Second Five-Year Review Report
For
Boomsnub/Airco Superfund Site
Clark County, Washington

Prepared by: US Army Corps of Engineers, Seattle District
Seattle, Washington

Prepared for: US Environmental Protection Agency, Region 10
Seattle, WA

24 September 2008

Five-Year Review Report

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For
Boomsnub/ Airco Superfund Site
City of Vancouver
Clark County, Washington

24 September 2008

PREPARED BY:

United States Army Corps of Engineers (USACE)
Seattle District
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Region 10
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Approved by: Date:

9/24/2008

Daniel D. Opalski, Director
Environmental Cleanup Office
U.S. Environmental Protection Agency, Region 10

Table of Contents

Table of Contents, Continued

Tables *(located within body of text)*

Figures *(located after end of text)*

Attachments *(located after end of text)*

Acronyms and Abbreviations

AOC	Administrative Order on Consent
ARARs	Applicable or Relevant and Appropriate Requirements
Boomsnub	Boomsnub Corporation
CD	Consent Decree
CERCLA	Comprehensive Environmental Response, Compensation, and Liability Act
CFR	Code of Federal Regulations
City	City of Vancouver
DCE	1, 1-dichloroethene
EA	EA Engineering, Science, and Technology, Inc.
Ecology	Washington State Department of Ecology
EPA	U.S. Environmental Protection Agency
FYR	Five-Year Review
GAC	Granular activated carbon
IAG	Interagency Agreement
IWS	In-Well Stripping
IX	Ion exchange
Linde	Formerly Airco, then BOC Gases, and currently Linde Group
LTMP	Long-Term Monitoring Plan
MTCA	Model Toxics Control Act
NCP	National Oil and Hazardous Substances Pollution Contingency Plan
NPL	National Priority List
O&M	Operations and Maintenance
OU	Operable Unit
PDT	Project Delivery Team
RAOs	Remedial Action Objectives
RCRA	Resource Conservation and Recovery Act
RI/FS	Remedial Investigation/Feasibility Study
ROD	Record of Decision
RPM	Remedial Project Manager
RSE	Remedial Systems Evaluation
SARA	Superfund Amendments and Reauthorization Act
Site	Boomsnub/Airco Superfund Site
SVE	Soil Vapor Extraction
TCE	Trichloroethene
TCLP	Toxicity Characteristic Leaching Procedure
TOPPS	Toe-of-Plume Pilot Study
µg/L	Micrograms per liter
$\mu g/m^3$	Micrograms per cubic meter
USACE	United States Army Corps of Engineers
VOC	Volatile organic compound
WAC	Washington Administrative Code

Executive Summary

The Boomsnub/Airco Site is located north of Vancouver in Hazel Dell, Washington. The site is approximately two miles east of Interstate 5 and one mile west of Interstate 205, near NE 78th Street and NE 47th Avenue (see Figure 1). The Linde facility, formerly known as BOC Gases and Airco, is an 11-acre, active gas production facility. Legal instruments such as the Consent Decree (CD) and Administrative Order on Consent (AOC) refer to BOC Gases instead of Linde. It is located across the street (47th) from the Boomsnub property. The site is divided into three operable units (OUs); Boomsnub soil is OU-1, BOC soil is OU-2, and site-wide groundwater is OU-3.

Chromium was identified in Boomsnub soils and groundwater by the Washington State Department of Ecology (Ecology) in the late 1980s. In 1991, during the course of the cleanup at Boomsnub, Ecology discovered VOCs in the groundwater. Over time, two major source areas were identified (OU-1 and OU-2). A groundwater extraction and treatment system was first installed in 1990. This extraction and treatment system has continuously operated since then, and has been expanded and upgraded under management by Boomsnub, Ecology, EPA and Linde.

In 1993, Ecology requested that the U.S. Environmental Protection Agency list the Site on the National Priorities List (NPL) because Ecology did not have the financial resources to continue cleanup at the Site. The site was listed on the NPL in April 1995.

The corrective actions taken at the site are excavation of chromium and lead-contaminated soils in OU-1, constructing *in-situ* soil and groundwater treatment systems to address the VOC source area in OU-2, constructing an extensive groundwater extraction network to capture the contaminated groundwater in OU-3, institutional controls in the form of public notice and long-term compliance monitoring for contaminated groundwater, and site access restrictions of the Boomsnub property for the duration of the pump and treat system's operation. In addition, restrictive covenants were executed to prevent persons from using the properties in any manner that would affect the protectiveness of the environmental cleanup and remediation activities for as long as these activities are being performed.

The ROD required treatment to reduce contaminant levels in the groundwater to or below cleanup standards with treatment performance levels for indicator chemicals based on federal Maximum Contaminant Levels (MCLs) and Washington State MTCA B standard. The area of attainment for the groundwater constituents of concern at the site is the entire groundwater plume in the alluvial aquifer. The area of attainment in the Upper Troutdale aquifer is the area defined by the existing monitoring wells screened within the Upper Troutdale aquifer at the site. Soil removal was effective at achieving industrial soil cleanup levels at the site as required in the ROD.

Post-ROD monitoring data indicated significant reduction in the plumes' contaminant concentrations and areal extent. The original groundwater plume of dissolved chromium and TCE was originally found to extend from the site approximately 4,000 ft in a west-northwest direction from the Boomsnub and Linde properties. Currently the new toe of plume is located

approximately 2,500 ft in a west-northwest direction from the Boomsnub and Linde properties. Since initiating operations in 1990, the cumulative total for chromium and TCE removal from groundwater are 22,107 and 2,122 pounds, respectively. Treated water was discharged to the Vancouver municipal wastewater treatment facility, but as of February 2006, treated water is discharged to the infiltration gallery on the Linde property. The effluent currently meets the interim discharge standards.

Since the last five year review, the plume appears to be controlled and data have indicated the plume has decreased in size. However, there is a recent, unusual increase in TCE concentrations measured at AMW-18. From the mid 1990's to 2006, TCE concentrations in this well never exceeded the clean-up level. TCE increased significantly from 5.1 µg/L in fall 2006 to 330 µg/L in fall 2007. To check this anomalous result, a confirmation sample was collected from well AMW-18 in December 2007. TCE was detected at a concentration of 410 µg/L in the confirmation sample. Based on this result, the previous TCE result was assumed to be valid. A Geoprobe investigation is currently being conducted in this area to characterize and better evaluate this increased contamination.

Though detected at low concentrations, TCE has seeped into the Upper Troutdale aquifer, which serves as the municipal water supply. Chromium has never been detected above the cleanup level in any of the Upper Troutdale samples. TCE continues to be detected above the cleanup level in two monitoring wells and one private well screened in the Upper Troutdale aquifer. Municipal water supply wells are not located in an area known to be contaminated. The closest municipal water supply well is approximately 3,400 feet away from the closest Troutdale well detected above the TCE cleanup level. In November 2006, a new Troutdale well (AMW-62) was added to the network to ensure that the TCE contamination is not reaching the municipal supply well. The Troutdale wells located within 600 and 1,700 feet of the closest municipal water supply well have no detections of TCE.

