SECOND FIVE-YEAR REVIEW REPORT FOR

MODESTO GROUNDWATER CONTAMINATION SUPERFUND SITE

STANISLAUS COUNTY, CALIFORNIA

PREPARED BY

United States Environmental Protection Agency
Region 9
San Francisco, California

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Executive Summary

This is the second Five-Year Review of the Modesto Groundwater Contamination Superfund Site (Site) located Modesto, Stanislaus County, California. The purpose of this Five-Year Review 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 Five-Year Review (FYR) was the signing of the previous FYR on September 9, 2008.

The Modesto Site is related to a dry cleaning facility that leaked tetrachloroethylene (PCE) into the soil and groundwater. The dry cleaning facility discharged wastewater containing PCE into the sewer system for approximately 50 years, and an unknown quantity of PCE was released into the subsurface.

An interim remedy for the site was selected in 1997 and included soil vapor extraction, groundwater extraction and treatment for containment of the source area, primarily tetrachloroethylene (PCE), from contaminated soil and groundwater. A final remedy has not been selected for the Site. The final remedy will address the groundwater dissolved-phase plume, the soil contamination, and soil vapor intrusion.

The assessment of this five-year review found that the remedy was constructed in accordance with the requirements of the Interim Record of Decision (IROD).

The interim remedy of groundwater and soil vapor extraction, treatment, and discharge is functioning as intended by the IROD. The goals of the interim remedy were to eliminate and contain the highest contaminant levels at the source (source control) and to prevent potential exposure of human or environmental receptors to PCE or other organic compounds released to the soil and groundwater. These goals have largely been achieved, and EPA has made recent steady progress and is on track to select a final remedy that will achieve appropriate groundwater cleanup levels. The exposure assumptions, cleanup levels, ARARs, and remedial action objectives selected at the time of the remedy are still valid. The Federal noncancer reference dose has increased slightly and the carcinogenicity slope factor has decreased substantially for PCE. However, the State of California's cancer slope factor for PCE has not changed. These changes in toxicity do not result in a significant increase in estimated risk, and therefore, do not impact protectiveness. No other information has come to light that could call into question the protectiveness of the interim remedy.

The interim remedy at the Modesto Groundwater Contamination Superfund Site is currently protective of human health and the environment. Soil vapor extraction (SVE) and sub-slab vapor intrusion mitigation have reduced indoor air PCE concentrations to be within acceptable levels, and there are no complete receptor pathways for ingestion of impacted Site groundwater. To be protective in the long term, the vapor intrusion pathway should be re-assessed when the SVE system is shut off.

Five-Year Review Summary Form

SITE IDENTIFICATION		
Site Name: Modesto Groundwater Contamination Superfund Site		
EPA ID: CAD981997752		
Region: 9	**State:** CA	**City/County:** Modesto, Stanislaus

SITE STATUS	
NPL Status: Final	
Multiple OUs? No	**Has the site achieved construction completion?** No

REVIEW STATUS
Lead agency: EPA **If "Other Federal Agency" was selected above, enter Agency name:** Click here to enter text.
Author name (Federal or State Project Manager): Marie Lacey
Author affiliation: USEPA Region 9
Review period: January 2013 – September 2013
Date of site inspection: February 21, 2013
Type of review: Policy
Review number: 2
Triggering action date: September 9, 2008
Due date *(five years after triggering action date)*: September 9, 2013

Issues/Recommendations				
OU(s) without Issues/Recommendations Identified in the Five-Year Review:				
None				
Issues and Recommendations Identified in the Five-Year Review:				
OU(s): 1	**Issue Category: Monitoring**			
	Issue: The SVE system may have reached its remedial action objectives set forth in the IROD; however, the system may be providing protection for indoor air vapor intrusion, an objective not originally considered in the IROD.			
	Recommendation: Continue to monitor sub-slab and indoor air PCE concentrations during cessation of the SVE system to ensure protective indoor air levels are maintained.			
Affect Current Protectiveness	**Affect Future Protectiveness**	**Implementing Party**	**Oversight Party**	**Milestone Date**
No	Yes	EPA	EPA	1/2015

Sitewide Protectiveness Statement (if applicable)	
For sites that have achieved construction completion, enter a sitewide protectiveness determination and statement.	
Protectiveness Determination: **Short-term Protective**	*Addendum Due Date (if applicable):* Click here to enter date.
Protectiveness Statement: The interim remedy at the Modesto Groundwater Contamination Superfund Site is currently protective of human health and the environment. Soil vapor extraction (SVE) and sub-slab vapor intrusion mitigation have reduced indoor air PCE concentrations to be within acceptable levels, and there are no complete receptor pathways for ingestion of impacted Site groundwater. To be protective in the long term, the vapor intrusion pathway should be re-assessed when the SVE system is shut off.	

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List of Abbreviations

ARAR	applicable or relevant and appropriate requirement
ATSDR	Agency for Toxic Substances and Disease Registry
bgs	below ground surface
Cal/EPA	California Environmental Protection Agency
CCR	California Code of Regulations
CERCLA	Comprehensive Environmental Response, Compensation, and Liability Act
cis-DCE	cis-dichloroethylene
CPT	Cone-Penetrometer Test
COC	contaminant of concern
DNAPL	dense non-aqueous phase liquid
DTSC	Department of Toxic Substances Control
EPA	Environmental Protection Agency
Ft	feet/foot
FYR	five-year review
GAC	granular activated carbon
GWETS	groundwater extraction and treatment system
gpm	gallons per minute
HHRA	Human Health Risk Assessment
IC	institutional control
IRA	Interim Remedial Action
IRIS	Integrated Risk Information System
IROD	Interim Record of Decision
LUC	land use covenant
MCL	maximum contaminant level
MWH	Montgomery Watson Harza
NAPL	non-aqueous phase liquid
NCP	National Contingency Plan
NPL	National Priorities List
O&M	Operations and Maintenance
OSHA	Occupational Safety and Health Administration
OSWER	Office of Solid Waste and Emergency Response
PCE	tetrachloroethylene
pCi/L	picocuries per liter
POTW	Publicly Operated Treatment Works
ppbv	parts per billion by volume
RAO	remedial action objective
RCRA	Resource Conservation and Recovery Act
RI	Remedial Investigation
RSL	regional screening level
RPM	Remedial Project Manager

RWQCB	Regional Water Quality Control Board
SVE	soil vapor extraction
TCE	trichloroethene
TSDF	Treatment, Storage and Disposal Facility
µg/L	micrograms per liter
USACE	United States Army Corps of Engineers
VI	vapor intrusion
VOC	volatile organic compound

Second Five-Year Review Report

for

Modesto Groundwater Contamination Superfund Site

1. Introduction

The purpose of a Five-Year Review (FYR) is to evaluate the implementation and performance of a remedy in order 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 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*."

Region 9 EPA conducted the FYR and prepared this report regarding the remedy implemented at the Modesto Groundwater Contamination Superfund Site (the Site) in Modesto, Stanislaus County, California. EPA Region 9 is the lead agency for developing and implementing the remedy for the Site. The Seattle District Corps of Engineers (USACE) project delivery team provided assistance to the EPA during the FYR process.

This is the second FYR for the Modesto Groundwater Contamination Superfund Site (Modesto Site, or "the Site"). The triggering action for this policy review is the previous FYR signed September 30, 2008. The FYR is required due to the fact that hazardous substances, pollutants, or contaminants remain at the site above levels that allow for unlimited use and unrestricted exposure.

The Interim Record of Decision (IROD) prescribed remedial actions of groundwater extraction and treatment and soil vapor extraction and treatment. Both the groundwater extraction and treatment system (GWETS) and the soil vapor extraction (SVE) and treatment systems are current operating remedies. The IROD also prescribed Institutional Controls (ICs) of fencing and signage installation and maintenance around the remedial system components. This FYR addresses groundwater and soil/soil vapor, and the related ICs implemented at the Site.

2. Site Chronology

The following table lists the dates and describes important events for the Modesto Site.

Table 1. Chronology of Site Events

Event	Date
Initial discovery of contamination: Modesto Municipal Well 11 found to be contaminated with PCE	September 1984
Pre-NPL responses: Investigations of soil, groundwater, and sanitary sewer lines by RWQCB and City of Modesto confirmed Halford's Cleaners as Municipal Well 11 PCE source.	April 1985 – April 1990
NPL listing: Modesto Site placed on National Priorities List	March 1989
EPA issued order to Potential Responsible Parties for treatment of contaminated soil	September 1990
Removal actions: Potential Responsible Parties conducted Removal Action consisting of limited soil vapor extraction (SVE) system	February 1991
EPA took over investigation and cleanup activities from Potential Responsible Parties	1991
Municipal Well 11 permanently deactivated due to presence of naturally occurring uranium	October 1995
Remedial Investigation completed	December 1996
Feasibility Study completed	March 1997
Baseline Human Health Risk Assessment completed	July 1997
IROD signed	September 1997

Event	Date
Remedial Actions: Soil Vapor Extraction (SVE) and Treatment System installed Groundwater Extraction and Treatment System (GWETS) installed	Start - May 2000 Start - June 2000
GWETS extraction well EW-01 permanently shut off due to operational difficulties	November 2004
GWETS replacement extraction well EW-01R installed	June 2006
Supplemental Site Investigation completed	January 2007
EPA conducted vapor intrusion investigation at source area	February 2008 - February 2012
EPA completed vapor intrusion mitigation in two businesses at source area	February 2008 – April 2010
First Five-Year Review	September 2008
SVE Optimization Report completed	June 2008
SVE system expanded	October 2008
Groundwater Remediation Optimization Report completed	March 2010
New extraction well EW-02 installed, GWETS optimized through operation of EW-02 and shut down of EW-01R	June-September 2012
GWETS operation transferred from EPA to state	July 2012

3. Background

The City of Modesto is located approximately 80 miles southeast of Sacramento, California in Stanislaus County. In 2011, the US Census Bureau estimated the population of Modesto to be 202,751. The Modesto Site is located approximately 1.5 miles north of downtown on McHenry Avenue, between West Fairmont Avenue and Griswold Avenue. The Site originated from Halford's Cleaners (941 McHenry), a commercial dry cleaning business (Figure 1). The site encompasses both the source area and the area affected by the dissolved-phase contaminant plume as discussed later in this section.

3.1. Physical Characteristics

Site topography is flat and ground surface elevation is about 90 feet above mean sea level. The Site and its immediate surroundings are within an older and highly developed and populated portion of Modesto. Nearly all the land surface above the contaminant source area is paved or covered by buildings. The Site is not located in or near an environmentally sensitive area.

Sediments beneath the Site are composed of San Joaquin River channel and floodplain deposits, and alluvial fan deposits from the Sierra Nevada Mountains which define the northeastern boundary of the San Joaquin Valley. These sediments generally consist of interbedded sands, silts, sand-silt mixtures, and clays; these beds are usually less than ten feet thick (EPA, IROD, 1997).

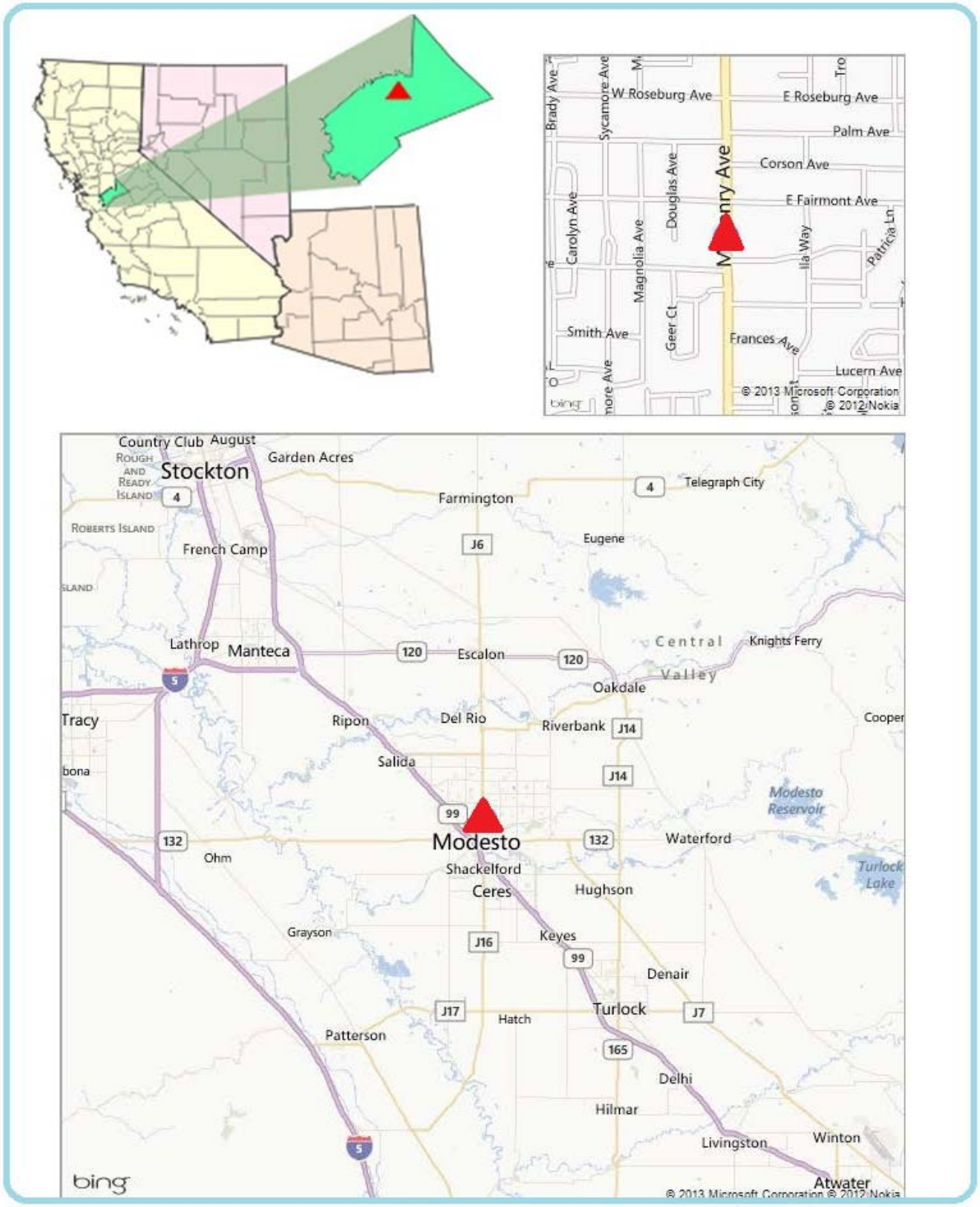

Figure 1. Location Map for the Modesto Groundwater Contamination Superfund Site

3.2. Hydrology

There are three relatively correlative and contiguous sandy horizons comprising the three principal aquifer zones, separated by much lower permeability aquitards, beneath the Site. The depositional environment was such that numerous thin, finer grained and laterally discontinuous layers are interwoven within the three principal aquifer zones.

The uppermost saturated, sandy horizon is referred to as the aquifer A zone. This zone occurs from near ground surface to a depth of approximately 95 to 100 feet. This zone is unconfined and contains the greatest proportion of more transmissive fine to medium grained sands. The A zone groundwater elevations range from approximately 47.5 ft msl to 50.5 ft msl. Groundwater horizontal hydraulic gradient in this zone averages about 0.0018 ft/ft toward the southeast.

A grouping of fine-grained silt, very fine-grained cemented silty sands and thin clay layers forms the A/B aquitard, which separates the A zone from the B zone below. This aquitard generally decreases in thickness from the north (near the contaminant source area), where its thickness is about 80 feet, to the south, where it is about 40 to 45 feet thick.

The aquifer B zone is described as the first lower level sandy horizon beneath the Site and is about 15 to 40 feet thick (thickening to the south). The B zone occurs beneath the A/B aquitard to a depth of 155 to 165 feet and is semi-confined. Sand is generally finer grained and hence less transmissive than in the A zone. B zone groundwater elevations range from about 46 ft msl to 49 ft msl. Horizontal hydraulic gradient for the B zone has been reported as 0.0011 ft/ft to the southeast.

The B/C aquitard is comprised of similar geologic strata as the A/B aquitard, and separates the B zone and C zone. It is generally thinner than the A/B aquitard, and its thickness varies from 10 to 40 feet.

The aquifer C zone is the second lower level sandy horizon. The top of this unit occurs from the bottom of the B/C aquitard and continues beyond the total depth monitored for the Modesto Site. C zone thickness varies throughout the Site from 45 feet to 10 feet or less. C zone groundwater elevations range from approximately 42.5 feet msl to 44 feet msl. While vertical gradients between aquifer zones are generally downward, vertical gradients within the C zone itself are reportedly upward. Horizontal hydraulic gradient for the C zone has been reported as approximately 0.0010 ft/ft to the south-southeast.

3.3. Land and Resource Use

McHenry Avenue is a busy thoroughfare with a range of commercial businesses, including two motels and a senior assisted living facility between the 800-900 blocks. The areas on either side of McHenry are primarily single-family residential units. Future land use within the vicinity of the Site is projected to continue to be commercial and residential. This entire portion of Modesto is on public city water supply; there are no known active private or commercial wells for consumptive groundwater use. The City well permitting process currently prohibits well installation for consumptive use. There are no complete pathways for ecological receptors.

3.4. History of Contamination

The Modesto Site is related to a dry cleaning facility that leaked tetrachloroethylene (PCE) into the soil and groundwater. The dry cleaning facility discharged wastewater containing PCE into the sewer system for approximately 50 years, and an unknown quantity of PCE was released into the subsurface. The old leaky dry cleaning equipment was replaced with new equipment, and PCE is no longer being discharged from the facility. The dry cleaner is located approximately 1,200 feet from a municipal well (Municipal Well 11) (Figure 2). Municipal Well 11 was contaminated with PCE from the dry cleaner because when the well was in operation, it pulled contaminated groundwater toward and eventually into the well. The City of Modesto began monitoring groundwater in 1984 and Municipal Well 11 was found to be contaminated with PCE at a concentration of 16.7 micrograms per liter (µg/L). The Safe Drinking Water Act Maximum Contaminant Level (MCL) for PCE is 5 µg/L.

3.5. Initial Response

To protect the public drinking water supply, Well 11 was taken out of service by the City in 1984 as soon as PCE above the MCL of 5 µg/L was detected in the well. In 1987, PCE and other volatile organic compounds (VOCs) were not detected in groundwater samples; therefore, Well 11 was reactivated. In February 1989, Well 11 was again taken out of service after PCE again exceeded the MCL. The well remained out of service until the City installed a wellhead granular activated carbon (GAC) treatment system in May 1991. The GAC system effectively reduced the PCE concentration to below the MCL prior to the water entering the public supply system. Municipal Well 11 was returned to service in June 1991 and operated until October 1995, when the City indefinitely deactivated it because naturally occurring uranium was detected above its MCL of 20 picocuries per liter (pCi/L) (MWH Americas, Inc., 2007). The uranium in some Central Valley California soils is naturally occurring and is believed to be derived from alluvial deposition of eroded uranium-containing Sierra Nevada igneous rocks.

The Modesto Site was placed on EPA's National Priorities List (NPL) on March 31, 1989.

3.6. Basis for Taking Action

The primary contaminant of concern for the Modesto Site is PCE. The presence of this contaminant in groundwater provided the basis for taking action under CERCLA. PCE is considered likely to be carcinogenic in humans by all routes of exposure, as well as having neurotoxic effects (EPA Integrated Risk Information System; February 10, 2012 update). The primary threat to human health listed in the Human Health Risk Assessment was posed by ingestion of groundwater. This potential threat was the basis for taking initial action. A secondary threat to human health was estimated to be posed by inhalation of indoor air vapors as a result of volatilization of PCE from groundwater and soil; this potential threat led to additional investigation and testing as well as mitigative efforts to reduce the threat.

