FOURTH FIVE-YEAR REVIEW REPORT FOR BOOMSNUB/AIRCO SUPERFUND SITE CLARK COUNTY, WASHINGTON

SEPTEMBER 2018

Prepared by

U.S. Environmental Protection Agency
Region 10
Seattle, Washington

for

Sheryl Bilbrey, Director
Office of Environmental Cleanup

9/13/2018

Date

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LIST OF ABBREVIATIONS & ACRONYMS

ARAR	Applicable or Relevant and Appropriate Requirement
CERCLA	Comprehensive Environmental Response, Compensation, and Liability Act
CFR	Code of Federal Regulations
COC	Contaminant of Concern
DCE	Dichloroethylene
EPA	United States Environmental Protection Agency
ESD	Explanation of Significant Differences
FYR	Five-Year Review
GAC	Granular Activated Carbon
HQ	Hazard Quotient
IC	Institutional Control
MCL	Maximum Contaminant Level
mg/kg	Milligram per Kilogram
MTCA	Model Toxic Control Act
NCP	National Contingency Plan
NPL	National Priorities List
O&M	Operation and Maintenance
OU	Operable Unit
PCE	Tetrachloroethylene
PFAS	Per- and Polyfluoroalkyl Substance
ppm	Parts per Million
PQL	Practical Quantitation Limit
PRP	Potentially Responsible Party
ROD	Record of Decision
RPM	Remedial Project Manager
TCE	Trichloroethylene
VOC	Volatile Organic Compound
WAC	Washington Administrative Code
µg/L	Microgram per Liter

I. INTRODUCTION

The purpose of a five-year review (FYR) is to evaluate the implementation and performance of a 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 FYR reports such as this one. In addition, FYR reports identify issues found during the review, if any, and document recommendations to address them.

The U.S. Environmental Protection Agency (EPA) is preparing this FYR pursuant to the Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA) Section 121, consistent with the National Contingency Plan (NCP) (40 Code of Federal Regulations (CFR) Section 300.430(f)(4)(ii)), and considering EPA policy.

This is the fourth FYR for the Boomsnub/Airco Superfund site (the Site). The triggering action for this statutory review is the completion date of the previous FYR. The FYR has been prepared because hazardous substances, pollutants or contaminants remain at the Site above levels that allow for unlimited use and unrestricted exposure (UU/UE).

The Site consists of three operable units (OUs); this FYR addresses all three OUs. OU1 addresses soil at the Boomsnub property. OU2 addresses soil and groundwater at the Airco (now Linde) property. OU3 addresses sitewide groundwater.

EPA remedial project manager (RPM) Jonathan Williams led the FYR. Participants included EPA hydrogeologists Bernie Zavala and Lee Thomas, EPA community involvement coordinator Jo Gallaher, and Hagai Nassau and Kelly MacDonald from EPA support contractor Skeo. The potentially responsible party (PRP) was notified of the initiation of the FYR. The review began on February 23, 2018.

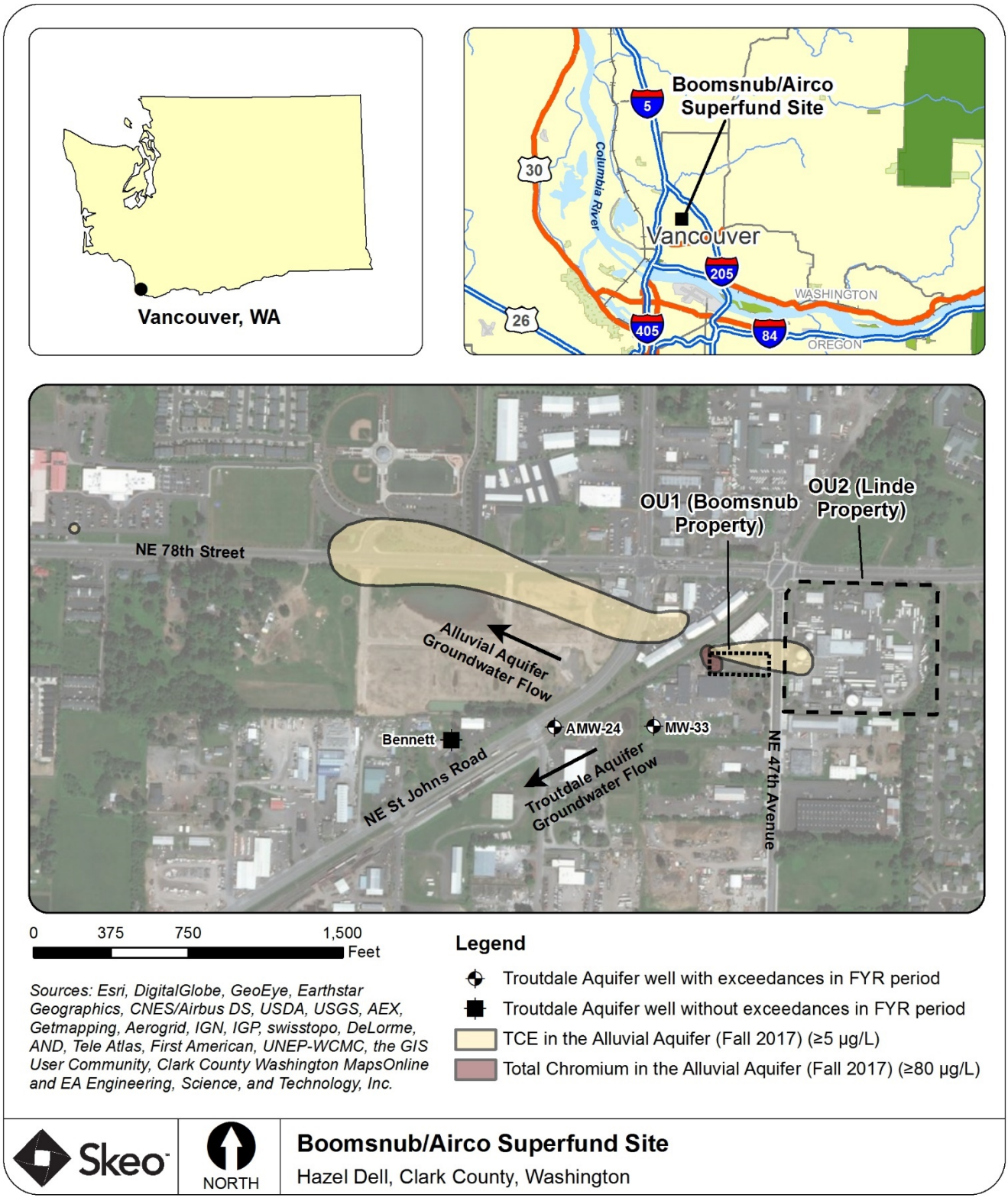
Site Background

The Site is located north of Vancouver in Hazel Dell, Washington (see Figure 1). The Boomsnub company operated a chrome-plating facility at the Site; the Boomsnub property now houses the Site's groundwater treatment system. The Linde facility, formerly known as BOC Gases and Airco, is an active gas production facility. Volatile organic compounds (VOCs) were discovered in 1991 at the Linde facility during response to releases of chromium at the Boomsnub facility. The Site includes a plume of groundwater contamination that emanates from the two facilities.

There are two principal hydrogeologic units of concern in the general area of the Site: the alluvial aquifer and the Troutdale aquifer, which are separated by an aquitard. Groundwater in the alluvial aquifer flows west-northwest. Groundwater in the Troutdale aquifer flows west-southwest. There are several private wells in the alluvial and Troutdale aquifers near the Site; however, groundwater is not used for potable purposes in the site area.

The Site's surroundings include commercial, light industrial, residential and recreational land uses. EPA expects that similar land uses will continue in the future; two properties above groundwater contamination are in the early stages of commercial development (see Section V Question B for more information). Refer to Appendix A for additional resources. Appendix B provides a chronology of events.

Figure 1: Site Vicinity Map[1]



Disclaimer: This map and any boundary lines within the map are approximate and subject to change. The map is not a survey. The map is for informational purposes only regarding EPA's response actions at the Site.

[1] There is no plume map for the Troutdale aquifer, so this map indicates which Troutdale wells have exceeded the TCE cleanup level during this FYR period.

FIVE-YEAR REVIEW SUMMARY FORM

SITE IDENTIFICATION		
Site Name: Boomsnub/Airco		
EPA ID: WAD009624453		
Region: 10	**State:** WA	**City/County:** Hazel Dell/Clark
SITE STATUS		
NPL Status: Final		
Multiple OUs? Yes	**Has the Site achieved construction completion?** No	
REVIEW STATUS		
Lead agency: EPA		
Author name: Jonathan Williams, with additional support provided by Skeo		
Author affiliation: EPA Region 10		
Review period: 2/23/2018 - 9/13/2018		
Date of site inspection: 4/5/2018		
Type of review: Statutory		
Review number: 4		
Triggering action date: 9/13/2013		
Due date *(five years after triggering action date)*: 9/13/2018		

II. RESPONSE ACTION SUMMARY

Basis for Taking Action

The Washington State Department of Ecology (Ecology) found chromium in soil and groundwater at the Boomsnub property in 1986. In 1991, Ecology detected VOCs in groundwater. Based on the concentrations and types of chemicals found in groundwater, Ecology suspected that the BOC Gases plant across the street was the source of the VOC contamination. BOC began investigating the nature and extent of VOCs in 1991. In June 1994, EPA assumed the role of lead agency. EPA listed the Site on the National Priorities List (NPL) in April 1995.

Site investigations found that chromium and VOCs in groundwater, emanating from two separate release points, extended about 4,400 feet downgradient in a west-northwest direction. The Site's groundwater contamination threatened public drinking water supply wells downgradient of the Site. The Site's soil contamination served as a source of ongoing groundwater contamination and posed a potential risk to future residents and workers at the Boomsnub property. Table 1 lists the Site's contaminants of concern (COCs). EPA's 2000 ROD stated that OU1 and OU3 did not pose significant ecological risk. The PRP's 1998 Site Evaluation for OU2 found that there was no excess ecological risk because there were no completed exposure pathways at OU2.

Table 1: COCs, by Medium

COC	Medium
Chromium Lead	OU1 Soil
Chromium Bromodichloromethane Carbon tetrachloride 1,2-Dibromo-3-chloropropane Dibromochloromethane 1,2-Dichloromethane 1,1-Dichloroethylene (1,1-DCE) Hexachlorobutadiene Tetrachloroethylene (PCE) 1,1,1-Trichloroethane Trichloroethylene (TCE)	Groundwater

Response Actions

In May 1990, Ecology issued an enforcement order requiring monitoring, groundwater studies, and extraction and treatment of groundwater. Boomsnub installed the groundwater extraction and treatment system in 1990. Ecology assumed responsibility for operating the extraction system in August 1990. Contaminated groundwater has been extracted and treated since 1990. The original system consisted of a single extraction well on the Boomsnub property. Since then, the system has been modified, upgraded and expanded several times to address both VOCs and chromium, to increase pumping and treatment capacity, and to increase contaminant-removal efficiency.

In 1994, EPA conducted a removal action at the Boomsnub property (OU1). EPA removed 400 drums of waste, demolished and removed site buildings and plating tanks, removed more than 6,000 tons of chromium-contaminated soil, and disposed of the soil off site. The soil excavation area was 70 feet in diameter by 28 feet deep (the depth where the water table was encountered). This action removed most of the contaminated soil from OU1; however, post-removal sampling indicated that some chromium-contaminated soil remained above the water table.

EPA issued an interim action Record of Decision (ROD) in 1997 to allow continued operation of the groundwater extraction and treatment system. In 2000, EPA issued the final ROD for OU1 and OU3. EPA issued an Explanation of Significant Differences (ESD) in 2006 to address changes to the extraction and treatment system (OU3) and to call for enhanced institutional controls (for all OUs). EPA issued another ESD in 2015 for OU3, which added in situ treatment as a remedy for groundwater and soil to supplement the groundwater extraction and treatment system, where needed to accelerate or improve remediation.

Instead of issuing a ROD for OU2, EPA issued an Action Memorandum in September 2001 calling for a removal action at OU2 to address VOC sources, treat contaminated groundwater on the property, and halt migration off-property. EPA and Linde signed a Consent Decree in 2007 in which Linde agreed to implement the remainder of response actions until VOCs meet cleanup levels.

EPA identified the following remedial action objectives for the Site:

Boomsnub Property (OU1; 2000 ROD and 2006 ESD)

- Prevent hexavalent chromium in soil from serving as an uncontrolled, ongoing source of contamination to the downgradient groundwater plume.
- Prevent future workers from being exposed to lead and chromium in soils at levels above industrial cleanup standards.
- Prevent future residential use of the Boomsnub property through deed restrictions precluding future residential uses of the property.

Linde Property (OU2; 2001 Action Memorandum)

- Remove VOCs from the vadose zone that may be acting as the source to groundwater.
- Remove VOCs from the groundwater on the western portion of the Linde property.
- Halt off-property migration of VOCs in groundwater.

Sitewide Groundwater (OU3; 2000 ROD)

- Prevent further impacts to the alluvial aquifer.
- Restore impacted groundwater to drinking water standards (Maximum Contaminant Levels [MCLs] or Model Toxic Control Act [MTCA] B standards).
- Prevent ingestion of contaminated groundwater above federal and state drinking water standards.
- Prevent impacts to the Upper Troutdale aquifer and the public drinking water supply by reducing contamination in the alluvial aquifer.

The selected remedy for the Boomsnub property (OU1) is institutional controls and removal of most contaminated soils that were considered accessible and a source for groundwater contamination. As identified in the 2000 ROD, the selected OU1 remedy comprises:

- Excavating soils with total chromium concentrations above 400 milligrams per kilogram (mg/kg) to a maximum depth of 15 feet.
- Treating hexavalent chromium in soils at a concentration greater than 8 mg/kg and less than 400 mg/kg by allowing infiltration of hexavalent chromium to groundwater for treatment by the selected groundwater remedy.
- Excavating soils with lead concentrations above 1,000 mg/kg.
- Placing deed restrictions on the Boomsnub property to maintain industrial land use of the property and to prevent soil below 15 feet from being disturbed.
- Controlling access to the Boomsnub property.
- Conducting long-term groundwater monitoring to demonstrate that cleanup standards for hexavalent chromium have been achieved.

Table 2 presents the soil cleanup levels for OU1.

As identified in the 2001 Action Memorandum, the cleanup actions selected for OU2 were in-well stripping and soil vapor extraction. In-well stripping is an in situ treatment process in which air-lift pumping is used to move groundwater through a vertical circulation well. Air is injected into the well to strip VOCs that are dissolved in the groundwater. Soil vapor extraction is an in situ soil treatment process in which a vacuum is applied to a well screened above the groundwater table to remove air from the soil pore space. Along with the air, VOCs are extracted and treated using granular activated carbon (GAC).

The selected remedy for sitewide groundwater (OU3) is continued groundwater extraction and treatment until groundwater cleanup levels are achieved throughout the groundwater plume. As identified in the 1997 and 2000 RODs and the 2006 and 2015 ESDs, the selected OU3 remedy comprises:

- Increasing capacity of the groundwater treatment system by upgrading the ion-exchange and air stripper and by increasing capacity of the conveyance pipe and discharge pipe.
- Improving the treatment building and other facility structures.
- Continuing extraction from existing wells and add new wells as needed to optimize removal and treatment.
- Conducting long-term groundwater monitoring.
- Providing institutional controls in the form of public notice during operation of the groundwater pump-and-treat system, accomplished by providing affected property owners a copy of groundwater sampling data for their property for all contaminants exceeding cleanup standards.

- Discharging treated groundwater to the infiltration gallery on the Linde property or to the city of Vancouver publicly owned treatment works.
- Disposing of waste from ion-exchange resin at an appropriate Resource Conservation and Recovery Act Subtitle D or C landfill. Send spent GAC off site for treatment/regeneration.
- Implementing institutional controls to protect the remedy constructed at the Site by obtaining easements from property owners whose properties are affected by the remedy.
- Augmenting groundwater extraction/treatment system with in-situ treatment to address recalcitrant TCE contamination in order to accelerate groundwater quality restoration.

Table 3 presents the Site's groundwater cleanup levels.

Table 2: OU1 Soil COC Cleanup Levels

Soil COC	2000 ROD Cleanup Level (mg/kg)	Basis
Chromium (total)	400	Site-specific remediation level[a]
Chromium VI (hexavalent)	8	MTCA 100x groundwater standard[b]
	17,500	MTCA C Industrial
Chromium III	1,600	MTCA 100x groundwater standard[b]
Lead	1,000	MTCA A Industrial[c]

Notes:
mg/kg – milligram per kilogram
a) The site-specific remediation level will be demonstrated to be effective at achieving the Model Toxic Control Act (MTCA) groundwater cleanup standard (80 µg/L) for hexavalent chromium at nearby monitoring wells. Hexavalent chromium remaining in soil between 400 mg/kg and 8 mg/kg will be allowed to infiltrate to groundwater for ex-situ groundwater treatment.
b) The soil cleanup level represents 100 times the MTCA groundwater cleanup level reported in the Ecology Cleanup Levels and Risk Calculations II database dated 2/28/96.
c) The 2000 ROD selected the MTCA Method A Industrial value for lead because there is no Method C Industrial value for lead.

Table 3: Sitewide Groundwater COC Cleanup Levels

Groundwater COC	2000 ROD Cleanup Level (µg/L)	Basis
Chromium VI (hexavalent)	80	MTCA B
Chromium (total)	100	MCL
Bromodichloromethane	1[a]	MTCA B
Carbon tetrachloride	1[a]	MTCA B
1,2-Dibromo-3-chloropropane	0.2	MCL
Dibromochloromethane	1[a]	MTCA B
1,2-Dichloroethane	5	MCL
1,1-DCE	1[a]	MTCA B
Hexachlorobutadiene	5[a]	MTCA B
PCE	5	MCL
1,1,1-Trichloroethane	200	MCL
TCE	5	MCL

Notes:
µg/L – microgram per liter
a) This cleanup level was set at the practical quantitation limit (PQL). The 2000 ROD established cleanup levels as the higher of the regulatory level or the PQL.

Status of Implementation

OU1 (Boomsnub Property)

The 1994 OU1 removal action is described under Response Actions above. In 2001, about 2,500 cubic yards of chromium-contaminated soil were excavated from OU1 and disposed of off site. During the excavation, EPA discovered that chromium-contaminated soil at concentrations above ROD cleanup levels extended under the groundwater extraction and treatment system. The soil was not removed due to its location and was further characterized in 2003. EPA determined that any contaminants that may leach into the groundwater from this soil would have minimal impact because of the relatively small quantity of contaminated soil. As described in the 2018 Closure Plan, this layer of soil will be excavated upon completion of the remedial actions for groundwater and removal of the groundwater treatment system.

A fence was installed to control access to the Boomsnub property. Long-term groundwater monitoring is underway to monitor progress toward achieving the cleanup standards for hexavalent chromium.

OU2 (Linde Property)

In September 2003, Linde began construction of the non-time critical removal action at their facility to address the VOC source area (OU2). The in-well stripping and soil vapor extraction systems became operational in February 2004. The soil vapor extraction system treated vadose zone soil in OU2. The soil vapor extraction system was shut down in 2008 after rebound testing and EPA approval. The in-well stripping system was operated to treat OU2 groundwater until it was turned off with EPA approval in August 2013. The systems successfully reduced TCE mass in groundwater and soil vapor by more than 97 percent before asymptotic removal rates were reached and the systems were shut off; however, groundwater concentrations of COCs remain above the cleanup levels.