Soil removal was effective at achieving industrial soil cleanup levels at the site as required in the ROD. Site access restrictions minimize the potential for exposure of the general public to site conditions. Long-term compliance monitoring ensures that the system is operating in accordance with applicable permit requirements and that necessary operational modifications are readily identified and implemented.

The soil remedy (OU-1) is expected to be protective of human health and the environment upon completion, and in the interim, exposure pathways that could result in unacceptable risks are being controlled. Most known and accessible contaminated soils at the site have been addressed through soil excavation, removal, and replacement with clean soil to a depth of at least 15 feet below ground surface and the site is fenced to prevent access. There remains a defined quantity of soil above lead and chrome cleanup levels directly below the treatment plant. The physical structure of the treatment plant limits exposure to these soils. The remedy anticipates removal of contaminated soils that are present through a depth of 15 ft below ground surface after the decommissioning of the site-wide groundwater treatment plant.

The remedy for the BOC gases property (OU-2) is expected to be protective of human health and the environment upon completion, and in the interim, exposure pathways that could result in

unacceptable risks are being controlled. Extraction and treatment systems are providing containment of the TCE plume and TCE concentrations in groundwater are decreasing across the site. No one is drinking the contaminated water and Institutional Controls are being implemented to ensure no one drinks the water before cleanup goals are achieved.

The site-wide groundwater remedy (OU-3) is expected to be protective of human health and the environment upon attainment of the groundwater cleanup goals. In the interim, exposure pathways that could result in unacceptable risks are being controlled. The extraction and treatment system is functioning as intended, no one is drinking the contaminated water and Institutional Controls are being implemented to ensure no one drinks the water before cleanup goals are achieved.

There are no apparent differences between the protectiveness statement from the previous and current five-year reviews. The previous five-year review stated "the remedy at the Boomsnub/Airco Superfund Site is expected to be protective of human health and the environment upon completion and in the interim, exposure pathways that could result in unacceptable risks are being controlled".

The Superfund Sitewide Human Exposure Environmental Indicator Status for the site remains "Under Control" because there are no complete human exposure pathways between contamination remaining at the site and human receptors. No one is currently drinking contaminated water, institutional controls are being implemented to ensure no one drinks contaminated water before cleanup goals are achieved, and measures are already in place to prevent exposure to the limited amount of contaminated soils that remain under the treatment plant.

The Groundwater Migration Environmental Indicator for the site remains "Under Control" because the remedy continues to function as intended and the groundwater data indicates the plume has decreased in size.

The Cross Program Revitalization Measure Status for the site is "protective for people under current conditions" due to the success of the remedial action for soils. Once the Institutional Controls are implemented and the soils that remain on site are removed, the site will fully meet the definition of "Ready for Anticipated Use."

Five-Year Review Summary Form

SITE IDENTIFICATION

Site name *(from WasteLAN)*: Boomsnub / Airco Superfund Site		
EPA ID *(from WasteLAN)*: WAD009624453		
Region: 10	**State:** WA	**City/County:** Hazel Dell, Clark County

SITE STATUS

NPL status: ☒ Final ☐ Deleted ☐ Other (specify)	
Remediation status (choose all that apply): ☐ Under Construction ☒ Operating ☐ Complete	
Multiple OUs?* ☒ YES ☐ NO	**Construction completion date:** Construction Not Yet Completed
Has site been put into reuse? ☐ YES ☒ NO	

REVIEW STATUS

Lead agency: ☒ EPA ☐ State ☐ Tribe ☐ Other Federal Agency	
Author name: Claire Hong	
Author title: Remedial Project Manager	**Author affiliation:** EPA Region 10
Review period:** 9/25/2003 to 9/25/2008	
Date(s) of site inspection: 4/9/2008	

Type of review:

☒ Post-SARA ☐ Pre-SARA ☐ NPL-Removal only
☐ Non-NPL Remedial Action Site ☐ NPL State/Tribe-lead
☐ Regional Discretion

Review number: ☐ 1 (first) ☒ 2 (second) ☐ 3 (third) ☐ Other (specify) _____

Triggering action:

☐ Actual RA Onsite Construction at OU #____ ☐ Actual RA Start at OU#
☐ Construction Completion ☒ Previous Five-Year Review Report
☐ Other (specify)

Triggering action date *(from WasteLAN)*: 9/25/2003

Due date *(five years after triggering action date)*: 9/25/2008

* ["OU" refers to operable unit.]
**[Review period should correspond to the actual start and end dates of the Five-Year Review in WasteLAN.]

Five-Year Review Summary Form, continued

Issues:

1. Deed restrictions to limit future use of the Boomsnub property have not been formally recorded
2. Obtaining easements and restrictive covenants from all property owners affected by remedy implementation in order to grant a right of access for remediation activities and prevent persons from using the property in a way that would adversely affect the remediation
3. Significant increase of TCE in well AMW-18, historically below cleanup level
4. Optimization of the long-term monitoring program is needed

Recommendations and Follow-up Actions:

1. Record deed restrictions to maintain industrial land use of the property and prevent disturbing soil below 15 feet
2. Continue to work on obtaining easements, access agreements, and restrictive covenants for properties above the plume
3. Start to investigate the source and extent of TCE contamination detected in AMW-18
4. Conduct Long Term Monitoring Optimization of groundwater monitoring prior to the next five-year review using tools and techniques outlined in EPA 542-R-05-003. Continue system optimization to restore groundwater to drinking water quality within a 30 year time frame

Five-Year Review Summary Form, continued

Protectiveness Statement(s):
The soil remedy (Operable Unit 1) is expected to be protective of human health and the environment upon completion, and in the interim, exposure pathways that could result in unacceptable risks are being controlled. Most known and accessible contaminated soils at the site have been addressed through soil excavation, removal, and replacement with clean soil to a depth of at least 15 feet below ground surface and the site is fenced to prevent access. There remains a defined quantity of soil above lead and chrome cleanup levels directly below the treatment plant. The physical structure of the treatment plant limits exposure to these soils. The remedy anticipates removal of contaminated soils that are present through a depth of 15 ft below ground surface after the decommissioning of the site-wide groundwater treatment plant.

The remedy for the BOC gases property (Operable Unit 2) is expected to be protective of human health and the environment upon completion, and in the interim, exposure pathways that could result in unacceptable risks are being controlled. Extraction and treatment systems are providing containment of the TCE plume and TCE concentrations in groundwater are decreasing across the site. No one is drinking the contaminated water and Institutional Controls are being implemented to ensure no one drinks the water before cleanup goals are achieved.

The site-wide groundwater remedy (Operable Unit 3) is expected to be protective of human health and the environment upon attainment of the groundwater cleanup goals. In the interim, exposure pathways that could result in unacceptable risks are being controlled. The extraction and treatment system is functioning as intended, no one is drinking the contaminated water and Institutional Controls are being implemented to ensure no one drinks the water before cleanup goals are achieved.

Other Comments: None

Boomsnub/ Airco Superfund Site
Vancouver, Washington
Second Five-Year Review Report

I. Introduction

This is the second Five-Year Review report of Remedial Actions for the Boomsnub/ Airco Superfund Site in Vancouver, Washington. The first Five-Year Review report completed in 2003 was the triggering action for this review.