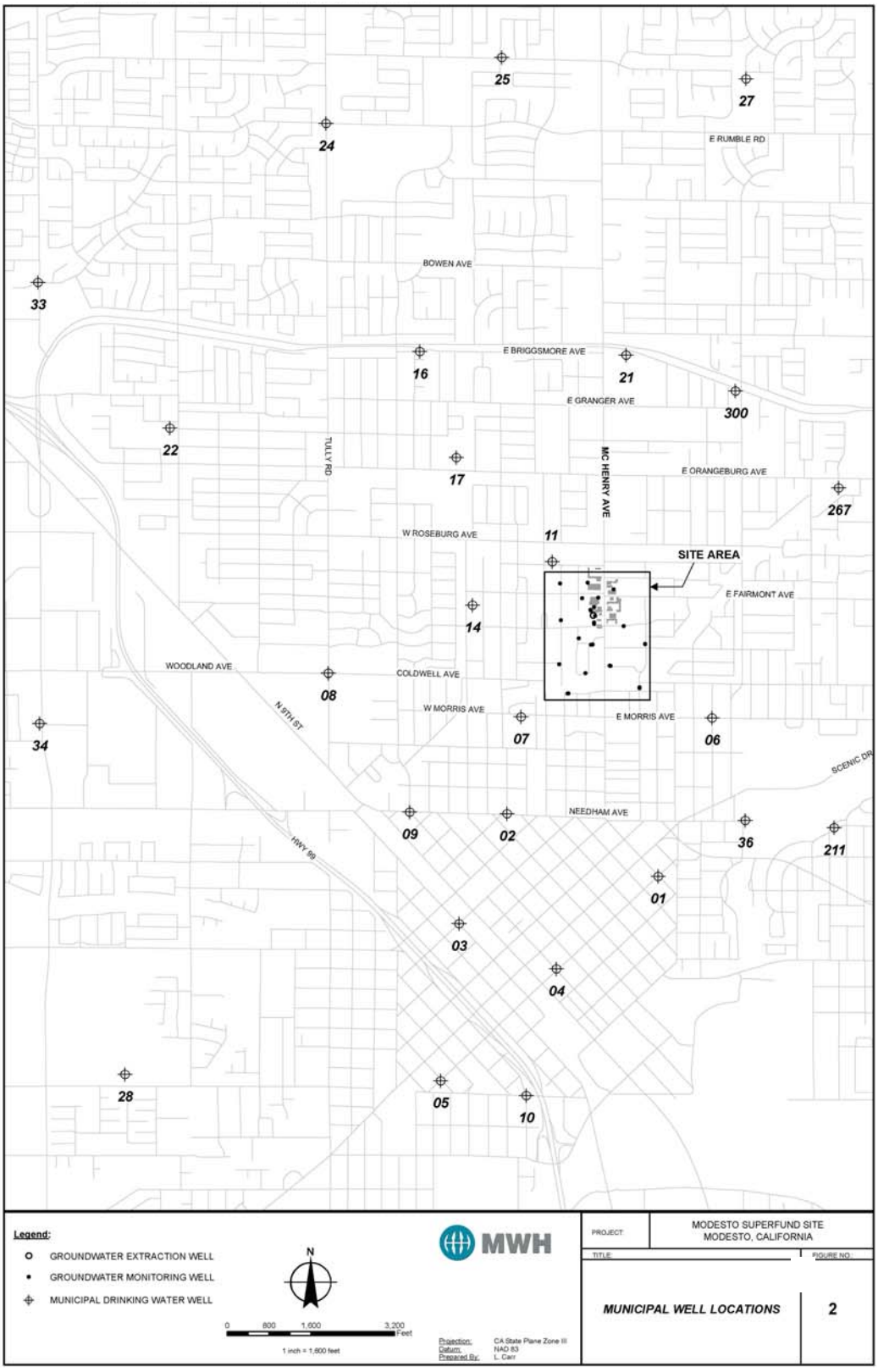

Figure 2. Detailed Map of the Modesto Groundwater Contamination Superfund Site Depicting Site Wells and Nearby Municipal Wells

4. Remedial Actions

4.1. Remedy Selection

In September 1997, EPA issued an interim Record of Decision (IROD) that selected soil vapor extraction/treatment and groundwater extraction/treatment as the interim remedial technologies for removal and treatment of contamination in soil and groundwater. EPA issued an interim Record of Decision instead of a final Record of Decision due to uncertainties over whether the groundwater cleanup standards could be met throughout the plume. The overall objective of the interim remedial action (IRA) selected in the IROD was "to eliminate and contain the highest contaminant levels at the source (source control) and to prevent potential exposure of human or environmental receptors to PCE or other organic compounds (e.g., toluene) released to the soil and groundwater."

The following remedial action objectives (RAOs) are listed in the IROD:

1) Eliminate and contain the highest contaminant levels at the source (source control),
2) Prevent exposure to contaminated groundwater, above acceptable risk levels, to protect human health and the environment (MCLs),
3) Minimize the impact of interim cleanup measures to the community,
4) Collect data to determine if Federal and State requirements can be met throughout the aquifer, and
5) Delineate more clearly the downgradient edges of the plume and prevent its further migration.

In addition, the IROD stated that the "operation of the extraction well will draw groundwater in the most contaminated, source-area portions of the plume to the well, thus inhibiting downgradient migration of those source area contaminants."

The primary components of the selected remedy include groundwater extraction, groundwater treatment by air stripping with carbon adsorption, discharge of treated groundwater to the City of Modesto's Publicly Operated Treatment Works (POTW) sanitary sewer system, and SVE followed by carbon adsorption.

The components of the interim remedy, as stated in the ROD, are summarized as follows:

- **Groundwater Extraction** - A pumping rate of 50 gallons per minute (gpm), which includes one or more extraction wells, will be used to achieve a capture zone of approximately 250 to 300 feet. This will remove the most contaminated groundwater near the source area and hydraulically isolate this area from the surrounding aquifer. EPA will be monitoring the downgradient edge of the plume to determine if natural attenuation is occurring since there will be no continuing source of contamination.
- **Groundwater Treatment by Air Stripping** - Air stripping is a simple, straightforward technology to transfer volatile organic compounds from a dissolved liquid phase to a vapor phase. Air will be sparged into a packed column or shallow trays designed to maximize interfacial surface area and shear, resulting in high mass transfer rates. The solvent-laden gas will then pass over a bed of activated carbon to remove PCE and other organic vapors from the off-gas stream.

- **Discharge of Treated Groundwater** - Treated groundwater is discharged to the sanitary sewer system. Although uranium is a naturally occurring, regional contaminant, additional treatment of extracted groundwater to remove uranium is necessary to satisfy disposal requirements.
- **Soil Vapor Extraction** - SVE in the vadose zone will be used to increase the rate of removal of contaminants that are diffusing from the groundwater to the vadose zone. SVE removal efficiency will be evaluated through the IRA. Some SVE wells will be screened near the water table to achieve effective removal. The solvent laden gas would be extracted, and then passed over a bed of activated carbon to remove PCE and other organic vapors from the off-gas stream.

  Based on data collected during the IRA, EPA will calculate the threat to groundwater from the soil. EPA will also calculate the extent to which the SVE system accelerates groundwater cleanup. EPA will cease SVE when the soil no longer poses a threat to groundwater and no longer accelerates contaminant removal from groundwater.
- **Institutional Controls** - The ROD referred to the engineering controls of signing and fencing around the treatment area as institutional controls. These engineering controls will be maintained for the duration of treatment, and the need for institutional controls will be included in the final remedy.

No chemical-specific cleanup standard was selected in the IROD. This was deferred until the final groundwater remedial action decision for the Site.

4.2. Remedy Implementation

Installation of the SVE and GWET systems were completed on May 16 and June 12, 2000, respectively. The SVE and GWET systems operated intermittently between May and October 2000 due to technical operating issues that required frequent operator attention. MWH Americas, Inc. (MWH) was contracted by the USACE Sacramento District office to operate, maintain, monitor, and report on the progress of the remedial systems between 2000 and 2009. Since 2009, URS Group, Inc. (URS) was contracted for these services.

4.2.1. Soil Vapor Extraction System

The implemented SVE system consists of soil vapor extraction wells, a blower, a condensate collection drum, air filters, silencers, one 2,000-pound vapor-phase granular activated carbon vessel, conveyance piping, control systems, and an air conditioning unit to keep the electronics from overheating. When the system first began operation, soil gas was extracted via a single extraction well, SVE-01. The system was optimized and expanded in 2008. Currently, vapor is extracted from three extraction wells (SVE-02, SVE-03, and SVE-04). The system is designed to extract at a rate of 180 standard cubic feet per minute. Extracted soil vapor passes through an air-water separator; liquid that accumulates in the condensate collection drum is pumped to the GWT system for treatment. The SVE system has run on a continual basis since late 2000, except for minor periods of maintenance or testing.

Additional site investigations were performed in January 2007 to address reduced effectiveness of the single extraction well SVE system and uncertainty as to the extent of groundwater contamination. The additional investigation identified significant residual contamination in borings adjacent to Halford's Cleaners and was the reason for system expansion in 2008.

4.2.2. Groundwater Extraction and Treatment System

The implemented GWETS consists of extraction wells, an equalization tank, an air stripper, two liquid-phase granular activated carbon vessels, one vapor-phase carbon vessel, and two ion exchange units, as well as piping and control systems. The GWETS has historically operated at the design capacity of approximately 50 gallons per minute throughout its operational history. The system uses an air stripper and a granular activated carbon filter to capture VOCs from groundwater and an ion exchange unit with resin to capture the naturally occurring uranium. Treated water is sent to the City of Modesto POTW via underground sanitary sewer lines.

The GWETS ran from late 2000 to November 2004 with only minor down-time for maintenance. The GWETS was not operational between November 2004 and June 2006, because the original extraction well (EW-01) was inoperable due to mechanical problems and well integrity issues. A new well was constructed (EW-01R) and the GWETS again ran with minimal downtime due to periodic maintenance between June 2006 and August 2012. In August 2012, well EW-01R was shut down and has not operated since that time. To better capture higher concentration dissolved PCE in groundwater downgradient of the source area, extraction well EW-02 was installed and brought online by September 2012. EW-02 has been in continuous operation since that time.

Additional Site and plume characterization work was conducted to further refine the implemented interim groundwater remedy. In 1997 EPA installed six monitoring wells to delineate the vertical and horizontal extent of the dissolved plume in the A zone (MW-10 through MW-15, now called MW-10A through MW-15A). These wells are screened, in general, between 69 and 100 feet. Quarterly sampling of these wells started in 1998. In 2007, EPA continued its investigation of the extent of the dissolved plume by drilling 14 borings, collecting grab groundwater samples at various depths and performing a Cone-Penetrometer Test (CPT) scan further downgradient from the source area. Based on the findings of this investigation, EPA installed 16 additional downgradient monitoring wells within all three aquifer zones in 2008 for further PCE plume delineation and characterization. A CPT and HydroPunch™ investigation was conducted in 2011 to optimize the location of the new groundwater extraction well, EW-02. Nine additional A zone and B zone wells were installed in 2011 to further define the PCE plume margins in those zones.

Responsibility for operation of the GWETS was transferred from EPA to the state of California Department of Toxic Substances Control (DTSC) on July 5, 2012.

4.3. Operation and Maintenance (O&M)

Table 2 shows the combined O&M costs for the GWETS and SVE. These costs include routine monitoring and operational costs, discharge permit fees, system performance monitoring, and contractor management and reporting costs. Also included are extraction well replacement evaluation

and installation costs. Costs from 2002-2003 were highest due to work conducted pursuant to a Remediation System Evaluation conducted jointly by EPA and USACE. Costs were lower from 2005 to 2006 as a result of the extraction well being shut off. Costs also dropped after sample analysis shifted from private labs to the EPA Region 9 Lab.

Table 2. Annual O&M Costs

Date Range	Total Cost (rounded to the nearest $1,000)	Average Monthly Cost
2008 IROD Alternative Assessment Estimate	$342,000	$28,500
2008	$195,000	$16,250
2009	$321,000	$26,750
2010	$231,000	$19,250
2011	$273,000	$22,750
2012	$254,000	$21,167

Groundwater monitoring costs increased after Fall 2008 due to installation of 16 new wells. In 2009 implementation of changes to optimize the remedy occurred, which resulted in some initial expense. In December 2009 the resin in the two ion exchange vessels had to be disposed as low-level radioactive waste at significant additional cost. Subsequently, the operators are initiating changeout sooner. Starting Fall 2007, sewer discharge fee increased incrementally from approximately $1,600 per month to approximately $3,300 within about two years.

O&M costs for the GWETS were assumed by the state of California in July 2012, when responsibility for that component of the interim remedy was transferred from EPA to the state DTSC.

5. Progress Since the Last Five-Year Review

5.1. Previous Five-Year Review Protectiveness Statement and Issues

The protectiveness statement from the 2008 FYR for the Modesto Site stated the following:

> *The Interim remedy at the Modesto Groundwater Contamination Superfund Site is not protective of human health and the environment due to the vapor intrusion of PCE into two businesses near the source. The operating groundwater portion of the remedy is protective of human health and the environment in the short term because there are currently no known complete receptor pathways (i.e., no drinking water wells within or downgradient of the plume). In order to be protective in the long-term, a final remedy for the Site must be selected to address the dissolved phase plume.*

The 2008 FYR included three issues with corresponding recommendations for their redress. Each recommendation and the current status are discussed below.

Table 3. Status of Recommendations from the 2008 FYR

Issues from previous FYR	Recommendations	Action Taken and Outcome	Date of Action
Indoor Air Vapor Intrusion Pathway	Add vapor extraction wells to SVE system to reduce vapor intrusion through slab floors	Three wells added to SVE system and vapor intrusion mitigation measures carried out in source area building. Subsequent indoor air sampling found that PCE decreased to levels below the EPA Regional Screening Level (RSL).	2008-2012
High soil/soil vapor PCE concentrations	See above	Three wells added to SVE system.	2008
Dissolved PCE plume not defined or controlled	Complete dissolved plume investigation, evaluate need for expansion of the interim remedy, and select final remedy for Site	Further investigation conducted; extraction well EW-02 completed and operating for better plume capture; FS for final remedy in progress. The installation of a new groundwater extraction well in 2012 optimized the GWETS to contain and capture higher-concentration dissolved-phase PCE.	2008-2013

5.2. Work Completed at the Site During the Past Five Years

Groundwater

Sixteen groundwater monitoring wells were installed in October-November 2008 to further define the lateral and vertical extents of the PCE plume in downgradient areas of all three aquifer zones as part of the groundwater optimization program. In August-September 2011, nine additional monitoring wells were installed for further plume definition in the A and B zones. A remediation optimization study conducted in 2010 by the remedial contractor (MWH Americas, Inc, 2010) concluded that a new groundwater extraction well was needed to meet the interim remedial action objective for the Site. To address this need, a cone penetrometer (CPT) and HydroPunch™ investigation consisting of 10 borings was conducted to determine the optimal placement location of a new groundwater extraction well (EW-02) in May-June 2011. EW-02 was then installed, connected to the GWETS, and tested in June-July 2012. A technical evaluation of Modesto Municipal Well production effects on the Site using a series of down-well pressure transducer/data loggers was performed in 2012. The results showed that municipal well pumping directly affects local water levels, especially in the C zone. Eight additional groundwater monitoring wells were installed in 2013 to improve plume definition. Finally, continued groundwater extraction and treatment, and quarterly groundwater monitoring,

including water elevations, VOCs, and select MNA parameter testing took place quarterly since the last FYR was completed.

Soil/Soil Vapor

In October 2008 the SVE system was expanded through the addition of three vapor extraction wells and two vapor monitoring wells, and conversion of previous single vapor extraction well to a vapor monitoring well. This work was performed based on recommendations made in an October 2007 SVE system optimization and enhancement report. During the same 2008 field mobilization, one borehole was drilled adjacent to vapor extraction well SVE-02, within seven feet of the dry cleaning machine inside Halford's Cleaners for a limited soils DNAPL investigation (no DNAPL was observed). Indoor air vapor intrusion sampling in source area businesses, outdoor ambient air sampling, and sub-slab soil vapor sampling was conducted in 2008-2012. Continued soil vapor extraction and treatment, vapor intrusion mitigation measures, and quarterly soil vapor monitoring for VOCs at the vapor extraction monitoring points has occurred quarterly since the last FYR.

6. Five-Year Review Process

6.1. Administrative Components

EPA Region 9 initiated the FYR in January 2013. The EPA FYR team was led by Marie Lacey, EPA Remedial Project Manager (RPM) for the Modesto Site, and also included the EPA site attorney and community relations personnel. The USACE provided technical support with the FYR and reporting. The USACE team included Cathy Martin (Seattle District chemist), Jefferey Powers (Seattle District hydrogeologist), John Wakeman (Seattle District risk assessor), and Doug Mackenzie (Sacramento District project lead and remedial contractor oversight). On January 3, 2013 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 review schedule was established that consisted of the following:

- 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 April 1, 2013, a public notice was published in *the Modesto Bee* announcing the commencement of the Five-Year Review process for the Modesto Groundwater Contamination Superfund Site and inviting community participation. Public notices were also published in *Vida En El Valle*, a Spanish language weekly publication, on April 3, 2013, and Mundo Hispana, a Spanish language monthly, on April 15, 2013.

The Five-Year Review report will be made available to the public when it is finalized. Copies of this document will be placed in the designated public repository, the name and address of which is: Stanislaus County Free Library, 1500 I Street, Modesto, California. Upon completion of the FYR, a public notice will be placed in the same three publications that were utilized for the announcement of the commencement of the review. A final copy of the FYR will also be placed at the designated public repository upon completion.

On April 15, 2013, the EPA RPM visited the Stanislaus County Free Library to verify Site-related Administrative Record documents were publicly available. She found that Site documents were available for public viewing by making a request to see them at the library's reference desk. The documents can also be requested on the library's website.

Quarterly monitoring reports for the Modesto Site are posted on the EPA website for public review.

6.3. Document Review

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

6.3.1. ARARs Review

Section 121 (d)(2)(A) of CERCLA specifies that Superfund RAs must meet any federal standards, requirements, criteria, or limitations that are determined to be legally ARARs. Applicable or Relevant and Appropriate Requirements 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.

The IROD identified several chemical-specific potential ARARs, but stated that " Operation of this alternative as part of the IRA would help determine whether chemical-specific ARARs could be met" ARARs identified in the 1997 IROD that are not pertinent to the operational phase of the remedy or chemical-specific are not included in Table 5. There have been no revisions to laws and regulations that affect the protectiveness of the remedy.

Table 4. Applicable or Relevant and Appropriate Requirements Evaluation

Requirement	Citation	Document	Description	Effect on Protectiveness	Comments	Amendment Date
Chemical-Specific ARARs						
Spent Carbon:						
RCRA	1 - Subtitle C, 42 USC §6921, et seq.	1997 IROD	1 - Requires generators to determine whether waste is subject to land disposal restrictions	There have been no changes to these law that that affect protectiveness	Requirement to determine whether carbon filtration units from treatment of vapors are subject to land disposal restrictions is applicable	1 – 28 March 2013
	2 - Hazardous Waste Control Act		2 - Established the California Hazardous Waste Control Program within DHS. California's hazardous waste regulatory effort became the model for the federal Resource Conservation and Recovery Act (RCRA). California's program, however, was broader and more comprehensive than the federal system, regulating wastes and activities not covered by the federal program			2 – February 2011
	3 - , Cal. Health & Safety Code §25100, et seq.		3 – Establish regulations and incentives which ensure that the generators of hazardous waste employ technology and management practices for the safe handling, treatment, recycling, and destruction of their hazardous wastes prior to disposal			3 – 2 March 1982
Action-Specific ARARs (SVE and GWET system usage)						
Clean Air Act,	42 USC §7401, et seq./ California State Implementation Plan (SIP)	1997 IROD	The SIP describes how the State air quality programs will be implemented to meet compliance with the CAA standards, including ambient air standards	There have been no changes to these law/regulations that that affect protectiveness	Remedial actions should comply with relevant substantive requirements of the SIP	5 May 2010
Clean Air Act,	42 USC §7401, et seq./ San Joaquin Valley Unified Air Pollution Control District, Rule 2201	1997 IROD	Stationary sources rule requires application of best available control technology to new or modified emissions unit if unit would increase emissions more than 2 pounds per day	There have been no changes to these law/regulations that that affect protectiveness	For controlling air emissions from soil vapor and groundwater treatment units, applicable depending on quantity and types of air emissions	21 April 2011
Clean Air Act,	42 USC §7401, et seq./ San Joaquin Valley Unified Air Pollution Control District, Rule 4101	1997 IROD	Visible emission limits prohibit emission of more than 3 minutes/hour of certain types of visible emissions	There have been no changes to these laws/regulations that that affect protectiveness	For controlling air emissions from soil vapor and groundwater treatment units	17 February 2005
Clean Air Act	42 USC §7401, et seq./ San Joaquin Valley Unified Air Pollution Control District, Rule 4102	1997 IROD	Prohibits discharge of air contaminants that will be a nuisance or will endanger the public	There have been no changes to these laws/regulations that that affect protectiveness	For controlling air emissions from soil vapor and groundwater treatment units	17 December 1992
Clean Air Act	42 USC §7401, et seq./ San Joaquin Valley Unified Air Pollution Control District, Rule 4201	1997 IROD	Particulate matter emission standard prohibits emission of dust, fumes or total suspended particulate matter greater than 0.1 grain per cubic foot of gas at dry standard conditions. Prescribes certain EPA analytical methods	There have been no changes to these laws/regulations that that affect protectiveness	For controlling air emissions from soil vapor and groundwater treatment units	17 December 1992
RCRA	42 USC §6901, et seq./ Air Emissions Standards for Process Vents, 40 CFR Part 264, Subpart AA	1997 IROD	Air emissions standards for process vents associated with air stripping operations managing hazardous wastes with organic concentrations of at least 10 ppmv	There have been no changes to these laws/regulations that that affect protectiveness	Potentially applicable to air strippers used in groundwater remediation, depending on concentrations of extracted groundwater	14 July 2006

6.3.2. Human Health Risk Assessment Review

In 1994, EPA conducted a baseline human health risk assessment, which was subsequently revised and updated in 1997 to incorporate Phase 3 Remedial Investigation (RI) data. The risk assessment identified the exposure pathways at the Modesto Site as residential groundwater ingestion (including drinking of water and inhalation of vapors from water) and inhalation of indoor air. Current and future land and groundwater use scenarios were evaluated using soil gas and groundwater data collected during the RI for PCE and other VOCs.

