

**FIFTH FIVE-YEAR REVIEW REPORT FOR
MIDDLEFIELD-ELLIS-WHISMAN (MEW) SUPERFUND STUDY AREA
MOUNTAIN VIEW AND MOFFETT FIELD
SANTA CLARA COUNTY, CALIFORNIA**

- Fairchild Semiconductor Corp. – Mountain View Superfund Site
 - Raytheon Company Superfund Site
 - Intel Corp. – Mountain View Superfund Site
- And portions of NAS Moffett Field Superfund Site



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Executive Summary

This is the fifth Five-Year Review of the Middlefield-Ellis-Whisman (MEW) Superfund Study Area (Site). The MEW Site consists of three Superfund sites: Fairchild Semiconductor Corp. – Mountain View Superfund site, Raytheon Company Superfund site, and Intel Corp. – Mountain View Superfund site, as well as several other facilities, and portions of the Naval Air Station Moffett Field Superfund Site, located in Mountain View and Moffett Field, Santa Clara County, California. The individual companies responsible for investigating and cleaning up the soil and groundwater and addressing the vapor intrusion pathway are collectively referred to as the MEW Companies. 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.

Because the groundwater contamination at the Site migrates northward and has mixed with contamination from Navy and National Aeronautics and Space Administration sources at Moffett Field, the groundwater remedy selected in the MEW Site Record of Decision also applies to the commingled regional groundwater contamination area at Moffett Field. The Site is within a heavily populated, light industrial, commercial, and residential area. The primary contaminants of concern for the Site are trichloroethene (TCE) and other volatile organic compounds in groundwater, soil, soil gas, and indoor air.

The U.S. Environmental Protection Agency (EPA) issued a Record of Decision in 1989 selecting the soil and groundwater cleanup remedy for the Site. EPA issued two Explanations of Significant Differences to the Record of Decision in 1990 and 1996 to clarify the remedy. The soil remedy consisted of excavation with treatment by aeration, and soil vapor extraction with treatment by vapor-phase granular activated carbon. The soil cleanup was completed in 2001 meeting the soil cleanup levels. The groundwater remedy includes slurry walls (barriers beneath the surface) to contain Site contaminants and groundwater extraction and treatment systems to contain and clean up contamination. Based on TCE and other contaminant concentration trends in the groundwater, the current groundwater remedy is not expected to achieve cleanup levels for many more decades.

The groundwater at the Site is not currently used for drinking water or other potable uses. Groundwater in the area is designated as a potential future source of drinking water, and therefore, groundwater cleanup standards were established based on that potential future use.

In 2010, EPA amended the Record of Decision selecting the vapor intrusion remedy that addresses the potential long-term exposure risks from TCE and other Site chemicals of concern

through the subsurface-to-indoor air vapor intrusion pathway. The remedy to address the vapor intrusion pathway consists of the following:

- For existing buildings, the appropriate response action is determined by indoor air sampling and other lines of evidence for each building. If determined necessary, the remedy requires installing, operating, maintaining, and monitoring of an appropriate sub-slab/sub-membrane ventilation system. Alternatively, for existing commercial buildings, using the building's indoor air mechanical ventilation system is acceptable if the property/building owner agrees to use, operate, and monitor the system to meet remedy performance criteria and the remedial action objectives.
- For future (new construction) buildings, the remedy requires installing a vapor barrier and passive sub-slab ventilation system with the ability to be made active. In addition, implementing institutional controls and monitoring to ensure the long-term effectiveness of the vapor intrusion remedy is also required.

While the operations of the current groundwater remedy are ongoing and TCE groundwater concentrations have decreased during the five-year review period, data analysis indicates that groundwater cleanup levels will not be achieved in shallow groundwater for many decades. This length of time for groundwater cleanup is inconsistent with the vapor intrusion remedial action objective to accelerate the reduction of the source of potential vapor intrusion (i.e., Site contamination in shallow groundwater and soil gas) to levels that are protective of current and future building occupants, such that the need for a vapor intrusion remedy is minimized or no longer necessary. In the Site Vapor Intrusion Study Area, all occupied commercial/non-residential buildings have been sampled. In buildings where TCE from subsurface vapor intrusion has exceeded the indoor air cleanup levels, mitigation measures have been implemented. Vapor intrusion control systems have been installed in all new construction overlying TCE Shallow Zone contamination. Institutional controls are in place, which include notification to EPA of building improvements that may create a vapor intrusion pathway into the building, interfere with the building foundation, or interfere with the existing vapor intrusion remedy.

Exposure assumptions used in the selection of the groundwater and vapor intrusion remedy are still valid. Toxicity data and federal and state maximum contaminant levels used to select indoor air and groundwater cleanup levels have changed since the selection of the remedy, but the changes do not affect the protectiveness of the remedy.

The groundwater and vapor intrusion remedy at the MEW Superfund Area is currently protective of human health and the environment because there is no direct exposure to contamination. Governmental controls are in place to prevent access to contaminated groundwater. The vapor intrusion control systems, monitoring program, and institutional controls are in place to minimize exposure risk from vapor intrusion. However, in order for the remedy to be protective in the long-term, alternative groundwater cleanup technologies should be selected to accelerate the reduction of the source of vapor intrusion in the Shallow Zone. Additionally, to ensure long-term protectiveness, sampling for PFAS (per- and polyfluoroalkyl substances) in groundwater to further assess potential risk is needed.

Contents

1. Introduction.....	8
1.1. Background	10
1.2. Physical Characteristics.....	13
1.3. Hydrology.....	14
2. Remedial Actions Summary	15
2.1. Basis for Taking Action.....	15
2.2. Remedy Selection	15
2.3. Remedy Implementation	19
2.4. System Operations/Operation and Maintenance	23
3. Progress Since the Last Five-Year Review	23
3.1. Previous Five-Year Review Protectiveness Statement and Issues.....	23
3.2. Work Completed at the Site During this Five-Year Review Period.....	24
4. Five-Year Review Process.....	26
4.1. Community Notification, Involvement and Site Interviews	26
4.1.1. Five-Year Review Public Notice and Press Release.....	26
4.1.2. Site Interviews	27
4.2. Data Review	27
4.2.1. Groundwater.....	27
4.2.2. Institutional Controls	32
4.2.3. Climate Resilience Screening	33
4.3. Site Inspection	37
5. Technical Assessment	37
5.1. Question A: Is the remedy functioning as intended by the decision documents?.....	37
5.2. Question B: Are the exposure assumptions, Cleanup Levels, and Remedial Action Objectives Used at the Time of Remedy Selection Still Valid?	38
5.3. Question C: Has Any Other Information Come to Light That Could Call Into Question the Protectiveness of the Remedy?	39
6. Issues/Recommendations	40
6.1. Issues and Recommendations	40
6.2. Other Findings.....	41
7. Protectiveness Statement	41

8. Next Review	42
Appendix A: List of Documents Reviewed	43
Appendix B: Summary Tables	51
Appendix C: ARARs Assessment	58
Appendix D: Public Notice and Press Release	62
Appendix E: Interview Responses	65
Appendix F: Site Inspection Summary and Photos	85

List of Figures

Figure 1. Location Map for the MEW Superfund Study Area Site.....	9
Figure 2. Location (Current Property Address) of Former MEW Facility-specific Source Areas South of U.S. Highway 101.	12
Figure 3. Regional and Source Control Extraction Wells and Treatment Systems – South of U.S. Highway 101.....	21
Figure 4. Regional and Source Control Extraction Wells and Treatment Systems – North of U.S. Highway 101.....	22
Figure 5. MEW Vapor Intrusion Study Area.....	34
Figure 6. MEW Vapor Intrusion Study Area – South of U.S. Highway 101.....	35
Figure 7. MEW Vapor Intrusion Study Area – North of U.S. Highway 101.....	36

List of Tables

Table 1. Five-Year Review Summary Form	10
Table 2. Former and Current MEW Company/Facility Names.....	11
Table 3. Former MEW Facility-Specific and Current Property Addresses	13
Table 4. Aquifer Depths by Zone	15
Table 5. Groundwater Cleanup Levels from 1989 ROD	17
Table 6. Indoor Air Cleanup Levels from 2010 ROD Amendment.....	18
Table 7. Groundwater Extraction and Treatment Systems Summary	20
Table 8. Status of Recommendations from the 2019 Five-Year Review	24
Table 9. Issues and Recommendations Identified in the Five-Year Review	40
Table 10. Protectiveness Statement.....	41

List of Acronyms and Abbreviations

ARAR	Applicable or Relevant and Appropriate Requirement
Bgs	Below ground surface
EIMP	Environmental Issues Management Plan
EPA	United States Environmental Protection Agency
GAC	Granular activated carbon
Gpm	Gallons per minute
HiPOx [®]	High-performance advanced oxidation process
ISCO	In-situ Chemical Oxidation
MCL	Maximum Contaminant Level
MEW	Middlefield-Ellis-Whisman Superfund Study Area
µg/L	Microgram per liter
µg/m ³	Microgram per cubic meter of air
ng/L	Nanogram per liter
NAS	Naval Air Station
NASA	National Aeronautics and Space Administration
NPDES	National Pollutant Discharge Elimination System
PFAS	per- and polyfluoroalkyl substances
ppb	Parts per billion
RAO	Remedial Action Objective
ROD	Record of Decision
SCGR	Source Control Groundwater Remediation
Site	Middlefield-Ellis-Whisman (MEW) Superfund Study Area, Mountain View and Moffett Field, California
TCE	Trichloroethene
USACE	United States Army Corps of Engineers
VOC	Volatile Organic Compound
WATS	West-side Aquifers Treatment System
ZVI	Zero-valent Iron

1. Introduction

The purpose of a Five-Year Review is to evaluate the implementation and performance of a Site remedy to determine if the remedy is and 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, any issues identified during the review, and recommendations to address them are presented in the Five-Year Review report.

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

This is the fifth Five-Year Review for the MEW Superfund Study Area (Site). The triggering action for this policy review is the completion date of the previous Five-Year Review on September 30, 2019. This Five-Year Review is necessary because hazardous substances, pollutants, or contaminants remain at the Site above levels that allow for unlimited use and unrestricted exposure.

The MEW Site is located in Mountain View and Moffett Field, California (Figure 1) and consists of three National Priorities List sites: Fairchild Semiconductor Corp. – Mountain View Superfund site; Raytheon Company Superfund site; and Intel Corp. – Mountain View Superfund site; several other facilities; and portions of the former Naval Air Station (NAS) Moffett Field Superfund Site.

National Aeronautics and Space Administration (NASA) Ames and the U.S. Navy have issued separate, draft Five-Year Review reports that include Site 28 West-side Aquifers Treatment System (WATS) Area and their areas of responsibility within the MEW Superfund Study Area and they expect to finalize their Five-Year Review reports in February 2025.

The MEW Five-Year Review was led by Alana Lee, EPA Superfund Project Manager, and Cynthia Ruelas, EPA Region 9 Superfund Five-Year Review Coordinator. Technical support was provided by U.S. Army Corps of Engineers (USACE) staff: Ashley Provow, Adan Prado, and Benino McKenna. The review began on October 25, 2023.

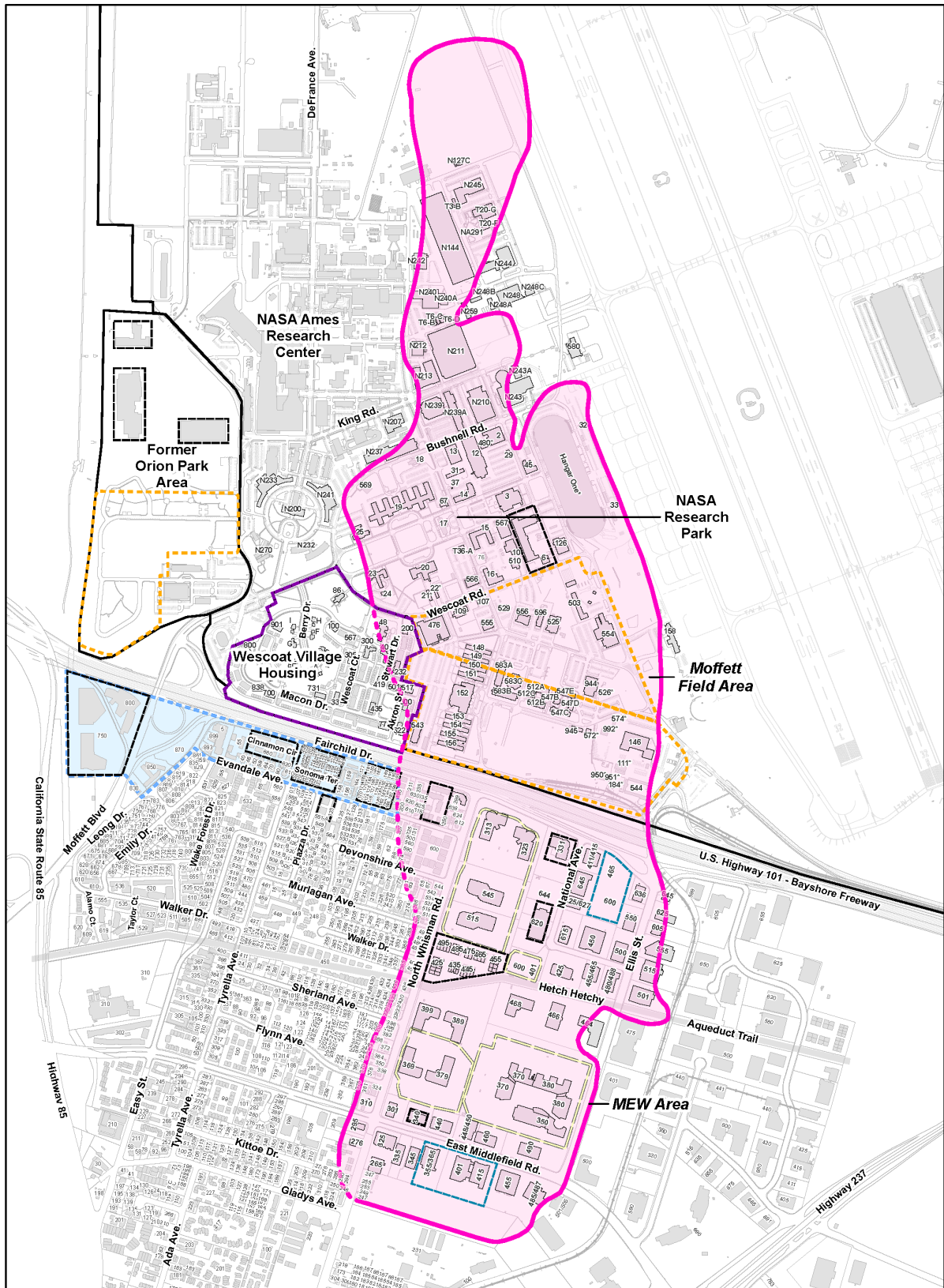


Figure 1. Location Map for the MEW Superfund Study Area Site.

Table 1. Five-Year Review Summary Form

SITE IDENTIFICATION		
Site Name: MEW Superfund Study Area		
EPA ID: (1) Fairchild Semiconductor Corp. – Mountain View – EPA ID: CAD095989778 (2) Raytheon Co. – EPA ID: CAD009205097 (3) Intel Corp. – Mountain View – EPA ID: CAD061620217 And portions of NAS Moffett Field - EPA ID: CA2170090078		
Region: 9	State: CA	City/County: Mountain View and Moffett Field, Santa Clara County
SITE STATUS		
National Priorities List Status: Final		
Multiple Operable Units? Yes	Has the site achieved construction completion? Yes	
REVIEW STATUS		
Lead agency: EPA		
Author name (Federal Project Manager): Alana Lee, EPA Superfund Project Manager		
Author affiliation: EPA Region 9		
Review period: 10/25/2023 – 8/1/2024		
Date of site inspection: 2/8/2024		
Type of review: Policy		
Review number: 5		
Triggering action date: 9/30/2019		
Due date (five years after triggering action date): 9/30/2024		

1.1. Background

The individual companies responsible for investigating and cleaning up soil and groundwater at their respective facility-specific source area properties at the Site are collectively referred to as the MEW Companies. The MEW Companies include the following: Fairchild Semiconductor Corp, Raytheon Company, Intel Corp., Schlumberger Technology Corp (Schlumberger), Renesas Electronics America, Inc. (NEC/Renesas), SMI Holding LLC (SMI), Vishay General Semiconductor

(Vishay), SUMCO USA Corporation (SUMCO), National Semiconductor Corporation, Tracor X-Ray, and Union Carbide.

In the 1960s and 1970s, several industrial companies involved in the semiconductor, electronics, and other manufacturing and research fields used volatile organic compounds (VOCs), primarily TCE, and through these operations contaminated the soil and groundwater. Activities by the Navy and NASA, including the use of chemicals historically used for dry cleaning, maintenance, and degreasing activities, contributed to the soil and groundwater contamination at Moffett Field.

The contamination addressed in the MEW Site Record of Decision (ROD) is both facility-specific and regional. Navy, NASA, and the individual MEW Companies are responsible for investigation, cleanup, and source control for soil and groundwater contamination at their individual facility-specific source area properties. None of the MEW Companies currently own or operate at their former facilities. Current addresses and building configurations at the MEW facility-specific source area locations south of U.S. Highway 101 are shown on Figure 2.

Some of the MEW Companies have altered their corporate identities through merger, acquisition, or restructuring. Table 2 provides the original MEW Company names, along with the associated current MEW Company identities.

Table 2. Former and Current MEW Company/Facility Names

Former MEW Company/Facility Name	Current MEW Company Name
Fairchild Semiconductor Corporation	Schlumberger Technology Corporation
Raytheon Corporation	RTX Corporation
Intel Corporation	Intel Corporation
NEC Electronics, Inc.	Renesas Electronics America, Inc.
Sobrato Development Companies	SMI Holding LLC
General Instrument Corporation	Vishay General Semiconductor, Inc.
Siltec Corporation	SUMCO USA Corporation
National Semiconductor Corporation	Texas Instruments
Tracor X-Ray, Inc.	Baker Hughes
Union Carbide Chemicals and Plastics Company	The Dow Chemical Company

Note: The former General Instrument Corporation and Siltec facilities are referred to collectively as the Vishay/SUMCO facility.

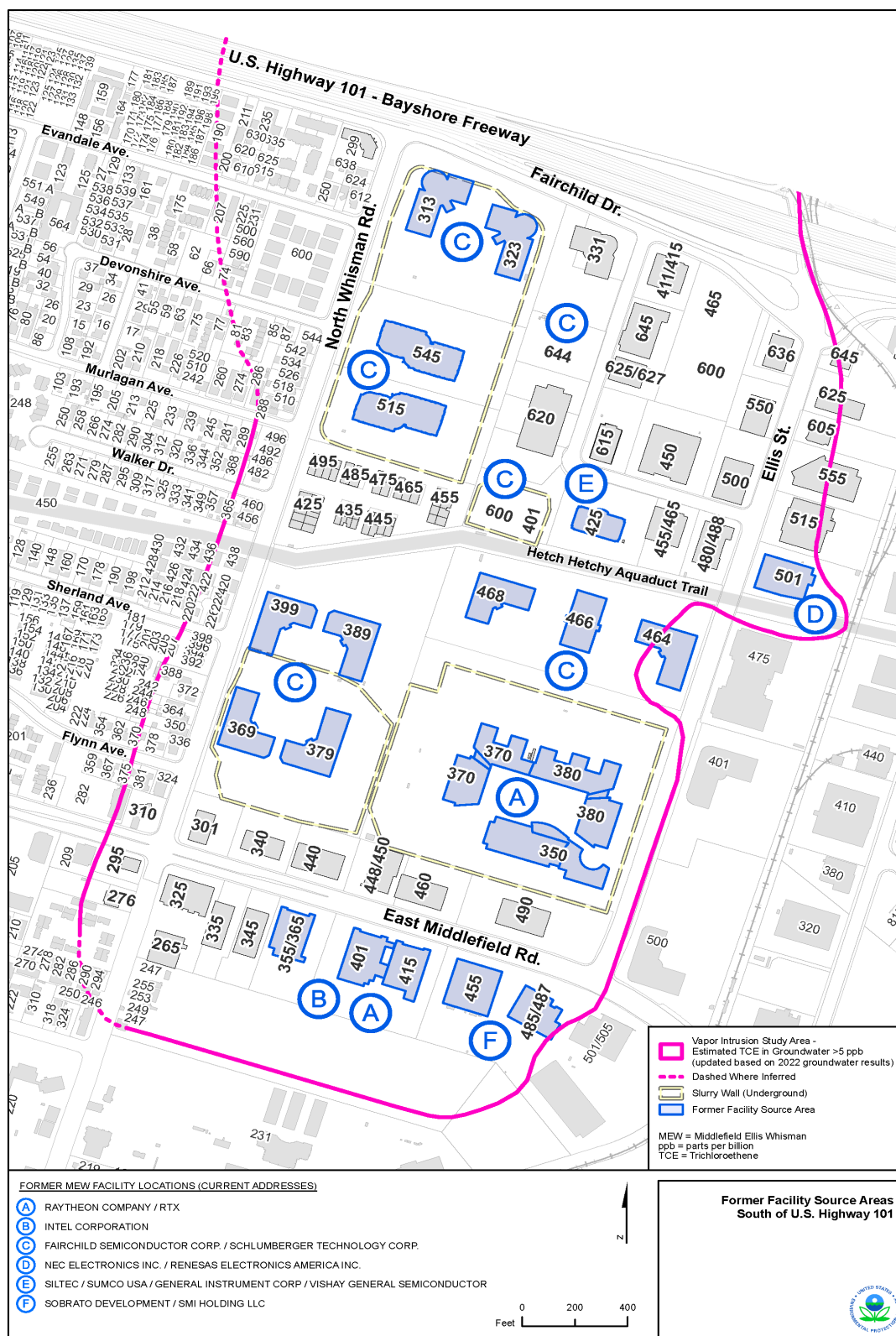


Figure 2. Location (Current Property Address) of Former MEW Facility-specific Source Areas South of U.S. Highway 101.

