FOURTH FIVE-YEAR REVIEW REPORT FOR FRESNO MUNICIPAL SANITARY LANDFILL SUPERFUND SITE FRESNO COUNTY, CALIFORNIA

PREPARED BY

U.S. Army Corps of Engineers, Seattle District

FOR

U.S. Environmental Protection Agency

Region IX

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Executive Summary

This is the fourth Five-Year Review of the Fresno Municipal Sanitary Landfill Superfund Site (Site) located in Fresno, 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 Site consists of approximately 145 acres in a primarily agricultural area of the San Joaquin Valley, located four miles southwest of the City of Fresno in Fresno County, California. In the 1993 Record of Decision (ROD), the U.S. Environmental Protection Agency (EPA) selected the remedy to address landfill closure and source control, including landfill gas. The landfill remedy consists of a landfill cover and a landfill gas management system that monitors, collects, and destroys volatile organic compounds. In the 1996 ROD, EPA selected the remedy to address contaminated groundwater. The groundwater remedy consists of groundwater monitoring, groundwater extraction and treatment via packed tower aeration, and institutional controls. In 2012, EPA issued an Explanation of Significant Differences to provide notice of several modifications and clarifications, which did not fundamentally change the previously selected remedies. The contaminants of concern for the Site are volatile organic compounds in groundwater and soil gas.

There have been no changes to chemical-specific Applicable or Relevant and Appropriate Requirements (ARARs), and no new promulgated standards have been implemented since the 2015 Five-Year Review. Toxicity values for several contaminants have changed since the RODs, although all ROD cleanup levels continue to be protective. All exposure pathways identified in the ROD are still valid and are currently incomplete.

The remedy for the landfill/source control continues to operate and function as designed and is currently protective of human health and the environment. The landfill cover prevents direct exposure to the landfill contents, and the gas extraction and treatment system controls exposure to landfill gas. However, landfill perimeter gas is currently only monitored for methane, and may not accurately represent the risk of lateral volatile organic compounds soil gas migration from the landfill. In order to be protective in the long-term, perimeter gas monitoring must be expanded to include volatile organic compounds.

The groundwater remedy continues to extract groundwater from the subsurface and remove contaminants through packed tower aeration as designed and is currently protective of human health and the environment. The lateral areal extent of the plume is decreasing, and for a majority of wells across the Site, concentrations of site contaminants are decreasing. Some wells, including those located closest to extraction wells or adjacent to the unlined landfill, appear to have increasing contaminants concentrations. While remedial actions in groundwater have prevented the plume from moving downgradient and affecting previously uncontaminated groundwater resources, current monitoring data appears to indicate vertical migration of contaminants into the D-zone aquifer. The groundwater response from the Phase 3 Remedial Action should continue to be monitored to ensure that existing extraction wells are stabilizing contaminant migration into these zones.

The remedy for the Fresno Sanitary Landfill Superfund Site is currently protective of human health and the environment as all exposure pathways are being controlled. The landfill cover prevents direct exposure to the landfill contents, and the gas extraction and treatment system controls exposure to landfill gas. The groundwater extraction and treatment system and the well installation restrictions prevent

exposure to contaminated groundwater. However, in order for the remedy to be protective in the long-term, perimeter gas monitoring must be expanded to include volatile organic compounds.

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List of Abbreviations

1,1-DCE	1,1-dichloroethene
1,1-DCA	1,1-dichloroethane
1,2-DCA	1,2-dichloroethane
1,2-DCP	1,2-dichloropropane
1,2-DCB	1,2-dichlorobenzene
1,4-DCB	1,4-dichlorobenzene
µg/L	micrograms per liter
ARAR	Applicable or Relevant and Appropriate Requirement
bgs	below ground surface
CA	State of California
cDCE	cis-1,2-dichloroethene
CERCLA	Comprehensive Environmental Response, Compensation, and Liability Act
CFR	Code of Federal Regulations
DTSC	State of California Department of Toxic Substances Control
EPA	United States Environmental Protection Agency
ESD	Explanation of Significant Differences
ft.	feet
MCL	maximum contaminant level
NPL	National Priorities List
O&M	Operations and Maintenance
PCE	tetrachloroethene
Site	Fresno Municipal Sanitary Landfill Superfund Site
ROD	Record of Decision
RWQCB	Regional Water Quality Control Board
TCE	trichloroethene
tDCE	trans-1,2-dichloroethene
USACE	United States Army Corps of Engineers

1. Introduction

The purpose of a five-year review 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 reviews are documented in five-year review reports. In addition, five-year review reports identify issues found during the review, if any, and document recommendations to address them.

The U.S. Environmental Protection Agency (EPA) is preparing this Five-Year Review pursuant to the Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA) Section 121, 40 Code of Federal Regulation (CFR) Section 300.430(f)(4)(ii) of the National Contingency Plan and EPA policy.

This is the fourth Five-Year Review for the Fresno Municipal Sanitary Landfill Superfund Site (Site). The triggering action for this statutory review is the previous Five-Year Review dated August 31, 2015. The Five-Year Review has been prepared because hazardous substances, pollutants, or contaminants remain at the Site above levels that allow for unlimited use and unrestricted exposure.

The Site consists of two Operable Units, the landfill closure and source control, Operable Unit 1, and impacted groundwater, Operable Unit 2, both of which will be addressed in this Five-Year Review.

The Fresno Municipal Sanitary Landfill Superfund Site Five-Year Review was led by Cynthia Ruelas, EPA Region 9 Remedial Project Manager. Participants included Cynthia Wetmore, EPA Region 9; David Clark, USACE Fort Worth District; and Justin McNabb, USACE Seattle District hydrogeologist. The review began on November 11, 2019.

Table 1. Five-Year Review Summary Form

SITE IDENTIFICATION		
Site Name: Fresno Municipal Sanitary Landfill Superfund Site		
EPA ID: CAD980636914		
Region: 9	**State:** CA	**City/County:** Fresno/Fresno
SITE STATUS		
NPL Status: Final		
Multiple OUs? Yes	**Has the Site achieved construction completion?** No	
REVIEW STATUS		
Lead agency: EPA		
Author name (Federal or State Project Manager): Cynthia Ruelas		
Author affiliation: EPA Region 9		
Review period: 11/1/2019 - 8/30/2020		
Date of Site inspection: 1/22/2020		
Type of review: Statutory		
Review number: 4		
Triggering action date: 8/31/2015		
Due date *(five years after triggering action date)*: 8/31/2020		

1.1. Background

The Site is located four miles southwest of the City of Fresno (City) in Fresno County, California, at 1707 West Jensen Avenue (Figure 1). The Site consists of approximately 145 acres in a primarily agricultural area of the San Joaquin Valley. The Site is bound on the north by Jensen Avenue, on the east by West Avenue, on the south by North Avenue, and on the west by agricultural fields. Several residences are adjacent to the northern and southern boundaries. The landfill is capped and is fenced. Mixed-use recreational fields and facilities (The Fresno Regional Sports Complex) are located adjacent to the west and southwest portions of the landfill (Figure 2).

The City owns and operated the Fresno Municipal Sanitary Landfill as a Class III municipal landfill, as defined in the California Code of Regulations, Title 27, Chapter 3 (Criteria for all Waste Management Units, Facilities, and Disposal Sites). The landfill is reported to be the oldest compartmentalized municipal landfill in the Western United States. Operations began in the north section of the landfill in 1935. Short trenches were dug to a depth of 3 feet (ft.), eventually increased to a depth of 25 ft. Waste was dumped into one trench by collection trucks and the pile leveled off and compacted. A second trench was dug adjacent to the first trench, and the soil from the second trench was used to cover the waste located in the first trench. Over time, landfill refuse accumulated to an average height of 45 ft. above the surrounding grade. There are no records indicating that the landfill was lined.

The Fresno Municipal Sanitary Landfill received municipal solid waste from approximately 1935 to 1987. The average waste stream consisted of 16,500 tons per month. The total waste quantity is approximately 4.7 million tons (assuming an in-place refuse density of 1,200 pounds per cubic yard), or 7.9 million cubic yards.

1.2. Physical Characteristics

The actual landfill is slightly less than a mile long. Prior to closure and capping, landfill refuse averaged a height of 45 ft. above the surrounding grade. The surrounding terrain is flat and contains large areas of agricultural fields. The region typically experiences hot, dry summers and moderate winters. The Fresno Municipal Sanitary Landfill is not located near any environmentally sensitive areas, and the projected land use for the Site does not appear to be changing for the near future. Residential properties adjacent to the Site have domestic wells.

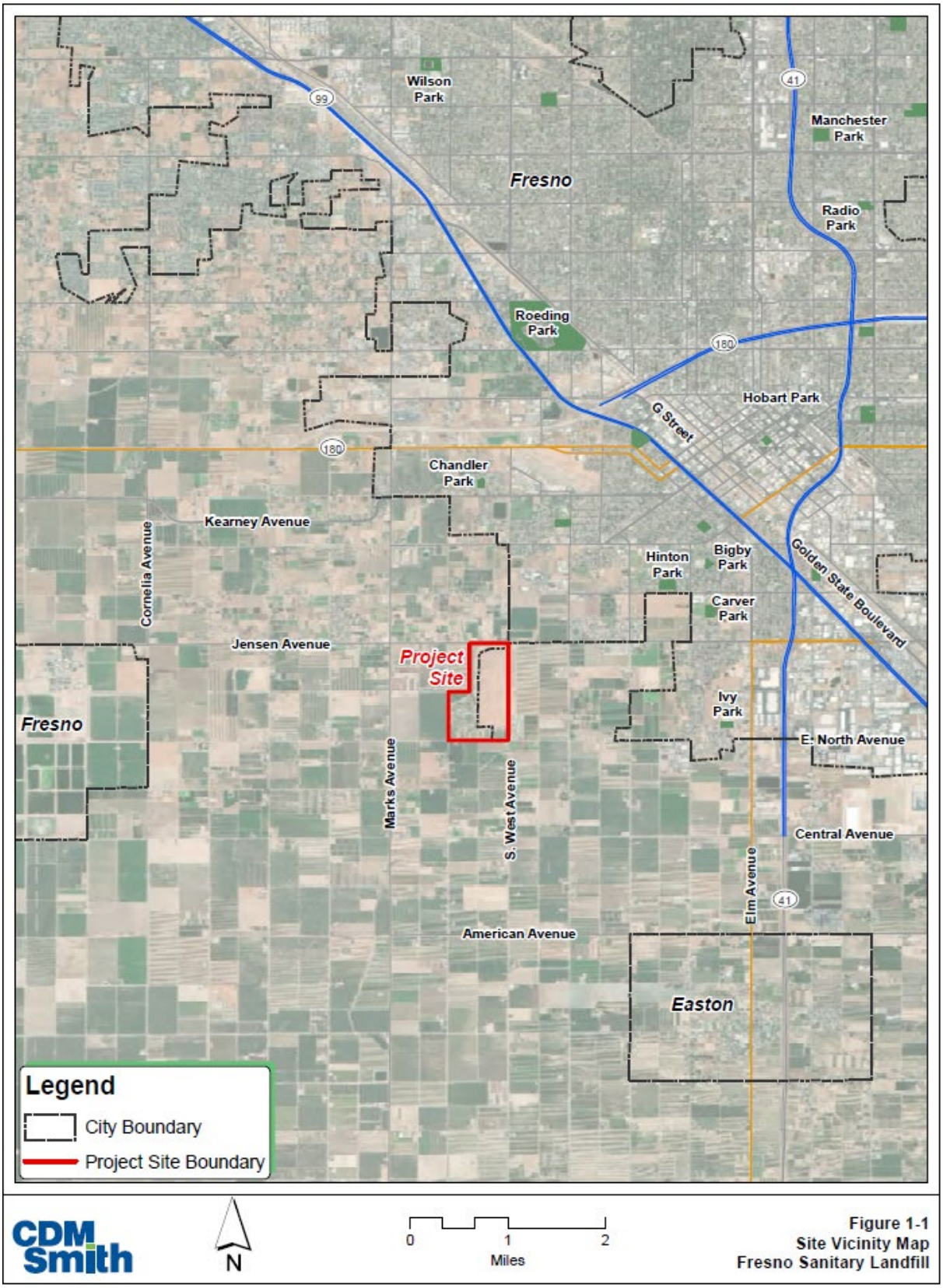


Figure 1. Location Map

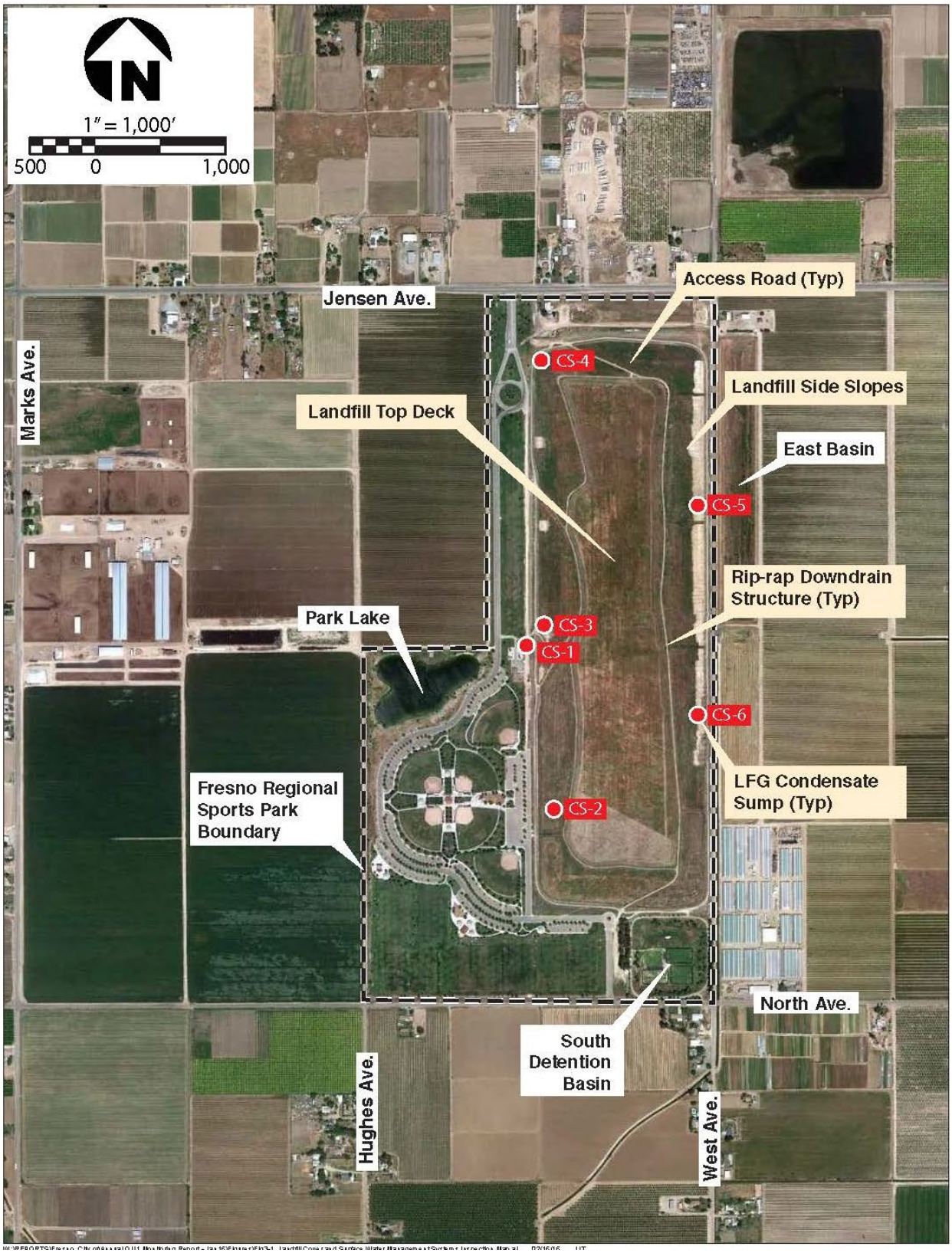


Figure 2. Fresno Sanitary Landfill Superfund Site Map

1.3. Hydrogeology

The Site is located in the San Joaquin Valley, which is in the southern portion of the Central Valley of California. The Central Valley is composed of alluvial plains, flood plains, and dissected uplands. Most groundwater originates as runoff from the Coast Ranges to the west and the Cascades and Sierra Nevada Ranges to the north and east, respectively.

The Central Valley is a structural trough approximately 400 miles long and 20 to 70 miles wide. The valley trough is up to 8,000 ft. thick. It is comprised of erosion-derived and continental sediments from the Coastal and Sierra Nevada mountain ranges, and marine sediments derived from past inland sea environments.

The geology under the Site consists of interbedded layers and lenses of clay, silt, sand, and gravels. These layers of Quaternary alluvium extend approximately 500 ft. below ground surface (bgs). The Riverbank and Turlock Lake geologic formations underlie the Site. The Riverbank Formation is younger and is located in the upper few hundred ft. of sediment in the Fresno area. The Riverbank Formation varies in thickness from 1 to 265 ft. and is described as predominantly sandy in texture. The Turlock Lake Formation varies in thickness from 165 ft. to 720 ft. and lies below the Riverbank Formation. The Turlock Lake Formation represents deposition as overbank sediments on the fluvial floodplain during periods of flooding when discharge exceeded river/stream channel capacity. The sequence coarsens upwards and contains fluvial sandstone with scattered pebbles overlying better-sorted, finer-grained floodplain siltstone.

Most groundwater in the area originates as runoff from distant mountains. Based on the vertically limited Site-specific hydrogeologic investigation, the primary hydrostratigraphic units identified beneath the Site consist of four water-bearing zones (A, B, C, and D- zone aquifers) with confining layers between each aquifer, as detailed below:

- A-zone aquifer with interbedded layers of fine to medium sand, silty sand, and silt (0 to 90 ft. bgs).
- B-zone aquifer with interbedded layers of fine to medium sand, silty sand, sandy silt, sandy clay, and clay (115 to 190 ft. bgs).
- C-zone aquifer with fine to medium sand and silty sand (215 to 250 ft. bgs).
- D-zone aquifer with interbedded sand and clay (270 to 300 ft. bgs).

Investigation into aquifers (water-bearing material) deeper than the D-zone aquifer has not been completed at the Site.

All the groundwater zones are classified as potential sources of drinking and/or irrigation water. The regional groundwater flow direction in this area is toward the southwest. In the immediate vicinity of the landfill, water flows in a southerly direction. Since the 1940s, the regional water table has steadily declined due to a combination of groundwater extraction and insufficient recharge; consequently, the A-zone aquifer wells are usually dry or produce insufficient yield to sample.

2. Remedial Actions Summary

2.1. Basis for Taking Action

The contaminants of concern for the Site are volatile organic compounds in groundwater and soil gas. The 1993 Record of Decision (ROD) identified methane as a proxy for volatile organic compounds in landfill gas directly above the landfill. The 1996 ROD identified sixteen chemicals as contaminants of concern for groundwater (Table 2).

Locally impacted groundwater aquifers associated with the landfill are a source of water for residential and agricultural wells. In 1994, both residential and agricultural wells were located near the known extent of the groundwater plume, which contained several contaminants that exceeded their corresponding maximum contaminant level (MCL) established in the Safe Drinking Water Act. The groundwater contamination, if left untreated, also presented a potential threat to the larger regional aquifer that provides the majority of municipal drinking water for the residents of the City of Fresno. Furthermore, in the Human Health Risk Assessment, EPA determined that nearby residents were potentially at risk of exposure to landfill gases via vapor intrusion.