OU3 (Sitewide Groundwater)

A groundwater extraction network is used to capture contaminated groundwater and pump it to a central treatment facility on the Boomsnub property. The system was originally constructed and operated by Boomsnub in 1990; it has been expanded and upgraded several times by Ecology, EPA and BOC/Linde. The groundwater extraction and treatment system has the following components:

- An extraction system, which at the maximum extent consisted of 24 extraction wells pumping about 160 gallons per minute of groundwater through about 10,000 feet of double-walled force main to a central treatment system on the Boomsnub property. Currently, 11 extraction wells are in operation, pumping about 125 gallons per minute of groundwater.
- A central treatment system used to treat the extracted groundwater. Chromium is removed using an ion exchange system; VOCs are removed using air stripping with GAC treatment of the off-gas.
- An infiltration gallery on the Linde property, which is used for treated water disposal; the water is discharged via a force main from the treatment system to the infiltration gallery.

In 2006, an in-situ treatment pilot test treated an area of recalcitrant chromium and VOC contamination west of the Church of God, in the area of wells MW-41 and AMW-63. The localized area of contamination appeared to result from continued desorption of TCE and chromium from lower permeability material at the bottom of the alluvial aquifer. These areas of lower permeability are not as effectively treated by groundwater extraction, thus a study was conducted to evaluate the potential use of in situ treatment by reductive dechlorination for areas of residual contamination within the groundwater plume. This effort is referred to as the Toe-of-Plume Pilot Study and included the injection of EHC-M™, a combination of controlled-release carbon and zero valent iron particles that stimulates reductive dechlorination of TCE and chemical reduction/precipitation of chromium. Chromium and TCE concentrations in the pilot study monitoring wells have remained below the cleanup level since that time, indicating the treatment was and remains effective.

The 2000 ROD stated that EPA would “re-evaluate available literature on permeable reactive barrier technology every five years to see if it has proven to be a reliable long-term technology.” EPA considers the in-situ treatment

that has been conducted (and may be conducted in the future) at the Site to be a form of permeable reactive barrier technology. EPA is not considering use of other forms of permeable reactive barriers at the Site.

In 2008, an investigation identified another plume of VOC contamination in groundwater north of the OU3 plume, in the area around well AMW-18. This plume is referred to as the Northern Plume. The Boomsnub/Airco Site does not appear to be the source of the Northern Plume. In May 2011, EPA and Linde performed a joint investigation of the Northern Plume area to get a better understanding of the source, extent and concentrations of VOCs in the plume. A new monitoring well (AMW-64) was installed in February 2012, at the request of EPA, to monitor the Northern Plume northwest of well AMW-18. Figure C-9 in Appendix C presents TCE concentrations in Northern Plume wells during 1995 to 2017. The Northern Plume appears to have merged with the OU3 plume along a portion of the northern OU3 boundary; specifically, in the well MW-38 area. To date, TCE concentrations in site extraction wells have not noticeably increased, indicating that the Northern Plume does not appear to be impacting these wells yet. Migration of the Northern Plume and potential impacts on site remediation are being closely monitored.

Institutional Control (IC) Review

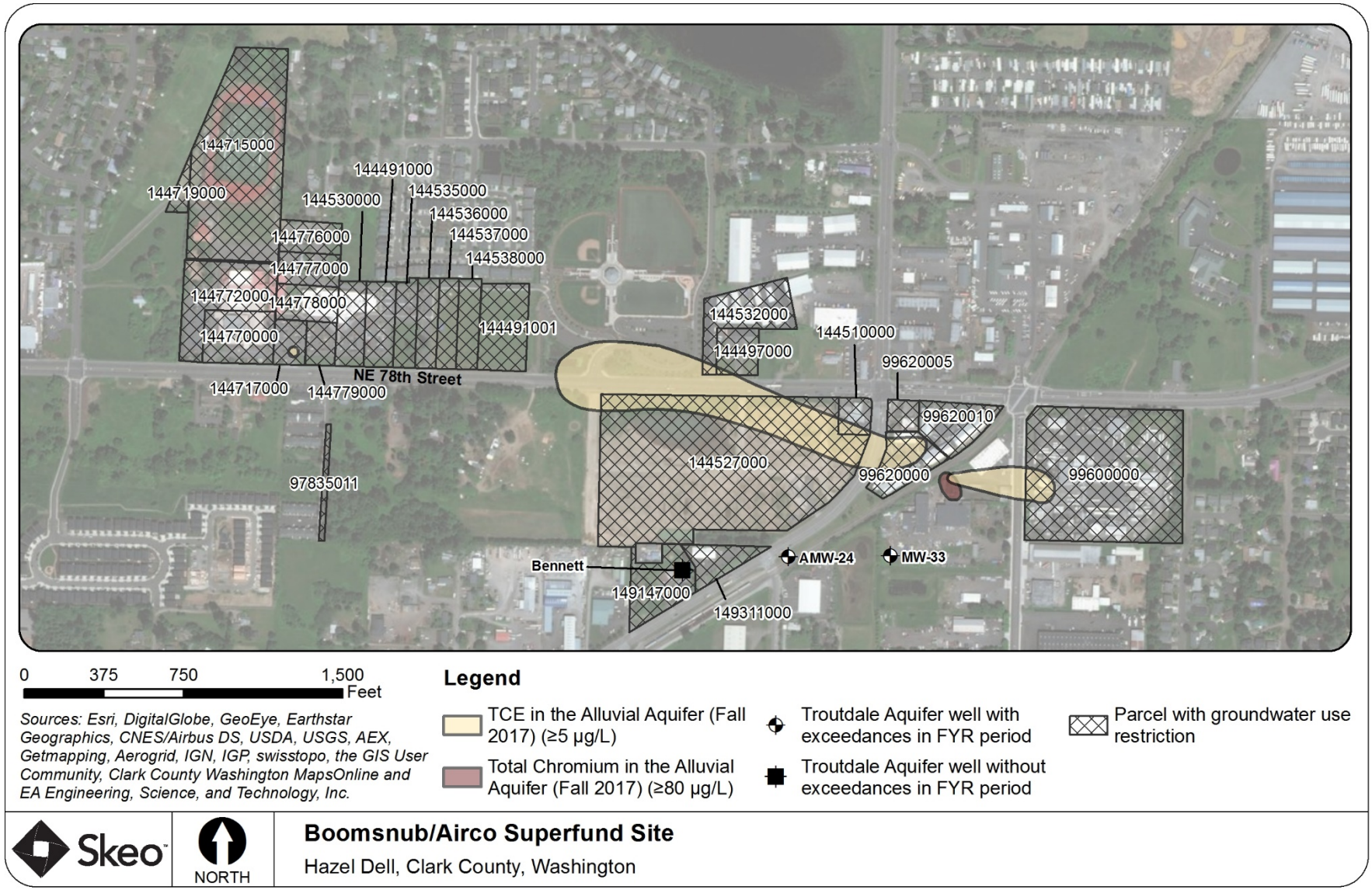
Table 4 summarizes the status of institutional controls at the Site.

The Washington Administrative Code states that water wells shall not be located within certain minimum distances of known or potential sources of contamination (WAC 173-160-171). As part of this FYR, EPA searched the Washington State Well Report Viewer website to determine if there have been any drinking water wells installed near the Site. Based on that data, there have been no drinking water wells installed in the last five years in areas near the Site's groundwater contamination. Based on communication with John Roth of Clark Public Utilities (the local water provider), all properties within a mile of the Site have access to public water, either from Clark Public Utilities or from the city of Vancouver.

Table 4: Summary of Institutional Controls (ICs)

Media, Engineered Controls, and Areas That Do Not Support UU/UE Based on Current Conditions	ICs Needed	ICs Called for in the Decision Documents	Impacted Parcels	IC Objective	Title of IC Instrument Implemented and Date
Groundwater	Yes	Yes	Parcels overlying current area of groundwater contamination in alluvial and/or Troutdale aquifers (see Figure 2)	Prohibit installing groundwater wells and using groundwater for potable purposes for as long as cleanup is being performed	Series of "Easement Agreements and Restrictive Covenants Regarding Environmental Remediation" recorded with Clark County Auditor for parcels identified on Figure 2. Groundwater use restrictions still need to be implemented for some parcels (see Figure 2).
				Prevent installation of wells in areas with groundwater contamination	Washington Administrative Code (WAC) states that water wells shall not be located near known or potential sources of contamination (WAC 173-160-171).
				Notify property owners about existence of groundwater contamination on their property	PRP contractor provides affected property owners a copy of biannual groundwater quality sampling data for their property for all contaminants exceeding cleanup standards.
			Boomsnub property (099631-000)	Evaluate or mitigate the potential for vapor intrusion before occupying buildings on the property	Not yet implemented
Soil	Yes	Yes	Boomsnub property (099631-000)	Restrict land use to industrial or commercial uses and prevent soil below 15 feet from being disturbed	Not yet implemented

Figure 2: Institutional Control Map[2]



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[2] There is no plume map for the Troutdale aquifer, so this map indicates which Troutdale wells have exceeded the TCE cleanup level during this FYR period.

Systems Operations/Operation and Maintenance (O&M)

In April 2002, interim responsibility for conducting the remedial action using the OU3 groundwater extraction and treatment system was transferred from EPA to BOC Gases with an Administrative Order on Consent. The Site is currently being operated by Linde, as the successor to The BOC Group, Inc., under a Consent Decree. Linde is responsible for groundwater remediation until cleanup levels for VOCs are achieved across the Site. If chromium concentrations in groundwater still exceed cleanup levels when VOCs achieve cleanup levels, then responsibility for O&M of the groundwater treatment system will revert to EPA at that time.

The Consent Decree with Linde requires that the treatment system be operational at least 90 percent of the time. During 2013 through 2017, the system was operational about 99 percent of the time. The groundwater treatment system has removed about 22,441 pounds of chromium and 2,230 pounds of TCE since it started in 1990.

The groundwater monitoring program is detailed in the 2007 Long-Term Monitoring Plan. Updates to the monitoring program are provided in the Annual Status Reports. Monitoring of the groundwater extraction system includes the following:

- Biweekly water sampling of effluent from primary and polishing vessels for total chromium and hexavalent chromium.
- Biweekly vapor sampling of off-gases from primary GAC vessel. VOC concentrations measured using TCE draeger tubes to determine if concentrations are less than 5 parts per million (ppm).
- Monthly treatment system influent and effluent samples are analyzed for total chromium and TCE.
- Semi-annual monitoring of water elevation and biennial monitoring for water quality around the Linde infiltration gallery to assess impacts.
- Measurement of extraction well flow rates.
- Semi-annual monitoring of groundwater elevation and quality.

In 2011 and 2012, Clark County and the Church of God constructed sports fields on the north side of the 3700 block of 78th Street. The PRP contractor made modifications to groundwater extraction system components on those properties to accommodate the construction of the sports fields. The PRP contractor is making additional modifications to groundwater extraction system components on a property south of 78th Street to accommodate that property's ongoing development as Padden Parkway Business Park.

Due to high water levels, water intrusion into the control vaults has shut down the groundwater extraction system more frequently than desired. The PRP's contractor has worked to re-grout problem vaults to minimize water intrusion.

III. PROGRESS SINCE THE PREVIOUS REVIEW

This section includes the protectiveness determinations and statements from the 2013 FYR as well as the recommendations from the 2013 FYR and the status of those recommendations.

Table 5: Protectiveness Determinations/Statements from the 2013 FYR

OU #	Protectiveness Determination	Protectiveness Statement
1	Will be Protective	The remedy at OU1 is expected to be protective of human health and the environment upon completion. In the interim, exposure pathways that could result in unacceptable risk are being controlled. All accessible chromium-contaminated soil has been removed to a depth of 15 feet below ground surface and access is restricted.

OU #	Protectiveness Determination	Protectiveness Statement
2	Short-term Protective	The remedy at OU2 currently protects human health and the environment. Soil treatment has been completed and the soil vapor extraction system has been turned off. Exposure pathways that could result in unacceptable risk for groundwater are being controlled using institutional controls to prevent consumption of groundwater. In order for the remedy to be protective in the long term, continued extraction and treatment of groundwater to prevent migration is necessary.
3	Short-term Protective	The remedy at OU3 currently protects human health and the environment. Exposure pathways that could result in unacceptable risk are being controlled through institutional controls. In order for the remedy to be protective in the long term, continued extraction of groundwater to reduce the plume size and completion of access agreements and restrictive covenants are necessary.

Table 6: Status of Recommendations from the 2013 FYR

OU #	Issue	Recommendation	Current Status	Current Implementation Status Description	Completion Date
2	Spikes in TCE concentrations observed at AMW-2A and AMW-12A located down-gradient of the in-well stripping wells.	Complete an evaluation/optimization on the operation of the remaining in-well stripping wells and develop a groundwater exit strategy consistent with EPA guidance.	Completed	The in-well stripping system was shut down with EPA's approval after monitoring data showed that over 97 percent of the VOC mass had been removed and removal rates had decreased below measurable rates.	8/31/2013
3	Access agreements and restrictive covenants have not been obtained for all properties with groundwater extraction system infrastructure.	Obtain access agreements and restrictive covenants from remaining high-priority properties.	Ongoing	PRP obtained access agreement with Clark County in 2018 for sports park property. PRP contractors have been able to access all properties as needed to conduct cleanup. Groundwater use restrictions still need to be implemented for some parcels (see Institutional Control Review section of this FYR report).	N/A
1	Deed restrictions to limit future use of the Boomsnub property have not been formally recorded.	Record deed restrictions to maintain industrial use of the Boomsnub property and prevent soil disturbance below 15 feet.	Ongoing	Land use restrictions still need to be implemented for the Boomsnub property. In the meantime, the PRP contractor controls access to the Boomsnub property.	N/A

IV. FIVE-YEAR REVIEW PROCESS

Community Notification, Community Involvement and Site Interviews

A public notice was made available on EPA's website at www.epa.gov/superfund/boomsnub-airco and in the May/June 2018 Northeast Hazel Dell Neighborhood Association Community Newsletter, which is mailed to all property owners in the neighborhood. The public notices stated that the FYR was underway and invited the public to submit any comments to EPA. Appendix D provides a copy of the public notice from the community newsletter. The results of the review and the report will be made available at the Site's information repository: Vancouver Public Library, 901 C Street, Vancouver, Washington.

During the FYR process, interviews were conducted to document any perceived problems or successes with the remedy that has been implemented to date. The interviews are summarized below. Appendix E provides the full interviews.

Ecology project manager Mohsen Kourehdar stated that, overall, he has a very good impression of the project. There has been excellent progress shrinking the plumes, but there is more work to be done. He thinks conducting in situ treatment is a good idea, while continuing to operate the groundwater pump-and-treat system. He suggests that EPA further delineate the Northern Plume.

Bryan DeDoncker, with Clark County Public Health, Hazard Assessment Program, stated that he would like to be regularly informed about the Site, and all Superfund sites in the county, because Clark County Public Health issues well installation permits and plays a vital role in notifying the community about public health concerns. He would like to know when EPA is reaching out to the community, so that the county can coordinate its communication with the public.

A representative of Linde (PRP) stated that the remedial activities have been very successful at reducing both the extent and magnitude of contamination. The remedy continues to effectively control and remediate the groundwater plume. Recovered groundwater is effectively treated before it is reinjected to the subsurface. Linde continues to send groundwater sampling results to property owners.

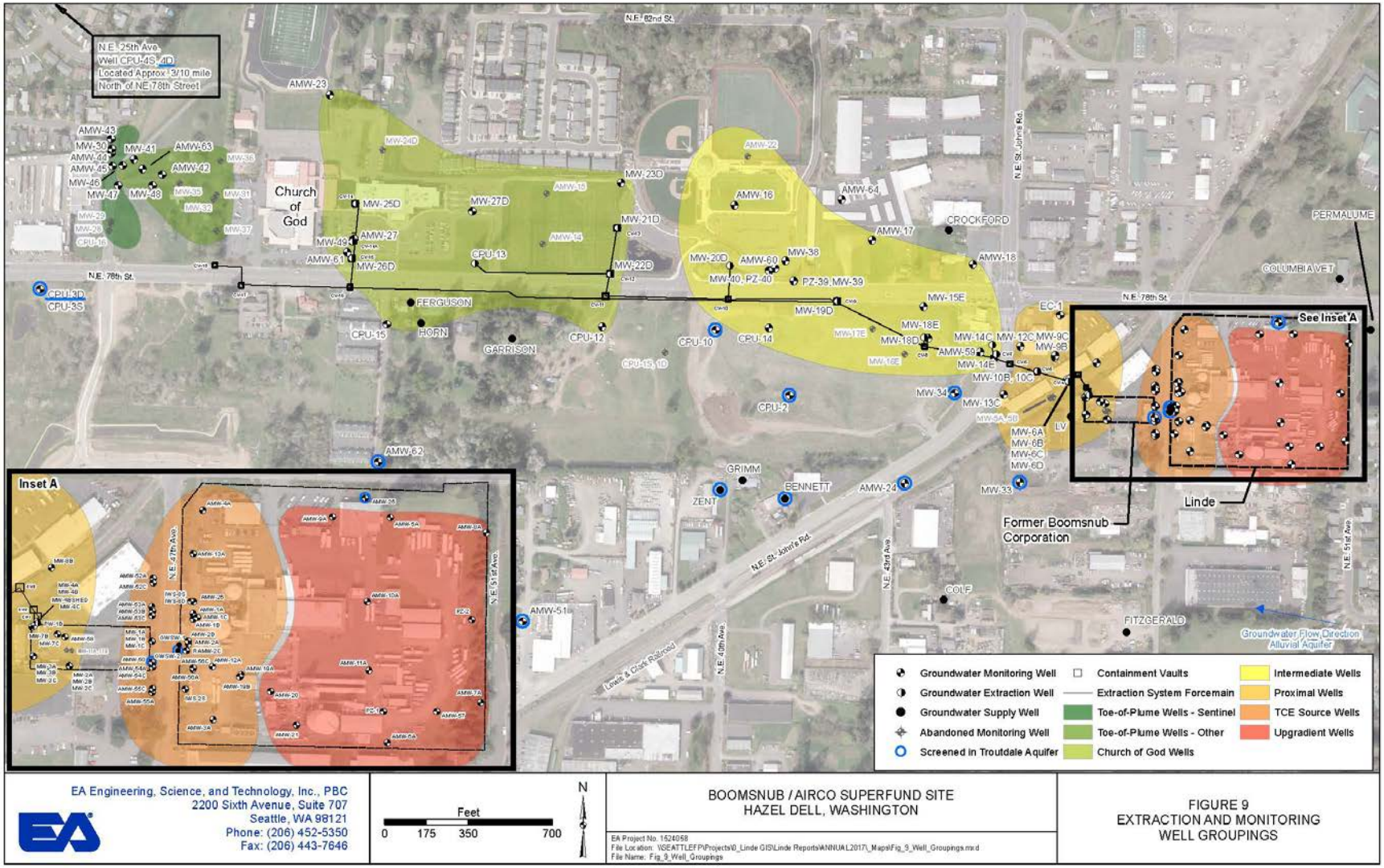
Jil Frain, of PRP contractor EA Engineering, Science, and Technology, Inc., stated that O&M of the plume is proceeding as required in the Consent Decree, with significant reductions in contaminant mass. The Northern Plume, which is not known to be associated with the Boomsnub Site, has encroached on the Boomsnub plume through operation of the extraction system. Due to high water levels, water intrusion into the control vaults has shut the system down more frequently than desired; EA has worked to re-grout problem vaults to minimize intrusion.