The Reasonable Maximum Exposure (RME) results of the 1997 risk assessment indicated the then-current and future carcinogenic risks from inhalation of indoor air potentially impacted by soil gas ranging from $9x10^{-7}$ to $9x10^{-6}$, with the hazard indices ranging from 0.1 to 0.5. These risk levels were considered in the acceptable range for cancer and non-cancer effects, respectively. Under future land use conditions assuming consumptive use of impacted Site groundwater, carcinogenic risks ranged from $1x10^{-2}$ to $5x10^{-2}$ while the hazard indices ranged from 100 to 400 (Table 5). These levels were considerably in excess of the acceptable risk range for carcinogenic and non-cancer effects; hypothetical ingestion of untreated groundwater and inhalation of contaminants volatilizing from that water contributed to the greatest risk.

Table 5. Exposure Pathways and Associated Reasonable Maximum Exposure Risks Based on 1997 HHRA

Exposure Scenario & Pathway	Hazard Index RME	Hazard Index Average	Cancer Risk RME	Cancer Risk Average
Current Indoor Air – Inhalation of Soil Gas	0.5	0.1	$9x10^{-6}$	$9x10^{-7}$
Future Indoor Air – Inhalation of Soil Gas	0.5	0.1	$9x10^{-6}$	$9x10^{-7}$
Future Ingestion and Inhalation of Groundwater as Drinking Water	400	100	$5x10^{-2}$	$1x10^{-2}$

The risk assessment and subsequent promulgated regulations were reviewed to identify any changes in exposure or toxicity that would impact protectiveness. EPA recently reassessed PCE toxicity literature for both cancer and non-cancer effects, and released an Integrated Risk Information System (IRIS) toxicological review in February 2012. However, the IROD values are consistent with the current California carcinogenic toxicity values and therefore the 1997 risk assessment conclusions are still appropriate.

Indoor air inhalation. The cancer risk screening level for PCE at the site was developed using Cal/EPA's cancer potency value in combination with U.S. EPA exposure assessment assumptions for commercial/industrial workers; the resultant $1x10^{-6}$ risk screening level is 2.1 µg/m3 (0.3 ppbv). Screening for non-cancer hazards utilizes the revised non-cancer RSL based on adverse neurological effects; this results in a level of concern of 180 µg/m3 (26.5 ppbv) for an industrial establishment. While RSLs for indoor air are not *de-facto* cleanup standards for a Superfund site, they may indicate whether additional actions or evaluations are needed. Site risks for indoor air inhalation at the maximum 8-hour sample value collected in 2012 are below EPA's risk range. The 8-hour sampling occurred during normal business hours and reflects the actual exposure. However, the 24-hour sampling

event result was greater than the 8-hour average sampling event indicating potential for vapor intrusion when the building is closed.

Table 6. Industrial Risk Screening Levels and Maximum Soil Vapor Exposure Values from 2012

Exposure Scenario & Pathway	Units	RSL: Hazard Quotient (HQ =1 for PCE)	Cancer Risk ($1x10^{-6}$ for PCE)	Maximum Detected Level at Halford's Cleaners in 2012	Inferred Maximum HQ	Inferred Maximum Carcinogenic Risk
Current Indoor Air	ppbv	26.5	0.3	0.28 (8-hour)	0.02	9.3×10^{-7}
Overnight Indoor Air	ppbv	26.5	0.3	0.42	0.02	1.4×10^{-6}

ppbv = parts per billion by volume (at 20° C and 1 atmosphere of pressure)

Hypothetical drinking water consumption. For the groundwater pathway, the PCE MCL of 5 µg/L remains protective for both cancer and non-cancer effects, and is the legal criterion for compliance, although the IROD did not select a clean-up level. Current groundwater results are shown in Table 7, in Section 6.4.

6.3.3. Ecological Risk Review

An ecological risk assessment was conducted in 1994 prior to the IROD issuance and EPA determined that there were no unacceptable ecological risks because there were no exposure pathways. There have been no changes to exposure pathways since EPA issued the IROD, and there remain no potential pathways to ecological receptors from the contaminants at the Site.

6.4. Data Review

Site-specific data collected since the last FYR were reviewed, with a focus on evaluation of progress towards achieving the remedial action objectives set forth in the IROD. Specific groundwater data reviewed and evaluated during this FYR included quarterly VOC data up to and including Fourth Quarter 2012, as well as groundwater gradient data from this time period. Additionally, aquifer hydraulic data and extraction well data were reviewed from the Interim Groundwater Extraction Well Installation Report for EW-02 published in September 2012. VOC data for soil gas were also reviewed.

The Technical Data Review Memorandum is included as Appendix E to this FYR report.

6.4.1. Groundwater Hydraulic Data

The primary goal of the hydraulic data evaluation was to determine the empirical capture zone of new extraction well EW-02. The capture zone of this extraction well is directly applicable to the remedial action objective of eliminating and containing the highest contaminant levels at the source beneath the dry cleaners and beneath the former leaking sanitary sewer line near the cleaners (e.g., source control).

Based on the December 2012 hydraulic data set, EW-02 impacts A-zone groundwater flow in the vicinity of this well (see Figure 1 in Appendix E) since it draws water directly from this zone. There is little to no influence of EW-02 on the deeper aquifer zones. Review of A-zone groundwater elevation differences between EW-02 (39.75 ft) and the nearest monitoring well MW-04A (47.04 ft) located about 75 feet away indicate a relatively steep cone of depression surrounding EW-02. Steep cones of depression correlate to smaller radii of influence due to either low-permeability formations, inefficient extraction, or both. Recent Site investigations determined the stratigraphy of the A zone in and around MW-04A and EW-02 to possess finer-grained sediments which would cause the steeper cone of depression. This is also supported by the low well efficiency of 33.5% estimated from constant-rate test data (EW-02 Installation Report, URS September 2012).

The estimated empirical capture zone for EW-02 based on December 2012 groundwater elevation data is depicted on Figure 3. At its maximum width in the upgradient direction, the capture zone is about 700 ft wide. At the location of EW-02, the capture zone width perpendicular to flow is about 470 ft. The distance between EW-02 and its downgradient stagnation point was estimated to be approximately 220 ft.

Figure 3 also shows the A zone plume map from August 2012 superimposed onto the potentiometric contour map and the EW-02 capture zone. For comparison purposes, the capture zone determined for EW-01R prior to shut-down is shown as well. It is evident that EW-02 is capturing more of the higher dissolved-concentration PCE plume than EW-01R did. A portion of the higher concentration dissolved PCE plume may be beyond the capture zone of EW-02 to the east; however, the capture zone does appear to fully encompass the source area and thus well EW-02 achieves the source control RAO for the A zone. Groundwater contours in the B zone indicate little to no capture of B zone groundwater and PCE from the A zone-screened EW-02; however, since the highest PCE concentrations and the majority of contaminant mass (e.g., the source) was contained within the A zone, and since the induced gradient from EW-02 operation acts to contain the source, the source control RAO is achieved.

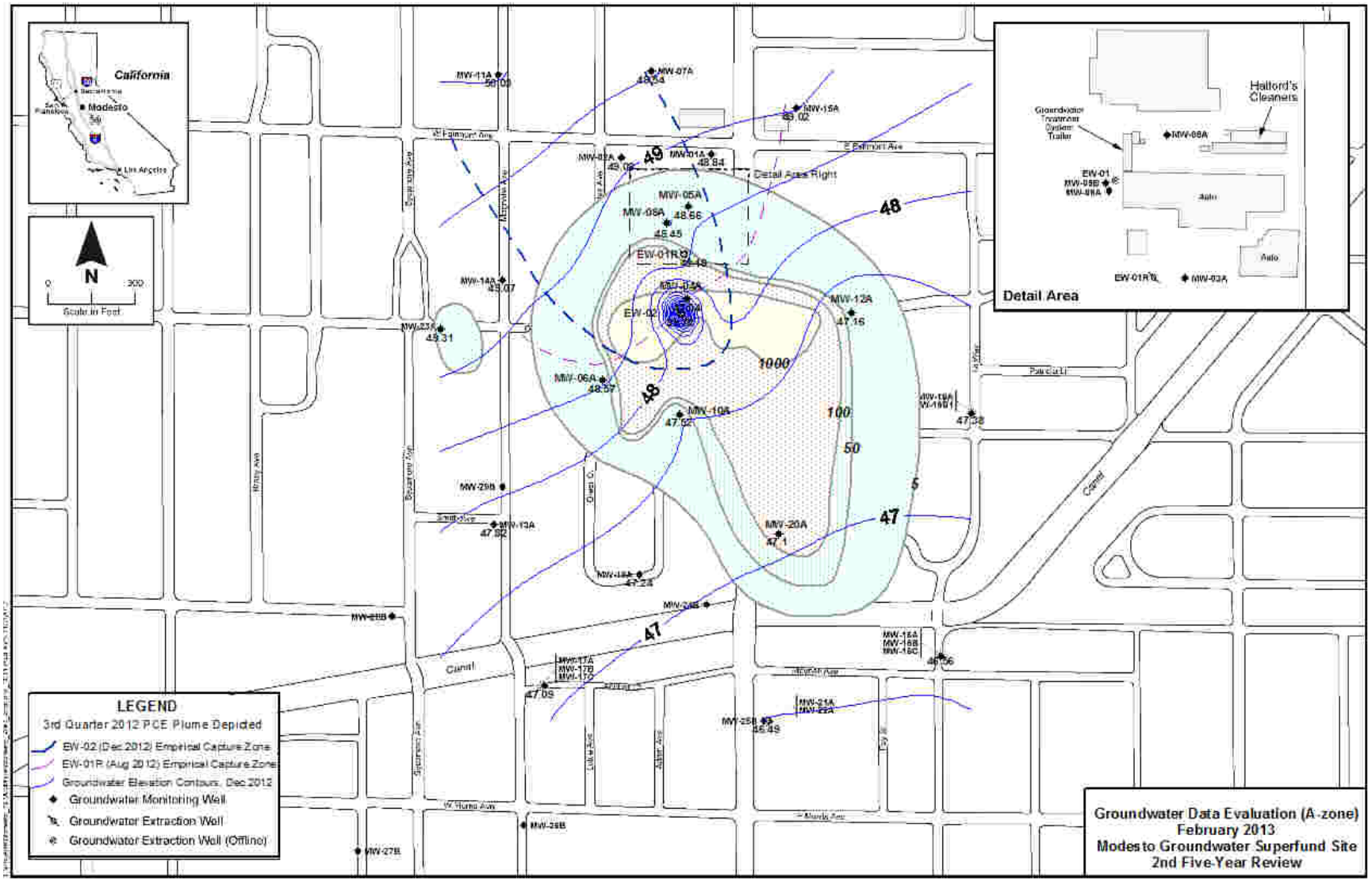

Figure 3. A Zone PCE Plume Map with Potentiometric Contour Map and Estimated Empirical Capture Zone for EW-02 (August 2012)

6.4.2. Groundwater Analytical Data and Trends

PCE is the principal Site contaminant of concern (COC) due to its historical widespread presence in soil, soil gas, and groundwater. The IROD noted an elevated toluene concentration of 13,200 µg/L at well MW-8A during the Phase III RI. However, toluene was not detected at MW-8A during the latest (August 2012) quarterly monitoring event and is below its Federal MCL of 1,000 µg/L and California MCL of 150 ug/L at all wells. Other contaminants including trichloroethene (TCE), cis-1,2-dichloroethene (cis-DCE), and chloroform have also been reported; however, these chemicals were either not detected above their method detection limit or infrequently detected at concentrations below regulatory limits in Site samples. Benzene and 1,2-dichloroethane have exceeded their respective MCLs at a fraction of the monitored wells (6 wells and 1 well respectively during December 2012); however, the Fourth Quarter 2012 O&M Report states that these detections are unrelated to Halford's Cleaners because these constituents have never been detected in wells closest to the PCE source area. Uranium in groundwater is elevated at the Site, but is naturally occurring and is not a Site COC. For these reasons, only PCE data is further evaluated herein with respect to RAOs attainment.

Analytical groundwater data were reviewed for all on-site wells from which data were collected since the last FYR. The nine wells installed in 2011 had only 4 sample results; two of the nine (MW-22A and MW-27B) had no detections of PCE. There were a total of 38 monitoring wells (See Appendix E for a complete listing). Of the 38, 20 were A zone wells, 13 were B zone wells, and 5 were C zone wells. Note that the number of wells more than doubled between the last FYR and this review, from 15 to 40. Additionally, data were reviewed for extraction well EW-01R, which ceased operation in August 2012. Data from groundwater wells were statistically evaluated using the Mann-Kendall test for trend analysis.

The groundwater analytical data were divided into two areas: source area and dissolved-phase PCE plume. The distinction was made to separately address the RAOs concerning source control and the larger-scale, dissolved-phase groundwater contaminant plume.

The source area is considered the original location of highest soil and soil gas PCE concentrations associated with PCE leaks from the dry cleaners and a private-to-public sanitary sewer connection behind the cleaners. Source area groundwater wells are considered to be laterally within a loosely-defined 150 foot buffer from the soil and soil gas source areas, which consist of: MW-03A, MW-05A, MW-08A, MW-09B, and EW-01R.

PCE trends at the source area wells between August 2008 and August 2012 generally were either stable or decreasing. Trend test results are shown in Table 7. MW-08A showed no trend with respect to PCE concentrations over this time period. Data from well MW-09B was determined to be stable. MW-03A and MW-05A both showed decreasing trends. MW-03A exhibited a PCE concentration of 42 µg/L in August 2012, down from 1,300 µg/L in August 2008. MW-05A exhibited a PCE concentration of 51 µg/L in August 2012, down from a high of 300 µg/L in November 2009. MW-05A is the closest groundwater monitoring location to the soil vapor extraction system that was expanded in 2008 and had a positive impact on decreasing soil vapor PCE concentrations. Overall, PCE concentrations within source area A zone wells are in the 5 to 50 µg/L range. This is evidence of significant progress in the source area through the withdrawal of source-area groundwater at former extraction well EW-01R. In the B zone beneath the source area at well MW-9B, PCE currently fluctuates from about 4 to 14 µg/L.

Table 7 Most Recent PCE Results in Source Area Groundwater (December 2012)

Well ID	Aquifer Zone	PCE (µg/L)	August 2008-August 2012 Trend Result
MW-03A	A zone	**100**	Decreasing
MW-05A	A zone	**77**	Decreasing
MW-08A	A zone	**25**	No Trend
EW-01R	A zone	NA	Decreasing
MW-09B	B zone	**6.8**	Stable

Notes:
PCE groundwater unit of measure is micrograms per liter (µg/L)
Bold indicates value exceeds PCE MCL of 5 µg/L
NA = not analyzed

PCE results at extraction well EW-01R showed a slow but steady, statistically significant decreasing trend between January 2009 and August 2012. This well was sampled monthly as part of the groundwater extraction and treatment system. PCE decreased during this period from almost 200 µg/L to less than 100 µg/L. EW-01R was shut off in August 2012, with A zone extraction shifting to the newly installed EW-02 located in a higher-concentration, downgradient portion of the plume.

The RAO of delineating the downgradient edges of the plume and preventing its further migration is applicable to the dissolved-phase plume beyond the source area. Statistical trends were evaluated for wells within the dissolved-phase PCE plume as part of this FYR to help assess plume migration. For the dissolved-phase PCE plume, PCE was present above 5 µg/L at 11 of 17 evaluated A zone wells not considered source area wells. All A zone wells hydraulically upgradient of the source area had either stable trend results (MW-07A, MW-11A, MW-15A) or decreasing trends (MW-01A, MW-02A). MW-18A, near the downgradient extent but west of the plume axis, had a decreasing trend, although all results were below 5 µg/L since August 2008. Within the central to slightly distal portions of the PCE plume, trends were variable, ranging from stable at MW-04A, no trend at MW-06A, and decreasing trend at MW-10A. The A zone wells which define the PCE plumes lateral and distal extents had either stable trend results (MW-13A), no trends (MW-16A, MW-17A, MW-19A, MW-23A), increasing trend (MW-14A), or probably increasing trend (MW-20A). For the most part, these results demonstrate the A zone plume is well bounded and not likely to migrate substantially beyond its current extent. One exception is downgradient of MW-20A, which has exhibited a probably increasing trend. MW-16A and MW-21A are positioned to further assess downgradient plume migration in the A zone.

PCE was present above 5 µg/L at 9 of 12 evaluated B zone wells not considered source area wells. The Mann-Kendall trend test results indicated that all evaluated wells except MW-16B, MW-17B, and MW-20B in the B zone were either stable or had no PCE trend over the period evaluated. MW-20B, located in the approximate center of the B zone PCE plume, showed a decreasing trend. PCE at this well has dropped from 160 µg/L in November 2008 to 57 µg/L in August 2012. PCE results at the most downgradient B zone well (MW-25B) have been stable but have exceeded the MCL. Results showed an increasing trend at MW-16B, located on the lateral-to-downgradient edge of the B zone PCE plume. Recent PCE results from the last three quarters at well MW-16B have increased from about 2 to 24 µg/L; therefore this is an area that should be closely watched during future sampling events. MW-17B showed a

probably increasing trend. This well is also located in a lateral to downgradient direction from the plume axis and should be closely watched. In light of the high concentrations experienced at MW-25B, and due to the increasing trend at MW-16B and probably increasing trend at MW-17B, further delineation of the B zone plume's distal extent appears warranted.

PCE was present above 5 µg/L at only 2 of 5 evaluated C zone wells during the monitored period (MW-04C and MW-20C), and at each of these wells only one sample was above 5 µg/L during the period of interest. All wells except one in the C zone showed either no trend (MW-04C, MW-16C, MW-20C) or stable trend (MW-10C). MW-17C had a probably decreasing trend result. The limited contamination in the C zone appears to be well delineated.

6.4.3. Groundwater Extraction and Treatment System Operational Data

EW-01R replaced EW-01 and was in operation from August 2006 to August 2012. EW-02 was installed to more effectively capture and contain the highest concentration portion of the PCE plume, and beginning in September 2012 EW-01R ceased operation and was replaced by operation of EW-02. Only limited operational data exists for EW-02 due to its limited operation as reported in the Fourth Quarter 2012 monitoring report.

During this FYR reporting period (Fourth Quarter 2008 through Third Quarter 2012), the GWETS has operated with an overall up time of 95 percent. The only significant prolonged system shutdown was during late Second Quarter 2012 to early Third Quarter 2012, when the system was down to replace the GWETS effluent pump. From August 2001 to September 2012, the GWETS had treated approximately 199 million gallons of water and removed approximately 518 pounds of PCE.

All GWETS effluent samples for this reporting period (Fourth Quarter 2008 through Third Quarter 2012) met applicable discharge criteria for PCE. Discharge criteria were met for uranium except during the Fourth Quarter 2010. At that time, resin was replaced in the primary ion exchange vessel because of a measured increase in uranium to just above 20 pCi/L.

The groundwater extraction and treatment system is operating as designed and continues to make progress at reducing contaminant mass within and downgradient of the source area.

6.4.4. Soil Vapor Analytical Data

All soil vapor data that has been evaluated is considered source area data, as the locations of all vapor monitoring and extraction wells are within close proximity of the historical PCE release locations. Since the last FYR, EPA has installed three SVE extraction wells SVE-02, SVE-03 and SVE-04, which are currently operating. SVE-01 was disconnected from the SVE extraction system and converted to a vapor monitoring well in 2008.

SVE data analyzed included that from the three SVE extraction wells from November 2008 to August 2012. Data evaluation also included nine vapor monitoring wells for the same period: SVE-01, DP-01A, DP-01B, DP-05A, DP-05B, DP-06A, DP-06B, OSVE-10, and OSVE-11. Data were collected

approximately every quarter. Analytical results from the Fourth Quarter 2012 monitoring report are included in Table 9.

Data from vapor monitoring wells were statistically evaluated using the Mann-Kendall test for trend. Results from the vapor monitoring wells showed only one statistically significant trend, which occurred at well OSVE-11. Data from OSVE-11 since March 2009 showed a decreasing trend. PCE soil vapor concentration at OSVE-11 was exceptionally high in March 2009, with a concentration measured at 27,000 ppbv. One year later in March 2010, concentration had decreased to 130 ppbv, and by August 2012 the concentration had further declined to 21 ppbv. Four wells showed no trends (DP-01A, DP-01B, DP-05B, and DP-06A) while two wells showed stable trends (SVE-01, OSVE-10). Two wells (DP-05A, DP-06B), which contained more than 50% non-detects for PCE vapor, were not statistically evaluated. Trend results are summarized in Table 8.