The purpose of a Five-Year Review (FYR) report is to determine whether the remedy at a Superfund site continues to be protective of human health and the environment. The methods, findings, and conclusions of reviews are documented in the FYR reports. In addition, FYR reports identify issues found during the review, if any, and identify recommendations to address those issues.

The United States Environmental Protection Agency (EPA) is preparing this FYR report pursuant to the Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA) §121 and the National Oil and Hazardous Substances Pollution Contingency Plan (NCP). CERCLA §121(c) states:

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

The EPA interpreted this requirement further in the NCP; 40 Code of Federal Regulations (CFR) §300.430(f)(4)(ii) states:

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

The purpose and focus of FYRs are further defined in EPA Office of Solid Waste and Emergency Response (OSWER) Directive 9355.7-03B-P (EPA 2001).

The EPA Region 10 has conducted a review of this site. This review was conducted by the U.S. Army Corps of Engineers (USACE), on behalf of EPA, between November 2007 and September

2008. The Seattle District USACE project delivery team (PDT) prepared this FYR through an Interagency Agreement (IAG) between EPA Headquarters and USACE.

This second FYR report is a statutory review, following five years after the completion of the first FYR report signed September 30, 2003. This statutory review is required because the remedial action occurred after the Superfund Amendments Reauthorization Act (SARA) and resulted in hazardous substances being left on site above levels that allow for unlimited use and unrestricted exposure. The first FYR report was triggered by the presence of elevated concentrations of chromium and volatile organic compounds that remain in groundwater and soils at the site above ROD specified cleanup levels.

II. Site Chronology

The following table summarizes, in chronological order, the major milestones or notable events for the Boomsnub/ Airco Superfund Site.

Table 1 – Chronology of Site Events

Event	Date
Initial discovery of problem or contamination	Washington Department of Ecology (Ecology) identified chromium in the groundwater -- 1987. Additional investigation by Ecology to determine lateral extent of contamination -- 1990 to 1994. Ecology issues enforcement order pursuant to MTCA to Boomsnub requiring company to extract and treat chromium-contaminated groundwater, monitor existing on-site wells, and conduct groundwater studies -- May 1990. Ecology assumes financial responsibility for operating extraction and treatment system – August 1990 Ecology determined volatile organic constituents (VOCs) present in groundwater at concentrations presenting human health concerns -- 1991. BOC Gases (Linde) Investigations -- 1991 to 1994. EPA took over operation of the extraction/treatment system from Ecology -- June 1994.
Pre-NPL responses	Limited Pump and Treat System implemented -- 1990.
NPL Listing	April 25, 1995 (60 Fed. Reg. 20330)
Removal Actions	Pump and treat system operation: 1990 to present Removal of 6,000 tons of chromium contaminated soil by EPA – 1994 Removal of an additional 2,500 cy of chromium contaminated soil by EPA – Spring 2001 Installation of In-well Stripping and Soil Vapor Extraction at Linde Vancouver Plant– September 2002
Remedial Investigation / Feasibility Study complete	July 1999

Event	Date
ROD	Interim Action ROD Interim Action Groundwater Pump & Treat) -- September 1997 ROD -- February 2000
ROD Amendments or ESDs	ESD to modify pumping rate, upgrade ion-exchange and air-stripping, use infiltration gallery and institutional controls – August 2006.
Enforcement documents (CD, AOC, Unilateral Administrative Order)	Agreed Order between Ecology and BOC Gases (Linde) – 1993 Unilateral Administrative Order (UAO) to obtain property access from Boomsnub -- May, 1994 Administrative Order on Consent (AOC) requiring BOC Gases (Linde) to conduct a site evaluation at its facility -- January 1997. Consent Decree (CD) to obtain past costs from Boomsnub -- March 2000 AOC requiring BOC Gases (Linde) to construct a sewer pipeline and pump station -- January 2001 AOC where BOC Gases (Linde) agrees to take over operation and maintenance of the groundwater extraction/treatment system – April 2002 AOC for non time-critical removal action installing in-well stripping and soil vapor extraction system at OU-2 -- September 2002 Consent Decree (CD) where BOC Gases (Linde) agrees to implement the reminder of the response actions until VOCs meet cleanup levels; also payment of past costs and future oversight costs. – July 2007
Remedial design start	November 11, 1999 (air stripper); February 3, 2000 (soil removal); January 8, 2001 (gravity sewer); November 2004 (infiltration gallery)
Remedial design complete	January 8, 2001 (air stripper); March 1, 2001 (soil removal); September 27, 2001 (gravity sewer); June 2005 (infiltration gallery)
Actual remedial action start	January 13, 1998 (groundwater treatment system); March 19, 2001 (soil removal); September 27, 2001 (gravity sewer); August 29, 2005 (infiltration gallery)
Construction dates (start, finish)	January 1998 – December 2005: groundwater treatment system operation and expansion March 19, 2001 – April 27, 2001: soil removal January 13, 1998 – April 4, 2002: System operation by EPA
Remedial System Evaluation	February 2002
Toe of the Plume Pilot Study	September 2006
Construction completion date	Not yet completed
Final Close-out Report	Not yet completed
Deletion from NPL	Not yet completed
Previous five-year review	September 2003

III. Background

Physical Characteristics

The Boomsnub/Airco Site is located north of Vancouver in Hazel Dell, Washington. The site is approximately two miles east of Interstate 5 and one mile west of Interstate 205, near NE 78th Street and NE 47th Avenue (see Figure 1). The Boomsnub property is approximately 0.75 acres, located at 7608 NE 47th Avenue, and is bordered by a mixture of residential, commercial, and light industrial properties. The Linde facility, formerly known as BOC Gases and Airco, is an 11-acre, active gas production facility. It is located across the street (47th) from the Boomsnub property at 4758 NE 78th Street (see Figure 1). The site also includes a plume of ground-water contamination that emanates from beneath the two facilities and originally extended 4,000-feet downgradient in a west-northwest direction to approximately NE 30th Avenue. Currently the new toe of plume extends 2,500 feet and is located west of the fence line in the field north of NE 78th Street and east of the Church of God building. There are no known flood plains, endangered species, historical landmarks, or structures with historical significance identified at the site. Designated wetlands have been identified along the south side of NE 78th Street just west of St. Johns Road, in the vicinity of extraction well MW-19D.

Although there are several surface water features in this area of Clark County, none of them is close enough to be impacted by the current extent of contamination. Vancouver Lake is a large lake that lies 3.5 miles west of the Site. Salmon Creek, the largest nearby creek, drains portions of Clark County flowing generally west approximately 2.5 miles north of the Site. Tributary streams to Salmon Creek that drain the area near the Site include Cougar Creek, Tenny Creek, and an unnamed intermittent stream, all of whose headwaters are located 1 to 1.5 miles north or northwest of the Boomsnub property, generally flowing away from the Site to the northwest. The Burnt Bridge/Salmon Creek drainage divide runs northeast across the Site, approximately 0.5 miles west of the Linde property. Surface water to the north and west of the divide flows into Salmon Creek. Surface water to the south and east of the divide flows into Burnt Bridge Creek via Cold Canyon. Both the Linde and Boomsnub properties are located to the east of this surface water divide.

