borings and a few deep borings associated with early monitoring well installations. It may be effectively much thicker than 30 feet in some areas, as most A-2 production well screens occur below 200 feet bgs. The A-2 aquifer is a sequence of discontinuous gravel layers extending from 180 to 350 feet bgs. The A-2 aquifer is the primary water supply aquifer in the Davis area and provides agricultural and municipal water supply.

3.3. Land and Resource Use

The Pine Tree Properties and Remainder Parcels are located in an area currently zoned for light industrial development at the eastern edge of Davis. The 11.43-acre parcel is located at 4301 Second Street (formerly known as Road 32A) in Davis, Yolo County, California. The nearest residence is approximately 600 feet north of the property boundary. The parcels surrounding the Site are currently zoned for light industrial and commercial development. Since the 2006 ROD, new buildings have been constructed near the Site. EPA negotiated an 2008 Agreement On Consent with Target, Inc. which included groundwater, soil gas, and sub-slab vapor investigations as the store was constructed near a monitoring well with low level detections of site COCs. As an added precaution, Target, Inc. agreed to include a passive venting system with a monitoring port to enable continued sub-slab monitoring.

There are no drinking water wells installed in the S1, S2, or A1 aquifer zones contaminated by Site chemicals of concern (COCs). Currently, these zones are not used for drinking water because of their

generally low yield (S1 and S2) and high total dissolved solids (S1, S2, and A1). Even though the shallow groundwater currently is not used for drinking water, shallow groundwater at this Site is designated as having the beneficial use of potentially providing municipal and domestic water supplies pursuant to the *Water Quality Control Plan for the Sacramento River and San Joaquin River Basins*, Fourth Edition (*Basin Plan*).

Groundwater used for the public water supply comes from the A-2 aquifer found at depths greater than 180 feet bgs. This aquifer does not contain Site contaminants. The nearest drinking water supply well (CD29) was located northwest of the Site and pumped water from depths greater than 696 feet bgs.

3.4. History of Contamination

The Barber-Rowland Company operated a pesticide and fertilizer distribution facility on the parcel from 1972 to 1982, and the Frontier Fertilizer Company continued operations from 1982 to 1987. Both companies handled chemicals on the western 4 acres of the triangular parcel. Chemical-related operations consisted of storing, mixing, and loading pesticides and fertilizers into mobile tanks that were used to transport the chemicals to agricultural fields for application. Tanks and containers were rinsed prior to re-use or disposal and the rinsate was disposed on site into one or more earthen disposal basins located at the northwest edge of the triangular parcel. The disposal basins were identified as the release point for most COCs detected at the Site—the exception being carbon tetrachloride (CCl4). Pesticide handling was discontinued during the 1980s when Yolo County discovered high levels of pesticides in an unlined disposal basin. The source of the CCl4 detected in groundwater has not been identified, but appears to be east of the disposal basins. On-site activities that may have resulted in CCl4 contamination include equipment maintenance, grain storage, and on-site wastewater disposal systems.

The first cleanup activities began at Frontier Fertilizer in 1983. Until 1994, when the Site was included in the National Priorities List, investigative and cleanup activities were performed by property owners or under the remedial orders issued by the state of California. In 1994, EPA took over management of the Frontier Fertilizer investigation after Frontier Fertilizer was added to the National Priority List.

3.5. Initial Response

Table 2 lists the companies and organizations and the scope of environmental cleanup activity of each one.

Table 2
Initial Response Activity

Sponsor, Contractor (Year)	Scope of Activity
Frontier Fertilizer Co., Laugenour and Meikle (1985)	Excavation and landfarm (aeration) of 1,100 cubic yards of soil from the disposal basin area. The excavation did not remove all of the contaminated soil from the disposal basin, but did help to mitigate the immediate threat of exposure to soil contamination.
DTSC, URS (1993)	Installed the initial groundwater pump-and-treat system with an extraction capacity of 0.25 gallons per minute (gpm).
EPA, CET Environmental Services (1996)	Installed a larger capacity groundwater pump-and-treat system to replace the initial system: 17 wells were online in July 1995. Produced approximately 28 gpm and production increased to approximately 50 gpm in April 1996.
EPA, URS (1999 to 2001)	Upgraded and repaired the groundwater extraction system, added three extraction well clusters, three monitoring wells to the northwest, and conducted extensive cone penetrometer test (CPT) investigation. Above-ground structures also were removed during the period.
EPA, CH2M HILL (2002 to 2005)	Expanded the extraction system and increased system capacity to 80 gpm.

3.6. Basis for Taking Action

The Site was first identified in the 1980s by Yolo County when staff discovered high levels of pesticides in an unlined disposal basin. It appears from the quantity of pesticides found that waste chemicals, mainly pesticides and fertilizer tank or container rinsate, were discharged into one or more of these disposal basins. Sample analytical results confirmed that the highest concentrations of COCs in soil and groundwater were below and downgradient of the former disposal basin. Groundwater investigations showed that a pesticide contaminated groundwater plume migrated north from the disposal basins or source area. The COCs in groundwater beneath the Site were found at levels exceeding screening levels for vapor intrusion (hypothetical on-site future residents and workers) and drinking water standards.

4. Remedial Actions

The Site Record of Decision (ROD), signed September 28, 2006, presents the remedial action objectives (RAOs) and selected remedial actions for the entire Frontier Fertilizer Superfund Site.

The specific RAOs for the Frontier Fertilizer Site include the following:

- Reduce levels of chemicals in on-site soil to prevent future exposures to chemicals in soil above health-protective levels.
- Reduce levels of chemicals in groundwater (and soil sources to groundwater) so that the groundwater could ultimately be used for domestic purposes.
- Prevent future on-site exposures (workers and/or residents) from being exposed to chemical vapors in indoor air above health-protective levels.
- Reduce risks to plants and animals to a level consistent with habitat quality and proposed future use of the Site.

Table 3
Remedial Action Objectives

Contaminant of Concern	Soil Cleanup Values (ug/kg)[a]	Groundwater Cleanup Value (ug/L)	Basis for Selection
DBCP	1.20	0.2	MCL
EDB	0.18	0.05	MCL
DCP	20	5	MCL
CCl4	90 [b]	0.5 [c]	CA MCL
TCP	2.5	0.5 [d]	Detection Limit

Frontier Fertilizer Record of Decision, September 2006

[a] Soil depth to 10 feet bgs for protection of groundwater
[b] CCl4 has not been detected in soil in past investigations
[c] California MCL, which is more stringent than the federal MCL
[d] Detection limit for TCP; there is no MCL for TCP

4.1. Remedy Selection

The selected remedy is a permanent solution that includes treating groundwater and soil contaminated with COCs to achieve RAOs. The major components of the selected remedy are listed below:

- In situ (in place) heating using electrical energy to heat source area soil and groundwater up to 60-90 feet below ground surface that are a continuing source of groundwater contamination. Vapor controls include ambient air monitoring and an impermeable layer of plastic over the source area. Soil vapor generated is collected, treated, and monitored;

- Continued operation of groundwater pump-and-treat system. Groundwater extraction and treatment will continue until monitoring indicates that the RAOs are achieved. The monitoring will also determine if additional pumping (extraction) wells or monitoring wells, or modifications to the system are necessary;

- Secondary enhanced anaerobic biological treatment of the source area to treat nitrate based on the following evaluation planned for the design phase. This evaluation will include a comparison of nitrate levels in Site groundwater and City monitoring/drinking water wells in addition to discussions with the City of Davis to determine whether any changes are anticipated for the Site's nitrate discharge requirements.

- Institutional Controls to prevent exposure to soil above acceptable cleanup levels and to prevent exposure to contaminated groundwater.

- Wood chip, pavement, or gravel cap to prevent ecological receptors from contacting surface soil.

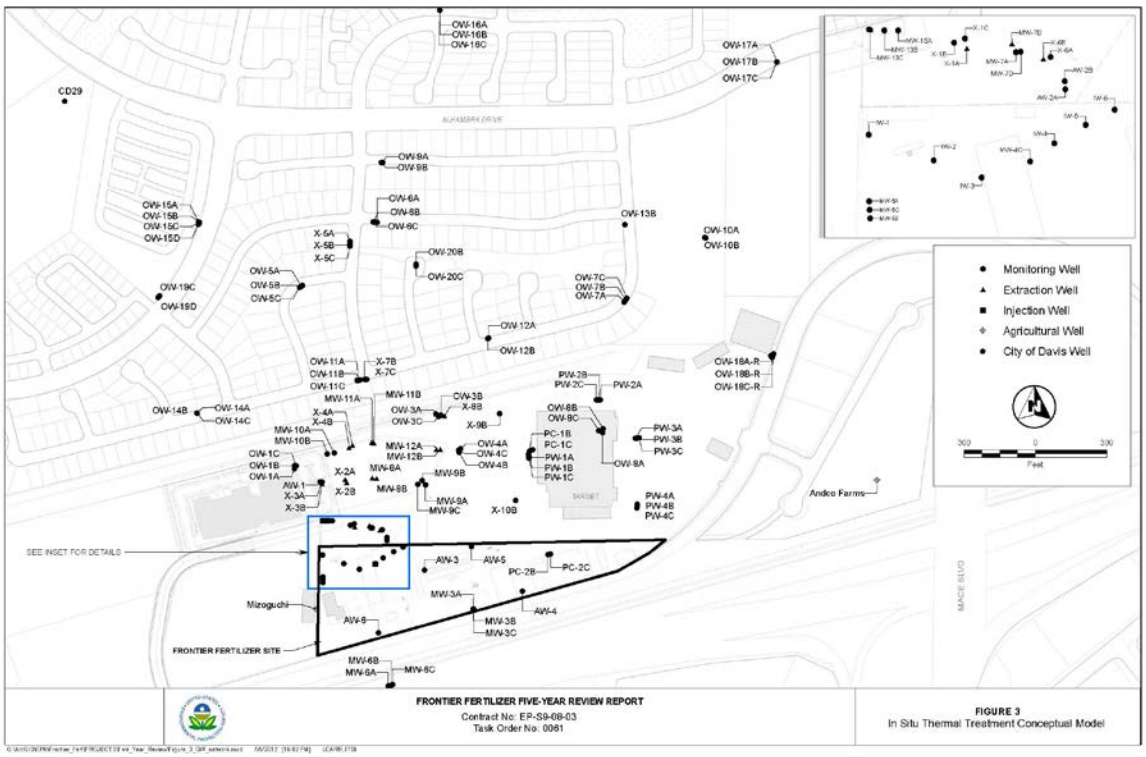

Figure 3. Groundwater Monitoring Well Network

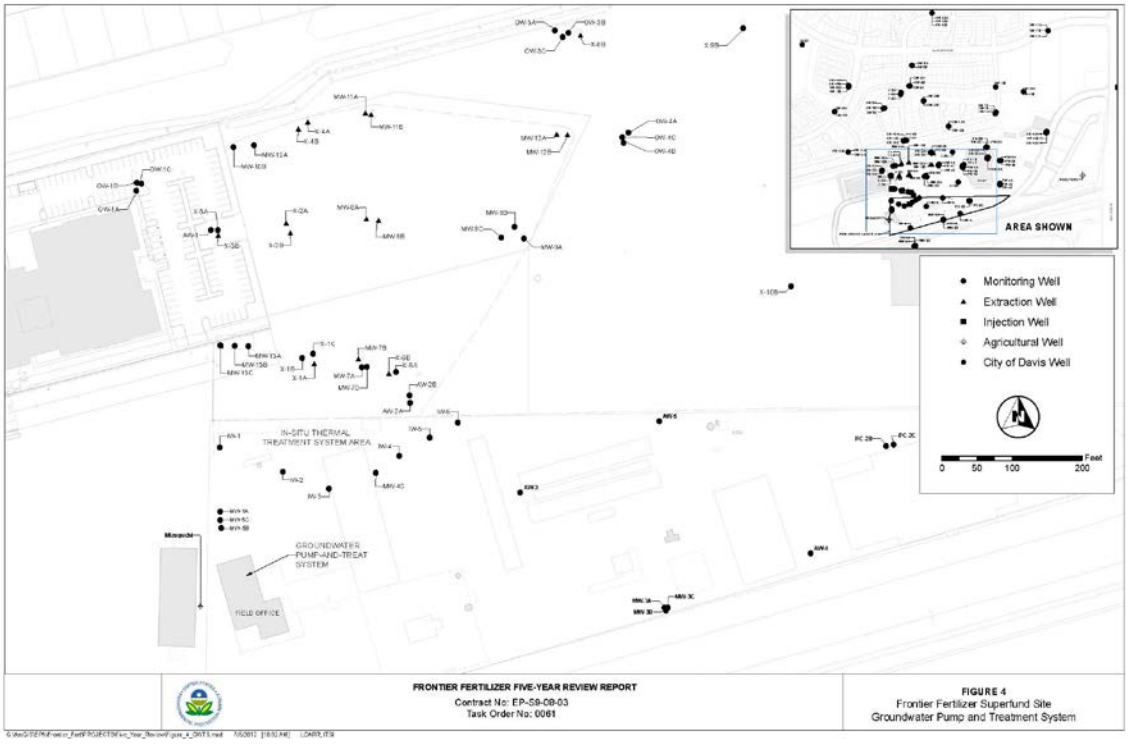

Figure 4. Frontier Fertilizer Superfund Site Groundwater Pump and Treatment System

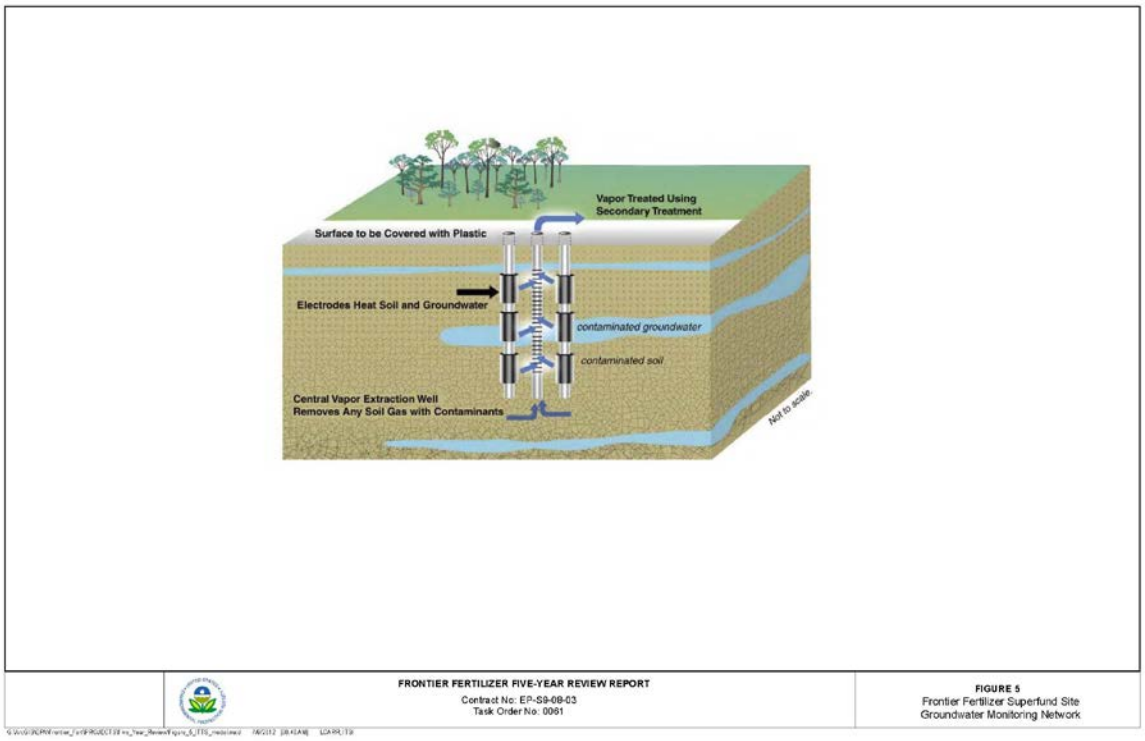

Figure 5. In-situ Heating Conceptual Model

4.2. Remedy Implementation

Electrical Resistance Heating (ERH)

The implementation strategy for operation of Electrical Resistance Heating (ERH) at the Site includes a phased heating approach for three different portions of the Site (referred to as Stages 1, 2, and 3) and the use of a diminishing returns evaluation to determine when to cease heating activities for each stage.