Results from the vapor extraction wells showed one decreasing trend (SVE-04), one probably decreasing trend (SVE-02) and one well, SVE-03, with no trend. PCE concentrations in vapor from SVE-04 showed a steady decline from 890 ppbv in November 2008 to 35 ppbv in August 2012. At SVE-02, PCE concentration at the start of the data set was 14,000 ppbv. Concentration declined drastically between 2008 and 2009. In August 2012 the concentration was 380 ppbv. The initial high PCE concentrations coupled with the decreasing and probably decreasing trends are evidence that the newly installed soil vapor extraction wells removed the bulk of contaminant mass soon after they became operational. The current low levels are associated with the continued operation of the SVE system.

Table 8. Most Recent PCE Results in Vadose Zone Soil Vapor (December 2012)

Well ID	PCE (ppbv)	August 2008-August 2012 Trend Result
SVE-01	9.6	Stable
SVE-02 (extraction well, screened 7-12 ft bgs)	180	Probably Decreasing
SVE-03 (extraction well, screened 13-23 ft bgs)	130	No Trend
SVE-04 (extraction well, screened 28-38 ft bgs)	23	Decreasing
DP-01A	ND	No Trend
DP-01B	32	No Trend
DP-05A	ND	Insufficient Data
DP-05B	2.7	No Trend
DP-06A	43	No Trend
DP-06B	ND	Insufficient Data
OSVE-10	5.3	Stable
OSVE-11	19	Decreasing

Notes:
PCE soil vapor unit of measure is parts per billion by volume (ppbv)
ND = not detected at detection limits of 0.32 – 2.2 ppbv

6.4.5. Soil Vapor Extraction and Treatment System Operational Data

During this FYR reporting period (Fourth Quarter 2008 through Third Quarter 2012), the SVE system has operated with an overall up time of greater than 99 percent. From June 2001 to September 2012, total cumulative PCE mass removed through the SVE system was approximately 3,465 pounds. This amount continues to be significantly greater than the total mass removed via the groundwater treatment system.

There was a transient spike in SVE system influent PCE concentration after new SVE wells SVE-02, SVE-03, and SVE-04 came online in November 2008. Prior to system redesign, December 2007 data revealed influent concentration of 54 ppbv, although measurements were as low as 4.4 ppbv in September 2007. In November 2008, after new wells were brought online, influent concentration was measured at 4,100 ppbv. This showed the new wells to be effective, at least initially, at extracting contaminant mass from soil via the vapor pathway. Latest sampling results show treatment system influent PCE concentrations ranging from 190 to 650 ppbv during Third Quarter 2012.

All SVE system effluent samples for this FYR reporting period (Fourth Quarter 2008 through Third Quarter 2012) met applicable discharge criteria for PCE with the exception of Fourth Quarter 2009, and First and Second Quarters 2010, when effluent concentrations ranged from 4 to 130 ppbv PCE. Vapor phase GAC was changed out prior to Third Quarter 2010, and discharge criteria have been met since that time.

Overall, more than 85% of PCE mass removed from the subsurface has been via the SVE system, while less than 15% has been as a result of removal via the GWETS (about 3,500 lbs versus 520 pounds for SVE and GWETS systems, respectively). Since about 2005, however, the percentage rates have been reversed, with the bulk of mass removed via the GWETS. This is due to changes in extraction wells EW-01R and EW-02 coming on line, and due to the quick path to asymptotic PCE vapor concentrations resulting from the optimized SVE system.

6.4.6. Indoor Air

Indoor air sampling was conducted at source area businesses in February 2008 prior to optimization and enhancement of the SVE system. PCE levels exceeding the RSL were found in two businesses, Halford's Cleaners and The Parts House, closest to the PCE source. Concentrations ranged from 420 ppbv to 990 ppbv. Following SVE optimization, which added three extraction wells to the SVE system in immediate proximity to the Halford's Cleaners building, indoor air sampling in August 2009 found marked improvement in PCE concentrations (up to 90% reduction at some sample locations). However, concentrations remained at unacceptable levels; in August 2009 results for PCE ranged from 7.5 ppbv to 500ppbv. Beginning in 2008, EPA carried out a series of vapor intrusion mitigation actions at the two businesses. These preliminary actions included sealing floor cracks and closing off the old SVE system indoor piping. A sub-slab depressurization system was installed in The Parts House in April 2010. In July 2010, PCE was discontinued as the dry cleaning agent in Halford's Cleaners. Subsequent indoor air samples have been either non-detect (at most locations) to low for PCE (no greater than 1.4 ppbv PCE, September 2011 at Halford's 941-IA-02 sample sub-location). The primary objective of the SVE system is to eliminate the source for groundwater contamination by removing contaminant mass in the vadose zone. A secondary objective of the SVE system – to remove contaminant mass in the upper vadose zone (above 15 feet bgs) – has the added benefit of reducing human health risk due to shallow soil gas and indoor air vapor intrusion. Table 9 shows the most recent PCE indoor air results.

Table 9. Most Recent PCE Results in Indoor Air (February 2012)

Sample Location	Sub-Location	PCE (ppbv) 8-hr	PCE (ppbv) 24-hr
Halford's	941-IA-01	0.26	0.37
Halford's	941-IA-02	0.28	0.42
Parts House	939-IA-01	ND (<0.34)	0.30
Parts House	939-IA-02	ND (<0.34)	0.25
Parts House	939-IA-03	ND (<0.34)	0.25
Outdoors	OA-01	Not sampled	0.27

Notes:

RSL = 0.3 ppbv

PCE soil vapor unit of measure is parts per billion by volume (ppbv)

ND = not detected; (Detection limit shown in parentheses)

The combined actions of SVE optimization and enhancement, continued SVE operation (which suppresses vapor intrusion into buildings), and vapor intrusion mitigation have reduced PCE indoor air risk to acceptable levels based on recent monitoring.

6.5. Site Inspection

The FYR Site Inspection was conducted on February 21, 2013 and was led by USEPA and USACE Sacramento District personnel (Marie Lacey, USEPA RMP, and Doug Mackenzie, respectively). Others in attendance at the Site Inspection included Tamrah Headrick, lead operator of the treatment plant, Tim Mathein, project engineer, Scott Dressler, project engineer, all with URS, the remedial contractor, and Jim Rohrer, engineering geologist with California DTSC.

The scope of the site inspection included a site walk encompassing the various groundwater and soil vapor treatment plant components (piping, sampling ports, tanks, vaults, storage vessels, air strippers, carbon adsorbers, control panels, blower, moisture knockout drum, steel containers housing various components, etc.), numerous site wells including monitoring wells, groundwater extraction wells, and soil vapor extraction wells. On-site written documentation such as safety and health documentation, O&M documents, and labeling were also reviewed. The condition of implemented physical ICs such as fencing and signage were also observed.

Site inspection results indicated overall good condition of most aspects of the operating GWETS and SVE remedial systems. CONEX containers, pumps, wellhead plumbing, electrical systems, pipelines, valves and valve boxes were found to be generally in good condition. Monitoring wells observed during the Site Inspection were found to be in good condition. Fencing and signage around the treatment plant systems was found to be intact and in good condition. Minor deficiencies needing attention included adjustment of a float valve inside the EW-02 well vault and missing locks to secure Wells MW-4A, MW-4B, and MW-4C. These minor deficiencies have been repaired.

Based on observations and results from the Site Inspection, the Site Inspection team concluded that the operational procedures in place are adequate to maintain the interim remediation systems in good working order. Opportunities for optimization of groundwater/soil vapor monitoring are being implemented including use of passive diffusion bag samplers for VOC samples, to be conducted during the First Quarter 2013 monitoring event. Due to marked increase in expense to dispose of treated groundwater via the city POTW, a recommendation was made in the checklist to consider alternate endpoints for treated water such as injection back into the aquifer. Additionally, soil vapor rebound testing is being planned to determine if shut-down or reduced or intermittent operation of the SVE system is appropriate.

A complete and comprehensive FYR Site Inspection Checklist is included as Appendix D.

6.6. Interviews

During the FYR process, interviews were conducted with parties involved with or impacted by the Site. Interviews were conducted with Jeff Taylor, owner of The Parts House, and Jim Rohrer, Remedial Project Manager for California DTSC, during the Site Inspection on February 21, 2013, and with City of Modesto officials on April 15, 2013. The purpose of the interviews was to document the perceived status of the Site and any perceived problems or successes with the phases of the remedy that have been implemented to date. Interviews are summarized below and complete interviews are included in Appendix C.

Although Mr. Taylor had a good overall impression of the Site and remediation project, he expressed concern that the process was taking longer than expected. He does not own the property his business operates from and he was not aware of any future property ownership changes; he did indicate his business has been there a long time. He indicated his business has been inconvenienced at times by after-hours access to his building, and several Site-related activities including indoor air sampling and sub-slab sampling as well as installation of two sub-slab depressurization systems. He is being reimbursed for costs related to power consumption associated with the sub-slab depressurization system.

Mr. Rohrer indicated that he is the DTSC Project Manager for the Site, and that his role includes State review of quarterly monitoring reports and other Site documentation. He also reviews O&M of the groundwater treatment system since that component of the remedy has become the responsibility of the State. Overall, Mr. Rohrer is unaware of any effluent discharge permit violations, and he believes he is kept well informed about activities and progress at the Site. He inquired about soil vapor monitoring procedures and recommended a California guidance document dealing with the subject.

As a whole, officials representing the City of Modesto had a positive impression of the Site, although the interviewees indicated they had no routine communications or activities related to the Site. It was noted on the interview form (Appendix C) that there was not a representative of the wastewater department present – this department manages the permit for treated effluent to the sanitary sewer system. The City of Modesto officials interviewed indicated the Modesto Site was not a high-profile issue for them, and hence they felt they did not have the most up–to-date information on the Site. They were appreciative of the interview meeting as a forum to learn more about recent happenings at the Site and to establish lines of communication between the EPA and the City.

6.7. Institutional Controls

The Institutional Controls portion of the remedy selected in the IROD stated the following:

> *Institutional controls will include signing and fencing around the treatment area. These institutional controls will be maintained for the duration of treatment, and the need for additional institutional controls will be evaluated in the final remedy.*

The Site Inspection checklist documents that the fencing surrounding the groundwater and SVE treatment system components remains intact and in good condition. Photo documentation taken during the Site Inspection (Appendix E) shows Site-related signage remains in place and in good condition.

In September 2012, a Land Use Environmental Restrictive Covenant (Land Use Covenant, or LUC) was drafted. The LUC is to be placed on the properties of 939 & 941 McHenry Street, the locations of the Parts House and Halford's Cleaners businesses. Once signed and recorded, the property owners and the California Department of Toxic Substances Control will be the LUC signator parties. The provisions of the Covenant will be enforceable by the EPA as a third party beneficiary. The LUC is necessary to preclude residential use of the property given that hazardous substances will remain at the property following completion of the interim remedial actions. The LUC also is necessary to preclude disruption of the selected constructed remedies. The LUC is considered a proprietary IC.

Additionally, City of Modesto ordinance prohibits wells within city limits served by their public water supply system for purposes other than groundwater monitoring or remedial treatment. This is considered a governmental IC. The entire Modesto Superfund Site falls within city limits and therefore within this provision. Well drilling permits for locations within Modesto city limits, normally obtained through the Stanislaus County Department of Environmental Resources, are referred to and denied by the City of Modesto.

The following table lists the ICs associated with areas of interest at the Site.

Table 10. IC Summary Table

Media	ICs Called for in the Decision Documents	Impacted Parcel(s)	IC Objective	Instrument in Place	Notes
Treatment system water and air	Yes (ROD refers to these engineering controls as IC's)	Not applicable	Restrict public access to treatment facilities	Warning signs and fencing	Remains in place and is maintained
Soil and groundwater	No (Will be included in final ROD)	113-006-036	Preclude residential land use and disruption of remedies	LUC	In process of being finalized and recorded
Groundwater	No (Will be included in final ROD)	Multiple	Prohibit private or commercial wells at Site	Governmental IC	Remains in place

7. Technical Assessment

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

In summary, the interim remedy is functioning as intended by the IROD. The following paragraphs explain the rationale behind this conclusion.

7.1.1. Remedial Action Performance

New extraction well EW-02, operating continuously at 46 gpm, is near the maximum GWETS capacity of 50 gpm. This well is capturing more of the high-concentration PCE remaining in the A zone than was captured by EW-01R, because it is more centrally located over the bulk of remaining dissolved phase mass. Future quarterly groundwater monitoring results should further evaluate EW-02 effectiveness both for hydraulic source control and reductions in concentrations throughout the plume.

It appears the PCE plume has been adequately characterized, with possible minor data gap areas remaining within the A and B zones. The Fourth Quarter 2012 monitoring report recommends two wells be installed and sampled in the A zone and 5 in the B zone to fully define the PCE plume extents. Twenty-five groundwater monitoring wells have been installed since the last FYR, and the number of wells now totals 40. In addition to the A zone, B and C aquifer zones have been characterized and delineated with respect to the PCE plume. Much progress has also been made in investigating monitored natural attenuation applicability.

Within the A zone, recent data demonstrate decreasing trends generally upgradient and within the source area. Two locations show decreasing trends downgradient of the source area; however, a third location (MW-20A) downgradient of the source area is probably increasing. Trends may vary in the immediate future, as impacts from operation of EW-02 have yet to be realized in groundwater data. In monitoring of B zone groundwater, careful observation of future quarterly data should be given to wells MW-16B and MW-17B, where PCE concentrations have risen.

Optimization of the SVE system, by installing three new SVE extraction wells, has removed contaminant mass from the soil in the source area and in lowered soil vapor concentrations. Based on Fourth Quarter 2012 data, PCE soil vapor exceeds 100 ppbv in just two active extraction wells, SVE-02 and SVE-03. The operating SVE system contributes to vapor intrusion mitigation along with the sub-slab depressurization system. The latest sampling indicates that indoor air PCE concentrations are at protective for the current commercial use and operation. However, there is indication that vapor intrusion may be occurring due to the low level of PCE detected in the overnight (24-hour) sample results. Future actions will include monitoring of SVE operation, sub-slab pressures and concentrations, and indoor air concentrations in affected structures.

Both the GWETS and SVE system are currently operating and meeting applicable discharge requirements with respect to VOCs, including PCE, and uranium.

While PCE remains above potentially applicable cleanup levels, the interim RAOs have been largely achieved based on actions taken at the Site prior to and since the last FYR. Operation of the interim remedy and associated monitoring will continue. The final Record of Decision will set new RAOs to achieve applicable cleanup levels through a selected final remedy for the Site.

7.1.2. System Operations/O&M

Review of available documentation in the quarterly reports and information obtained during the Site Inspection indicates that both the GWETS and SVE systems operate in an effective manner, with necessary controls, routine performance monitoring, and preventative maintenance conducted to keep the systems operating effectively in the future.

While there have been at times somewhat large variations in O&M costs in recent years, these variances have been the result of additional plume investigations and characterization and corresponding additional plume monitoring and interpretation efforts. For example, the number of wells sampled since the last FYR has increased from 15 to 40, resulting in at least 100 extra samples for laboratory VOCs analysis per year. Increased costs for this example would include not only sampling and analytical costs, but data validation, interpretation, and reporting costs as well.

7.1.3. Opportunities for Optimization

Several opportunities exist to improve the performance and/or reduce costs of monitoring, sampling, and treatment systems. First, a soil vapor rebound test is recommended and is currently being planned. Such a test would evaluate whether shut-down of the SVE system, now showing asymptotically-low vapor extraction levels, would be possible while still maintaining the protectiveness of the remedy with respect to vapor intrusion risks. If the SVE system cannot be fully shut down, then lower vapor extraction rates or operation of the SVE system in a pulsed mode might be effective, while reducing operating costs. Secondly, after the PCE plumes in the A zone and B zone have been fully characterized, future opportunities for monitoring network optimization by reducing the total number of wells for sampling could be evaluated. Lastly, costs for discharge of treated groundwater to the city sanitary sewer have considerably increased. Consideration and feasibility of discharging treated water back into the aquifer should be evaluated as a cost-savings measure to the project.

7.1.4. Early Indicators of Potential Issues

At this time, there are no known early indicators of potential issues at this time that would affect protectiveness.

7.1.5. Implementation of Institutional Controls and Other Measures:

Site signage and fencing are considered Site ICs and they remain in place and in good condition. They are maintained at the Site as remediation treatment continues.

A Land Use Covenant was drafted in September 2012 to be placed on the properties of 939 & 941 McHenry Street, the locations of the Parts House and Halford's Cleaners businesses. The LUC was necessary to preclude residential use of the property given that hazardous substances will remain at the property following completion of the interim remedial actions. The LUC also was deemed necessary to preclude disruption of the selected constructed remedies. The LUC is in draft form and has not received final signature or recording.

Additionally, the City of Modesto has their own IC prohibiting wells within city limits served by their public water supply system for purposes other than groundwater monitoring or remedial treatment.

These three ICs are adequate for the current Site conditions.

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?

No ARARs or To-Be-Considered requirements have been revised, and there have been no changes in risk assessment methodologies. PCE toxicity was revised in 2012 by EPA's IRIS, and is regarded as less toxic than reflected in the Human Health Risk Assessment, IROD, or first FYR. (See Section 6.3.2 for details of changes.) This change has not yet been reflected in a revised MCL, however.

In addition to the City of Modesto IC cited above, a land use covenant to be filed by the property owners prohibits residential use and disruption of the selected remedy. No human health routes of exposures have changed or new exposure pathways identified. Vapor intrusion is effectively being addressed at the site because additional SVE wells have been installed and vapor intrusion mitigation has been implemented.

While PCE in groundwater remains above MCLs, the interim RAOs have been largely achieved based on actions taken at the Site prior to and since the last FYR.

In consideration of the above, exposure assumptions, cleanup levels, ARARs, and Remedial Action Objectives selected at the time of the remedy are still valid. As noted, PCE toxicity has been revised downward and so has decreased the EPA indoor air screening level, but for groundwater the MCL continues to guide cleanup.

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

No other information is known at this time that could call into question the protectiveness of the interim remedy.

7.4. Technical Assessment Summary

The interim remedy of groundwater and soil vapor extraction, treatment, and discharge is functioning as intended by the IROD. The goals of the interim remedy were to eliminate and contain the highest contaminant levels at the source (source control) and to prevent potential exposure of human or environmental receptors to PCE or other organic compounds released to the soil and groundwater. These goals have largely been achieved, and EPA has made recent steady progress and is on track to select a final remedy that will achieve appropriate groundwater cleanup levels. The operating SVE system may contribute to vapor intrusion mitigation along with the sub-slab depressurization system. The current assessment indicates that SVE may no longer be efficient in removing mass. The exposure assumptions, cleanup levels, ARARs, and remedial action objectives selected at the time of the remedy are still valid However, the toxicity reference dose has increased and carcinogenicity slope factors have decreased for PCE. The changes in toxicity would not result in an increase in estimated risk, and therefore, would not impact protectiveness. No other information has come to light that could call into question the protectiveness of the interim remedy.

8. Issues

Table 11 summarizes current issues at the Modesto Groundwater Contamination Site that affect current or future protectiveness of the remedy.

Table 11. Current Issues for the Modesto Groundwater Contamination Superfund Site

Issue	Affects Current Protectiveness (Yes or No)	Affects Future Protectiveness (Yes or No)
The SVE system may have reached its remedial action objectives set forth in the IROD; however, the system may be providing protection for indoor air vapor intrusion, an objective not originally considered in the IROD.	No	Yes

The following minor issues do not affect protectiveness, but are included as items to be considered for remedy improvement:

- The GWETS is not fully optimized.
- From an engineering perspective, the optimized and expanded (in 2008) SVE system has reached a point of diminished returns on PCE mass extraction.

9. Recommendations and Follow-up Actions

Table 12 provides recommendations to address the current issues at the Modesto Groundwater Contamination Superfund Site.

Table 12. Recommendations to Address Current Issues at the Modesto Groundwater Contamination Superfund Site

Issue	Recommendations/ Follow-Up Actions	Party Responsible	Oversight Agency	Milestone Date	Affects Protectiveness? (Yes or No)	
					Current	Future
The SVE system may have reached its remedial action objectives set forth in the IROD; however, the system may be providing protection for indoor air vapor intrusion, an objective not originally considered in the IROD.	Continue to monitor sub-slab and indoor air PCE concentrations during cessation of the SVE system to ensure protective indoor air levels are maintained.	EPA	EPA	1/2015	No	Yes

The following are considerations that could reduce costs or potentially reduce costs while maintaining an adequate level of Site monitoring:

- Evaluate returning treated water to the aquifer instead of discharging to the city POTW
- Evaluate whether a reduction in the number of sampled wells would be warranted once plumes are fully characterized

In addition, the Land Use Covenant should be completed and recorded. Institutional controls should be included in the final ROD. EPA will continue to monitor indoor air at the Halford's property.

10. Protectiveness Statement

The interim remedy at the Modesto Groundwater Contamination Superfund Site is currently protective of human health and the environment. Soil vapor extraction (SVE) and sub-slab vapor intrusion mitigation have reduced indoor air PCE concentrations to be within acceptable levels, and there are no complete receptor pathways for ingestion of impacted Site groundwater. To be protective in the long term, the vapor intrusion pathway should be re-assessed when the SVE system is shut off.