The president of the Northeast Hazel Dell Neighborhood Association suggested some communication methods that EPA can use to get information about the Site to nearby residents, including the association's newsletter and email list. EPA gave the association president an update about the Site's cleanup status.

Data Review

To assess performance of the remedy, this FYR reviewed the following monitoring data collected over the past five years: groundwater, treated water effluent from the groundwater treatment system, and air effluent from the groundwater treatment system's air stripper. The data review focuses on TCE and chromium, which are used in site documents as indicator contaminants for site-related contamination.

Figure 3: Site Areas[3]



Disclaimer: This map and any boundary lines within the map are approximate and subject to change. The map is not a survey. The map is for informational purposes only regarding EPA's response actions at the Site.

[3] Figure is from 2017 Draft Annual Status Report, prepared by EA for Linde.

Figure 3 shows the Site's groundwater extraction and monitoring network. Most site monitoring wells are screened in the alluvial aquifer. Some wells screened in the Upper Troutdale aquifer have been sampled, including monitoring wells, production wells and private wells. For ease of discussion, site extraction and monitoring wells are divided geographically into several site areas (see Figure 3). Alluvial aquifer wells are divided into the following groupings: Upgradient, TCE Source, Proximal, Intermediate, Church of God, and Toe of Plume. Troutdale aquifer wells are treated as a separate well grouping.

Groundwater data collected to characterize the off-site Northern Plume are not discussed in this section; the Northern Plume is discussed in Section II of this FYR report, under Status of Implementation, and in Section VI, under Other Findings.

Alluvial Aquifer

Figures 4 and 5 depict the current locations of the chromium and TCE plumes (in the alluvial aquifer only). As can be seen from the figures, the areas of the plumes in the alluvial aquifer have decreased greatly since 1995.

Appendix C provides charts showing chromium and TCE concentrations in groundwater from the 1990s through 2017, focusing on areas of the Site with higher concentrations (Figures C-1 through C-8). Chromium concentrations in most of the monitoring wells in the Proximal Area have decreased below the 80 µg/L cleanup level (Figure C-1). Several wells in the Proximal Area remain above the cleanup level (MW-4A, MW-4B and MW-3A, all of which are on the Boomsnub property); concentrations in these three wells have been stable or increasing over the past five years, with maximum concentrations of about 800 µg/L. Chromium concentrations in most monitoring wells in the Intermediate Area have steadily decreased since the 1990s (Figure C-2). During the most recent sampling event (fall 2017), chromium concentrations were below the 80 µg/L cleanup level in all six sampled Intermediate Area wells.

Figures C-3 through C-8 show TCE concentrations in groundwater from the 1990s through 2017, for various areas of the Site. In all site areas, TCE concentrations have decreased greatly since the 1990s. In the Source Area (Figure C-3), TCE concentrations decreased rapidly from 2004 to 2007, when the soil vapor extraction system was operating (it was shut down in 2008). Since then, TCE concentrations in the source area have been relatively stable, with six of 11 wells below the cleanup level in the most recent sampling event. In the Proximal and Intermediate Areas (Figures C-4 and C-5), TCE concentrations have continued to decrease over the past five years in almost all wells. In the Proximal Area, only three wells (of 18 sampled) were above the TCE cleanup level in the most recent sampling event. In the Intermediate Area, nine wells (of 12 sampled) remain above the TCE cleanup level. In the Church of God area and the Toe of Plume area, TCE concentrations have decreased below the cleanup level except for monitoring well AMW-61 (located in the Church of God area), which remains slightly above the cleanup level (Figures C-6 and C-7).

Troutdale Aquifer

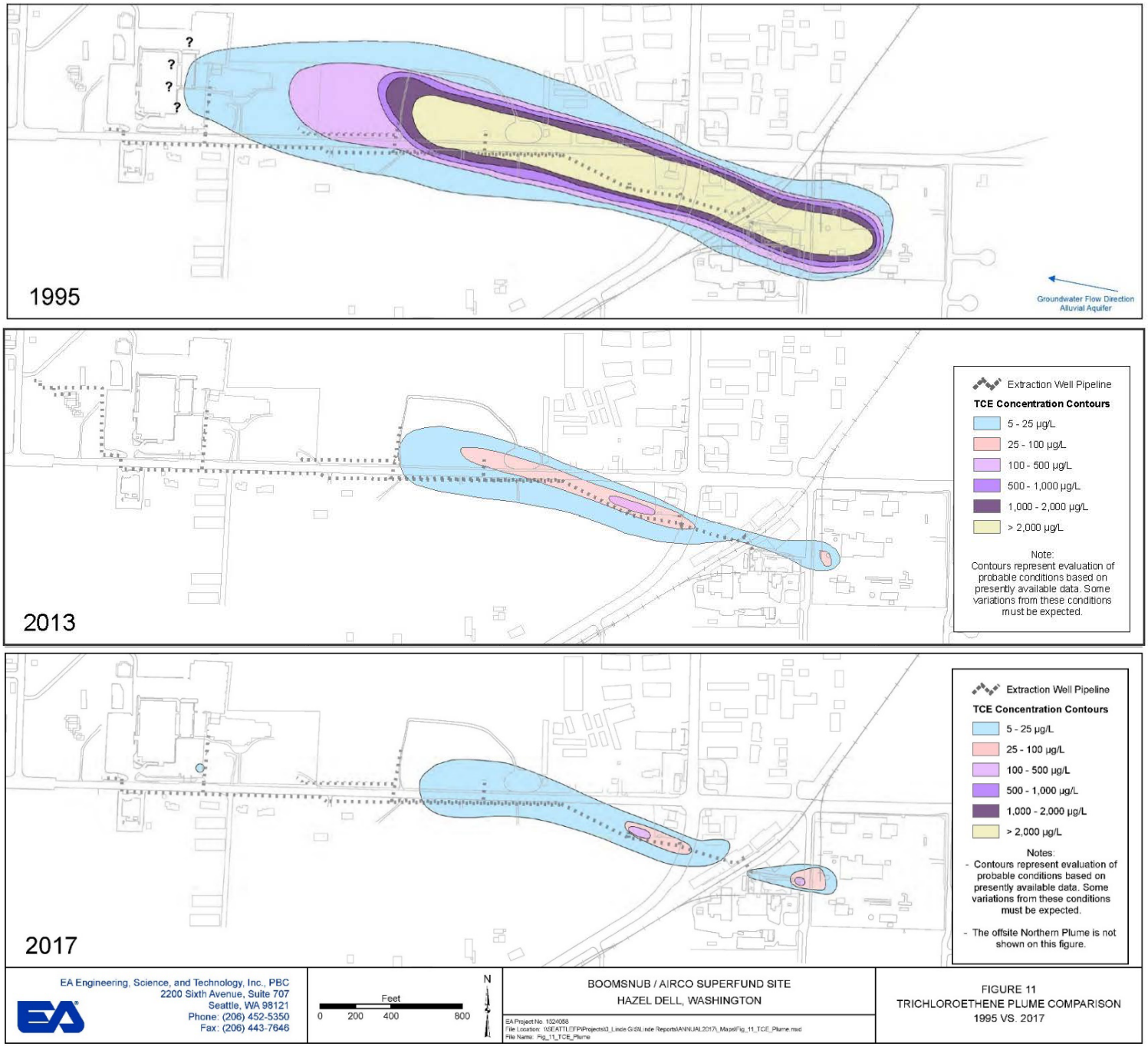
The Site's groundwater monitoring program includes three wells screened in the Troutdale aquifer (AMW-24, MW-33 and Bennett). Over the past five years, TCE concentrations in AMW-24 and MW-33 have consistently been above the cleanup level, at about 5 to 10 µg/L and declining slowly (see Figure C-8). Chromium has never been above its cleanup level in these wells.

Groundwater in the Troutdale aquifer flows toward the west-southwest. Historical sampling results from Troutdale wells farther downgradient (AMW-51, AMW-62 and CPU-3D) indicate that COCs were never detected in these wells above the Site's cleanup levels. These downgradient wells are no longer sampled.

Figure 4: Chromium Plume Comparison, 1995, 2013 and 2017[4]

[4] Figures are from 2013 and 2017 Draft Annual Status Reports, prepared by EA for Linde.

Figure 5: TCE Plume Comparison, 1995, 2013 and 2017[5]



[5] Figures are from 2013 and 2017 Draft Annual Status Reports, prepared by EA for Linde.

Other COCs

Other than TCE, the only VOCs detected above their cleanup levels during the past five years were 1,1-DCE and bromodichloromethane. These were detected primarily in the alluvial aquifer Intermediate Area, where the highest TCE concentrations remain. 1,1-DCE was also detected in the Troutdale aquifer from 2013 to 2016, at levels slightly above its cleanup level. During the last five years, bromodichloromethane was detected above its cleanup level in only two samples (both during the fall 2016 sampling).

Treated Water Effluent

The infiltration gallery discharge criteria were revised in February 2009. Criteria are currently 1.9 μg/L for TCE and 19.2 μg/L for chromium. Figure C-10 shows chromium and TCE concentrations entering (influent) and leaving (effluent) the groundwater treatment system from 1999 to 2017. The groundwater treatment system is effectively removing chromium and TCE from the groundwater (Figure C-10). TCE and chromium concentrations in effluent discharged to the infiltration gallery from 2013 to 2017 were consistently below the maximum allowable effluent concentrations of 1.9 μg/L for TCE and 19.2 μg/L for chromium.

Air Effluent

Twice per month, the PRP's contractor measures the TCE concentration in off-gas from the air stripper. The 2017 semi-annual progress reports document that the TCE concentration in the off-gas was less than 5 ppm during each monitoring event in 2017.

Site Inspection

The site inspection took place on April 5, 2018. Participants included: EPA RPM Jonathan Williams; EPA community involvement coordinator Jo Gallaher; EPA hydrogeologists Bernie Zavala and Lee Thomas; Hagai Nassau and Kelly MacDonald of EPA support contractor Skeo; Jil Frain and Rick Read of PRP contractor EA Engineering, Science and Technology; and Dave Sordi of PRP representative BSI Group. The purpose of the inspection was to assess the protectiveness of the remedy. Appendix F provides the site inspection checklist. Appendix G provides site inspection photographs.

Site inspection participants discussed the current cleanup status and toured the Site. PRP cleanup contractor EA stated that the farthest downgradient pumping wells are MW-21D and MW-22D, which are at the eastern edge of the Church of God playing field, adjacent to the Luke Jensen Sports Park. The pumping wells are extracting groundwater at their maximum capacity, about 127 gallons per minute. An extra pump is on standby at the groundwater treatment building in case the primary pump fails.

Participants inspected cleanup features at the Linde property, including the infiltration gallery, monitoring wells, and the shut-down soil vapor extraction and in-well stripping system. Linde stores trucks and tankers on the gravel top of the infiltration gallery.

No deficiencies were noted with any cleanup infrastructure. Some flush-mount monitoring wells had water in their annular spaces; this is not an immediate concern because the well casings are sealed with a cap. The Boomsnub property and the Linde property are both fenced and secured. EA reported that there has never been tampering with monitoring wells at the Site.

EA stated that O&M costs have been stable; power costs have decreased as extraction wells have been shut down. EA stated that in September 2017 they repaired and re-grouted around pipes and conduits in CV-9 to address the flooding problem in that containment vault.

The proposed Padden Parkway Business Park property, which contains a large portion of the remaining TCE plume, has been graded to its final grade. The PRP contractor adjusted monitoring wells on that property to

accommodate the planned development. The extraction force main pipeline has not been moved yet; the PRP contractor is waiting until the developer determines where buildings will be constructed before relocating the pipeline.

As part of the FYR, Skeo staff visited the local site information repository at the Vancouver Public Library, 901 C Street, Vancouver, Washington. The library had site documents through 2011. Since then, EPA has updated the repository with more recent documents.

V. TECHNICAL ASSESSMENT

QUESTION A: Is the remedy functioning as intended by the decision documents?

Yes, in general the remedy is functioning as intended by the decision documents.

On the Boomsnub property (OU1), soils with chromium concentrations exceeding 400 mg/kg and lead concentrations exceeding 1,000 mg/kg were removed in the upper 15 feet of the property, except under the air stripper secondary containment pad and the ion exchange building. The contaminants in these areas are currently covered and will be removed when the structures are removed during site decommissioning, as called for in the 2018 Closure Plan. Higher concentrations of chromium remain in the soil at depths greater than 15 feet.

On the Linde property (OU2), in-well stripping and soil vapor extraction removed most of the VOC contamination in the source area. However, based on continuing fluctuations in TCE concentrations in groundwater, including frequent TCE increases when the water table is higher, residual subsurface soil contamination likely occurs at depths near the water table in the OU2 area.

For sitewide groundwater (OU3), the groundwater extraction and treatment system continues to effectively remove chromium and VOCs from the groundwater. The system has greatly reduced the sizes of the chromium and TCE plumes in the alluvial aquifer since 1995. There are still wells in the Proximal Area where chromium concentrations in wells have been stable or increasing over the past five years. In the Source Area, TCE concentrations decreased rapidly from 2004 to 2007, when the soil vapor extraction system was operating. Since then, TCE concentrations in the source area have been relatively stable, with six of 11 wells below the cleanup level in the most recent sampling event. Monitoring of these trends will continue to determine whether the remedy continues to function as intended. EPA anticipates that the PRP may use in situ treatment in the future to address remaining hot spots of contamination, as called for in the 2015 ESD.

Over the past five years, samples were collected from three wells screened in the Troutdale aquifer. In two of these wells, TCE concentrations were consistently above the cleanup level, at about 5 to 10 µg/L. The current geographic extent of VOC contamination in the Troutdale aquifer may not be sufficiently delineated.

Restrictive covenants have been implemented for some parcels with groundwater contamination; these covenants prohibit installing wells and using groundwater for potable purposes. Other parcels with groundwater contamination still need groundwater use restrictions to be implemented. State regulations prohibit installing water wells near known or potential sources of contamination (WAC 173-160-171). As part of this FYR, EPA searched the Washington State Well Report Viewer website to determine if there have been any drinking water wells installed near the Site. Based on that data, drinking water wells have not been installed in the last five years near the Site's groundwater contamination. Public water is available to all properties within one mile of the Site. The PRP's contractor provides affected property owners a copy of biannual groundwater quality sampling data for their property for all contaminants exceeding cleanup standards.

The Boomsnub property (OU1) and the Linde property (OU2) are secured with fences to prevent unauthorized entry. Institutional controls need to be implemented for the Boomsnub property to restrict land use to industrial or

commercial uses and to prohibit disturbing soil deeper than 15 feet below the surface, as called for in the 2000 ROD.

The nearby area of off-site groundwater contamination (the Northern Plume) is not discussed in this section; the Northern Plume is discussed in Section II of this FYR report, under Status of Implementation, and in Section VI, under Other Findings.

QUESTION B: Are the exposure assumptions, toxicity data, cleanup levels and remedial action objectives used at the time of the remedy selection still valid?

The exposure assumptions and remedial action objectives used at the time of remedy selection are still valid. The remedy is making progress toward meeting the Site's remedial action objectives.

This FYR compared the groundwater cleanup levels from the 2000 ROD against the current values of the federal MCLs and MTCA Method B standards (see Table H-1 in Appendix H). The current ARAR values for five of the groundwater COCs are more stringent than the cleanup levels established in the 2000 ROD (chromium VI (hexavalent), bromodichloromethane, carbon tetrachloride, dibromochloromethane and hexachlorobutadiene), either because the COC's ARAR value has become more stringent since the 2000 ROD or because the COC's cleanup level was set at a practical quantitation limit that is greater than the ARAR value. Based on recent sampling results, three of these five COCs are present at levels above both their cleanup levels and their current ARAR values (chromium VI (hexavalent), bromodichloromethane and dibromochloromethane); carbon tetrachloride is no longer detected at the Site (detection level is below both its cleanup level and its current ARAR value); and hexachlorobutadiene is not detected (detection level is below its cleanup level but above its current ARAR value). Although there are no current exposures to contaminated groundwater, EPA should consider whether groundwater cleanup levels for these contaminants should be revised in a decision document.

This FYR compared the ARAR-based soil cleanup levels from the 2000 ROD against the current MTCA values (see Table H-2 in Appendix H). The MTCA value for chromium VI has become more stringent since the 2000 ROD was issued; however, this change does not affect protectiveness because soil was cleaned up to a more stringent standard of 400 mg/kg total chromium. The other ARAR-based soil cleanup levels are also still protective because the ARARs have either not changed or have become less stringent since the 2000 ROD.

One of the remedial action objectives for OU1 is to prevent future workers from being exposed to lead and chromium in soils at levels above industrial cleanup standards. This FYR reviewed the Site's one risk-based OU1 soil cleanup level to determine whether it is still protective for industrial use (see Table I-1 in Appendix I). The 400 mg/kg OU1 soil cleanup level for total chromium is within EPA's range of acceptable risk.

As part of this FYR, EPA contacted Clark Public Utilities, the area's water provider, to determine whether site contamination has affected any nearby public supply wells. Clark Public Utilities provided recent sampling data for nearby downgradient supply wells and confirmed that site contaminants have not been detected in any of these wells above drinking water standards.

Elevated levels of TCE in groundwater are present on the property where Padden Parkway Business Park is being constructed. The affected wells are screened at depths of 70 to 140 feet below ground surface. The EPA-approved 2018 Closure Plan states that, based on previous sampling of shallower wells and direct push samplers, a significant thickness of clean water overlies the area of VOC contamination, preventing contaminants from posing a vapor intrusion risk. In addition, periodic monitoring of vapor concentrations in vaults and well headspace has provided further evidence regarding the lack of a vapor intrusion pathway. If conditions in this area change in the future, then additional evaluation of vapor intrusion or preemptive mitigation may be needed.

Elevated levels of TCE in groundwater are present near the water table at the Boomsnub property, which currently does not have occupied structures, and at the Linde property in areas without occupied structures. Additional

evaluation of the potential for vapor intrusion or preemptive mitigation should be conducted before occupying structures in these areas.

In 2003 and 2004, samples from selected wells and from the groundwater extraction and treatment system influent and effluent were analyzed for 1,4-dioxane. Low concentrations of 1,4-dioxane (about 1 µg/L) were detected in wells near the TCE source area; lower concentrations were present downgradient of the source area. The results indicated there was no need to modify the extraction and treatment system to address 1,4-dioxane. EPA's current screening level for 1,4-dioxane in drinking water is 0.46 µg/L based on cancer risk, so the detected concentrations correspond to a cancer risk of about 2×10^{-6}, which is within EPA's range of acceptable risk. In addition, groundwater near the Site is not used for potable purposes.

EPA has recently identified former chrome-plating facilities to be potential sources of per- and polyfluoroalkyl substances (PFAS). Linde submitted a draft PFAS sampling and analysis plan in June 2018 for EPA review and approval.