The former and current MEW facility addresses and EPA site identification numbers for each facility are listed in Table 3. Several addresses have changed to accommodate redevelopment in a different configuration.

Table 3. Former MEW Facility-Specific and Current Property Addresses

Former MEW Facility-Specific Facility Address	Current Property Location Address
Fairchild Semiconductor Corp. – Mountain View (Fairchild/Schlumberger), EPA ID: CAD095989778	
369/441 North Whisman Road (Buildings 19, 13 and 23)	369/379/389/399 North Whisman Road
515/545 North Whisman Road (Buildings 1 and 2)	515/545 North Whisman Road
313 Fairchild Drive (Buildings 3 and 4)	313/323 Fairchild Drive
464 Ellis Street (Building 20)	464/466/468 Ellis Street
401 National Avenue (Building 9)	600 National Avenue (Parking structure)
644 National Avenue (Building 18)	Parking lot area of 331 Fairchild Drive
Raytheon Corp., EPA ID: CAD009205097	
350 Ellis Street	350/370/380 Ellis Street
415 E. Middlefield Road (Lots 4 and 5)	401/415 East Middlefield Road
Intel Corp. – Mountain View, EPA ID: CAD06160217	
365 East Middlefield Road (Lots 3 and 4)	355/365 E. and 401 East Middlefield Road
NEC Electronics America Inc. (Renesas), EPA IDs: CAD980883268/CAR000054973 (RCRAINFO database)	
501 Ellis Street	501 Ellis Street
SMI Holding LLC (SMI), EPA ID: CAD980638084	
455, 485/487, 501/505 East Middlefield Road	455, and 485/487 East Middlefield Road
General Instrument Corp./Siltec Corp. (Vishay/SUMCO), EPA ID: CAD088839105	
405 National Avenue	425 National Avenue

Regional Groundwater Contamination: Contaminated groundwater that has bypassed the facility-specific areas and has mixed with other contaminated groundwater from other source areas is considered part of the regional groundwater contamination plume, or the “regional plume.” The regional plume south of U.S. Highway 101 is being addressed by the individual MEW Companies at their facility-specific source properties and the MEW Regional Groundwater Remediation Program (or Regional Program). The regional plume north of U.S. Highway 101 is being addressed by the MEW Regional Program, Navy, and NASA.

1.2. Physical Characteristics

The Site is in a heavily populated, light-industrial, commercial, and residential area. Since the 1990s, major redevelopment and reuse have occurred in the MEW Area south of U.S. Highway 101. None of the new owners or tenants who occupy the buildings in the MEW Area were operating in the MEW Area at the time of the Site contaminant releases to the environment.

The Vapor Intrusion Study Area, shown on Figure 1, is generally defined as the area where the estimated TCE shallow groundwater contamination plume (ranging from approximately 5 to 35 feet below ground surface) exceeds 5 micrograms per liter ($\mu\text{g/L}$).

In 2020, the City of Mountain View adopted the East Whisman Precise Plan (City of Mountain View, 2020) which includes zone changes from commercial land use to also accommodate the increasing demand for residential use. In accordance with the East Whisman Precise Plan, new development within the MEW site boundary may need to allow access for site investigation, ongoing cleanup and monitoring activities, and implementation of the vapor intrusion remedy.

On Moffett Field, the U.S. Navy owned and operated the former NAS Moffett Field from the 1930s until 1994, then transferred most of the property to NASA, except for the housing. Orion Park and Wescoat Housing Areas were transferred in 1994 to the U.S. Air Force and then in 2001 to the U.S. Army.

The groundwater in the MEW Site area is not used as a drinking water source. Drinking water in this area comes from the Hetch Hetchy reservoir in the Sierra Nevada Mountains as well as local sources and is treated to meet all state and federal drinking water standards. Santa Clara Valley Water District has governmental controls in place to prevent the installation of wells in the contaminated aquifer zones. Groundwater that is extracted and treated is discharged under a general National Pollutant Discharge Elimination System (NPDES) permit to storm lines to Stevens Creek or under a City of Mountain View industrial wastewater permit to the sanitary sewer.

1.3. Hydrology

Groundwater aquifers within the MEW Site consist of shallow and deeper aquifer systems and are separated by a laterally extensive aquitard approximately 40 feet thick. Within the shallow system, four primary hydrogeologic aquifer zones have been identified: the A aquifer zone and the underlying B1, B2, and B3 aquifer zones. The regional B-C aquitard separates the B3 aquifer zone from the C aquifer zone and the deep aquifer system (Table 4). Current groundwater flow in the shallow aquifer zone is generally to the north, toward San Francisco Bay.

Table 4. Aquifer Depths by Zone

Aquifer	Approximate Depth Interval Below Ground Surface
A or A1 or Upper A ^(a)	0 to 45 feet
B1 or A2 or Lower A ^(b)	50 to 75 feet
B2	75 to 110 feet
B3	120 to 160 feet
C	200 to 240 feet
Deep	> 200 feet

(a) MEW Companies refer to this aquifer as “A” both south and north of U.S Highway 101. North of U.S. Highway 101, NASA refers to it as “A1” and Navy refers to it as “Upper A.”

(b) MEW Companies refer to this aquifer as “B1” both south and north of U.S. Highway 101. North of U.S. Highway 101, NASA refers to it as “A2” and Navy refers to it as “Lower A.”

2. Remedial Actions Summary

2.1. Basis for Taking Action

The primary contaminants of concern at the MEW Site are TCE and its degradation by-products in soil and groundwater. The presence of these contaminants in soil and groundwater provided the basis for taking action under the Comprehensive Environmental Response, Compensation, and Liability Act. EPA determined that there is potential exposure to contaminated groundwater (EPA, 1989) and direct exposure to surface soil contamination was unlikely under current land use conditions. EPA did not perform an ecological risk assessment because no ecological receptors were identified. EPA determined that the greatest public health risk is from potential inhalation exposure through the subsurface vapor intrusion pathway (EPA, 2010).

2.2. Remedy Selection

EPA selected the soil and groundwater remedy in its June 1989 Record of Decision and clarified the remedy in Explanations of Significant Differences in 1990 and 1996. EPA selected the vapor intrusion remedy for addressing the subsurface vapor intrusion pathway in its August 2010 ROD Amendment.

1989 Soil and Groundwater Remedy

In the 1989 ROD, EPA selected the following soil and groundwater remedial action objectives:

- Protect the local drinking water supplies.
- Restore the shallow and deep aquifers to meet maximum contaminant levels (MCLs) and a 10^{-6} risk level, respectively.
- Control and remediate contamination in subsurface soils.

- Prevent the vertical migration of groundwater contamination into the deeper, underlying aquifers.

The soil cleanup remedy at the MEW Site includes excavation, with treatment by aeration, and soil vapor extraction, with treatment by vapor phase granular activated carbon. Soil cleanup actions have been completed at all former source areas at the MEW Site.

The groundwater remedy for the MEW Site consists of the following:

- Hydraulic remediation by groundwater extraction and treatment using air-stripping towers plus incorporation of pre-existing liquid-phase granular activated carbon at operating treatment systems.
- Maintaining inward and upward hydraulic gradients by pumping inside the existing slurry walls.
- Identification and sealing of any potential conduit wells.
- Reuse of extracted groundwater to the maximum extent feasible, with 100% reuse as a goal.

EPA issued an Explanation of Significant Differences to the ROD in September 1990, clarifying that the cleanup goals established in the ROD for the MEW Site were the cleanup standards, and TCE is to be used as an “indicator compound.” The other chemicals of concern listed in the ROD are also to be cleaned up to their respective cleanup standards. A second Explanation of Significant Differences, issued in April 1996, provided formal interpretation of the groundwater remedy to include liquid-phase granular activated carbon for groundwater treatment.

The groundwater cleanup levels selected in the 1989 ROD are listed in Table 5. In addition to VOCs, the ROD lists phenol and four inorganic contaminants of concern. Although they are periodically analyzed during groundwater sampling events, the inorganic chemicals and phenol have not been detected at elevated concentrations and do not require cleanup; therefore, they are not discussed further in this document.

Table 5. Groundwater Cleanup Levels from 1989 ROD

Site Chemical of Concern	Cleanup Levels (µg/L)	Basis for Cleanup Level ¹
Chloroform	100	Federal MCL (1989 ROD) ²
1,2-Dichlorobenzene	--	N/A
1,1-Dichloroethane (1,1-DCA)	--	N/A
1,1-Dichloroethene (1,1-DCE)	6	State MCL (1989 ROD)
1,2-Dichloroethene ³ (1,2-DCE)	--	N/A
Freon-113	--	N/A
Phenol	--	N/A
Tetrachloroethene (PCE)	--	N/A
1,1,1-Trichloroethane	200	Federal and State MCL (1989 ROD)
Trichloroethene (TCE)	5 0.8 (Deep aquifer)	Shallow Aquifer: Federal and State MCL (1989 ROD). Deep Aquifer: Excess lifetime cancer risk no greater than 1×10^{-6}
Vinyl chloride (VC)	0.5	State MCL (1989 ROD)
Antimony	--	N/A
Arsenic	50	Federal and State MCL (1989 ROD)
Cadmium	10	Federal and State MCL (1989 ROD)
Lead	50	Federal and State MCL (1989 ROD)

Notes:

1. Drinking water standards are the maximum permissible concentration of a chemical in water considered safe to drink, as established by the Safe Drinking Water Act. These are also referred to as Maximum Contaminant Levels (MCL).
2. Currently there is no Federal or State MCL for Chloroform. The listed cleanup level is based on Title 22 of the California Code of Regulations detection limit for purposes of reporting, which is 100 µg/L.
3. 1,2-DCE exists as *cis* and *trans* isomers. The more stringent MCL (for *cis*) is used.

2010 Vapor Intrusion Remedy

In a 2010 ROD Amendment, EPA selected the vapor intrusion remedy to address the potential long-term exposure risks from TCE and other MEW Site chemicals of concern from shallow subsurface contamination through the vapor intrusion pathway, which was not addressed in the 1989 ROD. Indoor air cleanup levels from the 2010 ROD Amendment are shown in Table 6.

The vapor intrusion Remedial Action Objectives for the MEW Site are to:

- Ensure that building occupants (e.g., workers and residents) are protected from Site contamination by preventing subsurface Site contaminants from migrating into indoor air or accumulating in enclosed building spaces exceeding indoor air cleanup levels for long-term exposure.

- Accelerate the reduction of the source of vapor intrusion (i.e., Site contaminants in shallow groundwater and soil gas) to levels that are protective of current and future building occupants, such that the need for a vapor intrusion remedy would be minimized or no longer be necessary.

EPA's selected remedy to address the vapor intrusion pathway and ensure protection of human health of building occupants in the Vapor Intrusion Study Area consists of the following:

- For Existing Buildings - The appropriate response action is determined by indoor air sampling and other lines of evidence for each building. If necessary, installation, operation, maintenance, and monitoring of an appropriate sub-slab/sub-membrane ventilation system or alternatively, for existing commercial buildings, use of building's indoor air mechanical ventilation system if the property/building owner agrees to use, operate, and monitor the system to meet remedy performance criteria and the remedial action objectives.
- For future (new construction) buildings, installation of a vapor barrier and passive sub-slab ventilation system (with the ability to be made active). Implementation of Institutional Controls and monitoring to ensure the long-term effectiveness of the vapor intrusion remedy.

Table 6. Indoor Air Cleanup Levels from 2010 ROD Amendment

Chemical of Concern	Indoor Air Cleanup Level ($\mu\text{g}/\text{m}^3$)		Basis for Cleanup Level
	Residential Buildings	Commercial Buildings (Non-Residential)	
Trichloroethene (TCE)	1	5	Representing 1×10^{-6} lifetime target cancer risk through application of the Cal/EPA toxicity factor and a 1×10^{-4} lifetime target cancer risk through application of draft 2001 EPA toxicity factor.
Tetrachloroethene (PCE)	0.4	2	Representing 1×10^{-6} lifetime target cancer risk.
<i>cis</i> -1,2-Dichloroethene (<i>cis</i> -1,2-DCE)	60	210	Based on <i>trans</i> -1,2-DCE Non-cancer Hazard Index of 1.
<i>trans</i> -1,2-Dichloroethene (<i>trans</i> -1,2-DCE)	60	210	Representing Non-cancer Hazard Index of 1.
Vinyl Chloride	0.2	2	Representing 1×10^{-6} lifetime target cancer risk. EPA uses a larger conversion factor from residential to commercial for vinyl chloride because the residential value considers child exposure and higher sensitivity earlier in life.
1,1-Dichloroethane (1,1-DCA)	2	6	Representing 1×10^{-6} lifetime target cancer risk.
1,1-Dichloroethene (1,1-DCE)	210	700	Representing Non-cancer Hazard Index of 1.

2.3. *Remedy Implementation*

The remedy is generally implemented by the potentially responsible parties (PRPs): MEW Companies, Navy, and NASA. The MEW Companies' soil and groundwater cleanup programs include soil excavation and treatment, installation of four slurry walls, soil vapor extraction and treatment systems, and groundwater extraction and treatment systems. The slurry walls physically contain the shallow groundwater contamination; three 40-foot-deep walls are located around the former Fairchild facilities and one 100-foot-deep slurry wall is located around the former Raytheon facility.

In the mid-1990s, Fairchild, Raytheon, Intel, SMI, Vishay/SUMCO, and NEC implemented the soil remedy, excavating approximately 36,000 cubic yards of soil and installing five soil vapor extraction systems within the former source areas. The soil cleanup was completed in 2001.

Each of the MEW Companies operates and maintains individual facility-specific groundwater source control measures to contain and clean up contamination source areas in each area for which the MEW Company is responsible. The two MEW Regional Program groundwater extraction and treatment systems south of U.S. Highway 101 (MEW Area) and north of U.S. Highway 101 (Moffett Field Area) have been operating since 1998. The Site 28 West-side Aquifers Treatment System and NASA's groundwater extraction and treatment systems began operation in 1998 and 2001, respectively.

In accordance with the ROD, several of the groundwater treatment systems discharge to Stevens Creek under general NPDES permits. The ROD also permits discharge into the sewer system under industrial wastewater discharge permit issued by the City of Mountain View. The ROD specifies that the extracted groundwater be reused to the maximum extent feasible, with a goal of 100% reuse. Treated water from the MEW Regional North of U.S. Highway 101 (North of 101) treatment system is designated for reuse by NASA or discharged to Stevens Creek. The North of 101 treatment system has a bypass valve that allows treated groundwater to be diverted, further treated by microfiltration and reverse osmosis, and reused by NASA at their Leadership in Energy and Environmental Design (LEED) building (Building N232) or their industrial water pretreatment plant on an as-needed basis. In 2023, approximately 15.9 million gallons of groundwater were reused; and approximately 57 million gallons were reused during the five-year review period (2019-2023).

Appendix B provides the current remedy implementation status provided by the MEW Companies and NASA, including summaries of the status of gradients within slurry walls, groundwater treatment systems, and facility-specific optimization studies.

Table 7 provides a summary of the number of extraction wells by aquifer zone and the average total extraction rate and type of treatment system for each facility between 2019 and 2023.

Table 7. Groundwater Extraction and Treatment Systems Summary

Treatment System Facility	Number of Extraction Wells by Aquifer Zone				Total Average Extraction Rate (gpm)	Treatment System/Treatability Study
	A/A1	B1/A2	B2	B3 + Deeper		
Fairchild (System 19) ¹	9	4	2		84	Granular Activated Carbon (GAC)
MEW Regional Consolidated S101 ¹	11	9	5		124	GAC
Raytheon	5	1	2		24	Oxidation/GAC
Intel ²	N/A	N/A			N/A	Bioremediation pilot treatability study
NEC/Renesas	3				4	GAC
SMI ³	N/A (3 ³)				N/A (19 ³)	GAC/Bioremediation pilot treatability study
Vishay/SUMCO	7	1	1		14	Oxidation/Air stripper
MEW Regional Program N101	8	7			118	Air stripper/Vapor-phase GAC
Site 28 WATS ⁴	7	5			43	Oxidation/GAC + bioremediation treatability study
NASA Ames	2				13	GAC
Total	52	27	10	0	424	8 Systems

Notes:

¹ In November 2015, flow from Fairchild Systems 1 and 3 were consolidated to the MEW Regional South of 101 Treatment System. Total groundwater extracted and mass removed from January 2018 through December 2023 are included in the amount reported for the Consolidated South of 101 Treatment System.

² Groundwater extraction at the Intel facility was suspended in 2005, at the Fairchild/Schlumberger 401 National Avenue facility in 2015 and at the SMI facility in 2019 with EPA approval so that in-situ pilot treatability study tests could be performed and monitored.

³ Groundwater extraction at the SMI system was discontinued on June 28, 2019, and has been offline through the remainder of the review period. The gallons per minute (gpm) rate is from the last operational period from January 1 through June 18, 2019.

⁴ The Navy installed three new groundwater extraction wells EA1-7, EA2-4, and EA2-5 and began operations in 2023.

Figure 3 and Figure 4 show the locations of each regional and source control extraction well and treatment system South of U.S. Highway 101 and North of U.S. Highway 101, respectively.

The vapor intrusion remedy is currently being implemented, in accordance with the Vapor Intrusion ROD Amendment and EPA-approved work plans, design documents, and long-term operations, maintenance, and monitoring plans, and will be ongoing until shallow subsurface contamination no longer poses a vapor intrusion risk.