11. Next Review

This Site requires ongoing FYRs as long as hazardous substances, pollutants, or contaminants are left on site that do not allow for unrestricted use and unlimited exposure. PCE remains in Site groundwater above its cleanup level, preventing unlimited use and unrestricted exposure. PCE in soil remains at concentrations that are currently controlled by the SVE system and sub-slab vapor intrusion mitigation system. The next Five-Year Review is required by September 2018, five years from the date of this review.

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Appendix A: List of Documents Reviewed

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List of Documents Reviewed

AMEC Geomatrix, Inc., (date unknown). Wall Repair Completion Report, Halford's Cleaner's Modesto. (Based on reference in report, the date this report was published was no earlier than May 4, 2009).

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URS Group, Inc., 2013. Quarterly Operations and Monitoring Report, Groundwater Treatment and Soil Vapor Extraction Remediation Systems, Fourth Quarter 2012, Modesto Groundwater Superfund Site, Modesto, California. March 2013.

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URS Group, Inc., 2012. Quarterly Operations and Monitoring Report, Groundwater Treatment and Soil Vapor Extraction Remediation Systems, Fourth Quarter 2011, Modesto Groundwater Superfund Site, Modesto, California. February 2012.

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Appendix B: Press Notices

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Mundo Hispan

La Agencia de Protección Ambiental de los Estados Unidos (EPA) ha comenzado la segunda revisión de cinco años de acciones de limpieza en el sitio de Superfondo de Agua Subterránea de Modesto (sitio) en Modesto, California. La revisión evaluará si las acciones de limpieza provisional para el sitio protegen a la salud humana y el medio ambiente.

EL PROCESO DE REVISIÓN

La ley del Superfondo requiere al EPA evaluar la protección de los sistemas de remediación cada cinco años hasta que el sitio sea limpiado suficientemente para permitir acceso sin restricciones. Esta revisión de cinco años, el segundo para el sitio, evaluará la protección de las acciones de limpieza provisional en el sitio. Se evaluará los plazos corto y largo de protección a la salud humana y el medio ambiente. Al finalizar la revisión (30 de Septiembre, 2013), una copia del reporte final será puesta en el repositorio de información local a continuación, y un aviso anunciando la terminación de la revisión de cinco años se publicará en el periódico local. El sitio continuará siendo monitorizado y exámenes quinquenales continuarán hasta que el sitio se ha limpiado suficientemente para permitir uso sin restricciones. Porque esto es un remedio provisional, EPA continuará estudiando el sitio y evaluando otros posibles métodos de limpieza. EPA planea publicar un Plan Propuesto para el comentario del público en pocos años para seleccionar una solución final para la limpieza de la contaminación y para resolver todas las vías posibles de riesgo.

HISTORIA DEL SITIO

Una facilidad de limpieza en seco descargó aguas residuales conteniendo tetrachloroethylene (también conocido como PCE o "perc") en el agua subterranea por muchos años. Una cantidad indeterminada de PCE fue lanzada en el subsuelo y las aguas subterráneas. El sitio de Superfondo de Agua Subterránea de Modesto fue colocado en la lista nacional de prioridades (NPL) en 1989 para dirigir la contaminación. Un Registro de Decisión provisional fue firmado en el año 2000 que inició las acciones de limpieza.

OBJETIVO DE LA LIMPIEZA

El objetivo de limpieza provisional establecido para el sitio por el Registro de Decisión es limpiar el PCE en el agua subterránea. Para lograr este objetivo, la EPA instalo un sistema de extracción y tratamiento de las aguas subterráneas y una extracción de vapor del suelo (SVE) / sistema de tratamiento para tratar a los contaminado suelos.

PARTICIPACIÓN DE LA COMUNIDAD

Como parte de este proceso de revisión quinquenal, EPA realizará entrevistas en Modesto. Si usted conoce de cualquier problema o tiene alguna preocupación con el remedio y desea participar en las entrevistas, por favor contacte a Marie Lacey en EPA (información de contacto más abajo). Si desea ser incluido en nuestra lista de correo y recibir futuras hojas de información, por favor contacte a Jackie Lane en EPA (información de contacto más abajo).

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del mundo, aparece al final de la lista tomando en cuenta una serie de indicadores como el bienestar material, la educación, la salud y la seguridad, comportamientos y riesgos, y la vivienda y el medio ambiente.

El documento internacional señala que Washington ocupa el lugar 26 entre las 29 naciones seleccionadas, por detrás de Grecia y justo por encima de Lituania, Letonia y Rumania.

Precisa que en educación los estadounidenses ocupan el lugar 27, mientras en lo referente al bienestar material está en la plaza 26.

En este último acápite, la investigación se centra en las tasas de pobreza de cada país y la brecha relativa entre el ingreso medio y los niños clasificados como pobres, lo que evidencia que un 36 por ciento de los niños estadounidenses se encuentran por debajo la línea oficial de pobreza.

Aclara el estudio que los países con los niveles más altos de bienestar infantil son los países nórdicos y Europa Occidental, que aún conservan reformas sociales entre los más desarrollados, como es el caso Finlandia que tiene menos del cinco por ciento de la pobreza infantil.

Aunque en 2013 en su discurso sobre el Estado de la Unión, el presidente Barack Obama promocionó programas de educación, Global Research plantea que eso es "demagogia vacía".

De hecho, la Casa Blanca encabeza un ataque histórico en la educación

and the best interests of historic preservation."

What's unfolding is more than a story about the fate of a remote mining camp in the hottest, driest corner of America. It is part of a wider debate about how best to protect historic resources across the West in an era of limited and declining government resources.

Vandals strike

Much has been lost already. One example lies inside Death Valley National Park, where someone has chiseled into a rock wall in an attempt to steal American Indian petroglyphs, defacing the area forever.

In one of the most brazen cases, thieves used power saws, ladders and generators to steal centuries-old petroglyphs from federal land north of Bishop last year. Although the rock art has been recovered, no arrests have been made.

"It's akin to someone defacing part of the Vatican or damaging an important artistic piece, like the 'Mona Lisa,'" said Greg Haverstock, an archaeologist with the U.S. Bureau of Land Management. "A few greedy, self-minded individuals destroyed an amazing, finite resource."

His budget to monitor and protect such sites across 750,000 acres of public land is $52,000 — seven cents an acre. "It is just not a lot of money," Haverstock said. "It forces me to seek outside sources of funding."

that's one reason Preston Chiaro, president of the Death Valley Conservancy, cited in explaining why he believes Ryan should remain private.

"The fact that it's been in private hands rather than part of the national park has been one of the things that has helped to preserve it," said Chiaro, Rio Tinto's group leader for technology and innovation. "There is a proven model here. It works. Why would you want to change it?"

But private ownership of historic treasures raises questions: Who will have access? Under what conditions? What will it cost? How will tax-deductible contributions be spent?

"Once a site gets into private hands, there is really no control of it," said Michael Newland, past president of the Society for California Archaeology.

As the donation nears completion, some have asked the conservancy tough questions, in writing, about its budget, management and plans. They have learned little.

"I got one reply to four letters saying they have every right to do with this property whatever they want to do and, furthermore, they have no time to talk to me," said Steve Bruce, a member of a group called Save Ryan.

"As a public charity taking public money, they have a responsibility to respond to the public," Bruce said. "It's very frustrating."

peppered with old mine shafts, shacks and diggings, Ryan is a remarkable place, an outpost of culture and rustic comfort in a harsh, unforgiving wilderness.

It began humbly, with a cluster of cabins, lean-tos and dugouts at the base of a dark cliff overlooking Death Valley.

"A stranger would have been amused to see the heads pop up all over the place like prairie dogs when the warning whistle blew before breakfast," wrote mine superintendent Harry Gower in a memoir: "50 Years in Death Valley — Memoirs of a Borax Man."

But, like the cactus that clings to canyon walls, Ryan would blossom into something special.

Down a narrow, winding rail line came the heavy timber, wood stoves, concrete, bed frames, mattresses, wash basins, electrical wire, tools, windows, medical supplies and other building blocks of civilization.

Ryan was never large — just a few dozen buildings that housed 150 to 200 people, including some wives and children. But for a company town — it was owned by Pacific Coast Borax — it was surprisingly well furnished.

time caretaker, a practice ued by U.S. Borax o Tinto. Although ildings are deterio- ating, others are in great shape. Even the train engine that once carried tourists is kept in working order, though it is no longer used.

"It's just like going back in time," said Linda Greene-Smith, former chief of resources management at Death Valley National Park. "This place has really been lovingly cared for. It's a treasure."

Two Pacific Coast Borax executives, Stephen Mather and Horace Albright, even joined the National Park Service. As its first two directors from 1917 to 1933, they called for protection of Death Valley, which was declared a national monument by President Herbert Hoover in 1933. It became a national park in 1994.

Albright's daughter, 91-year-old Marian Schenck, said that before her father died in 1987, he told her he felt Ryan belonged in the park.

"It would be ridiculous not to bring it in," Schenck said. "The whole (park) concept came from borax. When you don't include Ryan, it's eliminating a big part of it."

cluding the folks at Rio Tin- to, worked a long time to get Ryan to the park service."

Since then, the park and Rio Tinto have remained quiet, kindling interest, speculation and numerous requests for information from the conservancy.

"If you go to them asking for details, asking for facts — one of my questions is, where is their money actually coming from? — their response is we don't have the time to deal with you," said Bruce of the Save Ryan group.

ly neat little mining town that should be part of the park service."

PUBLIC NOTICE

THE UNITED STATES ENVIRONMENTAL PROTECTION AGENCY BEGINS THE SECOND FIVE-YEAR REVIEW OF CLEANUP AT THE MODESTO GROUNDWATER CONTAMINATION SUPERFUND SITE

The United States Environmental Protection Agency (EPA) has begun the second five-year review of cleanup actions undertaken at the Modesto Groundwater Contamination Superfund Site (Site) in Modesto, California. The review will evaluate whether the interim cleanup actions for the Site are protective of human health and the environment.

THE REVIEW PROCESS

Superfund law requires EPA to evaluate the protectiveness of remedial systems every five years until the site has been cleaned up sufficiently to allow unrestricted access. This five-year review, the second for the Site, will address the protectiveness of the interim cleanup actions taken at the Site by evaluating short- and long-term protectiveness of human health and the environment. Upon completion of the review (September 30, 2013), a copy of the final report will be placed in the local information repository listed below and a notice will appear announcing the completion of the Five-Year Review Report in the local paper. The Site will continue to be monitored and five-year reviews will continue until the Site has been sufficiently cleaned up to allow unrestricted use. Because this is an interim remedy, EPA is continuing to study the Site and evaluate other potential cleanup methods. EPA plans to issue a Proposed Plan for public comment in a few years to select a final remedy for the contamination and to address all potential risk pathways.

SITE HISTORY

The Modesto Groundwater Contamination Superfund Site is related to a dry cleaning facility that leaked tetrachloroethylene (also known as PCE or "perc") into the soil and groundwater. The dry cleaning facility discharged wastewater containing PCE into the sewer system for many years, and an unknown quantity of PCE was released into the subsurface soils. The Site was placed on the National Priorities List (NPL) in 1989 to address the groundwater contamination. An interim Record of Decision was signed in 2000 that initiated the cleanup actions.

CLEANUP OBJECTIVE

The interim cleanup goal established for the Site by the Record of Decision is to clean up PCE in the groundwater. To achieve this goal, EPA installed a groundwater extraction/treatment system and a soil vapor extraction (SVE)/ treatment system.

COMMUNITY INVOLVEMENT

As part of this five-year review process, EPA will conduct interviews in Modesto. If you are aware of any problems or have any concerns with the remedy and would like to participate in the interviews, please contact Mario Lacey at EPA (contact information below). If you would like to be included in our mailing list and receive future fact sheets, please contact Jackie Lane at EPA (contact information below).

FOR MORE INFORMATION:

Please visit the EPA website at: www.epa.gov/region09/Modesto
Or visit the information repository in San Francisco or Modesto to review the Administrative Record:

INFORMATION REPOSITORY

EPA Superfund Records Center
95 Hawthorne Street
San Francisco, CA 94105
(415) 536-2000

Stanislaus County Free Library
1500 I Street
Modesto, CA 95354
(209) 558-7814

CONTACT INFORMATION

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San Francisco, CA 94105
(415) 972-3163
lacey.marie@epa.gov

Jackie Lane
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U.S. EPA
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San Francisco, CA 94105
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lane.jackie@epa.gov

CNS#2448736

Modesto Bee
April 1, 2013

Appendix C: Site Inspection Interview Reports

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INTERVIEW RECORD

Site Name: Modesto Groundwater Superfund Site		**EPA ID No:** CAD981997752
Subject: Second 5-yr review		**Time:** **Date:**
Type: ☐ Telephone ☐ Visit ☐ Other **Location of Visit:** On –Site, 941 McHenry Avenue, Modesto, CA		☐ Incoming ☐ Outgoing
Interviewer(s)		
Name: Doug Mackenzie Marie Lacey	**Title:** Environmental Engineer Remedial Project Manager	**Organization:** Corps of Engineers USEPA
Interviewee		
Name: Jeff Taylor	**Title:** Business Owner	**Organization:** The Parts House
Telephone No: (209) 524-8800 **Fax No:** **E-Mail Address:**		**Street Address:** 939 McHenry Avenue Modesto, CA 95350

Summary Of Conversation

Interview Questions

1. *What is your overall impression of the work conducted at the site to date? (general sentiment)*

   Mr. Taylor expressed that it was taking a long time. Other than that he had a good impression of the project.

2. *What is the current and projected future ownership status of the site (Is the property for sale, has it been sold, or subject to pending sale?)? What is the current zoning status of the property, and has that changed in the last five years?*

   Mr. Taylor does not own the property, and he was not able to answer directly to the questions. He has not heard anything about any change in ownership. He has operated the business for a long time and the property has always been in the same use.

3. *What business impacts have you experienced related to the site within the past five years? How many full-time and part time employees work in the building in which your business operates?*

There have been several events of indoor air and sub-slab sampling as well as installation of two sub-slab depressurization systems. Things go pretty well usually, but there was a time when the contractor had requested some after-hours time which meant that he had to be there. Mr Taylor would prefer that did not happen in the future.

There are two full-time employees.

4. *Do you have any comments, suggestions, or recommendations regarding any aspects of the Modesto GW Contamination Superfund Site?*

Sometimes Mr. Taylor receives mail from vendors to the O&M contractor. He suggested that the contractor might find a way to receive that correspondence directly.

EPA is having Mr. Taylor reimbursed for power cost associated with the sub-slab depressurization system. In order for the funding to get to him in an accountable manner, Mr. Taylor has to submit a bill to the O&M contractor. He requested more clarity on the process, and exactly what he needs to do.

INTERVIEW RECORD

Site Name: Modesto Groundwater Superfund Site		**EPA ID No:** CAD981997752
Subject: Second 5-yr review		**Time:** **Date:**
Type: ☐ Telephone ☐ Visit ☐ Other **Location of Visit:** On –Site, 941 McHenry Avenue, Modesto, CA		☐ Incoming ☐ Outgoing
Interviewer(s)		
Name: Doug Mackenzie Marie Lacey	**Title:** Environmental Engineer Remedial Project Manager	**Organization:** Corps of Engineers USEPA
Interviewee		
Name: James Rohrer	**Title:** Project Manager	**Organization:** California Dept. of Toxic Substance Control
Telephone No: (916) 255-3709 **Fax No:** **E-Mail Address:** jim.rohrer@dtsc.ca.gov		**Street Address:** 8800 Cal Center Drive Sacramento, CA 95826

Summary Of Conversation

Interview Questions

3. *What is your current role as it relates to the site? What is your overall impression of the work conducted at the site to date? (general sentiment)*

   Mr. Rohrer is the DTSC Project Manager for the Site. His role includes providing State review and input to the project. In addition, since O&M of the groundwater treatment system has become State responsibility, he reviews that activity.

   His overall impression of the project is favorable.

4. *Have there been routine communications or activities (site visits, inspections, reporting activities, etc.) conducted by your office regarding the site? If so, give purpose and results.*

The State's contractor for O&M of the groundwater system performs weekly site visits and provides quarterly reports to DTSC.

5. *Are you aware if the site has been in compliance with permitting or reporting requirements?*

Mr. Rohrer was not aware of any non-compliance with permitting and reporting associated with effluent discharge.

3. Have there been any complaints, violations, or other incidents related to the site requiring a response by your office? If so, please give details of the events and results of the responses.

Mr. Rohrer has not heard of any complaints, violations, or other incidents.

6. Has any individual contacted you voicing questions or concerns about the site?

Mr. Rohrer did not recall any inquiries.

7. Do you feel well informed about the site's activities and progress?

Yes

8. Are you aware of any changes in State/County/Local laws and regulations that may impact the protectiveness of the site?

No changes affecting operation of the remedy were recalled.

5. Do you have any comments, suggestions, or recommendations regarding the site's management, operation, or any other aspects of the site

During the site visit Mr. Rohrer inquired about the procedures for sampling soil vapor monitoring wells. California has a guidance document for sampling soil vapor, and it includes procedures for leak detection that he recommended.

INTERVIEW RECORD

Site Name: Modesto Groundwater Superfund Site		**EPA ID No:** CAD981997752
Subject: Second 5-yr review		**Time:** **Date:**
Type: ☐ Telephone ☐ Visit ☐ Other **Location of Visit:** City Office, 1010 Tenth Street, Modesto, CA		☐ Incoming ☐ Outgoing
Interviewer(s)		
Name: Doug Mackenzie Marie Lacey	**Title:** Environmental Engineer Remedial Project Manager	**Organization:** Corps of Engineers USEPA
Interviewee		
Name: Dennis Turner Robert Christensen Jesse Franco	**Title:** -Director of Public Works - Senior Civil Engineer -Assoc Civil Engineer	**Organization:** -City of Modesto Dept of Public Works -Utility Planning & Projects - Utility Planning & Projects
Telephone No: (209)m577-5404 **Fax No:** **E-Mail Address:** gnyhoff@modestogov.com		**Street Address:** 1010Tenth Street Modesto, CA

Summary Of Conversation

Interview Questions

Note: The interview was held in conjunction with a meeting with several City officials.

9. *What is your current role as it relates to the site? What is your overall impression of the work conducted at the site to date? (general sentiment)*

Business cards were handed out to clarify the positions of each attendee. The roles of the various officials involved coordination of project activities that had impacts on their various organizations' area of responsibility. In addition, they provide and receive information in regard to any issues of concern.

The overall impression of the site is positive.

10. *Have there been routine communications or activities (site visits, inspections, reporting activities, etc.) conducted by your office regarding the site? If so, give purpose and results.*

None of the interviewees had routine communications or activities related to the site.

Note: There was not a representative of the wastewater organization at the interview. That organization manages the permit for discharge of treated water to the sewer.

11. *Are you aware if the site has been in compliance with permitting or reporting requirements?*

Mr. Turner was not up to date on permit compliance. He will be checking with a point of contact.

4. Have there been any complaints, violations, or other incidents related to the site requiring a response by your office? If so, please give details of the events and results of the responses.

No complaints, violations, or other incidents were known.

5.Has any individual contacted you voicing questions or concerns about the site?

There had been an inquiry from a contractor working for another agency about collecting vapor samples in the area. No specific detail of that inquiry was recalled.

6.Do you feel well informed about the site's activities and progress?

This site had not been a high profile issue for MPW, so there had not been a lot of information exchange. The meeting was held to present information coming to light from recent investigations, and to generally open lines of communication. The interviewees expressed appreciation for the meeting and will be following up on information requests arising from the meeting. EPA provided the web site where the City can access the reports generated through the project, including the quarterly monitoring reports that they expressed interest in.

7.Are you aware of any changes in State/County/Local laws and regulations that may impact the protectiveness of the site?

No.

8.Do you have any comments, suggestions, or recommendations regarding the site's management, operation, or any other aspects of the site

Not at this time. The City representatives appreciated receiving point of contact information, which will facilitate more communication.

Appendix D: Site Inspection Checklist

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Site Inspection Checklist

I. SITE INFORMATION	
Site name: Modesto Groundwater Superfund Site	**Date of inspection: 21 February 2013**
Location and Region: Modesto, CA, Region IX	**EPA ID:**
Agency, office, or company leading the five-year review: US Army Corps of Engineers – Seattle District	**Weather/temperature:** Clear/ temperature in 60's

Remedy Includes: (Check all that apply)

Landfill cover/containment — Monitored natural attenuation
Access controls — Groundwater containment
Institutional controls — Vertical barrier walls
Groundwater pump and treatment
Surface water collection and treatment
Other Soil vapor extraction_____
_____

Attachments: Inspection team roster attached — Site map attached

II. INTERVIEWS (Check all that apply)

1. **O&M site manager** Tamrah Headrick_____ _Lead Operator___ _21 February 2013
   Name — Title — Date
   Interviewed at site at office by phone Phone no. (916) 869-0043_____
   Problems, suggestions; Report attached _____
   _____

2. **O&M staff** _____ _____ _____
   Name — Title — Date
   Interviewed at site at office by phone Phone no. _____
   Problems, suggestions; Report attached _____
   _____

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 California Dept. of Toxic Substances Control (DTSC)_____
Contact Jim Rohrer_____ Engineering Geologist 2/21/ 2013 (916) ___
Name Title Date Phone no.
Problems; suggestions; Report attached: _____
_____

Agency _____
Contact _____ _____ _____ _____
Name Title Date Phone no.
Problems; suggestions; Report attached: _____
_____

Agency _____
Contact _____ _____ _____ _____
Name Title Date Phone no.
Problems; suggestions; Report attached _____
_____

Agency _____
Contact _____ _____ _____ _____
Name Title Date Phone no.
Problems; suggestions; Report attached _____
_____

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

Mr Jeff Taylor – Business Owner – Parts House . Interviewed on the same day as the site inspection.