EPA is aware of development plans for two properties that have site-related cleanup infrastructure. Final grading has been completed for the Padden Parkway Business Park. The PRP contractor adjusted monitoring wells on that property to accommodate the planned development. The extraction force main pipeline has not been moved yet; the PRP contractor is waiting until the developer determines where buildings will be constructed before relocating the pipeline. Commercial redevelopment plans are in place for the property where the Bennett well is located. The developer is aware of the need to safeguard the Bennett well for groundwater monitoring purposes.

QUESTION C: Has any other information come to light that could call into question the protectiveness of the remedy?

No other information has come to light that calls into question the protectiveness of the remedy.

VI. ISSUES/RECOMMENDATIONS

Issues and Recommendations Identified in the FYR:

OU: 1	**Issue Category:** Institutional Controls			
	Issue: Land use restrictions called for in the ROD have not been implemented for the Boomsnub property. The property was cleaned up to industrial standards, contamination remains at depths greater than 15 feet below the surface, and there would be a potential for vapor intrusion if there were occupied structures.			
	Recommendation: Implement land use restriction for Boomsnub property to restrict land use to industrial or commercial uses, to prohibit disturbing soil deeper than 15 feet below the surface, and to evaluate or mitigate the potential for vapor intrusion before occupying buildings on the property.			
Affect Current Protectiveness	**Affect Future Protectiveness**	**Party Responsible**	**Oversight Party**	**Milestone Date**
No	Yes	EPA	EPA	9/13/2020

OU:2 and 3	**Issue Category:** Remedy Performance			
	Issue: Some VOC contamination may remain in subsurface soil near the water table, serving as a continuing source of groundwater contamination. The alluvial aquifer has finer-grained areas with recalcitrant contamination.			
	Recommendation: Implement in situ treatment to address remaining hot spots of contamination as called for in the 2015 ESD, as needed, and continue remedial action through extraction/treatment system operation.			
Affect Current Protectiveness	**Affect Future Protectiveness**	**Party Responsible**	**Oversight Party**	**Milestone Date**
No	Yes	PRP	EPA	9/13/2020

OU: 3	**Issue Category:** Other			
	Issue: The current ARAR values for five of the groundwater COCs are more stringent than the cleanup levels established in the 2000 ROD (chromium VI (hexavalent), bromodichloromethane, carbon tetrachloride, dibromochloromethane and hexachlorobutadiene), either because the COC's ARAR value has become more stringent since the 2000 ROD or because the COC's cleanup level was set at a practical quantitation limit that is greater than the ARAR value.			
	Recommendation: Consider whether groundwater cleanup levels for some contaminants need to be revised and issue decision document if needed.			
Affect Current Protectiveness	**Affect Future Protectiveness**	**Party Responsible**	**Oversight Party**	**Milestone Date**
No	Yes	EPA	EPA	9/13/2020

OU: 3	**Issue Category:** Institutional Controls			
	Issue: Some areas with groundwater contamination present above cleanup standards do not have groundwater use restrictions in place.			
	Recommendation: Implement groundwater use restrictions for parcels overlying groundwater contamination in the alluvial or Troutdale aquifers.			
Affect Current Protectiveness	**Affect Future Protectiveness**	**Party Responsible**	**Oversight Party**	**Milestone Date**
No	Yes	PRP	EPA	9/13/2020

OU: 3	Issue Category: Monitoring			
	Issue: The geographic extent of VOC contamination in the Troutdale aquifer may not be sufficiently delineated.			
	Recommendation: Consider sampling additional wells screened in the Troutdale aquifer to more fully delineate the TCE plume in the Troutdale aquifer.			
Affect Current Protectiveness	**Affect Future Protectiveness**	**Party Responsible**	**Oversight Party**	**Milestone Date**
No	Yes	EPA/PRP	EPA	9/13/2020

OU: 3	Issue Category: Monitoring			
	Issue: EPA has recently identified former chrome-plating facilities to be potential sources of PFAS.			
	Recommendation: After the planned sampling for PFAS, determine if action is needed to address PFAS contamination.			
Affect Current Protectiveness	**Affect Future Protectiveness**	**Party Responsible**	**Oversight Party**	**Milestone Date**
No	Yes	EPA/PRP	EPA	9/13/2020

OTHER FINDINGS

One additional recommendation was identified during the FYR. This recommendation does not affect current and/or future protectiveness for the Boomsnub/Airco Site because the Northern Plume is not considered to be part of the Site.

- High levels of TCE in the Northern Plume are present near a residential neighborhood west of the Luke Jensen Sports Park. Using EPA's Vapor Intrusion Screening Levels Calculator with default assumptions and the most recent TCE concentrations detected at MW-23D (140 µg/L and 180 µg/L) yields cancer risks and noncancer hazards above EPA's acceptable thresholds. However, this contamination is at depth below the ground surface; there is clean water above the contamination that could act as a barrier to vapor migration into overlying unsaturated soil and thus prevent vapor intrusion. Additional evaluation should be conducted to assess the potential for vapor intrusion associated with the Northern Plume.

VII. PROTECTIVENESS STATEMENTS

Protectiveness Statement	
Operable Unit: 1	*Protectiveness Determination:* Short-term Protective
Protectiveness Statement: The remedy at OU1 (Boomsnub property) currently protects human health and the environment because contaminated soil was excavated from the upper 15 feet of the property, the property is not being used for residential purposes, and there are no occupied buildings on the property. In order for the remedy to be protective in the long term, the following action needs to be taken: Implement land use restriction for Boomsnub property to restrict land use to industrial or commercial uses, to prohibit disturbing soil deeper than 15 feet below the surface, and to evaluate or mitigate the potential for vapor intrusion before occupying buildings on the property.	

Protectiveness Statement	
Operable Unit: 2	*Protectiveness Determination:* Short-term Protective
Protectiveness Statement: The remedy at OU2 (Linde property) currently protects human health and the environment because in-well stripping and soil vapor extraction removed most of the VOC contamination in the source area. In order for the remedy to be protective in the long term, the following action needs to be taken: Continue remedial actions until monitoring wells confirm that groundwater cleanup levels have been met and thus the residual source area sufficiently depleted.	

Protectiveness Statement	
Operable Unit: 3	*Protectiveness Determination:* Short-term Protective
Protectiveness Statement: The remedy at OU3 (sitewide groundwater) currently protects human health and the environment because the groundwater extraction and treatment system continues to effectively remove chromium and VOCs from the groundwater, and groundwater in the site area is not used for potable purposes. In order for the remedy to be protective in the long term, the following actions need to be taken: Continue remedial actions until monitoring wells confirm that groundwater cleanup levels have been met, consider whether groundwater cleanup levels need to be revised and issue decision document if needed; implement groundwater use restrictions for parcels overlying groundwater contamination in the alluvial or Troutdale aquifers; consider sampling additional wells screened in the Troutdale aquifer to more fully delineate the TCE plume in the Troutdale aquifer; and, after the planned sampling for PFAS, determine if action is needed to address PFAS contamination.	

VIII. NEXT REVIEW

The next FYR Report for the Boomsnub/Airco Superfund site is required five years from the completion date of this review.

APPENDIX A – REFERENCE LIST

Annual Status Report for the Boomsnub/Airco Superfund Site, Hazel Dell, Washington. EA Engineering, Science, and Technology, Inc. 2013.

Annual Status Report for the Boomsnub/Airco Superfund Site, Hazel Dell, Washington. EA Engineering, Science, and Technology, Inc. 2014.

Annual Status Report for the Boomsnub/Airco Superfund Site, Hazel Dell, Washington. EA Engineering, Science, and Technology, Inc. 2015.

Annual Status Report for the Boomsnub/Airco Superfund Site, Hazel Dell, Washington. EA Engineering, Science, and Technology, Inc. 2016.

Closure Plan, Boomsnub/Airco Superfund Site, Hazel Dell, Washington. EA Engineering, Science, and Technology, Inc. February 2018.

Explanation of Significant Differences for the Boomsnub/Airco Superfund Site, Hazel Dell, Washington. EPA Region 10. September 2015.

Progress and Groundwater Monitoring Report, January – June 2017, Boomsnub/Airco Superfund Site, Hazel Dell, Washington. EA Engineering, Science, and Technology, Inc. August 2017.

Progress and Groundwater Monitoring Report, July – December 2017, Boomsnub/Airco Superfund Site, Hazel Dell, Washington. EA Engineering, Science, and Technology, Inc. February 2018.

Record of Decision for Interim Remedial Action, Boomsnub/Airco Superfund Site, Vancouver, Washington. EPA Region 10. September 1997.

Third Five-Year Review Report for Boomsnub/Airco Superfund Site, Hazel Dell, Washington. EPA Region 10. September 2013.

Work Plan, In-Situ Treatment of Areas of Residual Contamination, Boomsnub/Airco Superfund Site, Hazel Dell, Washington, EA Engineering, Science, and Technology, Inc. August 2018.

APPENDIX B – SITE CHRONOLOGY

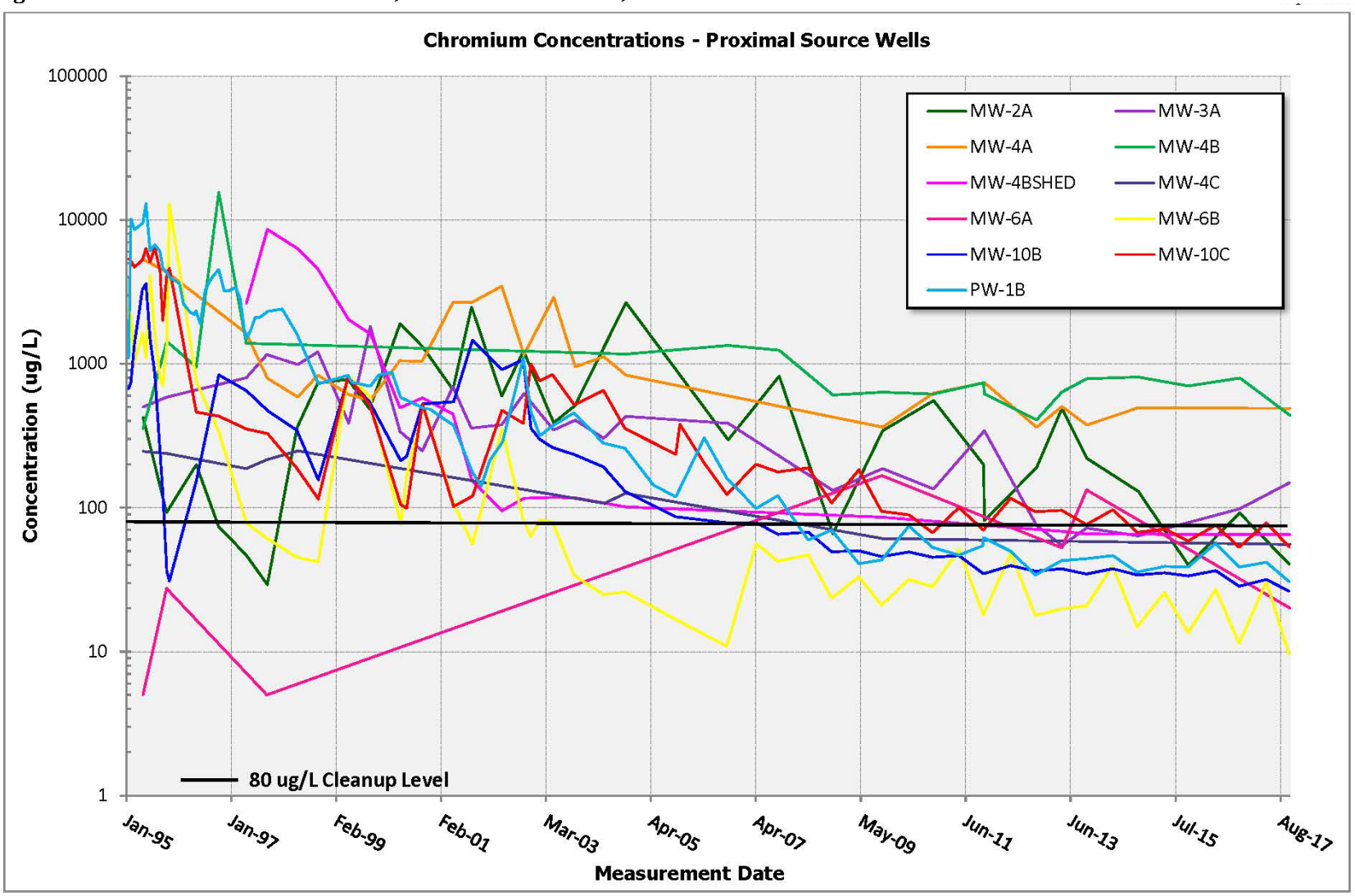
Table B-1: Site Chronology

Event	Date
Ecology identified chromium in the groundwater	1986
Ecology conducted additional investigation to determine the lateral extent of contamination	1990 - 1994
Ecology issued enforcement order pursuant to the MTCA to Boomsnub requiring company to extract and treat chromium-contaminated groundwater, monitor existing on-site wells, and conduct groundwater studies	May 1990
Boomsnub installed pumping wells and began the extraction and treatment of groundwater under order from Ecology	May 1990
Operation of extraction and treatment system	May 1990 - Present
Ecology assumed financial responsibility for operating extraction and treatment system	August 1990
Ecology determined VOCs were present in groundwater at concentrations presenting human health concerns	1991
BOC Gases conducted investigations	1991 - 1994
Ecology and BOC Gases signed Agreed Order	1993
EPA issued Unilateral Administration Order to obtain property access from Boomsnub	May 1994
EPA assumed responsibility for operation of the extraction and treatment system	June 1994
EPA completed removal of 6,000 tons of chromium-contaminated soil	1994
EPA listed the Site on the NPL (60 Fed. Reg. 20330)	April 25, 1995
EPA and BOC Gases entered into Administrative Order on Consent requiring BOC Gases to conduct a site evaluation at its facility	January 1997
EPA issued Interim Action ROD that selected groundwater extraction and treatment as interim remedy	September 1997
EPA operated groundwater treatment system	January 1998 – April 2002
EPA completed remedial investigation and feasibility study	July 1999
EPA issued ROD for OU1 and OU3 that selected extraction and treatment of groundwater	February 2000
EPA issued Consent Decree to obtain past costs from Boomsnub	March 2000
EPA and BOC Gases entered into Administrative Order on Consent to construct a sewer pipeline and pump station	January 2001
BOC Gases constructed gravity sewer	January – September 2001
EPA removed an additional 2,500 cubic yards of chromium-contaminated soil at Boomsnub facility	March – April 2001
EPA issued an Action Memorandum identifying requirements for remediation activities at OU2	September 2001
EPA completed Remedial System Evaluation	February 2002
EPA and BOC Gases entered into Administrative Order on Consent, pursuant to which BOC Gases assumed responsibility for O&M of the groundwater extraction/treatment system	April 2002
EPA and BOC Gases entered into Administrative Order on Consent non time-critical removal action requiring installation of in-well stripping and soil vapor extraction system at OU2	September 2002
BOC Gases installed in-well stripping and soil vapor extraction at its facility	September 2003 – February 2004
EPA signed First FYR	September 2003
BOC Gases constructed infiltration gallery for disposal of treated groundwater	November 2004 – June 2005

Event	Date
EPA issued an ESD for OU3, addressing modified pumping rate, upgrade of ion-exchange and air-stripping systems, use of infiltration gallery, and institutional controls	August 2006
BOC Gases conducted Toe-of-Plume Pilot Study	September 2006
EPA and Linde entered into Consent Decree requiring Linde to implement the remainder of the response actions until VOCs meet cleanup levels and to pay past costs and future oversight costs	July 2007
Linde stopped operation of the soil vapor extraction system, and started pulse pumping a subset of in-well stripping wells	February 2008
Linde conducted initial Northern Plume investigation	August 2008
EPA signed Second FYR	September 2008
Linde significantly decreased frequency of sentinel well monitoring	2008
Linde discontinued GAC treatment at in-well stripping wells	October 2009
Linde conducted second Northern Plume investigation	December 2011
EPA approved stopping operation of all in-well stripping wells	August 2013
EPA signed Third FYR	September 2013
EPA issued an ESD for OU3, adding in situ treatment as a remedy for groundwater and soil to supplement the groundwater extraction and treatment system	September 2015
EPA approved closure plan	February 2018
2017 Draft Annual Report presented summary of 2017 plume capture evaluation	April 2018
EPA approved Linde's work plan for in-situ groundwater treatment and fieldwork began	August 2018
Linde resubmitted draft sampling and analysis plan for PFAS	August 2018

APPENDIX C – SUPPORTING DATA[6]

Figure C-1: Chromium Concentrations, Proximal Area Wells, 1995-2017



[6] Figures are from 2017 Draft Annual Status Report, prepared by EA for Linde.