2.2. Remedy Selection

In 1993, EPA issued a ROD to address the landfill source area and landfill gas. After completion of a Remedial Investigation in 1994, EPA issued a second ROD in 1996 to address the groundwater contamination. In 2012, EPA issued an Explanation of Significant Differences (ESD) to provide notice of several modifications and clarifications to the remedies selected in the 1993 and 1996 RODs. None of the changes in the ESD fundamentally affected the previously selected remedies.

2.2.1. Landfill - Source Control

In the 1993 ROD, EPA addressed remedial actions associated with the landfill but excluded the surrounding area. The selected remedy for the landfill consisted of the following major components:

- Landfill cover system to minimize water infiltration, provide erosion control, and act as a barrier to fugitive landfill gas emissions.
- Landfill gas migration monitoring system consisting of monitoring probes along the landfill perimeter.
- Landfill gas collection and conveyance system that includes interior gas extraction wells, perimeter gas extraction wells, a blower system, and a piping system to move the landfill gas to the treatment system.
- Landfill gas treatment system (flare) to combust landfill gas on-site.
- Landfill gas condensate collection system to manage condensate formed during conveyance of landfill gas.
- Contingency leachate collection system to be implemented if the leachate liquid found in the gas wells was determined to be a threat to groundwater.

In the 1993 ROD, EPA further identified the following performance requirements:

- Periodic emissions monitoring to assess the effectiveness of the system in meeting the destruction efficiency.
- Continued operation of the landfill gas extraction system until landfill gas production has declined to the extent that the landfill gas monitoring requirements (defined as a maximum concentration of 1000 parts per million (ppm) methane at the surface and a maximum of 5% methane at the perimeter monitoring wells) can be met without active landfill gas extraction.

2.2.2. Groundwater Remediation

The objective of the groundwater remedy is to prevent the plume underlying the landfill from moving downgradient and affecting previously uncontaminated groundwater resources and to restore the aquifers to beneficial use. Beneficial use is defined as when groundwater contaminant levels are at or below the cleanup levels for the 16 chemicals identified in the 1996 ROD and the 2012 ESD (Table 2).

In the 1996 ROD, EPA selected the remedy for groundwater, which consisted of the following major elements:

- Groundwater monitoring.
- Groundwater extraction via wells on western side of landfill.
- Treatment of extracted groundwater via packed tower aeration.
- Decommissioning of certain agricultural, irrigation supply wells, and residential supply wells.
- Institutional controls to restrict the installation of water supply wells in the impacted aquifer and limit Site access. Controls placed on the use of the groundwater pumped from existing wells screened in the contaminated aquifer.

In the 1996 ROD, EPA delineated a phased approach to make the best use of Site-specific hydrogeologic and geochemical data collected during the early phases of the groundwater Site remediation program, in order to implement later actions in the most efficient and effective manner possible. The ROD defined three distinct phases as follows:

- Phase 1 – Create a hydraulic barrier at the downgradient perimeter of the landfill to contain the contaminated groundwater below the landfill.
- Phase 2 – Install additional extraction wells to prevent the downgradient expansion of the groundwater plume.
- Phase 3 – Complete any remaining actions necessary to restore the aquifer to beneficial use.

In the 2012 ESD, EPA changed some of the cleanup standards for the Site (Table 2). In the 1996 ROD, EPA chose the less stringent federal MCL (100 micrograms/liter [µg/L]) as the applicable cleanup standard for tDCE. In the 2012 ESD, EPA selected the more stringent state MCL (10 µg/L). In the 1996 ROD, EPA also selected 100 µg/L as the cleanup level for chloroform. Between 1996 and 2012, the federal MCL changed to 80 µg/L, and in the 2012 ESD, EPA selected the more stringent federal MCL.

Table 2. Site Cleanup Levels

Contaminant of Concern	Cleanup Levels (µg/L)	Basis for Standard
Trichloroethene (TCE)	5	Federal MCL
Tetrachloroethene (PCE)	5	Federal MCL
Vinyl Chloride (VC)	0.5	State MCL
1,1-Dichloroethene (1,1-DCE)	6	State MCL
1,2-Dichloroethane (1,2-DCA)	0.5	State MCL
Trans-1,2-Dichloroethene (tDCE)	10	State MCL
Cis-1,2-Dichloroethene (cDCE)	6	State MCL
1,2-Dochloropropane (1,2-DCP)	5	Federal MCL
1,2-Dichlorobenzene (1,2-DCB)	600	Federal MCL
1,4-Dichlorobenzene (1,4-DCB)	5	State MCL
Benzene	1	State MCL
Chlorobenzene	70	Federal MCL
Chloroform (as Total Trihalomethanes)	80	Federal MCL
1,1-Dichloroethane (1,1-DCA)	5	State MCL
Trichlorofluoromethane (or Freon 11)	150	State MCL
Toluene	150	State MCL

2.3. Remedy Implementation

2.3.1. Landfill/Source Control Remedy

Construction of the landfill-source control components occurred during 2000-2001. During that time, the landfill cover, landfill gas controls, and surface water management system were installed. The final cover system elements included a foundation layer, a geosynthetic low permeability membrane, a drainage geocomposite layer, filter fabric, and a soil layer capable of supporting vegetative growth. The landfill gas collection system included perimeter gas monitoring probes, collection wells, a conveyance system, and a treatment system (a flare). Over 100 gas extraction wells were installed throughout the landfill footprint. Thirteen active multi-depth landfill gas monitoring wells are distributed evenly around the perimeter of the landfill; the perimeter gas monitoring wells are sampled monthly for percent methane by volume.

The landfill gas flare system consists of two multi-stage centrifugal blowers for collecting and transporting the landfill gas to the flare for destruction. The landfill gas flare is also used to combust the off-gas from the air-stripper that is used to treat contaminated groundwater collected downgradient of the landfill site.

The surface water management system consisted of drainage channels, down drains, and stormwater retention basins.

In the 1993 ROD, EPA also specified a leachate collection system, if necessary. EPA ultimately determined that a leachate collection system was unnecessary. The basis for that determination was the small quantity of leachate reported in the 1994 Remedial Investigation Report.

2.3.2. Groundwater Remedy

The primary components of the groundwater remedy include groundwater extraction wells, raw (untreated) groundwater transmission piping, the groundwater treatment plant and associated facilities, chemical pre-treatment, off-gas treatment, and treated effluent discharge piping. The packed tower aerator removes contaminants from the raw groundwater, and the off gas from the air stripper is routed to the flare for destruction. Treated water discharges to the on-site park lake located west of the landfill, which is part of the Fresno Regional Sports Complex. Overflow stormwater is directed to the South Detention Basin, located on the southern corner of the Site.

Phases 1 and 2 of the remedy were implemented between 1999 through 2010. Following completion of the Phase 2 Groundwater Remedial Action in 2010, the *Phase 2 Groundwater Remedial Action Evaluation Report* (CDM, 2010) recommended additional remedial actions at targeted locations within the downgradient plume. The *Phase 2 Enhancements Basis of Design Report* (CDM, 2011) recommended the expansion of the existing groundwater extraction and groundwater monitoring systems. One new lower B-zone aquifer extraction well was installed to address vertical migration of contamination. Construction activities began in March 2013, and the new extraction well began operating in April 2014.

In July 2018, implementation of the Phase 3 Groundwater Remedial Action, as described in the 1996 ROD, began in order to complete any remaining actions necessary to restore the aquifer to beneficial use. The Phase 3 remedial actions focused on the lower aquifers and included the installation of two C-zone aquifer extraction wells, two new lower B-zone aquifer monitoring wells, three C-zone aquifer monitoring wells, and three D-zone aquifer monitoring wells, which represented the first remedial actions within the D-zone aquifer. Startup of the new C-zone aquifer wells occurred in May 2019.

2.3.3. Institutional Controls

In the 1996 ROD, EPA selected institutional controls to prevent exposure to contaminated groundwater. In 2003, the City and County initiated a Well Assessment and Prohibition Program to prevent exposure to contaminated groundwater and protect the remedy. The program established two zones: a Well Prohibition Zone and a Well Assessment Zone. When a well permit application is submitted to the County for a proposed well location within the Well Prohibition Zone, the permit is denied by the County. If the proposed well location is within the Well Assessment Zone, the County notifies the City and the City further evaluates the well application based on location, depth, assumed flow rate, usage characteristics, and potential impact to the plume migration and remediation system effectiveness. After evaluating the well design, including well depth, the City determines if the applicant can install and operate the well as proposed, or it specifies any necessary design modification

In the 2012 ESD, EPA adopted two restrictive covenants to formally restrict groundwater use and protect the remedies for the Site and adjacent areas. The Covenants prohibit activities that could interfere with the operation of the remedies or expose humans to contaminants at the Site. Both covenants were recorded in March 2012. The summary of implemented institutional controls are in Table 3.

Table 3. Summary of Planned and/or Implemented Institutional Controls

Media, engineered controls, and areas	Institutional Controls Called for in the Decision Documents	Institutional Control Objective	Title of Institutional Control Instrument Implemented and Date (or planned)
Groundwater	2012 ESD	Restrict installation of groundwater wells and groundwater use on and near the Site.	Well Assessment and Prohibition Program, implemented 2003
	2012 ESD	Prohibit groundwater use on-site and protect remedy operations.	Landfill Restrictive Covenant, adopted in 2012 ESD
	2012 ESD	Prohibit groundwater use and protect remedy operations.	Sports Complex Restrictive Covenant, March 2012
Landfill – Source Control	2012 ESD	Protect remedy operations and prevent exposure to Site contaminants.	Sports Complex Restrictive Covenant, March 2012
	2012 ESD	Protect landfill cap function and prevent exposure to Site contaminants.	Landfill Restrictive Covenant, March 2012

2.4. Operation and Maintenance (O&M)

The City of Fresno performs ongoing maintenance of both remedies.

In the landfill/source control remedy, the landfill gas collection system and flare operate continuously. O&M activities include the monthly monitoring and inspection of the landfill gas probes, landfill cover, surface water management systems, and landfill gas control. Several flare shutdowns and/or bypasses occurred in the last five years. The decreases in the landfill gas flow rates throughout 2019 are attributed to the maintenance and downtime of the landfill gas flare. Landfill gas flare shutdowns occurred periodically throughout the year as a result of power failures, other operational issues, system repair, or for routine system maintenance needs. Based on the operations data, the operational efficiency of the landfill gas flare during 2019 was approximately 84%. When the landfill gas flare shuts down, the groundwater treatment system is also shutdown. The modifications to the groundwater treatment system were made in 2008 to install a manually-operated valve in the off-gas piping system and a vertical stack for atmospheric emissions for the off-gas from the air stripper. If the landfill gas flare is off for an extended time, emissions are vented directly to the atmosphere are referred to as "landfill gas flare by-pass mode operations". There were several occasions where the groundwater treatment operated under by-pass mode operations in 2019.

Additionally, subsidence is a well-documented issue in the landfill, and settlement appears to occur at a rate of approximately one inch per year. No major subsidence repairs took place in the last five years. The City is in the process of preparing a Landfill Maintenance and Regrading Plan, which will update the approach for landfill inspection, maintenance and repair activities. The City sets and maintains squirrel bait traps to prevent burrowing rodents from damaging the geomembrane cover of the landfill.

For the groundwater remedy, O&M activities include groundwater monitoring, monitoring of the groundwater extraction system, monitoring of treated effluent, and maintenance of the groundwater treatment plant. The monitoring program consists of 81 monitoring wells, 10 extraction wells, and 8 residential wells across all four aquifers. Due to the regional receding water table, four of five A-zone aquifer extraction wells have not been operational since 2009, and the fifth has not been operational since 2013. The three B-zone aquifer extraction wells operate from 60 to 93 percent of the time, depending on maintenance requirements in those wells and other areas of the system. The two C-zone aquifer extraction wells have operated approximately 75 percent of the time since startup in May 2019.

The City monitors effluent to determine the effectiveness to the air stripping operation to remove volatile organic compounds from groundwater. In December 2019, during the troubleshooting process, it was determined that the air flow meter measuring air flow from the blower to the packed tower aerator was not providing accurate measurements. Monitored effluent has largely remained non-detect for site contaminants, although low-level detections have occurred, most recently in August 2019 for cDCE. Detections in effluent have resulted in alterations in air flow through the packed tower aerator, and most recently, addition of further packing media in the aerator. cDCE was detected in multiple effluent samples from August 2019 through April 2020. PCE was also detected intermittently between November 2019 and April 2020. Several operational adjustments were conducted by the City of Fresno, including the addition of more packing material to fill up interstitial spacing. On May 28, 2020, the packing material was replaced with the original packing media at start-up. Material packing placement was completed on May 29, 2020. The effluent sample collected on June 2, 2020 was non-detect for all volatile organic compounds. Effluent monitoring data is reported in the annual performance monitoring report provided by the City of Fresno to EPA.

3. Progress Since the Last Five-Year Review

3.1. Previous Five-Year Review Protectiveness Statement and Issues

The protectiveness statement from the 2015 Five-Year Review for the landfill/source control remedy of the Site stated the following:

> *The remedy for source area/landfill is protective of human health and the environment. The landfill cap prevents exposure to contaminated soil and materials within the landfill. The landfill gas extraction and treatment system controls the landfill gas exposure.*

The protectiveness statement from the 2015 Five-Year Review for the groundwater remedy of the Site stated the following:

> *The remedy for groundwater currently protects human health and the environment because exposure pathways for groundwater are being controlled. Exposure pathways to contaminated groundwater that could result in unacceptable risks are prevented through restrictive covenants and a wellhead protection program; furthermore, wellhead filtration systems and bottled water substitutes are provided to some homes immediately adjacent to the Site. However, in order for the remedy to be protective in the long-term, effective capture of groundwater contamination in all aquifers beneath the Site must be achieved to prevent further plume migration and to ensure protectiveness.*

The third Five-Year Review included one issue and recommendation.

Table 4. Status of Recommendations from the 2015 Five-Year Review

Issue	Recommendations	Current Status	Current Implementation Status Description	Completion Date
Hydraulic capture of groundwater plume migration has not yet been achieved in all aquifers. Available data indicates expansion of the plume in the C-aquifer.	Continue monitoring groundwater response to Phase 2 Enhancements and evaluate need for additional C-aquifer extraction wells.	Completed	Two C-aquifer extraction wells were installed as part of the Phase 3 Groundwater Remedial Action.	5/1/2019

3.2. Work Completed at the Site During this Five-Year Review Period

The Phase 3 Groundwater Remedial Action was implemented in July 2018. The Phase 3 remedial action included the installation of two C-zone aquifer extraction wells, two new lower B-zone aquifer monitoring wells, three C-zone aquifer monitoring wells, and three D-zone aquifer monitoring wells. Startup of the new C-zone aquifer extraction wells occurred in May 2019.

Additionally, regular groundwater monitoring events on a mixed schedule (quarterly, semi-annual, and annual) have been ongoing throughout the five-year review period.

4. Five-Year Review Process

4.1. Community Notification, Involvement and Site Interviews

A public notice was made available by newspaper posting in *The Fresno Bee* on January 30, 2019, stating that there is an ongoing five-year review to be completed by September 30, 2020, and inviting the public to submit any comments to the U.S. EPA (Appendix E). The results of the review and the report will be made available at the Site information repository located at the Fresno County Central Library, 2420 Mariposa Street, in Fresno. Copies of Site documents are also kept at the EPA Records Center on the third floor of the EPA Region 9 Office located at 75 Hawthorne Street, San Francisco, CA 94105.

During the Five-Year Review process, interviews were conducted to document any perceived problems or successes with the remedy that has been implemented to date**.** The results of these interviews are summarized below.

All of the interviews conducted acknowledged that downward vertical migration of contaminated groundwater appears to have occurred. The Phase 3 remedial action was primarily intended to evaluate and contain this vertical migration. Interviewees also stated that the system needs more time online before a determination could be made. In general, further remedial action would not be needed if the new D-zone aquifer monitoring wells show stable or decreasing concentrations. One interviewee stated that optimization of the C-zone extraction wells would likely be needed to assess the impact to the D-zone aquifer. As per the project schedule, the first detailed evaluation of the Phase 3 RA will occur in the 3rd quarter of 2020.

In terms of monitoring results, an interviewee stated that the landfill/source control monitoring almost never has any exceedances. In general, the groundwater concentrations are stable or decreasing, except those wells downgradient of the southwest corner of the landfill. Two newly installed extraction wells, from both Phase 2 and Phase 3, were located specifically to address this issue.

All interviewees addressed O&M issues in some fashion. One stated that the landfill gas flare had relatively significant downtime (1-2 days a month, 94% operational efficiency). Another identified landfill subsidence as a significant concern, one that had not been fully addressed. Also addressed was the ongoing investigation into the July 2019 cDCE effluent exceedance. Interviewees stated the exceedance was likely an issue with the packing media, which was due to be fully replaced in May 2020.

In response to a question concerning the potential for stranded mass to be present in the A-zone aquifer, interviewees stated that there likely was stranded mass in that now dry aquifer. It was stated that at the time of water table recession, the A-zone was showing non-detect or decreasing trends in groundwater. Thus, it was unlikely to pose a problem, either as soil gas released from the landfill surface, or as vapor intrusion in neighboring residences.

Finally, interviewees were questioned on the process and effectiveness of the institutional controls. The interviewees with knowledge of the Well Prohibition Zone/Well Assessment Zone indicated the program was operating as intended. Both the City and County were involved with well permitting, and the program has been quite active in the last couple of years due to the need for domestic well drilling at greater depths. In general, the Well Assessment Zone requires drillers to drill deeper for water and to change the annular seal of the well to prevent exposure. The City pays the cost of these adjustments.

The full interview records can be found in Appendix F.

4.2. Data Review

4.2.1. Groundwater

4.2.1.1 Aquifer restoration

In total, results from 25 wells were analyzed using trend analysis and regression analysis, focusing on the major contaminants (PCE, TCE and cDCE) with most wells exhibiting a decreasing trend in contaminant concentration. Further detail and figures presenting the data analysis can be found in Appendix C.

There are eleven wells with increasing concentrations in the B- and C-zone aquifers, although three of those have concentrations below MCLs. Two wells that have concentrations above the MCLs are located near the edge of the landfill, closest to the source of contamination. One of the wells, CDM-20B, is directly adjacent to an extraction well, which would draw water and contaminants to this location. TCE concentrations in well CDM-20B have increased from 0.64 to 10 µg/L since the last Five-Year Review. The second well, PZ-5B2, has had increasing concentration since the last Five-Year Review in cDCE from 12 to 90 µg/L.

Based on these regression calculations, concentrations of PCE in B-zone aquifer wells with decreasing concentrations are likely to reach the MCL for PCE of 5 µg/L in 16 years. Concentrations of PCE in C-zone aquifer wells could reach the MCL of 5 µg/L in 14 years. These assumptions are based on no changes to the system, and do not account for the areas which are currently increasing in PCE. These results also do not account for the newly implemented Phase 3, which should increase capture and restoration. Areas that are increasing are near extraction wells, which draw water and contaminants to this location, or are near the source of the contaminants. This does not mean contamination will linger forever but, without knowing what contaminant levels remain within the landfill, it is not possible to project a time to cleanup.