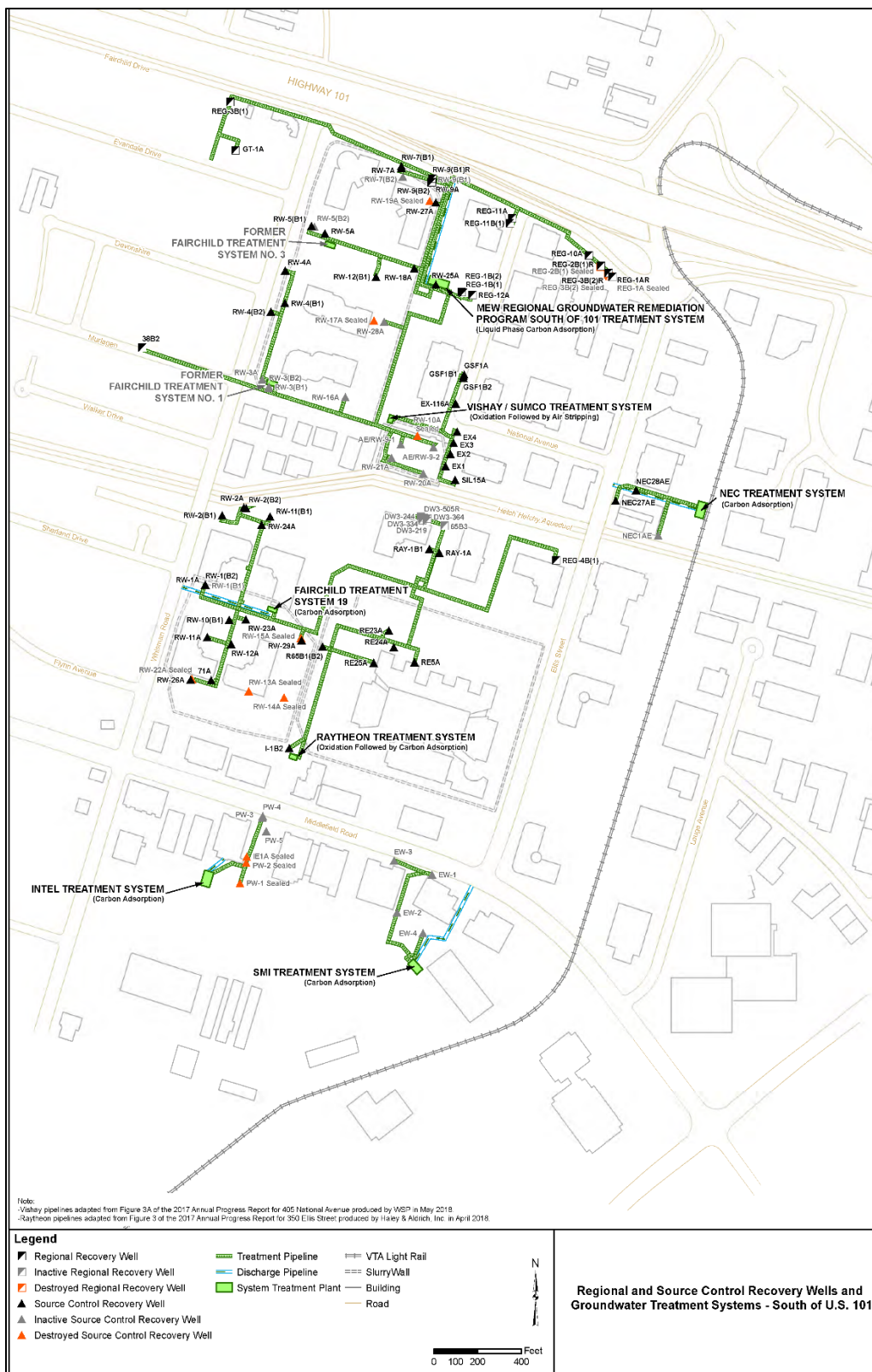
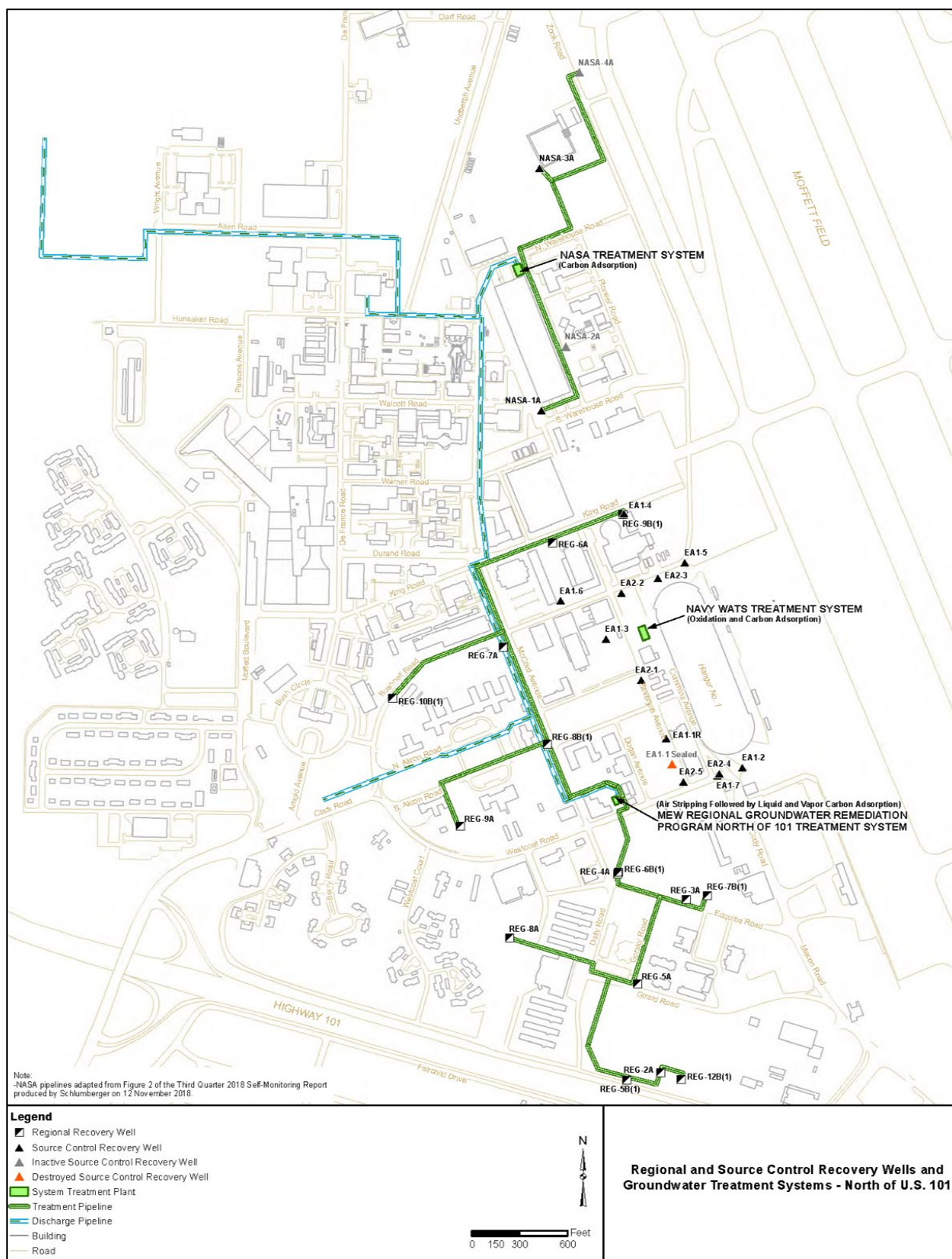


Figure 3. Regional and Source Control Extraction Wells and Treatment Systems – South of U.S. Highway 101.



2.4. System Operations/Operation and Maintenance

Operations, maintenance, and monitoring across the facility-specific and regional plume areas are routinely performed in accordance with the long-term groundwater operations, maintenance and monitoring plans and manuals.

A review of the O&M performance from the various groundwater extraction and treatment systems during the review period showed periods of downtime for repairs and upgrades. All parties are required to provide notification to EPA within 24 hours of when the party or its representatives first know or should have known that any component of the groundwater remedy fails to operate for 72 hours or more. Additionally, parties must also provide written notification to EPA when the remedy has been restarted.

3. Progress Since the Last Five-Year Review

3.1. Previous Five-Year Review Protectiveness Statement and Issues

The protectiveness statement from the 2019 Third Five-Year Review for the MEW Site stated the following:

The groundwater and vapor intrusion remedy at the Middlefield-Ellis-Whisman (MEW) Superfund Area is currently protective of human health and the environment because there is no direct exposure to contamination. Governmental controls are in place to prevent access to contaminated groundwater. The vapor intrusion control systems, monitoring program, and institutional controls are in place to minimize exposure risk from vapor intrusion. However, in order for the remedy to be protective in the long-term, alternative groundwater cleanup technologies should be selected in order to accelerate the reduction of the source of vapor intrusion in the Shallow Zone.

The 2019 Five-Year Review included one issue and recommendation. The recommendations and status are discussed in Table 8.

Table 8. Status of Recommendations from the 2019 Five-Year Review

OU #	Issue	Recommendations	Current Status	Current Implementation Status Description
Site-Wide	Due to declining efficiency and effectiveness, the existing groundwater remedy will not achieve groundwater cleanup levels for many decades and will not meet the vapor intrusion remedial action objective to accelerate the reduction of the source of vapor intrusion (i.e., Site contaminants in shallow groundwater and soil gas) to levels that are protective of current and future building occupants, such that the need for a vapor intrusion remedy would be minimized or no longer be necessary.	Evaluate alternative cleanup technologies that will accelerate TCE contaminant reduction and vapor intrusion source reduction in the Shallow Zone (soil gas and A aquifer zone) to address the vapor intrusion source remedial action objectives and prepare Shallow Zone Focused Feasibility Study, Proposed Plan and ROD Amendment to support and change the current remedy.	Ongoing	The MEW companies, Navy, and NASA continue to optimize groundwater cleanup operations and evaluate alternative technologies to accelerate the cleanup of groundwater in the Shallow Zone to address the vapor intrusion remedial action objective. The vapor intrusion study area is continually monitored, and vapor intrusion remedy is being implemented. The Shallow Zone Focused Feasibility Study, Proposed Plan, and ROD Amendment to support and change the current remedy has been delayed but is still planned.

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

Tables B-1, B-2, and B-3 in Appendix B present a summary of groundwater remedial work completed at the Site during this five-year review period (2019 to 2023).

This work generally included operations of facility-specific and regional groundwater extraction and treatment systems, monitoring of slurry walls at the four MEW facility-specific locations: Raytheon 350 Ellis St, Fairchild/Schlumberger 369 and 441 N Whisman Road, Fairchild/Schlumberger 515/545 N Whisman Road, and Fairchild/Schlumberger 401 National Avenue. In addition, Table B-3 provides the status of optimization, pilot tests, and treatability studies carried out during this five-year review period to target high Site contaminant concentration areas and accelerate reduction of those concentrations.

PFAS (per- and polyfluoroalkyl substances)

Although they are not identified as contaminants of concern in the 1989 ROD, PFAS have been evaluated at certain locations in the regional groundwater plume on Moffett Field during the review period. Groundwater influent and effluent samples were collected at the MEW Regional Groundwater Remediation Program (RGRP) North of 101 Treatment System, Site 28 WATS, and NASA's treatment system. PFOS (perfluorooctanesulfonic acid) and PFOA (perfluorooctanoic acid) were observed in August 2021 influent samples of MEW North of 101 treatment system at

concentrations exceeding the 2024 EPA MCLs (4 nanograms per liter [ng/L] each). PFOS was detected at 120-160 ng/L and PFOA was detected at 14-20 ng/L (SLB, 2022).

Also, during this review period, NASA conducted PFAS sampling in groundwater to assess potential source areas of this group of contaminants as part of the Site Inspection (SI) (Tetra Tech, 2023). Results indicated PFAS were present in groundwater at concentrations up to 40,000 ng/L for PFOS. In 2024, NASA began an Expanded Site Inspection (ESI) to further investigate potential source areas associated with PFAS contamination found during the SI.

Vapor Intrusion Activities for Residential Buildings

The following are examples of vapor intrusion remedial activities performed during this five-year review period:

- In 2021, as part of new construction, vapor intrusion control systems were installed in two new residential buildings.
- In 2023, for several planned new residential buildings, soil gas sampling was conducted as part of pre-construction activities. Results indicated that there is no potential for vapor intrusion impacts into the homes. After the homes were constructed, pre-occupancy indoor air confirmation samples were collected to ensure that there was not a vapor intrusion concern.
- In 2024, indoor air samples were collected at 17 residences. Results confirmed active vapor intrusion control systems are mitigating the potential vapor intrusion pathway.

Vapor Intrusion Activities for Commercial Buildings

Routine inspections, including indoor air sampling, were conducted of vapor intrusion systems in the commercial buildings in the MEW Vapor Intrusion Study Area. NASA and Navy sampled indoor air annually in a subset of buildings within their areas of responsibility. NASA and Navy are preparing their own Five-Year Review reports.

Routine inspections of the vapor intrusion systems in the MEW Vapor Intrusion Study Area identified operational issues, which were subsequently addressed during this five-year review period. Examples of these issues included wind turbine operation, blower system sensor, and HVAC motor repairs. Also, standard replacement activities were conducted, such as replacement of blowers and carbon vessels, as needed. An auto-dialer was installed to provide alerts if the vapor intrusion control system stopped operating.

Certain tenant improvement activities in non-residential buildings required more extensive response and the preparation of a soil management and air monitoring plan when the tenant

improvements compromise the building foundation (e.g., trenching) or add new potential vapor intrusion pathways.

Sewer Gas Pathway Assessment

In 2020, elevated levels of TCE were detected in indoor air in a residential development along Fairchild Drive. EPA investigated where the TCE was migrating from, including sampling along the sewer line servicing the development to determine whether the TCE was migrating with sewer gas into indoor air. EPA found that contaminated shallow groundwater from the MEW TCE regional groundwater plume was entering the Fairchild main sewer line, and from there entered the lateral servicing the residential development. Preliminary results of the investigation indicated TCE sewer gas concentrations reached along the full extent of the sewer lines, service laterals, and individual residential sewer cleanouts, confirming migration through this pathway and potential into the indoor air space. To cut off the pathway, a sewer gas siphon along the service lateral was installed in 2020 to minimize TCE in sewer gas from migrating along the sewer laterals and cleanouts and entering the indoor air space through this pathway. Confirmation sampling showed that the sewer siphon was effective in significantly reducing TCE migration from the sewer main to the sewer lateral and into indoor air through the sewer gas migration pathway. In 2022, five additional sewer siphons have been installed along sewer laterals to mitigate further TCE-contaminated sewer gas migration into other residential buildings along Fairchild Drive.

4. Five-Year Review Process

4.1. Community Notification, Involvement and Site Interviews

4.1.1. Five-Year Review Public Notice and Press Release

EPA issued a press release on February 8, 2024 (<https://www.epa.gov/newsreleases/epa-review-effectiveness-cleanups-14-privately-owned-california-superfund-sites-2024>), announcing the Five-Year Review. Copies of the public notice and press release are presented in Appendix D. Public notice was published in the Mountain View Voice, a local newspaper, on February 9, 2024. EPA also placed a notification on the Site website: epa.gov/superfund/mew-study-area stating that the Site was undergoing a Five-Year Review.

The final Five-Year Review Report will be made available at the Site information repository located at EPA Superfund Records Center, 75 Hawthorne Street, 3rd Floor, San Francisco, CA 94105 and will be available on the Site's webpage.

4.1.2. Site Interviews

During the Five-Year Review process, EPA conducted interviews with stakeholders and PRP representatives with knowledge of the Site to document any perceived problems or successes with the remedy as it has been implemented to date. Written responses were provided by interviewees representing ten stakeholder entities. The five-year review interview responses are presented in Appendix E.

4.2. *Data Review*

4.2.1. Groundwater

During this five-year review period, approximately 1.5 billion gallons of groundwater were treated at the Site. In total, approximately 8,300 pounds of VOCs were removed during the five-year review period and 127,000 pounds of VOCs have been removed through Site cleanup operations. The MEW Companies, Navy, and NASA have performed groundwater remedy optimization, including conducting pilot/treatability studies to target contaminant mass removal, consolidate treatment systems, modify pumping rates, and replace and install new source control extraction wells to enhance overall cleanup effectiveness and efficiency (see Appendix B). Each of the various MEW facilities, Navy, and NASA performed Mann-Kendall analysis in their individual annual groundwater progress reports. Results of the groundwater evaluation indicate that although cleanup progress is being made, alternate cleanup methods are needed as demonstrated by the effectiveness of in-situ pilot treatability tests at source area properties to accelerate cleanup to meet the remedial action objectives.

The following is a brief description of MEW facility-specific source control groundwater remedy operations and optimization efforts including ongoing pilot treatability studies within the MEW regional groundwater plume.

4.2.1.1 Former Fairchild Facilities

515/545 N. Whisman Road and 313/323 Fairchild Drive (Former Fairchild Buildings 1-4)

Schlumberger operates a groundwater treatment system consisting of ten extraction wells. They continued to operate the system through the five-year review period, though inward and upward gradients were not always maintained—particularly in the downgradient well pairs, vertical gradient well pairs, and the western wall cross gradient pairs. Four well pairs are used to monitor vertical gradients associated with the slurry wall, and seven well pairs monitor the horizontal gradient across the slurry wall. Horizontal gradients have been generally from the

south to the north (similar to the regional groundwater flow direction) across the slurry wall. In 2022, TCE concentrations in most wells across the properties remained above cleanup levels, with maximum TCE concentrations at 620 µg/L in the A zone and 6,500 µg/L in the B2 zone.

401 National Avenue (Former Fairchild Building 9)

The groundwater remedy at the former Fairchild Building 9 facility (also known as 401 National Avenue, now 600 National Avenue) includes four extraction wells and a slurry wall to provide hydraulic containment. To accelerate contaminant mass removal and groundwater cleanup, Schlumberger initiated an in-situ-chemical oxidation (ISCO) pilot treatability study in 2015. There have been eight injection events and the four groundwater extraction wells have been shut off for the duration of the treatability study. Based on the results from the eight injection events, concentrations of TCE and other Site VOCs significantly decreased. The maximum TCE concentrations in the A-zone reported in the 2022 monitoring event was 4,100 µg/L. ISCO pilot study performance monitoring is ongoing. A work plan for ninth injection event utilizing sequential application of in-situ bioremediation post ISCO is planned for 2024.

369/379/389/399 N. Whisman Road (Former Fairchild Buildings 19, 13 and 23)

Schlumberger continued to operate 14 source control extraction wells at former Fairchild Buildings 19, 13 and 23, and performed optimizations by increasing extraction rates to enhance contaminant mass removal. Results from monitoring well pairs indicated that inward and upward gradients were not always maintained across this facility-specific slurry wall. A regional extraction well downgradient of the northern slurry wall captures groundwater that flows through the slurry wall; the extraction rate of this well was increased as part of a pilot study that began in 2015. The pilot study concluded in 2020, and no additional optimization activities are currently planned. During the 2022 monitoring event, the maximum concentration of TCE in the A zone at the former Fairchild Building 19 area was 8,800 µg/L. Maximum TCE concentrations in the B2 zone was 410 µg/L.

644 National Avenue (Former Fairchild Building 18)

Schlumberger continued to operate one source control extraction well and three regional extraction wells in the former Fairchild Building 18 area. The monitoring wells showed a downward gradient from the A to the B1 aquifer zone. Maximum TCE concentrations during the 2022 monitoring event were 520 µg/L in the A zone and 2,100 µg/L in the regional extraction well REG-1B1 in the B1 zone.

4.2.1.2 Raytheon - 350 Ellis Street

Raytheon continued to operate the groundwater extraction and treatment system at the 350 Ellis Street property. Inward and upward gradients have not been maintained in the slurry wall in the last five years. Water levels confirmed that four of the seven well pairs along the northern slurry wall are not demonstrating an upward and inward gradient and several well pairs exhibit downward gradients during various times of the year. However, capture zone maps show that groundwater contamination is captured downgradient of the northern slurry wall at RAY-1A and RAY-1B1. Maximum TCE concentrations during the 2022 monitoring event were 1,400 µg/L at well 24A downgradient of the northern slurry wall, and up to 280 µg/L in B2 zone well R17-B2 located outside of the slurry wall on the southwestern corner of the property. Monitoring wells within the slurry wall are sampled once every four years. The maximum TCE concentrations detected in 2022 within the slurry wall were 6400 µg/L at A zone well RE24A, and 1,900 µg/L at B1 zone well RP21B.

4.2.1.3 Intel/Raytheon - 355/365, 401 and 415 E. Middlefield Rd (Lots 3, 4, and 5)

Intel/Raytheon continued to implement an *in-situ* bioremediation pilot test at the 355/365, 401 and 415 E. Middlefield Road property, which has accelerated cleanup of VOCs in the A zone. The pilot test began in 2005, and with EPA approval, Intel's groundwater extraction and treatment system was shut down. During the five-year review period, additional enhanced in-situ bioremediation (emulsified soybean oil and dechlorinating microorganisms) was conducted in 2020 in two localized areas with elevated residual TCE above 100 µg/L in the vicinity of well M-18A on Lot 3 and one near well R-52A on Lot 5. TCE concentrations in well M-18A decreased from 50 µg/L in June 2020 to 11 µg/L in December 2020. Similarly, TCE concentrations in well R-52A decreased from 170 µg/L in June 2020 to 5.6 µg/L in December 2020 and 1.5 µg/L in October 2022.

4.2.1.4 NEC/Renesas - 501 Ellis Street

Renesas continued to operate and optimize the A-zone groundwater extraction and treatment system at 501 Ellis Street. TCE concentrations across the 501 Ellis property are relatively low compared to other portions of the regional TCE groundwater contamination plume, though continue to remain above cleanup levels. In 2021, a modification was made and Renesas began treating groundwater using a granular activated carbon filter prior to discharge to the sanitary sewer. The filter medium is replaced every three months. TCE concentrations are generally decreasing or stable, except one well, which is located near downgradient extraction wells and

is likely influenced by capture of the upgradient TCE-containing groundwater. The maximum TCE groundwater concentration in October 2022 was 89 µg/L at A zone well NEC-8A which is fully captured by the source control extraction system.

4.2.1.5 SMI Holding LLC – 455 and 485/487E. Middlefield Rd

SMI continued to operate its A zone groundwater extraction and treatment system at 455 and 485/487 E. Middlefield Road until June 2019, when it began implementing a two-year *in-situ* sulfidated zero valent iron (ZVI) pilot treatability study. As part of the ZVI treatability study, five new monitoring wells were installed in 2019 prior to injection events in 2019 and 2020. The source control extraction and treatment system has remained off during the treatability study. To supplement the prior ZVI injections conducted in 2019 and 2020, PlumeStop® Liquid Activated Carbon (ZVI/PlumeStop®) and additional sulfidated ZVI were co-injected in October/November 2022 at 147 injection points in the former source area and downgradient northern property boundary area. Results from the performance monitoring following the treatability study demonstrate the effectiveness of the ZVI injections, and TCE concentrations have largely decreased across the property. In 2023, the maximum TCE concentration of 42 µg/L was found near A zone well SM-01.

4.2.1.6 Vishay/SUMCO - 405/425 National Avenue

Vishay/SUMCO operates groundwater and extraction system consisting of five on-property A zone source control extraction wells (EX1, EX2, EX3, EX4, SIL15A), four jointly shared groundwater A, B1, and B2 zone extraction wells (EX-116A, GSF1A, GSF1B1, and GSF1B) located hydraulically downgradient of the former 401 and 405 National Avenue source area properties. In January 2017, monitoring well 116A was converted to shared source control extraction well EX-116A to target high TCE groundwater contamination and optimize contaminant mass removal. Since the conversion, TCE has decreased substantially from 19,000 µg/L in 2016 to 2,300 µg/L in 2022.