Figure C-2: Chromium Concentrations, Intermediate Area Wells, 1995-2017

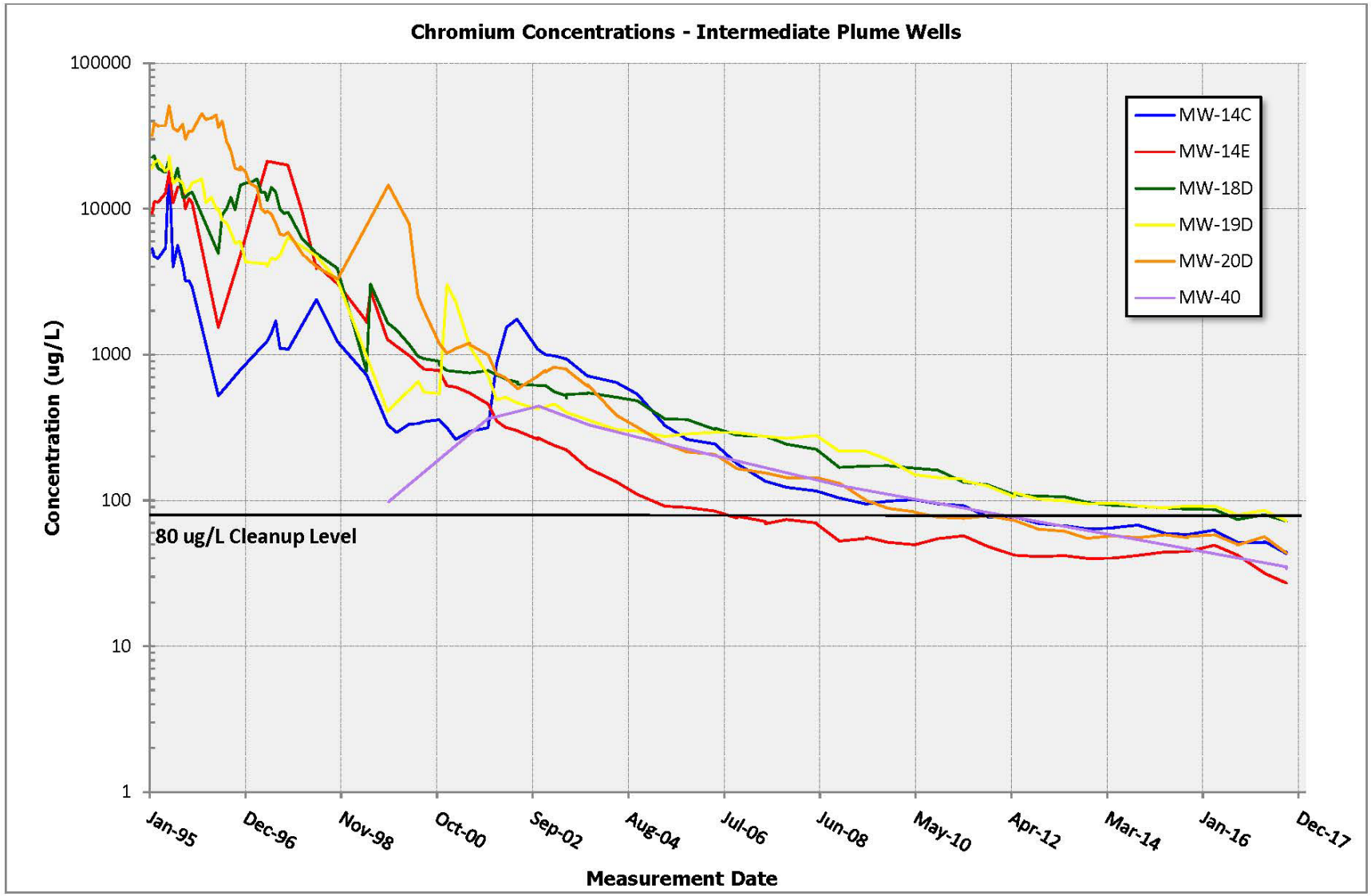


Figure C-3: TCE Concentrations, TCE Source Area Wells, 1995-2017

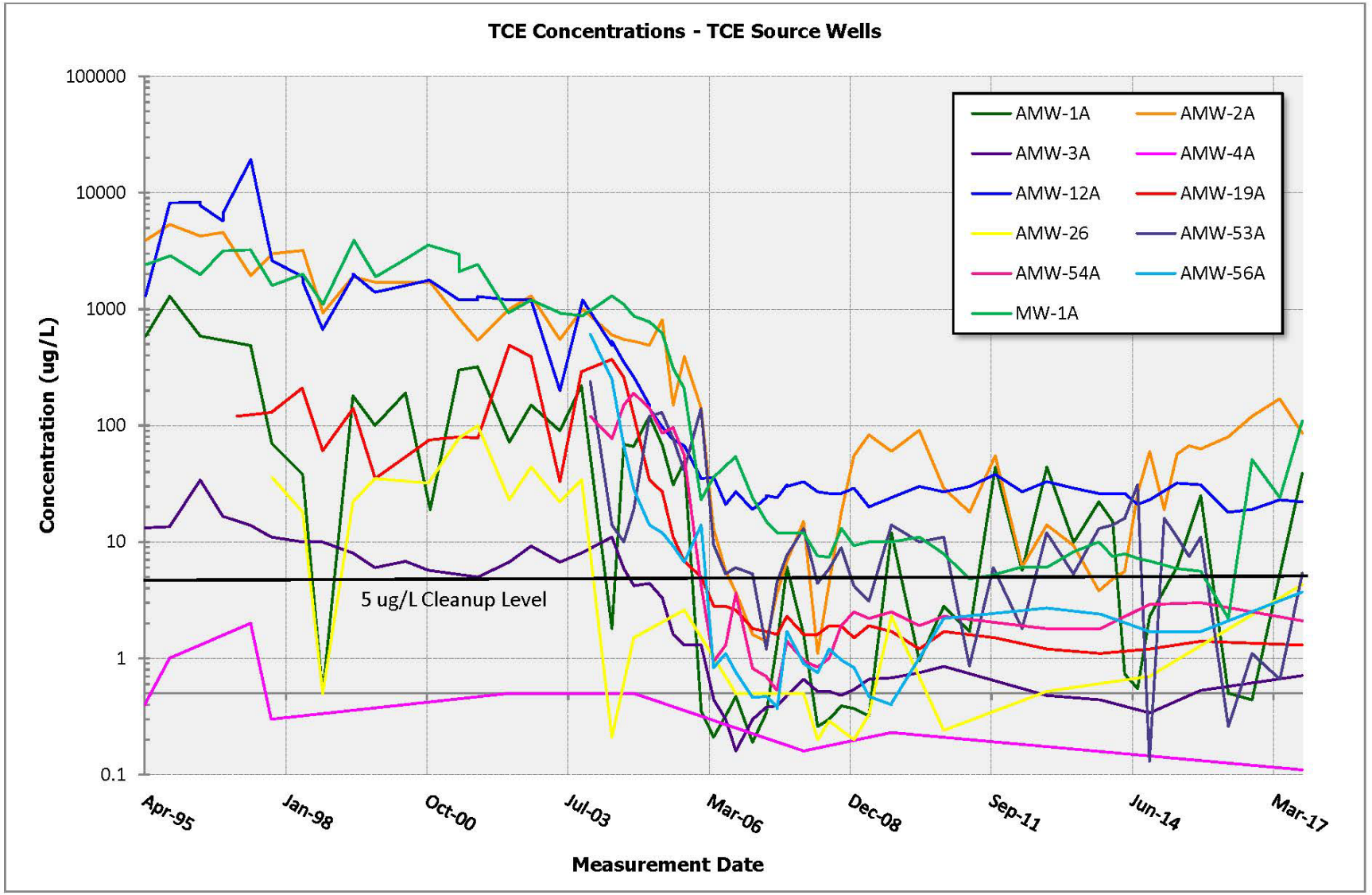


Figure C-4: TCE Concentrations, Proximal Area Wells, 1995-2017

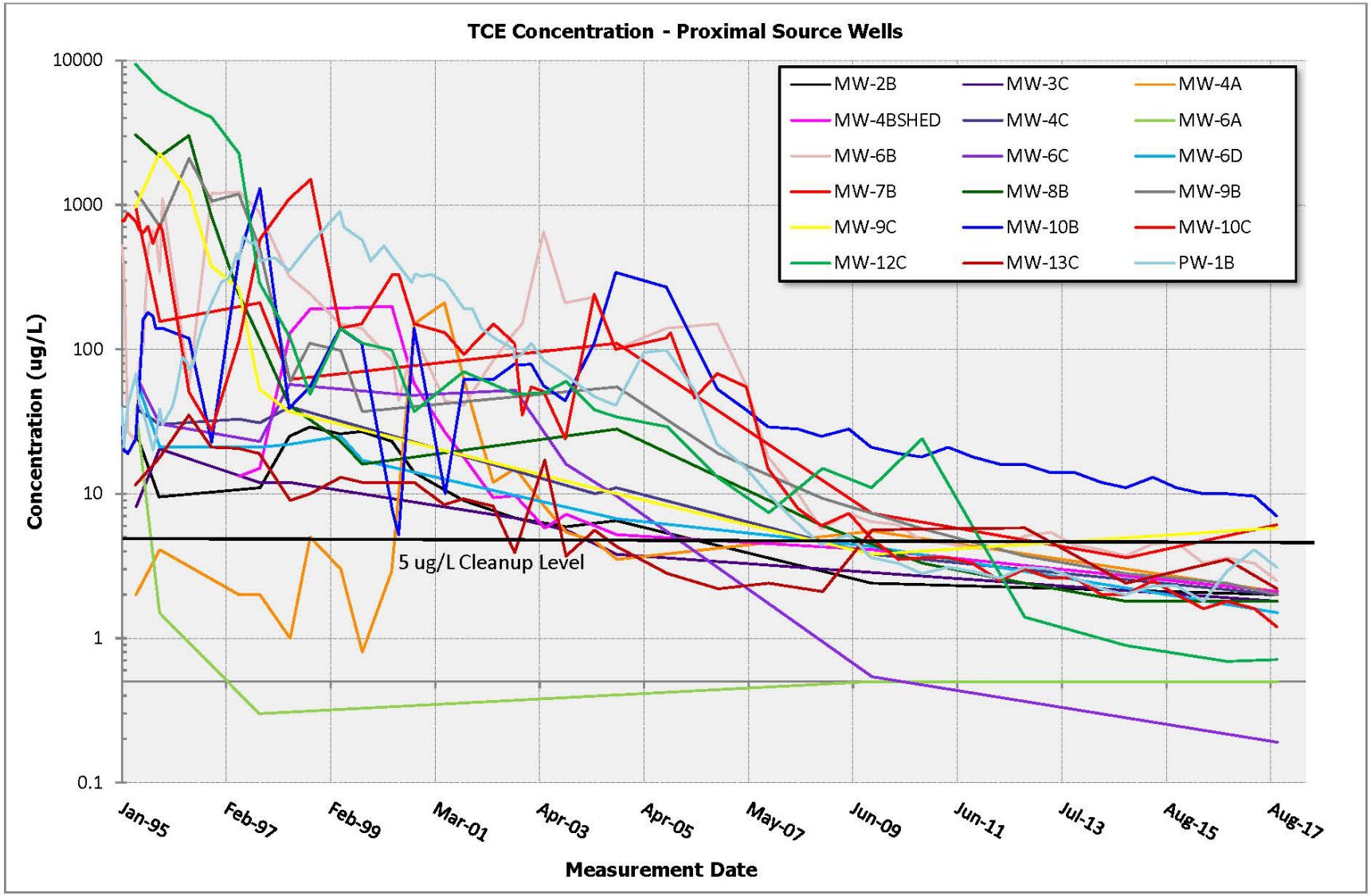


Figure C-5: TCE Concentrations, Intermediate Area Wells, 1995-2017

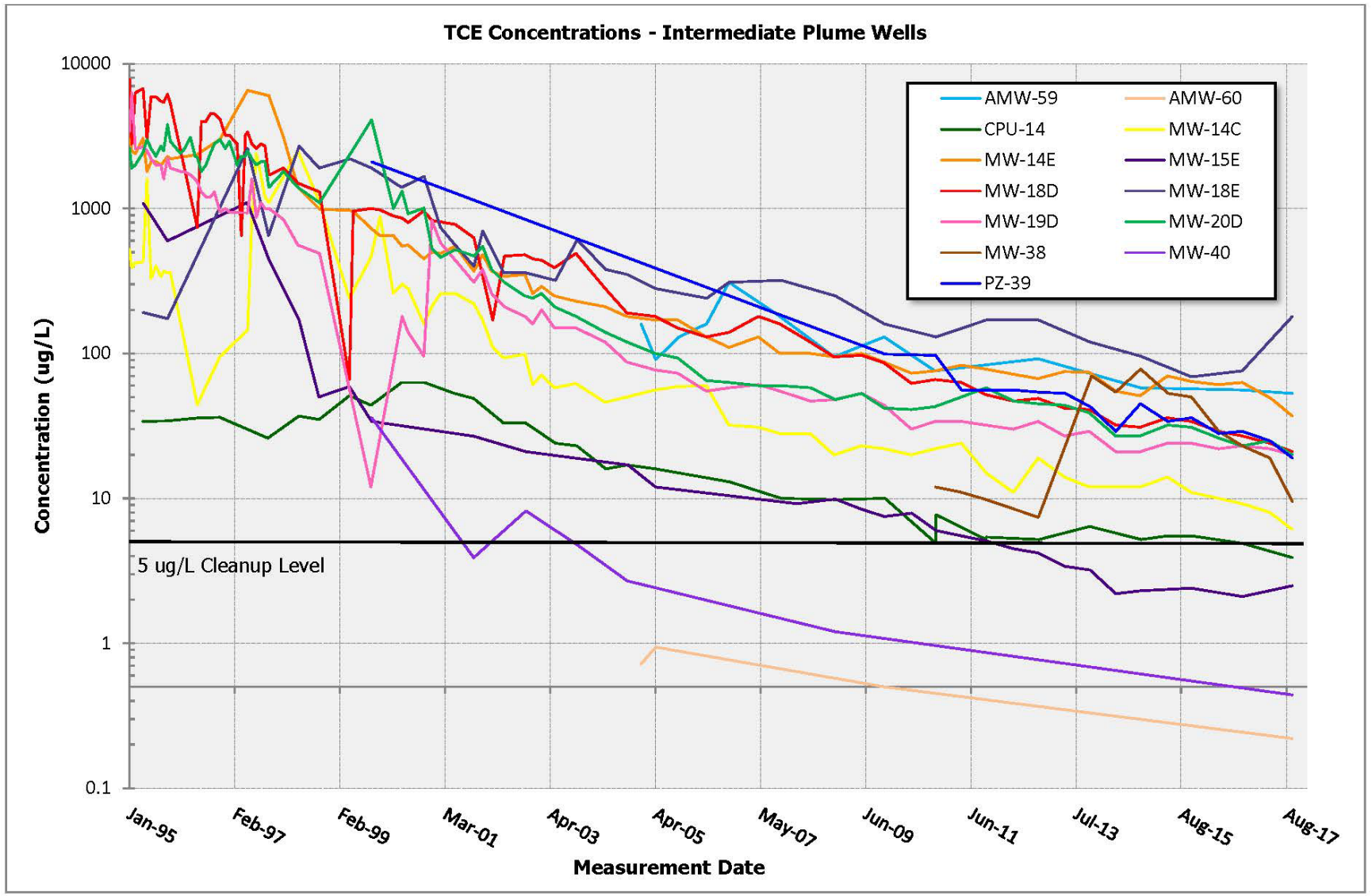


Figure C-6: TCE Concentrations, Church of God Area Wells, 1995-2017

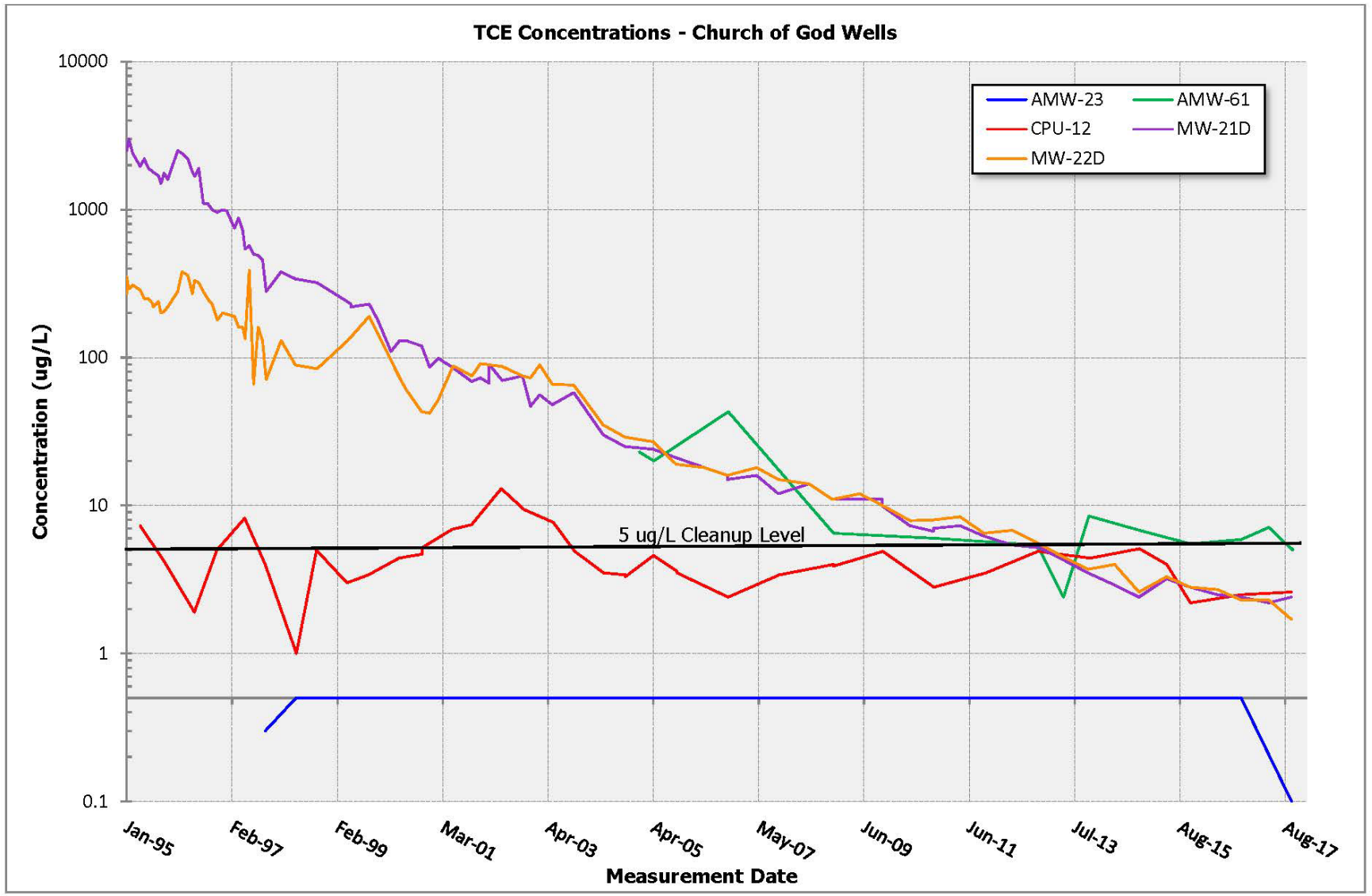


Figure C-7: TCE Concentrations, Toe of Plume Area Wells, 1999-2017

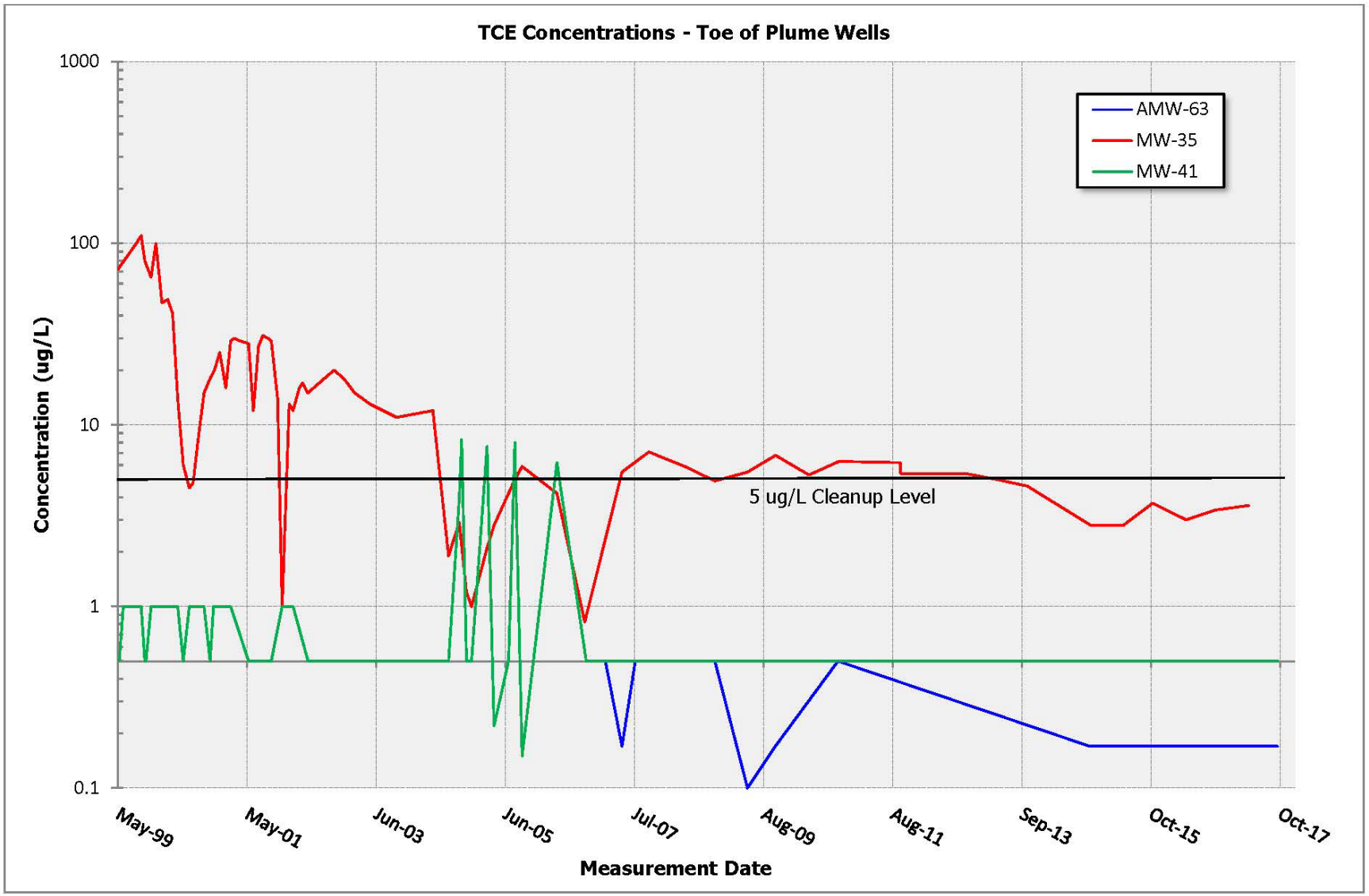


Figure C-8: TCE Concentrations, Troutdale Aquifer Wells, 1997-2017

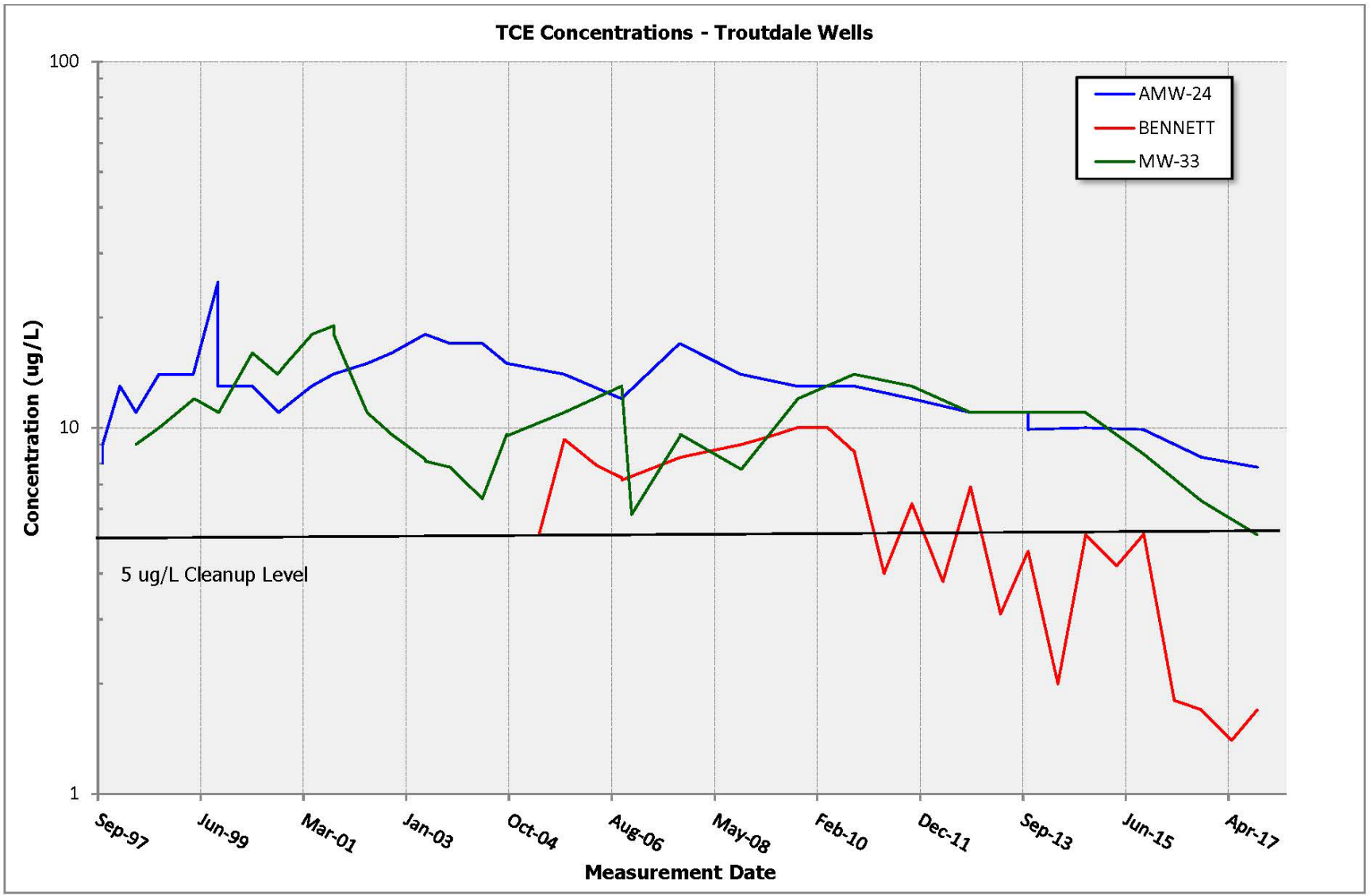


Figure C-9: TCE Concentrations, Northern Plume Wells, 1995-2017

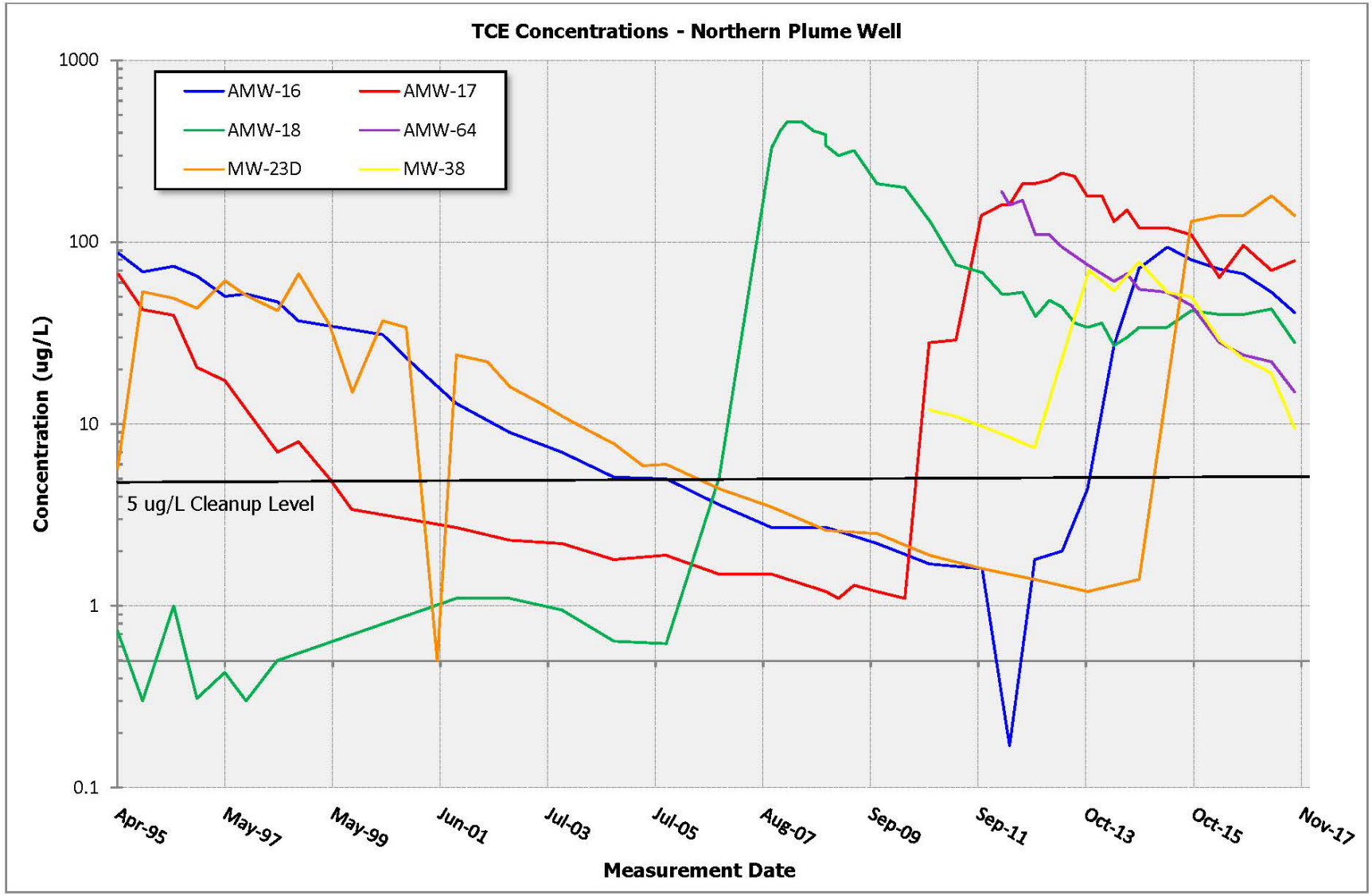
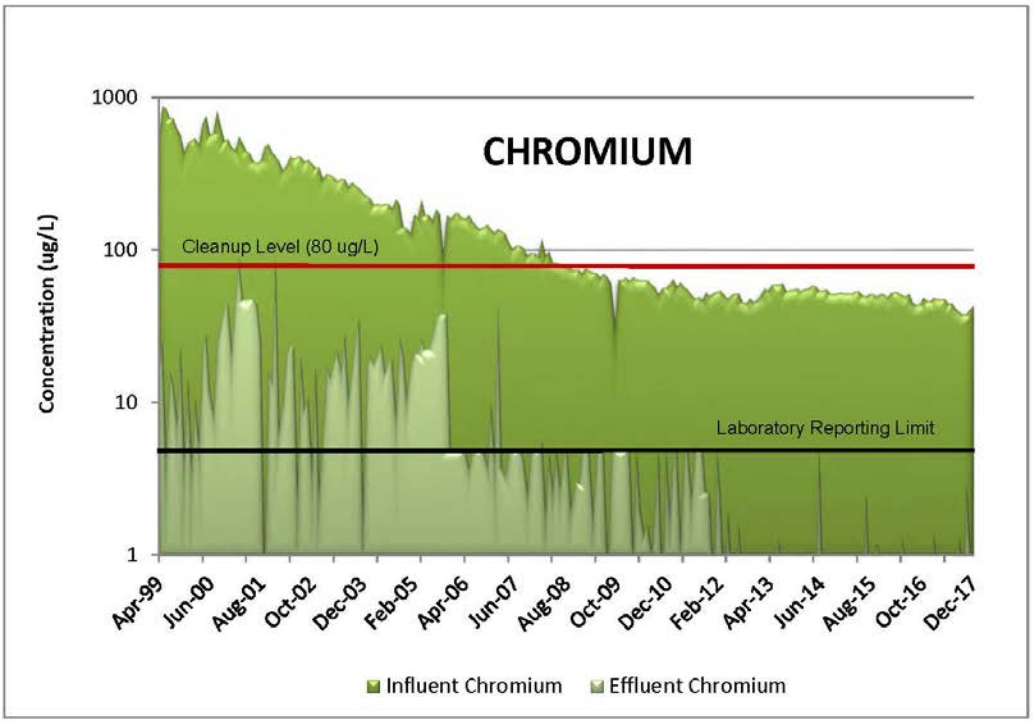
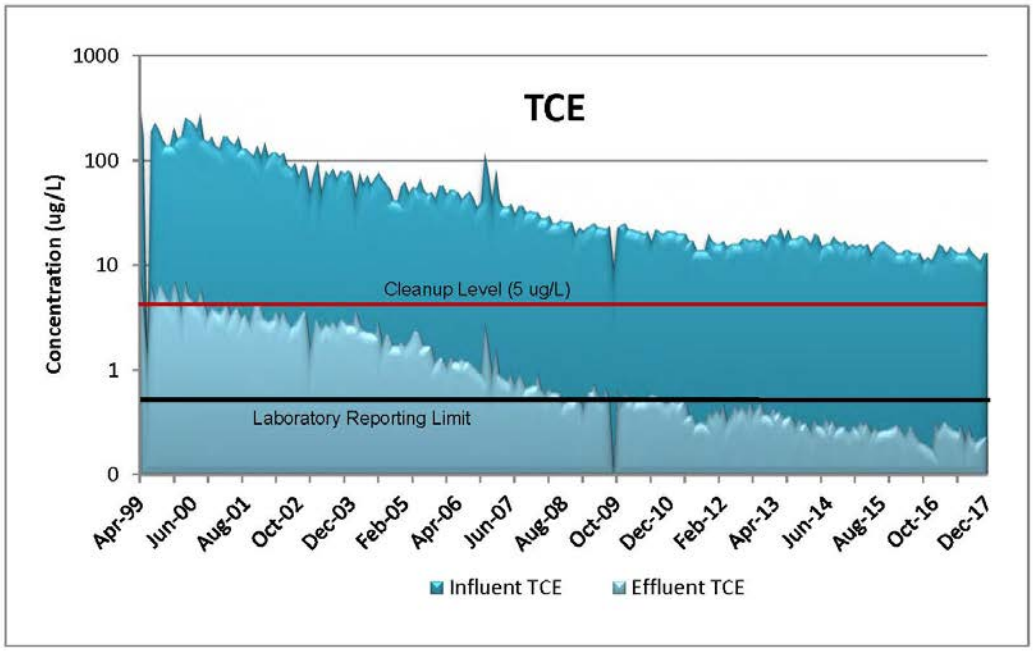


Figure C-10: Chromium and TCE Influent and Effluent Concentrations, 1999-2017





APPENDIX D – PRESS NOTICE

3 NE Hazel Dell Neighborhood Association

Meeting Guest Speakers for June Meeting

Our guest speakers have some great information to share with neighbors at our neighborhood association meetings scheduled on third Tuesday's from 7 - 9 PM at the Clark County Public Works Operations Center at 4700 NE 78th Street.

Tuesday June 19th, 2018:

7:30 PM to 8:00 PM – Vancouver Housing Authority
Leah Greenwood, Director of Property and Assets Manager.

8:00 PM to 8:30 PM – SW Washington Workforce Development Council
Miriam Martin, Manager - Youth Initiatives
Melissa Boles, Manager - Industry Initiatives

Boomsnub-Airco Superfund Site

Soil and groundwater contamination at the Boomsnub-Airco Superfund Site resulted from disposal of chrome-plating wastes, and solvents such as trichloroethylene (TCE), into dry wells. Chromium and volatile organic compounds (VOCs) seeped into the upper aquifer, and contaminated groundwater spread westward to form a cigar-shaped plume. As of 1995, the contaminated groundwater plume extended nearly a mile beneath the current Clark County recreational complex, the adjoining Church of God property, and at least as far west as the Bonneville Power Administration right-of-way.

Over the past twenty years, groundwater contamination has been greatly reduced through removal of the most contaminated soil, treatment in place of some contaminated soil, and continuous extraction and treatment of contaminated groundwater. The plume is now far less concentrated, and smaller, extending about a thousand feet from the source areas.

Extraction and treatment of contaminated groundwater, and associated monitoring of groundwater quality, is on-going and will continue until federal and state drinking water quality standards are met. As groundwater reaches these cleanup levels, infrastructure will be removed from the overlying properties.

Remedial action at the site is being performed by the Linde Corporation under U.S. Environmental Protection Agency (EPA) supervision. The governing legal agreement also requires Linde to reimburse EPA for its regulatory oversight costs.

EPA reviews Superfund sites every five years to assess cleanup progress and identify any additional actions that might be needed. The 2018 review is now underway and scheduled to be completed by September. As part of the review, EPA would like to hear from the community.

If you have concerns, questions, or information helpful to the review team please contact Jonathan Williams, EPA Remedial Project Manager, at 206-553-1369 or williams.jonathan@epa.gov .