There was no data from the A-zone aquifer for analysis, as there was no data collected during the five-year review period because of dry well conditions. The A-zone aquifer has been stated as non-detect for site contaminants in most annual reports since 2015, but this is due to the aquifer drying up, as opposed to the water-quality cleanup goals.

4.2.1.2 Plume containment

When compared to the previous Five-Year Review, the areal extent of the plume in observed aquifers has decreased laterally as well as the maximum concentrations in the B- and C-zones (54 µg/L PCE 2015 vs. 23 µg/L PCE 2019 B-zone). The B-zone plume of PCE is restricted to the park property. The C-zone PCE plume still manages to cross North Ave. (the southern boundary of the park) but does not have the same westward extent as observed in the previous Five-Year Review. The newly installed Phase 3 is within this lower aquifer and can potentially have a greater impact on the plume. This will allow for better evaluation of plume capture. While there are areas with trends of increasing concentrations in the plume, a majority of the wells across the plume have decreasing concentrations of PCE, TCE, and cDCE. There are no detections of contaminants at concentrations above MCLs in nearby water supply wells downgradient of the landfill.

While monitoring of the D-zone aquifer has not taken place long enough to have a sufficient amount of data to develop a trend, CDM-4D does have detectable concentrations of site contaminants present and

concentrations of PCE, TCE and cDCE have increased from January 2019 to April 2019. CDM-5C has a trend of increasing concentrations of contaminants, which is consistent with observations from the previous Five-Year Review. In addition, a vertical downward gradient has been observed between the B- and C-zone aquifers. C- and D-zone aquifers exhibit and upward gradient (CDM, 2019). The additional extraction wells added to the treatment network in the B- and C-zone aquifers should contribute to additional control on contaminant movement. Over the next five-year review, a study on the efficacy of these changes can track plume movement and evaluate how water is migrating from one zone to another.

While there are areas with trends of increasing concentrations in existing groundwater contaminant plumes, a majority of the monitoring wells across the plumes have decreasing concentrations of PCE, TCE, and cDCE. The plumes haves also decreased in areal extent, as compared to 2015 plume sizes for cDCE and PCE. There are no detections of Site contaminants at concentrations above MCLs in nearby water supply wells downgradient of the landfill. Currently, there is insufficient analytical data from the C-zone aquifer to evaluate plume capture. However, CDM-5C has a reported cDCE concentration that is currently above the MCL for cDCE (6 µg/L).

4.2.2. Soil Gas/Indoor Air

The City analyzes gas samples monthly for methane from the 13 permanent multi-depth landfill gas perimeter monitoring wells. From the beginning of 2016 to the end of 2019, methane gas was not detected in excess of 5% methane by volume during any monitoring event.

As stated in the 1993 ROD, methane gas was detected in the perimeter gas monitoring wells at a maximum of 58% methane by volume prior to implementation of the remedy. The current maximum measurements of ~5% methane by volume represent an order of magnitude decrease in concentration and demonstrates that the remedy has significantly reduced off-site gas migration.

The perimeter landfill gas monitoring wells are regularly sampled for methane gas. However, the primary contaminants for inhalation concern (VC, PCE, TCE, etc.) have not been evaluated in soil gas adjacent to the landfill since before the 1993 ROD. While it could be assumed that the control of the methane gas collection and treatment system would also capture all site contaminants, this should still be formally evaluated and confirmed.

The potential for a complete vapor intrusion pathway as a result of sufficiently volatile and toxic groundwater contaminants underlying offsite residences is also a possibility. However, the depth to A-zone aquifer is currently approximately 80 ft. below ground surface. Additionally, only two A-zone wells (CDM-17A and CDM-18A) contained enough water for a sample in the last four sampling events and was non-detect for volatile organic compounds. These wells are more than 200 ft. away from offsite residences. Given current site conditions, groundwater data indicates that the vapor intrusion pathway is incomplete. However, because the water table in the A-zone aquifer has receded, there may be stranded mass present in that zone. This possibility should be evaluated for offsite receptors.

4.3. Site Inspection

The Site inspection occurred on January 22, 2020. In attendance were Cynthia Ruelas (EPA Remedial Project Manager); Justin McNabb (United States Army Corps of Engineers); Kristen Gomes and Daniel Carlson (California Regional Water Quality Control Board – Central Valley Region); Juan Peng (California Environmental Protection Agency, Department of Toxic Substances Control); Yash Nyznyk (Camp Dresser and McKee/Smith); Rosa Lau Staggs, Michael Del Carlo, David Furtado and Jeff Gardner (City of Fresno); and Peter Phillips (Gilbane Federal). The purpose of the inspection was to assess the protectiveness of the remedies.

The Site inspection commenced with a meeting to discuss relevant questions from the Site inspection attendees. Mr. Nyznyk and Ms. Staggs relayed pertinent information from their perspectives concerning the operations of the facility. They also answered questions about the progress of Phase 3 implementation. An explanation of the treatment system downtime was provided which constituted of system maintenance related downtime and time associated with bringing the Phase 3 extraction wells online.

After this discussion, the site walk took place to inspect some of the newly installed Phase 3 extraction and monitoring wells and to inspect the landfill cap. The team noted subsidence was a major issue across the whole landfill, with several ft. of subsidence noted on the eastern portion of the landfill top deck and side. Some subsidence areas were full of water, some of which appeared to have been there for a significant amount of time based on plant growth. Additionally, burrowing animals have been tunneling across the surface of the landfill, affecting drainage features installed on the surface of the landfill. These burrows could be deep enough to go down to the geomembrane. CDM Smith stated that a subsidence and maintenance plan will be submitted to EPA in 2020 that will include a process for the City to correct subsidence across the landfill. There are impacts from burrowing animals on the landfill cap and potentially the buried geomembrane. The perimeter of the Site is fenced but is not restricted because it is also a public park. The Site perimeter fence is unlocked and locked each day by the City's park and recreation staff per the park's operational schedule. The footprint of the landfill is completely contained within the Site's perimeter fence. Access to the landfill is unrestricted. Signage identifying the entire park as a Superfund site exists at the park entrance and at specified locations around the Site, but signage within the park specifically identifying the landfill is limited and public access to the footprint of the landfill is not restricted (fenced).

During the Site inspection, the review team observed a private vehicle driving on the landfill surface, behind the Site inspection team. Because it was a one-way road, the civilian vehicle turned around off road and drove away in the opposite direction. The inspection report and photos are presented in Appendix G.

5. Technical Assessment

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

The remedies for the landfill and the groundwater continue to operate and function as designed. The landfill cover continues to act as a barrier to fugitive landfill gas emissions, and the landfill gas collection system continues to extract and destroy methane (as a proxy for volatile organic compounds) through combustion, as no methane above 5% by volume was detected in any of the perimeter landfill gas monitoring wells in the last five years. However, the primary contaminants for inhalation concern (VC, PCE, TCE, etc.) have not been evaluated in soil gas adjacent to the landfill since before the 1993 ROD.

The groundwater remedy continues to extract groundwater from the subsurface and remove contaminants through packed tower aeration, as designed. The areal extent of the plume is decreasing, and for a majority of wells across the Site, concentrations of Site contaminants are decreasing. Regression analysis predicts that some wells will achieve MCLs, and achieve restoration, within 20 years. Other monitoring wells, including those located closest to extraction wells within the B-zone and C-zone aquifers, have increasing concentrations. It is unlikely that the increasing trends will change, given the proximity to the source of the contaminants. These wells have been increasing since the last Five-Year Review. As a result, the wells with increasing concentrations are unlikely to reach MCLs in the same 20-year timeframe for certain contaminants.

While remedial actions in groundwater have generally prevented the plume from moving downgradient to affect previously uncontaminated groundwater resources, current monitoring data indicates that vertical migration of contaminants into the C-zone and D-zone aquifers exists onsite. Monitoring of groundwater response to the Phase 3 Remedial Actions should continue to ensure that existing extraction wells are stabilizing lateral and vertical contaminant migration.

O&M procedures at the Site are sufficient, as remediation systems in both the landfill and groundwater are actively monitored and maintained. However, the Site inspection raised questions regarding the adequacy of landfill cover maintenance operations. Subsidence was observed on the landfill cap, which appears to affect the slope drains. O&M activities related to the prevention of burrowing animals also appears to have stalled, as burrowing animals were observed throughout the landfill surface, potentially impacting the geomembrane of the landfill cover.

Institutional controls in place at the Site and in the surrounding areas further reduce the possibility of exposure to Site contaminants. The Well Assessment and Prohibition Program has successfully limited installation of wells in areas around the landfill. The two restrictive covenants in place have mostly prevented activities that could damage or interfere with the operation of the Site remedy. However, the Site inspection noted the lack of complete fencing or access controls to the landfill, such that private vehicles were noted driving on the surface, potentially indicating the need for additional Site engineering controls to minimize access to the landfill.

5.2. Question B: Are the exposure assumptions, Toxicity Data, Cleanup Levels, and Remedial Action Objectives Used at the Time of Remedy Selection Still Valid?

Yes, exposure assumptions, toxicity data, cleanup levels, and Remedial Action Objectives are still valid.

The cleanup levels are based on State and Federal MCLs, and there have been no changes to these chemical-specific ARARs that affect the protectiveness of the remedy. Several other ARARs have changed in the past five years, but those changes have no effect on the protectiveness of the remedy (Appendix D).

All exposure pathways identified in the ROD are still valid. The groundwater ingestion pathway is currently incomplete, as contaminated groundwater in the A- through D-zone aquifers is not used for drinking water purposes. The installation of wellhead activated carbon systems at many residences in the area further eliminates the potential risk of inhaling volatile organic compounds vapors while showering.

The soil gas and groundwater to soil gas pathways are considered incomplete, as the landfill gas collection and treatment system has reduced the potential for soil gas to migrate vertically or laterally from the landfill. However, the potential for lateral migration of landfill gas still exists and has not been evaluated since the 1993 ROD. The vapor intrusion pathway was also considered, as chlorinated compounds in the groundwater plume are sufficiently volatile to potentially complete the exposure pathway. However, the depth to A-zone aquifer is approximately 80 ft. below ground surface, and only one A-zone well (CDM-18A) contained enough water for a sample in the last four sampling events and was non-detect for volatile organic compounds. This well is more than 200 ft. away from offsite residences. As a result, the vapor intrusion pathway is considered to be incomplete. However, because the water table in the A-zone aquifer has receded, there may be stranded mass present in that zone. This possibility should be evaluated for offsite receptors.

Land use has not changed since the last Five-Year Review, and use can be reasonably expected to stay the same in the future. A well protection program is in place that prohibits the installation of groundwater wells near the Site without prior review and approval. Two restrictive covenants (one for the landfill and one for the adjacent areas) recorded in 2012 provide further restrictions on land and groundwater use and provide protections for the remedy.

The remedy continues to make progress towards achieving Remedial Action Objectives. The Remedial Action Objectives for the landfill (source control), namely, to collect and eliminate landfill gas emissions, have largely been achieved. The Remedial Action Objectives for groundwater are in varying stages of progress. The groundwater plume is largely stable and concentrations are decreasing, although some wells adjacent to extraction wells are showing increasing concentrations. The downgradient edge of the plume has largely been defined, although the vertical extent still has uncertainty. If variable or increasing concentrations continue in the B-, C-, or D-zone aquifers, future modifications will be needed.

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

Although most commonly understood climate change impacts are not expected to affect the remedy, the documented decline in the Fresno area regional water table has caused most (all but two) of A-zone aquifer wells to go dry. This withdrawal of water from the A-zone aquifer has the potential to strand contaminant mass in that aquifer zone.

There have been no impacts from earthquakes or other natural disasters that would call into question the protectiveness of the remedy. Additionally, no new ecological risks have been identified.

6. Issues/Recommendations

Table 5. Issue and Recommendation Identified in the Five-Year Review

Issue and Recommendation Identified in the Five-Year Review:				
OU(s): Landfill – Source Control	**Issue Category:** Monitoring			
	Issue: Landfill perimeter gas is only monitored for methane and may not accurately represent the risk of lateral soil gas migration from the landfill.			
	Recommendation: Monitor the perimeter gas wells for volatile organic compounds gas as well as methane.			
Affect Current Protectiveness	**Affect Future Protectiveness**	**Party Responsible**	**Oversight Party**	**Milestone Date**
No	Yes	City of Fresno	EPA	3/1/2022

6.1. Other Findings

In addition, the following are recommendations that improve performance of the remedy but do not affect current and/or future protectiveness and were identified during the Five-Year Review:

- In December 2019, the City of Fresno discovered that the air flow meter measuring air flow from the blower to the packed tower aerator was not providing accurate measurements. Any equipment that is not performing within range should be repaired or replaced as soon as possible.
- Evaluate the possibility of stranded mass in the A-zone aquifer as a result of water table decrease.
- The public has access to the landfill surface, and vehicles were noted driving on the landfill cover. Reevaluate the need for access controls in order to prevent the possibility of eventual geomembrane damage from public access.
- The landfill has been subject to subsidence and impacts from burrowing animals. The City intends to submit a subsidence and maintenance plan to EPA in late 2020. After approval, the maintenance and repairs from the plan should be implemented.

- The landfill gas flare system operated at lower operational efficiency due to maintenance and planned downtimes. During these times, emissions from the air stripper are vented directly to the atmosphere. As the concentration of methane decreases, the need for the flare system may not be needed as frequently, a possible alternate treatment for the air stripper emissions should be evaluated.

7. Protectiveness Statement

Table 6. Protectiveness Statement

Protectiveness Statement(s)		
Operable Unit: OU1	*Protectiveness Determination:* Short-term Protective	*Planned Addendum Completion Date:* N/A
Protectiveness Statement: The remedy for the landfill is currently protective of human health and the environment. The landfill cover prevents direct exposure to the landfill contents, and the gas extraction and treatment system controls exposure to landfill gas. However, in order to be protective in the long-term, perimeter gas monitoring must be expanded to include volatile organic compounds.		
Protectiveness Statement(s)		
*Operable Unit:*OU2	*Protectiveness Determination:* Short-term Protective	*Planned Addendum Completion Date:* N/A
Protectiveness Statement: The remedy for the groundwater is protective of human health and the environment. The groundwater extraction and treatment system and the well installation restrictions prevent exposure to contaminated groundwater.		

Sitewide Protectiveness Statement	
Protectiveness Determination: Short-term Protective	*Planned Addendum Completion Date:* N/A
Protectiveness Statement: The remedy at the Fresno Sanitary Landfill Superfund Site is currently protective of human health and the environment as all exposure pathways are being controlled. The landfill cover prevents direct exposure to the landfill contents, and the gas extraction and treatment system controls exposure to landfill gas. The groundwater extraction and treatment system and the well installation restrictions prevent exposure to contaminated groundwater. However, in order for the remedy to be protective in the long-term, perimeter gas monitoring must be expanded to include volatile organic compounds.	

8. Next Review

The next Five-Year Review report for the Fresno Municipal Sanitary Landfill Superfund Site is required five years from the completion date of this review.

Appendix A: List of Documents Reviewed

CDM, 1993. Excerpt: Fresno Sanitary Landfill Draft Remedial Investigation. February 1993.

CDM, 1994. Excerpt: Fresno Sanitary Landfill Remedial Investigation. May 1994.

CDM, 2000. Performance Monitoring Program Plan Operable Unit 2, City of Fresno, Fresno Sanitary Landfill, November 30.

CDM, 2003. Fresno Sanitary Landfill Technical Memorandum – Institutional Controls. January 21.

CDM, 2006. Ecological Risk Contaminant Pathway Analysis. October 2.

CDM, 2007. Final Phase 1 Groundwater Remedial Action Evaluation Report #2, Fresno Sanitary Landfill. March 15.

CDM, 2009. Addendum to Supplemental Analysis of Risk, Fresno Sanitary Landfill. April 2.

CDM, 2010a. Phase 2 Groundwater Remedial Action Interim Remedial Action Report, Fresno Sanitary Landfill, Operable Unit No. 2. March 10.

CDM, 2010b. Phase 2 Groundwater Remedial Action Evaluation Report, Fresno Sanitary Landfill, November 29.

CDM Smith, 2014. Annual Performance Monitoring Program Report, Fresno Sanitary Landfill, July 31.

CDM Smith, 2015a. Annual Performance Monitoring Program Report, Fresno Sanitary Landfill. July 30, 2015.

CDM Smith, 2015b. Phase 2 Enhancements Groundwater Remedial Action Evaluation Report, Fresno Sanitary Landfill, Operable Unit No. 2, December 30.

CDM Smith, 2016a. Fresno Sanitary Landfill, 2016 Operable Unit No. 1 Annual Report. February 29, 2016.

CDM Smith, 2016b. Annual Performance Monitoring Program Report, Fresno Sanitary Landfill. July 29, 2016.

CDM Smith, 2017a. Fresno Sanitary Landfill, 2017 Operable Unit No. 1 Annual Report. February 28, 2017.

CDM Smith, 2017b. Annual Performance Monitoring Program Report, Fresno Sanitary Landfill. July 31, 2017.

CDM Smith, 2018a. Fresno Sanitary Landfill, 2018 Operable Unit No. 1 Annual Report. February 28, 2018.

CDM Smith, 2018b. Annual Performance Monitoring Program Report, Fresno Sanitary Landfill. July 31, 2018.

CDM Smith, 2019a. Fresno Sanitary Landfill, 2019 Operable Unit No. 1 Annual Report. February 28, 2019.

CDM Smith, 2019b. Annual Performance Monitoring Program Report, Fresno Sanitary Landfill. July 31, 2019.

CDM Smith, 2019c. Phase 3 Groundwater Remedial Action, Interim Remedial Action Report, Fresno Sanitary Landfill, Operable Unit No. 2. December 19, 2019.

CDM Smith, 2020. Operable Unit No. 1 Annual Report. February 28, 2020.

CH2M Hill, 2005. First Five-Year Review Report for Fresno Sanitary Landfill Superfund Site, Fresno County, California. September.

City of Fresno, 2020. Fresno Sanitary Landfill Quarterly Progress Report – 4th Quarter 2019. January 10, 2020.

Fresno County, 2012a. Covenant to Restrict Use of Property, Environmental Restriction (#0003622059). March 13, 2912.

Fresno County, 2012b. Covenant to Restrict Use of Property, Environmental Restriction (#0003633155). March 29, 2912.

Kleinfelder, Inc. and GeoSyntec Consultants, Inc. 2003. Final Post-Closure Operations and Maintenance Plan for the Source Control Operable Unit (SCOU), Fresno Sanitary Landfill, Fresno, California. June 13.

USEPA, 1993. Record of Decision, Fresno Municipal Sanitary Landfill, OU1, Fresno, California, September 30.

USEPA, 1994. Revised Draft Human Health Risk Assessment for the Fresno Sanitary Landfill Superfund Site, Fresno, California. Prepared by ICF Technology, Inc. April.

USEPA, 1996. Record of Decision, Fresno Municipal Sanitary Landfill, OU2, Fresno, California, September 30.

USEPA, 2010. Second Five-Year Review Report for Fresno Municipal Sanitary Landfill Superfund Site, Fresno County, California. September.

USEPA, 2012. Explanation of Significant Differences, Fresno Municipal Sanitary Landfill Superfund Site, Operable Units 1 and 2, Fresno California. September.