Significant groundwater extraction and treatment system downtime has occurred during the five-year review period. During 2023, the system was offline for routine, non-routine and unscheduled shutdown periods, resulting in an operational runtime percentage of 73.7%. To improve system performance and reliability, in 2024 the removal of the groundwater extraction and treatment system and consolidation of the effluent into the MEW Regional South of 101 treatment system is being evaluated. Alternatively, modifications to the treatment system may be considered to use carbon instead of HiPOx pre-treatment to reduce system downtime.

4.2.1.7 Site 28 West-side Aquifers Treatment System Area

Traffic Island Source Area: During the Five-Year Review period, the Navy completed work described in the Remedial Action Work Plan to address source reduction and hydraulic containment at the Traffic Island Area within Site 28. This included replacement of source control extraction well EA1-1 and installment of three new source control extraction wells, EA1-7, EA2-4, and EA2-5 to address Traffic Island and former Building 88 source areas. Work also included Enhanced Anaerobic Bioremediation/In-situ Chemical Reduction injection work. Groundwater extraction from the newly installed extraction wells will be used long-term to maintain hydraulic containment and additional containment removal.

West-side Aquifers Treatment System: NASA currently conducts operations, maintenance, and monitoring of the extraction and treatment system. The Navy continues to address the vapor intrusion pathway at 23 buildings within its area of responsibility within Site 28. WATS had considerable operational downtime in 2019 through 2022. The downtime was due to repairs, replacement, and maintenance of the primary advanced oxidation process units and granular activated carbon vessels, as well as the auxiliary system and extraction well components and remote monitoring systems.

4.2.1.8 NASA Ames

The NASA Ames groundwater treatment system has been optimized to increase groundwater extraction rates in its two operating A extraction wells. TCE concentrations (2022) remain above cleanup levels, up to 39 µg/L.

Additional optimization activities, including monitored natural attenuation, are being considered to further optimize efficiency and effectiveness of the groundwater remedy in NASA's area of responsibility.

NASA Treatability Study: NASA also operates a pilot phytoremediation treatability study within the MEW Area of Responsibility, using endophyte-assisted hybrid poplars to treat VOCs as contaminated groundwater passes beneath Highway 101 onto Moffett Field. The phytoremediation pilot treatability study has grown to over 1,000 trees in three phytobarrier test plots within the regional plume area just north of Highway 101. Results show a significant reduction of TCE and cis-1,2-DCE in wells within the phytobarrier test plot compared to the well immediately downgradient of the test plot. Vapor Intrusion Study Area

The MEW Site Vapor Intrusion Study Area is generally defined as the extent of the estimated TCE shallow groundwater contamination plume area greater than 5 µg/L. The MEW Companies, Navy, NASA, and EPA continue to implement the vapor intrusion remedy selected in the 2010 ROD Amendment throughout the MEW Vapor Intrusion Study Area (Figure 5). A more detailed map depicting the Vapor Intrusion Study Area south of U.S Highway 101 is presented in Figure 6 and north of U.S. Highway 101 is presented in Figure 7. To date, hundreds of commercial/non-residential buildings and residences have been sampled in the Vapor Intrusion Study Area.

Vapor Intrusion Evaluation Area - North of Evandale Avenue and West of Leong Drive

EPA continues to evaluate the high TCE concentrations detected in soil gas and groundwater at the 850 and 870 Leong Drive properties. Vapor intrusion evaluations also continue in the area north of Evandale and west of Leong Drive. EPA has sampled homes along Evandale Avenue and determined there are no vapor intrusion concerns. EPA continues to evaluate the sewer gas pathway along Fairchild Drive (see Section 3.2).

4.2.2. Institutional Controls

The vapor intrusion remedy includes ongoing institutional controls to ensure that the remedy is properly implemented over time and that all stakeholders are aware of the remedy's implementation and ongoing requirements. The following Institutional Controls specifically selected for the vapor intrusion remedy are being implemented.

- 1) Some properties with an implemented vapor intrusion control system have recorded proprietary controls which run with the land that inform future property owners of the ongoing operation of the building vapor intrusion remedy at the property.
- 2) Governmental controls in the form of City of Mountain View planning and permitting procedures are being implemented. These procedures are intended to inform and allow for EPA to comment when work conducted anywhere overlying the shallow TCE regional groundwater contamination plume may either impact the remedy itself or cause a new pathway for vapors to enter any overlying structure.
- 3) The institutional controls also include the implementation of informational mechanisms, which are two-fold: use of an information gathering service that can keep EPA and the MEW Companies informed of property ownership changes in the MEW Site area and provision of information to owners and occupants in the MEW Site area to ensure understanding of the remedy and its requirements.

For Moffett Field, the institutional controls selected for the vapor intrusion remedy are those requirements found in NASA's, Planetary Ventures', and U.S. Geological Survey's Environmental Issues Management Plans (EIMP) which applies to the NASA Research Park area and a portion of the Moffett Federal Airfield Leasehold by Planetary Ventures. The EIMP provides a decision framework for the management of residual chemicals in soil, groundwater and existing structures, and describes procedures to address the known remaining environmental conditions as well as contingency actions to be taken in the event that previously unknown environmental conditions are encountered during development. Thus, for the full implementation of the Moffett Field Area institutional controls, NASA has expanded the applicability of the vapor intrusion remedy requirements to areas of groundwater contamination outside the NASA Research Park.

4.2.3. Climate Resilience Screening

The MEW Site and the Navy and NASA Ames Research Center are in the South Bay Area region adjacent to the San Francisco Bay. The Bay Area is known for seismic activity and thus could make the existing remedies prone to earthquake damage.

The proximity of the MEW Site and Moffett Field to the San Francisco Bay poses the potential threat of flooding associated with sea level rise. With climate change resulting in projected sea level rise, the risk of flooding exists for the groundwater extraction and treatment systems located on Moffett Field. The Fairchild Semiconductor-Mountain View, Intel-Mountain View and Raytheon sites are listed as moderate flood hazards as indicated by the Government Accountability Office's Superfund Climate Change interactive map. This flood hazard has the potential to temporarily reduce the effectiveness of vapor intrusion control systems and operating groundwater extraction and treatment systems.

California's Fire Hazard Severity Zone Maps indicate that the MEW Site is outside of the state responsibility area for fire hazards.

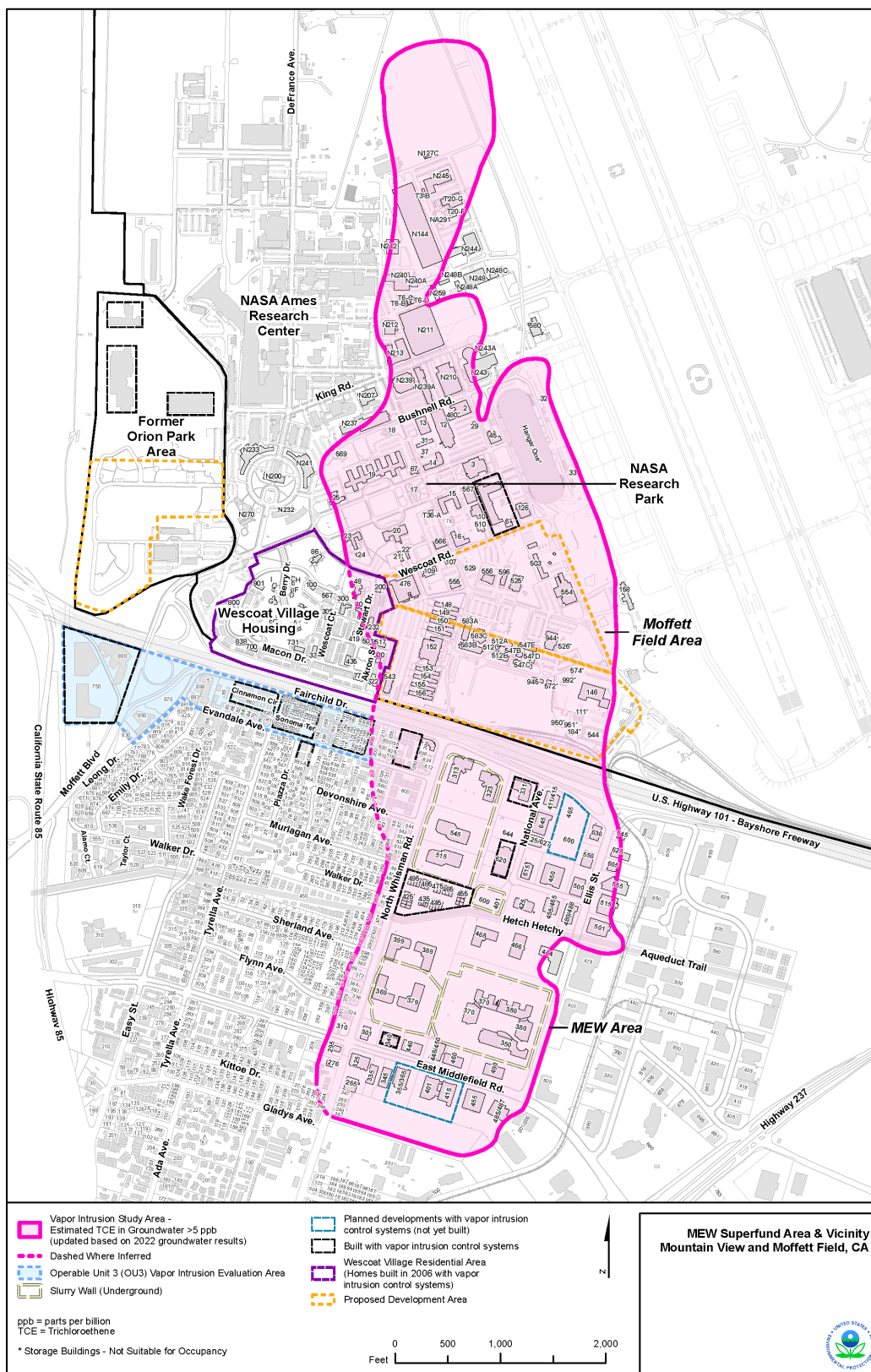


Figure 5. MEW Vapor Intrusion Study Area.

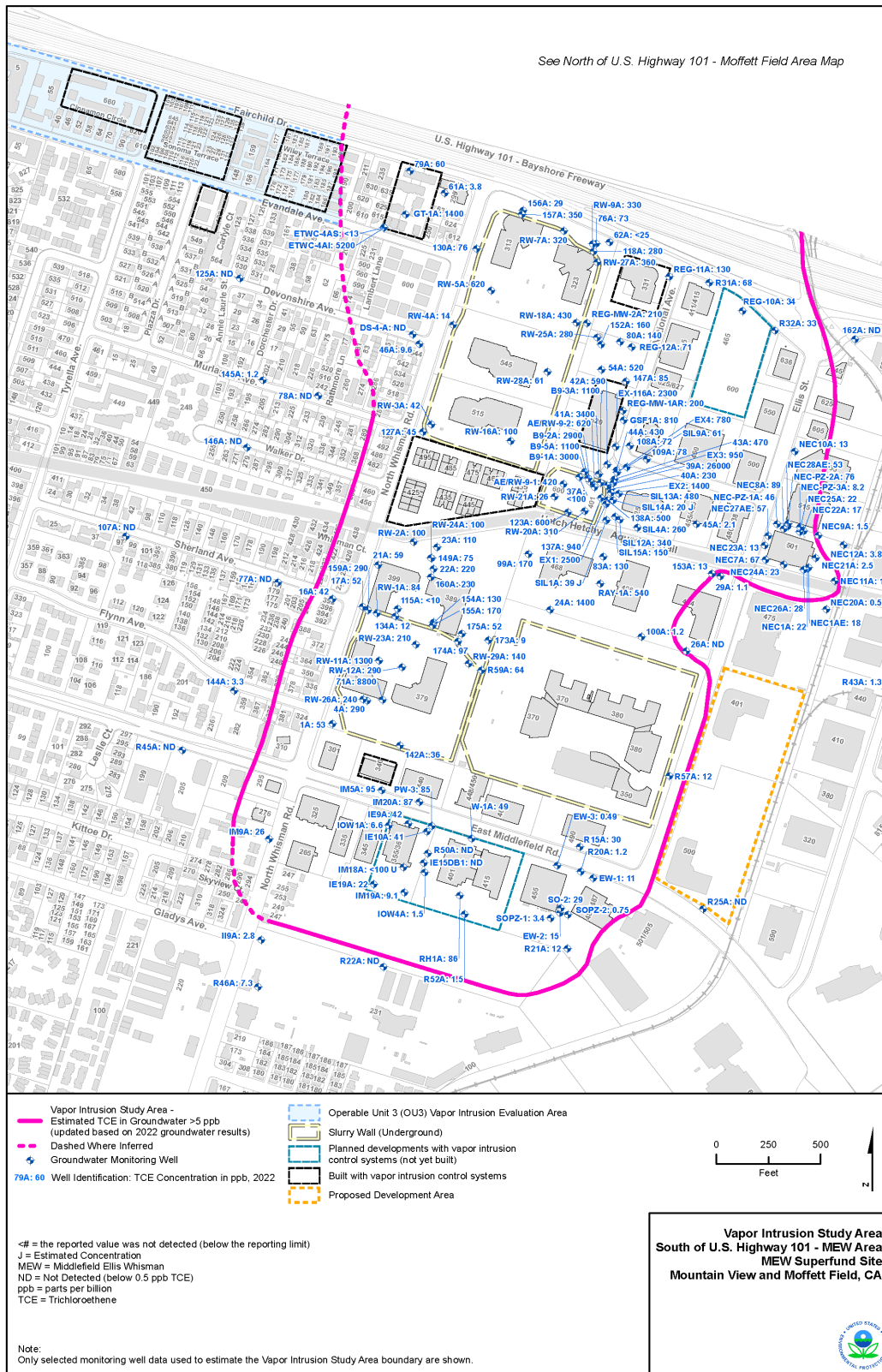


Figure 6. MEW Vapor Intrusion Study Area – South of U.S. Highway 101.

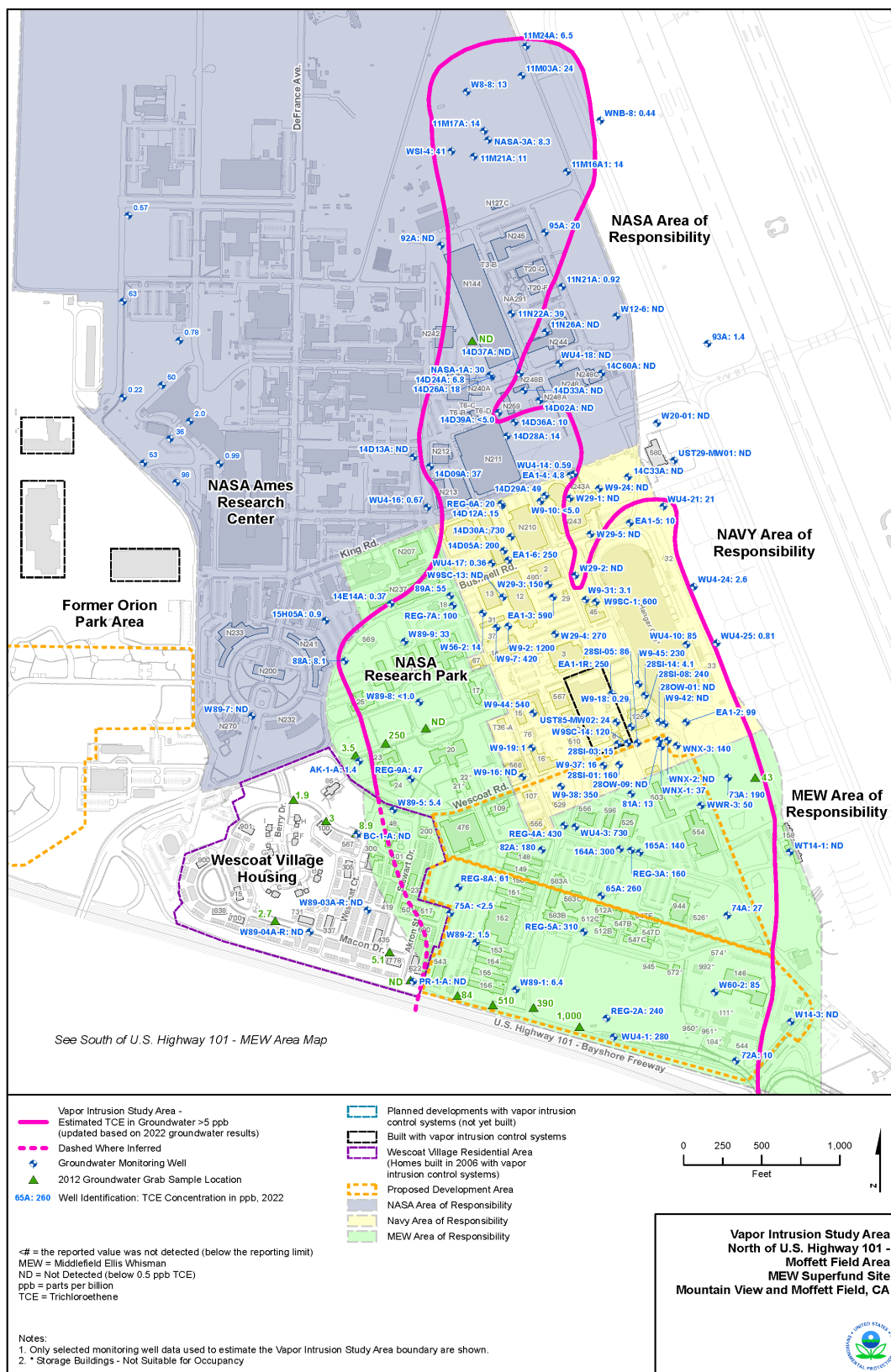


Figure 7. MEW Vapor Intrusion Study Area – North of U.S. Highway 101.

4.3 Site Inspection

The site visit inspection of the MEW Site was conducted on February 8, 2024. In attendance were Alana Lee, EPA, Adan Prado of the USACE Sacramento District, and representatives from the MEW Companies, Navy and NASA. No significant concerns were observed during the Site visit. The site visit inspection summary is included in Appendix F.

5. Technical Assessment

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

The groundwater remedy is operating as intended by the decision documents. The MEW Companies, Navy, and NASA have performed groundwater remedy optimizations, including pilot/treatability studies to target contaminant mass removal, consolidate treatment systems, modify pumping rates and remove source control extraction wells to enhance overall cleanup effectiveness and efficiency.

Optimization of the existing groundwater extraction and treatment system has improved performance at the Regional Program systems and some of the former Facility-specific areas including Fairchild/Schlumberger, Vishay/SUMCO, Renesas, and NASA. The MEW Companies, Navy, and NASA have completed treatability studies of alternate groundwater cleanup technologies. Treatability study tests of *in-situ* remediation by SMI are showing promising results in accelerating the reduction of Site contaminant concentrations in groundwater. In order to further accelerate the reduction of TCE in the shallow aquifer and soil gas, treatment alternatives will be evaluated in a focused feasibility study.

Per the data analysis of groundwater concentrations in selected wells for the MEW Site, it appears that TCE groundwater concentrations continue to decrease; and analysis of monitoring data indicates that TCE concentration in the groundwater plume are decreasing at concentrations above the cleanup level. However, the declining efficiency of the operations of the current groundwater remedy indicates that groundwater cleanup levels will not be achieved in shallow groundwater for many decades. This extended period of time is inconsistent with the vapor intrusion remedy Remedial Action Objectives to accelerate source reduction of the vapor intrusion (i.e., Site contaminants in shallow groundwater and soil gas) to levels that are protective of current and future building occupants, such that the need for a vapor intrusion remedy would be minimized or no longer be necessary.

The groundwater is currently not used for drinking water, and Santa Clara Water Valley Water District has governmental controls in place to prevent the installation of wells in the contaminated aquifer zones.

The vapor intrusion remedy is functioning as intended by the 2010 Record of Decision Amendment. In the Vapor Intrusion Study Area, all occupied commercial/non-residential buildings have been sampled and institutional controls are in place for new building construction and building improvements that may interfere with the vapor intrusion remedy. Residential buildings have also been sampled. Vapor intrusion mitigation and control measures have been implemented in affected buildings.

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

Federal and state MCLs identified as ARARs (Appendix C) in the decision documents have changed since the selection of the remedy (see Table D-1), but the changes do not affect the protectiveness of the remedy. Institutional controls are in place to prevent future direct exposure to contaminated groundwater. Exposure assumptions used in the selection of the groundwater and vapor intrusion remedies are still valid.

Due to declining efficiency and effectiveness, the existing groundwater remedy will not achieve the groundwater remedy Remedial Action Objectives to restore aquifers to groundwater cleanup levels for several decades, since concentrations of contaminants of concern in the plume are stabilizing at concentrations above cleanup levels. Also, the existing groundwater remedy does not address the vapor intrusion Remedial Action Objectives to accelerate the reduction of the source of vapor intrusion (i.e., Site contaminants in shallow groundwater and soil gas) to levels that are protective of current and future building occupants, such that the need for a vapor intrusion remedy would be minimized or no longer be necessary for many decades. Pilot tests and treatability studies are ongoing to explore alternative groundwater cleanup technologies, to expedite contaminant mass removal and cleanup timeframe and reduce VOC concentrations.