For more information visit the EPA site page at: https://www.epa.gov/superfund/boomsnub-airco

10 Ways to Prevent Elder Abuse

1- Talk - with trusted family members, friends and professionals to help plan your or a loved one's future.
2- Be Cautious - if something doesn't feel right, listen to your gut.
3- Stay Connected - keep in touch with others regularly.
4- Engage - in an activity that you or a loved one enjoys or try a new one together.
5- Volunteer - with a social organization that works with seniors (like RSVP) or one that provides services for seniors (like Meals On Wheels).
6- Do A Wellness Check - stop by or pick up the phone to see how a

APPENDIX E – INTERVIEW FORMS

Boomsnub/Airco Superfund Site — Five-Year Review Interview Form

Site Name: Boomsnub/Airco **EPA ID No.:** WAD009624453

Interviewer Name: Hagai Nassau **Affiliation:** Skeo
Subject Name: Mohsen Kourehdar **Affiliation:** Washington State Department of Ecology

Time: 10:30 am Pacific Time **Date:** 4/20/2018

Interview Format (circle one): In Person **Phone** Mail Other:

Interview Category: State Agency

1. What is your overall impression of the project, including cleanup, maintenance and reuse activities (as appropriate)?

   Overall, I have a very good impression of the project. Looking at the 1994 TCE and chromium plume sizes, there has been excellent progress in shrinking the plumes. But there is still more work to be done.

2. What is your assessment of the current performance of the remedy in place at the Site?

   I think conducting in situ treatment is a good idea, while continuing to operate the groundwater pump-and-treat system.

3. Are you aware of any complaints or inquiries regarding site-related environmental issues or remedial activities from residents in the past five years?

   No.

4. Has your office conducted any site-related activities or communications in the past five years? If so, please describe the purpose and results of these activities.

   I talk to the EPA project manager occasionally. I have not communicated with community members about the Site in the past five years.

5. Are you aware of any changes to state laws that might affect the protectiveness of the Site's remedy?

   No.

6. Are you comfortable with the status of the institutional controls at the Site? If not, what are the associated outstanding issues?

   I am not aware of any problems; however, I have not been to the Site in the past five years.

7. Are you aware of any changes in projected land use(s) at the Site?

   No. [Discussed status of proposed Padden Parkway Business Park.]

8. Do you have any comments, suggestions or recommendations regarding the management or operation of the Site's remedy?

   I would suggest that EPA further delineate the Northern Plume; I think they are already doing that to some extent.

9. Do you consent to have your name included along with your responses to this questionnaire in the FYR report?

   Yes.

Boomsnub/Airco Superfund Site — Five-Year Review Interview Form

Site Name: Boomsnub/Airco **EPA ID No.:** WAD009624453

Interviewer Name: Hagai Nassau **Affiliation:** Skeo
Subject Name: Bryan DeDoncker **Affiliation:** Clark County Public Health, Hazard Assessment Program

Time: 11:00 am Pacific Time **Date:** 4/27/2018

Interview Format (circle one): In Person **Phone** Mail Other:

Interview Category: Local Government

1. Are you aware of the former environmental issues at the Site and the cleanup activities that have taken place to date?