Groundwater Extraction and Treatment

In April 1995, EPA constructed a groundwater extraction and treatment system to control migration of groundwater containing pesticides and to remove pesticides from the groundwater. The system, which replaced a similar but smaller system installed and operated by the state of California, began operation in late June 1995.

The groundwater extraction and treatment system operates year-round, 24 hours/day. Contaminated groundwater is pumped from the extraction wells into a collection manifold that conveys the contaminated water back to the treatment system. The water enters one of two collection tanks and then is pumped through three GAC vessels in series to remove contaminants. After treatment, the water enters a discharge tank and is discharged to the sewer system under a permit with the City of Davis.

Institutional Controls (Restrictive Covenant)

Descriptions of contaminated groundwater and soil and their respective restrictions will be incorporated into the property deeds to minimize risk until cleanup action objections are reached. Restrictions also may include excavating, grading, and trenching in the soil source area, pending evaluation of the ERH effectiveness. The restrictive covenant will be finalized once any extraction well network upgrades are complete. EPA currently restricts access, with fencing and security gates, to prevent exposure to COCs and to protect remediation facilities.

Ecological Barrier

After the ERH is complete in 2012, EPA will install the gravel, wood chips or pavement barrier to minimize animal contact with contaminated surface soil.

4.3. Operation and Maintenance

The ERH system, groundwater extraction and treatment system, and Site access controls require active operation and maintenance (O&M).

ERH System—Source Zone Remedy

The ERH system is relatively complex and requires significant effort to achieve and maintain media temperature and control emissions. The heated volume (52,478 cubic yards) is divided into three zones (referred to as Stages 1, 2, and 3) due to limited electrical power. Stage 1 began February 23, 2011, and the project team reached agreement that Stage 1 reached diminishing returns on November 8, 2011. Stage 2 began operation in August 2011 and reached diminishing returns on August 15, 2012. Stage 2 contains roughly the same area as Stage 1 but is twice as deep. Stage 3 began operation in January 2012.

One incident during the operation involved a fire that the heating vendor extinguished in the heating area. It appears to be have been caused by a faulty splice block in the electrode cable. Identical splice blocks were replaced. The heating was shut off for a few days during the repairs.

ERH remedial action is a short-term duration (less than 2 years) cleanup activity. It is currently underway and final costs will be available in winter 2012 and reviewed in the next FYR.

Groundwater Extraction and Treatment

There are 16 active extraction wells that draw water from the shallow zones, S-1 and S-2. Figure 4 presents a view of the well field showing the extraction wells and treatment system. GAC contained in three above-ground vessels plumbed in series is used to remove volatile organic compounds (VOCs) from the extracted water. Treated groundwater is discharged to the city of Davis sanitary sewer system under an industrial pretreatment permit.

Since 1995, the treatment process has been optimized to improve performance and reduce operation and maintenance costs. Significant improvements are listed below.

- April – June 2004: The discharge line was converted from a 2-inch pressure line to a 6-inch gravity line, which reduced energy demand by approximately 25%. In addition, power and signal wires for six of the original extraction wells were replaced to improve operation.
- September – October 2006: Above-ground temporary well heads were converted to belowground vaults and all wells were converted to variable frequency drives.
- November 2007: 5.7 kilowatt (kW) DC (direct current) photovoltaic (PV) solar electric generation system was installed on the roof of the treatment plant building.
- April – July 2008: New extracted groundwater conveyance plumbing, and power and signal wires were installed to reroute utilities to the west and north of the source area because existing utilities were in the footprint of planned ERH.
- May – August 2010: 68.88 kW DC PV solar electric generation system was installed on approximately 0.5 acres of land to the southeast of the treatment plant building.

Carbon Exchange Strategy

Routine carbon exchanges are performed by taking the lead vessel offline, then making the secondary vessel the new lead, the tertiary vessel the new secondary, and a fresh vessel in the tertiary position.

Exhaustion of activated carbon is based, not on time, but on the number of gallons treated and the concentration of contaminated groundwater treated. Between 2 and 5 million gallons can be treated per exchange, the amount varying with conditions at the site. The influent contaminant concentrations are the predominant variable that changes the amount of gallons that can be treated. The removal efficiency, influent concentration, and system flow are then used to calculate the mass of accumulated EDB and DCP in each vessel. Carbon change outs can be predicted using an estimate for the system flow rate and influent concentration.

Access Controls

Access to the triangular parcel and the Remainder Parcel is restricted to prevent exposure to COCs, and to protect remediation facilities. Site access controls, including cyclone fencing topped with three stands of barbed wire and locked personnel and vehicle gates, are routinely inspected to maintain integrity. Gates are visually monitored and access controlled while unlocked. Table 4 includes site access controls and O&M costs for this system.

Table 4
Annual Groundwater Extraction, Treatment and Site Access Control O&M Costs

Date Range	Total Cost (rounded to the nearest $1,000)
10/2007-9/2008	$495,000
10/2008-9/2009	$679,000
10/2009-9/2010	$630,000
10/2010-9/2011	$601,000
10/2011-6/2012	$452,000

In the ROD, EPA estimated $778,300 for yearly O&M costs and costs are running below that estimate. The city has informed EPA that the cost for treated groundwater discharge is scheduled to increase significantly during the winter months.

5. Progress Since the Last Five-Year Review

This is the first FYR for the Site.

6. Five-Year Review Process

6.1. Administrative Components

EPA Region 9 initiated the FYR in November 2011 and scheduled its completion for September 2012. The EPA team was led by Bonnie Arthur of EPA, Remedial Project Manager (RPM) for the Site, and also included the EPA site attorney, Michele Benson; EPA toxicologist Stan Smucker; EPA biologist Ned Black; Community Involvement Coordinator, Jackie Lane; and ITSI Gilbane provided document development and technical review support. In March 2012, EPA held a scoping call with the review team to discuss the Site and items of interest as they related to the protectiveness of the remedy currently in place. A schedule was established for implementation of the following review activities:

- Community notification;
- Document review;
- Data collection and review;
- Site inspection;
- Local interviews; and
- Five-Year Review Report development and review.

6.2. Community Involvement

On March 22, 2012, a public notice was published in the *Davis Enterprise* announcing the commencement of the FYR process for the Frontier Fertilizer Site, providing Jackie Lane and Bonnie Arthur's contact information, and inviting community participation. The press notice is available in Appendix B. No one contacted EPA as a result of this advertisement.

The Five-Year Review Report will be made available to the public once it has been finalized. Copies of this document will be placed in the designated public information repositories.

The public information repositories for the Site are at the following locations:

Yolo County Library,
315 East Fourteenth St.,
Davis, CA 95616

University of California,
Shields Library Government Documents Department,
Davis, CA 95616
The final FYR report will be placed in the Site document repositories, as well as, on-line at the U.S. EPA Pacific Southwest, Region 9: Superfund website:
[*http://yosemite.epa.gov/r9/sfund/r9sfdocw.nsf/ViewByEPAID/cad071530380?OpenDocument*]

6.3. Document Review

This FYR includes a review of relevant site-related documents including the ROD, remedial action reports, and recent monitoring data. A complete list of the documents reviewed can be found in Appendix A.

ARARs Review

Section 121 (d)(2)(A) of CERCLA specifies that Superfund remedial actions (RAs) must meet any federal standards, requirements, criteria, or limitations that are determined to be legally applicable or relevant and appropriate requirements (ARARs). ARARs are those standards, criteria, or limitations promulgated under federal or state law that specifically address a hazardous substance, pollutant, contaminant, RA, location, or other circumstance at a CERCLA site.

ARARs identified for the selected remedies within the ROD and considered for this FYR are listed in Appendix A. There have been no changes in regulations that affect the protectiveness of the selected remedy.

6.4. Risk Assessment Review

A human health risk assessment (HHRA) was completed for the Site in April 1999. Risk assessment factors that can have an impact on protectiveness include changes in exposure pathways and/or new or revised toxicity values.

Changes in Exposure Pathways

Based on the current and potential future land use, the risk assessment identified the following exposure pathways and associated risks for:

- off-site current residents in the Mace Ranch residential area, the only potential exposure pathway identified in the 1999 HHRA was indoor vapor intrusion;

- hypothetical on-site future residents living at the source area, within the 11.43-acre parcel, potential exposure pathways evaluated include, indoor vapor inhalation, outdoor vapor inhalation, direct contact with soils/dust, home gardening exposure pathway, and domestic use of groundwater, i.e. drinking, showering, and washing activities; and

- hypothetical on-site future workers potental exposure pathways evaluated include, indoor vapor inhalation, outdoor vapor inhalation, direct contact with soils / dust (includes soil ingestion, dust inhalation, and dermal contact.

There has been no change in exposure pathways that would affect protectiveness. Table 5 presents the major Exposure Scenarios/Exposure Pathways Evaluated in the 1999 Frontier Fertilizer Site Human Health Risk Assessment.

Table 5 Major Exposure Scenarios/Exposure Pathways Evaluated in the 1999 Frontier Fertilizer Site Human Health Risk Assessment

Exposure Scenario/Exposure Pathways	Risk Driver(s)	Risk Estimate
Off-site current residents in the Mace Ranch residential area	Indoor vapor inhalation	Carcinogens: 6×10^{-7} Non-cancer: hazard index estimate of 0.06
Hypothetical on-site future residents living at the source area, within the 11.43-acre Site.	Indoor vapor inhalation, Domestic use of groundwater	Carcinogens: Indoor vapor inhalation (3×10^{-4}) Domestic use of groundwater (8×10^{-1}) Non-cancer: Indoor vapor inhalation (HI = 24) Domestic use of groundwater (HI = 11,000)
Hypothetical on-site future workers.	Indoor vapor inhalation	Carcinogens: Indoor vapor inhalation (1×10^{-4}) Non-cancer: Indoor vapor inhalation (HI = 0.9)

Changes in Toxicity Values

Current USEPA and California OEHHA toxicity values were reviewed as part of the Site Five Year Review. This toxicity review assesses changes in inhalation toxicity values that can affect risk estimates for the vapor intrusion pathway and changes in water ingestion toxicity values that could affect risk assessments for future drinking water. Table 6 presents the inhalation toxicity values that were applied in the 1999 HHRA and compares these to current toxicity values for the site contaminants of concern (EDB, DBCP, DCP, TCP, carbon tetrachloride). TCP and carbon tetrachloride are the only COCs found in the shallow aquifer zone, S1, below the neighborhood and the concentrations have declined since the 1999 risk assessment.

EPA's Integrated Risk Information System (IRIS) has a program to update toxicity values used by the Agency in risk assessment when newer scientific information becomes available. In the past five years, there have been a number of changes to the toxicity values for some contaminants of concern at the Site.

Revisions to the toxicity values for the COCs (DBCP, EDB, DCP, TCP, carbon tetrachloride) indicate that some COCs have a lower risk and other a higher risk from exposure to these chemicals than previously considered.

Table 6. A Comparison of Inhalation Toxicity Criteria used in the 1999 Human Health Risk Assessment with Current Toxicity Criteria for Frontier Fertilizer Site Contaminants of Concern

Contaminant of Concern	**Inhalation Toxicity Values** [1] Cancer Inhalation Unit Risk (IUR) $(ug/m3)^{-1}$ Non-Cancer Reference Concentration (RfC) mg/m3				**Risk Higher or Lower than 1999 Risk Estimate?**
	1999 Risk Assesment	**Source**	**Current 2012**	**Source**	
CCl_4	IUR = 1.5E-05	IRIS	IUR = 4.2E-05	Cal	2.8X higher cancer risk
	RfC = 2E-03	IRIS	RfC = 4E-02	Cal	20X lower non-cancer HQ
DCP	IUR = 1.9E-05	IRIS	IUR = 1E-05	Cal	1.9X lower cancer risk
	RfC = 4E-03	IRIS	RfC = 4E-03	IRIS	No change in non-cancer HQ
EDB	IUR = 7.1E-05	Cal	IUR = 6E-04	IRIS	8.5X higher cancer risk
	RfC = 2E-04	IRIS	RfC = 8E-04	Cal	4X lower non-cancer HQ
TCP	IUR = 2E-03	IRIS Route-X	IUR = 8.6E-03	IRIS Route-X	4.3X higher cancer risk
	RfC = 1.8E-02	IRIS	RfC = 3E-04	IRIS	60X higher non-cancer HQ

[1] Sources: IRIS (USEPA Integrated Risk Information System), Cal (California OEHHA)
Route-X refers to route-to-route extrapolation from oral route. In accordance with California policy, the oral cancer slope factor is route-extrapolated to derive an inhalation toxicity value for TCP because there is currently no inhalation criteria available.
HQ (Hazard quotient) is the ratio of the potential exposure to the substance and the level at which no adverse effects are expected.
Inhalation Reference Doses (iRfD) and inhalation Slope Factors (iSF) used in the 1999 HHRA have been replaced with inhalation Reference Concentrations (RfC) and Inhalation Unit Risk (IUR) values. To facilitate a comparison, iRfDs were converted to RfCs and iSFs were converted to IURs using the following equations:
RfC(mg/m3) = iRfD (mg/kg-day) x day/20m3 x 70kg
IUR(m3/ug) = iSF (kg-day/mg) x 20m3/day x 1/70kg x mg/1000 ug

Since the 1999 HHRA, EPA re-evaluated the groundwater to indoor air pathway, also known as the "vapor intrusion pathway." This is the only exposure pathway that has the potential to affect residents living in the Mace Ranch area under the current land use scenario. Three types of environmental samples were utilized in this evaluation: (1) groundwater from the S-l zone, (2) soil gas, and (3) flux chamber.