Appendix B: Site Chronology

Event	Date
Fresno Municipal Sanitary Landfill accepts waste	1937
Fresno Municipal Sanitary Landfill expanded south of Annadale Avenue	1945
City of Fresno began closing process for landfill	1981
Off-site migration of soil gas and contaminated groundwater discovered	1984
Fresno Municipal Sanitary Landfill receives last waste	July 1, 1987
City installs methane barriers at north and south ends of landfill	1988
Site is listed on National Priorities List (NPL)	October 1989
EPA issued Unilateral Administrative Order (UAO) the City of Fresno to apply an active vacuum system to the methane barriers and install a landfill gas extraction system	September 1990
EPA and City of Fresno signed Administrative Consent Order (AOC) wherein the City agreed to conduct a Remedial Investigation/Feasibility Study	September 1990
EPA issued an amendment to the UAO to add a requirement that the City also implement a monitoring program of residences near the landfill	February 1991
Vacuum system added to methane barriers	1990-1991
Feasibility Study completed for landfill/source control	September 1992
Record of Decision (ROD) for landfill/source control signed	September 30, 1993
AOC was amended to include design of landfill cap	December 1993
Remedial Investigation for groundwater completed	May 1994
Human Health Risk Assessment completed for groundwater	September 1994
Feasibility Study completed for groundwater	July 1996
ROD for groundwater signed	September 1996
Consent Decree signed that included agreements to initiate a groundwater monitoring program, construction of source control remedy, and remedial design development and cleanup activities for groundwater	September 1997
Operation of Early Groundwater Remedial Action System	May 1999 – July 2001
Landfill cover, landfill gas control, and surface water management systems constructed	July 1999 – June 2000
Groundwater Treatment Plant started up	September 2001
Fresno Regional Sports Complex completed	2001
Well Protection Program implemented	2003
Decommissioning of nearby agricultural water wells completed	April 2005
First Five-Year Review report completed	September 2005
Phase 2 Groundwater Remedial Action (RA): Remedial Design approved by EPA	September 2007

Event	Date
Phase 2 Groundwater RA: Construction activities occurred	2007 – 2008
Phase 2 Groundwater RA: Extraction well pumping initiated	2008
City completed design for landfill cap repairs	April 2010
Second Five-Year Review report completed	September 2010
Phase 2 Groundwater RA Evaluation Report completed	November 2010
Phase 2 Enhancements Basis of Design Report completed	September 2011
Landfill cap repairs completed	2011
Sports Complex Restrictive Covenant recorded	March 13, 2012
Landfill Restrictive Covenants recorded	March 29, 2012
Explanation of Significant Differences (ESD) signed	September 2012
Phase 2 Enhancements: Construction activities occurred	March 2013 – April 2014
Phase 2 Enhancements: New extraction well pumping initiated	April 2014
Phase 2 Enhancements Interim RA (Remedial Action) Report completed	August 2014
Phase 3 RA Basis of Design Report completed	August 2016
Phase 3 RA: Construction activities occurred	June 2018 – January 2019
Phase 3 RA: New extraction well pumping initiated	May 2019
Phase 3 Interim RA Report completed	December 2019
Performance Monitoring of groundwater treatment plant Influent/Effluent, Groundwater, and Landfill gas	Ongoing

Appendix C: Data Review

Mann-Kendall trend analysis was performed on the provided data of site contaminant concentrations across the Site. Mann-Kendall analysis is a non-parametric statistical procedure that is used for analyzing trends in data over time. Non-parametric methods do not require any assumptions about the distribution of the data and the Mann-Kendall test is not sensitive to the sampling interval of the data. This is useful because exact sampling periodicity is not feasible in most situations. Mann-Kendall is also useful because it can handle missing data and is not susceptible to outliers. This trend analysis was performed on data collected in annual reports produced during this five-year review period from wells associated with the Site, specifically focusing on the compounds PCE, TCE, and cDCE. Data from the A-zone aquifer could not be analyzed, as there were not enough data points collected during the five-year review period to develop a trend. This is due to the wells being dry during most of the review period. Other wells were also not used in the analysis if they had four or fewer data points in different aquifers. Figure C-1, C-2, and C-3 are examples of each of the Mann-Kendall results produced for each analyzed compound. Additionally, groundwater gradients were calculated for the B- and C-zone aquifers with a B-zone gradient of 0.00172 ft./ft. to the southwest and a C-zone aquifer gradient of 0.00086 ft./ft. to the southwest.

In total, results from 25 wells were analyzed. Seventy-two percent of the wells sampled over the last five-years have concentrations over the MCLs established for PCE, TCE and cDCE as of the most recent annual report. However, most wells demonstrating decreasing trends in contaminant concentrations. There are some wells with increasing concentrations: two wells with increasing PCE concentrations, three wells with increasing TCE concentrations, and six wells with increasing cDCE concentrations. The increases in cDCE are likely due to the breakdown of source TCE and PCE in the groundwater. Of these wells, three have concentrations below MCLs for their respective compound: PZ-4B (PCE), CDM-22C (cDCE), and DW-1C (cDCE). For the wells with concentrations above the MCLs, most are located near the edge of the landfill, and closest to the source of contamination. The other well with concentrations above MCLs, CDM-20B, is directly adjacent to an extraction well. Because contaminants are being drawn to this location by an extraction well, it is likely that this is contributing to an increase in concentrations observed at this location. The rest of the wells with increasing concentrations are spread across both B- and C-zone aquifers. There are three wells with concentrations that are stable above the MCL of PCE (DW-1B) and cDCE (CDM-13B and CDM-19B). The third phase of treatment started in May 2019 and targeted the C-aquifer (CDM Smith, 2019). The newly installed Phase 3 extraction wells should help with capture and containment of the plume based on the location of the new wells.

While analysis of the D-zone aquifer is limited due to the recent completion of the Phase 3 Remedial Action, CDM-4D does have concentrations of contaminants of concern present. CDM-4D has shown an increase in concentrations for PCE, TCE and cDCE from January 2019 (2.7, 2.5, and 1.1 µg/L respectively) to April 2019 (5.2, 3.0, and 1.5 µg/L).

The A-zone aquifer is reported as non-detect for contaminants of concern in most annual reports since 2015, but none of the reports in this five-year review examine the possibility of stranded contaminants in these soils. These contaminants would be stranded from the A-zone aquifer drying up. If the regional water table were to ever recover, it is possible that contaminants would be remobilized from

adsorbed particles in the soil. Clean soils would need to be confirmed in the previous A-zone aquifer before declaring this unit clean, due to the potential of contaminant remobilization if water table levels recover.

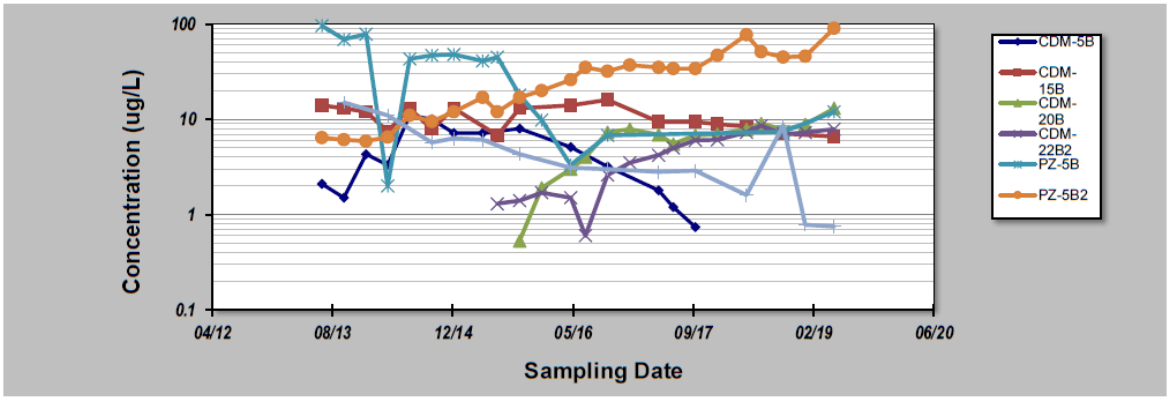
A regression analysis was performed on data from the wells with decreasing trends across the Site in the B- and C-zone aquifers. The regression analysis used the freeware program R to calculate the time to reduce the remaining mass of PCE in the groundwater to the concentration of the MCL, assuming no further changes in treatment take place. The specific program was a fitting linear model called lm. Based on these regression calculations, the PCE concentration in the B-zone aquifer is likely to reach the MCL for PCE of 5 µg/L in 16 years. The PCE concentration in the C-zone aquifer is likely to reach the MCL for PCE in 14 years. These assumptions are based on no changes to the system, and do not account for the areas which are currently increasing in PCE.

While there are spots of increasing concentration trends in the plume, it appears that a majority of the wells across the plume have decreasing concentrations of PCE, TCE, and cDCE. It appears that the plume has also decreased in areal extent, as compared to the 2015 plume size for cDCE and PCE. Additionally, testing found no contaminants above the MCL in nearby water supply wells downgradient of the landfill in the B- and C-Zone aquifers. For the C-zone aquifer, there is not enough data to evaluate plume capture currently, but CDM-5C should be monitored to track containment as it is increasing in cDCE concentration, and the current concentration is above the MCL for cDCE.

GSI MANN-KENDALL TOOLKIT
for Constituent Trend Analysis

Evaluation Date: 2-Jan-20 | Job ID: Fresno
Facility Name: USACE- Seattle District | Constituent: cDCE
Conducted By: Justin McNabb | Concentration Units: ug/L

Sampling Point ID:	CDM-5B	CDM-15B	CDM-20B	CDM-22B2	PZ-5B	PZ-5B2	CDM-4B
Sampling Event	Sampling Date	CDCE CONCENTRATION (ug/L)						
1	Jul-13	2.1	14			96	6.4	
2	Oct-13	1.5	13			69	6.1	15
3	Jan-14	4.3	12			78	5.9	
4	Apr-14	3.3	7.5			2	6.5	11
5	Jul-14	11	13			43	11	
6	Oct-14	10	7.9			47	9.5	5.7
7	Jan-15	7.2	13			48	12	6.3
8	May-15	7.2				41	17	6.1
9	Jul-15		6.8		1.3	45	12	
10	Oct-15	8	13	0.53	1.4	18	17	4.3
11	Jan-16			1.9	1.7	9.8	20	
12	May-16	5.1	14	3	1.5	3.3	26	3.1
13	Jul-16			4	0.6		35	
14	Oct-16	3.2	16	7.3	2.6	6.8	32	3
15	Jan-17			7.9	3.5		37	
16	May-17	1.8	9.4	6.9	4.2		35	2.8
17	Jul-17	1.2		5.5	5		34	
18	Oct-17	0.74	9.4	6.8	6		34	2.9
19	Jan-18		8.9	7	6.1		47	
20	May-18		8.4	7.8	7.3		77	1.6
21	Jul-18			9	8.6		51	
22	Oct-18		7.1	7.8	7	7.4	45	8.6
23	Jan-19			8.8	7.3		46	0.78
24	May-19		6.6	13	7.9	12	90	0.75
25								
Coefficient of Variation:		0.71	0.29	0.48	0.61	0.85	0.75	0.79
Mann-Kendall Statistic (S):		-24	-33	76	101	-57	232	-67
Confidence Factor:		89.4%	92.4%	>99.9%	>99.9%	99.8%	>99.9%	>99.9%
Concentration Trend:		Stable	Prob. Decreasing	Increasing	Increasing	Decreasing	Increasing	Decreasing



Notes:
1. At least four independent sampling events per well are required for calculating the trend. *Methodology is valid for 4 to 40 samples.*
2. Confidence in Trend = Confidence (in percent) that constituent concentration is increasing (S>0) or decreasing (S<0): >95% = Increasing or Decreasing; ≥ 90% = Probably Increasing or Probably Decreasing; < 90% and S>0 = No Trend; < 90%, S≤0, and COV ≥ 1 = No Trend; < 90% and COV < 1 = Stable.
3. Methodology based on "MAROS: A Decision Support System for Optimizing Monitoring Plans", J.J. Aziz, M. Ling, H.S. Rifai, C.J. Newell, and J.R. Gonzales, *Ground Water*, 41(3):355-367, 2003.

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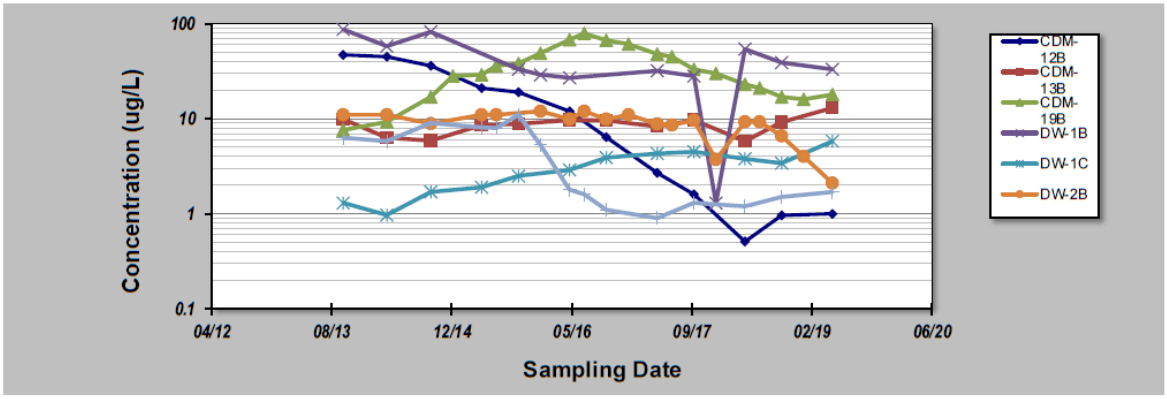
Figure C-1. Mann-Kendall trend analysis for cDCE in the B-zone aquifer with multiple increasing wells. All increasing wells are above the MCL for cDCE.

GSI MANN-KENDALL TOOLKIT
for Constituent Trend Analysis

Evaluation Date:	2-Jan-20	Job ID:	Fresno
Facility Name:	USACE- Seattle District	Constituent:	cDCE
Conducted By:	Justin McNabb	Concentration Units:	ug/L

Sampling Point ID:		CDM-12B	CDM-13B	CDM-19B	DW-1B	DW-1C	DW-2B	PZ-2B
Sampling Event	Sampling Date	CDCE CONCENTRATION (ug/L)						
1	Jul-13							
2	Oct-13	47	9.9	7.6	87	1.3	11	6.3
3	Jan-14							
4	Apr-14	45	6.3	9.3	58	0.97	11	5.8
5	Jul-14							
6	Oct-14	36	5.9	17	82	1.7	8.9	9
7	Jan-15			28				
8	May-15	21	8.6	29		1.9	11	8.1
9	Jul-15			36			11	8
10	Oct-15	19	8.8	38	33	2.5		11
11	Jan-16			49	29		12	5.3
12	May-16	12	9.7	68	27	2.9	9.9	1.8
13	Jul-16			79			12	1.6
14	Oct-16	6.4	9.6	67		3.9	9.9	1.1
15	Jan-17			61			11	
16	May-17	2.7	8.3	48	32	4.3	8.8	0.9
17	Jul-17			45			8.6	
18	Oct-17	1.6	9.7	33	28	4.5	9.6	1.3
19	Jan-18			30	1.3		3.7	
20	May-18	0.51	5.8	23	54	3.8	9.3	1.2
21	Jul-18			21			9.3	
22	Oct-18	0.96	9.2	17	39	3.4	6.6	1.5
23	Jan-19			16			4	
24	May-19	1	13	18	33	5.8	2.1	1.7
25								
Coefficient of Variation:		1.10	0.23	0.58	0.58	0.47	0.32	0.81
Mann-Kendall Statistic (S):		-60	11	-9	-23	50	-96	-55
Confidence Factor:		>99.9%	74.9%	59.5%	93.3%	>99.9%	>99.9%	99.7%
Concentration Trend:		Decreasing	No Trend	Stable	Prob. Decreasing	Increasing	Decreasing	Decreasing



Notes:

1. At least four independent sampling events per well are required for calculating the trend. *Methodology is valid for 4 to 40 samples.*
2. Confidence in Trend = Confidence (in percent) that constituent concentration is increasing (S>0) or decreasing (S<0): >95% = Increasing or Decreasing; ≥ 90% = Probably Increasing or Probably Decreasing; < 90% and S>0 = No Trend; < 90%, S≤0, and COV ≥ 1 = No Trend; < 90% and COV < 1 = Stable.
3. Methodology based on "MAROS: A Decision Support System for Optimizing Monitoring Plans", J.J. Aziz, M. Ling, H.S. Rifai, C.J. Newell, and J.R. Gonzales, *Ground Water*, 41(3):355-367, 2003.

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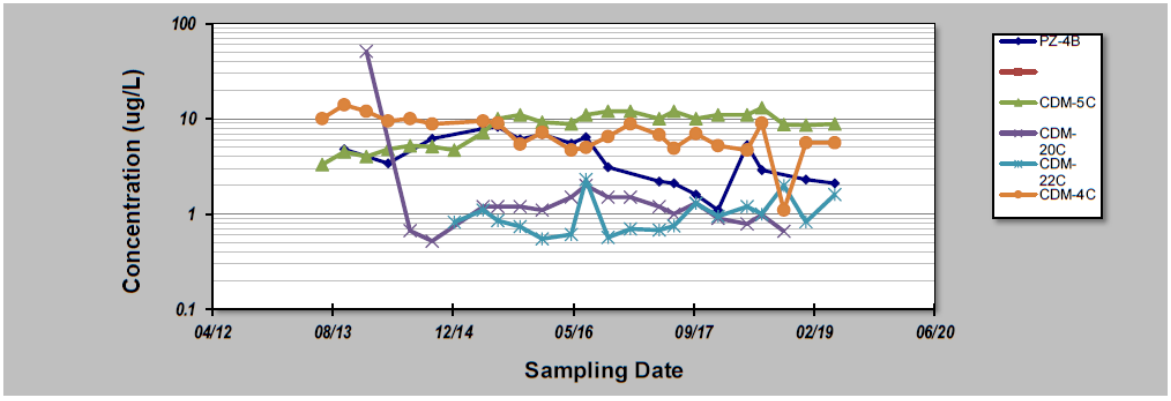
Figure C-2. Mann-Kendall trend analysis for cDCE in the B-zone aquifer. Three wells are above the MCL for cDCE but are stable or probably decreasing. One well is increasing but currently below the MCL.