   I am generally familiar with the Site's history. I am the most appropriate county employee to interview about the Site's environmental cleanup.

2. Do you feel well-informed regarding the Site's activities and remedial progress? If not, how might EPA convey site-related information in the future?

   I am not routinely notified about the Site's status; I would like to change that because Clark County Public Health plays a vital role in notifying the community about public health concerns. Clark County Public Health also issues well site approvals for drinking water wells and irrigation wells. Someone who wants to install a well has to apply for permission from the county. We consider criteria like setback from septic. Minimal water testing is required (fecal coliform, nitrate, arsenic). I am currently creating a process to determine where there is contamination, to improve the well permitting process. At this time, the well permitting process would not necessarily prevent wells from being installed in areas with groundwater contamination. I don't think we would approve a drinking water well to be installed where public water is available.

   I would like to be regularly informed about all Superfund sites in the county. We get a lot of calls from the public about sites, but I haven't received any calls from the public about this Site in the past couple years. It would be good to be copied on report submittals. I would like to know whether private wells near the Site were sampled, and whether property owners were notified about testing results. It would also be good to know when EPA is reaching out to the community, so that the county can coordinate its communication with the public.

3. Have there been any problems with unusual or unexpected activities at the Site, such as emergency response, vandalism or trespassing?

   I am not aware of any.

4. Are you aware of any changes to state laws or local regulations that might affect the protectiveness of the Site's remedy?

   I am not aware of any.

5. Are you aware of any changes in projected land use(s) at the Site?

   I am not aware of any. [We discussed the proposed development projects that EPA is aware of near the Site: the Padden Parkway Business Park and the proposed redevelopment of the Bennett property.]

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

   As the local public health agency, we would like to be aware of cleanup activities at the Site (and at all sites in the county). We would also like to coordinate public messaging about cleanup sites with EPA. We would like to build a better partnership with EPA.

7. Do you consent to have your name included along with your responses to this questionnaire in the FYR report?

   Yes.

Boomsnub/Airco Superfund Site — Five-Year Review Interview Form

Site Name: Boomsnub/Airco **EPA ID No.:** WAD009624453

Interviewer Name: Hagai Nassau **Affiliation:** Skeo
Subject Name: Withheld for privacy **Affiliation:** Representative of Linde
Time: 9:35 am Eastern Time **Date:** 4/25/2018
Interview Location: via email

Interview Format (circle one): In Person Phone Mail Other: email

Interview Category: Potentially Responsible Parties (PRPs)

1. What is your overall impression of the remedial activities at the Site?

   The remedial activities have been very successful at reducing both the extent and magnitude of contamination. The activities continue to meet regulatory requirements and protect human health and the environment.

2. What have been the effects of this Site on the surrounding community, if any?

   The area surrounding the site continues to be a vibrant, thriving community therefore, it appears the Site has not adversely impacted the community.

3. What is your assessment of the current performance of the remedy in place at the Site? In particular, what is your impression of the effectiveness of the groundwater extraction and treatment system?

   The remedy continues to effectively control and remediate the groundwater plume. Recovered groundwater is effectively treated before it is reinjected to the subsurface.

4. The 2013 FYR recommended continued monitoring of the Northern Plume. Can you describe what work has been done over the past five years?

   During the last five years, annual monitoring of a subset of wells identified as impacted by the Northern Plume has been sampled and the results have been reported to the Agency.

5. Are you aware of any complaints or inquiries regarding environmental issues or the remedial action from residents since implementation of the cleanup?

   The only inquiries I am aware of are from one property owner regarding how much longer monitoring would be needed. The monitoring on that owner's property has ended and the wells removed.

6. Do you feel well-informed regarding the Site's activities and remedial progress? If not, how might EPA convey site-related information in the future?

   Yes, Linde is well informed.

7. Does Linde continue to send groundwater sampling results to property owners?

   Results are provided as required by the agreement with the Agency.

8. Have access agreements and restrictive covenants been implemented for remaining high priority properties with groundwater extraction system infrastructure, as recommended in the 2013 FYR?

   A site access agreement was negotiated with Clark County for groundwater monitoring and infrastructure access and maintenance.

9. Do you have any comments, suggestions or recommendations regarding the management or operation of the Site's remedy?

   Linde has no comments, suggestions, or recommendations.

10. Do you consent to have your name included along with your responses to this questionnaire in the FYR report?

    No. [Ok to include responses in the report, but not name.]

Boomsnub/Airco Superfund Site — Five-Year Review Interview Form

Site Name: Boomsnub/Airco **EPA ID No.:** WAD009624453

Interviewer Name: Hagai Nassau **Affiliation:** Skeo
Subject Name: Jil Frain **Affiliation:** EA Engineering, Science, and Technology, Inc., PBC
Time: **Date:** 4/18/2018
Interview Location: via email

Interview Format (circle one): In Person Phone Mail **Other: email**

Interview Category: O&M Contractor

1. What is your overall impression of the project, including cleanup, maintenance and reuse activities (as appropriate)?

   Operations and monitoring of the plume are proceeding as required in the consent decree, with significant reductions in contaminant mass.

2. What is your assessment of the current performance of the groundwater extraction and treatment system in place at the Site?

   System continues to perform well, removing VOCs and Chromium from groundwater.

3. What are the findings from the monitoring data? What are the key trends in contaminant levels that are being documented over time at the Site?

   Contaminant levels continue to decline. Northern plume, contamination not associated with the Boomsnub Site, has encroached on the Boomsnub plume through operation of the extraction system.

4. Is there a continuous on-site O&M presence? If so, please describe staff responsibilities and activities. Alternatively, please describe staff responsibilities and the frequency of site inspections and activities if there is not a continuous on-site O&M presence.

   Operator has an office on the former Boomsnub property, and is onsite the majority of a work week. He is responsible for maintaining system operations to a minimum 90% availability, sampling system influent and effluent, inspecting wells, vaults, and treatment system infrastructure, responding to requests from property owners and utility locate requests, monitoring well sampling.

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

   No.

6. Have there been unexpected O&M difficulties or costs at the Site since start-up or in the last five years? If so, please provide details.

   Due to high water levels, water intrusion into the control vaults has shut the system down more frequently than desired. We have worked to re-grout problem vaults to minimize intrusion.

7. Have there been opportunities to optimize O&M activities or sampling efforts? Please describe changes and any resulting or desired cost savings or improved efficiencies.

   Major system optimization activities were conducted prior to 2013, leaving fewer opportunities during this review cycle. Annual review of monitoring data provides opportunities to optimize sampling strategy, and closure and decommission of downgradient wells and vaults has reduced maintenance requirements.

8. The 2013 FYR recommended the development of a groundwater exit strategy for in-well stripping wells consistent with EPA guidance. Can you describe how this occurred?

   System operations were discontinued upon consultation with EPA when monitoring data showed that removal rates were too low to show measurable removal rates. Up to that point, over 98% of VOC mass had been removed.

9. Do you have any comments, suggestions or recommendations regarding O&M activities and schedules at the Site?

   No.

10. Can you provide O&M costs for the last five years (per year)?

    No.

11. Do you consent to have your name included along with your responses to this questionnaire in the FYR report?

    Yes. But no contact information.

Boomsnub/Airco Superfund Site — Five-Year Review Interview Form

Site Name: Boomsnub/Airco **EPA ID No.:** WAD009624453

Interviewer Name: Jo Gallaher and Jonathan Williams **Affiliation:** EPA

Subject Name: Withheld for privacy **Affiliation:** President, Northeast Hazel Dell Neighborhood Association

Time: 8:00 am **Date:** 4/18/2018

Interview Location: Conference call

Interview Format (circle one): In Person **Phone** Mail Other:

Interview Category: Residents

EPA: EPA is currently conducting a five-year review for the Site, so we encourage community members to contact us with any concerns about the Site. What is the best way for EPA to get information about the Site to nearby residents?

Interviewee: The Northeast Hazel Dell Neighborhood Association's newsletter is the best way, short of going door to door. The next newsletter will go out in early to mid-May; it is mailed to all property owners in the Neighborhood Association's area. The county provides mailing for the newsletter. Please provide a quarter-page blurb about the Site with EPA contact information if residents want to learn more; I will include it in the newsletter. I also have an email list of about 400 community members; I could forward them the information that EPA sent me about the Site.

The local newspaper (*Daily Columbian*) is not widely subscribed to. Another nearby newspaper is the *Reflector*, based in Battle Ground, Washington. The Clark County Live website is another good avenue.

At the Neighborhood Association meeting last night, I presented the information that EPA sent me about the Site. About 15 residents were at the meeting, a mix of longtime residents and newcomers. We talked about the Site for about 20 minutes. Most people weren't aware of the Site. The entire plume is within the boundaries of the Northeast Hazel Dell Neighborhood Association.

EPA: Thank you; we will send you a brief site update to include in the newsletter.

Interviewee: There has been a lot of growth in the area: homes, a sports park. A business park has been proposed. Before the Luke Jensen Sports Park was built near the Site, someone from EPA came and talked about the Site's cleanup status.

EPA: As development continues, EPA wants to ensure that the cleanup infrastructure is protected. EPA has been in contact with Clark County planner Jan Bazala to ensure that the county is aware of the need to keep the cleanup project in mind as development continues.

Interviewee: From the information you sent, it looks like the plume has retreated significantly.

EPA: We have seen a tremendous reduction in groundwater contamination. The chromium plume especially has retreated a lot. The TCE plume is still more extensive. The next step is to use in situ treatment to address residual contamination in fine-grained soil. This technique will use a chemical reaction to reduce TCE to chlorine and carbon dioxide. The responsible party (Linde) is motivated to address the groundwater contamination as quickly as possible. The partners at this Site have been very cooperative.

Interviewee: Is EPA maintaining a wide array of monitoring wells to see if contamination re-emerges?

EPA: The groundwater extraction and treatment system is pumping at a rate that draws groundwater toward the wells. We still have monitoring wells in places where the plume used to be; they now meet drinking water standards. After a well meets the required standards over eight consecutive episodes of sampling, then EPA considers cleanup complete at that location and the cleanup infrastructure can be removed from that location. We have done that at two properties so far (Bonneville Power Administration and an adjacent parcel between Bonneville Power Administration and the Church of God).

The sources of contamination have been addressed, so there is no ongoing contribution of contamination to the groundwater.

Interviewee: A previous EPA project manager said that the groundwater pump-and-treat system would have to keep working forever.

EPA: Back then, people didn't know how long it would take to clean up the groundwater. This Site is a positive story, thanks to the removal of the sources of contamination.

APPENDIX F – SITE INSPECTION CHECKLIST

FIVE-YEAR REVIEW SITE INSPECTION CHECKLIST

I. SITE INFORMATION

Site Name: Boomsnub/Airco	**Date of Inspection:** 4/5/2018
Location and Region: Hazel Dell, WA; Region 10	**EPA ID:** WAD009624453
Agency, Office or Company Leading the Five-Year Review: EPA Region 10	**Weather/Temperature:** rainy, about 50°F

Remedy Includes: (Check all that apply)

- ☐ Landfill cover/containment
- ☒ Access controls
- ☒ Institutional controls
- ☒ Groundwater pump and treatment
- ☐ Surface water collection and treatment
- ☒ Other: excavation and disposal of contaminated soil
- ☐ Monitored natural attenuation
- ☐ Groundwater containment
- ☐ Vertical barrier walls

Attachments: ☒ Inspection team roster attached ☐ Site map attached

II. INTERVIEWS (check all that apply)

1. **O&M Site Manager** Jil Frain (Name) | project manager with EA (Title) | 04/18/2018 (Date)
   Interviewed ☐ at site ☐ at office ☐ by phone Phone: _____
   Problems, suggestions ☐ Report attached: see Appendix E

2. **O&M Staff** _____ (Name) | _____ (Title) | _____ (Date)
   Interviewed ☐ at site ☐ at office ☐ by phone Phone: _____
   Problems/suggestions ☐ Report attached: _____

3. **Local Regulatory Authorities and Response Agencies** (i.e., state and tribal offices, emergency response office, police department, office of public health or environmental health, zoning office, recorder of deeds, or other city and county offices). Fill in all that apply.

   Agency Washington State Department of Ecology
   Contact Mohsen Kourehdar (Name) | project manager (Title) | 04/20/2018 (Date) | _____ (Phone No.)
   Problems/suggestions ☐ Report attached: see Appendix E

   Agency Clark County Public Health
   Contact Bryan DeDoncker (Name) | Environmental Health Specialist II (Title) | 04/27/2018 (Date) | _____ (Phone No.)
   Problems/suggestions ☐ Report attached: see Appendix E

   Agency _____
   Contact _____ (Name) | _____ (Title) | _____ (Date) | _____ (Phone No.)
   Problems/suggestions ☐ Report attached: _____

   Agency _____
   Contact _____ (Name) | _____ (Title) | _____ (Date) | _____ (Phone No.)
   Problems/suggestions ☐ Report attached: _____

   Agency _____

Contact	Name	Title	Date	Phone No.
Problems/suggestions ☐ Report attached:				
4. **Other Interviews** (optional) ☐ Report attached: see Appendix E				
Representative of Linde				
President of Northeast Hazel Dell Neighborhood Association				
III. ON-SITE DOCUMENTS AND RECORDS VERIFIED (check all that apply)				
1. **O&M Documents**				
☒ O&M manual	☒ Readily available	☒ Up to date	☐ N/A	
☐ As-built drawings	☐ Readily available	☐ Up to date	☒ N/A	
☒ Maintenance logs	☒ Readily available	☒ Up to date	☐ N/A	
Remarks:				
2. **Site-Specific Health and Safety Plan**	☐ Readily available	☐ Up to date	☒ N/A	
☐ Contingency plan/emergency response plan	☐ Readily available	☐ Up to date	☒ N/A	
Remarks:				
3. **O&M and OSHA Training Records**	☐ Readily available	☐ Up to date	☒ N/A	
Remarks:				
4. **Permits and Service Agreements**				
☐ Air discharge permit	☐ Readily available	☐ Up to date	☒ N/A	
☐ Effluent discharge	☒ Readily available	☒ Up to date	☐ N/A	
☐ Waste disposal, POTW	☒ Readily available	☒ Up to date	☐ N/A	
☐ Other permits:	☐ Readily available	☐ Up to date	☒ N/A	
Remarks:				
5. **Gas Generation Records**	☐ Readily available	☐ Up to date	☒ N/A	
Remarks:				
6. **Settlement Monument Records**	☐ Readily available	☐ Up to date	☒ N/A	
Remarks:				
7. **Groundwater Monitoring Records**	☒ Readily available	☒ Up to date	☐ N/A	
Remarks:				
8. **Leachate Extraction Records**	☐ Readily available	☐ Up to date	☒ N/A	
Remarks:				
9. **Discharge Compliance Records**				
☒ Air	☒ Readily available	☒ Up to date	☐ N/A	
☒ Water (effluent)	☒ Readily available	☒ Up to date	☐ N/A	
Remarks:				

10. **Daily Access/Security Logs** ☐ Readily available ☐ Up to date ☒ N/A

Remarks: _____

IV. O&M COSTS

1. **O&M Organization**

☐ State in-house ☐ Contractor for state

☐ PRP in-house ☒ Contractor for PRP

☐ Federal facility in-house ☐ Contractor for Federal facility

☐ _____

2. **O&M Cost Records**

☐ Readily available ☐ Up to date

☒ Funding mechanism/agreement in place ☒ Unavailable

Original O&M cost estimate: _____ ☐ Breakdown attached

Total annual cost by year for review period if available

From: _____ To: _____ _____ ☐ Breakdown attached
Date Date Total cost

From: _____ To: _____ _____ ☐ Breakdown attached
Date Date Total cost

From: _____ To: _____ _____ ☐ Breakdown attached
Date Date Total cost

From: _____ To: _____ _____ ☐ Breakdown attached
Date Date Total cost

From: _____ To: _____ _____ ☐ Breakdown attached
Date Date Total cost

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

Describe costs and reasons: _____

V. ACCESS AND INSTITUTIONAL CONTROLS ☒ Applicable ☐ N/A

A. Fencing

1. **Fencing Damaged** ☐ Location shown on site map ☒ Gates secured ☒ N/A

Remarks: _____

B. Other Access Restrictions

1. **Signs and Other Security Measures** ☐ Location shown on site map ☐ N/A

Remarks: Superfund signs are present on Boomsnub property

C. Institutional Controls (ICs)

1. **Implementation and Enforcement**

Site conditions imply ICs not properly implemented ☐ Yes ☒ No ☐ N/A

Site conditions imply ICs not being fully enforced ☐ Yes ☒ No ☐ N/A

Type of monitoring (e.g., self-reporting, drive by): EPA five-year reviews

Frequency: every five years

Responsible party/agency: EPA

Contact _____ _____ _____ _____

Name Title Date Phone no.

Reporting is up to date ☐ Yes ☐ No ☒ N/A

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

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

Violations have been reported ☐ Yes ☒ No ☐ N/A

Other problems or suggestions: ☐ Report attached

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

Remarks: Still need groundwater use restrictions for some parcels. Boomsnub property needs ICs to restrict land use to industrial or commercial uses, to prohibit disturbing soil deeper than 15 feet, and to evaluate the potential for vapor intrusion before occupying buildings on the property.

D. General

1. **Vandalism/Trespassing** ☐ Location shown on site map ☒ No vandalism evident

Remarks: _____

2. **Land Use Changes On Site** ☒ N/A

Remarks: _____

3. **Land Use Changes Off Site** ☐ N/A

Remarks: Nearby property above plume is being developed as a business park

VI. GENERAL SITE CONDITIONS

A. Roads ☒ Applicable ☐ N/A

1. **Roads Damaged** ☐ Location shown on site map ☒ Roads adequate ☐ N/A

Remarks: _____

B. Other Site Conditions

Remarks: _____

VII. LANDFILL COVERS ☐ Applicable ☒ N/A

A. Landfill Surface

1. **Settlement** (low spots) ☐ Location shown on site map ☐ Settlement not evident

Area extent: _____ Depth: _____

Remarks: _____

2.	**Cracks**	☐ Location shown on site map	☐ Cracking not evident
	Lengths: _____	Widths: _____	Depths: _____
	Remarks: _____		
3.	**Erosion**	☐ Location shown on site map	☐ Erosion not evident
	Area extent: _____		Depth: _____
	Remarks: _____		
4.	**Holes**	☐ Location shown on site map	☐ Holes not evident
	Area extent: _____		Depth: _____
	Remarks: _____		
5.	**Vegetative Cover**	☐ Grass	☐ Cover properly established
	☐ No signs of stress	☐ Trees/shrubs (indicate size and locations on a diagram)	
	Remarks: _____		
6.	**Alternative Cover** (e.g., armored rock, concrete)		☐ N/A
	Remarks: _____		
7.	**Bulges**	☐ Location shown on site map	☐ Bulges not evident
	Area extent: _____		Height: _____
	Remarks: _____		
8.	**Wet Areas/Water Damage**	☐ Wet areas/water damage not evident	
	☐ Wet areas	☐ Location shown on site map	Area extent: _____
	☐ Ponding	☐ Location shown on site map	Area extent: _____
	☐ Seeps	☐ Location shown on site map	Area extent: _____
	☐ Soft subgrade	☐ Location shown on site map	Area extent: _____
	Remarks: _____		
9.	**Slope Instability**	☐ Slides	☐ Location shown on site map
	☐ No evidence of slope instability		
	Area extent: _____		
	Remarks: _____		
B. Benches		☐ Applicable	☐ N/A
	(Horizontally constructed mounds of earth placed across a steep landfill side slope to interrupt the slope in order to slow down the velocity of surface runoff and intercept and convey the runoff to a lined channel.)		
1.	**Flows Bypass Bench**	☐ Location shown on site map	☐ N/A or okay
	Remarks: _____		
2.	**Bench Breached**	☐ Location shown on site map	☐ N/A or okay
	Remarks: _____		
3.	**Bench Overtopped**	☐ Location shown on site map	☐ N/A or okay
	Remarks: _____		

C. Letdown Channels ☐ Applicable ☐ N/A

(Channel lined with erosion control mats, riprap, grout bags or gabions that descend down the steep side slope of the cover and will allow the runoff water collected by the benches to move off of the landfill cover without creating erosion gullies.)