As noted in Section 3.2, PFAS contamination has been detected in Site groundwater. Further investigations will be required to better characterize PFAS groundwater contamination at the Site (Section 6). While PFAS were not historically listed as contaminants of concern in the 1989 ROD, recent developments reflect increased regulatory concerns about potential health effects associated with these compounds. These regulatory developments include the 2024

promulgation of EPA MCLs for six PFAS compounds [PFOA, PFOS, PFHxS (perfluorohexanesulfonic acid), PFNA (perfluorononanoic acid), HFPO-DA (hexafluoropropylene oxide dimer acid, or GenX), and PFBS (perfluorobutanesulfonic acid)]. MCLs for five individual PFAS include: PFOA (4 ng/L), PFOS (4 ng/L), PFHxS (10 ng/L), PFNA (10 ng/L), and HFPO-DA (10 ng/L), whereas a combined MCL based on a Hazard Index of 1 (noncancer health effects) was developed for four PFAS (PFHxS, PFNA, HFPO-DA, and PFBS).

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

No, there is no other information that has come to light that could call into question the protectiveness of the remedy.

6. Issues/Recommendations

6.1. Issues and Recommendations

Table 9. Issues and Recommendations Identified in the Five-Year Review

Issues and Recommendations Identified in the Five-Year Review:				
OU(s): Site-wide	Issue Category: Remedy Performance			
	Issue: Due to declining efficiency and effectiveness, the existing groundwater remedy will not achieve groundwater cleanup levels for many decades and will not meet the vapor intrusion remedial action objective to accelerate the reduction of the source of vapor intrusion (i.e., Site contaminants in shallow groundwater and soil gas) to levels that are protective of current and future building occupants, such that the need for a vapor intrusion remedy would be minimized or no longer be necessary.			
	Recommendation: Continue to evaluate alternative cleanup technologies that will accelerate TCE contaminant reduction and vapor intrusion source reduction in the Shallow Zone (soil gas and A aquifer zone) to address the vapor intrusion source remedial action objectives and prepare Shallow Zone Focused Feasibility Study, Proposed Plan and ROD Amendment to support and change the current remedy.			
Affect Current Protectiveness	Affect Future Protectiveness	Party Responsible	Oversight Party	Milestone Date
No	Yes	EPA	EPA	10/30/2026
Issues and Recommendations Identified in the Five-Year Review:				
OU(s): Site-wide	Issue Category: Other			
	Emerging Contaminants			
	Issue: PFAS groundwater concentrations exceeding 2024 EPA MCLs were detected in the influent of the MEW Regional Groundwater Remediation Program (RGRP) North of 101 Treatment System, as well as in extraction and groundwater monitoring wells in the Moffett Field area.			
	Recommendation: Conduct additional influent and effluent sampling at all the groundwater extraction and treatment systems within the MEW Site. Based on sampling results, conduct further assessment.			
Affect Current Protectiveness	Affect Future Protectiveness	Party Responsible	Oversight Party	Milestone Date
No	Yes	PRP	EPA	8/1/2025

6.2. Other Findings

In addition, the following are recommendations that improve performance of the remedy, reduce costs, improve management of O&M, accelerate site close out, conserve energy, and promote sustainability, but do not affect current and/or future protectiveness:

- EPA should continue to evaluate potential sewer gas pathways into buildings where Site contamination intersects with the sewer lines and preemptively mitigate them where possible.
- A review of the O&M performance from the various groundwater extraction and treatment systems during the review period showed significant periods of downtime for repairs or upgrades. All parties are required to provide notification to EPA within 24 hours of when the party or its representatives first know or should have known that any component of the groundwater remedy fails to operate for 72 hours or more. Additionally, parties must also provide written notification to EPA when the remedy has been restarted.

7. Protectiveness Statement

Table 10. Protectiveness Statement

Sitewide Protectiveness Statement	
<i>Protectiveness Determination:</i> Short-term Protective	<i>Planned Addendum Completion Date:</i> 9/30/2029
Protectiveness Statement: The groundwater and vapor intrusion remedy at the MEW Superfund Area is currently protective of human health and the environment because there is no direct exposure to contamination. Governmental controls are in place to prevent access to contaminated groundwater. The vapor intrusion control systems, monitoring program, and institutional controls are in place to minimize exposure risk from vapor intrusion. However, in order for the remedy to be protective in the long-term, alternative groundwater cleanup technologies should be selected to accelerate the reduction of the source of vapor intrusion in the Shallow Zone. Additionally, to ensure long-term protectiveness, sampling for PFAS (per- and polyfluoroalkyl substances) in groundwater to further assess potential risk is needed.	

8. Next Review

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

Appendix A: List of Documents Reviewed

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Appendix B: Summary Tables

Table B-1. Status of Inward and Upward Gradients within Slurry Walls.

MEW Facility-Specific Slurry Wall Location Area	Inward and upward gradient maintained?	Efforts to achieve inward and upward gradient? If not, what other work is being performed?
Raytheon 350 Ellis St	Not completely. Groundwater measurements collected in 2023 demonstrated an inward gradient in all but two well pairs along the northern slurry wall, and one each along the eastern and western slurry walls. Seven of the 11 A/B1 well pairs showed an upward gradient in March 2023 and eight of the A/B1 well pairs showed an upward gradient in September 2023. The four B1/B2 well pairs consistently show an upward vertical gradient.	Raytheon operates extraction wells installed in the A and B1 zones immediately downgradient of the slurry wall. These wells provide capture for the area downgradient of the slurry wall. No changes to extraction system to maintain inward or upward gradient are currently planned.
Fairchild/Schlumberger 369 and 441 N Whisman Road (Former Fairchild Buildings 13, 19 & 23)	Not completely. Horizontal gradients are inward along the southern and eastern slurry wall and outward on the northern slurry wall. The horizontal gradient along the western wall has been variable inward and outward between 2019 and 2023. Five well pairs are used to evaluate vertical gradient. Three well pairs showed generally upward gradients and two showed generally downward gradients.	Extraction wells within the slurry wall are operated at capacity to promote inward and upward gradients. Operation of wells is closely monitored, and a preventative maintenance program is in place to redevelop wells and/or replace pumps when well capacity decreases.
Fairchild/Schlumberger 515/545 N Whisman Road (Former Fairchild Buildings 1 through 4)	Not completely. Horizontal gradients are inward along the southern, eastern and western slurry wall (except for one occasion along the western slurry wall in 2019) and outward on the northern slurry wall. Four well pairs are used to evaluate vertical gradient. Two well pairs showed upward gradients and the two well pairs showed downward gradients.	Extraction wells within the slurry wall are operated at capacity to promote inward and upward gradients. Operation of wells is closely monitored, and a preventative maintenance program is in place to redevelop wells and/or replace pumps when well capacity decreases.
Fairchild/Schlumberger 401 National Avenue (Former Fairchild Building 9)	Inward and upward gradients have been historically maintained when source contrail recovery wells (SCRWs) are operating at former Fairchild Building 9. Since 2015, the SCRWs have been offline as part of an EPA-approved in situ chemical oxidation (ISCO) pilot study. During the past five years of the pilot study, horizontal gradients have been inward along the southern slurry wall, and outward along the eastern and northern slurry walls. Vertical gradients have been downward.	Additional information on the ongoing ISCO pilot study at the former Fairchild Building 9 is included in Table B-3.

Table B-2. Status of Facility-Specific and Regional Groundwater Treatment Systems.

Facility-Specific Groundwater Treatment System	Volume Treated (Million Gallons)	Mass Removed between 2019 and 2023 (lbs VOCs)	Cumulative Mass Removed (lbs VOCs)	Comments
Fairchild/Schlumberger				
Systems 1 and 2: (Former Bldgs 1 -4, 18)	0	0	41,900	Cumulative
System 19 (Former Bldgs 19, 13, and 23)	241	1,379	15,579	Groundwater elevations, graphical flow net analysis, capture zone width calculations, and VOC concentration trends provide converging lines of evidence that the extraction wells at the former Fairchild Buildings 19, 13, and 23 remediation areas are achieving adequate horizontal and vertical capture. TCE concentrations have been decreasing, stable, or have no significant statistical trend in most monitoring and extraction wells. In addition, VOC mass loading to the groundwater treatment system has been decreasing since startup.
Raytheon/RTX				
350 Ellis Street	61	1,579	20,419	Overall plume capture is adequate within the facility-specific source area. Trend analysis of monitoring wells indicate decreasing or not statistically significant TCE concentrations in all monitoring wells. Concentrations of VOCs in the groundwater continue to decrease.
Intel				
355/365 East Middlefield Road	Not applicable	Not applicable	364	As part of the enhanced in-situ bioremediation pilot treatability study test, the groundwater extraction and treatment system has been suspended since 2005. TCE concentrations in many A-zone wells have declined significantly since implementation of the Enhanced In Situ Bioremediation Pilot Test in 2005 or remained stable compared to historical ranges. The B1-zone monitoring wells show decreasing or stable TCE concentrations, and show decreasing or stable cis-1,2-DCE and vinyl chloride trends.
SMI Holding LLC				
455, 485/487, and 501/505 East Middlefield Road	165	1.5	106	The groundwater extraction system was shut down on June 18, 2019, with EPA approval to implement an alternative in-situ treatment method.

Facility-Specific Groundwater Treatment System	Volume Treated (Million Gallons)	Mass Removed between 2019 and 2023 (lbs VOCs)	Cumulative Mass Removed (lbs VOCs)	Comments
Renasas/NEC				
501 Ellis Street	10.5	8	63.6	Plume capture is occurring. Of the 20 wells at the Site, 14 exhibited decreasing TCE concentration trends, two exhibited increasing TCE concentration trends, and four did not demonstrate a TCE concentration trend at a 90% confidence level.
Vishay/SUMCO				
405/425 National Avenue	34	558	9,421	Multiple lines of evidence indicate that the hydraulic containment provided by on-property source control extraction wells met or exceeded the target capture zones when under normal system operations during the time period from 2019 to 2023. VOC concentrations in groundwater are stable or decreasing beneath the suspected source areas and throughout most of the plume extent.
MEW Regional				
South of U.S. Highway 101	348	3,291	17,291	Groundwater elevations, graphical flow net analysis, capture zone width calculations, vertical gradients, and VOC concentration trends provide converging lines of evidence that the MEW Regional Recovery Wells and the extraction wells at the former Fairchild Buildings 1 - 4, 9, and 18 remediation areas are achieving adequate horizontal and vertical capture of the regional plume. TCE concentrations have been decreasing, stable, or have no significant statistical trend in most monitoring and extraction wells. In addition, VOC mass loading to the groundwater treatment system has been decreasing since startup.
North of U.S. Highway 101	260	1,353	14,153	
NASA				
WATS	249	124.3	7,084	Groundwater extraction volumes and mass removal calculations prior to Q3 2016 are based on Navy documentation. Additional information can be obtained in the quarterly and annual NPDES Self-Monitoring Reports (Geotracker ID SL0608557397).
NASA Ames Regional Groundwater	5	1.4	87.3	Additional information can be obtained in the quarterly and annual NPES Self-Monitoring Reports (Geotracker ID TI0000006705).
Total	1,148	8,295	126,468	

Table B-3. Status of Facility-Specific Optimization/Pilot Tests/Treatability Studies.

Facility/Responsible Party	Proposed Optimization	Status of Work	Comments
Fairchild/Schlumberger			
369 and 441 N Whisman Road (Former Buildings 19, 13, and 23)	Optimize Pump and Treat	The scope of the pilot study for enhanced groundwater extraction included modifying groundwater extraction rates and evaluating resulting changes in VOC mass recovery. The pilot study concluded in 2021, and no further Building 19 site optimization activities are planned.	A Pilot Study Work Plan for Enhanced Groundwater Extraction was submitted to EPA in June 2015. Pilot study results are documented in the Annual Progress Reports for the Fairchild facility sites.
401 National Avenue (Former Building 9)	In Situ Chemical Oxidation (ISCO) / In-Situ Bioremediation (ISBR)	Schlumberger has been implementing an ISCO pilot treatability study test since 2013. To date, eight ISCO injection events have been completed.	Pilot study results are documented in the Annual Progress Reports for the Fairchild facility sites. A work plan for an ISBR injection followed by performance monitoring will be submitted in 2024.
515/545 N Whisman Road, 313 Fairchild Drive, 644 National Ave, 464 Ellis (Former Buildings 1 - 4, 18, 20)	No optimization currently planned		Based on remedy performance and progress toward achieving remedial action objectives.
Raytheon			
350 Ellis Street	Raytheon continues to optimize operations in extraction wells to maximize mass removal	Ongoing	---

Facility/Responsible Party	Proposed Optimization	Status of Work	Comments
Intel/Raytheon			
355/365 and 401 East Middlefield Road	In Situ Bioremediation Injections	Completed addition injections of emulsified soybean oil in 2020 to target two remaining areas with groundwater TCE concentrations greater than 100 µg/L. Based on 2022 performance monitoring, groundwater TCE concentrations now less than 100 µg/L throughout the facility.	Monitoring and evaluating the enhanced in-situ bioremediation pilot treatability study test.
SMI Holding LLC			
455, 485/487, and 501/505 East Middlefield Road	In-situ chemical reduction using sulfidated micron-sized zero valent iron (ZVI) pilot test	Sulfidated ZVI and micro-sized granular activated carbon (PlumeStop®) injections Completed July 2019.	Based on the post-injection monitoring results, additional injections were proposed in the northern portion of the properties near wells R-20A and C-3 in 2020.
	Additional sulfidated micron-sized ZVI injections	Completed in October and November 2020.	Post-injection monitoring results generally indicate decreasing concentration trends and shrinking of the areal extent of groundwater concentrations on the property.
	Sulfidated ZVI and micro-sized granular activated carbon (PlumeStop®) injections	Completed in October and November 2022	Combined remedial technologies of in-situ chemical reduction using sulfidated micron-sized ZVI and sorption using PlumeStop® Liquid Activated Carbon (PlumeStop®) to further reduce groundwater concentrations.

Facility/Responsible Party	Proposed Optimization	Status of Work	Comments
NEC/Renesas			
501 Ellis Street	Optimize Pump and Treat	Recommended optimizations have been implemented. No further optimization currently planned based on remedy performance and progress toward achieving remedial action objectives (RAOs).	
Vishay/SUMCO			
405/425 National Avenue	Optimize Pump and Treat	The groundwater treatment system technology may be modified to increase system uptime. Pumping modifications may be proposed based on ongoing modeling results.	A high-resolution sampling data collection program was conducted in 2016, and a report on the results was submitted to EPA in 2017. Additional work may be planned.
MEW Regional Groundwater Remediation Program			
South of U.S. Highway 101 – MEW Area	Well Network Optimization	MEW Regional Program is currently conducting a well network optimization effort and plans to share the results with EPA in 2024.	---
North of U.S. Highway 101 – Moffett Field Area	Passive Remedy Evaluation	A <i>Passive Remedy Evaluation Work Plan</i> submitted in 2024 consists of temporary shutoff of two recovery wells, groundwater monitoring at existing and proposed new monitoring wells in the vicinity of the recovery well, and analysis of monitoring data to evaluate plume stability and lines of evidence for biological degradation in the absence of active groundwater extraction.	EPA approved the work and installation of the new monitoring wells will be initiated in 2024.

Facility/Responsible Party	Proposed Optimization	Status of Work	Comments
NASA/Navy			
West-Side Aquifers Treatment System (WATS) – Site 28	Optimize Pump and Treat. Incorporation of Navy Traffic Island extraction wells.	On-going field work to optimize extraction rates. Review of 2021 Navy EAB/ISCR work and hydrogeologic impact of three recently installed Navy Traffic Island extraction wells, ongoing in 2024.	Chemical rebound has been observed following Navy's EAB/ISCR treatment at Traffic Island. Operations of the newly installed extraction wells have been intermittent, preventing a complete assessment of hydrogeologic impact and contribution to the remedy. Refer to NASA 2023 Annual Progress Report for further discussion.
NASA Ames			
Northern portion of Regional Plume area in A2/B1 Aquifer	No optimization proposed. Continue to monitor.	A2/B1-Aquifer wells W8-2 and W8-11 were added to NASA's RGRP biennial sampling schedule in 2015 to monitor leading edge of A2/B1-Aquifer plume.	Most VOCs in both wells have generally been below detection levels. VOCs that are consistently detected yield stable Mann-Kendall trends at levels below the MCL. Refer to Appendix J and Appendix K of NASA's 2023 Annual Progress Report.
Northern portion of Regional Plume area in A1 Aquifer	Identify leading edge	Voluntary fieldwork has been tentatively scheduled for 2024-2025 to further characterize the northern portion of Regional Plume area.	Fieldwork tentatively planned for 2024-2025 will include the following: CPT logging, Hydropunch groundwater sampling, groundwater monitoring, well Installation, groundwater sampling.
NASA Area of Responsibility (NASA Groundwater Treatment System [GWTS])	Optimize Pump and Treat MNA Evaluation	On-going field work to support groundwater extraction optimization. Draft MNA Evaluation Work Plan submitted. Field implementation on hold pending funding.	Fieldwork tentatively planned for 2024-2025 will include identifying leading edge of A1 Aquifer, groundwater sampling to evaluate geochemistry supporting MNA and microbial and stable isotope studies and identify potential vapor intrusion issues within study area.

Appendix C: ARARs Assessment

Section 121 (d)(2)(A) of Comprehensive Environmental Response, Compensation, and Liability Act specifies that Superfund remedial actions must meet any Federal standards, requirements, criteria, or limitations that are determined to be legally applicable or relevant and appropriate requirements (ARARs). ARARs are those standards, criteria, or limitations promulgated under Federal or State law that specifically address a hazardous substance, pollutant, contaminant, remedial action, location, or other circumstance at a Comprehensive Environmental Response, Compensation, and Liability Act site.

The 1989 Record of Decision identified chemical-specific ARARs for groundwater contamination and set Site groundwater and soil cleanup goals. With the 1990 Explanation of Significant Differences, EPA changed the cleanup goals to cleanup standards and clarified that the other chemical-specific ARARs also constitute cleanup standards; the April 1996 Explanation of Significant Differences did not impact chemical-specific ARARs. The 2010 Record of Decision Amendment adopted risk-based cleanup levels for indoor air.

Changes (if any) in ARARs are evaluated to determine if the changes affect the protectiveness of the remedy. Each ARAR and any change to the applicable standard or criterion are discussed below.

Chemical-specific ARARs identified in the 1989 Record of Decision, 1990 Explanation of Significant Differences, and 2010 Record of Decision Amendment for groundwater were evaluated (Table D-1).

There have been no changes to the chemical-specific ARARs since the previous 2019 Five-Year Review, and because groundwater in the MEW Study Area is not currently used for domestic purposes, any prior changes to chemical-specific ARARs would not affect the groundwater remedy's short-term protectiveness. The current MCLs for chloroform, 1,2-dichlorobenzene, 1,1-DCA, 1,2-DCE, PCE, antimony, cadmium, and arsenic are more stringent than the cleanup levels set in the Site decision documents. However, because concentrations of chloroform, 1,2-dichlorobenzene, PCE, antimony, cadmium, and arsenic are generally below current MCLs at the Site, these changes do not affect protectiveness. For 1,2-DCE, although the promulgated standards have changed from what was selected in ARARs and current concentrations of 1,2-DCE at the site exceed the current MCL, it is anticipated that 1,2-DCE concentrations will decrease to below the MCL before the remedy has achieved its cleanup level for TCE. Until the

cleanup levels are reached, institutional controls prevent direct exposure to groundwater contamination.

Table D-2 describes the action- and location-specific ARARs that have been promulgated or changed since the previous Five-Year Review. No ARARs changes affect the protectiveness of the remedy.

Federal and State laws and regulations other than the chemical-specific ARARs discussed in Table D-1 that have been promulgated or changed since the 1989 Record of Decision, 1990 Explanation of Significant Differences, and 2010 Record of Decision Amendment are described in Table D-2. There have been no revisions to laws or regulations that affect the protectiveness of the remedy.