The highest reported concentrations of EDB, DCP, TCP, and CCl4 in groundwater, soil gas, and flux chamber samples collected in or near the neighborhood were used to estimate potential indoor exposures. Groundwater extraction has reversed the northerly migration of chemicals of concern resulting in a significant decline of concentrations detected in the shallow aquifer below the neighborhood. Carbon

tetrachloride, the only COC detected in the shallow aquifer above the RAO, has declined to less than the 32 ug/L that was assumed in the HHRA, resulting in increased protectiveness of the remedy.

TCP's cancer toxicity values have been upgraded (4.3 times higher toxicity) since the HHRA, however, the groundwater concentrations in shallow groundwater below the neighborhood north of the Site are 200X below the 1 ug/L TCP concentration that was assumed in the HHRA. Thus, the anticipated indoor exposure levels were all below EPA levels of concern. New soil gas studies performed May and November 2009 and July 2010 confirmed the earlier risk assessment findings. Based on the above analyses, the vapor intrusion exposure pathway is currently not a pathway of concern for off-site residents.

The oral toxicity values also were re-evaluated for the hypothetical future use of groundwater as a drinking water source. As noted in Table 7, EPA has concluded that TCP is more toxic than previously believed at the time of the ROD. TCP is now considered by the Agency to be a mutagenic chemical that poses an increased cancer risk, especially for children, who are more sensitive to TCP exposure than adults. Given these recent developments, EPA is currently evaluating whether to lower the TCP cleanup value to protect future uses of groundwater.

Table 7. A Comparison of Oral Toxicity Criteria used in the 1999 Human Health Risk Assessment with Current Toxicity Criteria for Frontier Fertilizer Site Contaminants of Concern

Contaminant of Concern	Oral Toxicity Values [1] Cancer Slope Factor (CSF) $(mg/kg\text{-}day)^{-1}$ Non-Cancer Reference Dose (RfD) mg/kg-day				Risk Higher or Lower than 1999 Risk Estimate?
	1999 Risk Assessment	Source	Current 2012	Source	
CCl_4	CSF = 1.3E-01	IRIS	CSF = 1.5E-01	CAL	1.2X higher cancer risk
	RfD = 7E-03	IRIS	RfD = 4E-03	IRIS	1.8X higher non-cancer HQ
DBCP	CSF = 7E+00	CAL	CSF = 7E+00	CAL	No change
	RfD = 5.7E-05	IRIS Route-X	RfD = 2E-04	PPRTV	3.5X lower non-cancer HQ
DCP	CSF = 6.8E-02	HEAST	CSF = 3.6E-02	CAL	1.9X lower cancer risk
	RfD = 1.1-03	IRIS Route-X	RfD = 9E-01	ATSDR	820X lower non-cancer HQ
EDB	CSF = 2E+00	IRIS	CSF = 2E+00	IRIS	No change
	RfD = 9E-03	IRIS	RfD = 9E-03	IRIS	No change
TCP	CSF = 2E+00	IRIS	CSF = 3E+01	IRIS	>15X higher cancer risk (mutagen)
	RfD = 9E-03	IRIS	RfD = 4E-03	IRIS	2.3X higher non-cancer HQ

[1] Sources: IRIS (USEPA Integrated Risk Information System), PPRTV (USEPA Provisional Peer Review Toxicity Value), CAL (California OEHHA), HEAST (USEPA Health Effects Assessment Summary Tables),
Route-X refers to route-to-route extrapolation from inhalation route. In accordance with California policy, the inhalation reference dose was route-extrapolated to derive an oral toxicity value for DCP in the absence of an oral toxicity value for this compound.
Mutagens (DBCP and TCP) require an additional calculation as per USEPA's Cancer Guidelines (2005) that was not presented in the table which increases the cancer risk by a factor of 2 to 3X for a 0 to 30 year exposure.

Screening Level Ecological Risk Assessment

The Screening Level Ecological Risk Assessment (CH2M HILL, 2006) identified EDB and other non-VOCs as contaminants of potential ecological concern in Site soil. The results of the assessment indicated that there is a risk to ecological receptors from exposure to surface soil. An uncertainty in the risk assessment concerns the analytical data that were collected prior to 1999, which might overestimate the current ecological risk due to continuing degradation of the COPCs since that time. The assessment determined that the quality of on-site habitat was generally poor at the 11.43-acre Site due to previous land use activities. There is also limited connectivity to off-site habitat because of concrete slabs and roadways covering the Site and railroad tracks and Interstate 80 adjacent to the Site across 2nd Street. To protect ecological receptors from the contamination in the surface soil, the selected remedy includes a cap of wood chips, pavement, or concrete for the area not included in the heating remedy.

6.5. Data Review

Source Zone—Soil and Groundwater

ERH, the in-situ source zone remedy, has operated since February 2011. To evaluate the on-going effectiveness of the ERH, the following operations data have been reviewed throughout operation:

- Energy application to source zone media (kilowatt-hours);
- Heated media temperature and vacuum;
- Extracted gas and groundwater pressure, temperature, flow rate, and COC concentrations;
- Ex-situ treatment system vacuum, temperature, vapor and liquid flow rates, and COC concentrations; and
- Ambient air COC concentrations.

The operational parameters indicate that the ERH has operated according to the design. Treatment system vacuum and temperatures are monitored continuously and every hour, respectively. During the design phase, the ERH system was modified twice because new developments near the Site reduced the availability of electricity. As a result, the treatment zone was divided into three stages, heated sequentially, moving from south to north: Stage 1 from 0 to 40 ft bgs, Stage 2 from 0 to 80 ft bgs, and Stage 3 from 15 to 80 ft bgs. The design anticipated that the ERH would operate until extracted vapor concentrations became de minimis, which was expected when the treatment depths reached target temperatures, near 100 degrees Celsius. As of August 15, 2012, two stages have been shutdown and the third and final stage has reached the target temperature at about 89 of the monitoring points (83% of the Stage 3 monitoring points). The COC mass extracted to date is higher than the pre-ERH calculated mass of 58 pounds. The technology evaluation performed during the Feasibility Study identified that ERH could remove a significant portion of the COC mass present in the source zone. As of August 15, 2012, 75 pounds of total COCs have been extracted from the three treatment stages.

The ambient monitoring stations have been monitored at least every other week to confirm that there are no fugitive releases from the ERH. During the 18-month operations period from February 2011 through

July 2012, only one sampling round showed detection above the detection limit but less than the human health screening value. ERH operations are expected to continue until October/November 2012.

Groundwater—Extraction and Treatment System

The groundwater extraction and treatment system operates year-round, 24 hours a day. For the time period between June 2011 and March 2012, an average of 1,527,564 gallons per month was treated, and 0.37 kilograms (kg) of total COCs per month was extracted. A total of 689 kg (1,519 pounds) of VOCs has been extracted during the 15 years the treatment system has been operating.

More than 110 groundwater monitoring wells are monitored on a quarterly, semiannual, or annual basis to evaluate the effectiveness of the groundwater treatment system**.** Groundwater analytical data show declining concentration trends for the five primary COCs since the pump-and-treat remedial system began operating in 1995. A capture zone analysis was completed in October 2011 to evaluate the effectiveness of the groundwater extraction system. It demonstrated that there is a limited area near the "toe of the plume" and in the deeper aquifer, A-1, where the extraction system does not achieve complete capture, although monitoring wells located farthest north at the "toe of the plume" show a general decreasing trend for the five primary COCs in groundwater. For example, in the shallow S-1 aquifer zone, X-5A shows declining COC concentrations. X-5A was installed in 2001 and is just outside the capture zone. In 2001, CCl4 was detected at 22 ug/L, above maximum contaminant levels (MCLs). By 2008, CCl4 levels dropped to 2.9 ug/L and have continued to decline.

Thirty one A-1 wells are monitored at least every 6 months and only four of these wells show COC concentrations above MCLs. For example, DCP concentrations in OW 11C, which was installed in 1997, have dropped to a range of 30 to 50 ug/L from previous levels of 170 to 200 ug/l. One of the other four A-1 monitoring wells with COCs above MCLs, X-7C, has stayed consistent with a range of 58 to140 ug/L during the past few years.

Groundwater monitoring data also indicate that the groundwater gradient changes and possible downward migration (from the upper aquifer S-2 to the lower aquifer A-1) may occur during the irrigation seasons when agricultural pumping increases to irrigate nearby crops. In 2011, EPA installed transducers in eight wells, on the east side nearest the agricultural fields, to evaluate the irrigation effect throughout a few seasons.

Groundwater extraction effectiveness and the groundwater model will be re-evaluated following completion of the ERH in 2012 to ensure that ROD groundwater cleanup goals are met in the source area. The extraction well system has reduced the COC mass in the S-1 and S-2 aquifer zones, which prevents downward migration to the A-1 aquifer zone. The ERH also is removing the COC mass in the source area. Additional extraction wells will be considered as part of the planned re-evaluation.

Soil Gas

EPA performed soil gas surveys during May and November 2009 and July 2010 to confirm that the current groundwater sampling effectively monitors potential vapor intrusion exposure for the nearby

residents. Ninety-seven soil gas samples were collected from 26 locations north of the Site and in the nearby residential neighborhood. No COCs were detected in soil gas above analytical method quantitation limits. Target, Inc., as part of the Agreement on Consent with EPA, completed a 2008 soil gas and groundwater investigation. The groundwater and soil gas studies indicate that the COC levels in groundwater remained low and follow-up sub-slab investigations are still underway.

6.6. Site Inspection

The EPA RPM performed the Site inspection on June 4, 2012. Follow-up interviews were completed on June 20, 2012, with Matt Marlatt (CH2MHill Project Manager, ERH Component) and on July 10, 2012, with Paul Seday (ITSI Gilbane Project Manager, Groundwater Extraction and Treatment).

The June 4, 2012, inspection included a review of the groundwater treatment system, the ERH system, available on-site documents, and a fence-to-fence walk around the site perimeter. At the time of the inspection there were two contractors working on the groundwater treatment system operation and maintenance and three contractors overseeing the ERH.

The major components of the groundwater treatment system have remained fairly constant over the past 5 years and have not had major changes since July 2008. The ERH is a relatively short-term portion of the remedial action.

On the date of the inspection both the groundwater treatment system and ERH were operating as designed. All the fences were in good condition.

The Site Inspection Checklist is included in Appendix D.

6.7. Interviews

In April/May 2012, Jackie Lane and Bonnie Arthur completed interviews with the Technical Advisory Grant awardee [Frontier Fertilizer Superfund Oversight Group (FFSOG)], State of California (Regional Water Quality Control Board and the Department of Toxic Substances Control), representatives from Congressman Mike Thompson's office, Davis City Councilman Stephan Souza, and Yolo County Supervisor Jim Provenza.

The involvement of all the parties has increased over the past few years due to the start up of the ERH. Many of the interviewees expressed willingness to stay involved. Some of the parties liked to stay involved through the Frontier Fertilizer Fact Sheets and/or participating in monthly calls between the FFSOG, State of California, and EPA. The FFSOG has been an active participant since receiving the Technical Advisory Grant from EPA in 1995. They felt that the relationship with EPA has improved over the past 5 years. They currently receive weekly updates from EPA and participate in monthly calls.

Two interviewees (DTSC and the FFSOG) sent in their entire interview questionnaires, which are included in Appendix C. The remaining interviews are included as summaries. Three of the respondents,

the FFSOG, DTSC, and RWQCB, have had extensive involvement in report review throughout the investigation, design and cleanup phases.

All of the elected officials stated that they have not received any inquiries about the remedial actions at the Site within the past year. A few of the elected officials requested that EPA provide presentations to the City Council members and County Supervisors after the ERH is complete.

Many of the interviewees stated that they felt the fact sheets to be the best form of outreach because they provide good summary information. Several stated that EPA should increase outreach to the City Council, County Supervisors, and the press once the ERH is complete and requested that the sub-slab monitoring at the Target store continue.

6.8. Institutional Controls

Restrictive covenant(s) were included as part of the remedy selected in the ROD. Institutional Controls prevent exposure to soil above acceptable cleanup levels and prevent exposure to contaminated groundwater. The City of Davis has zoned the Site and the surrounding parcels as light industrial or commercial. Currently, EPA has control over the property, and the property owner is not viable although he does pay property taxes. EPA will finalize the restrictive covenant once extraction well upgrades are complete. EPA currently restricts access, with fencing and security gates, to prevent exposure to COCs and to protect remediation facilities.

7. Technical Assessment

7.1. Question A: Is the remedy functioning as intended by the decision documents?

The review of Site data, documents, ARARs, risk assumptions and the results of the site inspection indicates that the groundwater component of the remedy is functioning as intended by the ROD. Groundwater analytical data show declining concentration trends for the five primary COCs since the pump-and-treat remedial system began operating in 1995. The groundwater extraction and treatment system has effectively contained the COC-impacted groundwater with the exception of the “toe of the plume” and the A-1 aquifer zone. In both of these areas, however, COC concentrations have declined with the exception of a few A-1 wells with steady concentrations. In late 2012, after the ERH is shut off, EPA will evaluate options to optimize the groundwater remedy. The S-1, S-2, and A-1 aquifer zones are not currently used as drinking water sources.

The ERH remedial action is currently being implemented having started in February 2011 and is expected to finish in the fall 2012. The operational parameters indicate that the ERH has operated according to the design. Total mass removed to date exceeds the pre-design estimate removal mass.

EPA will finalize the restrictive covenant after the ERH is complete and any extraction well upgrades are complete. EPA currently restricts access, with fencing and security gates, to prevent exposure to COCs and to protect remediation facilities. The Site is currently zoned for light industrial/commercial development and the City of Davis has an ordinance to restrict drilling groundwater wells.

7.2. Question B: Are the Exposure Assumptions, Toxicity Data, Cleanup Levels, and Remedial Action Objectives (RAOs) Used at the Time of Remedy Selection Still Valid?

There have been no changes in the ARARs that should affect the protectiveness of the remedy and there have been no changes in standards or To Be Considered (TBCs) for the Site. The ARARs are considered to be health protective and reasonable in evaluating risk for this site. There has been a change to the toxicity value for TCP that indicates that the current cleanup level may not be considered protective. There have been no other changes in the toxicity factors or other contaminant characteristics that could affect the protectiveness of the remedy.

Substantial progress has been achieved since implementing the remedy toward meeting the RAOs.

7.3. Question C: Has Any Other Information Come to Light That Could Call Into Question the Protectiveness of the Remedy?

No information has come to light that could call into question the short-term protectiveness of the remedy.