GSI MANN-KENDALL TOOLKIT
for Constituent Trend Analysis

Evaluation Date: 2-Jan-20 | Job ID: Fresno
Facility Name: USACE- Seattle District | Constituent: cDCE
Conducted By: Justin McNabb | Concentration Units: ug/L

Sampling Point ID:	PZ-4B		CDM-5C	CDM-20C	CDM-22C	CDM-4C	PZ-5C
Sampling Event	Sampling Date	CDCE CONCENTRATION (ug/L)					
1	Jul-13		3.3			10	
2	Oct-13	4.8	4.5			14	1.8
3	Jan-14		4	51		12	2.2
4	Apr-14	3.4	4.8			9.5	48
5	Jul-14		5.2	0.67		10	
6	Oct-14	6.2	5.1	0.52		8.8	2.9
7	Jan-15		4.7		0.82		3
8	May-15	7.9	7.2	1.2	1.1	9.5	6
9	Jul-15	8.2	10	1.2	0.85	9	10
10	Oct-15	6.1	11	1.2	0.74	5.4	10
11	Jan-16	6.9	9.2	1.1	0.55	7.2	6.9
12	May-16	5.5	8.8	1.5	0.61	4.7	12
13	Jul-16	6.4	11	2	2.3	5	18
14	Oct-16	3.1	12	1.5	0.57	6.5	17
15	Jan-17		12	1.5	0.7	8.8	17
16	May-17	2.2	10	1.2	0.68	6.8	10
17	Jul-17	2.1	12	1	0.75	4.9	15
18	Oct-17	1.6	10	1.3	1.3	7	5.1
19	Jan-18	1.1	11	0.9	0.95	5.2	6.3
20	May-18	5.3	11	0.79	1.2	4.7	25
21	Jul-18	2.9	13	0.98	1	9	18
22	Oct-18		8.7	0.66	2	1.1	9.7
23	Jan-19	2.3	8.6		0.83	5.6	0.83
24	May-19	2.1	8.8		1.6	5.6	2.7
25							
Coefficient of Variation:		0.53	0.35	3.01	0.48	0.39	0.93
Mann-Kendall Statistic (S):		-74	135	-34	45	-137	34
Confidence Factor:		99.8%	>99.9%	89.3%	95.2%	>99.9%	82.2%
Concentration Trend:		Decreasing	Increasing	No Trend	Increasing	Decreasing	No Trend



Notes:
1. At least four independent sampling events per well are required for calculating the trend. *Methodology is valid for 4 to 40 samples.*
2. Confidence in Trend = Confidence (in percent) that constituent concentration is increasing (S>0) or decreasing (S<0): >95% = Increasing or Decreasing; ≥ 90% = Probably Increasing or Probably Decreasing; < 90% and S>0 = No Trend; < 90%, S≤0, and COV ≥ 1 = No Trend; < 90% and COV < 1 = Stable.
3. Methodology based on "MAROS: A Decision Support System for Optimizing Monitoring Plans", J.J. Aziz, M. Ling, H.S. Rifai, C.J. Newell, and J.R. Gonzales, *Ground Water*, 41(3):355-367, 2003.

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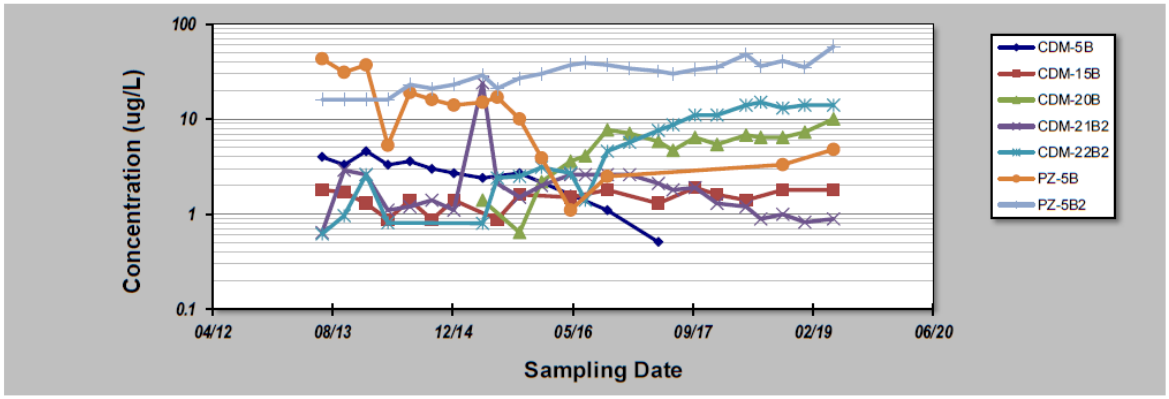
Figure C-3. cDCE Mann Kendall trend analysis for the B-zone and C-zone aquifer monitoring wells. Only one well, CDM-5C, is above the MCL for cDCE but this well is also increasing in contaminants.

GSI MANN-KENDALL TOOLKIT
for Constituent Trend Analysis

Evaluation Date: 2-Jan-20 | Job ID: Fresno 2020
Facility Name: USACE- Seattle District | Constituent: TCE
Conducted By: Justin McNabb | Concentration Units: ug/L

Sampling Point ID:	CDM-5B	CDM-15B	CDM-20B	CDM-21B2	CDM-22B2	PZ-5B	PZ-5B2
Sampling Event	Sampling Date	TCE CONCENTRATION (ug/L)						
1	Jul-13	4	1.8		0.64	0.62	43	16
2	Oct-13	3.3	1.7		2.9	0.96	31	16
3	Jan-14	4.6	1.3		2.6	2.6	37	16
4	Apr-14	3.3	0.88		1.1	0.81	5.3	16
5	Jul-14	3.6	1.4		1.2		19	23
6	Oct-14	3	0.88		1.4		16	21
7	Jan-15	2.7	1.4		1.1		14	23
8	May-15	2.4		1.4	24	0.8	15	29
9	Jul-15		0.88		2.1	2.4	17	21
10	Oct-15	2.7	1.6	0.64	1.5	2.5	10	27
11	Jan-16			2.2	2	3.1	3.9	30
12	May-16	1.6	1.5	3.6	2.6	2.7	1.1	37
13	Jul-16			4.1	2.6	1.4		39
14	Oct-16	1.1	1.8	7.7	2.6	4.6	2.5	37
15	Jan-17			7.1	2.6	5.7		34
16	May-17	0.51	1.3	5.8	2.1	7.6		32
17	Jul-17			4.7	1.8	8.7		30
18	Oct-17		1.9	6.4	1.9	11		33
19	Jan-18		1.6	5.4	1.3	11		35
20	May-18		1.4	6.8	1.2	14		48
21	Jul-18			6.4	0.89	15		36
22	Oct-18		1.8	6.4	1	13	3.3	41
23	Jan-19			7.3	0.82	14		35
24	May-19		1.8	10	0.89	14	4.8	58
25								
Coefficient of Variation:		1.21	0.84	2.38	2.29	1.30	0.88	0.35
Mann-Kendall Statistic (S):		-183	-184	128	-403	-110	-69	193
Confidence Factor:		>99.9%	99.9%	98.9%	>99.9%	93.1%	>99.9%	>99.9%
Concentration Trend:		Decreasing	Decreasing	Increasing	Decreasing	Prob. Decreasing	Decreasing	Increasing



Notes:

1. At least four independent sampling events per well are required for calculating the trend. *Methodology is valid for 4 to 40 samples.*
2. Confidence in Trend = Confidence (in percent) that constituent concentration is increasing (S>0) or decreasing (S<0): >95% = Increasing or Decreasing; ≥ 90% = Probably Increasing or Probably Decreasing; < 90% and S>0 = No Trend; < 90%, S≤0, and COV ≥ 1 = No Trend; < 90% and COV < 1 = Stable.
3. Methodology based on "MAROS: A Decision Support System for Optimizing Monitoring Plans", J.J. Aziz, M. Ling, H.S. Rifai, C.J. Newell, and J.R. Gonzales, *Ground Water*, 41(3):355-367, 2003.

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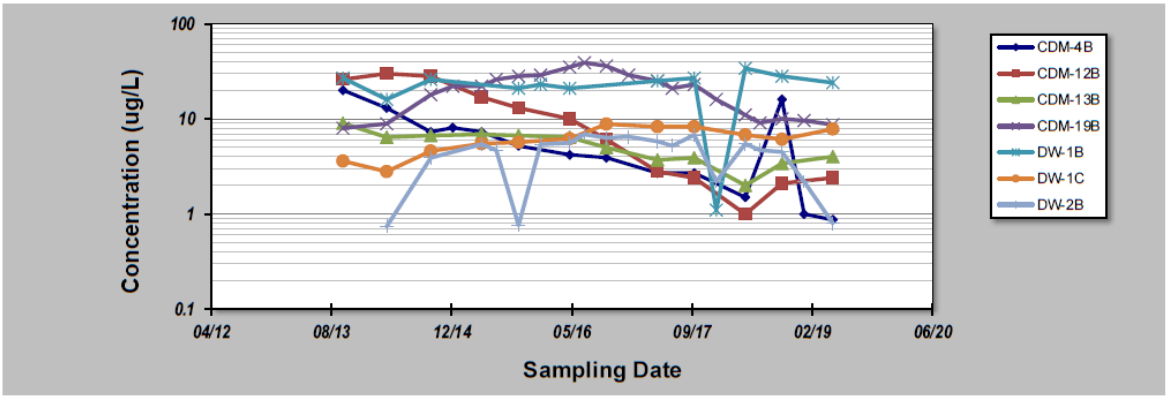
Figure C-4. Mann-Kendall trend analysis for TCE in the B-zone aquifer. Three wells are above the MCL for TCE and two wells are increasing in concentration, and one well is probably decreasing.

GSI MANN-KENDALL TOOLKIT
for Constituent Trend Analysis

Evaluation Date: 2-Jan-20
Facility Name: USACE- Seattle District
Conducted By: Justin McNabb

Job ID: Fresno 2020
Constituent: TCE
Concentration Units: ug/L

Sampling Point ID:		CDM-4B	CDM-12B	CDM-13B	CDM-19B	DW-1B	DW-1C	DW-2B
Sampling Event	Sampling Date	TCE CONCENTRATION (ug/L)						
1	Jul-13							
2	Oct-13	20	26	9	8	27	3.6	
3	Jan-14							
4	Apr-14	13	30	6.4	8.9	16	2.8	0.74
5	Jul-14							
6	Oct-14	7.3	28	6.7	18	26	4.6	3.9
7	Jan-15	8.1			22			
8	May-15	7.3	17	6.9	22		5.5	5.4
9	Jul-15				26			4.7
10	Oct-15	5.2	13	6.7	28	21	5.7	0.76
11	Jan-16				29	23		5.4
12	May-16	4.2	10	6.4	35	21	6.2	5.6
13	Jul-16				39			6.9
14	Oct-16	3.9	6.1	5	36		8.8	6.3
15	Jan-17				29			6.5
16	May-17	2.7	2.8	3.7	25	25	8.3	5.8
17	Jul-17				21			5.2
18	Oct-17	2.7	2.4	3.9	23	27	8.3	6.8
19	Jan-18				16	1.1		2.2
20	May-18	1.5	1	2	11	34	6.8	5.5
21	Jul-18				9.1			4.7
22	Oct-18	16	2.1	3.4	10	28	6.1	4.5
23	Jan-19	1			9.6			2.2
24	May-19	0.87	2.4	4	8.7	24	7.8	0.8
25								
Coefficient of Variation:		1.59	1.74	2.21	1.05	1.22	0.31	0.47
Mann-Kendall Statistic (S):		-226	-230	-15	-324	-143	37	-4
Confidence Factor:		>99.9%	>99.9%	62.0%	>99.9%	99.9%	99.5%	54.1%
Concentration Trend:		Decreasing	Decreasing	No Trend	Decreasing	Decreasing	Increasing	Stable



Notes:

At least four independent sampling events per well are required for calculating the trend. *Methodology is valid for 4 to 40 samples.*

Confidence in Trend = Confidence (in percent) that constituent concentration is increasing (S>0) or decreasing (S<0): >95% = Increasing or Decreasing; ≥ 90% = Probably Increasing or Probably Decreasing; < 90% and S>0 = No Trend; < 90%, S≤0, and COV ≥ 1 = No Trend; < 90% and COV < 1 = Stable.

Methodology based on "MAROS: A Decision Support System for Optimizing Monitoring Plans", J.J. Aziz, M. Ling, H.S. Rifai, C.J. Newell, and J.R. Gonzales, *Ground Water*, 41(3):355-367, 2003.

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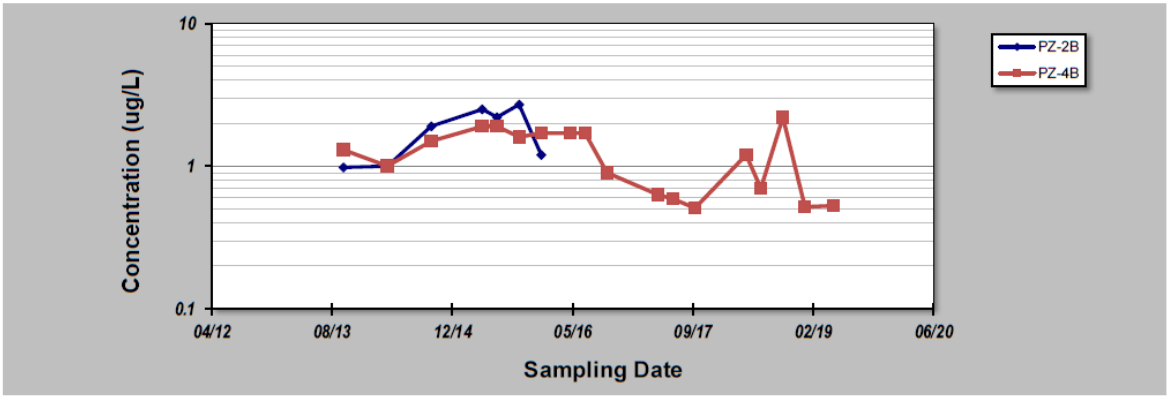
Figure C-5. Mann-Kendall trend analysis for TCE in the B-zone aquifer. Three wells are above the MCL for TCE. One well is increasing (DW-1C) and two wells are decreasing.

GSI MANN-KENDALL TOOLKIT
for Constituent Trend Analysis

Evaluation Date: 2-Jan-20
Facility Name: USACE- Seattle District
Conducted By: Justin McNabb

Job ID: Fresno 2020
Constituent: TCE
Concentration Units: ug/L

Sampling Point ID:	PZ-2B	PZ-4B					
Sampling Event	Sampling Date	TCE CONCENTRATION (ug/L)					
1	Jul-13						
2	Oct-13	0.98	1.3				
3	Jan-14						
4	Apr-14	1	1				
5	Jul-14						
6	Oct-14	1.9	1.5				
7	Jan-15						
8	May-15	2.5	1.9				
9	Jul-15	2.2	1.9				
10	Oct-15	2.7	1.6				
11	Jan-16	1.2	1.7				
12	May-16		1.7				
13	Jul-16		1.7				
14	Oct-16		0.9				
15	Jan-17						
16	May-17		0.63				
17	Jul-17		0.59				
18	Oct-17		0.51				
19	Jan-18						
20	May-18		1.2				
21	Jul-18		0.7				
22	Oct-18		2.2				
23	Jan-19		0.52				
24	May-19		0.53				
25							
Coefficient of Variation:		1.38	0.91	1.55	0.77	1.91	
Mann-Kendall Statistic (S):		-43	-292	-23	25	23	
Confidence Factor:		88.0%	>99.9%	88.3%	88.0%	85.9%	
Concentration Trend:		No Trend	Decreasing	No Trend	No Trend	No Trend	



Notes:

1. At least four independent sampling events per well are required for calculating the trend. *Methodology is valid for 4 to 40 samples.*
2. Confidence in Trend = Confidence (in percent) that constituent concentration is increasing (S>0) or decreasing (S<0): >95% = Increasing or Decreasing; ≥ 90% = Probably Increasing or Probably Decreasing; < 90% and S>0 = No Trend; < 90%, S≤0, and COV ≥ 1 = No Trend; < 90% and COV < 1 = Stable.
3. Methodology based on "MAROS: A Decision Support System for Optimizing Monitoring Plans", J.J. Aziz, M. Ling, H.S. Rifai, C.J. Newell, and J.R. Gonzales, *Ground Water*, 41(3):355-367, 2003.

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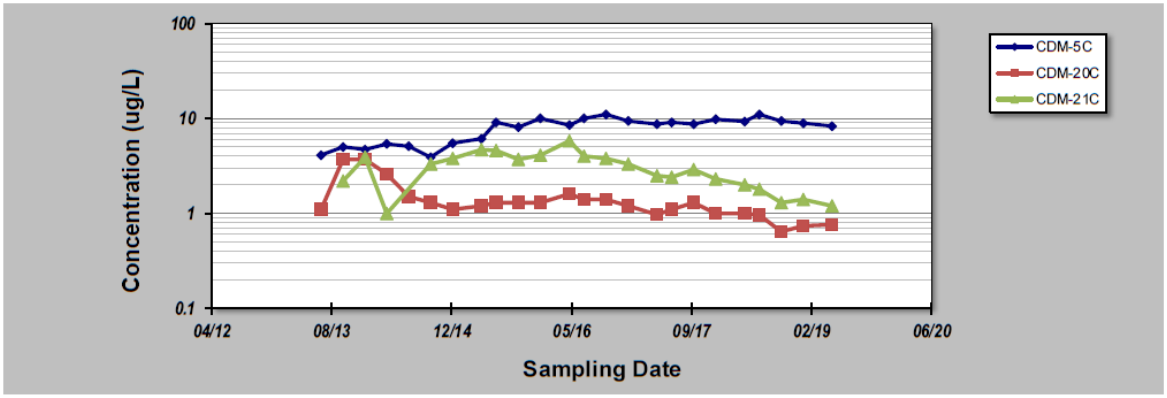
Figure C-6. Mann-Kendall trend analysis for TCE in the B-zone aquifer. Both wells are below the MCL and one well is decreasing while the other is stable. These wells are right on the western edge of the landfill.