The following action- or location-specific ARARs have not changed in the past five years, and therefore do not affect protectiveness:

- California Site Mitigation Decision Tree Manual
- California Resolution 68-16 “Antidegradation Policy”
- Section 1412 of the Safe Drinking Water Act, 42 USC Section 300g-I
- 22 CCR 64444
- Mountain View City Code, CH. 35, Article 3, Div. 3
- Federal Clean Water Act Pretreatment Standards: 40 CFR 403.5
- Bay Area Air Quality Management District Reg. 8 Rule 47
- Bay Area Air Quality Management District Reg. 8 Rule 40
- CCR Title 22, Div. 4.5, 66250-66265.1103

Table C-1. Summary of Groundwater Chemical-Specific ARAR Changes

Chemical	Previous 1989 ROD Cleanup Levels (µg/L)		Current 2024 Regulations (µg/L)		Notes
	CA MCL	EPA MCL	CA MCL	EPA MCL	
Chloroform	--	100	80 ¹	80 ¹	The State and Federal MCLs are now more stringent than the regulations selected at the time of the 1989 ROD.
1,2-Dichlorobenzene	--	--	600	600	State and Federal MCLs have now been established.
1,1-Dichloroethane (1,1-DCA)	--	--	5	--	A State MCL has been established.
1,1-Dichloroethene ² (1,1-DCE)	6	7	6	7	No changes.
1,2-Dichloroethene (1,2-DCE)	--	--	6	70	State and Federal MCLs have now been established.
Freon-113	--	--	--	--	No changes from the time of the 1989 ROD. (No MCL selected)
Phenol	--	--	--	--	No changes.
Tetrachloroethene (PCE)	--	--	5	5	State and Federal MCLs have now been established.
1,1,1-Trichloroethane	200	200	200	200	No changes.
Trichloroethene (TCE) ³	5	5	5	5	No changes.
Vinyl chloride	0.5	2	0.5	2	No changes.
Antimony	--	--	6	6	State and Federal MCLs have now been established.
Cadmium	10	10	5	5	The State and Federal MCLs are now more stringent than the regulations selected at the time of the 1989 ROD.
Arsenic	50	50	10	10	The State and Federal MCLs are now more stringent than the regulations selected at the time of the 1989 ROD.
Lead	50	50	--	--	The State and Federal MCLs have been removed, however, the Lead and Copper Rule selected 15 µg/L as an action level

¹ Chloroform is now regulated as part of total trihalomethanes (TTHMs). The Federal and state MCLs for TTHMs are 80 µg/L.

² DCE exists as *cis*- and *trans*- isomers. The more stringent MCL (*cis*- in this case) is used here.

³ The MCL is the cleanup level for the shallow aquifers (A and B1, B2, B3). The cleanup level for the C and deep aquifers is 0.8 µg/L, which is based on toxicity (excess lifetime cancer risk no greater than 1 x 10⁻⁶).

Table C-2. Summary of ARAR Changes for Site in the Past Five Years

Requirement and Citation	Document	Description	Effect on Protectiveness	Comments	Amendment Date
San Francisco Bay Basin Water Quality Control Plan (Basin Plan)	1989 ROD	The Basin Plan classifies shallow aquifers in the area as “potentially suitable for municipal or domestic water supply.” Standards in the Basin Plan are used by the Regional Water Quality Control Board to set NPDES effluent discharge limitations.	Changes do not affect protectiveness.	Amending the water quality control plan for SF Bay Basin to establish chlorine water Quality Objectives, replace the total residual chlorine technology-based effluent limitations with water quality-based effluent limitations.	Last updated November 25, 2020

Appendix D: Public Notice and Press Release

Public Notice published in the *Mountain View Voice* on February 9, 2024:

**EPA REVIEWING REMEDY for the
MIDDLEFIELD-ELLIS-WHISMAN
(MEW) SUPERFUND STUDY
AREA in MOUNTAIN VIEW, CA**

The U.S. Environmental Protection Agency (EPA) has started the review of the remedy — the plan to address contamination — for the Middlefield-Ellis-Whisman (MEW) Superfund Study Area (Mountain View, Calif.) This area is made up of three Superfund sites — Fairchild Semiconductor Corp. (Mountain View), Raytheon Company, and Intel Corp. (Mountain View). This review will show if the remedy is working as EPA intended. Federal law requires EPA to review its cleanup plans every five years if:

- a cleanup takes more than five years to complete; or
- hazardous waste is still on-site

What is included in the review?

- An inspection of the site and technologies used for the cleanup
- A review of site data and maintenance records
- A review of any new laws or requirements that could affect the cleanup

How can I learn more?

If you would like to learn more about the site, please contact:

- Alana Lee, Superfund Project Manager, 415-972-3141, lee.alana@epa.gov

Visit EPA's webpage at epa.gov/superfund/mew-study-area

EPA also set up an information repository with paper copies of the site's Administrative Record for you to view:

- EPA's Superfund Records Center, 75 Hawthorne Street, 4th Floor San Francisco, CA 94105 415-947-8717

EPA will complete the Five-Year Review report no later than September 30, 2024. When complete, EPA will post a copy on the webpage and send a copy to the information repository listed above.

CNSB #3780403

EPA to Review Effectiveness of Cleanups at 14 Privately-Owned California Superfund Sites in 2024

February 8, 2024

Contact Information

John Senn (senn.john@epa.gov)
415-972-3999

SAN FRANCISCO – The U.S. Environmental Protection Agency (EPA) will perform comprehensive five-year reviews this year of 14 National Priorities List Superfund privately-owned sites in California where cleanup remedies have been implemented. The sites will undergo a legally required review to ensure that previous remediation efforts continue to protect public health and the environment. Once the five-year reviews are complete, the findings will be posted to each Superfund site's web page.

"Reviewing the cleanup work that has occurred at these Superfund sites across California is critical to ensuring that public health and the environment are protected," said **EPA Pacific Southwest Superfund and Emergency Management Division Director Mike Montgomery**. "These reviews also serve as important ways to deliver information to the public about Superfund sites where pollution remains and additional work could be needed."

The California privately-owned Superfund sites where EPA will conduct five-year reviews in 2024 are:

- Advanced Micro Devices (Building 915) <<https://epa.gov/superfund/advancedmicrodevices915>> in Sunnyvale
- Fairchild Semiconductor Corporation South San Jose Plant <<https://epa.gov/superfund/fairchildsemiconductorsouth>>
- Industrial Waste Processing <<https://epa.gov/superfund/industrialwasteprocessing>> in Fresno
- Middlefield-Ellis-Whisman (MEW) Study Area <<https://epa.gov/superfund/mew-study-area>> in Mountain View, which comprises three Superfund sites: the Fairchild Semiconductor Corp.-Mountain View site, the Raytheon Company site, and the Intel Corp.-Mountain View site as well as portions of the Naval Air Station Moffett Field Superfund site.
- Palos Verdes Shelf portion of the Montrose Chemical Corp. site <<https://epa.gov/superfund/montrose>> in Torrance
- Teledyne <<https://epa.gov/superfund/teledyne>> and Spectra-Physics <<https://epa.gov/superfund/spectra-physics>> sites in Mountain View (joint cleanup and review)
- Triple Site <<https://epa.gov/superfund/triplesite>> in Sunnyvale, which comprises the following Superfund sites: the Advanced Micro Devices 901-902 Thompson Place site, the TRW Microwave site, and the Signetics site. The Signetics site is not part of the five-year review because it is not on the National Priorities List.
- Valley Wood Preserving, Inc. <<https://epa.gov/superfund/valleywood>> in Turlock
- Waste Disposal, Inc. <<https://epa.gov/superfund/wastedisposal>> in Santa Fe Springs

Background

Throughout the process of designing and constructing a cleanup at a hazardous waste site, EPA's primary goal is to make sure the remedy will be protective of public health and the environment. At many sites, where the remedy has been constructed, EPA continues to ensure it remains protective by requiring reviews of cleanups every five years. It is important for EPA to regularly check on these sites to ensure the remedy is working properly. These reviews identify issues (if any) that may affect the protectiveness of the constructed remedy and, if necessary, recommend action(s) necessary to address them.

There are many phases of the Superfund cleanup process including considering future use and redevelopment at sites and conducting post cleanup monitoring of sites. EPA must ensure the remedy is protective of public health and the environment and any redevelopment will uphold the protectiveness of the remedy into the future.

The Superfund program, a federal program established by Congress in 1980, investigates and cleans up the most complex, uncontrolled or abandoned hazardous waste sites in the country and endeavors to facilitate activities to return them to productive use. In total, there are 135 Superfund sites across the EPA's Pacific Southwest Region.

Learn more about Superfund and other cleanup sites in the Pacific Southwest <<https://epa.gov/aboutepa/epa-region-9-pacific-southwest>>.

Learn more about EPA's Superfund program <<https://epa.gov/superfund>>.

Learn more about EPA's Pacific Southwest Region <<https://epa.gov/pacific-southwest-media-center>>. Connect with us on Facebook <<https://www.facebook.com/eparegion9>> and on X <<https://twitter.com/eparegion9>>.

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Appendix E: Interview Responses

EPA Five-Year Review Interview Record				
Site:	Middlefield-Ellis-Whisman (MEW) Superfund Study Area: Mountain View and Moffett Field, California		EPA ID No:	CAD095989778 CAD009205097 CAD061620217
Date: 3/28/2024	Interview Questionnaire			
(Fill in the components below, one line per person if multiple persons are providing responses)				
Name	Organization	Title	Telephone	Email
Lindsay Hagan	City of Mountain View	Assistant Community Development Director	650-903-6306	Lindsay.Hagan@mountainview.gov
Ed Arango	City of Mountain View	Assistant Public Works Director	650-903-6311	Ed.Arango@mountainview.gov
Record responses to the Five-Year Review Questions below (2019-present)				
- What is your overall impression of the MEW Superfund Site area? - The Vapor Intrusion Record of Decision Amendment was signed in August 2010 and the Groundwater Record of Decision was signed in June 1989. Are the vapor intrusion and groundwater remedies functioning as expected? - How do you interact with the EPA Project Manager regarding questions or concerns related to the MEW Superfund Area? The City of Mountain View staff will reach out to the listed oversight agency point of contact on publicly-accessible online databases/websites for contaminated sites or contact the US EPA District staff directly regarding any private or public property or City right-of-way in the MEW Superfund Area. Contact occurs via phone or email. - Are there any concerns with the implementation of the vapor intrusion and groundwater remedies? - How well are the institutional controls component of the remedy performing? - Are the City's permitting procedures in place regarding new construction activities, including tenant improvements that may impact the vapor intrusion remedy? The City of Mountain View has standard procedures for coordinating the review of permits on properties and public right-of-way within the MEW Superfund Area with outside agencies, such as the US EPA, SFRWQCB, DTSC or other oversight government agencies. - Have there been any changes to property owners or issues with access regarding implementation of the vapor intrusion remedy within the MEW Superfund Site area in the last five years? - Are you aware of any events, incidents, or activities at the site such as vandalism, trespassing, or emergency responses from local authorities? If so, please give details. - Are you aware of any changes in Federal/State/County/Local laws and regulations that may impact the protectiveness of the remedy and human health and the environment? - Do you have any comments, suggestions, or recommendations regarding the Site's management or operation? - Do you have any comments, suggestions, or recommendations regarding the project?				
Thank You!				

EPA Five-Year Review Interview Record				
Site:	Middlefield-Ellis-Whisman (MEW) Superfund Area Mountain View and Moffett Field, California	EPA ID No:	CAD095989778 CAD009205097 CAD061620217 CA2170090078	
Interview Questionnaire				
Date: March 22, 2024				
Name	Organization	Title	Telephone	Email
Lenny Siegel	Center for Public Environmental Oversight (CPEO)	Executive Director	650-961-8918	LSiegel@cpeo.org
Please record responses to the Five-Year Review Questions below (2019-present)				
- How long have you been involved with the MEW Superfund Area (Site) cleanup and in what capacity? <i>42 years. Activist, elected official, manager of TAG grant</i> - Do you feel well informed about the MEW Superfund Site's activities and progress? <i>Yes</i> - What is your overall impression of the MEW Superfund Site? <i>Most exposures are under control but, the new remedies called in previous five-year reviews have not yet been proposed or evaluated.</i> <i>Both the influent and effluent from the groundwater treatment systems should be evaluated for PFAS, both targeted compounds and total organic fluorine, to determine whether the GWETS is spreading PFAS.</i> - What effects have the MEW Superfund site operations had on the surrounding community in the past five years? <i>It has complicated proposals to build housing over the plume, on Middlefield and at Moffett Field.</i> - Are you aware of any community concerns regarding the Site or its operation and administration of the vapor intrusion and groundwater remedies? Please provide details. <i>I hear from people who wonder if they should buy a home nearby.</i> What is your biggest concern? <i>There is no plan to reduce groundwater contamination to the point where vapor mitigation systems will not be needed.</i> - Do you feel federal/state/local government officials involved at the MEW Site are responsive to your concerns? <i>Yes.</i> - How do you interact with the EPA Project Manager or Community Involvement Coordinator regarding questions or concerns related to the MEW Superfund Area? <i>They are responsive to e-mails and phone calls.</i> - Are you aware of any events, incidents, or activities at the site such as vandalism, trespassing, or emergency responses from local authorities? If yes, please give details. <i>No</i> - Has EPA kept the community up-to-date on the MEW Site cleanup and progress? <i>No, but the 5-year review should help.</i> - Do you have any comments, suggestions, or recommendations regarding the MEW Superfund Site's management or operation? - Do you have any comments, suggestions, or recommendations regarding this project? <i>The building occupants exposed to or threatened by vapor intrusion should be made aware of the risks, as well as what is being done to address them.</i>				
Thank you!				

EPA Five-Year Review Interview Record				
Site:	Middlefield-Ellis-Whisman (MEW) Superfund Area Mountain View and Moffett Field, California	EPA ID No:	CAD095989778, CAD009205097, CAD061620217, CA2170090078	
Interview Questionnaire				
Date: 03/24/2024				
Name	Organization	Title	Telephone	Email
Greg Unangst				
Please record responses to the Five-Year Review Questions below (2019-present)				
1. How long have you been involved with the MEW Superfund Area (Site) cleanup and in what capacity? I have been involved for over 12 years as a member of the Moffett RAB which is just downstream from MEW. Some of the Responsible Parties from MEW have responsibilities at Moffett. What occurs or does not occur in MEW may have effects at Moffett, therefore I try to pay attention to MEW. 2. Do you feel well informed about the MEW Superfund Site's activities and progress? I get the technical reports which help in staying informed. Attending MEW meetings would be helpful but I;m not invited. 3. What is your overall impression of the MEW Superfund Site? Seems to be well managed. 4. What effects have the MEW Superfund site operations had on the surrounding community in the past five years? None that I am aware of. 5. Are you aware of any community concerns regarding the Site or its operation and administration of the vapor intrusion and groundwater remedies? Please provide details. What is your biggest concern? Undetected Vapor Intrusion 6. Do you feel federal/state/local government officials involved at the MEW Site are responsive to your concerns? Yes How can these interactions be improved? Hold periodic community updates 7. How do you interact with the EPA Project Manager or Community Involvement Coordinator regarding questions or concerns related to the MEW Superfund Area? By email when necessary 8. Are you aware of any events, incidents, or activities at the site such as vandalism, trespassing, or emergency responses from local authorities? If so, please give details. No 9. Has EPA kept the community up-to-date on the MEW Site cleanup and progress? I am not aware of any recent community updates. 10. Do you have any comments, suggestions, or recommendations regarding the MEW Superfund Site's management or operation? 11. Do you have any comments, suggestions, or recommendations regarding this project? Many members of the community are not aware of the presence of TCE and other pollutants. I am a firm believer of periodic updates to the community to accommodate turnover in the community				
Thank You!				

EPA Five-Year Review Interview Record				
Site:	Middlefield-Ellis-Whisman (MEW) Superfund Area Mountain View and Moffett Field, California	EPA ID No:	CAD095989778 CAD009205097 CAD061620217 CA2170090078	
Interview Questionnaire				
Date: April 2, 2024				
Name	Organization	Title	Telephone	Email
Eric Suchomel	Geosyntec Consultants	Senior Principal Engineer	(510) 285-2786	esuchomel@geosyntec.com
Please record responses to the Five-Year Review Questions below (2019-present)				
1. How long have you been involved with the MEW Superfund Area (Site) cleanup and in what capacity? <i>Geosyntec Consultants, Inc. (Geosyntec) has been retained by Schlumberger Technology Corporation (STC) to work on the MEW Fairchild Sites and Regional Groundwater Remediation Program (RGRP) since 2008. I have worked on the project for the entirety of that period. Geosyntec's role at MEW includes (1) remedial design and implementation of in-situ chemical oxidation (ISCO) and monitored natural attenuation (MNA) pilot studies; (2) optimization of existing groundwater extraction and treatment systems, engineering design and construction oversight of modifications to existing groundwater extractions systems and groundwater extraction infrastructure expansion, and engineering design and construction oversight of an upgrade program that consolidated operation of multiple treatment systems into a single plant; (3) scoping and implementation of soil vapor, sub-slab, and indoor air sampling programs to evaluate the vapor intrusion pathway and engineering design and construction oversight of active and passive vapor intrusion mitigation systems; and (4) working with other stakeholders to develop and implement a program-wide cleanup strategy for chlorinated volatile organic compounds (VOCs) in groundwater and to address associated vapor intrusion issues at the site.</i> 2. What is your overall impression of the project? <i>The project is going well. Progress toward the Remedial Action Objectives (RAOs) continued between 2019 and 2024.</i> 3. Is the groundwater and vapor intrusion remedy functioning as expected? <i>Groundwater: Yes, the MEW RGRP and Fairchild facility-specific groundwater remedies are performing as intended. The objectives of the remedy are to control and reduce concentrations of VOCs in groundwater. Groundwater elevations and gradients, graphical flow net analysis, capture zone width calculations, and VOC concentration trends provide converging lines of evidence that the Fairchild source control recovery wells (SCRWs) and RGRP regional recovery wells (RRWs) are achieving adequate horizontal and vertical capture of the VOC plume at MEW. In addition, VOC concentrations are decreasing over time, indicating the remedy is effectively removing VOC mass.</i> <i>Vapor Intrusion (VI): Yes. Where required within the MEW VI Study area, vapor intrusion remedies are functioning as expected. The extent of the MEW VI Study Area is based on the 5 micrograms per liter (µg/L) trichloroethene (TCE) isoconcentration contour in shallow groundwater and has decreased since issuance of the VI Record of Decision Amendment (VI ROD Amendment) in 2010 due to continued implementation of the groundwater remedy. As such, some properties are no longer within the VI Study Area. Further, many buildings where the potential for VI to impact indoor air quality is being controlled are not currently occupied.</i> 4. What does the monitoring data show? Are there any trends you believe show contaminant levels are decreasing or increasing? How well is the remedy performing?				

As documented in annual projects reports to the EPA, VOC concentrations in groundwater are well below historical maximums and generally show long-term decreasing trends with a few exceptions. TCE concentrations within the MEW plume have decreased significantly since remedy implementation and the perimeter extent of TCE concentrations has largely stabilized.

5. Is there a continuous operations, maintenance, and monitoring (OM&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.

The contractor responsible for OM&M is located within one mile of the site. Contractor staff routinely inspect and/or remotely monitor the groundwater and vapor intrusion remedies to verify operation. When needed, scheduled and unscheduled maintenance is performed promptly, and system downtime is minimal. When system or well downtime is expected to exceed 72 hours, EPA is promptly notified of the shutdown, planned response actions, and the anticipated schedule for resumption of operation.

6. Have there been any significant changes in the OM&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. The MEW Companies plan to optimize the groundwater sampling program during the next five-year review period (see Question 8).

7. Have there been unexpected OM&M difficulties at the Site in the last five years (e.g., parts replacement, unexpected treatment system or extraction well shutdown, vandalism, storm damage, unanticipated costs associated with O&M, etc.)? If so, please provide details.

None.

One RGRP extraction well, REG-9B(1) has per- and polyfluorinated alkyl substances (PFAS) present due to historical operations by NASA and the Navy at Moffett Field. The MEW Companies have asked NASA to assume responsibility for the well and have asked EPA permission to turn the well off temporarily pending NASA assuming responsibility for the well.

8. Have there been opportunities to optimize the remedy, OM&M, and/or sampling efforts? Please describe changes and desired results or improved efficiency and effectiveness.

Sampling:

During an October 2023 meeting, EPA suggested that a statistical spatial optimization of the monitoring network be conducted. Geosyntec is currently conducting this well network optimization effort and plans to share the results with EPA in 2024.

On September 18, 2023, Geosyntec submitted a letter to the EPA requesting the removal of metals from the groundwater sampling program since they are not detected at concentrations exceeding Maximum Contaminant Levels (MCLs).

Groundwater remedy:

On March 25, 2024, Geosyntec submitted a Passive Remedy Evaluation Work Plan. The work plan consists of temporary shutoff of two recovery wells, groundwater monitoring at existing and proposed new monitoring wells in the vicinity of the recovery wells, and analysis of monitoring data to evaluate plume stability and lines of evidence for biological degradation in the absence of active groundwater extraction.

EPA has requested that the MEW parties work to optimize performance of the groundwater remedy with respect to mass removal. Optimization performance with respect to mass removal is being evaluated at the Former Fairchild Building 9 site. Optimization began in 2013 and includes an ongoing in situ chemical oxidation (ISCO) pilot study within the site slurry wall boundary. Activities performed as part of the ISCO pilot study are summarized each year in the Annual Progress Report for the MEW Study Area. A work plan for a ninth round of injections will be submitted in 2024, utilizing sequential application of in-situ bioremediation as a post-ISCO mass removal polishing step.

9. Have there been any modifications to the remedy in the last five years? If so, please give details.

There have been no changes to the remedies prescribed in the MEW ROD and VI ROD Amendment (groundwater extraction and treatment and vapor intrusion tiering and mitigation, where required). Three extraction wells connected to the RGRP South of 101 Treatment System were relocated in 2021 as part of a property redevelopment. One air stripper at the RGRP North of 101 Treatment System was decommissioned and replaced with granular activated carbon in 2022.