1. **Settlement** (Low spots) ☐ Location shown on site map ☐ No evidence of settlement
   Area extent: _____ Depth: _____
   Remarks: _____

2. **Material Degradation** ☐ Location shown on site map ☐ No evidence of degradation
   Material type:_____ Area extent: _____
   Remarks: _____

3. **Erosion** ☐ Location shown on site map ☐ No evidence of erosion
   Area extent: _____ Depth: _____
   Remarks: _____

4. **Undercutting** ☐ Location shown on site map ☐ No evidence of undercutting
   Area extent: _____ Depth: _____
   Remarks: _____

5. **Obstructions** Type: _____ ☐ No obstructions
   ☐ Location shown on site map Area extent: _____
   Size: _____
   Remarks: _____

6. **Excessive Vegetative Growth** Type: _____
   ☐ No evidence of excessive growth
   ☐ Vegetation in channels does not obstruct flow
   ☐ Location shown on site map Area extent: _____
   Remarks: _____

D. Cover Penetrations ☐ Applicable ☐ N/A

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

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

3. **Monitoring Wells** (within surface area of landfill)

☐ Properly secured/locked ☐ Functioning ☐ Routinely sampled ☐ Good condition

☐ Evidence of leakage at penetration ☐ Needs maintenance ☐ N/A

Remarks: _____

4. **Extraction Wells Leachate**

☐ Properly secured/locked ☐ Functioning ☐ Routinely sampled ☐ Good condition

☐ Evidence of leakage at penetration ☐ Needs maintenance ☐ N/A

Remarks: _____

5. **Settlement Monuments** ☐ Located ☐ Routinely surveyed ☐ N/A

Remarks: _____

E. Gas Collection and Treatment ☐ Applicable ☐ N/A

1. **Gas Treatment Facilities**

☐ Flaring ☐ Thermal destruction ☐ Collection for reuse

☐ Good condition ☐ Needs maintenance

Remarks: _____

2. **Gas Collection Wells, Manifolds and Piping**

☐ Good condition ☐ Needs maintenance

Remarks: _____

3. **Gas Monitoring Facilities** (e.g., gas monitoring of adjacent homes or buildings)

☐ Good condition ☐ Needs maintenance ☐ N/A

Remarks: _____

F. Cover Drainage Layer ☐ Applicable ☐ N/A

1. **Outlet Pipes Inspected** ☐ Functioning ☐ N/A

Remarks: _____

2. **Outlet Rock Inspected** ☐ Functioning ☐ N/A

Remarks: _____

G. Detention/Sedimentation Ponds ☐ Applicable ☐ N/A

1. **Siltation** Area extent: _____ Depth: _____ ☐ N/A

☐ Siltation not evident

Remarks: _____

2. **Erosion** Area extent: _____ Depth: _____

☐ Erosion not evident

Remarks: _____

3. **Outlet Works** ☐ Functioning ☐ N/A

Remarks: _____

4. **Dam** ☐ Functioning ☐ N/A

Remarks: _____

H. Retaining Walls ☐ Applicable ☐ N/A

1. **Deformations** ☐ Location shown on site map ☐ Deformation not evident

Horizontal displacement: _____ Vertical displacement: _____

Rotational displacement: _____

Remarks: _____

2. **Degradation** ☐ Location shown on site map ☐ Degradation not evident

Remarks: _____

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

1. **Siltation** ☐ Location shown on site map ☐ Siltation not evident

Area extent: _____ Depth: _____

Remarks: _____

2. **Vegetative Growth** ☐ Location shown on site map ☐ N/A

☐ Vegetation does not impede flow

Area extent: _____ Type: _____

Remarks: _____

3. **Erosion** ☐ Location shown on site map ☐ Erosion not evident

Area extent: _____ Depth: _____

Remarks: _____

4. **Discharge Structure** ☐ Functioning ☐ N/A

Remarks: _____

VIII. VERTICAL BARRIER WALLS ☐ Applicable ☒ N/A

1. **Settlement** ☐ Location shown on site map ☐ Settlement not evident

Area extent: _____ Depth: _____

Remarks: _____

2. **Performance Monitoring** Type of monitoring: _____

☐ Performance not monitored

Frequency: _____ ☐ Evidence of breaching

Head differential: _____

Remarks: _____

IX. GROUNDWATER/SURFACE WATER REMEDIES ☒ Applicable ☐ N/A

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

1. **Pumps, Wellhead Plumbing and Electrical**

☒ Good condition ☒ All required wells properly operating ☐ Needs maintenance ☐ N/A

Remarks: _____

2. **Extraction System Pipelines, Valves, Valve Boxes and Other Appurtenances**

☒ Good condition ☐ Needs maintenance

Remarks: _____

3. **Spare Parts and Equipment**

☒ Readily available ☒ Good condition ☐ Requires upgrade ☐ Needs to be provided

Remarks: _____

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

1. **Collection Structures, Pumps and Electrical**

☐ Good condition ☐ Needs maintenance

Remarks: _____

2. **Surface Water Collection System Pipelines, Valves, Valve Boxes and Other Appurtenances**

☐ Good condition ☐ Needs maintenance

Remarks: _____

3. **Spare Parts and Equipment**

☐ Readily available ☐ Good condition ☐ Requires upgrade ☐ Needs to be provided

Remarks: _____

C. Treatment System ☒ Applicable ☐ N/A

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

☒ Metals removal ☐ Oil/water separation ☐ Bioremediation

☒ Air stripping ☒ Carbon adsorbers

☐ Filters: _____

☐ Additive (e.g., chelation agent, flocculent): _____

☐ Others: _____

☒ Good condition ☐ Needs maintenance

☒ Sampling ports properly marked and functional

☐ Sampling/maintenance log displayed and up to date

☒ Equipment properly identified

☒ Quantity of groundwater treated annually: 67 million gallons in 2017

☐ Quantity of surface water treated annually: _____

Remarks: _____

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

☐ N/A ☒ Good condition ☐ Needs maintenance

Remarks: _____

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

☐ N/A ☒ Good condition ☒ Proper secondary containment ☐ Needs maintenance

Remarks: _____

4. **Discharge Structure and Appurtenances**

☐ N/A ☒ Good condition ☐ Needs maintenance

Remarks: _____

5. **Treatment Building(s)**

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

☒ Chemicals and equipment properly stored

Remarks: _____

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

☒ Properly secured/locked ☒ Functioning ☒ Routinely sampled ☒ Good condition

☐ All required wells located ☐ Needs maintenance ☐ N/A

Remarks: _____

D. Monitoring Data

1. **Monitoring Data**

☒ Is routinely submitted on time ☒ Is of acceptable quality

2. **Monitoring Data Suggests:**

☒ Groundwater plume is effectively contained ☒ Contaminant concentrations are declining

E. Monitored Natural Attenuation

1. **Monitoring Wells** (natural attenuation remedy)

☐ Properly secured/locked ☐ Functioning ☐ Routinely sampled ☐ Good condition

☐ All required wells located ☐ Needs maintenance ☒ N/A

Remarks: _____

X. OTHER REMEDIES

If there are remedies applied at the site and not covered above, attach an inspection sheet describing the physical nature and condition of any facility associated with the remedy. An example would be soil vapor extraction.

XI. OVERALL OBSERVATIONS

A. Implementation of the Remedy

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

The purpose of the remedy is to restore groundwater to drinking water standards and to prevent exposure to soil and groundwater contamination. The remedy is effective and functioning as designed. Contaminated soil was removed from the Boomsnub property; remaining soil contamination will be removed after the groundwater treatment plant is removed. Over 97 percent of the VOC source mass was removed from the Linde property; remaining hot spots may be addressed using in situ treatments. The groundwater extraction and treatment system continues to effectively remove chromium and VOCs from the groundwater. The system has greatly reduced the sizes of the chromium and TCE plumes in the alluvial aquifer since 1995.

B. Adequacy of O&M

Describe issues and observations related to the implementation and scope of O&M procedures. In particular, discuss their relationship to the current and long-term protectiveness of the remedy.

Linde's contractor continues to properly operate and maintain the groundwater extraction and treatment system. Extraction system components have been removed or modified to accommodate off-site property development.

C.	Early Indicators of Potential Remedy Problems
	Describe issues and observations such as unexpected changes in the cost or scope of O&M or a high frequency of unscheduled repairs that suggest that the protectiveness of the remedy may be compromised in the future. None identified
D.	**Opportunities for Optimization**
	Describe possible opportunities for optimization in monitoring tasks or the operation of the remedy. In situ treatment may be used in the future to address remaining hot spots of VOC contamination on the Linde property, as called for in the 2015 ESD.

Site inspection participants:
EPA RPM Jonathan Williams
EPA community involvement coordinator Jo Gallaher
EPA hydrogeologists Bernie Zavala and Lee Thomas
Hagai Nassau and Kelly MacDonald of EPA support contractor Skeo
Jil Frain and Rick Read of PRP contractor EA Engineering, Science and Technology
Dave Sordi of PRP representative BSI Group

APPENDIX G – SITE INSPECTION PHOTOS

Sign at Boomsnub property


Fenced entry to Boomsnub property

Infiltration gallery on Linde property

Monitoring well on Linde property

Soil vapor extraction and in-well stripping systems (now shut down) on Linde property

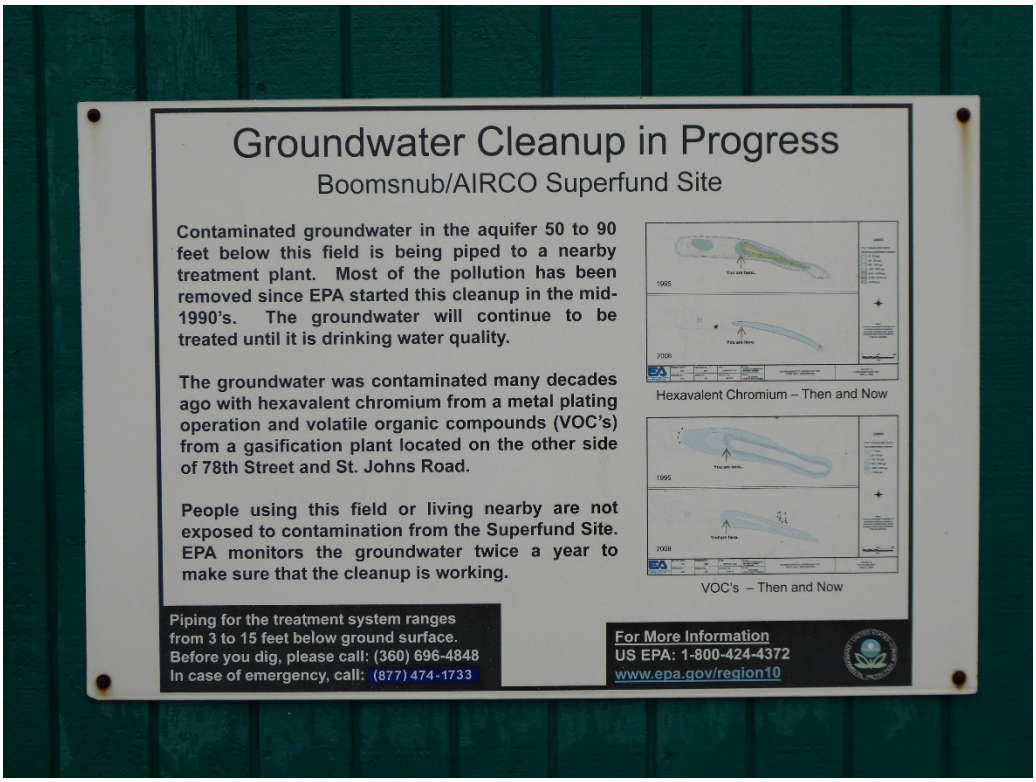
Extraction well PW-1

Air stripper

Ion exchange tanks

"For sale" sign on property under development as Padden Parkway Business Park


Property under development as Padden Parkway Business Park



Informational sign on shed near sports field at Church of God school

Containment vault CV-9

Monitoring well MW-16 under turf field at Luke Jensen Sports Park

Monitoring well MW-22D

APPENDIX H – ARAR REVIEW

CERCLA Section 121(d)(1) requires that Superfund remedial actions attain "a degree of cleanup of hazardous substance, pollutants, and contaminants released into the environment and of control of further release at a minimum which assures protection of human health and the environment." The remedial action must achieve a level of cleanup that at least attains those requirements that are legally applicable or relevant and appropriate. In performing the FYR for compliance with applicable or relevant and appropriate requirements (ARARs), only those ARARs that address the protectiveness of the remedy are reviewed.

Groundwater ARARs
According to the Site's 2000 ROD, the primary groundwater ARARs are:

- Federal MCLs.
- Washington State Model Toxics Control Act (MTCA) Method B groundwater cleanup standards.

This FYR compared the groundwater cleanup levels from the 2000 ROD against the current values of the federal MCLs and MTCA Method B standards (Table H-1). The current ARAR values for five COCs are more stringent than the cleanup levels established in the 2000 ROD; the ARAR value for one COC has become less stringent; and the ARAR values for six COCs have not changed.

Table H-1: Groundwater ARAR Review

COC	2000 ROD ARAR		Current ARAR (µg/L)		Comparison of Current ARAR Against 2000 ROD Cleanup Level
	Cleanup Level (µg/L)	Basis	Federal MCL[a]	MTCA B[b]	
Chromium VI (hexavalent)	80	MTCA B	no MCL	48	More stringent
Chromium (total)	100	MCL	100	N/A[c]	No change
Bromodichloromethane	1[d]	MTCA B	80[e]	0.706	More stringent
Carbon tetrachloride	1[d]	MTCA B	5	0.625	More stringent
1,2-Dibromo-3-chloropropane	0.2	MCL	0.2	N/A[c]	No change
Dibromochloromethane	1[d]	MTCA B	80[e]	0.521	More stringent
1,2-Dichloroethane	5	MCL	5	N/A[c]	No change
1,1-DCE	1[d]	MTCA B	7	400	Less stringent
Hexachlorobutadiene	5[d]	MTCA B	no MCL	0.561	More stringent
PCE	5	MCL	5	N/A[c]	No change
1,1,1-Trichloroethane	200	MCL	200	N/A[c]	No change
TCE	5	MCL	5	N/A[c]	No change

Notes:
µg/L – microgram per liter
a) Current MCLs are available at: https://www.epa.gov/ground-water-and-drinking-water/national-primary-drinking-water-regulations (accessed 4/27/2018). State MCLs were not identified as ARARs; Washington state MCLs are equal to Federal MCLs.
b) Current Washington state MTCA Method B groundwater cleanup standards are available at: https://fortress.wa.gov/ecy/clarc/CLARCDataTables.aspx (accessed 6/15/2018). Table presents more stringent of cancer or non-cancer standard (except for PCE and TCE, whose MTCA B values are given in Washington state's September 2012 CLARC Guidance at https://fortress.wa.gov/ecy/clarc/FocusSheets/CLARC%20guidance%20TCE%20PCE.pdf).
c) MTCA value is not applicable for this COC because the cleanup level was based on the MCL.
d) This cleanup level was set at the practical quantitation limit (PQL). The 2000 ROD established cleanup levels as the higher of the regulatory level or the PQL.
e) MCL for total trihalomethanes

Soil ARARs

The 2000 ROD selected some of the soil cleanup levels based on ARARs. Table H-2 compares the ARAR-based soil cleanup levels against the current ARARs. The ARAR for chromium VI has become more stringent since the 2000 ROD was issued; however, this change does not affect protectiveness because OU1 soil was cleaned up to a more stringent standard of 400 mg/kg total chromium. The ARAR for chromium III has become less stringent. The ARAR for lead has not changed.

See Appendix I for a screening-level risk review of the Site's one risk-based soil cleanup level.

Table H-2: Soil ARAR Review

COC	2000 ROD ARAR		Current ARAR		ARAR Change
	Cleanup Level (mg/kg)	Basis	ARAR (mg/kg)[a]	Basis	
Chromium VI (hexavalent)	17,500	MTCA C Industrial	10,500	MTCA C Industrial	More stringent
Chromium III	1,600	MTCA 100x groundwater standard[b]	2,400	MTCA 100x groundwater standard[c]	Less stringent
Lead	1,000	MTCA A Industrial[d]	1,000	MTCA A Industrial[d]	No change

Notes:
mg/kg – milligram per kilogram

a) Current Washington State MTCA cleanup standards are available at: https://fortress.wa.gov/ecy/clarc/CLARCDataTables.aspx (accessed 5/2/2018).
b) The soil cleanup level represents 100 times the MTCA groundwater cleanup level reported in the Ecology Cleanup Levels and Risk Calculations II database dated 2/28/96.
c) The most stringent current MTCA groundwater standard for chromium III is the Method B standard (24 milligrams per liter).
d) The MTCA Method A Industrial value for lead is shown (no Method C Industrial value exists for lead).

APPENDIX I – SCREENING-LEVEL RISK REVIEW

One of the remedial action objectives for OU1 is to prevent future workers from being exposed to lead and chromium in soils at levels above industrial cleanup standards. This FYR reviewed the Site's one risk-based OU1 soil cleanup level to determine whether it is still protective for industrial use (see Table I-1). The 400 mg/kg cleanup level for total chromium is within EPA's range of acceptable risk.

See Appendix H for a review of the Site's ARAR-based cleanup levels.

Table I-1: Screening-Level Risk Evaluation of Risk-Based OU1 Soil Cleanup Level

COC	2000 ROD Cleanup Level (mg/kg)	Screening Level for Industrial Land Use (mg/kg)[a]		Screening-Level Risk Evaluation	
		Cancer-Based	Noncancer-Based	Cancer Risk[b]	Noncancer HQ[c]
Chromium (total)	400	6.3[d]	3,500[d]	6. 3 × 10^{-5}	0.1

Notes:
mg/kg – milligram per kilogram
a) Current EPA screening levels, dated May 2018, are available at https://www.epa.gov/risk/regional-screening-levels-rsls-generic-tables (accessed 5/29/2018).
b) The cancer risk was calculated using the following equation, based on the fact that screening levels are derived based on 1 x 10^{-6} risk:
cancer risk = (cleanup level ÷ cancer-based screening level) × 10^{-6}.
c) The noncancer hazard quotient (HQ) was calculated using the following equation:
HQ = cleanup level ÷ noncancer-based screening level.
d) There is no screening level for total chromium. To be conservative, this evaluation uses the screening levels for chromium (VI).