GSI MANN-KENDALL TOOLKIT
for Constituent Trend Analysis

Evaluation Date: 2-Jan-20
Facility Name: USACE- Seattle District
Conducted By: Justin McNabb
Job ID: Fresno 2020
Constituent: TCE
Concentration Units: ug/L

Sampling Point ID:	CDM-5C	CDM-20C	CDM-21C				
Sampling Event	Sampling Date	TCE CONCENTRATION (ug/L)						
1	Jul-13	4.1	1.1					
2	Oct-13	5	3.7	2.2				
3	Jan-14	4.7	3.7	3.9				
4	Apr-14	5.4	2.6	1				
5	Jul-14	5.1	1.5					
6	Oct-14	3.9	1.3	3.3				
7	Jan-15	5.5	1.1	3.8				
8	May-15	6.1	1.2	4.7				
9	Jul-15	9.1	1.3	4.6				
10	Oct-15	8.1	1.3	3.7				
11	Jan-16	10	1.3	4.1				
12	May-16	8.5	1.6	5.8				
13	Jul-16	10	1.4	4				
14	Oct-16	11	1.4	3.8				
15	Jan-17	9.4	1.2	3.3				
16	May-17	8.7	0.97	2.5				
17	Jul-17	9.1	1.1	2.4				
18	Oct-17	8.7	1.3	2.9				
19	Jan-18	9.8	1	2.3				
20	May-18	9.3	1	2				
21	Jul-18	11	0.96	1.8				
22	Oct-18	9.4	0.64	1.3				
23	Jan-19	8.9	0.74	1.4				
24	May-19	8.3	0.76	1.2				
25								
Coefficient of Variation:		0.86	0.95	2.66	0.77	1.91		
Mann-Kendall Statistic (S):		-168	-490	-2	25	23		
Confidence Factor:		97.9%	>99.9%	50.5%	88.0%	85.9%		
Concentration Trend:		Decreasing	Decreasing	No Trend	No Trend	No Trend		



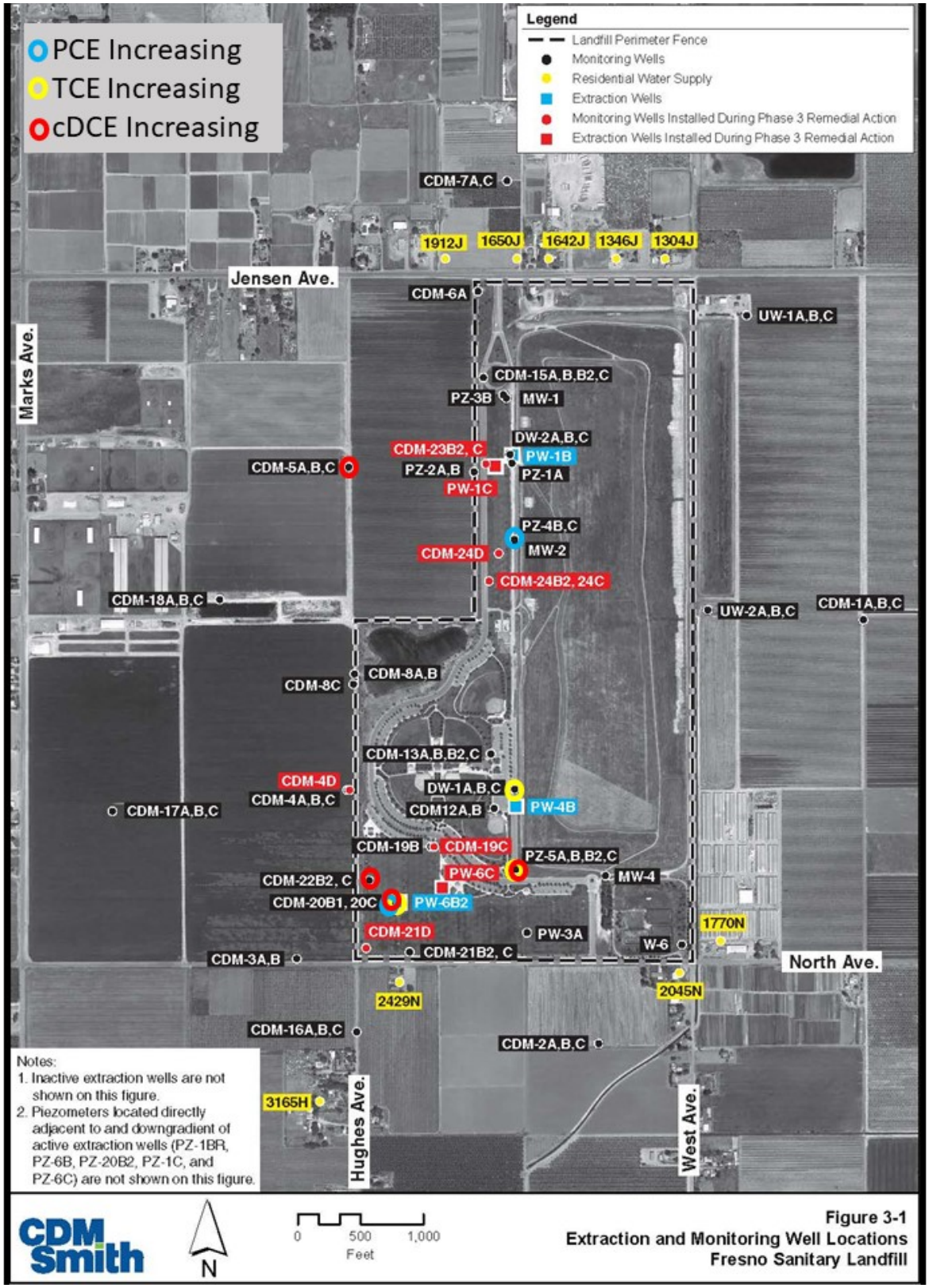
Notes:

1. At least four independent sampling events per well are required for calculating the trend. *Methodology is valid for 4 to 40 samples.*
2. Confidence in Trend = Confidence (in percent) that constituent concentration is increasing (S>0) or decreasing (S<0): >95% = Increasing or Decreasing; ≥ 90% = Probably Increasing or Probably Decreasing; < 90% and S>0 = No Trend; < 90%, S≤0, and COV ≥ 1 = No Trend; < 90% and COV < 1 = Stable.
3. Methodology based on "MAROS: A Decision Support System for Optimizing Monitoring Plans", J.J. Aziz, M. Ling, H.S. Rifai, C.J. Newell, and J.R. Gonzales, *Ground Water*, 41(3):355-367, 2003.

DISCLAIMER: *The GSI Mann-Kendall Toolkit is available "as is". Considerable care has been exercised in preparing this software product; however, no party, including without limitation GSI Environmental Inc., makes any representation or warranty regarding the accuracy, correctness, or completeness of the information contained herein, and no such party shall be liable for any direct, indirect, consequential, incidental or other damages resulting from the use of this product or the information contained herein. Information in this publication is subject to change without notice. GSI Environmental Inc., disclaims any responsibility or obligation to update the information contained herein.*

GSI Environmental Inc., www.gsi-net.com

Figure C-7. Mann-Kendall trend analysis for TCE in the C-zone aquifer. One well is above the MCL but has a decreasing trend, and the other two wells are decreasing or have no trend below the MCL.


PCE Increasing
TCE Increasing
cDCE Increasing
Legend
Landfill Perimeter Fence
Monitoring Wells
Residential Water Supply
Extraction Wells
Monitoring Wells Installed During Phase 3 Remedial Action
Extraction Wells Installed During Phase 3 Remedial Action
CDM-7A,C
1912J
1650J
1642J
1346J
1304J
Jensen Ave.
CDM-6A
UW-1A,B,C
Marks Ave.
CDM-15A,B,B2,C
PZ-3B
MW-1
DW-2A,B,C
CDM-23B2, C
PW-1B
CDM-5A,B,C
PZ-2A,B
PZ-1A
PW-1C
PZ-4B,C
CDM-24D
MW-2
CDM-24B2, 24C
CDM-18A,B,C
UW-2A,B,C
CDM-1A,B,C
CDM-8C
CDM-8A,B
CDM-13A,B,B2,C
CDM-4D
CDM-4A,B,C
DW-1A,B,C
CDM-17A,B,C
CDM12A,B
PW-4B
CDM-19B
CDM-19C
PZ-5A,B,B2,C
CDM-22B2, C
PW-6C
MW-4
CDM-20B1, 20C
PW-6B2
1770N
CDM-21D
PW-3A
W-6
CDM-3A,B
CDM-21B2, C
North Ave.
2045N
2429N
CDM-16A,B,C
CDM-2A,B,C
Notes:
1. Inactive extraction wells are not shown on this figure.
2. Piezometers located directly adjacent to and downgradient of active extraction wells (PZ-1BR, PZ-6B, PZ-20B2, PZ-1C, and PZ-6C) are not shown on this figure.
3165H
Hughes Ave.
West Ave.
CDM Smith
N
0
500
1,000
Feet
Figure 3-1
Extraction and Monitoring Well Locations
Fresno Sanitary Landfill

Appendix D: ARAR Assessment

Section 121(d)(1)(A) of CERCLA requires that remedial actions at CERCLA sites attain (or justify the waiver of) any federal or state environmental standards, requirements, criteria, or limitations that are determined to be legally applicable or relevant and appropriate requirements (ARARs). Federal ARARs may include requirements promulgated under any federal environmental laws. State ARARs may only include promulgated, enforceable environmental or facility-siting laws of general application that are more stringent or broader in scope than federal requirements and that are identified by the state. ARARs are identified on a site-specific basis from information about the chemicals at the Site, the RAs contemplated, the physical characteristics of the Site, and other appropriate factors. ARARs include only substantive, not administrative, requirements and pertain only to onsite activities. There are three general categories of ARARs: chemical-specific, location-specific, and action-specific.

EPA selected chemical-specific ARARs in the 1993 and 1996 RODs and subsequent 2012 ESD (Table D-1). In the 1996 ROD, EPA selected the California MCL as the cleanup level for nine of the 16 contaminants of concern, and federal MCLs were selected for all others. There have been no changes in the past five years that affect the protectiveness of the cleanup levels, and all current regulations are either the same or less stringent than the cleanup levels. Since issuance of the 1996 ROD, the state has adopted a more stringent MCL for tDCE of 10 µg/L, and the 2012 ESD updated the tDCE cleanup level to match the more stringent state MCL. Both the current state and federal MCLs for chloroform are more stringent than the original 1996 cleanup standard, and the 2012 ESD updated the chloroform cleanup level to match the more stringent current state and federal MCLs. The federal MCL for chlorobenzene is now less stringent than the cleanup level.

Table D- 1. Chemical-Specific ARARs

Chemical of Concern	ROD or ESD Cleanup Standard (µg/L)	Basis	Current Regulations (µg/L)		ARARs Changed?
			State MCL	Federal MCL	
TCE	5	Federal MCL	5	5	No change
PCE	5	Federal MCL	5	5	No change
VC	0.5	State MCL	0.5	2	No change
1,1-DCE	6	State MCL	6	7	No change
1,2-DCA	0.5	State MCL	0.5	5	No change
tDCE[1]	10	State MCL	10	100	No change
cDCE	6	State MCL	6	70	No change
1,2-DCP	5	Federal MCL	5	5	No change
1,2-DCB	600	Federal MCL	600	600	No change
1,4-DCB	5	State MCL	5	75	No change
Benzene	1	State MCL	1	5	No change
Chlorobenzene	70	Federal MCL	N/A	100	Less stringent
Chloroform[2,3]	80	Federal MCL	80	80	No change
1,1-DCA	5	State MCL	5	N/A	No change
trichlorofluoromethane (or Freon 11)	150	State MCL	150	N/A	No change
Toluene	150	State MCL	150	1000	No change

[1] The 1996 ROD incorrectly cited the less stringent federal MCL (100 µg/L). The 2012 ESD selected the more stringent state MCL (10 µg/L).
[2] The 1996 ROD selected 100 µg/L as the cleanup level. Since then, the federal MCL has changed to 80 µg/L. The 2012 ESD selected the more stringent federal MCL.
[3] MCL shown is for Total Trihalomethanes, a class of chemicals that include chloroform.

Federal and State laws and regulations other than the chemical-specific ARARs that have been promulgated or changed over the past five years are described in Table D-2. ARARs that have not changed over the last five years are listed in bullets below. In the 2012 ESD, EPA updated the ARARs for the Site to remove and replace ARARs identified in the previous RODs that were superseded or were incorrectly identified, and ARARs that were removed are no longer included in the ARAR assessment. Additionally, the table and list does not include ARARs that are no longer pertinent now that the response action has transitioned from construction to long-term O&M phase work. For example, ARARs related to remedial design and construction are not included if they do not continue into long-term O&M. There have been no revisions to laws or regulations that affect the protectiveness of the remedy.

The following ARARs have not changed in the past five years:

- 33 United States Code (USC) §§1311-1312 (Clean Water Act, Sections 301 and 302)
- 33 USC §1317 (Clean Water Act, Section 307)
- CA Health and Safety Code 25249.5
- California Code of Regulations (CCR) Title 22, 66264.117
- CCR Title 22, 66264.170-66264.178
- CCR Title 22, 67391.1
- CCR Title 23, Division 3, Ch. 15, Article 123, CCR 2511(d)

- CCR Title 23, Division 3, Ch. 15, Article 123, CCR 2510(g)
- CCR Title 23, 2550.6
- CCR Title 23, 2550.7
- CCR Title 23, 2550.9
- CCR Title 23, 2550.10
- CCR Title 27, 20415
- CCR Title 27, 20918
- CCR Title 27, 20919
- CCR Title 27, 20921
- CCR Title 27, 20925
- CCR Title 27, 20931
- CCR Title 27, 20932
- CCR Title 27, 20933
- CCR Title 27, 20937
- CCR Title 27, 21180
- CCR Title 27, 21190
- CCR Title 27, 21200
- Safe Drinking Water Act, 40 CFR 144
- State Water Resources Control Board Resolution #92-49 III G
- State Water Resources Control Board Resolution #88-63
- San Joaquin Valley Unified Air Pollution Control District Rule 46-42

Table D- 2. ARAR Analysis

ARAR and Citation	ROD	Description	Comments	Effect on Protectiveness
National Emissions Standards for Hazardous Air Pollutants, Clean Air Act 40 CFR 61	1993 ROD	Identifies and establishes emissions standards for specific hazardous air pollutants.	No new changes in chemical standards. Last revised March 2019.	None
Regional Water Quality Control Board (Central Valley) Basin Plan	1996 ROD	Establishes water quality objectives to protect the beneficial use of surface and groundwater in the Sacramento and San Joaquin River drainage basins	No new changes to chemical standards. Last revised May 2018.	None
CCR Title 22, 66264.90-66264.101	1996 ROD	Creates broad groundwater monitoring and compliance standards for owners and operators of permitted hazardous waste facilities	Revised October 2018	None

Appendix E: Press Notice

The following notice was published in The Fresno Bee on January 30, 2020.

RINGO H.W. CHIU AP

An airplane carrying U.S. citizens being evacuated from Wuhan, China, lands Wednesday at March Air Reserve Base in Riverside, Calif. The crew was kept isolated from passengers, who will undergo additional screenings in California.

Human-to-human spread of new virus worries WHO

BY KEN MORITSUGU
Associated Press

BEIJING

World health officials, back from a visit to Beijing, expressed great concern Wednesday that a dangerous new virus is spreading between people outside of China, even as the number of illnesses continue to grow dramatically inside that Asian nation.

The new virus has now infected more people in China than were sickened during the 2002-2003 SARS outbreak. On Wednesday, the number of cases jumped to 5,974, surpassing the 5,327 people diagnosed with SARS.

The death toll, which stood at 132 Wednesday, virus outbreak are undergoing three days of monitoring at a Southern California military base to make sure they do not show signs of the virus, officials said Wednesday.

The people flown out of China on a plane chartered by the U.S. government are not quarantined, Dr. Chris Braden of the Centers for Disease Control and Prevention told reporters after the plane landed at March Air Reserve Base.

Officials could quarantine any of those evacuated if officials determine they need to do so, Braden said.

None of the passengers showed signs of having the virus when they were screened before leaving the Chinese city of Wuhan

The new virus is from the coronavirus family, which includes those that can cause the common cold as well as more serious illnesses such as SARS and MERS.

Ryan, the WHO official, noted there were several aspects of the new virus outbreak that are extremely worrying, citing the recent rapid spike in cases in China. He said that while scientists believe the outbreak was sparked by an animal virus, it's unclear if there are other factors driving the epidemic.

"Without understanding that, it's very hard to put into context the current transmission dynamics," he said.

Meanwhile, countries began evacuating their from the mainland at midnight.

The number of cases in China rose 1,459 from the previous day, a smaller increase than the 1,771 new cases reported Tuesday. Australia and Singapore were among those reporting new cases, as the number outside China topped 70. The vast majority are people who came from Wuhan.

In China's Hubei province, 17 cities including Wuhan have been locked down, trapping more than 50 million people in the most far-reaching disease control measures ever imposed.

Get answers to your coronavirus questions Friday

BY PATTY GUERRA
pguerra@modbee.com

The coronavirus outbreak continues to spread. As of Thursday, Chinese officials confirmed more than 6,000 cases, with more than 130 deaths, according to The New York Times.

World Health Organization officials, who decided last week not to declare the outbreak a public health emergency, planned to again consider doing so Thursday, its director general said.

Foreign governments continue to pull their citizens out of Wuhan, China, where the outbreak began. A plane of Americans landed in Southern California on Thursday.

And public health in communities around the country have been inundated with calls from concerned residents.

What does any of this mean to you? How much of a danger is the coronavirus to people who live in the United States, and what can you do to protect yourself from infection?

We want to offer you the opportunity to ask questions and get answers from Dr. Mink, who is serving on the staff of The Modesto Bee and McClatchy Newspapers under the Report for America program.

Mink is a pediatric infectious disease specialist, as well as a clinical professor of pediatrics at UCLA. She said she has gotten numerous text messages

ChrisAnna Mink

from her friends and family with questions about the coronavirus and what it could mean to them.

We want to offer our readers the chance to ask their own questions, and we will be producing a live video at 10 a.m. on Friday.

Mink cautions that she will be giving out general information. As always, people seeking medical advice for specific issues should talk to to their medical providers.

The video will be shown on The Modesto Bee's YouTube channel, and there will be links to it from our websites.

You can tune in and ask questions then, or email them in advance to local@modbee.com.

This important video will be available for viewing on all of McClatchy's California websites, including The Sacramento Bee, The Fresno Bee, Merced Sun-Star and San Luis Obispo Tribune. We will also update this story with the link to the live video on Friday.

Help us cover your community through The Modesto Bee's partnership with Report For America. Contribute now to help fund ChrisAnna Mink's important health coverage.

Patty Guerra: @pattyguerra

is lower than the 348 people who died in China from SARS, or severe acute respiratory syndrome. Scientists say there are still many questions to be answered about the new virus, including just how easily it spreads and how severe it is.

The World Health Organization's emergencies chief told reporters on Wednesday that China was taking "extraordinary measures in the face of an extraordinary challenge" posed by the outbreak.

Dr. Michael Ryan spoke at a news conference after returning from a trip to Beijing to meet with Chinese President Xi Jinping and other senior government leaders. He said the epidemic remains centered in the city of Wuhan and in Hubei province but that "information is being updated and is changing by the hour."

Ryan said the few cases of human-to-human spread of the virus outside China – in Japan, Germany, Canada and Vietnam – were part of the reason the U.N. health agency's director-general has reconvened an expert committee to meet Thursday. It will assess whether the outbreak should be declared a global emergency.

To date, about 99% of the nearly 6,000 cases are in China. Ryan estimated the death rate of the new virus at 2%, but said the figure was very preliminary. With fluctuating numbers of cases and deaths, scientists are only able to produce a rough estimate of the fatality rate and it's likely many milder cases of the virus are being missed.

In comparison, the SARS virus killed about 10% of people who caught it.

Among the other developments Wednesday:

Americans evacuated: The 201 Americans evacuated from the Chinese ci[illegible]t the center of the that is the epicenter of the virus or when they were screened again during a refueling stop in Anchorage, Alaska.

Russia closes border: Deputy Prime Minister Tatiana Golikova said Wednesday that the land border with China will remain closed to car traffic until March 1.

French patient: An 80-year-old Chinese tourist was on artificial respiration in a Paris hospital with the new virus, after two French hospitals initially declined to test him for the sickness. France has four confirmed cases of the deadly coronavirus, including two people in intensive care.

citizens from the Chinese city hardest-hit by the virus. Chartered planes carrying about 200 evacuees each arrived in Japan and the United States early Wednesday as other countries planned similar evacuations from the city of Wuhan, which authorities have shut down to try to contain the virus.

The first cases in the Middle East were confirmed Wednesday, a family of four from Wuhan that was visiting the United Arab Emirates. Airlines around the world announced they were cutting flights to China, and Hong Kong was suspending rail travel to and

EPA SEEKS PUBLIC INPUT ON CLEANUP WORK AT FRESNO MUNICIPAL SANITARY LANDFILL SUPERFUND SITE

The U.S. Environmental Protection Agency (EPA) is reviewing cleanup work done by the City of Fresno to clean up the Fresno Municipal Sanitary Landfill Superfund site in Fresno, CA. The City of Fresno is responsible, under the Superfund law, to clean up the landfill. This review—called a "Five-Year Review"—will determine if the remedy selected is still working as designed and continues to be protective of human health and the environment. According to the Superfund law, EPA is required to review the remedy every five years if either the cleanup takes more than five years to complete, or if hazardous waste remains on site.