10. Have there been any issues with implementation of the vapor intrusion remedy (including access and institutional controls) within the MEW/Navy/NASA Areas of Responsibility in the last five years?

Yes. The EPA did not approve a Site-Wide Tiering Work Plan until December 2022 which delayed implementation of the tiering-related activities. EPA has yet to approve the Site-Wide Long-Term Operations, Monitoring and Maintenance Plan or the Site-Wide Institutional Controls Implementation, Management, and Monitoring Plan, both of which were submitted to EPA on March 31, 2023. The MEW Companies have completed the tiering-related activities on the former Fairchild and RGRP properties. However, where already established, preparation and implementation of building-specific monitoring, maintenance, and institutional control requirements are on hold until EPA approves the Site-wide plans.

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

No.

12. Do you have any comments, suggestions, or recommendations regarding the project?

We recommend EPA review and approve the following documents as they are submitted to facilitate remedy implementation and optimization:

The Site-Wide Long-Term Operations, Monitoring and Maintenance Plan and the Site-Wide Institutional Controls Implementation, Management, and Monitoring Plan (submitted)

The Passive Remedy Evaluation Work Plan (submitted)

Recommendations for monitoring program optimization (forthcoming)

Request to turn off REG-9B(1) (submitted)

In addition, we recommend EPA allow temporary shutdown of active vapor intrusion control systems in currently unoccupied buildings. The systems would be restarted should the buildings be reoccupied.

Thank you!

EPA Five-Year Review Interview Record				
Site:	Middlefield-Ellis-Whisman (MEW) Superfund Area Mountain View and Moffett Field, California Former Intel Facility (355/365 E. Middlefield Road) and Intel/Raytheon			EPA ID No: CAD061620217
Facility:	Shared Lot 4 (401 E Middlefield Road)			
Interview Questionnaire				
Date: March 25, 2024				
Name	Organization	Title	Telephone	Email
Mary Stallard	Weiss Associates	Associate Hydrogeologist	510-220-6767	mls@weiss.com
Please record responses to the Five-Year Review Questions below (2019-present)				
1. How long have you been involved with the MEW Superfund Area (Site) cleanup and in what capacity? <i>30 years as Intel Program Manager.</i>				
2. What is your overall impression of the project? <i>The enhanced in situ bioremediation treatability study pilot test operates smoothly and continues to progress toward meeting the cleanup goals. During this review period (2019-2023), groundwater trichloroethene (TCE) concentrations throughout the facility were reduced to less than 100 micrograms per liter (µg/L).</i>				
3. Is the groundwater and vapor intrusion remedy functioning as expected? <i>The Record of Decision (ROD) remedy of groundwater extraction with above-ground treatment and discharge of the treated groundwater to surface water started operation at the facility prior to the ROD (in 1982) and continued through 2005, by which time it had limited effectiveness at this facility in terms of volatile organic compound (VOC) groundwater concentration reduction and mass removal. Therefore, other remedial technologies were evaluated and the most promising for this facility, enhanced in situ bioremediation, is being tested through a treatability study pilot test. As part of this test, groundwater extraction and treatment has been suspended since August 2005. Five rounds of enhanced in situ bioremediation injections were conducted prior to this review period, and a targeted sixth round was conducted during this period, in 2020.</i> <i>This groundwater remedy of enhanced in situ bioremediation is functioning as expected. The VOC plume sizes and concentrations are generally decreasing (see #4) and the plumes are contained.</i> <i>There is currently no engineered vapor intrusion remedy at the facility. Based on indoor air sampling results from 2013, no engineered vapor intrusion remedy is required for the existing commercial buildings at the facility (i.e., results were below the commercial cleanup levels without the HVAC systems operating). The facility buildings are all currently unoccupied. Mechanisms are in place such that the needs for a vapor intrusion remedy (including monitoring, institutional controls, and engineering controls) will be re-evaluated and the remedy implemented if the facility is redeveloped or reoccupied in the future.</i>				
4. What does the monitoring data show? Are there any trends you believe show contaminant levels are decreasing or increasing? How well is the remedy performing? <i>Concentration vs time plots for facility monitoring wells indicate groundwater contaminant levels have been stable or decreasing in most wells during this review period. Following additional in situ bioremediation</i>				

injections in 2020, all groundwater TCE concentrations are less than 100 µg/L based on the most recent (2022) monitoring event results. TCE concentrations in soil gas when last measured (2020) were consistently lower than those measured at the same locations in 2018. Based on these data, the remedy is performing well.

5. Is there a continuous operations, maintenance, and monitoring (OM&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.

Because the groundwater extraction and treatment system has been shut off since 2005, there is not a continuous OM&M presence at the facility. The dormant treatment system is inspected on a semi-annual basis and the dormant extraction wells are inspected at least once a year by the Weiss Field Operations team, which works out of Weiss's local office at 453 Ravendale Drive, Suite E, Mountain View, less than 1 mile from the facility.

6. Have there been any significant changes in the OM&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 OM&M requirements and maintenance schedules in the last five years. In 2020 and with EPA approval, 6 A-zone groundwater monitoring wells (2 of which were dormant extraction wells) and 2 B1-zone wells were properly destroyed under Valley Water permit and oversight. For the 2022 annual groundwater monitoring event, EPA approved a one-time removal of 12 additional monitoring wells from the sampling round, including 4 A-zone, 7 B1-zone, and 1 B2-zone wells. These monitoring wells were not needed to adequately monitor the groundwater plume; therefore, these changes do not affect the protectiveness of the remedy.

7. Have there been unexpected OM&M difficulties at the Site in the last five years (e.g., parts replacement, unexpected treatment system or extraction well shutdown, vandalism, storm damage, unanticipated costs associated with O&M, etc.)? If so, please provide details.

No.

8. Have there been opportunities to optimize the remedy, OM&M, and/or sampling efforts? Please describe changes and desired results or improved efficiency and effectiveness.

The enhanced in situ bioremediation treatability study pilot test was expanded in 2020 to inject emulsified soybean oil and dechlorinating bacteria in the only two locations where TCE remained in groundwater at concentrations exceeding 100 µg/L: the well M-18A area at 355/365 E Middlefield Road (Lot 3) and the well R-52A area at 401 E Middlefield Road (Lot 4). As described under #4 above, these injections have reduced groundwater TCE concentrations to less than 100 µg/L. Sampling efforts were optimized by eliminating unnecessary and/or redundant monitoring wells (as described under #6 above), resulting in improved efficiency of the monitoring program.

9. Have there been any modifications to the remedy in the last five years? If so, please give details.

No modifications have been made to the remedy in the last five years besides the additional in situ bioremediation injections described under #8 and the well destructions and monitoring reductions described under #6.

10. Have there been any issues with implementation of the vapor intrusion remedy (including access and institutional controls) within the MEW/Navy/NASA Areas of Responsibility in the last five years?

Not for this facility.

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

No.

12. Do you have any comments, suggestions, or recommendations regarding the project?

None at this time.

Thank you!

EPA Five-Year Review Interview Record				
Site:	Middlefield-Ellis-Whisman (MEW) Superfund Area Mountain View and Moffett Field, California			EPA ID
Facility:	Raytheon Company Superfund Site			No: CAD009205097
Date:	Interview Questionnaire			
Name	Organization	Title	Telephone	Email
Danny Samorano	Raytheon Company	Sr. Project Manager	(520) 471-3010	Daniel.S.Samorano@rtx.com
Elie Haddad	Haley & Aldrich, Inc.	Principal	(408) 961-4806	EHaddad@haleyaldrich.com
Patrick Keddington	Haley & Aldrich, Inc.	Program Manager	(619) 285-7107	pkeddington@haleyaldrich.com
Please record responses to the Five-Year Review Questions below (2019-present)				
1. How long have you been involved with the MEW Superfund Area (Site) cleanup and in what capacity? Danny Samorano became the Raytheon Company's point of contact for this project in January 2024. Elie Haddad and Patrick Keddington are consultants responsible for the OM&M of the GWET and SSD Systems at 350 Ellis Street and have been involved in the project since 1987 and 2021, respectively. 2. What is your overall impression of the project? The groundwater remedy maintains proper capture of the plume, continues to remove VOC mass from the groundwater and reduce groundwater concentrations. The vapor intrusion mitigation measures meet the design criteria and maintain indoor air COC concentrations below their respective commercial indoor air cleanup levels in EPA's 16 August 2010 "Record of Decision Amendment for the Vapor Intrusion Pathway, Middlefield-Ellis-Whisman (MEW) Superfund Study Area, Mountain View and Moffett Field, California." 3. Is the groundwater and vapor intrusion remedy functioning as expected? Horizontal gradients across most sides of the slurry wall were generally inward during the review period with some exceptions. However, these exceptions do not have a significant impact on remediation because: 1) Raytheon installed two recovery wells in the "A" and "B1" Zones immediately downgradient of the slurry wall, and the two wells provide a proper capture of the groundwater immediately downgradient of the wall, and 2) the slurry wall is a low-permeability wall that allows only minimal chemical migration across its walls even if the gradient is outward. That, combined with the fact that chemicals tend to take the easier pathway and migrate toward recovery wells within the wall enclosure, rather than across the low-permeability wall, would minimize outward chemical migration. Therefore, the slurry wall and the pumping activities within its enclosure physically contain chemicals. If a small flux of chemicals migrates through the slurry wall, it is captured immediately downgradient of the wall by the two Raytheon recovery wells. The SSD system maintains appropriate pressure differential at pressure monitoring points. Indoor air COC concentrations are below their respective ROD commercial indoor air cleanup levels. 4. What does the monitoring data show? Are there any trends you believe show contaminant levels are decreasing or increasing? How well is the remedy performing? Capture zone analysis during the review period indicates containment of the target capture areas. The plume is not expanding, and the capture is appropriate. Concentrations have decreased significantly since remedial measures began. Recent indoor air samples collected in 2022 during a property transaction process with the HVAC system on and off showed COC concentrations below the commercial indoor air cleanup level in EPA's 16 August 2010 "Record of Decision Amendment for the Vapor Intrusion Pathway, Middlefield-Ellis-Whisman (MEW) Superfund Study Area, Mountain View and Moffett Field, California." 5. Is there a continuous operations, maintenance, and monitoring (OM&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.				

There is no need for a continuous OM&M presence on site. Trained system operators visit the site as needed for OM&M of the groundwater extraction and treatment system (weekly), SSD system equipment (quarterly), SSD system moisture traps (as need based on notification from telemetry system), and air purification units (quarterly). Telemetry units continuously monitor the groundwater extraction and treatment system and the SSD system operations and issue alarms to system operators under certain conditions, including if the systems shut down.

6. Have there been any significant changes in the OM&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

7. Have there been unexpected OM&M difficulties at the Site in the last five years (e.g., parts replacement, unexpected treatment system or extraction well shutdown, vandalism, storm damage, unanticipated costs associated with O&M, etc.)? If so, please provide details.

There have been no significant unexpected OM&M difficulties or costs within the last five years.

8. Have there been opportunities to optimize the remedy, OM&M, and/or sampling efforts? Please describe changes and desired results or improved efficiency and effectiveness.

Raytheon continues to optimize operations in extraction wells to maximize mass removal.

9. Have there been any modifications to the remedy in the last five years? If so, please give details.

The Telemetry and instrumentation for the SSD system was upgraded in 2020 so all communications and alarms were routed through a single cellular device, rather than four separate cellular devices, to notify OM&M contractors of alarm conditions.

10. Have there been any issues with implementation of the vapor intrusion remedy (including access and institutional controls) within the MEW/Navy/NASA Areas of Responsibility in the last five years?

There have been no issues.

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

No.

12. Do you have any comments, suggestions, or recommendations regarding the project?

No.

Thank you!

EPA Five-Year Review Interview Record			
Site:	Middlefield-Ellis-Whisman (MEW) Superfund Area Mountain View and Moffett Field, California	EPA ID	CAD095989778
Facility:	Renasas/NEC – 501 Ellis Street	No:	CAD009205097 CAD061620217
Interview Questionnaire			
Date: March 21, 2024			
Name	Organization	Title	Telephone
John Jeter	Renasas Electronics America Inc	Director, Commercial Law	408-588-6185
Eric Suchomel	Geosyntec Consultants	Senior Principal	510-285-2786
Email			
John.jeter@renesas.com			
Eric.suchomel@geosyntec.com			
Please record responses to the Five-Year Review Questions below (2019-present)			
1. How long have you been involved with the MEW Superfund Area (Site) cleanup and in what capacity? <i>Renasas (formerly NEC) has been the responsible party for cleanup at 501 Ellis Street within the MEW Study Area since the 1990s. Geosyntec Consultants, Inc. (Geosyntec) has been retained by Renesas as their environmental contractor since the early 2000s and the current project team has been in place since 2006. Geosyntec's role at MEW for Renesas includes (1) compliance monitoring and reporting; (2) optimization of the existing groundwater extraction and treatment system; (3) scoping and implementation of sub-slab vapor and indoor air sampling programs to evaluate the vapor intrusion pathway; and (4) working with other stakeholders to develop and implement a program-wide cleanup strategy for chlorinated volatile organic compounds (VOCs) in groundwater and to address associated vapor intrusion issues at the site.</i> 2. What is your overall impression of the project? <i>The project is going well. Progress toward the Remedial Action Objectives (RAOs) continued between 2019 and 2024.</i> 3. Is the groundwater and vapor intrusion remedy functioning as expected? <i>Yes. The source control groundwater remediation (SCGWR) system is function as designed. Plume capture is occurring. Indoor air sampling has been conducted and a vapor intrusion control system is not required for the building at 501 Ellis Street.</i> 4. What does the monitoring data show? Are there any trends you believe show contaminant levels are decreasing or increasing? How well is the remedy performing? <i>The groundwater remedy is performing as designed. Of the 20 wells at the Site, 14 exhibited decreasing TCE concentration trends, two exhibited increasing TCE concentration trends, and four did not demonstrate a TCE concentration trend at a 90% confidence level. One of the two wells with an increasing trend, NEC-PZ-2A, is located near downgradient groundwater extraction wells NEC-27AE and NEC-28AE and the increasing statistical trend is likely related to capture of upgradient groundwater with higher TCE concentrations. At the other well with an increasing TCE trend, NEC-12A, the concentrations are within historical ranges and are below the MEW Study Area cleanup objective of 5 µg/L.</i> 5. Is there a continuous operations, maintenance, and monitoring (OM&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. <i>Yes, there is a continuous OM&M presence at the site. Locus Technologies is located within one mile of the site and implements the OM&M program. OM&M activities include (1) system status inspections every 72 hours to record flow meter readings and extraction flow rates; (2) monthly sampling at carbon drums to monitor breakthrough in the treatment media; and (3) quarterly effluent sampling in accordance with the 2018-2023 Waste Discharge Permit (WDR) for volatile organic compounds (VOC), methyl ter-butyl ether (MTBE), and total dissolved solids (TDS) that the groundwater treatment system operates under.</i> 6. Have there been any significant changes in the OM&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. <i>A pretreatment system consisting of four 55-gallon aqueous phase granular activated carbon (GAC) drums was</i>			

installed at the facility on March 25, 2021. The number of drums was subsequently reduced to two on March 22, 2022, based on an annual review of monthly analytical data and rates of drum degradation. Additionally, as of July 29, 2022, the primary drum is replaced every 3 months regardless of breakthrough status to ensure continuous operation. These changes have not impacted performance of the remedy.

7. Have there been unexpected OM&M difficulties at the Site in the last five years (e.g., parts replacement, unexpected treatment system or extraction well shutdown, vandalism, storm damage, unanticipated costs associated with O&M, etc.)? If so, please provide details.

No.

8. Have there been opportunities to optimize the remedy, OM&M, and/or sampling efforts? Please describe changes and desired results or improved efficiency and effectiveness.

Recommendations from the 2008 Optimization Evaluation have been implemented. The remedy is performing as designed and, based on progress toward achieving remedial action objectives, no further optimization is planned.

9. Have there been any modifications to the remedy in the last five years? If so, please give details.

Other than the addition of GAC treatment prior to discharge as described in Response #6, the remedy has not been modified.

10. Have there been any issues with implementation of the vapor intrusion remedy (including access and institutional controls) within the MEW/Navy/NASA Areas of Responsibility in the last five years?

Sampling to tier the building has been completed and suggest a Tier 3B designation is appropriate for the building. Consequently, vapor intrusion control measures are not required.

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

No.

12. Do you have any comments, suggestions, or recommendations regarding the project?

No.

Thank you!

EPA Five-Year Review Interview Record				
Site:	Middlefield-Ellis-Whisman (MEW) Superfund Area Mountain View and Moffett Field, California SMI Holding, LLC – 455 and 485/487 E. Middlefield Road			EPA ID No: CAD095989778 CAD009205097 CAD061620217
Facility:				
Date:	Interview Questionnaire			
Name	Organization	Title	Telephone	Email
Susan Gahry	ETIC (consultant for SMI Holding LLC)	Principal Engineer	415-314-6447	sgahry@eticeng.com
Please record responses to the Five-Year Review Questions below (2019-present)				
1. How long have you been involved with the MEW Superfund Area (Site) cleanup and in what capacity? 27 years as consulting engineer for SMI Holding, LLC. 2. What is your overall impression of the project? The project has a low likelihood of eventually coming to regulatory closure as the pump-and-treat technology being used to treat groundwater is generally considered to be ineffective and at best only suitable for migration control. 3. Is the groundwater and vapor intrusion remedy functioning as expected? The ROD-mandated groundwater remedy of pump-and-treat for the SMI Holding LLC property was removing very little mass and has been replaced, on a pilot test basis, with an alternative in-situ treatment approach which has a greater probability of reaching the groundwater cleanup goals of MCLs. A ROD Amendment is needed to allow for alternative groundwater treatment methods so that such treatment doesn't need to be considered a "pilot test"; this ROD Amendment is long overdue. Starting in 2002, multiple rounds of indoor air sampling have been completed, including the most recent requirement for two rounds of indoor air sampling in the cold weather months (between December and February only); the requirement for the amount and type of indoor air sampling are above and beyond those required at other sites that are overseen by California EPA. No indoor air issues of concern have been identified at this property. 4. What does the monitoring data show? Are there any trends you believe show contaminant levels are decreasing or increasing? How well is the remedy performing? Based on monitoring results, the in-situ treatments conducted in 2019, 2020, and 2022 have been very effective in removing TCE; during the last monitoring event completed in January 2024, TCE was not detected in groundwater on the property, with the exception of upgradient wells associated with migration of off-site TCE. The concentrations of cis-1,2-DCE and VC detected in groundwater are within the range of concentrations that existed prior to the in-situ treatments in July 2019. Additional monitoring is being completed in an attempt to demonstrate achievement of cleanup goal of MCLs to obtain a "no further action with respect to groundwater" letter from EPA. It is noted that other nearby properties that are overseen by California EPA have achieved regulatory closure based on a risk-based low-threat closure policy that has not yet been promulgated by federal EPA. 5. Is there a continuous operations, maintenance, and monitoring (OM&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. There is no continuous OM&M presence at the property, nor was there an on-property presence prior to the treatment system shut down in 2019. When the system operated, an auto-dialer provided notification on shut-down/alarm issues. As the alternative treatment method that was implemented at the property was done so on a "pilot test basis", the EPA has required that the treatment system remain in plan, albeit they have recently agreed that the activated carbon can be removed from the vessels. Periodic property visits are still completed to ensure the treatment compound does not become a nuisance to the property owner; during such visits, leaves from nearby trees are cleaned up and storm water that accumulates in the bermed treatment area is drained during the rainy season. 6. Have there been any significant changes in the OM&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. As previously advised, the treatment system was shut down in 2019 with EPA approval; this shut down does not affect the protectiveness of the remedy.				

7. Have there been unexpected OM&M difficulties at the Site in the last five years (e.g., parts replacement, unexpected treatment system or extraction well shutdown, vandalism, storm damage, unanticipated costs associated with O&M, etc.)? If so, please provide details. **No.**

8. Have there been opportunities to optimize the remedy, OM&M, and/or sampling efforts? Please describe changes and desired results or improved efficiency and effectiveness. **Yes, after the initial in-situ treatment in 2019 additional treatments were conducted in 2020 and 2022 to further reduce groundwater concentrations. The injections have been effective at reducing groundwater concentrations as noted in the groundwater monitoring result trends and areal extent of the plume at the property.**

9. Have there been any modifications to the remedy in the last five years? If so, please give details. **Yes. The groundwater extraction and treatment system was shut down in June 2019 and in-situ injections were completed in 2019, 2020, and 2022. In July 2019, extensive injections of sulfidated micron-sized zero valent iron (ZVI) (to facilitate abiotic degradation of TCE) was completed as a “pilot test”. Additional injections of sulfidated ZVI were conducted in the northern portion of the property near wells R-20A and C-3 in 2020. In October and November 2022, additional extensive sulfidated ZVI and micro-sized granular activated carbon (PlumeStop®) injections were conducted to further reduce concentrations in groundwater.**

10. Have there been any issues with implementation of the vapor intrusion remedy (including access and institutional controls) within the MEW/Navy/NASA Areas of Responsibility in the last five years? **No.**

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

12. Do you have any comments, suggestions, or recommendations regarding the project? **Yes. An amended ROD is needed to allow for the implementation of alternative in-situ treatment technologies without such being considered a “pilot test”. Recognition of the difficulty in meeting the cleanup goals of MCLs should also be formalized with consideration given to a risk-based low threat closure policy similar to that utilized by California EPA, Regional Water Quality Control Board, San Francisco Bay. More EPA resources should be devoted to amending the ROD for alternative treatment technologies and moving towards a risk-based closure policy. When alternative in-situ treatments are proposed and/or implemented, technology limitations associated with pre-existing microbes and/or non-homogenous subsurface soils should be recognized rather than criticism associated with potential limited short-term effects (i.e., intermittent spikes in TCE daughter product concentrations).**

Thank you!