Land and Resource Use

The site includes two adjacent facilities, the former Boomsnub Corporation (Boomsnub) chrome plating facility and the Linde facility. Linde owns and operates an industrial gas production facility adjacent to the Boomsnub property. The Linde plant manufactures compressed and liquefied gas products including nitrogen, oxygen, and argon. The plant also stores and distributes other specialty gases such as hydrogen, acetylene, and helium. The facility was built by Air Liquide America Corporation in 1963 and has been in operation since 1964. The Linde property is zoned for light industrial use. The Boomsnub Corporation and its predecessor company, Pioneer Plating, conducted chrome plating operations at this location from 1967 until 1994, when Boomsnub moved its business to another location at 3611 NE 68th Street. The electroplating process used by Boomsnub involved the use of a chromic acid solution containing hexavalent chromium. The Boomsnub property is currently zoned for industrial use.

Four principal geologic units underlay the site: recent flood alluvium, Pleistocene Alluvial deposits (Alluvial aquifer), the Upper Troutdale formation, and the Lower Troutdale formation. There are two principal hydrogeologic units of concern in the general area of the site, the Alluvial aquifer and the Upper Troutdale formation. The Pleistocene Alluvial deposits are the near surface material and overlie the Upper Troutdale formation. The Alluvial deposits consist of an unsaturated zone, an upper permeable aquifer where site related contamination has been primarily detected and a lower, low-permeability silty/clayey aquitard. This aquitard separates the Alluvial aquifer from the Upper Troutdale, which is the source of drinking water for approximately 65,000 residents in Clark County. The aquitard varies from approximately 5 to 20 feet in thickness, and there are breaches in the aquitard in the vicinity of the Site. Sampling indicates low concentrations of TCE in the Upper Troutdale aquifer since 1997.

There are several private wells in the Alluvial and Upper Troutdale aquifers in the general area of the site. None of the private wells within the area of groundwater contamination are currently being used for drinking water. Those residents whose wells have been affected by the groundwater contamination in the Alluvial aquifer or within the path of the groundwater contaminant plume are connected to the municipal water system owned by the local water purveyor, Clark Public Utilities (CPU). CPU water supply wells are in the Upper Troutdale formation; the closest of these wells is within 2400 feet of the TCE contaminant plume. Site-related contamination has not been found in this well.

The area related to the contaminated groundwater is made up of land zoned for commercial, light industrial and residential uses. Businesses in the immediate area include Advanced Plastic Products Incorporated, GL&V Cellico (fiberglass tank manufacturer), Clark County Maintenance Yard, and a 7-eleven store. Residential neighborhoods are located adjacent and southwest of the facility.

History of Contamination

EPA divided the site into three operable units (OUs) to manage cleanup activities:

- Boomsnub Soil – OU-1
- BOC Soil – OU-2
- Site-Wide Groundwater – OU-3

The principal contaminants of concern include chromium and lead for OU-1, TCE and other VOCs for OU-2, and chromium, TCE, and other VOCs for OU-3. Chromium was identified in Boomsnub soils (OU-1) and groundwater by Washington Department of Ecology (Ecology) in 1986. A limited groundwater pump and treat system was installed in 1990 by Ecology to address chromium in groundwater. Soil removal actions were completed in 1994 and 2001 to remove most lead and chromium-contaminated soils that were considered accessible and a source for groundwater contamination. In 2002, soil characterization activities were conducted on the Boomsnub property around the current groundwater extraction and treatment system building. The areas were identified where soils less than 15 ft below ground surface contained lead and chromium at concentrations exceeding the clean-up levels.

In 1991, during the course of the cleanup at Boomsnub, Ecology discovered VOCs in the groundwater. Based on the concentrations and types of chemicals found in ground water, Ecology suspected BOC Gases as the source of the contamination (OU-2). Since the identification of the VOC plume in 1991, Linde has undertaken a number of steps to identify the extent of the VOC plume, mitigate the plume, and to control plume migration. TCE was identified as one of the main contaminants of concern due to its high mobility in water; TCE's presence in water samples acts as an overall surrogate to track other VOCs at the site. Linde has conducted numerous site investigations, performed groundwater treatment, and conducted a removal action on their property in OU-2. The removal action involved constructing *in-situ* soil and groundwater treatment systems to address the VOC source area.

The groundwater plume of dissolved chromium and TCE were found to extend from the site approximately 4,000 ft in a west-northwest direction from the Boomsnub and Linde properties. Currently the new down-gradient boundary (toe) of plume is located east of the Church of God building. Though detected at low concentrations the TCE concentrations have seeped into the Upper Troutdale aquifer. Groundwater contamination migrates downward in the alluvial aquifer with increasing distance from the source areas.

Initial Response

The groundwater extraction and treatment system has been operational since 1990 (see Figure 2). Since 1990, the system has been modified, upgraded, and expanded several times to handle the VOCs and chromium, to increase pumping and treatment capacity, and to increase removal efficiency. In June 1994, EPA took over the role of lead regulatory agency from Ecology and in April 1995 the site was placed on the National Priorities List. In 1994, EPA removed 400 drums of waste, demolished and removed site buildings and plating tanks, and removed and disposed off-site, more than 6,000 tons of chromium contaminated soil in OU-1. In 2001, an additional 2,500 cy of chromium contaminated soil was removed from various areas of OU-1 and processed for off-site disposal. The In-Well Stripping (IWS) and Soil Vapor Extraction (SVE) systems became operational in February 2004 to remove VOCs from both the soil and groundwater in OU-2. The SVE system removed significant quantities of VOCs from the soil and was subsequently turned off in February 2008 after removal rates reached asymptotic conditions (see Figure 6).

As of March 2008, the cumulative total for chromium and TCE removal from groundwater are 22,107 and 2,122 pounds, respectively, since initiating operations in 1990 (see Figure 7). The volume of contaminants removed during the reporting period continued to decline compared to the previous reporting period. This is consistent with a continuing contaminant concentration downward trend over the past few years. Figures 4 and 5 compare chromium and TCE concentrations in groundwater at the Site in 1995 and 2007. These figures indicate that the groundwater extraction and treatment system has been effective in mass removal and decreasing the footprint of the plume over time. EA is currently under contract to Linde to operate and maintain the groundwater treatment system along with the IWS and SVE system on the Linde property.

Basis for Taking Action

The following were listed as site-specific contaminants of concern (COCs) for groundwater: hexavalent chromium, total chromium, bromodichloromethane, carbon tetrachloride, dibromochloromethane, 1, 1-dichloroethene (DCE) and 1, 2-DCE, tetrachloethene, and TCE. In addition, to address concerns that 1,4-dioxane might be present at the site, a limited number of samples were collected from selected wells and the groundwater extraction and treatment system influent and effluent, and analyzed for 1,4-dioxane. The samples were collected in March 2003, as well as during the spring 2003, fall 2003, and spring 2004 semiannual sampling events. No further sampling for 1,4-dioxane was required, because the results from the effluent samples remained consistent with previous sampling results (low concentrations of 1.1 µg/L vs. 1.2 µg/L).