7.4. Technical Assessment Summary

According to the data reviewed, the site inspection, and the interviews, the groundwater remedy is functioning as intended by EPA's ROD. The soil and vadose zone remedy is not complete, but early results demonstrates that it is performing as intended. In late 2012, after the ERH is shut off, EPA will evaluate measures to optimize the groundwater remedy. There have been no changes in the ARARs that would affect the protectiveness of the remedy. The assumptions used in determining exposure pathways are considered to be health protective and reasonable in evaluating risk for this site. There has been a change in the TCP toxicity value that may affect the long term protectiveness. There have been no other changes in the toxicity factors or other contaminant characteristics that could affect the protectiveness of the remedy. There has been no change to the standardized risk assessment methodology that could affect the protectiveness of the remedy. There is no other information that calls into question the protectiveness of the remedy.

8. Issues

Table 8 summarizes the current issues identified for the Frontier Fertilizer Site.

Table 8
Current Issues for the Frontier Fertilizer Site

Issue	Affects Current Protectiveness (Yes or No)	Affects Future Protectiveness (Yes or No)
Potential difficulties in obtaining deed restriction from owners. Currently, EPA has control of Frontier Fertilizer and owners are not viable PRPs.	No	Yes
The toxicity of TCP has changed so the current TCP cleanup value may not be protective for future benefical use of groundwater.	No	Yes
Groundwater extraction system capture zone does not include all contaminated groundwater.	No	Yes

9. Recommendations and Follow-up Actions

Table 9 provides recommendations to address the current issues at the Frontier Fertilizer Site .

Table 9
Recommendations to Address Current Issues at the Frontier Fertilizer Site

Issue	Recommendations/ Follow-Up Actions	Party Respon-sible	Over-sight Agency	Milestone Date	Affects Protectiveness? (Yes or No)	
					Current	Future
Potential difficulties in obtaining deed restriction from owners. Currently, EPA has control of Frontier Fertilizer and owners are not viable PRPs.	After extraction system upgrades are complete, initiate negotiations with property owners	DTSC, EPA	EPA	12/2013	No	Yes
The toxicity of TCP has changed so the current TCP cleanup value may not be protective for future benefical use of groundwater.	Evaluate lowering the TCP groundwater cleanup value.	EPA	EPA	12/2013	No	Yes
Groundwater extraction system capture zone may not include all contaminated groundwater.	Evaluate options to optimize the groundwater remedy.	EPA	EPA	12/2013	No	Yes

In addition to the items noted in Table 9, the following recommendations identified during the FYR may improve the effectiveness of the remedy, but do not affect current protectiveness:

- Identify further options to reduce energy demand and operation and maintenance cost.
- Continue to work with project team to identify options to reduce the volume of treated groundwater discharged to the sanitary sewer, including aquifer recharge and re-use.

10. Protectiveness Statements

The remedy at the Frontier Fertilizer Superfund Site is currently protective of human health and the environment because all exposure pathways are being controlled. However, for the remedy to be protective in the long term, a restrictive covenant should be placed on the Frontier Fertilizer property, options to optimize the groundwater remedy should be evaluated, and the cleanup level for TCP should be re-evaluated to incorporate the newer TCP toxicity number.

11. Next Review

This is a statutory Site that requires ongoing FYRs as long as waste is left on the Site that does not allow for unrestricted use and unlimited exposure. The next FYR will be due within 5 years of the signature date of this FYR.

Appendix A: List of Documents Reviewed and Applicable or Relevant and Appropriate Requirements

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LIST OF DOCUMENTS REVIEWED

Bechtel, 1999. *Baseline Risk Assessment Report*, Frontier Fertilizer Superfund Site.

California Regional Water Quality Control Board Central Valley Region, 1998. *Water Quality Control Plan for the Sacramento River and San Joaquin River Basins*, Fourth Edition (Basin Plan). September.

CH2M HILL. 2006. *Screening-Level Ecological Risk Assessment*, Frontier Fertilizer Superfund Site. June.

CH2M Hill, 2011. *First and Second Quarter 2009 Groundwater Monitoring Report*. July.

CH2M Hill, 2011. *Third and Fourth Quarter 2009 Groundwater Monitoring Report*. August.

CH2M Hill, 2011. *Annual 2010 Groundwater Monitoring Report*. September.

CH2M HILL, 2011. *Capture Zone Analysis and Monitoring Natural Attenuation Effectiveness*, Frontier Fertilizer Superfund Site. September.

CH2M Hill, 2011. *Supplemental Soil Gas and Shallow Groundwater Investigation Results*, Frontier Fertilizer. November.

CH2M Hill, 2012. *First and Second Quarter 2011 Groundwater Monitoring Report*. May.

U.S. Environmental Protection Agency (USEPA), 2001. *Comprehensive Five-Year Review Guidance.* Office of Emergency and Remedial Response (OSWER). EPA 540-R-01-007. June.

USEPA, 2006. *Record of Decision, Soil and Groundwater Frontier Fertilizer Superfund Site*. September.

USEPA OSWER, 2011. *Recommended Evaluation of Institutional Controls: Supplement to the "Comprehensive Five-Year Review Guidance*", OSWER Directive 9355.7-18. September.

Applicable or Relevant and Appropriate Requirements Evaluation

Requirement	Citation	Document	Description	Affect on Protectiveness	Comments	Amendment Date
Resource Conservation and Recovery Act (RCRA) Hazardous Waste Determination	Title 22 California Code of Regulations (CCR), Division 4.5, Chapter 11, 66262.21, 66261.22(a)(1), 66261.22(a)(2), 66261.23, and 66261.24(a)(1) or Article 4, Chapter 11, 22 CCR 66260.200	2006 ROD	A hazardous waste is considered a RCRA hazardous waste if it exhibits any of the characteristics of ignitability, corrosivity, reactivity, or toxicity, or if it is listed as a hazardous waste.	There has been no change to this regulation.	Wastes generated during construction, monitoring, or remediation at Frontier Fertilizer must be characterized and managed in accordance with RCRA requirements.	Title 22 CCR, Division 4.5, Chapter 11- NC
California Hazardous Waste Determination	22 CCR 66261.24(a)(2), 22 CCR 66262.11	2006 ROD	Wastes can be classified as non-RCRA, state-only hazardous wastes if they exceed the Soluble Threshold Limit Concentration (STLC) or Total Threshold Limit Concentration (TTLC) values, but do not exceed the federal standards.	There has been no change to this regulation.	Wastes generated during construction, monitoring, or remediation at Frontier Fertilizer must be characterized and managed appropriately.	Title 22 CCR, Division 4.5, Chapters 11 and 12– NC

Requirement	Citation	Document	Description	Affect on Protectiveness	Comments	Amendment Date
National Drinking Water Standards (MCLs), Federal Safe Drinking Water Act	42 United States Code (U.S.C.) 300g-1; 40 CFR 141.61	2006 ROD	Establishes national primary drinking water standards and Maximum Contaminant Levels (MCL) to protect the quality of water in public water systems. MCLs represent the maximum concentrations of contaminants permissible in a water system delivered to the public. MCLs are generally relevant and appropriate when determining acceptable exposure limits for groundwater that is a current or potential source of drinking water.	There has been no change to this law.	National primary drinking water standards are health-based standards for public water systems (MCLs). The National Contingency Plan (NCP) defines MCLs as relevant and appropriate for groundwater determined to be a current or a potential source of drinking water in cases where MCL goals are not ARARs. Groundwater in the vicinity of Frontier Fertilizer has been designated for drinking water use.	42 U.S.C. 300g-1; 40 CFR 141.61–NC

Requirement	Citation	Document	Description	Affect on Protectiveness	Comments	Amendment Date
California Safe Drinking Water Standards (MCLs) State MCLs	22 CCR §64435 and §64444.5	2006 ROD	Establishes primary MCLs for contaminants that cannot be exceeded in public water systems. In some cases, the California drinking water standards are more stringent than the federal MCLs.	The changes in the regulation does not affect protectiveness	Like federal MCLs, state MCLs are relevant and appropriate as cleanup goals for groundwater determined to be a current or a potential source of drinking water. Groundwater in the vicinity of Frontier Fertilizer has been designated for drinking water use.	22 CCR §64435 and §64444.5. – NC. Note: Cal/EPA OEHHA established a Public Health Goal (PHG) of 0.0007 parts per billion (ppb) for 1,2,3-TCP on August 20, 2009.
Regional Water Quality Control Board's Water Quality Control Plan (Basin Plan)	Porter-Cologne Water Quality Act (California Water Sections 13000, 13304, 13240, 13241, 13242, 13243)	2006 ROD	The Water Quality Control Plan (also known as the Basin Plan) for the Sacramento and San Joaquin river basins, dated September 1, 1998, establishes beneficial uses for groundwater and surface water, water quality objectives designed to protect those beneficial uses, and implementation plans to achieve water quality objectives.	The changes in the Plan does not affect protectiveness	The narrative water quality objectives (WQOs) described in the Basin Plan may be considered for groundwater discharges. The substantive provisions of Chapters 2 and 3, narrative standards for groundwater and surface water standards, are potentially applicable..	Revisions to Water Quality Control Plan for the Sacramento and San Joaquin River Basins, revised Oct 2011a.

Requirement	Citation	Document	Description	Affect on Protectiveness	Comments	Amendment Date
Waste Discharge Requirements (WDRs),	23 CCR 2591 (a)	2006 ROD	A WDR establishes narrative and chemical-specific requirements for the discharge of treated wastewater to land (including an evaporation/percolation pond and irrigation fields) in the vicinity of Frontier Fertilizer.	There has been no change to this regulation.	Potentially applies to any remedial activity at Frontier Fertilizer that will potentially impact the nature or volume of wastewater discharged to land	23 CCR 2591 (a) – NC
HWF Background Water Quality Protection Standard Concentration Limits	22 CCR 66264.94 (b),(c)	2006 ROD	Provides basis for decision-making on alternate concentration limits for hazardous constituents.	There has been no change to this regulation.	Potentially applicable to the technical infeasibility of remediating to background levels.	22 CCR 66264.94 (b),(c) – NC

Requirement	Citation	Document	Description	Affect on Protectiveness	Comments	Amendment Date
Critical habitat such as nesting habitat upon which endangered species or threatened species depend.	Substantive portions of the Endangered Species Act of 1973 (16 USC 1531-1538, 1539); 50 CFR Part 200, 50 CFR Part 402 Substantive portions of the California Endangered Species Act (CA Fish and Game Code, Division 3, Chapter 1.5) Substantive portions of the Native Plant Protection Act (CA Fish and Game Code, Division 2, Chapter 10)	2006 ROD	Requires action to conserve endangered species or threatened species, including consultation with the United States Department of the Interior, Fish and Wildlife Service.	There has been no change to this law.	No endangered or threatened species have been identified at Frontier Fertilizer. The Frontier Fertilizer Site may be a habitat for the burrowing owl, a species of concern in California. Remedial actions at Frontier Fertilizer must be sensitive to the regulations that protect wildlife and plant species of special status.	(16 USC 1531-1538, 1539); 50 CFR Part 200, 50 CFR Part 402; California Endangered Species Act (CA Fish and Game Code, Division 3, Chapter 1.5); Native Plant Protection Act (CA Fish and Game Code, Division 2, Chapter 10) – NC

Requirement	Citation	Document	Description	Affect on Protectiveness	Comments	Amendment Date
Within area where action may cause harm to migratory birds (that is, nesting habitats, foraging areas, etc.).	Migratory Bird Treaty Act (16 USC 703), 50 CFR 10.13	2006 ROD	Establishment of a federal prohibition, unless permitted by regulations, to "pursue, hunt, take, capture, kill…" any migratory bird or any part, nest, or egg of any such bird.	There has been no change to this law.	Many common migratory species have been identified at Frontier Fertilizer. Remedial actions at Frontier Fertilizer must be sensitive to the regulations that protect migratory birds.	(16 USC 703), 50 CFR 10.13 – NC
Within area where action may cause harm to birds (that is, nesting habitats, foraging areas, etc.).	California Fish and Game Code, Div. 4, Part 2, Chapter 1, 3503.	2006 ROD	It is unlawful to take, possess, or needlessly destroy the nest or eggs of any bird, except as otherwise provided by this code or any regulation made pursuant thereto.	There has been no change to this law.	Many common avian species have been identified at Frontier Fertilizer. Remedial actions at Frontier Fertilizer must be sensitive to the regulations that protect birds, including the burrowing owl.	California Fish and Game Code, Div. 4, Part 2, Chapter 1, 3503. – NC

Requirement	Citation	Document	Description	Affect on Protectiveness	Comments	Amendment Date
Within area where action may cause irreparable harm, loss, or destruction of significant artifacts	National Archaeological and Historical Preservation Act (16 USC Section 469); 36 CFR Part 65	2006 ROD	Alteration of terrain that threatens significant scientific, prehistoric, historic, or archaeological data may require actions to recover and preserve artifacts.	There has been no change to this law.	The selected remedy will not alter or destroy any known prehistoric or historic archaeological features at Frontier Fertilizer. Although Frontier Fertilizer is completely developed, it remains unpaved in many areas. However, because there is a possibility that buried historic or prehistoric remains could be discovered during construction, mitigation measures to protect the area would be required if such a discovery were uncovered.	(16 USC Section 469); 36 CFR Part 65. – NC
RCRA hazardous waste treatment	22 CCR 66265.370 and 66265.377	2006 ROD	Establishes requirements for owners and operators of interim status facilities that thermally treat hazardous waste in devices other than those that use flame combustion.	There has been no change to this regulation.	Substantive provisions are relevant and appropriate for treatment by in situ electrical resistance heating.	22 CCR 66265.370 and 66265.377. – NC

Requirement	Citation	Document	Description	Affect on Protectiveness	Comments	Amendment Date
Cleanup of releases to the environment	27 CCR Section 20400 and 23 CCR 2550.4	2006 ROD	Concentration lists must be established for groundwater, surface water, and the unsaturated zone. Must be based on background, equal to background, or for corrective actions, may be greater than background, not to exceed the lower of the applicable WQO or the concentration technologically or economically achievable. Specific factors must be considered in setting cleanup standards above background levels.	There has been no change to this regulation.	Applies in setting groundwater cleanup levels for all discharges of waste to land.	27 CCR Section 20400 and 23 CCR 2550.4. – NC
Land use covenants (LUCs)	22 CCR 67391.1 (a)(b)(d)(g)(i) CA Civil Code Section 1471 (a)	2006 ROD	LUC Agreements are proprietary controls that run with the land, agreed to by property owners, to implement Institutional Controls at sites where there has been a release of hazardous substances, and where some wastes will remain in place.	There has been no change to this regulation.	Substantive provisions are relevant and appropriate if contamination will remain on site above levels suitable for unrestricted use.	22 CCR 67391.1 (a)(b)(d)(g)(i) CA Civil Code Section 1471 (a). – NC

Requirement	Citation	Document	Description	Affect on Protectiveness	Comments	Amendment Date
Groundwater monitoring	22 CCR 66264.97(b)(1)(a)(b) (c)(d), (2), (4), (5), (6), (7) and (e)(1), (2), (3), (4), (5)	2006 ROD	Establishes general requirements for groundwater monitoring systems for hazardous waste facilities.	There has been no change to this regulation.	These regulations require general water quality monitoring of groundwater at Frontier Fertilizer. The intent of these requirements currently is being met under the existing groundwater monitoring program. Additional monitoring wells may be required during remedy implementation.	22 CCR 66264.97(b)(1)(a)(b) (c)(d), (2), (4), (5), (6), (7) and (e)(1), (2), (3), (4), (5). – NC
Control of air emissions	Yolo-Solano Air Quality Management District (AQMD)—Rule 2.5, Nuisance	2006 ROD	No discharge from any source, contaminants which cause injury, detriment, nuisance, or annoyance.	There has been no change to this rule.	Substantive provisions are relevant and appropriate to the selected remedy with a potential for air emissions.	Yolo-Solano AQMD—Rule 2.5, Nuisance. – NC
Control of air emissions	Yolo-Solano AQMD—Rule 2.11, Particulate Matter	2006 ROD	Limits visible particulate emissions to the property line.	The changes in the rule does not affect protectiveness	Applicable to the selected remedy if it results in the production of particulate matter.	Yolo-Solano AQMD—Rule 2.11, Revised January 13, 2010a.No applicable changes.