EPA Five-Year Review Interview Record				
Site:	Middlefield-Ellis-Whisman (MEW) Superfund Area Mountain View and Moffett Field, California			EPA ID No:
Facility:	Vishay/SUMCO – 405/425 National Avenue			CAD095989778 CAD009205097 CAD061620217
Interview Questionnaire				
Date: 3/27/2024				
Name	Organization	Title	Telephone	Email
Luis Muñoz	Vishay Intertechnology	Senior Director – EHS The Americas & Global Remediation Coordinator	(610) 407-4897	Luis.Munoz@vishay.com
Guy Graening	GHD Services, Inc.	Project Engineer	(916) 245-4225	Guy.Graening@ghd.com
Please record responses to the Five-Year Review Questions below (2019-present)				
1. What is your overall impression of the project? The groundwater remedy is achieving contaminant mass removal. Multiple lines of evidence indicate that the extents of hydraulic containment provided by on-site and off-site groundwater extraction meet the target capture zones. It is expected that the groundwater extraction and treatment system (GETS) will continue to operate in conformance with the design parameters outlined in the final remedy and as required by its operating permits. 2. Is the groundwater and vapor intrusion remedy functioning as expected? How well is the remedy performing? The remedy is functioning as expected. Hydraulic containment is achieved by on-site and off-site groundwater extraction meeting the target capture zones. 3. What does the monitoring data show? Are there any trends you believe show contaminant levels are decreasing? Influent VOC concentrations have continued a downward trend since the addition of EX-116A to the GETS in 2016. Based on groundwater data collected in 2023, VOC concentrations in groundwater are stable or decreasing beneath the suspected source areas and throughout most of the plume extent. Stable or decreasing trends at downgradient monitoring wells (147A, 77B1, and 143B1) indicate effective remediation and hydraulic isolation of the upgradient source areas. 4. Is there a continuous operations, maintenance, and monitoring (OM&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. There is 24/7 remote monitoring of the GETS with an in-person weekly inspection and immediate troubleshooting and maintenance is completed as necessary. 5. Have there been any significant changes in the OM&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. OM&M requirements, maintenance schedules, and sampling routines have been consistent over the last five years. Maintenance of GETS parts that have been shown to be problematic or prone to failure have had their service intervals revised to decrease the probability of early failure. 6. Have there been unexpected OM&M difficulties at the Site in the last five years (e.g., parts replacement, unexpected treatment system or extraction well shutdown, vandalism, storm damage, unanticipated costs associated with O&M, etc.)? If so, please provide details.				

GETS runtime percentage was reduced to 93% in 2021, 86% in 2022, and 74% in 2023 mainly due to issues related to repairing the HiPOx® oxygen and ozone generator systems, including supply chain challenges in obtaining replacement parts. Groundwater depth-to-water and chemical analysis completed has not indicated a change in groundwater gradients nor an increase in contaminant concentrations.

7. Have there been opportunities to optimize the remedy, OM&M, and/or sampling efforts? Please describe changes and desired results or improved efficiency and effectiveness.

Individual extraction well flow is adjusted as necessary to maintain target flow rates which continue to achieve target capture zones and maintain upward groundwater flow gradients. Two internal capital improvement studies were completed to study the feasibility of changing the GETS treatment technology to improve system runtime.

8. Have there been any modifications to the remedy in the last five years? If so, please give details.

No modifications to the remedy were made over the last 5 years.

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

No. We expect the remedy to continue to be protective.

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

Two capital improvement reviews were completed to study the feasibility of changing the GETS treatment technology to improve system runtime. Results will be communicated to EPA when the feasibility study is completed.

Thank you!

EPA Five-Year Review Interview Record				
Site:	Middlefield-Ellis-Whisman (MEW) Superfund Area Mountain View and Moffett Field, California			EPA ID No:
Facility:	NASA Ames Research Center			
CAD095989778 CAD009205097 CAD061620217 CA2170090078 CA1800005034				
Interview Questionnaire				
Date: 3/29/2024				
Name	Organization	Title	Telephone	Email
Garrett Michael Turner	NASA	Restoration Program Manger	650-604-1406	garrett.michael.turner@nasa.gov
Lili Pirbazari	NASA	Vapor Intrusion Technical Manager	650-604-1767	lili.pirbazari-1@nasa.gov
Brian Reddig	BB&E	Restoration Group Manager	650-604-1315	brian.d.reddig@nasa.gov
Jeff Linder	ERT	WATS/Site 28 Subject Matter Expert	650-604-4294	jeffery.l.linder@nasa.gov
Ingrid Warburg	ERT	GWTS Subject Matter Expert	650-604-1129	ingrid.j.dittmar@nasa.gov
Please record responses to the Five-Year Review Questions below (2019-present)				
1. How long have you been involved with the MEW Superfund Area (Site) cleanup and in what capacity? Garrett Turner has been involved with the MEW Superfund Area since 1990 while working as a contractor for one of the MEW companies. In the early 1990s, he worked as an EPA contractor providing comments to Naval Air Station Moffett Field documents. He then worked as the contractor restoration program lead for NASA from 1995 through 2000. Garrett became the NASA Restoration Program Manager civil servant in 2018. NASA Ames has been involved with the MEW Superfund Area since the mid 1980s as a landowner who was impacted by the release of the chlorinated solvents onto its property. NASA Ames voluntarily installed a groundwater treatment system at the northern area of the MEW plume. NASA entered into a Settlement and Allocation Agreement with the MEW Companies in 1998. NASA entered into a Federal Facility Agreement with EPA and the Regional Water Board in 2014 that included MEW Superfund Area responsibilities. 2. What is your overall impression of the project? I believe that the MEW Superfund Area has been successful at minimizing the additional spread of chlorinated solvents outside of the initially defined plume area and has begun to reduce the toxicity of the heart of the plume. The selected groundwater remedy may never reduce the groundwater plume below the cleanup levels in the ROD and alternate risk-based approaches should be considered. 3. Is the groundwater and vapor intrusion remedy functioning as expected? The groundwater remedy is functioning as expected. From 2019-2023, WATS had an average runtime of 84% (94% in 2023) and the GWTS had an average runtime of 98% (97% in 2023), with the majority of downtime scheduled for routine maintenance activities. Hydrogeologic interpretation indicates that contaminated groundwater emanated from known and suspected source areas is being adequately captured (additional information is needed to assess the Traffic Island and Building 88 areas), while large portions of the regional plume are being hydraulically controlled. Vapor Intrusion (VI) Long-Term Monitoring sampling and reporting has continued annually throughout the last five years. All seven sampled buildings within NASA's VI AOR are classified as either Tier 3A or 3B; the tiering status of the buildings has remained consistent from the initial tier designation through the review period. Institutional Controls for VI at NASA are closely monitored and reported on in accordance with the Land Use Controls Implementation and Monitoring Plan.				

4. What does the monitoring data show? Are there any trends you believe show contaminant levels are decreasing or increasing? How well is the remedy performing?

Groundwater elevations, graphical flow net analysis, capture zone width calculations, vertical gradients, and VOC concentration trends provide converging lines of evidence that the NASA RGRP extraction wells are achieving adequate capture of the regional plume. Primary VOC concentrations have been decreasing or stable in most monitoring and extraction wells. In addition, VOC mass loading to the WATS and GWTS has been decreasing since startup. Mann-Kendall trend results for all 130 NASA RGRP sampling network wells for the four primary VOCs are provided in NASA's 2022 Annual Progress Report.

Data collected from the Traffic Island/Building 88 area indicate the post-treatment chemical rebound is occurring in several wells. In addition, large swings in concentrations in the dechlorination products of PCE have been observed throughout the Traffic Island Area, which is commonly observed after in-situ ISCR application. Additional monitoring is required to determine if concentrations ultimately begin declining trends.

5. Is there a continuous operations, maintenance, and monitoring (OM&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.

Routine inspection, maintenance, and NPDES sampling activities are carried-out by dedicated onsite staff in accordance with the respective treatment system O&M Manuals. BB&E, NASA's environmental services contract also has two O&M subcontractors available to respond to non-routine O&M issues. Both the WATS and GWTS allow for remote systems control and alarm notifications. Site groundwater gauging and sampling activities are performed by onsite staff, in conjunction with additional offsite subcontractor support, in accordance with the ROD. Results are evaluated and reported in each annual progress report to ensure the remedy is functioning as intended.

6. Have there been any significant changes in the OM&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.

In 2022, NASA obtained a NPDES Permit modification to address the addition of the Navy's Traffic Island/Building 88 groundwater pretreatment system which treats groundwater from newly installed Navy extraction wells EA1-7, EA2-4 and EA2-5. The Navy's pretreatment system passes partially treated groundwater to the WATS influent equalization tank for further treatment and polishing before discharge. The Navy is responsible for the O&M of the pretreatment system and associated wells.

No changes have been made to the groundwater sampling requirements. However, NASA voluntarily began retrofitting all down-hole sampling equipment prior to the 2023 sampling event with PFAS-free equipment and will complete the conversion to PFAS-free equipment prior to the 2024 sampling event. The technology, sampling routines, and protectiveness of the remedy remain unchanged.

In 2023, a second Black Thursday water-level gauging event was required by EPA to evaluate abnormal high precipitation levels encountered during 2022/2023.

7. Have there been unexpected OM&M difficulties at the Site in the last five years (e.g., parts replacement, unexpected treatment system or extraction well shutdown, vandalism, storm damage, unanticipated costs associated with O&M, etc.)? If so, please provide details.

In an on-going effort to rehabilitate the WATS since the transfer of operational responsibility from the Navy to NASA on October 1, 2016, numerous repairs to critical system infrastructure have been made to restore functionality of the treatment system.

The most significant O&M difficulty occurred at WATS in 2019. System piping replacement resulted in significant downtime that required system restart protocol to be followed in accordance with the NPDES Permit. An air compressor failure resulted in significant downtime, resulting in NASA installing an additional air compressor to

provide operational redundancy. An effluent exceedance caused by the placement of contaminated GAC by the vendor during a routine GAC replacement resulted in significant downtime that required system restart protocol to be followed in accordance with the NPDES Permit.

8. Have there been opportunities to optimize the remedy, OM&M, and/or sampling efforts? Please describe changes and desired results or improved efficiency and effectiveness.

WATS and GWTS groundwater extraction rates are continuously monitored and adjusted to maximize mass removal while maintaining hydraulic containment of the regional plume.

The Navy installed additional monitoring and extraction wells in the Traffic Island Area as part of their site investigation and remediation effort. Because the extraction wells and pretreatment system were operating intermittently during 2023, it is not possible to accurately assess the hydraulic control and capture provided by the recently-installed Traffic Island/Building 88 areas pump and treat system. It is uncertain if the Navy is attempting to optimize extraction rates and capture zones for the newly installed Traffic Island and Building 88 area extraction wells.

9. Have there been any modifications to the remedy in the last five years? If so, please give details.

After evaluating its performance and effectiveness, NASA terminated operations of the Orion Park air sparge/vapor extraction system on August 30, 2019. This system had been voluntarily installed by NASA to reduce the spread of VOCs onto NASA Ames from an unidentified offsite source that EPA has not assigned responsibility for the contamination. NASA continues to sample the former air sparge/vapor extraction area on an annual basis to assess post-system-shutdown changes and includes this data as part of the RGRP Annual Report.

The WATS AOP treatment components were upgraded with the latest HiPOx reactor technology in 2019, which still utilizes hydrogen peroxide and ozone for chemical treatment of influent contamination.

The Navy has performed site investigations, EAB/ISCR, and groundwater extraction/treatment work at the upgradient margin of the Site 28 area. Pretreated water from the Navy extraction wells in the Traffic Island and Building 88 areas enters the WATS influent stream for further treatment under a recently modified NPDES permit.

10. Have there been any issues with implementation of the vapor intrusion remedy (including access and institutional controls) within the MEW/Navy/NASA Areas of Responsibility in the last five years?

There have been no issues with implementation of the VI remedy within the NASA VI AOR.

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

None at this time. NASA is anticipating important changes to the upcoming NPDES permit which may impact protectiveness of the remedy and treatment system operations.

12. Do you have any comments, suggestions, or recommendations regarding the project?

Considering the project timeframe for Site cleanup, recommend revising the Site groundwater cleanup levels, while still being protective of the vapor intrusion remedy.

Thank you!

Appendix F: Site Inspection Summary and Photos

On February 8, 2024, EPA conducted a site visit to visually inspect the conditions and components of the remedy and the Site and the surrounding area.

The list of attendees and their affiliation are listed below:

Attendee	Agency/Company/Representing
Alana Lee	EPA Superfund Project Manager – MEW & Moffett Field
Izzat Amadea	U.S. Navy
Charles Crocker	Weiss for Schlumberger/Regional Program
Mike Gonsalves	Siemens Corp for SMI
Guy Graening	GHD for Vishay GSI
Dawn Greening	Schlumberger
Glen Falconio	Haley Aldrich for RTX/Raytheon
Ryan Haughy	ETIC for SMI
John Jeter	Renesas Electronics America
Patrick Keddington	Haley & Aldrich for RTX/Raytheon
Jeff Linder	BB&E for NASA Ames
Michael Ninokata	ERT/BB&E for NASA Ames
Adan Prado	USACE for EPA (Five-Year Review)
Brian Reddig	ERT/BB&E for NASA Ames
Claire Saylor	Geosyntec for Schlumberger / Regional Program
Kelly Sprague	Nixon Peabody for Vishay GSI
Mary Stallard	Weiss Associates for Intel
Eric Suchomel	Geosyntec for Schlumberger / Regional Program and Renesas Electronics America
Johnny Tomlin	GHD for Vishay GSI
Garrett Michael Turner	NASA Restoration Program Manager
Deborah Varty	ERT/BB&E for NASA Ames
Ingrid Warburg	ERT/BB&E for NASA Ames

SUMMARY of SITE INSPECTION VISIT

Middlefield-Ellis-Whisman (MEW) Superfund Area, Mountain View and Moffett Field, CA

EPA visited the MEW facility-specific areas and the MEW Regional Groundwater Treatment systems, NASA groundwater treatment system, Site 28 West-side Aquifers Treatment System (WATS), Navy

Traffic Island Area, and Buildings 3, 10, 45, and 126 within the Navy's Vapor Intrusion Area of Responsibility. No major issues or concerns were observed during the Site visit.

Renesas Electronics America – 501 Ellis Street. The site visit inspection began at the Renesas 501 Ellis Street facility. The groundwater treatment system was secured and operational and no evidence of vandalism. Location of the sewer discharge point was identified. Observed wells were in good condition and showed no signs of damage. The office building was partially occupied. The property is easily accessible.

Raytheon/RTX - 350 Ellis Street. The groundwater treatment system was operating, in good condition, and showed no signs of malfunctions or issues. The 350-380 Ellis Street buildings have been vacant since 2020. The vapor intrusion control treatment system was secured and operational. Two large generators were installed in the center of the parking lot behind the vacant building. There was no evidence of vandalism or breaches to any of the systems observed. Observed wells were in good condition and showed no signs of damage. The property is easily accessible.

SMI - 455 and 485/487 East Middlefield Road. The system is not currently operating since 2021 while the in-situ bioremediation pilot treatability study is ongoing. The groundwater treatment system was secured, and no evidence of vandalism were observed. The property is easily accessible and pedestrian traffic is moderate. 455 E Middlefield Rd building is occupied, and the 487 E Middlefield Rd building is unoccupied. Wells were in good condition and locked.

Intel - 355/365 and 401 East Middlefield Road. The groundwater treatment system is not currently operating since 2005 with EPA approval. The system was secured, and no evidence of vandalism or breaches were observed. Wells were in good condition and locked. The property is easily accessible and pedestrian traffic is low, due to the 355 and 401 E. Middlefield Road buildings being unoccupied since 2020.

Vishay/SUMCO/Schlumberger - 405/425 National Avenue. The groundwater treatment system was operating during the site visit. Notification to operations & maintenance (O&M) personnel was posted on reporting and notification procedures and clearly visible. Wells were in good condition and locked. The system was secured, and no signs of vandalism or breaches were observed. The property is easily accessible. The 425 National Ave office building is occupied, and the 620 National Ave office building has not been occupied since built in 2016.

MEW Regional Treatment System – South of 101 and Fairchild Treatment System 19. The systems were operating during the Site visit. The systems were in good condition and showed no signs of malfunctions or issues. The systems were secured, and no evidence of vandalism or breaches were observed. Nearby buildings in the Quad 369-399 N Whisman Road were vacant. Other buildings along N. Whisman Road and Fairchild Drive were also vacant.

Residential Vapor Intrusion Treatment Systems. Residential vapor intrusion treatment systems were operating and secured with emergency contact information. Pedestrian traffic is high in residential area. Wells observed on the residential properties were secure and locked.

MEW Regional Treatment System – North of 101. The system was operating during the Site visit. The system was secured, and no evidence of vandalism or breaches were observed. Pedestrian traffic is moderate. Adjacent buildings are occupied. Wells are in good condition and locked.

NASA Ames Regional Treatment System – NASA Ames. The system was operating during the Site visit. Access to the northern plume and NASA's vapor intrusion study area is restricted. The system was secured, and no evidence of vandalism or breaches were observed.

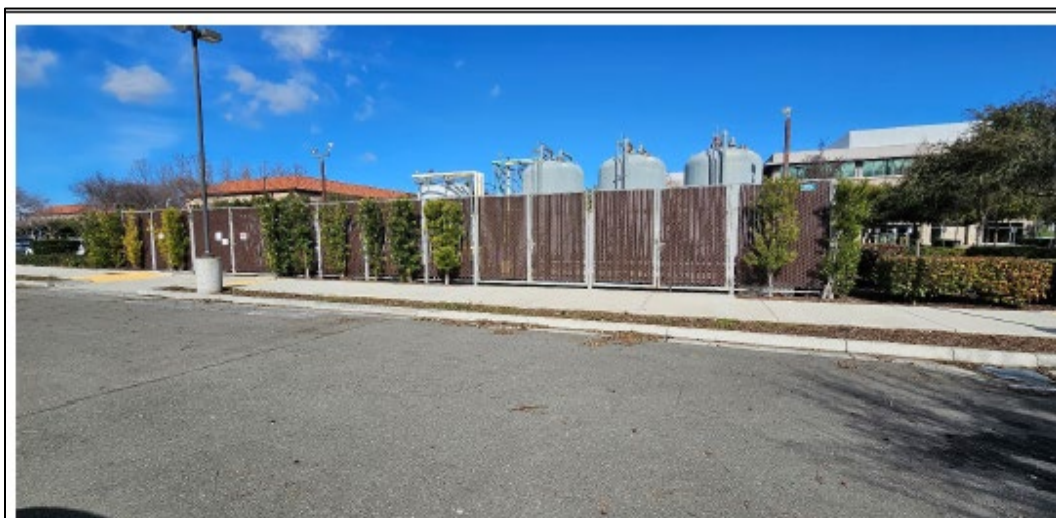
Site 28 WATS and Traffic Island Area, and Moffett Buildings 3, 10, 45, and 126.

WATS was operating during the Site visit. The system was secured, and no evidence of vandalism or breaches were observed. Nearby construction work is ongoing, including near the Traffic Island area where remedial actions are being implemented, including the operation of three new source control extraction wells in the A/A1 aquifer zone (EA1-7) and A2/B1 aquifer zone (EA2-4 and EA2-5).

Vapor intrusion control systems located in Buildings 3, 45, and 126 have been installed. In locations that are visibly and publicly accessible, signage should be displayed to prevent tampering. Air purifying units were operating in Building 10 with one placed in Building 3 to address elevated TCE levels until the vapor intrusion control systems are fully operational and post-remedial action indoor air testing confirms that the indoor air cleanup levels are met.



350 Ellis Street Groundwater Treatment System



MEW Regional - South of 101 Treatment System



501 Ellis Street groundwater treatment system



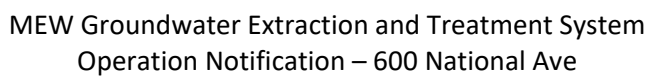
Vapor Intrusion treatment system – 350 Ellis St



Site 28 West-side Aquifers Treatment System (WATS) – exterior (locked and secured). Temporary pre-treatment also pictured.



Site 28 - Traffic Island – PCE/TCE source area



MEW Regional North of 101 Treatment System



Vapor intrusion control system in Moffett Building 126



Vapor intrusion control system in Moffett Building 145



Air treatment unit in Moffett Building 10



Phytoremediation treatability study – NASA Research Park – South - Moffett Field Area