Soil removal actions were completed in 1994 and 2001 to remove most chromium-contaminated soils that were considered accessible and a source for groundwater contamination. Institutional Controls (ICs) include public notice during operation of the groundwater pump and treat system, deed restrictions, and controlled site access for the Boomsnub property to prevent soil contamination below 15 feet in depth from being disturbed without appropriate precautions and preclude residential use of the Boomsnub property. The most recent monitoring data show that average groundwater concentrations of chromium and TCE are in excess of the federal drinking water standard. Actual or threatened releases of hazardous substances from the site may have presented an imminent and substantial endangerment to public health, welfare, or the environment if not addressed by implementing the response actions selected in the ROD.

IV. Remedial Actions

Remedy Selection

The ROD for OU-1 and OU-3, dated February 2000, established the following remedial action objectives (RAOs) for the Boomsnub soil OU (OU-1):

- 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 above industrial cleanup standards
- Prevent future residential use of the Boomsnub property through deed restrictions precluding future residential uses of the property.

The selected remedy for OU-1 was ICs and removal of most contaminated soils that were considered accessible and a source for groundwater contamination. Chromium contaminated soil left in-place will be removed following site closure. ICs include deed restrictions and controlled site access for the Boomsnub property to prevent soil contamination below 15 feet in depth from

being disturbed without appropriate precautions and preclude residential use of the Boomsnub property.

The contaminants of concern and the corresponding cleanup levels for OU-1 presented in the ROD are shown in the following table.

Table 2. OU-1 COC Cleanup Levels for Soil

Contaminant of concern	Cleanup Level (mg/kg)	Basis for Cleanup Level
Total Chromium	400	Site-specific remediation level[1]
Chromium VI	8	MTCA 100x groundwater standard[2]
	17,500	MTCA C Industrial
Chromium III	1,600	MTCA 100x groundwater standard[2]
Lead	1,000	MTCA A Industrial[3]

Notes:
[1] The Site-specific remediation level will be demonstrated to be effective achieving the MTCA ground-water cleanup standard (80 ppb) for hexavalent chromium at nearby monitoring wells. Hexavalent chromium remaining in soil between 400 ppm and 8 ppm will be allowed to infiltrate to ground water for ex-situ ground water treatment.
[2] Soil cleanup level represents 100 times the MTCA ground-water cleanup level reported in the Ecology CLARCII database dated 2/28/96.
[3] MTCA Method A Industrial value shown for lead (no Method C Industrial value exists for lead).

The BOC Gases OU (OU-2) is being addressed under a September 2001 Action Memorandum. The operating objectives for OU-2 include the following:

- 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

IWS and SVE have been identified for source control for OU-2. The remedy for the Site-wide Groundwater OU assumes implementation of, and is compatible with, the IWS and SVE alternative identified for source control at OU-2.

The ROD for OU-1 and OU-3 identified the remedy for OU-3 as continued groundwater extraction and treatment until groundwater cleanup levels are achieved throughout the groundwater plume. The remediation goals include the reduction of hexavalent chromium in groundwater to 80 µg/L and the reduction of TCE to 5 µg/L. The ROD established the following remedial action objectives (RAOs) for OU-3 groundwater remediation:

- Prevent further impacts to the Alluvial aquifer

- Restore impacted groundwater to drinking water standards (MCLs or MTCA B standards)
- Prevent ingestion of contaminated groundwater above federal and state drinking water standards through completion
- Prevent impacts to the upper Troutdale aquifer and the public drinking water supply by reducing contamination in the Alluvial aquifer.

The contaminants of concern and the corresponding cleanup levels for OU-3 presented in the ROD are shown in the following table.

Table 3. OU-3 COC Cleanup Levels for Groundwater

Contaminant of concern	Cleanup Level (µg/L)	Basis for Cleanup Level
Chromium VI	80	MTCA B
Total Chromium	100	MCL
Bromodichloromethane	1	MTCA B
Carbon Tetrachloride	1	MTCA B
1,2-Dibromo-3-Chloropropane	0.2	MCL
Dibromochloromethane	1	MTCA B
1,2-Dichloromethane	5	MCL
1,1-Dichloroethene	1	MTCA B
Hexachlorobutadiene	5	MTCA B
Tetrachloroethene	5	MCL
1,1,1-Trichloroethane	200	MCL
Trichloroethene	5	MCL

Remedy Implementation

A soil removal action in OU-1 was conducted by EPA in 1994, removing soil from a 70-foot diameter area to a depth of 28 ft. According to the ROD, the removal action removed the majority of contaminated soil, however post-removal sampling indicated chromium contaminated soil remains on the site at levels exceeding the cleanup level. Additional contaminated soil was removed from various areas of OU-1 in 2001. There is note of intent to remove additional chromium contaminated soil upon site closure. Cleanup of these soils will occur if and when the location of the groundwater treatment building is moved or if the site use is changed in the future. ICs include deed restrictions and controlled site access for the Boomsnub property to prevent soil contamination below 15 feet in depth from being disturbed without appropriate precautions and preclude residential use of the Boomsnub property.

The IWS and SVE treatment systems for the VOC source area (OU-2) became operational in February 2004. IWS is an *in-situ* treatment process where air lift pumping is used to move groundwater through a vertical circulation well. The VOCs dissolved in the water are stripped from the groundwater within the well casing by the injected air. SVE is an *in-situ* soil treatment process where 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. The off-gas for both systems is collected for aboveground treatment by granular activated carbon (GAC). The VOC treatment system consists of 21 wells and associated piping. The treatment equipment consists of moisture separators, blowers, and GAC treatment for air discharge. The SVE system removed significant quantities of VOCs from the soil until removal rates reached asymptotic conditions in 2006. The system then underwent month-long shutdown periods required for rebound testing and was subsequently turned off in February 2008 after TCE results were less than 65 micrograms per cubic meter (µg/m3), the baseline concentration. Since starting IWS operations, TCE concentrations have decreased significantly in all monitoring wells across the VOC source area. The termination of the IWS system has begun by terminating treatment in various wells. As individual IWS wells are shut down, the associated airflow is re-directed to the IWS wells remaining in operation. Currently, 4 of the 9 wells continue operating to treat the remaining hot spot in the OU-2 groundwater.

An extensive groundwater extraction network is used to capture the contaminated groundwater in OU-3. The system was originally constructed and operated by Boomsnub in 1990 and has been expanded and upgraded several times by Ecology, EPA, and Linde. The groundwater extraction and treatment system for OU-3 consists of the following components:

- An extraction system consisting of 24 extraction wells and approximately 10,000 ft of piping used to transport extracted groundwater to a central treatment system on Boomsnub property.

- 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.

- As of February 2006, treated water is discharged via force main to the infiltration gallery on the Linde property. Treated water used to be discharged to the Vancouver municipal wastewater treatment facility.