Requirement	Citation	Document	Description	Affect on Protectiveness	Comments	Amendment Date
Control of air emissions	Yolo-Solano AQMD—Rule 2.13, Organic Solvents	2006 ROD	Limits emissions of organic solvents into the atmosphere that may result from the use of organic solvents.	There has been no change to this rule.	Substantive provisions apply if the selected remedy results in the production of organic solvents	Yolo-Solano AQMD—Rule 2.13, Organic Solvents. – NC
Control of air emissions	Yolo-Solano AQMD—Rule 2.19 (a) Particulate Matter Process Emission Rate	2006 ROD	Provides PM10 emission rates (pounds per hour [lbs/hr]) based on process material weights.	There has been no change to this rule.	Applicable to the selected remedy if it results in air emissions exceeding AQMD thresholds.	Yolo-Solano AQMD—Rule 2.19 (a) Particulate Matter Process Emission Rate. – NC
Control of air emissions	Yolo-Solano AQMD—Rule 3.4 New Source Review	2006 ROD	Establishes performance and monitoring standards for new air emission sources. New sources exceeding the primary pollutant thresholds are required to apply the best available control technology (BACT).	There has been no change to this rule.	Substantive provisions are relevant and appropriate to the selected remedy if there is a potential to emit primary pollutants to the atmosphere that exceed AQMD thresholds.	Yolo-Solano AQMD—Rule 3.4 New Source Review. – NC

Requirement	Citation	Document	Description	Affect on Protectiveness	Comments	Amendment Date
Control of air emissions	Yolo-Solano AQMD—Rule 3.13, Toxics New Source Review (T-BACT for HAPs)	2006 ROD	Requires the best available control technology for toxics (T-BACT) at any constructed or reconstructed major source of hazardous air pollutants (HAPs).	There has been no change to this rule.	Applicable to selected remedy if it results in emissions of HAPs (currently CCl4 and 1,2-DBCP are listed as HAPs) in quantities greater than 10 tons per year of one HAP, or a combined total of 25 tons for multiple HAPs). Rule 3.13.110 contains criteria for exemptions from this process.	Yolo-Solano AQMD—Rule 3.13, Toxics New Source Review (T-BACT for HAPs). – NC
Hazardous waste treatment facility	22 CCR 66264.14	2006 ROD	Any proposed treatment facility is anticipated to maintain a fence in good repair that completely surrounds the active portion of the facility. A locked gate at the facility should restrict unauthorized personnel entrance.	There has been no change to this regulation.	Security prevents entry by unauthorized personnel.	22 CCR 66264.14. – NC

Requirement	Citation	Document	Description	Affect on Protectiveness	Comments	Amendment Date
Hazardous waste treatment facility	22 CCR 66264.15-16	2006 ROD	The hazardous waste facility standards require routine facility inspections conducted by trained hazardous waste facility personnel. Inspections are to be conducted at a frequency to detect malfunctions and deterioration, operator errors, and discharges that may be causing or leading to a hazardous waste release and a threat to human health or the environment.	There has been no change to this regulation.	Substantive provisions are relevant and appropriate to the groundwater treatment facilities for this Site.	22 CCR 66264.15-16. – NC
Hazardous waste treatment facility	22 CCR Div. 4.5, Chap. 14, Art. 3	2006 ROD	Facility design and operation to minimize potential fire, explosion, or unauthorized release of hazardous waste.	There has been no change to this regulation.	Substantive provisions are relevant and appropriate to the groundwater treatment facilities for this Site.	22 CCR Div. 4.5, Chap. 14, Art. 3. – NC

Requirement	Citation	Document	Description	Affect on Protectiveness	Comments	Amendment Date
Hazardous waste treatment facility	22 CCR Div. 4.5, Chap. 14, Art. 6	2006 ROD	The requirements present the groundwater monitoring system objectives and standards to evaluate the effectiveness of the corrective action program (remedial activities). After completion of the remedial activities and closure of the facility, groundwater monitoring will continue for an additional 3 years to ensure attainment of the remedial action objectives.	There has been no change to this regulation.	Substantive provisions are relevant and appropriate to the groundwater treatment facilities for this Site.	22 CCR Div. 4.5, Chap. 14, Art. 6. – NC
Hazardous waste treatment facility	22 CCR Div. 4.5, Chap. 14, Art. 7	2006 ROD	The closure and post-closure requirements establish standards to minimize maintenance after facility closure to protect human health and the environment.	There has been no change to this regulation.	Substantive provisions of the closure and post-closure requirements are relevant and appropriate to the selected remedy. Clean closure of the treatment facility through equipment decontamination and removal of any hazardous waste is anticipated.	22 CCR Div. 4.5, Chap. 14, Art. 7. – NC

Requirement	Citation	Document	Description	Affect on Protectiveness	Comments	Amendment Date
Hazardous waste container storage	22 CCR 66264.171, 172, 173, 174	2006 ROD	Containers of RCRA hazardous waste must (1) be maintained in good condition, (2) be compatible with hazardous waste to be stored, (3) be closed during storage except to add or remove waste, (4) have adequate secondary containment when stored on site.	There has been no change to this regulation.	These requirements are applicable to any hazardous wastes that are generated and stored temporarily in containers at Frontier Fertilizer prior to off-site disposal, and may include wastes such as soil, debris, or treatment residuals (water, sludge, filters).	22 CCR 66264.171, 172, 173, 174. – NC
Hazardous waste container storage	22 CCR 66264.175 (a) and (b)	2006 ROD	Place containers on a sloped, crack-free base, and protect from contact with accumulated liquid. Provide a containment system with a capacity of 10 percent of the volume of containers with liquids. Remove spilled or leaked waste in a timely manner to prevent overflow of containment system.	There has been no change to this regulation.	These requirements are applicable to hazardous wastes that are generated and stored temporarily in containers at Frontier Fertilizer prior to off-site disposal.	22 CCR 66264.175 (a) and (b) . – NC

Requirement	Citation	Document	Description	Affect on Protectiveness	Comments	Amendment Date
Hazardous waste container storage	22 CCR 66262.30 through 66262.33	2006 ROD	Prior to transportation, containers would be packaged, labeled, marked, and placarded in accordance with RCRA and Department of Transportation requirements.	There has been no change to this regulation.	These requirements are applicable to containers that are used to contain hazardous wastes that are sent off site for disposal.	22 CCR 66262.30 through 66262.33 . – NC
Shipping hazardous waste off site	22 CCR 66262.11-66262.23	2006 ROD	Prior to transportation, generator must determine whether waste is hazardous prior to shipping waste off site. Once determination has been made, generator must obtain and use a manifest.	There has been no change to this regulation.	Applicable to actions that send hazardous waste (including treatment byproducts) off site for treatment, storage, or disposal.	22 CCR 66262.11-66262.23. – NC
Hazardous waste accumulation	22 CCR 66262.34	2006 ROD	Accumulation of hazardous wastes on site for longer than 90 days would be subject to the substantive RCRA requirements for storage facilities.	There has been no change to this regulation.	Substantive provisions are relevant and appropriate to hazardous waste that is stored temporarily on site prior to off-site disposal.	22 CCR 66262.34. – NC

Requirement	Citation	Document	Description	Affect on Protectiveness	Comments	Amendment Date
Treatment	22 CCR 66264.601-603 and 22 CCR 66265.401	2006 ROD	These regulations include design, operation, maintenance, and closure requirements for miscellaneous treatment units and units that use chemical, physical, or biological treatment methods to treat hazardous waste.	There has been no change to this regulation.	Substantive provisions are relevant and appropriate.	22 CCR 66264.601-603 and 22 CCR 66265.401. – NC
Treatment	22 CCR 66264.192, 193, 194, and 196	2006 ROD	These regulations include requirements to ensure that tanks and ancillary equipment are adequately designed, operated, and maintained to ensure that the tank system will not fail.	There has been no change to this regulation.	Substantive portions of these requirements may be relevant and appropriate to tanks that are used during hazardous waste treatment.	22 CCR 66264.192, 193, 194, and 196. – NC

Appendix B: Press Notices

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FRONTIER FERTILIZER SUPERFUND SITE FIRST FIVE-YEAR REVIEW

Appeared in the March 22, 2012 issue of the *Davis Enterprise*

As part of its Superfund process, the United States Environmental Protection Agency (EPA) is required to conduct a Five-Year Review (FYR) at the Frontier Fertilizer Superfund Site (Site) in Davis, CA. EPA conducts these reviews every five years at sites throughout the country where cleanup is on-going and/or where hazardous substances are left in place above levels that allow for unrestricted use and unlimited exposure. Through the FYR process, EPA makes the determination whether the implemented remedy is functioning as intended and is still protective of human health and the environment. The process can include review of previous site documents, inspections, relevant laws and regulations, sampling if necessary, and conducting interviews.

EPA is beginning its first Five-Year Review process for the Site located and the final report is due September 28, 2012. The report will be available to the public in the Site's Information Repositories listed below.

EPA's primary responsibility at the Site is to protect the public and environment from contaminants associated with past Site activities. The soil and groundwater at the Site are contaminated with pesticides and fertilizers. The following final Site remedies were selected in the 2006 Record of Decision (ROD): 1) The use of an in-place electrical resistive heating system to run 16 months until fall 2012. The system sends electrical current through 236 subsurface electrodes to reduce the highest levels of contamination in the soils and groundwater contamination located on the property; 2) The groundwater extraction and treatment system will continue to operate by extracting and treating groundwater, which has migrated away from the Site, until the groundwater meets the cleanup goals specified in the ROD. Currently, the extracted contaminants in groundwater are treated by a carbon system, and the treated water is piped to the City of Davis Wastewater Treatment Plant.

As part of this first FYR, EPA will interview representatives from the Frontier Fertilizer Superfund Oversight Group, Congressman Thompson's office, City of Davis, Yolo County, and State (Department of Toxic Substances Control and Regional Water Quality Control Board). To become involved in the process, please call Jackie Lane directly at (415) 972-3236 or leave a message at (800) 231-3075 before April 16th, 2012. Your involvement would include an interview to gather concerns about the Site cleanup which will be responded to as part of the final report. If you have any technical questions about the Site, please call Bonnie Arthur, Remedial Project Manager, at (415) 972-3030.

Site Information Repositories where more information is housed are located at:

Yolo County Library, 315 East Fourteenth St., Davis, CA 95616
University of California, Shields Library Government Documents Department, Davis, CA 95616

Site information is on-line is at: www.epa.gov/region09/FrontierFertilizer

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Appendix C: Interview Summaries and Forms

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Community Interviews--Summaries

Elly Fairclough, Yolo County District Representative, Congressman Thompson, 1st Congressional District, May 4, 2012

Ms. Fairclough's believes regular fact sheets and community meetings are best for updates. She also likes receiving a hard copy of fact sheets.

Ms Fairclough drives by the site frequently. Residents have contacted her office in prior years regarding their concerns about the Site, however, she has not heard from anyone in the past year.

Ms. Fairclough believes it is essential to have the community network in place. She encourages EPA to continue regular meetings/calls with the FFSOG.

Stephen Souza, Davis City Council, May 3, 2012

Councilman Souza was impressed with EPA's solar installation. He relies on information that he receives from the FFSOG. He wants EPA to give a presentation to the City Council (and possibly the Natural Resources Commission) after the heating is complete and after the new council is elected. Councilman Souza wants remediation done as quickly as possible so that business can expand in this area. He also wants to ensure that the City of Davis production wells are protected. He would like EPA to increase the signage surrounding the Site.

Jim Provenza, Yolo County Supervisor, May 4, 2012

Supervisor Provenza is concerned about EPA's continued budget and the DTSC's budget once the State takes over management of Frontier Fertilizer in 2016. He has been informed of Frontier Fertilizer since Target, Inc. started development plans. He became involved once he heard questions from the FFSOG and other residents regarding contamination levels near the proposed Target, Inc. development. He has not heard any concerns in the past few years. He requests that EPA meet with him so that he can stay informed. He recommends that EPA report back to the County Supervisors, the "Two by Two" meetings (two City Council and two County Supervisors)and the press once ERH is complete.

Supervisor Provenza wants to ensure that Target, Inc.'s contractors continue sampling until EPA can say conclusively that there is no demonstrated risk to workers.

Amy Terrell, Project Manager, Regional Water Quality Control Board, May 15, 2012

Ms. Terrell consults and gives guidance regarding protection and remediation of groundwater resources. She has been most involved with the development of the Report of Waste Discharge (May 2010) and discussions regarding EPA's Discharge Permit with the City of Davis. Ms. Terrell's primary activities include: 1) providing comments on community outreach documents and technical documents (formal and informal), 2) participation in meetings and monthly conference calls between FFSOG, EPA, DTSC and technical staff. She interacts with EPA and DTSC to identify groundwater protections and treatments. She feels that EPA, the State of California and consultants have been effective teammates. Ms. Terrell provided comments and participated in design meetings for the implementation of the ERH. She assisted in identifying action items and encouraging closure so that the cleanup could move forward.

Ms. Terrell's role is to ensure that items are covered in community calls and with technical team members. With the large ERH design team she felt that her carefulness and consciousness helped the team effort. She feels that the frequent ambient air analyses have helped satisfy community concerns regarding ERH.

Ms. Terrell has the lead role for State groundwater reuse. To that end, she has worked toward encouraging EPA to use low level TCP analyses and has assisted with City of Davis groundwater permit issues. She is focused on whether the ERH will be successful in treating TCP and believes that the low level analytical methods will help detect this.

Jeff Pinnow, Supervising Hazardous Materials Specialist, Division of Environmental Health, Yolo County Health Department, May 30, 2012

Mr. Pinnow has one staff person assigned to oversight of Frontier Fertilizer. He receives all the formal deliverables and in general, receives 5-10 public record inquiries a year. Mr. Pinnow attended a tour of the heating system with all the City emergency responders prior to startup.

He feels that fact sheets are the most effective form of communication because of the large mailing list and the update they provide. Some of his concerns about the heating operation are as follows:

1) That there would be a serious system breakdown which could emit toxic substances.