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

1. **O&M Documents**
   O&M manual — Readily available — Up to date — N/A
   As-built drawings — Readily available — Up to date — N/A
   Maintenance logs — Readily available — Up to date — N/A
   Remarks: Maintenance logs are kept in possession of the lead operator. Copies are provided in quarterly reports.

2. **Site-Specific Health and Safety Plan** — Readily available — Up to date — N/A
   Contingency plan/emergency response plan — Readily available — Up to date — N/A
   Remarks__Last update on site, dated 2010._____

3. **O&M and OSHA Training Records** — Readily available — Up to date — N/A
   Remarks: Training records kept at home office.

4. **Permits and Service Agreements**
   Air discharge permit — Readily available — Up to date — N/A
   Effluent discharge — Readily available — Up to date — N/A
   Waste disposal, POTW — Readily available — Up to date — N/A
   Other permits_____ — Readily available — Up to date — N/A
   Remarks: _Effluent discharged to City POTW. Report provided to City monthly._____

5. **Gas Generation Records** — Readily available — Up to date — N/A
   Remarks

6. **Settlement Monument Records** — Readily available — Up to date — N/A
   Remarks

7. **Groundwater Monitoring Records** — Readily available — Up to date — N/A
   Remark: _Provided to EPA in quarterly reports.

8. **Leachate Extraction Records** — Readily available — Up to date — N/A
   Remarks

9. **Discharge Compliance Records**
   Air — Readily available — Up to date — N/A
   Water (effluent) — Readily available — Up to date — N/A
   Remarks_There is no air discharge permit, though substantive requirements are observed. SVE discharge is sampled and system flow is logged. This information as well as water discharge information is provided to EPA in quarterly reports.

10. **Daily Access/Security Logs** — Readily available — Up to date — N/A
    Remarks: _Contractor's routine site presence is one day per week. The facility is locked all other days.

IV. O&M COSTS

1. **O&M Organization**

State in-house Contractor for State
PRP in-house Contractor for PRP
Federal Facility in-house Contractor for Federal Facility
Other__Facility is operated by a contractor under a Corps of Engineers contract. The Corps provides the service to EPA through an interagency agreement._____
_____

2. **O&M Cost Records**

Readily available Up to date
Funding mechanism/agreement in place
Original O&M cost estimate_____ Breakdown attached

Total annual cost by (fiscal) year for review period if available

For 2008 $195,000
Date Total cost

For 2009 $321,000
Date Total cost

For 2010 $231,000
Date Total cost

For 2011 $273,000
Date Total cost

For 2012 $254,000
Date Total cost

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

Describe costs and reasons: Groundwater monitoring costs increased after Fall 2008 due to installation of 16 new wells. In 2009 implementation of changes to optimize the remedy occurred, which resulted in some initial expense. In December 2009 the resin in the two ion exchange vessels had to be disposed as low-level radioactive waste at significant additional cost. Subsequently, the operators are initiating changeout sooner. Starting Fall 2007, sewer discharge fee increased incrementally from approximately $1,600 per month to approximately $3,300 within about two years. In January 2010 a new contract was awarded to a different contractor in a competitive bid process. _____

V. ACCESS AND INSTITUTIONAL CONTROLS Applicable N/A

A. Fencing

1. **Fencing** Location shown on site maps Gates secured N/A

Remarks: Fencing surrounds the GWTP and SVE sytems. It is intact and in good condition. ___
_____

B. Other Access Restrictions

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

Remarks: _There are signs on the fence around the treatment systems.
_____
_____

C. Institutional Controls (ICs)

1. **Implementation and enforcement**

Site conditions imply ICs properly implemented Yes No N/A

Site conditions imply ICs being fully enforced Yes No N/A

Type of monitoring : (e.g., self-reporting, drive by)_____

Frequency _____

Responsible party/agency _____

Contact_____ _____ _____ _____

Name Title Date Phone

Reporting is up-to-date Yes No N/A

Reports are verified by the lead agency Yes No N/A

Specific requirements in deed or decision documents have been met Yes No N/A

Violations have been reported Yes No N/A

Other problems or suggestions:

A land use covenant is currently in development. It restricts groundwater usage and what can be built on the property._____

_____

2. **Adequacy** ICs are adequate ICs are inadequate N/A

Remarks: _____

_____

D. General

1. **Vandalism/trespassing** Location shown on site map No vandalism evident

Remarks: _Approximately 1-2 years ago a portable generator was stolen from within the locked fence. There have been times when homeless people go over the fence, but no damage resulted. Last time that was noticed was about 8 months ago._____

_____

2. **Land use changes on site** N/A

Remarks: _The site is in suburban older commercial and residential area. That condition is expected to continue into the foreseeable future._____

_____

3. **Land use changes off site** N/A

Remarks: _____

_____

VI. GENERAL SITE CONDITIONS

A. Roads Applicable N/A

1. Roads damaged Location shown on site map Roads adequate N/A

Remarks_Installation of new SVE wells in 2008 resulted in re-paving of the alley on the north side of Halford's. The previous paving was severely "alligatored" and had potholes._____

_____

B. Other Site Conditions

Remarks:

There is a low spot in the paving at the entrance to the GWTP. This leaves a pond that the operators must deal with when entering._____

_____

_____

_____

VII. LANDFILL COVERS Applicable N/A

A. Landfill Surface

1. **Settlement** Location shown on site map Settlement not evident
   Areal extent_____ Depth_____
   Remarks_____
   _____

2. **Cracks** Location shown on site map Cracking not evident
   Lengths_____ Widths_____Depths_____
   Remarks_____
   _____

3. **Erosion** Location shown on site map Erosion not evident
   Areal extent_____ Depth_____
   Remarks_____
   _____

4. **Holes** Location shown on site map Holes not evident
   Areal extent_____ Depth_____
   Remarks_____
   _____

5. **Vegetative Cove** Grass Cover properly established No signs of stress
   NoTrees/Shrubs (indicate size and locations on a diagram)
   Remarks_____
   _____

6. **Alternative Cover (armored rock, concrete, etc.)** N/A
   Remarks_____
   _____

7. **Bulges** Location shown on site map Bulges not evident
   Areal extent_____ Height_____
   Remarks_____
   _____

8. **Wet Areas/Water Damage** Wet areas/water damage not evident
   Wet areas Location shown on site map Areal extent_____
   Ponding Location shown on site map Areal extent_____
   Seeps Location shown on site map Areal extent_____
   Soft subgrade Location shown on site map Areal extent_____
   Remarks_____
   _____

9.	**Slope Instability** Slides Location shown on site map No evidence of slope instability Areal extent_____ Remarks_____ _____
B. Benches	Applicable N/A (Horizontally constructed mounds of earth placed across a steep landfill side slope to interrupt the slope in order to slow down the velocity of surface runoff and intercept and convey the runoff to a lined channel.)
1.	**Flows Bypass Bench** Location shown on site map N/A or okay Remarks_____ _____
2.	**Bench Breached** Location shown on site map N/A or okay Remarks_____ _____
3.	**Bench Overtopped** Location shown on site map N/A or okay Remarks_____ _____
C. Letdown Channels	Applicable N/A (Channel lined with erosion control mats, riprap, grout bags, or gabions that descend down the steep side slope of the cover and will allow the runoff water collected by the benches to move off of the landfill cover without creating erosion gullies.)
1.	**Settlement** Location shown on site map No evidence of settlement Areal extent_____ Depth_____ Remarks_____ _____
2.	**Material Degradation** Location shown on site map No evidence of degradation Material type_____ Areal extent_____ Remarks_____ _____
3.	**Erosion** Location shown on site map No evidence of erosion Areal extent_____ Depth_____ Remarks_____ _____
4.	**Undercutting** Location shown on site map No evidence of undercutting Areal extent_____ Depth_____ Remarks_____ _____
5.	**Obstructions** Type_____ No obstructions Location shown on site map Areal extent_____ Size_____ Remarks_____ _____
6.	**Excessive Vegetative Growth** Type_____ No evidence of excessive growth Vegetation in channels does not obstruct flow Location shown on site map Areal extent_____ Remarks_____ _____

D. Cover Penetrations Applicable N/A

1. **Gas Vents** Active Passive
   Properly secured/locked Functioning Routinely sampled Good condition
   Evidence of leakage at penetration Needs Maintenance
   N/A
   Remarks_____
   _____

2. **Gas Monitoring Probes**
   Properly secured/locked Functioning Routinely sampled Good condition
   Evidence of leakage at penetration Needs Maintenance N/A
   Remarks_____
   _____

3. **Monitoring Wells** (within surface area of landfill)
   Properly secured/locked Functioning Routinely sampled Good condition
   Evidence of leakage at penetration Needs Maintenance N/A
   Remarks_____
   _____

4. **Leachate Extraction Wells**
   Properly secured/locked Functioning Routinely sampled Good condition
   Evidence of leakage at penetration Needs Maintenance N/A
   Remarks_____
   _____

5. **Settlement Monuments** Located Routinely surveyed N/A
   Remarks_____
   _____

E. Gas Collection and Treatment Applicable N/A

1. **Gas Treatment Facilities**
   Flaring Thermal destruction Collection for reuse
   Good condition Needs Maintenance
   Remarks_____
   _____

2. **Gas Collection Wells, Manifolds and Piping**
   Good condition Needs Maintenance
   Remarks_____
   _____

3. **Gas Monitoring Facilities** (*e.g.*, gas monitoring of adjacent homes or buildings)
   Good condition Needs Maintenance N/A
   Remarks_____
   _____

F. Cover Drainage Layer Applicable N/A

1. **Outlet Pipes Inspected** Functioning N/A
   Remarks_____
   _____

2. **Outlet Rock Inspected** Functioning N/A
   Remarks_____
   _____

G. Detention/Sedimentation Ponds Applicable N/A

1. **Siltation** Areal extent_____ Depth_____ N/A
   Siltation not evident
   Remarks_____
   _____

2. **Erosion** Areal extent_____ Depth_____
   Erosion not evident
   Remarks_____
   _____

3. **Outlet Works** Functioning N/A
   Remarks_____
   _____

4. **Dam** Functioning N/A
   Remarks_____
   _____

H. Retaining Walls Applicable N/A

1. **Deformations** Location shown on site map Deformation not evident
   Horizontal displacement_____ Vertical displacement_____
   Rotational displacement_____
   Remarks_____
   _____

2. **Degradation** Location shown on site map Degradation not evident
   Remarks_____
   _____

I. Perimeter Ditches/Off-Site Discharge Applicable N/A

1. **Siltation** Location shown on site map Siltation not evident
   Areal extent_____ Depth_____
   Remarks_____
   _____

2. **Vegetative Growth** Location shown on site map N/A
   Vegetation does not impede flow
   Areal extent_____ Type_____
   Remarks_____
   _____

3. **Erosion** Location shown on site map Erosion not evident
   Areal extent_____ Depth_____
   Remarks_____
   _____

4. **Discharge Structure** Functioning N/A
   Remarks_____
   _____

VIII. VERTICAL BARRIER WALLS Applicable N/A

1. **Settlement** Location shown on site map Settlement not evident
   Areal extent_____ Depth_____
   Remarks_____
   _____

2. **Performance Monitoring** Type of monitoring_____
Performance not monitored
Frequency_____ Evidence of breaching_____
Head differential_____
Remarks_____
_____

IX. GROUNDWATER/SURFACE WATER REMEDIES Applicable N/A

A. Groundwater Extraction Wells, Pumps, and Pipelines Applicable N/A

1. **Pumps, Wellhead Plumbing, and Electrical**
Good condition All required wells properly operation Needs Maintenance N/A
Remarks_EW-2 was installed in summer 2012. The float valve that senses water level in the well vault needs adjustment. It is currently set too low, and will trigger nuisance shut-downs in the event there is even minor leakage of rain water into the vault._____
_____
_____

2. **Extraction System Pipelines, Valves, Valve Boxes, and Other Appurtenances**
Good condition Needs Maintenance
Remarks_____
_____

3. **Spare Parts and Equipment**
Readily available Good condition Requires upgrade Needs to be provided
Remarks_The systems are contained in CONEX freight containers. There is not much room for a lot of spare parts and equipment. The operators carry a lot of what they need in the utility vehicle they drive to the site. There have not been significant impacts due to lack of spare parts._____
_____

B. Surface Water Collection Structures, Pumps, and Pipelines Applicable N/A

1. **Collection Structures, Pumps, and Electrical**
Good condition Needs maintenance
Remarks_____
_____

2. **Surface Water Collection System Pipelines, Valves, Valve Boxes, and Other Appurtenances**
Good condition Needs maintenance
Remarks_____
_____

3. **Spare Parts and Equipment**
Readily available Good condition Requires upgrade Needs to be provided
Remarks_____
_____

C. Treatment System Applicable N/A

1. **Treatment Train** (Check components that apply)

Metals removal Oil/water separation Bioremediation

Air stripping Carbon adsorbers

Filters__Bag filters for solids removal_____

Additive (*e.g.*, chelation agent, flocculent)__Scale control_____

Others: __Metals removal is ion exchange to remove uranium (naturally occurring)_____

Good condition Needs Maintenance

Sampling ports properly marked and functional

Sampling/maintenance log displayed and up to date

Equipment properly identified

Quantity of groundwater treated annually: _25 MG_____

Quantity of surface water treated annually: _____

Remarks: _System treats 50 gpm, and uptime is approximately 95%_____

_____

2. **Electrical Enclosures and Panels** (properly rated and functional)

N/A Good condition Needs Maintenance

Remarks_____

_____

3. **Tanks, Vaults, Storage Vessels**

N/A Good condition Proper secondary containment Needs Maintenance

Remarks__The CONEX container housing the system is on top of a containment structure. The floor of the system has several holes that allow any leakage from system to drain into the containment. Level controllers in the containment trigger pumping of the captured water to the system for treatment._____

_____

4. **Discharge Structure and Appurtenances**

N/A Good condition Needs Maintenance

Remarks_____

_____

5. **Treatment Building(s)**

N/A Good condition (esp. roof and doorways) Needs repair

Chemicals and equipment properly stored

Remarks_CONEX has been recently painted. De-scalant chemical is the only chemical product on site. It is within the system containment._____

_____

6. **Monitoring Wells** (pump and treatment remedy)

Properly secured/locked Functioning Routinely sampled Good condition

All required wells located Needs Maintenance N/A

Remarks: _The wells are sampled quarterly. To date, 15 of the 40 wells have dedicated purge pumps and the remainder have been sampled by standard purge-and-bail. Next quarter will begin sampling with passive diffusion bags. New well caps have recently been installed. Wells 4a,b,c were found without locks. Steel traffic lids were securely bolted._____

_____

D. Monitoring Data

1. Monitoring Data
Is routinely submitted on time Is of acceptable quality

2. Monitoring data suggests:
This discussion is provided in five-year review report text.

D. Monitored Natural Attenuation N/A

1. **Monitoring Wells** (natural attenuation remedy)
Properly secured/locked Functioning Routinely sampled Good condition
All required wells located Needs Maintenance N/A
Remarks_____
_____

X. OTHER REMEDIES

Soil Vapor Extraction

The SVE treatment system is located adjacent to the groundwater treatment system, also within the fence. A separate CONEX container houses the blower, moisture knockout drum, piping, and system control panel. The vapor is treated through a carbon filter located outside the CONEX. Spare parts, materials, and some documents are located in this system container. The system was running, and no issues were noted. Three extraction wells, screened at different depths, are located at the northwest corner of Halford's. These wells were all on line. The single original extraction well is located approximately 50 feet to the west and it is currently off-line. No issues noted with the extraction wells.

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.).

The interim remedy was intended to eliminate and contain the highest contaminant levels at the source, while preventing exposure to contaminated groundwater. The interim remedy has significantly reduced PCE concentrations in the vicinity of extraction wells 1 and 1R, where concentrations were highest. Monitoring wells 8a,5a,3a located near Halford's have all shown significantly decreased_PCE concentrations. Concentrations at well 4a further downgradient have varied widely, but have continued to show values at approximately 1,000ug/L. Extraction well 2 was installed in that area in Summer 2012. The single sampling event at MW-4a since the startup of extraction well 2 shows a result of 130 ug/L. There is no evidence of current exposure to contaminated water from the site.

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.

_The interim remedy is effective at reducing concentrations at source areas, which is the intent of the interim ROD. The operational procedures are adequate to maintain the sytems in good working order. For long term protectiveness, the final remedy must cover a broader scope. The PCE plume in groundwater is too large to remediate by source area control alone. As identified in the previous 5-year review, the interim ROD did not address the vapor intrusion pathway. The vapor intrusion pathway has been undergoing investigation and mitigation in the last 5 years. The final ROD must clarify whether the vapor intrusion pathway requires further mitigation, and if so, establish the remedial action.

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.

There have been no early indicators of problems with the interim remedy that affect protectiveness.

D. Opportunities for Optimization

Describe possible opportunities for optimization in monitoring tasks or the operation of the remedy.

Use of passive diffusion bags for groundwater sampling has been identified and will be implemented in the next monitoring event.

A soil vapor rebound test is in planning stages to determine whether shut-down of the SVE system is viable. If it is shown that the SVE system provides control on vapor intrusion in Halford's, A reduced level of extraction should be considered to reduce O&M cost.

As the site characterization is finalized, the groundwater sampling program could be optimized through reducing the number of wells sampled as well as the frequency of sampling.

Discharge of treated groundwater to sewer has become considerably more expensive. Discharge back into the aquifer would eliminate discharge fees and could potentially eliminate the need for removal of uranium , another significant O&M cost. This is being considered in the feasibility study.

GWTP CONEX container inside fence. Warning signs on fence.

Doorway to GWTP. Vapor Phase GAC unit located outside.

Information posted on fence.

Looking east toward McHenry Avenue. Halford's Cleaners on the right.

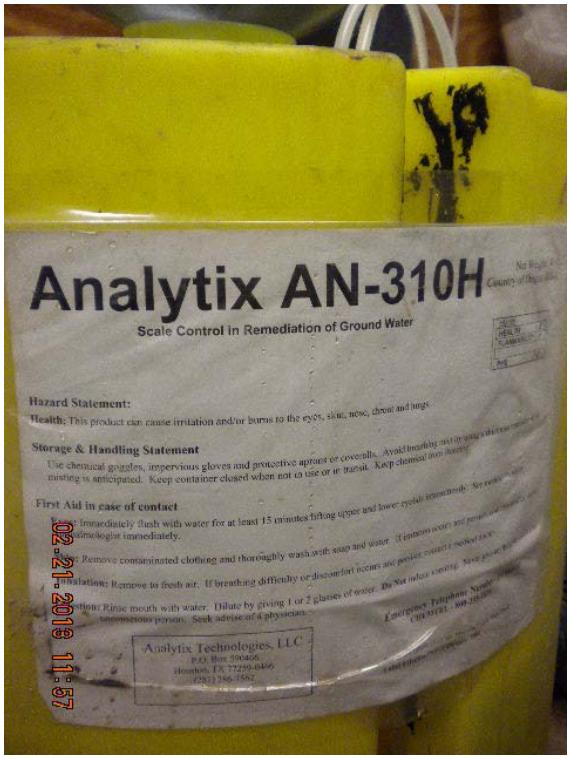
Ion Exchange vessels

Air Stripper. Gaskets between trays had recently been replaced. No leaks observed.

Bag filters pre-air stripper

Influent tank. Sequestering agent in yellow container.

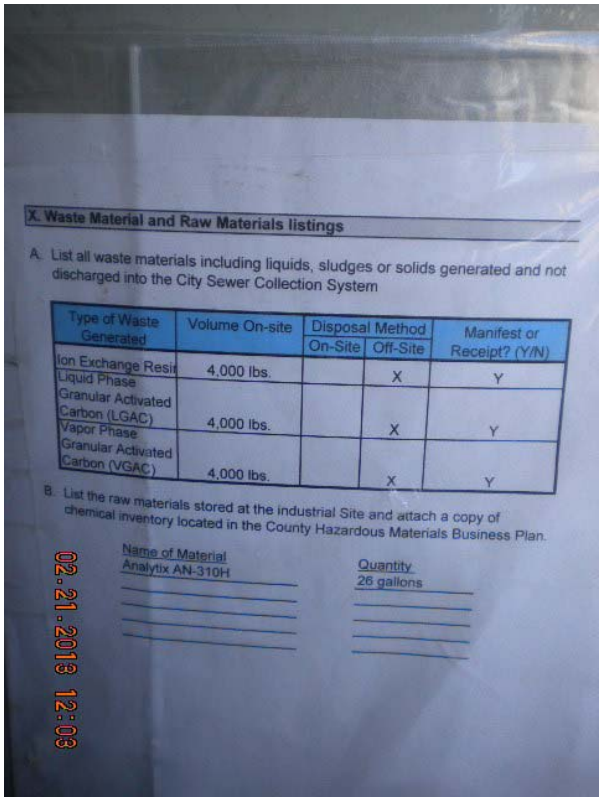
GWTP Control system panels



Sequestering agent to control scale.