Background
The site is located four miles southwest of the City of Fresno in Fresno County, California. The landfill covers 145 acres and rises 60 feet above the surrounding lands. West Jensen Avenue borders the site to the north; South Hughes Avenue borders the site to the west; West North Avenue borders the site to the south; and South West Avenue borders the site to the east. Agricultural land surrounds the landfill in all directions. The city accepted and disposed waste into the landfill between 1937 and 1989 and remains the landfill owner. Because the bottom of the landfill is unlined, waste in the landfill polluted underlying soil and groundwater. Landfill gases also polluted the air.

Cleanup Plans Reviewed
In 1993, EPA signed a cleanup plan, called a "Record of Decision" (ROD), to control methane gas and waste movement under the landfill. This cleanup plan was finished being built in 2001 and included a landfill cover system, a landfill gas control system and a surface water management system. The remaining portion of the site was undeveloped and consisted of grassy land. In 1996, EPA signed another ROD for the groundwater cleanup. It involved constructing a groundwater treatment system that would contain the contaminated groundwater under the landfill. Once the groundwater is contained, the system treats the groundwater until it meets all drinking water standards.

What Is Included in This Five-Year Review?
The last Five-Year Review, completed in 2015, found that the remedies selected in the ROD worked as intended and continued to protect human health and the environment.

The 2020 Five-Year Review will include:
- inspecting of the site and cleanup technologies;
- reviewing site monitoring data, operating data and maintenance records; and
- determining if any new relevant regulatory requirements have been established since EPA's original cleanup plans were finalized.

EPA Would Like to Hear from You!
EPA invites the community to learn more about the site and provide input on how the site cleanup is going in an interview. If you would like to be interviewed, please contact Cynthia Ruelas, Remedial Project Manager, at (415) 972-3329 or at Ruelas.Cynthia@epa.gov before May 30, 2020.

The 2020 Five-Year Review report will be completed by September 30, 2020. EPA will post a copy of the report on the site webpage at: www.epa.gov/superfund/fresnomunicipallandfill, and a copy will be sent to the site's information repository, which contains the site's "administrative record" (*i.e.*, a set of key documents EPA used to develop the cleanup plan) and other project reports, documents, fact sheets and other reference material. The information repository is found at the Fresno County Central Library, 2420 Mariposa Street, Fresno, CA 93721. The library's phone number is (559) 488-3195. To speak with a librarian, press option 4. For current library hours, press option 2.

CNS-3334232#

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For additional information please call Yvette at 559.278.7137.

The following public notice was published in Vida En El Valle on March 4, 2020.

VALLE

Viviendo su sueño de infancia

POR MARÍA G.
ORTIZ-BRIONES
mortizbriones@vidaenelvalle.com

Con tan solo 21 años Elvis Laínez sabe lo que quiere ser profesionalmente – un conductor de *Monster Jam*, la experiencia de automovilismo más llena de acción para todas familias.

De hecho, es algo que estaba en la mente de Laínez desde que tenía solamente dos años.

"Toda mi vida he jugado deportes, siempre me ha gustado a mí la adrenalina," dijo Laínez quien nació en Houston, TX de padres salvadoreños.

Laínez dijo que fue a su primer show de *Monster Jam* con su familia en el Houston Astrodome a la edad de dos años.

"Desde ese momento yo supe que eso era lo que yo quería ser. So toda mi vida tenia en mi mente que yo quería hacer eso," dijo de su recuerdo de infancia.

Y este fin de semana Laínez estará mostrando su talento en Fresno durante el '*Monster Jam Triple Threat Series West*' que se estará llevando acabo en el Save Mart Center del 6 al 8 de marzo donde estará manejando la camioneta 'El Toro Loco.'

Nota completa: www.vidaenelvalle.com

NOTICIA PÚBLICA

El Consejo de Gobiernos de Fresno llevará a cabo una audiencia pública para el Proceso Anual de Necesidades do Tránsito No Cumplidas que comenzará a las 5:30 p.m. el Jueves de Marzo del 2020 en el Salón Sequoia room del Consejo de Gobiernos de Fresno, 2035 Tulare St., Suite 201 Fresno, California.

La Junta de Politicas de Fresno COG tomará comentarios en esta audiencia público en la región del Condada do Fresno que sean razonables para cumplir durante el año fiscal 2020-21. Además de esta audiencia pública, Fresno COG a llevado a cabo reunions de alcance en todo el condado. Las agencias de tránsito involucradas en este proceso incluyen Fresno Area Express, la Agencia de Tránsito Rural de Fresno, Tránsito de Clovis, y la Comisión de Oportunidades Económicas de Fresno. Para obtener información adicional, visite www.fresnocog.org o comuníquese con Todd Sobrado, Fresno Area Express al número (559) 621-1532.

Las personas con discapacidades pueden llamar a Fresno COG (con un preaviso de 3 días laborables) para solicitor las ayudas auxiliares necesarias para participar en la audiencia pública. Los servicios de traducción están disponibles (con un preaviso de 3 días laborables) a los participantes que hablan cualquier idioma con los servicios de traducción profesional y disponible.

/s/ TONY BOREN, Director Ejecutivo Consejo de Gobiernos de Fresno

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EPA BUSCA LA OPINIÓN DEL PÚBLICO SOBRE EL TRABAJO DE LIMPIEZA EN EL SITIO SUPERFUND EN EL RELLENO SANITARIO MUNICIPAL DE FRESNO

La Agencia de Protección Ambiental de los Estados Unidos (EPA) está revisando el trabajo de limpieza realizado por la ciudad de Fresno para limpiar el sitio Superfund en el relleno sanitario Municipal de Fresno en Fresno, CA. La Ciudad de Fresno es responsable bajo la ley de Superfund de limpiar el relleno sanitario. Esta revisión —llamada "Revisión de cinco años"— determinará si el remedio seleccionado sigue funcionando como fueron diseñados y que todavía protegen la salud humana y el medio ambiente. De acuerdo con la ley Superfund, EPA está obligada a revisar el remedio del sitio cada cinco años si una limpieza toma más de cinco años para completarse o si los desechos peligrosos permanecen en el sitio.

Antecedentes
El sitio esta ubicado a cuatro millas al suroeste de la ciudad de Fresno en el condado de Fresno, California. El relleno sanitario ocupa 145 acres y se eleva 60 pies por encima de las tierras circundantes. West Jensen Avenue es el límite norte; South Hughes Avenue es el límite occidental; West North es el límite sur y South West Avenue es el límite oriental del sitio. El relleno sanitario esta rodeado de tierras agrícolas en todas las direcciones. La ciudad acepto eliminar los desechos en el relleno sanitario entre 1937 y 1989 y sigue siendo propietaria del relleno sanitario. Debido a que el fondo del relleno sanitario no está recubierto, los residuos del relleno sanitario contaminaron la tierra subyacente y el agua subterránea. Los gases del relleno sanitario también contaminaron el aire.

Revisión de los planes de limpieza
En 1993 EPA aprobo un plan de limpieza, llamado "Registro de Decisión" (ROD), para controlar el gas metano y el movimiento de desechos bajo el relleno sanitario. Este plan de limpieza se terminó de desarrollar en 2001 e incluyó un sistema de cobertura en el relleno sanitario, un sistema de control del gas en el relleno sanitario y un sistema de gestión del agua superficial. La fracción restante del sitio no estaba urbanizada y consistía en tierra de pastizales. En 1996 la EPA aprobó otro ROD para la limpieza del agua subterránea. Esto implicó la construcción de un sistema de tratamiento de agua subterránea que contuviera el agua subterránea contaminada debajo en el relleno sanitario. Una vez contenida el agua subterránea, el sistema trata el agua subterránea hasta satisfacer todos los requisitos de agua potable.

¿Qué se incluye en esta Revisión de cinco años?
La última Revisión de cinco años, realizada en 2015, determinó que los remedios de limpieza seleccionados en el ROD estaban funcionando según lo previsto y que seguían protegiendo la salud de las personas y el medio ambiente.

La Revisión de cinco años de 2020 incluirá lo siguiente:
- Inspección del sitio y de las tecnologías de limpieza;
- Revisión de los datos de monitoreo del sitio, los datos operativos y los registros de mantenimiento; y
- Determinar si se ha establecido algún nuevo requisito reglamentario pertinente desde que finalizaron los planes de limpieza originales de la EPA.

¡EPA le gustaría saber de usted!
Invitamos a la comunidad a conocer más sobre el sitio y a dar su opinión sobre como se está llevando a cabo la limpieza del sitio en una entrevista. Si desea ser entrevistado, comuníquese con Cynthia Ruelas, Gerente de Proyectos (415) 972-3329 o en Ruelas.Cynthia@epa.gov antes del 30 de mayo de 2020.

El informe de la Revisión de cinco años de 2020 se completará a más tardar el 30 de septiembre de 2020. La EPA publicará una copia del informe en la página web del sitio en: www.epa.gov/superfund/fresnomunicipallandfill y se enviará una copia al repositorio de información del sitio, que contiene el "registro administrativo" del sitio (es decir, un conjunto de documentos clave que la EPA utilizó para desarrollar el plan de limpieza) y otros informes de proyectos, documentos, fichas técnicas y demás material de referencia. El repositorio de información se encuentra en la Biblioteca Central del Condado de Fresno, 2420 Mariposa Street, Fresno, CA 93721. El número de teléfono de la biblioteca es (559) 488-3196. Para hablar con un bibliotecario, presione la opción 4. Para conocer el horario actual de la biblioteca, presione la opción 2.

CNS-3334233#

Noticia Pública

El Consejo de Gobiernos de Fresno (Fresno COG) en el 3 de marzo, 2020 publicará el plan preliminar 2020 de Fresno COG del Plan de Participación Pública (PPP) para una revisión pública de 45 días y comentarios. El período de comentarios públicos se cierra a las 5:00 pm el 17 de abril 2020. El PPP es un plan con la intencion de brindar orientación a la Junta de Políticas de Fresno COG y a su personal para proporcionar participación pública y consultas entre agencias de manera temprana y frecuente durante el proceso de planificación regional. Contiene políticas, pautas, procesos y procedimientos que Fresno COG se compromete a implementar mientras busca y fomenta la participación pública abierta durante el proceso de tomar decisiones, sobre todos los asuntos con discreción. El PPP también identifica oportunidades para participar en el proceso de planificación del transporte metropolitano.

El 26 de marzo de 2020, la Junta de Políticas de Fresno COG llevará a cabo una audiencia pública durante su reunión mensual normal que comienza a las 5:30 pm en la Sala de Conferencias Sequoia en el 2035 Tulare Street, Fresno, CA 93721 en el centro de Fresno. La reunión es accesible para discapacitados. Las personas con discapacidades pueden llamar a Fresno COG (con aviso previo de 3 días hábiles) para solicitar las ayudas auxiliares necesarias para participar en la audiencia pública. Los servicios de traducción están disponibles (con aviso previo de 3 días) para los participantes que hablen cualquier idioma con los servicios de traducción profesionales disponibles. Los comentarios públicos son bienvenidos en la audiencia pública o pueden enviarse por escrito por correo o correo electrónico a lo siguiente:

Brenda Veenendaal
Gerente de Servicios Administrativos de Fresno COG
2035 Tulare Street, Suite 201
Fresno, CA 93721

Después de abordar todos los comentarios presentados, el Plan de Participación Pública 2020 se considerará para su aprobación, por resolución, el 28 de mayo de 2020, por la Junta de Política de Fresno COG en su reunión regularmente programada. Todos los documentos están disponibles para su revisión o descarga en el sitio web de Fresno COG en www.fresnocog.org o en copia en papel en las oficinas de Fresno COG. Si tiene alguna pregunta sobre el plan, comuníquese con Brenda Veenendaal por correo electrónico a brendav@fresnocog.org o llamando al 559-233-4148 ext. 219.

/ s / TONY BOREN, Director Ejecutivo
Consejo de Gobiernos de Fresno

Ciudad de Fresno
Revisión pública de la enmienda sustancial No. 2019-02 A Plan de acción anual 2019-2020

La Ciudad de Fresno es recipiente anual de fondos federales del Bloque de Desarrollo Comunitario (CDBG – Community Development Block Grant) suministrados por el Departamento de Vivienda y Desarrollo Urbano de los Estados Unidos (HUD). La Ciudad adoptó un Plan de Acción Anual 2019-2020 el 2 de Mayo del 2019, que especifica las actividades financiadas por el programa CDBG. La ciudad propone una enmienda (2019-02) al Plan de Acción para reprogramar $2.55 millones incluyendo un pago de aproximadamente $2.5 millones a HUD y aproximadamente $50,000 en ahorros de proyectos completados para financiar la construcción de un centro multigeneracional.

Una junta pública para recibir comentarios para la Enmienda Sustancial y el propuesto uso de fondos se llevarán a cabo en la junta de la Comisión de Vivienda y Desarrollo Comunitario el Miércoles 25 de Marzo del 2020 a las 5:00 p.m. en El Ayuntamiento de la Ciudad de Fresno, 2600 Fresno Street, Salón 2120, segundo piso. El Jueves 9 de Abril del 2020 se llevará a cabo una junta pública y un elemento de acción en el Concejo Municipal. Los lugares de reunión son fisicamente accesibles. Se pueden proveer servicios de un intérprete y servicios adicionales, como dispositivos de asistencia auditiva. Solicitudes de estos requerimientos deben hacerse mínimo cinco días antes de las fechas de la junta contactando a la División de Vivienda, al (559) 621-8300, por TTY (559) 621-8721, o enviando un correo electrónico a HCDD@fresno.gov.

La Enmienda Sustancial 2019-02 está disponible para indagación por 30 días a partir del 28 de febrero del 2020 y finaliza el 31 de Marzo de 2020. La enmienda se puede ver en City Hall en la Oficina del Secretario de la Ciudad (Salón 2133) y la División de Vivienda y Desarrollo Comunitario (Salón 3065). El informe también se puede encontrar en las Bibliotecas del Condado de Fresno, los Centros Públicos de la Ciudad y en www.fresno.gov/darm/housing-community-development/.

Se animan comentarios escritos y se pueden remitir a la Ciudad de Fresno, División de Vivienda y Desarrollo Comunitario, 2600 Fresno Street, Salón 3065, Fresno, California 93721, o por correo electrónico a HCDD@fresno.gov.

Appendix F: Interviews

Five-Year Review Interview Record			
Site:	Fresno Municipal Sanitary Landfill	**EPA ID No:**	CAD980636914

Interview Type: Site Visit/Email
Location of Visit: FMSL Site, Fresno, CA
Date: January 22, 2020/February 3, 2020
Time: 1000-1300/1000-1300

Interviewers

Name	Title	Organization
Justin McNabb	Hydrogeologist	USACE
Cynthia Ruelas	RPM	EPA

Interviewees

Name	Organization	Title	Telephone	Email
Juan Peng	DTSC	Sr. Hazardous Substances Eng.	916-255-3802	Juan.Peng@dtsc.ca.gov

Summary of Conversation

1) What is your overall impression of the project?

The project is professionally managed. City and their consultants from CDM Smith are on top of things, and communicate frequently with the regulators.

2) Is the remedy functioning as expected? How well is the remedy performing?

Overall the remedy is functioning as expected. Two new C-zone extraction wells were installed in 2018 to address vertical migration of contaminants in groundwater. It may take some time to see if the plume is fully contained.

3) What does the monitoring data show? Are there any trends that show contaminant levels are decreasing?

Monitoring data shows vertical migration has occurred. Locations need close attention are: CDM-5 series on the north, and CDM-4 series and PZ-5 series on the south. Most of the A-zone wells are dry now. B-zone extraction seems to be going well, and many wells have stable or decreasing concentrations, but the wells also vary annually especially after the system just went through two enhancements. The system needs more time to demonstrate clear trends.

4) Is there a continuous O&M presence? If so, please describe staff and activities. If there is not a continuous on-site presence, describe staff and frequency of site inspections and activities. How often are the treatment tower and flares down per year?

Yes. City of Fresno has staff running the O&M continuously for both OUs. Flares were down quite regularly in the past a few years according to the OU1 annual report (mainly due to PLC malfunction). On average the system was down about 1-2 days a month.

5) Have there been any significant changes in the O&M requirements, maintenance schedules, or sampling routines in the last five years? If so, do they affect protectiveness of the remedy? Please describe changes and impacts.

Not that I am aware of. Packing materials in the Packed Tower Aerator (PTA) tower were replaced in September 2019; they don't need special O&M once installed.

6) What are the annual operating costs (O&M costs) for your organization's involvement with the site?

Our annual oversight cost ranged between $5,000 and $15,000 during the past five years.

7) Have there been unexpected O&M difficulties or costs at the site in the last five years? If so, please give details.

PTA packing material replacement may be an unexpected cost to the City. As for O&M difficulties, landfill subsidence has not been fully addressed.

8) Have there been opportunities to optimize O&M or sampling efforts? Please describe changes and resultant or desired cost savings or improved efficiency.

CDM Smith makes recommendations to the groundwater monitoring program annually based on the most recent results. More D-zone monitoring wells were added to the monitoring network after Phase 3 of the RA.

9) Are you aware of any changes in Federal/State/County/Local laws and regulations that may impact the protectiveness of the remedy?

No.

10) Do you have any comments, suggestions, or recommendations regarding the project?

The City needs to closely monitor the new extraction well PW-1C to make sure it is operating as expected. PW-1C was installed to address contaminant migration on the north. Data so far shows the well is not extracting much contaminants. If continuous monitoring suggests PW-1C may not have been placed at the right location, the City should consider relocating this well.

Additional Site-Specific Questions

11) The most recent O&M report indicated a 1,1-DCE exceedance in GW treatment effluent; does you think this indicates a larger problem?

I suppose this question is referring to 1,2-cDCE in the effluent since August 2019 sampling.

1,2-cDCE in the effluent has exceeded the reporting limit of 0.5 µg/L but remained below the MCL of 6 µg/L since August 2019. It has been non-detect in the past. Several factors may have contributed to its elevation, such as O&M of the PTA, and change in influent condition after Phase 3 enhancements. The packing materials in the PTA have already been replaced but 1,2-cDCE was still detected above the RL as of November 2019. CDM Smith did not identify any significant change in influent constituents after Phase 3. All thing considered, I think the exceedance probably have more to do with the operation of the PTA. But it is too early to call it a larger problem before we collect more information. The City is still fining tune the operational parameters of the PTA to maximize the volatilization of all VOCs. If the issue persists after a few more months, more aggressive measures make need to be taken.

12) How well does the Well Prohibition Zone/Well Assessment Zone (offsite ICs) work? Have there been any problems with domestic or agricultural well installation?

I'm not familiar with the offsite ICs.

13) What is the level of concern for the downward migration of GW contaminants into the D- zone aquifer? Do you expect further remedial actions needed in the D-zone aquifer?

Downward migration has already occurred. In the three newly installed D-zone wells, CDM-4D had PCE exceeding the MCL once in April 2019. We will have to see if the newly installed C-zone extraction wells can achieve hydraulic containment in the C-zone. Further remediation actions are not necessary if the D-zone contamination remains stable or decreasing. The City should also consider installing a D-zone monitoring well near CDM-5 wells.