2) Fire could create problems.

3) Person could get through security fences and injure self or change system

Mr. Pinnow thinks that the current communication system works pretty well for keeping the community informed.

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Interview Forms

FIVE-YEAR REVIEW INTERVIEW RECORD		
Site Name: Frontier Fertilizer	Account No:	
Review Report: 2012 Five-Year Review	*Review Period:*	
Individual Contacted:		
Name: Pam Nieberg and Steve Deverel	*Title:* President and Technical Advisor	*Organization:* Frontier Fertilizer Superfund Oversight Group
Telephone No.: *Fax No.* *E-Mail Address:*	*Office/Group:* *Street Address:* *City, State, Zip:*	
Contact Type: ☐ *Incoming Call* ☐ *Outgoing Call* ☒ *Visit* ☐ *Other*	*Location (if Visit):* *Date:* *Time:*	

Summary of Conversation/Questionnaire Reponses (Question 1-14 Technical, 15-20 Community Driven) :

1. *What is your role or responsibility at the Site?* We are a Technical Assistance Grant (TAG) group that organized in 1994 in response to USEPA's listing of the Frontier Fertilizer property in Davis, CA as a federal superfund site. We organized as representatives of neighborhoods/communities affected by the superfund site. Since 1995, we have been funded by EPA's TAG program to conduct oversight work at the site. We are a non-profit formed as a community oversight group dedicated to keeping the larger community informed of progress in EPA's progress in clean-up activities at the Frontier Fertilizer Superfund Site and to ensure and facilitate meaningful public input into the process. We have a Board of Directors that holds regular meetings of the FFSOG and also meets with EPA, their contractors and relevant state agencies to discuss issues related to clean-up at the site, relay our concerns and those of interested community members regarding the site and site clean up; review and comment on reports, data and other relevant information regarding clean-up at the site; and convey this information to the community at large through meetings, flyers/ newsletters, and news releases or op eds to the local newspaper site clean-up activities and other issues concerning the site. Our mission is to keep the community informed as to clean-up activities at the site and to relay concerns to EPA. Our Technical Advisor reviews and analyses the technical documents, reports, and data and submits comments to EPA and state agencies. He meets regularly with the FFSOG to discuss his analyses and comments with the group. He also meets regularly with EPA and their contractors and representatives from state agencies to discuss the work at the site. It is through the work of the technical advisor that the FFSOG can then keep the community informed of progress.

2. *Do you supervise others (i.e., staff or contractors) involved in Site activities? If so, what is their relationship to you and what are their responsibilities at the Site?* We do not directly supervise any staff or contractors. We work with our Technical Advisor, Steve Deverel of Hydrofucus. The FFSOG Board of Directors hired him as the TA in 1995 out of a field of 16 applicants. His responsibilities are listed above. Steve Deverel supervises technical staff members that help in the processing and analysis of Frontier site data.

3. *What Site activities have you and/or those you supervise been involved in from 2007 to date?* Our group has been involved with virtually every phase of the activities at the site since 1995. Since 2007, we have reviewed and commented on various reports and data including the ROD, numerous remedial action and design reports, Target reports, soil, ground water and soil gas sampling reports and other technical memos. We have also attended/held meetings with the FFSOG, EPA and their contractors and relevant state agencies and with the public.

Below we list reports/documents/data analyses that the FFSOG/TA have reviewed and commented on and/or been involved in developing since 2007. These are generally in chronological order.

1.) Continued ROD analysis and discussion of the ROD in relation to the RD process. FFSOG questions and comments in relation to this: How will you determine heating depth? How are non-COCs affected by heating and how will capture be ensured? How does temperature relate to the contaminants? Will carbon capture them all? What about safety issues? What will be the response for leaks? What if there is a power failure? What about air monitoring? How does uncertainty in

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Site Name: Frontier Fertilizer		Account No:
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Individual Contacted:		
Name: Pam Nieberg and Steve Deverel	*Title:* President and Technical Advisor	*Organization:* Frontier Fertilizer Superfund Oversight Group

mass affect the treatment? What are the effects of Target coming in? What about the contingency plan-p and t? What about possible failures in thermal treatment? What are the treatment by-products and how will they be treated? What about potential for groundwater contamination from the biological treatment plan? How to contain contaminated groundwater? What about additional ex-situ treatment? There are inconsistencies in ROD about bench scale studies for the biological treatment. Will there be third-party review? Will Community Acceptance Criteria be developed? The FFSOG developed a list of Action Items from a Table from July 17, 2006 to be addressed during development of the remedial action.

2.) Subsurface Investigation Work Plan review and comments.

3.) Anaerobic degradation study review and comments.

4.) Thermal Treatment Plan reviews and comments.

5.) Biological Field Test Results review and comments. Phase I Anaerobic Bioremediation Field Study Results (May 2007). FFSOG comments: There was no evidence for reduction of nitrate or sulfate beyond the injection well. There was no conclusive evidence for reduction of target HVOCs in MW7A and beyond. MW7B is not suitable as an injection well as MW7A (the receptor well) was screened at a different depth. The FFSOG had already commented that this was a problem in the plan. There is no evidence that an estimate of the anaerobic treatment zone or determination of dose or frequency of subsequent injections were met. Results inconclusive. FFSOG does not agree on further studies or implementation of injection for anaerobic treatment. The results did not satisfy the original objectives. The primary objective was stated as:"Evaluate the feasibility of utilizing the existing injection well network for larger scale test injection." The data are inconclusive on this point and we do not know the feasibility of using existing injection wells.. Inducing transport of the fermentation waste to down gradient wells is the largest uncertainty and the results of this test do not offer any evidence that this can occur in a way that will result in large scale reduction of target compounds. 6.) Scope of Work for Well Installation Activities Associated with Target Development on the Eastern Side of the FFSS review and comments.

7.) Recommended CPT locations to identify new well locations re Target.

8.) Geosurvey for sub-surface work review and comments.

9.) Drafting of Community Involvement Plan (later to be call Community Notification Plan.) The FFSOG was heavily involved in development of this plan.

10.) Heating vendor bid solicitation package review and comments.

11.) White Paper with COC physical and chemical date review and comments. Overall, more work was needed for defining by-products of thermal treatment, to understand human implications, and for implementing and managing groundwater and vapor capture.

12.) Field Sampling Plan and QAPP for Target review and comments. FFSOG objected to 3 samplings in 3 years in the spring. Felt there was a need to collect at least during high and low groundwater cycles.

13.) Target Agreement re location of 8 gw monitoring wells on privately owned parcels to the north and west of the FFSS. The FFSOG did not agree that soil samples tested for COCs was a substitute for soil gas sampling. What if new wells do not meet the requirements of the project?

14.) Geophysical Plan to close sumps and pits review and comments.

15.) Klienfelder responses to comments on QAPP and Field Sampling Plan review and comments. Insufficient detail on sampling procedures and significant departure from DTSC guidelines.

16.) Waste Water Pretreatment Discharge Sewer Rate Analysis review and comments.

17.) Revised QAPP and FSP.

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18.) SOW for Capital Development for review and comment.

19.)Pit Sampling Results and Recommendations Report for review and comments. Data from Pits 1-3.

20.) Pit and Source Zone Characterization Results for review and comment. Pit 4 data.

21.)Fact Sheet out on Target Agreement (To allow Target with EPA oversight, move 8 monitoring wells on private properties to the north and west of the site. Requires certain actions of Target. Mentions CIP and future availability. Reviewed progress from ROD signing in 9-2006 through the present, including P and T and Scope of Work for Well Replacements.)

22.) Site Management Plan review and comments.

23.) 30% RAMP review and comments.

24.) Environmental Protection Waste Management Plan review and comments.

25.) Design Component for the 30% RAMP

26.) Subcontractor Quality Control Plan for 30% RAMP

27.) 30% RAMP Sample and Analysis Plan

28.) Remediation Delineation Sampling Plan for the 30% RAMP. FFSOG wanted to know what were the mechanisms for protecting neighbors from exposure to hazardous chemicals during drilling and sampling phases. Drill cuttings and well development fluids to be stored on site for up to 90 days.

29.) Kleinfelder Field Investigation Report

30.) TCP detections. In November 2008 the FFSOG learned of detections above the state action level for TCP in the October Klienfelder report. The FFSOG believed there was a need for further testing. Target was not amenable to that. In the end, after the FFSOG notified appropriate elected officials, the press, and the community, EPA did perform more gas and groundwater sampling between the Target detects and the homes to the north, as the groundwater moves in that direction. The levels for TCP near the Target store were nearly 3000 times the action level for TCP. The Cal Aggie, Davis Enterprise and Davis Vanguard did articles on the TCP. The city wrote a letter asking for further study. Several electeds also weighed in asking for further sampling.

31.) TCP work plan review and comments.

32.) Sub-Slab Venting System from Kleinfelder for review and comment.

33.) Preliminary model runs for review and comment.

34.) Work with city/county 2 by 2 to encourage involvement of AQMD in site activities in relation to air monitoring. The local AQMD wanted to be involved during development of the ISTTS and bioremediation.

35.) Supplemental Soil Gas and Shallow Groundwater Characterization Work Plan (for further testing for TCP between thedetect near Target and homes to the north) for review and comment.

326Air Monitoring Plan review and comments.

37.) Prefinal ISTTDesign Report review and comments.

38.) Updated Prefinal Design for In-Situ Heating for review and comment.

39.) Site Management Plan for the In-Situ Thermal Treatment Frontier Fertilizer NPL Site and Appendix A and figures for In-Situ Thermal Treatment Plan for review and comments.

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40.) Completed design reports for heat treatment for review and comments.

41.) Design Reports for Power for review and comments.

42.) Heat Treatment Process Monitoring Plan for review and comments.

43.)Environmental Protection Plan for review and comments.

44.) Target Air Monitoring Plan for review and comments.

45.) Updated CNP for review and comments.

46.) Sampling and Analysis Plan and final Thermal Treatment Plan for review and comments.

47.) Updated table for RAMP and SOP for Hapsites GC/MS for review and comment.

48.) Target sampling data and response to comments review and comments.

49.) ISSTST Air/Gas Monitoring Work Plan and the Decision Rule for review and comments.

50) Developed and submitted to EPA the "Preliminary Estimates of Concentrations of Contaminants in the Neighborhood North of the FF Site Due to a Release During Thermal Treatment" for review. This concluded that any release, even a "catastrophic release" would not endanger the neighbors because of dispersion and dilution.

41.) Issue with RALS. Where did they come from? How are they determined? Seemed arbitrary at first. FFSOG felt that since system was designed to have no releases, any release at all even if below the RAL, would indicate a problem. There was also no discussion of RALs in the ROD. After several discussions including the EPA toxicologist, project manager and consultants , the final plan was to use laboratory detection limits instead of the RAL. If there is a detection the following protocol will be implemented: 1.) The laboratory results will be confirmed. This may include such actions as checking the result against a duplicate sample (if one exists), reviewing PE results (if any exist), reviewing laboratory calibration data, verifying reported values with laboratory personnel and determining if more quantitative results are available. 2) The ISTT system monitoring data will be reviewed. 3) Evaluation of background data (which includes prior sample events and upwind samples, ifthey exist, from the event in question), 4) To assess the location and cause of the detection,EPA will bring out the mobile HAPSITE and and/or increase the number sample locations and/or and frequencies for no longer than 96 hours. Note: the HAPSITE statement of work is included in Appendix E, 5) After the completion of step 4, if a concentration in ambient air at any of the sample locations is confirmed as detected above the Region 8 reporting limit, then the application of energy to the subsurface will be reduced or discontinued to reduce contaminant mobilization and another sample event will occur

52.) New drafts of CNP and AMP for review and comment.

53.) Continued discussion of the AMP. Still problems with the decision rule and frequency of sampling events. In the end, the decision was to sample once per week unless there was a detect above the detection limit, then sampling would take place twice per week until the detects were below the detection limits. In December of 2011, the FFSOG also agreed to reduction of the air samplings to twice monthly until Stage 3 was up to 60 or 70 degrees.

54.) Addressed noise complaint.

55.) Target sub-slab sampling report for review and comment. Also issue with whether or not the passive sub-slab system was to be constructed as to be easily converted to an active system. Target says no, but the FFSOG believes that was to be the case.

56.) Review and comment, if needed, on weekly updates on mass removal and air monitoring results during heat treatment.
57.) Quarterly Ground Water reports review and comments throughout this period.

58). Technical meetings, meetings with EPA and state agencies, public meetings and FFSOG meetings throughout this

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process.

4. *List key technical documentation produced by you or on your behalf from 2007 to date that should be considered in this five-year review effort.* See above, especially 1, 3, 5, 7, 9, 11, 12, 13, 15, 23, 24, 27, 28, 29, 30, 31, 32, 34, 35, 36, 37, 38, 39, 40, 42, 44, 45, 46, 48, 49, 50, 51, 52, 53, 55, 56, 57.

5. *Summarize any additional information that is not included in the documentation listed above that should be considered in this five-year review effort.*

The FFSOG regularly interacts with community members and potential community members related to the site. The FFSOG receives several calls a year from people considering purchasing a home in the Mace Ranch area who are concerned about the presence of the site and its potential impact on their home value and on health. They are seeking information on the site and progress of site clean-up. The FFSOG provides that information to them both verbally and by directing them to the website and to EPA for more information. The FFSOG has also been asked for interviews by students at the UC campus who are doing papers or studies on the toxic waste site. The FFSOG has provided the information needed by the students for their research. The FFSOG also writes articles for the newspapers, such as the Davis Enterprise and California Aggie, and for a popular on-line blog in Davis called the Davis Vanguard on issues related to the superfund site and clean-up efforts. We have also been interviewed by the papers and the blog when issues arise related to the site. The FFSOG also has interacted with/lobbied political entities from the local to federal level on various issues related to the site. Some of these have been funding issues; others related to concerns of the FFSOG and/or community members on toxic issues related to the site, exposure potential, timing issues, clean-up efforts and interactions with EPA.

The activities of the TAG have resulted in increased public knowledge and awareness of the site and site activities and in a community dialogue on the site with the FFSOG, EPA and their contractors and relevant state agencies while work at the site progresses. This dialogue has resulted in a better understanding on the part of the interested community of the site, hazards, and progress of remediation activities and has served to listen to and address community concerns.

6. *Describe any significant issues, problems, or difficulties encountered by your work at the Site from 2007 to date.* In late 2006 and early 2007, there were still issues with communications with EPA regarding some of the technical issues, but these are being worked out. The FFSOG's primary concerns were that the final remedy was appropriate, would work on the COCs at the site which were not typical, and that risk to the neighborhood was minimal. The FFSOG Technical Advisor is very knowledgeable and his input should be given strong consideration. There were also concerns that the process was moving too fast at this important stage.