Sample tap – post GAC, pre ion exchange

Inside the GWTP CONEX container.



X. Waste Material and Raw Materials listings

A. List all waste materials including liquids, sludges or solids generated and not discharged into the City Sewer Collection System

Type of Waste Generated	Volume On-site	Disposal Method		Manifest or Receipt? (Y/N)
		On-Site	Off-Site	
Ion Exchange Resin Liquid Phase	4,000 lbs.		X	Y
Granular Activated Carbon (LGAC) Vapor Phase	4,000 lbs.		X	Y
Granular Activated Carbon (VGAC)	4,000 lbs.		X	Y

B. List the raw materials stored at the industrial Site and attach a copy of chemical inventory located in the County Hazardous Materials Business Plan.

Name of Material	Quantity
Analytix AN-310H	26 gallons

02-21-2013 12:03

Inventory of materials posted

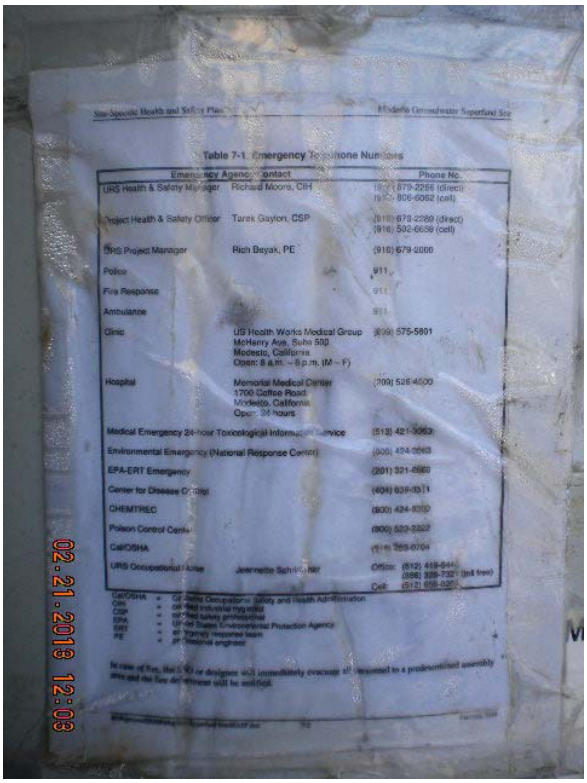


Table 7-1 Emergency Telephone Numbers

Emergency Agency/Contact		Phone No.
URS Health & Safety Manager	Richard Moore, CIH	(916) 679-2256 (direct) (916) 806-6062 (cell)
Project Health & Safety Officer	Tarek Gaylon, CSP	(916) 679-2289 (direct) (916) 502-0639 (cell)
URS Project Manager	Rich Beyak, PE	(916) 679-2000
Police		911
Fire Response		911
Ambulance		911
Clinic	US Health Works Medical Group McHenry Ave, Suite 500 Modesto, California Open: 8 a.m. – 5 p.m. (M – F)	(209) 575-5801
Hospital	Memorial Medical Center 1700 Coffee Road Modesto, California Open: 24 hours	(209) 526-4500
Medical Emergency 24-hour Toxicological Information Service		(513) 421-3053
Environmental Emergency (National Response Center)		(800) 424-8802
EPA-ERT Emergency		(201) 321-6660
Center for Disease Control		(404) 639-[illegible]1
CHEMTREC		(800) 424-9300
Poison Control Center		(800) 523-2222
Cal/OSHA		(510) 286-7000
URS Occupational Nurse	Jeannette Schiffbauer	Office: (512) 419-5[illegible] (866) 339-7321 (toll free) Cell: (512) 656-0371

Cal/OSHA = California Occupational Safety and Health Administration
CIH = certified industrial hygienist
CSP = certified safety professional
EPA = United States Environmental Protection Agency
ERT = emergency response team
PE = professional engineer

In case of fire, the [illegible] or designee will immediately evacuate all personnel to a predetermined assembly area and the fire department will be notified.

02-21-2013 12:03

Emergency contacts posted

Liquid phase GAC

Vapor Phase GAC

Influent structure on left. Separate power meters for GWTP and SVE

Inside SVE container. Manometer for vacuum readings. Air conditioner to protect control system from summer heat.

SVE blower and moisture knock-out vessel

GWTP on the right, SVE on the left.

SVE GAC outside container in enclosure on left.

Original SVE well under metal plate in foreground. New SVE wells off the corner of Halford's in the background.

New SVE wells

SVE extraction well #2

Appendix E: Technical Data Review Memorandum

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MEMORANDUM FOR RECORD

SUBJECT: Technical Data Review, Modesto Groundwater Contamination Superfund Site, Second Five-Year Review

PREPARED BY: Jefferey Powers, U.S. Army Corps of Engineers, Seattle District

DATE: 22 February 2013 (Revised 1 July 2013)

Introduction, Purpose, and Background

The U.S. Army Corps of Engineers, Seattle District (USACE) is assisting the U.S. Environmental Protection Agency, Region 9 (USEPA) with the completion of the Second Five-Year Review (FYR) for the Modesto Groundwater Contamination Site (e.g., the Site). This technical data review memorandum documents the review and evaluation of groundwater, soil vapor, groundwater extraction and treatment system, and soil vapor extraction and treatment system operational data in support of the protectiveness determination to be made in the FYR report.

In 1997 an interim, rather than final, Record of Decision (IROD) was established for the Site because of uncertainties in remediation technology capabilities, and because further delineation of the downgradient and vertical extent of the contaminant plume was needed. The interim remedial action objectives (RAOs) of the IROD were:

- Eliminate and contain the highest contaminant levels at the source (source control),
- Prevent exposure to contaminated groundwater, above acceptable risk levels, to protect human health and environment,
- Minimize the impact of interim cleanup measures to the community,
- Collect data to determine if Federal and State requirements can be met throughout the aquifer, and
- To delineate more clearly the downgradient edges of the plume and to prevent its further migration.

Subsequent to the First FYR in 2008, and in part to address issues brought forward both prior to and during the First FYR, additional characterization and interim remedy work took place. With respect to groundwater, further characterization was conducted to better define the lateral and vertical dissolved-phase groundwater plume extents. The groundwater monitoring well network was expanded in 2008 and again in 2011 by the addition of 16 and 9 wells, respectively. A new groundwater extraction well (EW-02) was installed and brought online in September 2012 to better address the source control RAO by capturing not only source area groundwater but also the plume's highest concentration area located farther downgradient than that being captured by EW-01R. With respect to soil vapor, a soil vapor extraction (SVE) optimization plan was implemented in November 2008, which included installation of three new SVE wells SVE-02, SVE-03, and SVE-04 in the source area to replace SVE-01 previously converted from a vapor extraction well to a vapor monitoring well.

This memorandum addresses the interim RAOs dealing with Site subsurface data collected to date, with an emphasis on data collected between the First FYR and this, the Second FYR. The applicable interim RAOs are the first, second, fourth, and fifth bulleted items listed above. Note that the interim remedial actions were intended as a source control/containment measure to prevent unacceptable health risks to human receptors in the short term, and were not designed to clean up the Site to levels allowing for

unlimited use/unrestricted exposure. The data was reviewed in this context. The memorandum also assesses operational data associated with the interim remedial systems to ensure they are operating as intended.

Data Utilized

The period of time for which data were evaluated as part of this review was August 2008 through August 2012 for analytical data, and December 2012 for groundwater hydraulic data. August 2012 and December 2012 correspond to the latest quarterly Site monitoring data available for analytical and water level data, respectively.

Data were obtained from the following sources in support of the evaluation:

- Fourth Quarter 2009 Quarterly Operations and Monitoring Report for Modesto Superfund Site (Montgomery Watson Harza; February 2010) – *Note this report contains all historical analytical and hydraulic data up to and including November 2009 monitoring event*,
- First, Second, Third, and Fourth Quarter 2010 Quarterly Operations and Monitoring Reports for Modesto Superfund Site (URS; May, August, November 2010 and February 2011),
- First, Second, Third, and Fourth Quarter 2011 Quarterly Operations and Monitoring Reports for Modesto Superfund Site (URS; May, August, November 2011 and February 2012),
- First, Second, and Third Quarter 2012 Quarterly Operations and Monitoring Reports for Modesto Superfund Site (URS; May, August, and November 2012),
- Spreadsheet containing unpublished groundwater elevation data for Fourth Quarter 2012, Modesto Site (USACE Sacramento District, January 2013), and
- Interim Groundwater Extraction Well Installation Report (Draft), Modesto Groundwater Superfund Site, Modesto, California (URS, September 2012).

PCE is the Site contaminant of potential concern (COPC) due to its historical widespread presence in soil, soil gas, and groundwater. The IROD noted an elevated toluene concentration of 13,200 ug/L at well MW-8A during the Phase III RI, and this chemical is listed as a "Site contaminant of concern" in Table B1 of the latest quarterly O&M report (URS 2012). However, toluene was not detected at MW-8A during the latest (August 2012) quarterly monitoring event. Other contaminants including trichloroethene (TCE), cis-1,2-dichloroethene (cis-DCE), and chloroform have also been reported; however, these chemicals were either not detected above their method detection limit or infrequently detected at concentrations below regulatory limits in Site samples. Uranium in groundwater is elevated at the Site but is naturally occurring and is not a Site COPC. For these reasons, only PCE is further evaluated as a COPC in this memorandum.

Trend Evaluation Method

Trends in analytical monitoring data were evaluated using the Mann-Kendall test, a non-parametric statistical procedure that is well suited for analyzing trends in data over time. This test does not require any assumptions as to the type of statistical distribution of the data (e.g. normal, lognormal, etc.) and can be used with data sets which include irregular sample intervals and missing data. Trend results are reported as one of six possibilities: increasing, probably increasing, no trend, stable, probably decreasing, or decreasing.

Increasing trends are the result of the Mann-Kendall Statistic (s) being greater than 0 and >95% confidence in trend. Probably increasing trends result when s>0 and the confidence in trend is between 90-95%, while no trend is the result of when s>0 and confidence in trend is <90% or s≤0, confidence in trend is <90%, and the coefficient of variation (COV) is ≥1. Trends are determined to be stable when s≤0, confidence is <90%, and COV<1. Trends are probably decreasing when s<0 and confidence is 90-

95%, while they are determined as decreasing when s<0 and confidence is >95%. Note that trend analysis summary tables are included at the end of this memorandum for groundwater and soil vapor well data.

The resultant trend assignment is summarized in the following table.

Trend Status	Mann-Kendall Statistic (s)	Confidence (1 minus P-value)	Coefficient of Variation (COV)
Increasing	>0	>95%	Value not relevant
Probably Increasing	>0	90-95%	Value not relevant
No Trend	>0	<90%	Value not relevant
No Trend	≤0	<90%	≥1
Stable	≤0	<90%	<1
Probably Decreasing	<0	90-95%	Value not relevant
Decreasing	<0	>95%	Value not relevant

Groundwater

Hydraulic Data

The primary goal of the hydraulic data evaluation was to attempt to determine the empirical capture zone of new extraction well EW-02 and to compare to the most recent plume map to see how well the plume is being captured. To conduct such an evaluation, the latest published results of the remedial contractor, from the Third Quarter 2012 monitoring event in August 2012, was not adequate because equilibrium groundwater flow conditions had yet to be established for EW-02. This is because EW-02 was installed in June 2012, but not brought online until September 2012. Approximately three months later in December 2012, the first groundwater elevation measurements were collected subsequent to full-time operation of EW-02. The groundwater potentiometric map was expected to change to show capture associated with EW-02 as opposed to EW-01R based on the published results from August 2012.

Modesto municipal wells currently operating in the vicinity of the Site continue to impart an effect on the Site's hydraulic gradient. There are reportedly as many as 26 municipal wells within a one mile radius of the Site. Modesto Municipal Wells 06 and 07 are located approximately 900 and 600 feet southeast and southwest, respectively, from the downgradient plume extent.

Based on the December 2012 hydraulic data set, the horizontal groundwater gradient computed for the A-zone away from the direct influence of EW-02, and considering municipal well influences, was 0.0017 ft/ft to the southeast, and is consistent with previously measured gradient conditions. For the B-zone it was 0.0011 ft/ft to the southeast. Since EW-02 had little to no influence on B-zone conditions as evidenced by the lack of deflection of the groundwater elevation contours around this well, C-zone gradients were not determined for this evaluation.

EW-02 impacts A-zone groundwater flow in the vicinity of this well, as shown in Figure 1, since it draws water directly from this zone. It has been assumed EW-02 was continuously pumped at 46 gallons per minute (gpm) based on recommendations in the EW-02 installation and testing report (URS, September 2012). Figure 2 shows that there is little to no influence of EW-02 on the deeper aquifer zones. Review of A-zone groundwater elevation differences between EW-02 (39.75 ft) and the nearest monitoring well MW-04A (47.04 ft) located about 75 feet away indicate a relatively steep cone of depression surrounding EW-02. Steep cones of depression correlate to smaller radii of influence due to either low-permeability formations, inefficient extraction, or both. Recent Site investigations determined the stratigraphy of the A zone in and around MW-04A and EW-02 to possess finer-grained sediments which

would cause the steeper cone of depression. This is also supported by the low well efficiency of 33.5% estimated from constant-rate test data (EW-02 Installation Report, URS September 2012).

If the water table were flat, an extraction well's capture zone would be circular and would be equal to its cone of depression. Because the water table slopes downward to the southeast, the capture zone of EW-02 is elongated, extending slightly downgradient of the pumping well and extending to the nearest groundwater divide (assuming steady-state conditions) in the upgradient direction. The estimated empirical capture zone for EW-02 based on December 2012 groundwater elevation data is depicted on Figure 1. At its maximum width in the upgradient direction, the capture zone is about 700 ft wide. At the location of EW-02, the capture zone width perpendicular to flow is about 470 ft. The distance between EW-02 and its downgradient stagnation point was estimated to be approximately 220 ft.

Figure 1 also shows the latest plume map (August 2012) superimposed onto the potentiometric contour map and the EW-02 capture zone. For comparison purposes, the capture zone determined for EW-01R prior to shut-down is shown on the figure as well. It is evident that EW-02 is capturing more of the higher dissolved-concentration PCE plume than EW-01R did; however, the easternmost portion of PCE greater than 1,000 ug/L may still not be captured. The EW-02 capture zone extends approximately 175 feet east of EW-02, while the 1,000 ug/L PCE contour extends about 475 feet east of this well. However, the capture zone does appear to fully encompass the source area and thus well EW-02 achieves the source control RAO for the A zone.

Analytical Data

Analytical groundwater data were reviewed for all on-site wells from which data were collected during the period of review. The nine wells installed in 2011 had only 4 sample results; two of the nine (MW-22A and MW-27B) had no detections of PCE. The 38 monitoring wells for which data were evaluated were: monitoring wells MW-01A, MW-02A, MW-03A, MW-04A, MW-05A, MW-06A, MW-07A, MW-08A,MW-10A, MW-11A, MW-12A, MW-13A, MW-14A, MW-15A, MW-16A, MW-17A, MW-18A, MW-19A, MW-20A, MW-23A, MW-04B, MW-09B, MW-10B, MW-16B, MW-17B, MW-19B1, MW-20B, MW-24B, MW-25B, MW-26B, MW-27B, MW-28B, MW-29B, MW-04C, MW-10C, MW-16C, MW-17C, and MW-20C. Of the 38, 20 were A zone wells, 13 were B zone wells, and 5 were C zone wells. Note that the number of wells more than doubled between the last FYR and this review, from 15 to 40. Additionally, data were reviewed for extraction well EW-01R, which ceased operation in August 2012.

The groundwater analytical data were divided into two areas, that of source area and dissolved-phase PCE plume. The distinction was made to separately address the RAOs concerning source control and the larger-scale, dissolved-phase groundwater contaminant plume.

<u>Source Area</u>

The source area is considered the original location of highest soil and soil gas PCE concentrations associated with PCE leaks from the dry cleaners and private-to-public sanitary sewer connection behind the cleaners. Source area groundwater wells are considered to be laterally within a loosely-defined 150 foot buffer from the soil and soil gas source areas, which consist of: MW-03A, MW-05A, MW-08A, MW-09B, and EW-01R.

PCE trends at the source area wells between August 2008 and August 2012 generally were either stable or decreasing. MW-08A showed no trend with respect to PCE concentrations over this time period. Data from well MW-09B was determined to be stable. MW-03A and MW-05A both showed decreasing trends. MW-03A exhibited a PCE concentration of 42 ug/L in August 2012, down from 1,300 ug/L in August 2008. MW-05A exhibited a PCE concentration of 51 ug/L in August 2012, down from a high of

300 ug/L in November 2009. MW-05A is the closest groundwater monitoring location to the soil vapor extraction system that was expanded in 2008 and had a positive impact on decreasing soil vapor PCE concentrations. Overall, PCE concentrations within source area A zone wells are in the 5 to 50 ug/L range. This is evidence of significant progress in the source area through the withdrawal of source-area groundwater at EW-01R. Decreases in PCE in source area groundwater may also be attributed to advective and dispersive processes transporting the contaminant with groundwater in the downgradient direction. In the B zone beneath the source area at well MW-9B, PCE currently fluctuates from about 4 to 14 ug/L.

PCE results at extraction well EW-01R showed a slow but steady, statistically significant decreasing trend between January 2009 and August 2012. This well was sampled monthly as part of the groundwater extraction and treatment system. PCE decreased during this period from almost 200 ug/L to under 100 ug/L. EW-01R was shut off in August 2012, with A zone extraction shifting to the newly installed EW-02 located in a higher-concentration, downgradient portion of the plume.

Dissolved-Phase Plume

PCE was present above 5 ug/L at 11 of 17 evaluated A zone wells not considered source area wells. All A zone wells hydraulically upgradient of the source area had either stable trends results (MW-07A, MW-11A, MW-15A) or decreasing trends (MW-01A, MW-02A). MW-18A, near the downgradient extent but west of the plume axis, had a decreasing trend, although all results were below 5 ug/L since August 2008. Within the central to slightly distal portions of the PCE plume, trends were variable, ranging from stable at MW-04A, no trend at MW-06A, and decreasing trend at MW-10A. The A zone wells which define the PCE plumes lateral and distal extents, for the most part, had either stable trend results (MW-13A) or no trends (MW-16A, MW-17A, MW-19A, MW-23A). There were two exceptions – MW-14A and MW-20A.

In the Third Quarter 2012 monitoring report, the A zone PCE plume is depicted to bifurcate, with a small, disconnected PCE lobe centered on well MW-23A to the west of the main plume (Figure 1). The well defining the lower concentration point within the two lobes is MW-14A. This well had an increasing trend. PCE has fluctuated between lows of around 2 ug/L to highs upwards of 25 ug/L at MW-14A, with the highs primarily in the second and third quarters (May and August) each year. The seasonal variability is likely related to on/off cycles of nearby municipal wells. MW-20A, located on the distal downgradient edge of the plume, had a probably increasing trend.

PCE was present above 5 ug/L at 9 of 12 evaluated B zone wells not considered source area wells. The Mann-Kendall trend test results indicated that all evaluated wells except MW-16B, MW-17B, and MW-20B in the B zone were either stable or had no PCE trend over the period evaluated. MW-20B, located in the approximate center of the B zone PCE plume, showed a decreasing trend. PCE at this well has dropped from 160 ug/L in November 2008 to 57 ug/L in August 2012. Results showed an increasing trend at MW-16B, located on the lateral-to-downgradient edge of the B zone PCE plume. Recent PCE results from the last three quarters at well MW-16B have increased from about 2 to 24 ug/L; therefore this is an area that should be closely watched during future sampling events. MW-17B showed a probably increasing trend. This well is also located in a lateral to downgradient direction from the plume axis and should be closely watched.

PCE was present above 5 ug/L at only 2 of 5 evaluated C zone wells during the monitored period (MW-04C and MW-20C), and at each of these wells only one sample was above 5 ug/L during the period of interest. All wells except one in the C zone showed either no trend (MW-04C, MW-16C, MW-20C) or stable trend (MW-10C). MW-17C had a probably decreasing trend result.