14) Monitoring data shows that water levels have dropped such that most, if not all, A-zone aquifer wells are dry. What is the potential that contaminants could be stranded in the A-zone?

It is highly likely that the contaminants are stranded in the A-zone. They may gradually infiltrate downward during the rainy season every year, but I doubt that would be anything significant. Natural attenuation will be extremely slow, if possible at all. Given the fact that the A-zone wells are relatively deep (60-102 ft below top of casing) and that the area is agricultural, vapor intrusion risk may not be a big concern.

15) The previous FYR noted that the landfill gas flare is not permitted and has no effluent monitoring requirements. Is this still the case?

Not under DTSC Cleanup Program's jurisdiction.

Five-Year Review Interview Record			
Site:	Fresno Municipal Sanitary Landfill	**EPA ID No:**	CAD980636914

Interview Type: Site Visit/Email
Location of Visit: FMSL Site, Fresno, CA
Date: 4/25/2020
Time: 0700

Interviewers

Name	Title	Organization
Justin McNabb	Hydrogeologist	USACE
Cynthia Ruelas	RPM	EPA

Interviewees

Name	Organization	Title	Telephone	Email
Rosa Staggs	City of Fresno	Wastewater Manager	559-621-5130	Rosa.staggs@fresno.gov

Summary of Conversation

1) What is your overall impression of the project?

The phased approach (OU-2) was at the time unique and it allowed continuous and consisting progress for this project. Each phase provided directions and validated the next phase moving forward. It was also good for the City's budgeting needs, as year-to-year expenses could be justified with short term projects while, at the same time, focused on the long term goals.

Beneficial use of unusable land was achieved through the Regional Sports Park, which is a benefit to the City of Fresno. The City has been approached about installation of solar panels in the area and that is always a future possibility.
We are confident Phase 3 will complete groundwater remedial action activities for OU-2 with a success story. O&M will be ongoing for both OU-1 and OU-2

2) Is the remedy functioning as expected? How well is the remedy performing?

OU-1 remedial activities are performing well. An Inspection and Maintenance Program is being developed to ensure the area is properly and timely maintained, including managing the subsidence of side slopes, which is a priority.
OU-2 remedial activities have been implemented in phases with significant improvements to water quality (A and B aquifer) showing decrease of VOC concentrations of impacted groundwater. Control of lateral migration of VOC has been effective. Vertical migration into the C- and D- aquifers will be assessed through ongoing operation and monitoring of the Phase 3 Remedial Action.

3) What does the monitoring data show? Are there any trends that show contaminant levels are decreasing?

For OU-1, the City uses landfill perimeter gas probes to monitor levels of methane gas. Monitoring data effectively demonstrate methane gas migration is not occurring beyond the perimeter of the landfill. Also, there is no exceedance of the regulatory standard.
For OU-2, data show that VOC concentrations trends are predominantly either decreasing or stable or both for most wells. Some increasing trends have been noted southwest and downgradient from the FSL. Monitoring of extraction wells recently installed under Phase 3 and one previously installed as part of the Phase 2 Enhancements are being monitored to determine effectiveness in addressing the downgradient plume.

4) Is there a continuous O&M presence? If so, please describe staff and activities. If there is not a continuous on-site presence, describe staff and frequency of site inspections and activities. How often are the treatment tower and flares down per year?

There is one permanent staff located at the facility whose date-to-date activities are all FSL operation and maintenance related for both OU-1 and OU-2. His duties include and are not limited to: operation of landfill gas control system, monitoring activities, including quarterly collection of monitoring wells and residential wells samples, operation of the gas flare, operation and monitoring of the extraction well system and overall maintenance and repairs.
The FSL also is supported by maintenance, electrical, instrumentation and data support personnel from the Wastewater Management Division for repairs, SCADA activities.

During 2018, the LFG flare operational efficiency was about 94%.

5) Have there been any significant changes in the O&M requirements, maintenance schedules, or sampling routines in the last five years? If so, do they affect protectiveness of the remedy? Please describe changes and impacts.

No significant changes besides increase monitoring as wells are added to the overall schedule.

6) What are the annual operating costs (O&M costs) for your organization's involvement with the site?

The annual O&M cost for FY20 is approximately $809,000

7) Have there been unexpected O&M difficulties or costs at the site in the last five years? If so, please give details.

Neighboring homes replacing wells due to drought conditions needed City approval prior to well installation if within the "Well Assessment Zone." If modifications were required to the original well design (such a drilling the well deeper than originally proposed) the City would pay for the additional cost incurred to meet the required changes.

The packing media for the packed tower aerator for treatment of VOC was replaced after 17 years of service. The City is in the process to replace the media again due to performance issues with the first replacement media.

8) Have there been opportunities to optimize O&M or sampling efforts? Please describe changes and resultant or desired cost savings or improved efficiency.

Sampling is evaluated annually and planned accordingly. Optimizing sampling has saved in testing costs.
Also, being able to utilize some of the resources from Wastewater Management Division (maintenance, electrical, SCADA) has been very helpful and effective.

9) Are you aware of any changes in Federal/State/County/Local laws and regulations that may impact the protectiveness of the remedy?

Not yet.

10) Do you have any comments, suggestions, or recommendations regarding the project?

Not at this time.

Additional Site-Specific Questions

11) The most recent O&M report indicated a 1,1-DCE exceedance in GW treatment effluent; does you think this indicates a larger problem?

We have been working and troubleshooting this unexpected situation. The City is in the process of replacing the media we recently installed due to poor performance issues. The new replacement media will arrive May 2020. We do not believe there is a larger problem

12) How well does the Well Prohibition Zone/Well Assessment Zone (offsite ICs) work? Have there been any problems with domestic or agricultural well installation?

The County of Fresno and the City of Fresno work in parallel since the moment a well application is submitted until completion of the project. The County of Fresno informs the City of a well application within the Well Assessment Zone and the information is provided to the consultant who runs the groundwater model and assess potential impacts of the new well to the FSL remedial process.
In the majority of cases, there is the recommendation to drill the well deeper or changes to depth of the annular seal. The City pays for additional cost incurred for the recommendations. During the drought period, there were many applications for well replacements.

13) What is the level of concern for the downward migration of GW contaminants into the D- zone aquifer? Do you expect further remedial actions needed in the D-zone aquifer?

As we get more data, we will have a better understanding of the D-aquifer. Optimizing operations of the Phase 3 extraction wells will be needed to assess the impact to the D-zone.

14) Monitoring data shows that water levels have dropped such that most, if not all, A-zone aquifer wells are dry. What is the potential that contaminants could be stranded in the A-zone?

Data collected prior to wells becoming dry were showing decreased VOC concentrations or non-detect. It might take a lot of years before getting water back in the A-zone.

15) The previous FYR noted that the landfill gas flare is not permitted and has no effluent monitoring requirements. Is this still the case?

As a Supefund site, the FSL is exempt from many requlations, including air or wastewater regulations. Once delisted, all exemptions will no longer be valid and the FSL will have to go to various processes to acquire Air, WDR, Title 27, or other regulatory permits.

Five-Year Review Interview Record			
Site:	Fresno Municipal Sanitary Landfill	**EPA ID No:**	CAD980636914

Interview Type: Site Visit/Email
Location of Visit: FMSL Site, Fresno, CA
Date: April 14, 2020
Time: N/A

Interviewers

Name	Title	Organization
Justin McNabb	Hydrogeologist	USACE
Cynthia Ruelas	RPM	EPA

Interviewees

Name	Organization	Title	Telephone	Email
Yash Nyznyk	CDM Smith	Project Manager	925-296-8065	nyznykjp@cdmsmith.com

Summary of Conversation

1) What is your overall impression of the project?
It has been a long process, beginning for me in 1992. The City of Fresno has been responsible in planning and implementation of the work performed as part of the Superfund process and has made consistent progress in their work at the Fresno Sanitary Landfill (FSL). The work performed at the site has been innovative (phased implementation of the groundwater remedial action) and has added value to the community, including construction of the regional sports park that was completed as part of the construction of the remedies for OU-1 (landfill closure) and OU-2 (groundwater remediation). Remaining remedial action activities at the site will be focused on groundwater remedial action activities with the goal of demonstrating control of the volatile organic compound (VOC) impacts to groundwater.

2) Is the remedy functioning as expected? How well is the remedy performing?

- For OU-1, the Remedial Action (RA) consisted of closure of the landfill and included installation of a final landfill cover, surface water management, and landfill gas control systems. The OU-1 RA has performed well. O&M activities are ongoing.

- For OU-2, the RA consists of groundwater extraction and treatment to address VOC impacts to groundwater. As designed, OU-2 was to be implemented over a series of phases. In general, the OU-2 RA has performed well, achieving a substantial improvement in groundwater quality in the upper water-bearing zones. Since implementation of the Phase 1 Groundwater RA, we have observed significant decreases in VOC concentrations. Additionally, control of lateral migration of VOCs in groundwater has been effective. However, vertical migration of VOCs has been observed over time. The Phase 3 Groundwater RA (start-up May 2020) was implemented to address VOC migration to the C-aquifer. A detailed evaluation of the performance of the Phase 3 Groundwater RA will be performed during the third Quarter of 2020.

An important element of a remedial action is ongoing monitoring and maintenance to ensure continued effective performance. City staff have been responsible for monitoring and maintenance activities at the FSL for both operable units and have done an excellent job addressing maintenance and repair/replacement issues that periodically arise since implementation of the operable unit RAs.

3) What does the monitoring data show? Are there any trends that show contaminant levels are decreasing?

- For OU-1, the primary monitoring activity involves monitoring gas quality at thirteen multi-depth perimeter monitoring probes. The data indicate that the landfill gas extraction system has been effective in preventing migration of methane to the landfill perimeter. On an annual basis, there are typically no exceedances of the regulatory standard (5 percent by volume in air, which is the lower explosive limit for methane).
- For OU-2, The OU-2 Annual Performance Monitoring Report provides a detailed discussion of groundwater concentrations and concentration trends (Appendix C consists of concentrations trend plots). In general, the concentration trends in most of the wells are decreasing and/or stable. The monitoring wells which have recently exhibited an increasing concentration trend are located downgradient of the southwest corner of the landfill. Two recently installed extraction wells [Phase 2 Enhancements (PW-6B2) and the Phase 3 (PW-6C)] were specifically sited to address this downgradient area of the FSL.

4) Is there a continuous O&M presence? If so, please describe staff and activities. If there is not a continuous on-site presence, describe staff and frequency of site inspections and activities. How often are the treatment tower and flares down per year?
The City has a full-time technician who performs all monitoring and maintenance activities for both OU-1 and OU-2. The technician's responsibilities for OU-1 include operations of the landfill gas control system (checking and adjusting wellhead flows, operations of the landfill flare), maintenance and repair activities, and monitoring activities (landfill perimeter probe measurements). Under OU-2, the technician is responsible for operation of the groundwater extraction well system and performing the groundwater monitoring sampling and residential well sampling (mixed quarterly, semi-annual, and annual).

5) Have there been any significant changes in the O&M requirements, maintenance schedules, or sampling routines in the last five years? If so, do they affect protectiveness of the remedy? Please describe changes and impacts.
There have been no significant changes in the O&M requirements, maintenance schedules, or sampling routines since the last 5-year Review. Throughout operation of the OU-1 and OU-2 RA, there have been vandalism-related issues (e.g., damaged piping, stolen power cable).

6) What are the annual operating costs (O&M costs) for your organization's involvement with the site?
Refer to responses from the City.

7) Have there been unexpected O&M difficulties or costs at the site in the last five years? If so, please give details.
The City is currently in the process of replacing the packing media in the packed tower aerator for the groundwater treatment system (packing had been installed as part of the Phase 1 system). The packing replacement is expected to be completed during May 2020.

8) Have there been opportunities to optimize O&M or sampling efforts? Please describe changes and resultant or desired cost savings or improved efficiency.
The monitoring program is revisited on an annual as a way of optimizing the monitoring program. Additionally, the City intends to undertake landfill regrading operations as ongoing maintenance rather than contracting out this work.

9) Are you aware of any changes in Federal/State/County/Local laws and regulations that may impact the protectiveness of the remedy?
No.

10) Do you have any comments, suggestions, or recommendations regarding the project?
No additional comments.

Additional Site-Specific Questions

11) The most recent O&M report indicated a 1,1-DCE exceedance in GW treatment effluent; does you think this indicates a larger problem?
No. The issue has to do with old packing media in the packed tower aerator (PTA). When the original media was removed, it was observed that portions of the media were clumped and had adhered to the PTA sidewall, effectively, reducing the geometric surface area important for treatment. We believe that this was the primary cause of the effluent detections of 11DCE. Replacement of the packing is expected to resolve the issue.

12) How well does the Well Prohibition Zone/Well Assessment Zone (offsite ICs) work? Have there been any problems with domestic or agricultural well installation?
The system has worked well, relying on good communication between the Fresno County well permitting agency (County) and the City. Upon receipt of an application for a new well permit, the County notifies the City. The City moves forward with groundwater modeling to evaluate possible impacts to the FSL remediation system from operation of the proposed well. The process has typically imposed design requirements (e.g., deeper well, extended annular seal, etc.), but has not prevented the installation of new wells in the well assessment zone.

13) What is the level of concern for the downward migration of GW contaminants into the D- zone aquifer? Do you expect further remedial actions needed in the D-zone aquifer?
Groundwater samples from the three D-aquifer monitoring wells have been collected during January, April, July, and October 2019. One of the three D-aquifer wells (CDM-4D) has had detections of the primary VOC constituents of concern (PCE, TCE, and cDCE). For the four quarters of monitoring, all VOC detections were below MCLs except for a single detection of PCE at 5.2 ug/L during April 2019 (MCL = 5 ug/L). The detections in the D-aquifer appear to be low level and not widespread. Operation of the Phase 3 extraction wells coupled with monitoring data during 2020 will be important for assessing the extent of impact in the D-aquifer.

14) Monitoring data shows that water levels have dropped such that most, if not all, A-zone aquifer wells are dry. What is the potential that contaminants could be stranded in the A-zone?
With the water level decline in the A-aquifer, VOCs may remain in the A-aquifer, adsorbed onto soil particles. However, it is important to note that prior to the water level declines, monitoring of the A-aquifer wells have indicated significant concentration decreases, with many of the wells at non-detect (these data are available in the Appendix C concentration trend plots, which included the trend plots for several A-aquifer wells through the Annual Report prepared in July 2019).

15) The previous FYR noted that the landfill gas flare is not permitted and has no effluent monitoring requirements. Is this still the case?
Yes. CERCLA [Section 121 (e)], provides permit exemptions for State and local permits at Superfunds sites "… for the portion of any removal or remedial action conducted entirely on site, when the action is in compliance with cleanup standards." This permit exemption does apply to the landfill gas flare. Note that monitoring of landfill gas flare emissions was performed twice during the initial couple of years of operations (at the request of the regulatory agencies overseeing work at the FSL). If the FSL is delisted from the National Priorities List, operation of the LFG flare must be in compliance with state/local permitting requirements.

Appendix G: Site Inspection Report and Photos

Trip Report
Fresno Municipal Sanitary Landfill, Fresno, California

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1. INTRODUCTION

a. Date of Visit: 22 January 2020

b. Location: Fresno, California

c. Purpose: A Site visit was conducted to visually inspect and document the conditions of the remedy, the Site, and the surrounding area for inclusion into the Five-Year Review Report.

d. Participants:

Cynthia Ruelas	USEPA Region 9 Remedial Project Manager
Kristen Gomes	California Regional Water Quality Control Board
Justin McNabb	USACE Seattle District Geologist
Yash Nyznyk	CDM Smith
Daniel Carlson	California Regional Water Quality Control Board
Rosa Lau Staggs	City of Fresno
Michael Del Carlo	City of Fresno
David Furtado	City of Fresno
Jeff Gardner	City of Fresno
Peter Phillips	Gilbane Federal
Juan Peng	California EPA, Department of Toxic Substances Control

2. SUMMARY

A Site visit to the Fresno Municipal Sanitary Landfill was conducted on 22 January 2020. All participants met onsite for preliminary briefings and health and safety check in. The Site is currently a park and capped landfill with multiple recreation-based buildings and parking. Currently, landfill gas and groundwater extraction and treatment take place at the Site. Participants toured the Site and observed evidence of recent well installations, evidence of landfill settlement, and the groundwater treatment plant and soil gas flare facilities.

3. DISCUSSION

On 21 January 2020, Justin McNabb flew to Fresno, California to meet for the Five-Year Review Site Visit. On 22 January 2020, Justin McNabb met the City of Fresno regulatory oversight and City of Fresno consultants and staff at the Site. The weather was sunny and warm (temperature approximately 65º F). The Site is accessed from Jensen Avenue and is located southwest of downtown Fresno.

Mr. McNabb arrived at the Site at 0900 and did a preliminary walk around the Site to note the locations of existing wells in the facility parking lot. The other participants arrived at 1000 and met in the treatment plant-control station onsite. USEPA gave an overview of the objectives of the Site visit. Mr. McNabb detailed what groundwater data had been reviewed for the Five-Year Review period and verified if any additional pertinent information should be included in the Five-Year Review Report.

The participants had no additional data for the report aside from the soon to be published Landfill O&M report in February.

After the overview and discussion, the team proceeded outside and inspected numerous well locations that had been installed in the past five years. Some existing wells were photographed and documented, though not all were visited due to time and property access issues. The recently installed wells consisted of both extraction wells and monitoring wells for the Phase 3 Remedial Action. The current monitoring well network maintains wells in each of the subsurface water-bearing zones. The Groundwater Extraction and Treatment System (GWETS) compound is located onsite to the west of the landfill. All existing wells were secured, locked and in good condition. There is a perimeter fence along the eastern side of the landfill; it is about five ft. tall chain-link fence that is the perimeter fence for the entire park. There is no fence specifically around the landfill, aside from the eastern side. The fence has no barbed wire along the top but appears to be in good repair. In some areas, the fence is about three ft. high.

After this, CDM Smith, DTSC, RWQCB, USEPA, USACE, and Gilbane Federal toured the landfill itself to inspect subsidence locations and how maintenance of the landfill cap was continuing during this review period. Several locations on all sides of the landfill were experiencing subsidence, with the eastern side exhibiting erosion. There were several areas with standing water, and some aspects of the drainage network were blocked. In addition, burrowing animals were found across the landfill. This can be potentially hazardous to the geomembrane of the landfill. While driving along the top of the landfill, an apparently privately-owned tan van drove up behind the vehicles of the Site visit and followed for a few minutes before turning around off road and leaving. This was behind the last vehicle of the Site visit team so Mr. McNabb, Ms. Gomes, Mr. Carlson, and Ms. Peng were able to see the vehicle.

After viewing the GWETS compound and the landfill cap, the Site inspection was concluded and Mr. McNabb left the Site at 1330 along with all other participants.

Justin McNabb
Geologist
CENWS-ENT-G

Extraction well electrical panel

Filled slope drain now animal burrow

Monitoring well PZ-10

Subsidence since repair (~12 years and 1.5 ft depth)

Subsidence in drainage ditch

Standing water, southern landfill cap

Animal burrow in landfill cap

Subsidence seen where tumbleweeds gather