In 2007, there were concerns with the Target facility that was planned for next to the site and which would impact some monitoring wells in that area. The FFSOG was concerned that EPA not allow Target to move forward until the FFSOG and EPA were satisfied that the new wells were in locations that would ensure data from them would duplicate data from the old wells to the greatest extent. Placement of the new wells was a critical consideration to ensure continuation of data on ground water and contaminant movement. The FFSOG was also concerned that the planned development not interfere in any way with EPA's clean-up activities or timeliness of implementation and completion of the final remedy.

There were issues with ground water sampling and calibration methods used in the field and consequent accuracy of data from the samplings. There was concern that the sampling methods were not consistent with EPA protocols There were also ongoing problems with the pump and treat system especially with continued downward movement of contaminants in the A1 in some areas.

There were concerns about the proposed bioremediation. Those concerns are mentioned above.

There were concerns about public acceptance of the heat treatment so close to a neighborhood. It was important that the risks be addressed and minimized. There are concerns about the heat treatment and potential for release of toxic vapors and how to ensure that the neighborhood is not at risk from any potential leak or release. The FFSOG had considerable input into the development and implementation of the Air Monitoring and Response Plans and with the Community Notification

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Plan as a result.

The FFSOG was also very concerned when it was discovered during soil gas sampling in the footprint for the proposed Target store that TCP had been found at levels considerably above the State of California action level. At first, it appeared that neither Target or EPA intended to pursue the issue, but the FFSOG felt that it was important to ensure that the contaminant was not moving toward homes to the north of the site and Target location, as ground water did move in that direction. EPA finally did agree to further testing between the detects near the Target footprint and the homes. No TCP was found near the homes.

As a result of the TCP detects near the footprint of the Target and the potential for contaminant in the groundwater under the future store, Target was required to install a passive sub-slab venting system to allow any vapors that might accumulate under the store to be vented out through the walls. This was to protect store employees who would have the strongest potential for exposure in the store. The FFSOG had some concerns that this system had actually been installed properly and would allow for proper venting and sampling when needed. There were also concerns with the infrequency of monitoring that Target proposed for the site.

During development of the Community Notification Plan and Air Monitoring Plan, the FFSOG had concerns that the plans were inadequate to accomplish their goals, in particular, protection of the near-by neighborhoods in case of toxic release. There were issues with air monitoring frequencies and responses in the event a release was detected during the heat treatment. What would trigger a shut down of the system? How long after shut-down would the release continue? How would notification of the neighborhood take place? Who were first responders? There were also issues with use of Residential Action Levels (RALs) to trigger a response. RALs were never discussed in the ROD. Where did they come from? They also seemed arbitrary, as the action levels for one chemical changed from 0.38 to 9 when the FFSOG pointed out that 0.38 was at the detection limit for that chemical.

There were problems getting ground water monitoring reports in a timely fashion through out this period. This has been an ongoing problem. Reports have often been behind by a year. The FFSOG felt it was even more of an issue to be able to follow the contaminants during the heat treatment, so it was important to seek some resolution to this issue. It was decided that EPA's contractor, CH2MHill, would get at least the ground water data to the FFSOG, if the full report could not be completed in a timely fashion. This has resolved some of the issue.

7. *Describe any progress and/or successes achieved by your work at the Site from 2007 to date.*

1.) Better dialogue with EPA and development of open technical dialogue with EPA's technical staff.

2.) Had significant input into the ROD and especially its relation to the RD and RA.

3.) Helped facilitate discussions with concerned neighbors and community members related to the thermal treatment, air monitoring, CNP, and other issues related to the thermal treatment and protection of the neighborhood.

4.) The FFSOG had considerable input into the Air Monitoring and the Community Notification Plans with input from concerned community members to the extent that the planned thermal treatment was accepted by the community with few problems.

5.) In relation to the AMP, the FFSOG TA developed and submitted the "Preliminary Estimates of Concentrations of Contaminants in the Neighborhood North of the FF Site Due to a Release During Thermal Treatment" for review. This concluded that any release, even a "catastrophic release" would not endanger the neighbors because of dispersement and dilution.

6.) The FFSOG had considerable input into issues related to the planned development near the site (Target store), including helping determine appropriate locations for new monitoring wells to replace those that had to be destroyed for the new building; giving input into the requirements for Target to install the sub-slab venting and

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monitoring system beneath the store and into frequency and timing of sampling; .

7.) Recommended CPT locations to identify new well locations re Target.

8.) The FFSOG had considerable input into the proposal to do bioremediation in the field using beer waste from a near-by brewery. Since both bench tests and one field test indicated that there was no effect on nitrates and sulfates and were inconclusive in relation to the COC's, there appeared to be no evidence that bioremediation would accomplish its goals.

9.) The FFSOG successfully encouraged EPA to conduct further testing for TCP to ensure that it was not moving toward homes to the north of the site after TCP at relatively high levels was found during soil gas sampling near the Target footprint.

10.) The FFSOG helped resolve issues with late ground water reports by suggesting that at least the data be released in a timely fashion, even if the full report could not be, so that the FFSOG and the community could continue to monitor the movement of gw and contaminants.

8. *Describe any significant implemented or planned changes in approach or execution of your work at the Site from 2007 to date.*
See above.

9. *What effect, if any, have the items discussed in response to Questions 6, 7, and 8 had on the protectiveness or effectiveness of Site remedial actions?*
The FFSOG's input into the AMP improved the effectiveness of the plan in terms of frequency of sampling and location of sampling to be more protective of the neighborhood, and in providing specific language for response to an accidental leak: confirm detect, search for cause, if not resolved within 96 hours, shut the system down. The FFSOG's involvement with development of the CNP resulted in a much tighter plan for action in the event of leak or release of toxic vapors and in actions to be taken to notify the neighborhood of potential hazards.

The FFSOG's input helped open up better communication with EPA and technical staff and facilitated better community access to information about the site.

The FFSOG raised several questions about the ROD and its relationship to the RA and RD including how uncertainty affects the clean-up, how to ensure that by-products of the thermal treatment would be captured or destroyed, issues related to the bioremediation that may have put that on hold. The FFSOG's input resulted in better addressing of many of these issues.

The FFSOG contributed locations for cpt and well locations in replacement of the old wells that were to be abandoned due to Target. This input helped ensure that the new well locations were as good in terms of data and continuity as the wells replaced.

The FFSOG TA provided the data to demonstrate that even in the event of a catastrophic release, the neighborhood would be safe from exposure to toxic vapors at harmful levels. This helped in advancing community acceptance of the final remedy and in allaying strong concerns expressed by some of the neighbors.

The FFSOG actions in relation to the TCP discovery near the Target footprint resulted in more extensive sampling for TCP both near homes to the north and in proximity to the future Target store and in the implementation of measures to protect store employees, patrons and neighbors of the site.

The FFSOG's input into the tardiness of the ground water monitoring reports resulted in more timely availability to at least the data, so that the FFSOG and the community could be provided with information related to the contamination in the ground water, its movement and effectiveness of clean-up activities.

10. *What effect, if any, have the items discussed in response to Questions 6, 7, and 8 had on treatment system O&M?*

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Questioning and discussion has resulted in substantial changes to the air monitoring plan.

11. *Have there been any significant changes in treatment system O&M requirements, maintenance schedules, or sampling routines from 2007 to date? If so, provide details including the impacts/cost of these changes.*

Groundwater sampling procedures have changed. For field parameters, more frequent meter calibration and calibration with more representative standards is occurring.

12. *Have there been any opportunities to optimize treatment system O&M or sampling requirements? If so, provide details. Describe resultant/desired cost savings or improved efficiency.*
    N/A

13. *Have there been any changes in city, state, or federal standards/regulations/guidance from 2007 to date which may impact Site operations and/or call into question the current protectiveness or effectiveness of Site remedial actions?*
    N/A

14. *Do you routinely work cooperatively with others involved in Site activities that are not under your supervision? If so, what is their relationship to you and what is your impression of their work?*

    We routinely interact with Department of Toxic Substances Control and the Regional Water Quality Control Board in addition to EPA and its consultants. In general, their work is adequate.

    COMMUNITY TYPE QUESTIONS:

15. *Have you been effectively informed of Site activities and issues? If so, what communication mechanisms have been the most helpful? If not, what alternative communication mechanisms would you suggest?*

16. *What is your most significant concern/issue with respect to Site activities (either your own involvement or others)?*

17. *What effects have the Site or Site operations had on you (or the surrounding community)?*

18. *What effects, if any, have your activities had on the Site or Site operations?*

19. *Are you aware of any complaints or other adverse issues (e.g., dumping, vandalism or anything that required emergency response from local authorities) related to the Site (or a particular region of the Site)? If so, please elaborate.*

20. *Do you have any comments, suggestions, or recommendations to improve Site activities?*

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Individual Contacted:		
Name: Steve Ross	*Title:* Project Manager	*Organization:* Department of Toxic Substances Control
Telephone No.: *Fax No.* *E-Mail Address:*		*Office/Group:* *Street Address:* *City, State, Zip:*
Contact Type: ☐ *Incoming Call* x *Outgoing Call* ☐ *Visit* ☐ *Other*		*Location (if Visit):* *Date:* *Time:*

Summary of Conversation/Questionnaire Reponses (Question 1-14 Technical, 15-20 Community Driven) :

1. *What is your role or responsibility at the Site? I am the Department of Toxic Substances Control lead project manager for this fund lead US EPA NPL site. I am responsible for review, comment, and communication on EPA response action deliverables for purposes of relaying a State point of view. As a fund lead project, I am responsible for assuring State matching funds are available for implementing, operating and maintaining all remedial actions undertaken at the Site. I am responsible for identifying State ARARs where necessary. I am also responsible for ensuring environmental covenants for institutional controls are recorded on properties which do not meet unrestricted use standards. I am responsible for State interests with regards to the future long-term response action project transfer. I am responsible for review and concurrence of EPA's future proposal to delist the site from the NPL list. Responsible for participation in community outreach activities.*

2. *Do you supervise others (i.e., staff or contractors) involved in Site activities? If so, what is their relationship to you and what are their responsibilities at the Site? Issued a contract for Title Search of the Frontier Fertilizer Site for purposes of assessing recorded documents on the property. TLI Solutions, Inc. produced a Final Chain-of-Title Report for parcels 071-411-015, 071-411-016, and 071-411-017 in March 2012.*

3. *What Site activities have you and/or those you supervise been involved in from 2007 to date? Entered into negotiations leading into Contracts with USEPA for certain State assurances (e.g. cost share) for two remedial action implementation activities. Participated in conference calls held on an approximate monthly basis between USEPA, USEPA contractors, FFSOG, and the Water Board regarding activities at the site. Participated in outreach activities with adjacent landowners and other stakeholders through meetings/teleconferences on replacement of monitoring wells, assessing potential vapor intrusion, environmental due diligence, solar energy, and treated water disposal/reuse. Reviewed and commented on EPA contractor solicitation bid packages for source area remedial action. Reviewed remedial design, remedial action implementation, and operation and maintenance documents. Regarding supervision, use of Contract in 2012 as described in 2 above.*

4. *List key technical documentation produced by you or on your behalf from 2007 to date that should be considered in this five-year review effort. Documents provided from September 2007 include an agreement with adjacent property owner for oversight of their implementation plans to build a store which impact existing remediation and monitoring systems; risk based soil gas concentrations for potential indoor air exposure assessment, support of USEPA objection to City of Davis proposed sewer rate increase, recommendations for the groundwater monitoring program, comments and concurrence with USEPA Pre-final ISTT Design Report; recommendations for the compliance monitoring of air emission systems, comments on the sampling and analysis plan for the ISTT operations, concurrence with diminishing returns for Stage 1 heating and Stage 2 heating (minus TMW-8 area).*

5. *Summarize any additional information that is not included in the documentation listed above that should be considered in this five-year review effort. No additional information.*

6. *Describe any significant issues, problems, or difficulties encountered by your work at the Site from 2007 to date. None that I know of.*

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Name: Steve Ross	*Title:* Project Manager	*Organization:* Department of Toxic Substances Control

7. *Describe any progress and/or successes achieved by your work at the Site from 2007 to date. Obtaining State assurances through contracting to allow USEPA to proceed with implementing the remedial action. Timely review of deliverables and frequent communications to achieve progress towards cleanup.*

8. *Describe any significant implemented or planned changes in approach or execution of your work at the Site from 2007 to date. None.*

9. *What effect, if any, have the items discussed in response to Questions 6, 7, and 8 had on the protectiveness or effectiveness of Site remedial actions? Frequent communication and timely review of deliverables has allowed USEPA led remedial actions to progress effectively towards cleanup.*

10. *What effect, if any, have the items discussed in response to Questions 6, 7, and 8 had on treatment system O&M?* There continues to be an executable contract to continue operation and maintenance of the groundwater treatment plant. Operation of the in-situ electric resistive heating continues to be reported on a weekly basis to the project team allowing for decisions regarding optimizing operation.

11. *Have there been any significant changes in treatment system O&M requirements, maintenance schedules, or sampling routines from 2007 to date? If so, provide details including the impacts/cost of these changes. DTSC is concerned by the potential for exponential rising costs of continued handling of the treated water by the City of Davis. From reports which DTSC is copied, appears to be about 35 gpm on average of groundwater being treated by the carbon vessels.*

12. *Have there been any opportunities to optimize treatment system O&M or sampling requirements? If so, provide details. Describe resultant/desired cost savings or improved efficiency. USEPA solar system to supplement power requirements for the groundwater treatment plant. Initial water reuse efforts for the treated water are underway which continue to this date.*

13. *Have there been any changes in city, state, or federal standards/regulations/guidance from 2007 to date which may impact Site operations and/or call into question the current protectiveness or effectiveness of Site remedial actions? An announcement of a final public health goal for 1,2,3-trichloropropane in drinking water at 0.0007 parts per billion on August 20, 2009. The Department of Public Health considers PHG in setting MCL drinking water standards.*

14. *Do you routinely work cooperatively with others involved in Site activities that are not under your supervision? If so, what is their relationship to you and what is your impression of their work? Yes. USEPA is federal lead agency in the NPL responses. RPM is Bonnie Arthur. USEPA construction contractor is CH2M Hill. USEPA contracts with Current Environmental Solution work related to ISTT remedial action implementation and operation and maintenance FFSOG is the community group in Davis for the site and has a technical consultant, Hydrofocus. Overall quality of work products are excellent and communications through meetings/teleconferences have been productive.*

Appendix D: Site Inspection Checklist

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Frontier Fertilizer Five-Year Review Site Inspection Checklist

I. SITE INFORMATION	
Site name: Frontier Fertilizer	**Date of inspection: June 4, 2012**
Location and Region: Davis, CA, Region IX	**EPA ID: CAD071530380**
Agency, office, or company leading the five-year review: Region 9	**Weather/temperature: 60 degrees F, 6 mph wind**

Remedy Includes: (Check all that apply)

G Landfill cover/containment

G Monitored natural attenuation

XX Access controls

XX Groundwater containment

XX Institutional controls

G Vertical barrier walls

XX Groundwater pump and treatment

G Surface water collection and treatment

XX Other Source zone electrical resistive heating, gravel, wood chip cap, biological treatment of nitrate in groundwater

Attachments: G Inspection team roster attached G Site map attached

II. INTERVIEWS (Check all that apply)

1. **O&M site manager** ___Paul Seday_____ __Project Manager_____ July 10, 2012____

Name Title Date

Interviewed G at site G at office G by phone Phone no. _530-878-6061____

Problems, suggestions; G Report attached __Electrical anomalies affect extraction well operation. Have electrician that specializes in PLC determine source of anomalies.