Groundwater Extraction and Treatment System Operational Data

EW-01R replaced EW-01 and was in operation from August 2006 to August 2012. EW-02 was installed to more effectively capture and contain the highest concentration portion of the PCE plume, and beginning in September 2012 EW-01R ceased operation and was replaced by operation of EW-02. Since the Third Quarter 2012 O&M Report only describes sampling and Site operations up to September 2012, no operational data has been reported for EW-02.

During this FYR reporting period (Fourth Quarter 2008 through Third Quarter 2012), the groundwater treatment system (GWTS) has operated with an overall up time of 95 percent. The only significant prolonged system shutdown was during late Second Quarter 2012 to early Third Quarter 2012, when the system was down to replace the GWTS effluent pump. From August 2001 to September 2012, the GWTS had treated approximately 199 million gallons of water and removed approximately 518 pounds of PCE.

All GWTS effluent samples for this reporting period (Fourth Quarter 2008 through Third Quarter 2012) met applicable discharge criteria for PCE. Discharge criteria were met for uranium except during the Fourth Quarter 2010. At that time, resin was replaced in the primary ion exchange vessel because of a measured increase in uranium to just above 20 pCi/L.

Soil Vapor

Analytical Data

All soil vapor data that has been evaluated is considered source area data since the locations of all vapor monitoring and extraction wells are within close proximity of the historical PCE release locations. Since the last FYR, EPA has installed three SVE extraction wells SVE-02, SVE-03 and SVE-04, which are currently operating. SVE-01 was disconnected from the SVE extraction system and converted to a vapor monitoring well in 2008.

SVE data analyzed included that from the three SVE extraction wells from November 2008 to August 2012. Data evaluation also included nine vapor monitoring wells for the same period: SVE-01, DP-01A, DP-01B, DP-05A, DP-05B, DP-06A, DP-06B, OSVE-10, and OSVE-11. Data were collected approximately every quarter.

Data from vapor monitoring wells were statistically evaluated using the Mann-Kendall test for trend. Results from the vapor monitoring wells showed only one statistically significant trend, which occurred at well OSVE-11. Data from OSVE-11 since March 2009 showed a decreasing trend. PCE soil vapor concentration at OSVE-11 was exceptionally high in March 2009, with a concentration measured at 27,000 ppbv. One year later in March 2010, concentration had decreased to 130 ppbv, and by August 2012 the concentration had further declined to 21 ppbv. Four wells showed no trends (DP-01A, DP-01B, DP-05B, and DP-06A) while two wells showed stable trends (SVE-01, OSVE-10). Two wells (DP-05A, DP-06B) contained more than 50% non-detects for PCE vapor hence were not statistically evaluated.

Results from the vapor extraction wells showed one decreasing trend (SVE-04), one probably decreasing trend (SVE-02) and one well, SVE-03, with no trend. PCE concentrations in vapor from SVE-04 showed a steady decline from 890 ppbv in November 2008 to 35 ppbv in August 2012. At SVE-02, PCE concentration at the start of the data set was 14,000 ppbv. Concentration declined drastically between 2008 and 2009. In August 2012 the concentration was 380 ppbv. The initial high PCE concentrations coupled with the decreasing and probably decreasing trends are evidence that the newly installed soil vapor extraction wells removed the bulk of contaminant mass soon after they became operational.

Soil Vapor Extraction and Treatment System Operational Data

During this FYR reporting period (Fourth Quarter 2008 through Third Quarter 2012), the SVE system has operated with an overall up time of greater than 99 percent. From June 2001 to September 2012, total cumulative PCE mass removed through the SVE system was approximately 3,465 pounds. This amount continues to be significantly greater than the total mass removed via the groundwater treatment system.

There was a transient spike in SVE system influent PCE concentration after new SVE wells SVE-02, SVE-03, and SVE-04 came online in November 2008. Prior to system redesign, December 2007 data revealed influent concentration of 54 ppbv, although measurements were as low as 4.4 ppbv in September 2007. In November 2008, after new wells were brought online, influent concentration was measured at 4,100 ppbv. This showed the new wells to be effective at extracting contaminant mass from soil via the vapor pathway. Latest sampling results show treatment system influent PCE concentrations ranging from 190 to 650 ppbv during Third Quarter 2012.

All SVE system effluent samples for this FYR reporting period (Fourth Quarter 2008 through Third Quarter 2012) met applicable discharge criteria for PCE with the exception of Fourth Quarter 2009, and First and Second Quarters 2010, when effluent concentrations ranged from 4 to 130 ppbv PCE. Vapor phase GAC was changed out prior to Third Quarter 2010, and discharge criteria have been met since that time.

Conclusions

With respect to progress towards meeting the RAOs established in the IROD, the following conclusions are made regarding the evaluation of groundwater, soil vapor, groundwater extraction and treatment system, and soil vapor extraction and treatment system operational data in support of the Second FYR:

- New extraction well EW-02, assumed to be operating continuously at 46 gpm which is near the maximum GWTS capacity of 50 gpm, is capturing more of the high concentration PCE remaining in groundwater than EW-01R did because it is more centrally located over the bulk of remaining dissolved phase mass. The capture zone of EW-02 appears to fully encompass the former PCE source area. Future quarterly groundwater monitoring results may be used to further evaluate EW-02 effectiveness both for hydraulic source control and reductions in concentrations throughout the plume.
- It appears the PCE plume has been adequately characterized, with possibly minor data gap areas remaining. 25 groundwater monitoring wells have been installed since the last FYR, and the number of wells now totals 40. In addition to the A zone, B and C aquifer zones have been characterized and delineated with respect to the PCE plume. .
- Within the A zone, recent data demonstrate decreasing trends generally upgradient and within the source area. Two locations show decreasing trends downgradient of the source area; however, a third location downgradient of the source area is probably increasing. Trends in data are likely to be in flux in the immediate future as impacts from operation of EW-02 have yet to be realized in groundwater data.
- In monitoring of B zone groundwater, careful observation of future quarterly data should be given to wells MW-16B and MW-17B, where PCE concentrations have been on the rise.
- Optimization of the SVE system by installing three new SVE extraction wells has had some positive effect on removing contaminant mass from the soil in the source area and in lowering soil vapor concentrations. Soil vapor in several wells still exceeds 200 ppbv. Other mitigating measures conducted, such as the response action at the Parts House, and Halford's cessation of using PCE, have contributed to mitigate risk to acceptable levels in indoor air within Halford's Cleaners and the Parts House.

- Both SVE and GWT systems are currently meeting applicable discharge requirements with respect to VOCs, including PCE, and uranium.
- While PCE remains above the MCL of 5 ug/L, the interim RAOs pertaining to source control and plume delineation and migration assessment have been largely achieved based on actions taken at the Site prior to and since the last FYR. Operation of the interim remedy and associated monitoring will continue. The final ROD will set new RAOs to achieve applicable cleanup levels through a selected final remedy for the Site.

MAROS Mann-Kendall Statistics Summary

Project: Modesto Superfund Site **User Name:** Blair C. Kinser

Location: Modesto **State:** California

Time Period: 8/19/2008 **to** 8/10/2012
Consolidation Period: Quarterly
Consolidation Type: Geometric Mean
Duplicate Consolidation: Maximum
ND Values: Detection Limit
J Flag Values : Actual Value

Well	Source/ Tail	Number of Samples	Number of Detects	Coefficient of Variation	Mann-Kendall Statistic	Confidence in Trend	All Samples "ND" ?	Concentration Trend
TETRACHLOROETHYLENE(PCE)								
MW-01A	T	17	17	0.25	-55	98.8%	No	D
MW-02A	T	17	17	0.16	-54	98.6%	No	D
MW-03A	S	17	17	0.55	-43	95.8%	No	D
MW-04A	S	17	17	0.54	-24	82.6%	No	S
MW-04B	S	16	16	0.72	4	55.3%	No	NT
MW-04C	S	16	8	2.10	-26	86.7%	No	NT
MW-05A	T	17	17	0.49	-51	98.1%	No	D
MW-06A	T	16	16	1.17	8	62.2%	No	NT
MW-07A	T	16	3	0.54	-10	65.5%	No	S
MW-08A	T	17	17	0.47	16	72.9%	No	NT
MW-09B	T	17	17	0.83	-27	85.6%	No	S
MW-10A	T	17	17	0.61	-95	100.0%	No	D
MW-10B	T	16	16	0.26	-7	60.5%	No	S
MW-10C	T	16	3	0.80	-28	88.6%	No	S
MW-11A	T	17	17	0.45	-1	50.0%	No	S
MW-12A	T	17	17	0.21	-84	100.0%	No	D
MW-13A	T	17	17	0.82	-20	78.0%	No	S
MW-14A	T	17	17	0.87	56	98.9%	No	I
MW-15A	T	17	4	0.24	-20	78.0%	No	S
MW-16A	T	16	2	1.27	-2	51.8%	No	NT
MW-16B	T	16	16	1.11	38	95.2%	No	I
MW-16C	T	16	6	1.71	17	76.1%	No	NT
MW-17A	T	16	14	1.28	7	60.5%	No	NT
MW-17B	T	16	16	0.37	30	90.3%	No	PI
MW-17C	T	16	5	1.25	-36	94.2%	No	PD
MW-18A	T	16	16	0.22	-39	95.7%	No	D

MAROS Mann-Kendall Statistics Summary

Project: Modesto Superfund Site **User Name:** Blair C. Kinser

Location: Modesto **State:** California

TETRACHLOROETHYLENE(PCE)

Well	Source/ Tail	Number of Samples	Number of Detects	Coefficient of Variation	Mann-Kendall Statistic	Confidence in Trend	All Samples "ND" ?	Concentration Trend
MW-19A	T	16	6	2.96	-22	82.5%	No	NT
MW-19B1	T	16	12	1.21	-24	84.7%	No	NT
MW-20A	T	16	16	0.41	35	93.6%	No	PI
MW-20B	T	16	15	0.42	-66	99.9%	No	D
MW-20C	T	16	4	3.88	-10	65.5%	No	NT
MW-21A	T	4	4	0.22	-2	62.5%	No	S
MW-22A	T	4	0	0.00	0	37.5%	Yes	ND
MW-23A	T	4	4	0.20	3	72.9%	No	NT
MW-24B	T	4	4	0.31	-2	62.5%	No	S
MW-25B	T	4	4	0.17	-1	50.0%	No	S
MW-26B	T	4	2	0.22	5	89.6%	No	NT
MW-27B	T	4	0	0.00	0	37.5%	Yes	ND
MW-28B	T	4	4	0.11	-4	83.3%	No	S
MW-29B	T	4	4	0.39	-5	89.6%	No	S

Note: Increasing (I); Probably Increasing (PI); Stable (S); Probably Decreasing (PD); Decreasing (D); No Trend (NT); Not Applicable (N/A)-Due to insufficient Data (< 4 sampling events); Source/Tail (S/T)

The Number of Samples and Number of Detects shown above are post-consolidation values.

MAROS Mann-Kendall Statistics Summary

Project: Modesto Superfund Site **User Name:** Blair C. Kinser

Location: Modesto **State:** California

Time Period: 8/19/2008 **to** 8/10/2012
Consolidation Period: Quarterly
Consolidation Type: Geometric Mean
Duplicate Consolidation: Maximum
ND Values: Detection Limit
J Flag Values : Actual Value

Well	Source/ Tail	Number of Samples	Number of Detects	Coefficient of Variation	Mann-Kendall Statistic	Confidence in Trend	All Samples "ND" ?	Concentration Trend
TETRACHLOROETHYLENE(PCE)								
SVE-01	T	11	11	0.73	-2	53.0%	No	S
SVE-02	T	16	16	1.71	-36	94.2%	No	PD
SVE-03	S	16	16	1.35	9	63.9%	No	NT
SVE-04	T	16	14	1.43	-69	99.9%	No	D

Note: Increasing (I); Probably Increasing (PI); Stable (S); Probably Decreasing (PD); Decreasing (D); No Trend (NT); Not Applicable (N/A)-Due to insufficient Data (< 4 sampling events); Source/Tail (S/T)

The Number of Samples and Number of Detects shown above are post-consolidation values.

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Release 352, September 2012

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Additional Mann-Kendall Statistics Summary

for wells not included in MAROS data set

Project: Modesto Groundwater Superfund Site, Modesto, California
Time Period: 1/30/2009 to 8/8/2012
Analyte: PCE
Non-detect Values: Use Detection Limit
J Flag Values: Use Actual Value

Groundwater Well ID	# Samples	# Detects	Coefficient of Variation	Mann-Kendall Statistic	Confidence in Trend	All Samples "ND"?	Concentration Trend
EW-01R	45	45	0.17	-447	>95%	No	Decreasing
SVE Monitoring Well ID	# Samples	# Detects	Coefficient of Variation	Mann-Kendall Statistic	Confidence in Trend	All Samples "ND"?	Concentration Trend
DP-01A	11	11	1.08	10	<90%	No	No Trend
DP-01B	11	9	1.25	-6	<90%	No	No Trend
DP-05A	9	3	n/a	n/a	n/a	No	Not evaluated
DP-05B	9	5	1.13	-14	<90%	No	No Trend
DP-06A	11	11	1.02	2	<90%	No	No Trend
DP-06B	11	2	n/a	n/a	n/a	No	Not evaluated
OSVE-10	12	12	0.91	-4	<90%	No	Stable
OSVE-11	12	12	3.40	-32	>95%	No	Decreasing

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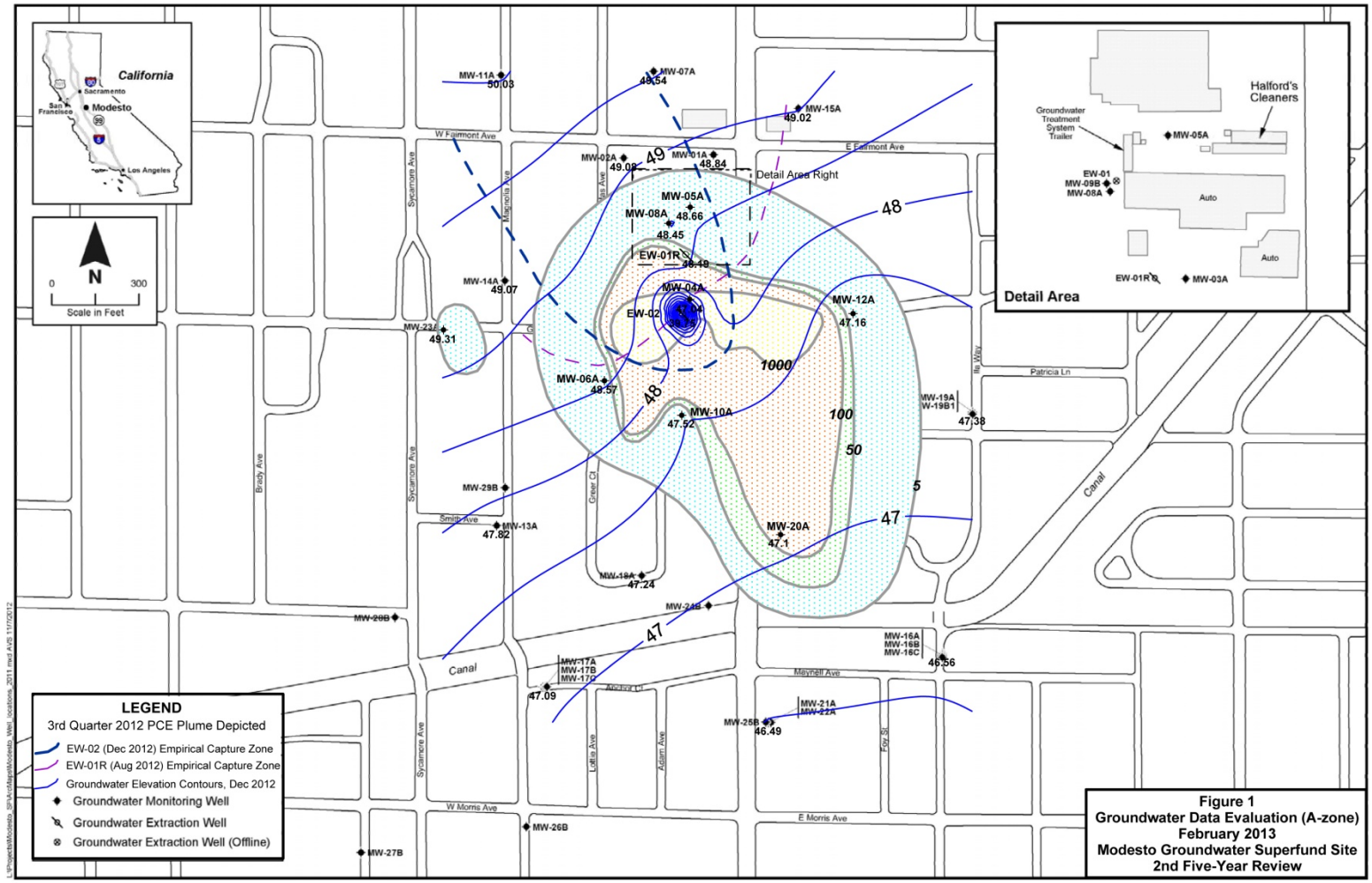

Basemap and plume depiction from Third Quarter 2012 O&M Report (URS 2012)

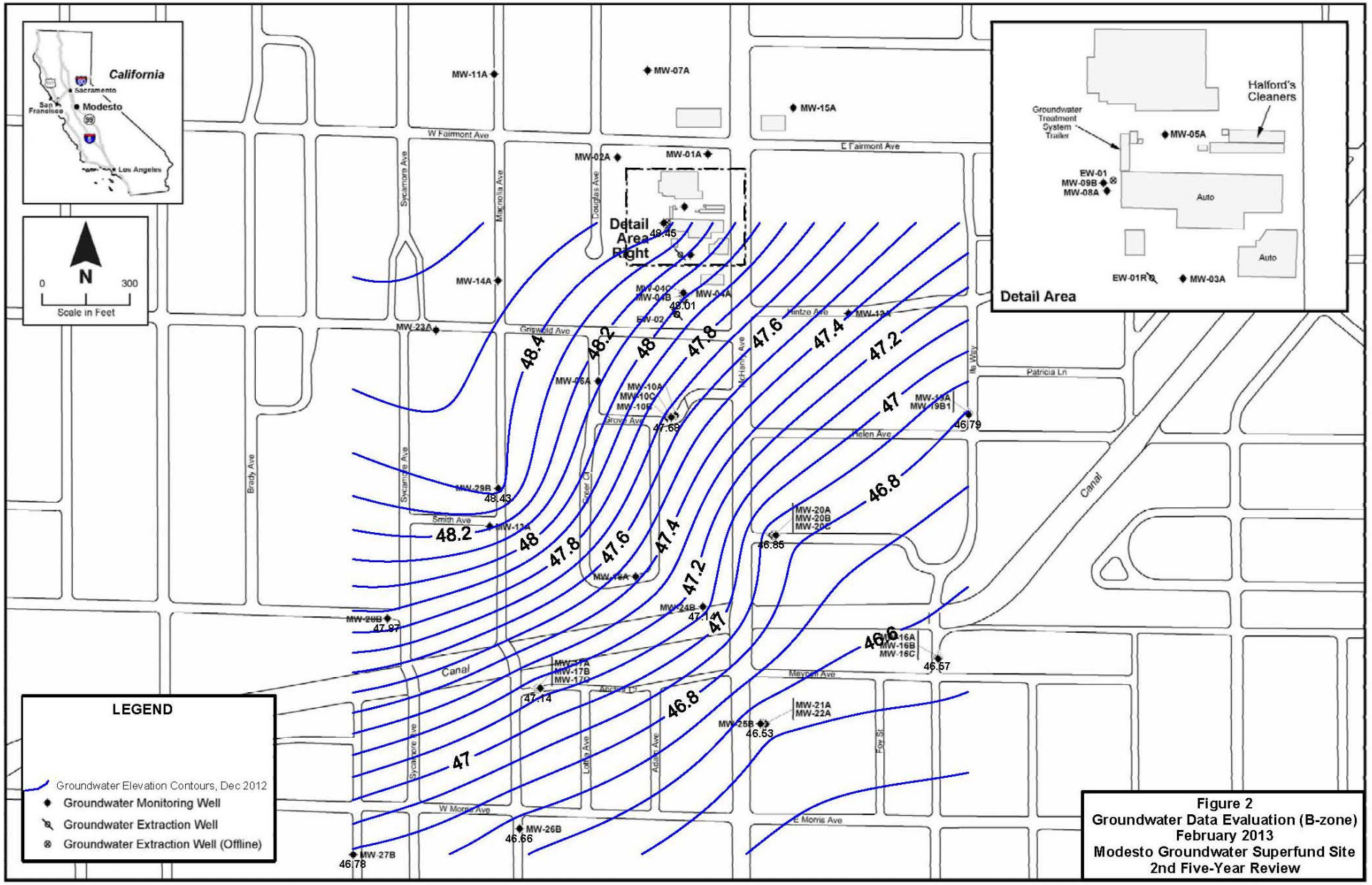

Figure 2
Groundwater Data Evaluation (B-zone)
February 2013
Modesto Groundwater Superfund Site
2nd Five-Year Review

Basemap from Third Quarter 2012 O&M Report (URS 2012)