The extraction well network for the site is presented in Figure 2. In 2006, the Explanation of Significant Differences (ESD) revised the required pumping rate capacity for the extraction and treatment system from a minimum capacity of 200 gpm to a maximum of 160 gpm. Post-ROD monitoring data indicated significant reduction in the plumes' contaminant concentrations and areal extent at the current capacity of 160 gpm (Figures 4 and 5). Significant mass removal was achieved and the groundwater extraction and treatment system exceeded expectations for mass removal. The new flow and transport model presented to EPA in 2004 concluded that at 160 gpm the site could be remediated in a time frame considerably less than the 30 years predicted by the groundwater model used by the ROD. The annual total flow rate over the past five years has averaged between 148 and 152 gpm with individual well flow rates ranging from 1 to 18 gpm.

As of 2006, contamination in the area referred to as the "toe-of-plume" had been reduced to a single "hot spot" immediately upgradient of extraction well MW-41. The hot spot area is believed to be located in the silt layer exhibiting low permeability, at a depth of approximately 80 ft to 90 ft below ground surface (bgs). Experience with other extraction wells at the site has demonstrated that contaminants in the silt layer are not effectively removed by pumping.

Therefore, the Toe-of-Plume Pilot Study (TOPPS) *in-situ* remediation was initiated in September 2006 in an effort to remediate the "hot spot" in the toe-of-plume area and to test the effectiveness of this technology at the site.

ICs are established to assure that the remedial action will continue to protect human health and the environment. EPA is responsible for implementing, monitoring, and enforcing ICs related to OU-1 and Linde is responsible for ICs related to OU-2 and OU-3. ICs exist in the form of public notice during operation of the groundwater pump and treat system, accomplished by providing affected property owners a copy of biannual groundwater quality sampling data for their property for all contaminants exceeding cleanup standards. Long-term compliance monitoring for contaminated groundwater is required to assess the operational efficiency of the pump and treat system and monitor groundwater contaminant migration. There are site access restrictions to the Boomsnub property for the duration of the pump and treat system's operation. ICs also include deed restrictions and controlled site access for the Linde property. The Washington Administrative Code (WAC) states that all wells shall not be located within certain minimum distances of known or potential sources of contamination (WAC 173-160-171). The minimum set-back distance for proposed water wells other than for public water supply is 100 feet from all potential sources of contamination, except for solid waste landfills.

The ESD enhanced institutional control requirements to protect the remedy constructed at the site. As a result, easement agreements were executed to grant a right of access over the properties for the purposes of implementing, facilitating and monitoring the environmental cleanup and remediation activities. Restrictive covenants were executed as an effort to prevent persons from using the properties in any manner that would interfere with or adversely affect the implementation, integrity, or protectiveness of the environmental cleanup and remediation activities for as long as these activities are being performed. Additionally, persons are prohibited from installing groundwater well(s) and using groundwater beneath the properties for potable purposes for as long as environmental cleanup and remediation activities are being performed. The general public has no right of access to the properties. Linde has already recorded a number of easements from property owners whose properties are affected by remedy implementation and they are actively negotiating easements from those property owners with whom they have not yet reached an agreement. Linde also provided a deed restriction for the Linde property (OU-2). Figure 10 is a map overlaying the area requiring ICs on a property map with parcels identified. Deed restrictions to limit future use of the Boomsnub property have not been formally recorded. Access restrictions to the Boomsnub property are in place to minimize the potential for exposure of the general public to site conditions.

System Operations and Maintenance

The operating objectives of the OU-2 systems include removing VOCs from the vadose zone that may be acting as the source to groundwater, removing VOCs from groundwater on the western portion of the Linde property, and halting the off-property migration of VOCs in groundwater. The SVE system was turned off in February 2008 after removal rates reached asymptotic conditions. As individual IWS wells are shut down the associated airflow has been redirected to the IWS wells remaining in operation to accelerate remediation. This approach has been

effective in reducing TCE levels in the VOC source area. Minimal periods of downtime were due to maintenance requirements, power outages at the site, and system alarms.

The operating objectives of the groundwater extraction and treatment system include reducing further contaminant migration within the alluvial aquifer, continuing mass removal activities, and reducing contaminant migration into the Troutdale aquifer. The operating objectives have been achieved by utilizing a groundwater flow model to define the capture zone of the extraction system and to improve system operations, installing additional groundwater extraction wells in the alluvial aquifer and monitoring wells in the Troutdale aquifer, upgrading treatment plant components to improve contaminant removal, changing pumping rates in extraction wells or other forms of pulse pumping, and using alternative treatment to portions of the site where there remains significant contaminant that may not be impacted by pumping operations (i.e., where contaminants are bound up in the silt, such as the toe of plume area). A long-term monitoring plan (LTMP) was drafted to consolidate sampling efforts and to focus on wells that provide information needed for decision-making and site understanding. These measures have been effective in accomplishing the operational strategy.

The Linde Company has worked with property owners and developers to ensure that projects and use changes can best be integrated with the remedy. In the summer of 2005, the Church of God began constructing new facilities on their property, over portions of the commingled plumes. Linde, with EPA approval, worked with the Church to identify conflicts between the proposed facilities and components of the groundwater extraction and monitoring systems. Linde assisted the Church's contractors by moving/abandoning wells and pipelines on the property to allow the construction to proceed. EA marked utilities on the property for contractors throughout construction. Sections of the system were turned off periodically so that if the pipelines or controls were accidentally damaged during construction, the impact to the overall system and the environment would be reduced. Similarly, the pumping system and pipeline configuration on Parcel No. 144527 (formerly referred to as Castry property) will be impacted by site development and modifications will be required once development plans are finalized. The development is currently slated for summer 2008, pending approval by Clark County.

In February 2002, a team of expert hydrogeologists and engineers independent of the site performed a Remedial System Evaluation (RSE). The RSE provided a third party evaluation of site operations and considered the goals of the remedy, the site conceptual model, aboveground and subsurface performance, and the site exit strategy. The RSE team recommended that the site team and responsible party consider at least partial reinjection of treated groundwater at the site to improve system effectiveness and reduce operating costs. An infiltration gallery was constructed on Linde property and went into operation in February 2006. Use of the infiltration gallery on the Linde property reduces the burden on the municipal wastewater treatment facility, recharges the alluvial aquifer, and reduces the cost associated with discharging effluent to the sanitary sewer. Operating costs have been reduced by $350,000 per year (50%); the new discharge scheme is expected to save $3.5 million over the life of the remedy.

Operational costs have averaged roughly $824,400 as outlined in Table 4. This is a nominal 5% increase from the $787,000 annual operational cost that was estimated in the first five-year review. The treated water disposal cost has dramatically decreased to less than $500 per year

since all treated water began to be disposed through the infiltration gallery in 2006. The average operational cost is $637,900 using the current treated water disposal cost of $500 per year. This is a 19% decrease from the annual operational cost estimated in the first five-year review.