2. **O&M staff** **Stan Wenninger** Junior Engineering Tech **and Brian Dee** O&M Supervisor__ Tech_____

Names Titles Date: 6/4/2012

Interviewed XX at site G at office G by phone Stan's Phone no. 408-230-5196_____

Problems, suggestions; G Report attached _____

___Stan Wenninger has worked at Frontier since 2003 and has many years of experience sampling 100 plus monitoring wells as well as the treatment plant. O&M has stayed consistent. On-going troubleshooting of extraction wells and variable frequency drives which operate the pumps.

3. **Local regulatory authorities and response agencies** (i.e., State and Tribal offices, emergency response office, police department, office of public health or environmental health, zoning office, recorder of deeds, or other city and county offices, etc.) Fill in all that apply.

Agency _____

Contact _____ _____ _____ _____

Name Title Date Phone no.

Problems; suggestions; G Report attached _____

Agency _____

Contact _____ _____ _____ _____

Name Title Date Phone no.

Problems; suggestions; G Report attached _____

Agency _____

Contact _____ _____ _____ _____

Name Title Date Phone no.

Problems; suggestions; G Report attached _____

Agency _____

Contact _____ _____ _____ _____

Name Title Date Phone no.

Problems; suggestions; G Report attached _____

4. **Other interviews** (optional) G Report attached.

III. ON-SITE DOCUMENTS & RECORDS VERIFIED (Check all that apply)

1. **O&M Documents**

XX O&M manual	XX Readily available	XX Up to date	G N/A
XX As-built drawings	XX Readily available	XX Up to date	G N/A
XX Maintenance logs	XX Readily available	XX Up to date	G N/A

Remarks___Maintenance logs are located on on-site computer_____

2.	**Site-Specific Health and Safety Plan**	XX Readily available	XX Up to date	G N/A
	XX Contingency plan/emergency response plan	XX Readily available	XX Up to date	G N/A
	Remarks____HSP onsite, CH2M HILL HSP contains emergency contacts and responses, CES-environmental protection plan for spill responses, and CES site management plan for heating related responses. Hospital route posted on site building wall.			
3.	**O&M and OSHA Training Records**	XX Readily available	XX Up to date	G N/A
	Remarks_O&M records maintained on site computer electronically; accessible to offsite project staff via remote access. CH2M HILL OSHA training identified in HSP, for mobilized projects staff maintain copy of training records on individual or with project site safety coordinator in binder.			
4.	**Permits and Service Agreements**			
	G Air discharge permit	G Readily available	G Up to date	G N/A
	G Effluent discharge	G Readily available	G Up to date	G N/A
	XX Waste disposal, POTW	XX Readily available	XX Up to date	G N/A
	G Other permits_____	G Readily available	G Up to date	G N/A
	Remarks_____			
5.	**Gas Generation Records**	G Readily available	G Up to date	XX N/A
	Remarks_____			
6.	**Settlement Monument Records**	G Readily available	G Up to date	XX N/A
	Remarks__not applicable			
7.	**Groundwater Monitoring Records**	XX Readily available	XX Up to date	G N/A
	Remarks___Available through on-site computers			
8.	**Leachate Extraction Records**	G Readily available	G Up to date	XX N/A
	Remarks_____			

9.	**Discharge Compliance Records**			
	G Air	G Readily available	G Up to date	XX N/A
	XX Water (effluent)	XX Readily available	XX Up to date	G N/A
	Remarks___City of Davis Treated Groundwater Permit, available on-line and accessible from on-site computers			
10.	**Daily Access/Security Logs**	XX Readily available	XX Up to date	G N/A
	Remarks___Check in log located near front security gate			
	IV. O&M COSTS			
1.	**O&M Organization**			
	G State in-house	G Contractor for State		
	G PRP in-house	G Contractor for PRP		
	G Federal Facility in-house	G Contractor for Federal Facility		
	XX Other_EPA Contractor_____			

2. **O&M Cost Records**

XX Readily available XX Up to date

XX Funding mechanism/agreement in place

Original O&M cost estimate___$778,000_____ G Breakdown attached

Total annual cost by year for review period if available

From__10/2007____To___9/2008_____ $495,313_____ G Breakdown attached

Date Date Total cost

From__10/2008____ To_9/2009____ _$678,580_____G Breakdown attached

Date Date Total cost

From__10/2009____ To_9/2010_____$630,108_____G Breakdown attached

Date Date Total cost

From_10/2010_____ To_9/2011_____ _$601,409_____G Breakdown attached

Date Date Total cost

From__10/2011_____ To__6/2012_____ $452,990_____ G Breakdown attached

Date Date Total cost

3. **Unanticipated or Unusually High O&M Costs During Review Period**

Describe costs and reasons: There has been a slight increase in City of Davis discharge fees during winter months, however, the larger fee increase has not occurred yet.

V. ACCESS AND INSTITUTIONAL CONTROLS XX Applicable G N/A

A. Fencing

1. **Fencing damaged** G Location shown on site map XX Gates secured XX N/A

Remarks_____Last fence inspection occurred on 5/31/12 (per Stan Wenninger, ITSI)

Fencing check is part of routing monitoring from O&M plan

B. Other Access Restrictions

1. **Signs and other security measures** G Location shown on site map G N/A

Remarks___Signage on fencing, locking gate, access procedures, and remote monitoring are in place.

C. Institutional Controls (ICs)			
1.	**Implementation and enforcement**		
	Site conditions imply ICs not properly implemented	G Yes	xxNo G N/A
	Site conditions imply ICs not being fully enforced	G Yes	xx No G N/A
	Type of monitoring (*e.g.*, self-reporting, drive by) ___Visual inspection and remote monitoring in coordination with the City of Davis police Department		
	Frequency: Continuous		
	Responsible party/agency: EPA		
	Contact _Bonnie Arthur_____ Site Manager__ __NA (415) 972-3030		
	Name Title Date Phone no.		
	Reporting is up-to-date	G Yes	G No G N/A
	Reports are verified by the lead agency	G Yes	G No G N/A
	Specific requirements in deed or decision documents have been met.	G Yes	G No G N/A
	Violations have been reported	G Yes	G No G N/A
	Other problems or suggestions: G Report attached		
2.	**Adequacy** xx ICs are adequate G ICs are inadequate G N/A		
	Remarks_____		
D. General			
1.	**Vandalism/trespassing** G Location shown on site map G No vandalism evident		
	Remarks___Fence broken by auto accident (2011); connex box broken into (2010)		
	Heating vendor connex box, unauthorized entry and theft of SCBA.		
	Solar Panel (on roof) attempted theft, door kicked in and pump taken.		
	Unauthorized camping on site.		
	Car contact fence pole along 2nd street.		
	Damage was quickly identified and repaired by contractors.		

2.	**Land use changes on site** G N/A Remarks_____
3.	**Land use changes off site** G N/A Remarks__Land around the site is being developed in coordination with EPA to protect the selected remedy.
VI. GENERAL SITE CONDITIONS	
A. Roads	xx Applicable G N/A
1.	**Roads damaged** G Location shown on site map G Roads adequate G N/A Remarks_Acceptable condition_____
B. Other Site Conditions	
VII. LANDFILL COVERS G Applicable xx N/A	
VIII. VERTICAL BARRIER WALLS G Applicable xx N/A	

IX. GROUNDWATER/SURFACE WATER REMEDIES xxApplicable G N/A
A. Groundwater Extraction Wells, Pumps, and Pipelines XX Applicable G N/A
1. **Pumps, Wellhead Plumbing, and Electrical** XX Good condition G All required wells properly operating G Needs Maintenance G N/A Remarks: System operated each day for past 365 days. Individual wells experience minor downtime, but are repaired quickly and efficiently by contractors.
2. **Extraction System Pipelines, Valves, Valve Boxes, and Other Appurtenances** XX Good condition G Needs Maintenance Remarks_____
3. **Spare Parts and Equipment** XX Readily available G Good condition G Requires upgrade G Needs to be provided Remarks_Major spare parts are available on site. Parts list maintained on site computer and updated as parts removed or added.
B. Surface Water Collection Structures, Pumps, and Pipelines G Applicable G N/A
1. **Collection Structures, Pumps, and Electrical** G Good condition G Needs Maintenance
2. **Surface Water Collection System Pipelines, Valves, Valve Boxes, and Other Appurtenances** G Good condition G Needs Maintenance
3. **Spare Parts and Equipment** G Readily available G Good condition G Requires upgrade G Needs to be provided

C. Treatment System	XX Applicable G N/A
1.	**Treatment Train** (Check components that apply) G Metals removal G Oil/water separation G Bioremediation G Air stripping XX Carbon adsorbers XX Filters_____ G Additive (*e.g.*, chelation agent, flocculent)_____ G Others_____ XX Good condition G Needs Maintenance XX Sampling ports properly marked and functional G Sampling/maintenance log displayed and up to date G Equipment properly identified XX Quantity of groundwater treated annually March 2011 to March 2012 treated approximately 23,000,000 gallons_____ G Quantity of surface water treated annually_(none)_____ Remarks_____
2.	**Electrical Enclosures and Panels** (properly rated and functional) G N/A XX Good condition G Needs Maintenance Remarks_____
3.	**Tanks, Vaults, Storage Vessels** G N/A XX Good condition G Proper secondary containment G Needs Maintenance Remarks: Tank/vessel integrity will be reviewed against seismic codes during the upcoming upgrade.
4.	**Discharge Structure and Appurtenances** G N/A XX Good condition G Needs Maintenance Remarks_____

5.	**Treatment Building(s)** G N/A XX Good condition (esp. roof and doorways) G Needs repair G Chemicals and equipment properly stored Remarks__The treatment building is of suitable quality for treatment equipment and field staff.
6.	**Monitoring Wells** (pump and treatment remedy) XX Properly secured/locked XX Functioning XX Routinely sampled XX Good condition XX All required wells located G Needs Maintenance G N/A Remarks_____
D. Monitoring Data	
1.	Monitoring Data XX Is routinely submitted on time XX Is of acceptable quality
2.	Monitoring data suggests: G Groundwater plume is effectively contained xx Contaminant concentrations are declining Capture zone analysis indicated portion contaminated groundwater in S-1 and S-2 zone and A-1 zone are not effectively captured. Options to achieve the RAOs in these volumes will be reviewed post-heating remedy. COC concentrations in most monitoring wells are declining, with the exception of some immediately down gradient of the heated zone.
D. Monitored Natural Attenuation	
1.	**Monitoring Wells** (natural attenuation remedy) G Properly secured/locked G Functioning G Routinely sampled G Good condition G All required wells located G Needs Maintenance XX N/A Remarks_____
X. OTHER REMEDIES	
	If there are remedies applied at the site which are not covered above, attach an inspection sheet describing the physical nature and condition of any facility associated with the remedy. An example would be soil vapor extraction. In-situ thermal treatment remedy implemented. Facilities include soil vapor extraction system and electrical resistive heating power units. Facilities are temporary and to be removed at end of treatment.

XI. OVERALL OBSERVATIONS	
A.	**Implementation of the Remedy**

Describe issues and observations relating to whether the remedy is effective and functioning as designed. Begin with a brief statement of what the remedy is to accomplish (i.e., to contain contaminant plume, minimize infiltration and gas emission, etc.).

Inspected elements of the remedy included groundwater pump-and-treat system, In-Situ Thermal Treatment using Electric Restive Heating (ERH), and Access Restrictions (i.e., fencing).

- The objective of in-situ thermal treatment is to reduce COCs available to contaminate groundwater passing through 52,478 cubic yards of source media, down to 90 feet below ground surface. The process known as electrical resistance heating (ERH) applies potential difference (voltage) at electrodes, causing electrical current to pass through the soil and groundwater, which increases the temperature of the COCs. At elevated temperatures, the COCs are available for removal with soil gas and groundwater and are converted to less hazardous chemicals. Gas in the heated media is contained, collected, and treated ex situ; and ambient air is monitored to detect emissions. Groundwater is collected from the heated media and treated ex situ.

- The objective of the groundwater pump-and-treat system is to collect contaminated groundwater in S-1 and S-2 aquifer zones downgradient of the source zone and remove VOCs from the extracted groundwater. Treatment is accomplished using granular activated carbon (GAC). Groundwater extraction and treatment will continue until monitoring indicates that the RAOs are achieved. The monitoring also will determine if additional pumping (extraction) wells or monitoring wells, or modifications to the system are necessary.

- Access Restrictions include fencing around the triangular parcel and an adjacent 7 acres (part of a 10.98-acre parcel, APN 071-411-07, known as the "Remainder Parcel") and locking well caps, which prevent exposure to chemicals of concern (COCs) and protects remediation facilities.

These remedial systems appear to be functioning as designed. After the ERH is shut-off, the groundwater model will be re-evaluated to determine if additional extraction wells are necessary to achieve capture.

B.	Adequacy of O&M
	Describe issues and observations related to the implementation and scope of O&M procedures. In particular, discuss their relationship to the current and long-term protectiveness of the remedy. All three of the remedial elements inspected are operated and maintained to function continuously. Both the ERH and groundwater extraction and treatment systems are monitored on-site and remotely 24 hours a day. The fence is inspected weekly and when gates are open, personnel monitor them to control access.
C.	**Early Indicators of Potential Remedy Problems**
	Describe issues and observations such as unexpected changes in the cost or scope of O&M or a high frequency of unscheduled repairs, that suggest that the protectiveness of the remedy may be compromised in the future. P&T: Indicators of problems, quarterly groundwater monitoring and water level data. Weekly monitoring of extraction wellheads to monitor extracted groundwater flow rate. ERH: System experiences many operational challenges; for example, additional carbon has been necessary for the gas treatment to ensure stack emissions remain low. The ERH will be fully evaluated in the next five year review.
D.	**Opportunities for Optimization**
	Describe possible opportunities for optimization in monitoring tasks or the operation of the remedy. After post-ERH data evaluation, the groundwater monitoring program will be evaluated for reduced sampling frequency. Pump and treat optimizations could include installation of additional GAC vessels and piping system sizing. Having a 4th vessel may allow the full saturation of the lead vessel to maximize GAC use while reducing the possibilities of discharge exceedances.

Appendix E: Photographs from Site Inspection Visit

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Frontier Fertilizer Superfund Site Groundwater Treatment System Enclosure

Frontier Fertilizer Superfund Site Groundwater Treatment System

Frontier Fertilizer Superfund Site Groundwater Treatment System Electrical Power Scource