Table 4 – Annual Average System Operations/O&M Costs since the Last Five-Year Review

Activity	Cost/Year
Project Management	$20,000
Sampling and Reporting	$234,000
Routine Maintenance	$289,000
Data Management	$39,000
Chemical Analysis (routine monitoring)	$23,000
Electricity	$28,000
Treated Water Disposal *	$187,000
Ion Exchange Resin	$4,400
Annual Operating Costs	$824,400

* Treated water disposal is currently <$500/year. Since 2006 all treated water is disposed through the infiltration gallery

V. Progress Since the Last Five-Year Review

The major activities that were conducted at the site since the last five-year review are as follows:

- The IWS and SVE systems became operational in February 2004 to remove VOCs from both the soil and groundwater in OU-2. The SVE system removed significant quantities of VOCs from the soil and was subsequently turned off in February 2008 after removal rates reached asymptotic conditions

- Groundwater Flow and Transport model was completed in February 2004. The model was used to assess how changes in pumping in the Toe-of-Plume area would affect capture effectiveness, to evaluate the overall capture effectiveness of the extraction system and provide recommendations for pumping rates at extraction wells, to evaluate the impacts of infiltrating treated groundwater back into the alluvial aquifer using an infiltration gallery, and comparing *in-situ* treatment options.

- Extraction system modifications were performed between the summers of 2005 to 2006 due to Church of God construction over portions of the commingled plumes.

- Upgrades to the air stripper, blower system, GAC canisters, and ion-exchange (IX) system were made in December 2005 to increase removal efficiencies and improve contaminant removal.

- An infiltration gallery was constructed on Linde property and went into operation in February 2006. Use of the infiltration gallery on the Linde property reduces the burden on the municipal wastewater treatment facility, recharges the alluvial aquifer, and reduces the cost associated with discharging effluent to the sanitary sewer.

- In 2006, the ESD
    - revised the required pumping rate capacity for the extraction and treatment system from a minimum capacity of 200 gpm to a maximum of 160 gpm,
    - allowed treated groundwater to be discharged to the Linde infiltration gallery or the municipal wastewater treatment facility,
    - approved upgrading the IX system and the air-stripping unit to improve contaminant removal rather than upgrading the units for increased treatment volume, and
    - enhanced the institutional control requirements to protect the remedy constructed at the site by obtaining easements from property owners whose properties are affected by the remedy

- TOPPS *in-situ* remediation was initiated in September 2006 in an effort to remediate the "hot spot" in the toe-of-plume area. Contaminants in the silt layer were not effectively being removed by pumping

- Geoprobe investigation is currently being conducted at well AMW-18 where a dramatic increase in TCE was recently observed.

Most of the recommendations from the last Five-Year Review have been implemented. The two outstanding recommendations are:

- Record deed restrictions for the Boomsnub property to limit future use of the property, and

- Remove contaminated soil through a depth of 15 feet to allow industrial use of the property following the decommissioning, demolition, and removal of treatment facilities

After further consideration, the second recommendation is no longer relevant since removal of contaminated soils that are considered accessible and a source for groundwater contamination is part of the remedy. The physical structure of the treatment plant limits exposure to these soils.

Previous Protectiveness Statement

The protectiveness statement in the last five year review (2003) stated:

"The remedy at the Boomsnub/Airco Superfund Site is expected to be protective of human health and the environment upon completion and in the interim, exposure pathways that could result in unacceptable risks is being controlled".

Status of Recommendations

A summary of the recommendations made in the previous five-year review (2003) and an evaluation of their progress are presented below.

- **Complete groundwater modeling to assess contaminant migration potential, evaluate benefits of increasing system capacity on contaminant removal and evaluate the efficiency of the remedy in removing site contaminants. Use modeling results to modify the remedy as appropriate: Completed and ongoing**

The development of a groundwater flow and transport model was completed in February 2004 with some limitations in its use for future decision-making purposes. The model was used to assess how changes in pumping in the Toe-of-Plume area would affect capture effectiveness, to evaluate the overall capture effectiveness of the extraction system and provide recommendations for pumping rates at extraction wells, and comparing *in-situ* treatment options. As a result of these assessments, the pumping rates at the toe of the plume were modified to maximize pumping from areas with the highest concentrations of contaminants and monitoring was performed to verify sustained compliance with clean-up levels. Results were also used to help determine where new extraction wells were installed. Currently the model is being used to determine the new target capture zone at the revised Toe-of-Plume, located east of the Church of God. Initial modeling shows effective capture.

In 2006, the ESD revised the required pumping rate capacity for the extraction and treatment system from a minimum capacity of 200 gpm to a maximum of 160 gpm. Significant mass removal was achieved and the groundwater extraction and treatment system exceeded expectations for mass removal. The new flow and transport model concluded that at 160 gpm the site could be remediated in a time frame considerably less than the 30 years predicted by the groundwater model used by the ROD. The plume has shrunk significantly since this prediction was made in 2004.

The groundwater model was also used to evaluate the impacts of infiltrating treated groundwater back into the alluvial aquifer using an infiltration gallery. Two potential infiltration gallery locations were simulated; one on Linde property and a second on Boomsnub property. The groundwater model was used to assess changes in capture effectiveness of the extraction well network, changes in water elevations over time, the extent of changes to plume boundaries, and the impact of infiltration on a smaller and unrelated groundwater plume that crosses the northeast corner of the Linde property. Model results indicated infiltrating treated water to the Linde property had fewer impacts on the effectiveness of the extraction network compared to using the infiltration gallery on Boomsnub property. The ESD allowed treated groundwater to be discharged to the Linde infiltration gallery or the municipal wastewater treatment facility.

The ESD allowed the use of all known available and reasonable technologies (AKART) to comply with Washington water discharge regulations when the system was upgraded in December 2005. The upgrades to the air stripper, blower system, GAC canisters, and IX system were made to increase removal efficiencies and improve contaminant removal. The pre-2005 groundwater treatment system averaged 24 µg/L chromium and 3 µg/L TCE in the discharge

going to the municipal waste water treatment facility. To ensure AKART was achieved, the discharge standards for the plant were established based on actual plant data rather than other standards, such as MCLs or MTCA Method A or B for groundwater. The initial and operating discharge standards are or will be more stringent than MCLs or MTCA Method A or B. The ESD approved upgrading the IX system and the air-stripping unit to improve contaminant removal rather than upgrading the units for increased treatment volume.

- **Construct and implement the BOC Gases Soil OU remedy: Completed and ongoing**

Construction of source removal activities at the Linde facility began in September 2003 to address the potential TCE source area. The selected removal action was IWS and SVE to remove VOCs from both the soil and groundwater. The IWS and SVE systems became operational in February 2004. The SVE system removed significant quantities of VOCs from the soil and was subsequently turned off in February 2008 after removal rates reached asymptotic conditions. Since starting IWS operations TCE concentrations have decreased significantly in all monitoring wells across the VOC source area. The termination of the IWS system has begun by terminating treatment in various wells. Operation of the IWS system will continue until the contaminants in the source area are sufficiently removed. IWS system optimization continues to concentrate treatment in the center of the source area.

- **Complete modeling of contaminant migration potential from the Alluvial aquifer. Continue groundwater monitoring of the Troutdale aquifer: Completed and ongoing**

In September 2004, the groundwater model was used to assess the capture effectiveness for the extraction well network. The model showed contamination in deeper intervals was captured in some areas, although complete vertical hydraulic control was not being maintained in regions where the sand unit is thickest. The assessment concluded the extraction system is not effective in capturing contamination present in the silt unit due to the relatively low conductivity of the silt unit which overlies the aquitard. Furthermore, deeper contaminated groundwater within the lower alluvial aquifer is not contained and is moving into the silt unit. Due to the concerns raised by the model a new Troutdale aquifer monitoring well (AMW-62) was installed in November 2006. The well was installed to monitor the possible presence of TCE downgradient of two existing Troutdale aquifer monitoring wells (AMW-24 and MW-33) and a private well which contain TCE at concentrations above the Site cleanup criterion. The concentrations have been relatively consistent over the past 5 years. Chromium was not detected above the cleanup level in any of the Troutdale samples collected over the past five years. Troutdale aquifer wells are sampled on a semiannual or annual basis to monitor chromium and TCE concentrations.

- **Regional development needs to be coordinated with site activities to minimize the impacts of development on system components and operations: Ongoing**

The Linde Company has worked with property owners and developers to ensure that projects and use changes can best be integrated with the remedy. In the summer of 2005, the Church of God began constructing new facilities on their property, over portions of the commingled plumes. Linde, with EPA approval, worked with the Church to identify conflicts between the proposed facilities and components of the groundwater extraction and monitoring systems. Linde assisted

the Church's contractors by moving/abandoning wells and pipelines on the property to allow the construction to proceed. EA, who manages the treatment system, marked utilities on the property for contractors throughout construction. Sections of the system were turned off periodically so that if the pipelines or controls were accidentally damaged during construction, the impact to the overall system and the environment would be reduced. Similarly, the pumping system and pipeline configuration on Parcel No. 144527 (formerly referred to as Castry property) will be impacted by site development and modifications will be required once development plans are finalized. The development is currently slated for summer 2008, pending approval by Clark County.

VI. Five-Year Review Process

Administrative Components

The Boomsnub/ Airco Superfund Site Five-Year Review team was lead by Claire Hong, the EPA Remedial Project Manager (RPM), Region 10 and included personnel from the USACE, Seattle District. Emile Pitre and Marlowe Laubach, both with the USACE, Seattle District, assisted with the review as representatives of the support agency.

Components of Review

By November 2007, the review team had been formed, and had established the review schedule and its major components including:

- Document Collection and Review;
- Data Assessment/Analysis;
- Site Inspection;
- Interviews and Community Notification and Involvement
- Five-Year Review Report Development and Review.

The FYR has a statutory completion date of September 25, 2008.

Community Notification and Involvement

Community involvement has been an on-going part of remediation activities at the site. A number of EPA post cards have been developed and distributed to nearby property owners and residents. In addition, public meetings have been periodically held to update the general public on the status of site activities. Owners of property on which EPA extraction/monitoring wells are located also receive data from routine groundwater sampling events.

The community was notified of the five-year review process by means of a post card notice that was mailed to 219 stakeholders and neighbors who are on the Boomsnub-Airco project mailing list on July 24, 2008. In addition, a display advertisement ran on page E2 of the Vancouver Columbian Newspaper on Friday, July 25, 2008.

Interviews were completed with nearby property owners and interested parties. The purpose of the interviews was to identify issues and concerns related to the implementation and on-going operation of the site remedy.

Document Review

A review of reports pertinent to this five-year review was conducted by the review team. The types of documents reviewed included decision documents; risk assessment documents; annual data reports; technical memoranda; and other supporting materials. Attachment 1 is a complete list of documents reviewed during this Five-Year Review.

Data Review and Evaluation

Soil removal actions were completed to remove most lead and chromium-contaminated soils that were considered accessible and a source for groundwater contamination. Confirmation sampling indicated approximately 185 cy of contaminated soils are present less than 15 ft below ground surface around the current groundwater extraction and treatment system building. Cleanup of these soils will occur if and when the location of the groundwater treatment building is moved or if the site use is changed in the future. Chromium concentrations in a majority of groundwater monitoring wells on the Boomsnub property are notably above the cleanup level while the edge of the plume has not migrated down gradient. Additional efforts are needed to enhance the removal of chromium from OU-1 in the groundwater. Under current site conditions these soils do not present a risk to site workers.

All wells except those identified as Troutdale aquifer wells are screened within the alluvial aquifer. All groundwater monitoring data associated with the site since October 2003 was reviewed and evaluated. To facilitate analysis of contaminant concentrations across the site, sampling data are grouped by aquifer and geographical location as follows:

- Upgradient wells
- TCE source wells (includes OU-2 monitoring wells)
- Proximal wells
- Intermediate wells
- Church of God wells
- Toe-of-Plume wells (including Sentinel and Other toe wells)
- Troutdale aquifer wells.

The aquifer and geographic well groupings are presented in Attachment 2. The spatial distribution of the well groupings is identified in Figure 2. Groundwater gradient direction has historically been to the west-northwesterly direction in the alluvial aquifer and west-southwest in the Troutdale aquifer (see Figures 8 and 9). There is no change in seasonal gradient magnitudes within each aquifer. For the alluvial aquifer, effluent discharge to the infiltration gallery causes a noticeable increase to the hydraulic gradient magnitude across the Linde property. Impacts appear to be primarily limited to the OU-2 source area treatment wells and, to a lesser extent, the

proximal wells. The extraction system continues to provide containment for the TCE plume preventing further migration within the alluvial aquifer.

Groundwater monitoring results indicate that the current pumping scenario is generally maintaining control of the plume and that overall concentrations for both chromium and TCE are on a decreasing trend. The possible exception is at well AMW-18 where a dramatic increase in TCE was recently observed. The cause of this increase is currently being investigated, but past and present data suggests it is a detached plume from an old upgradient source of TCE, or possibly a loss of hydraulic control in this area. There are currently 109 extraction and monitoring wells being actively sampled under the long-term monitoring plan at the Boomsnub/Airco Site. Of these wells, 21 have groundwater concentrations that exceed the groundwater cleanup standard for either TCE, chromium, or both. There are also 17 wells with groundwater concentrations below the cleanup levels.

Upgradient wells. During this reporting period, the maximum TCE concentration was detected above the cleanup level at AMW-8A in fall 2004 (40 µg/L). By fall 2007 the maximum TCE concentration was below the cleanup level at AMW-8A (1.7 µg/L). The maximum chromium concentration was detected below the cleanup level at AMW-6A in early 2006 (17.7 µg/L) and remains at this level as of fall 2007. Well AMW-6A is one of four monitoring wells scheduled to be collected on a quarterly basis as part of the infiltration gallery monitoring program. Chromium concentrations at AMW-6A are near background concentrations and below discharge standards. Prior to operation of the infiltration gallery this well was not regularly sampled.

TCE source wells (includes OU-2 monitoring wells). After fall 2004, chromium samples were not obtained from wells in this grouping as concentrations of chromium in samples collected from these wells were below the cleanup level since 2000. The maximum TCE concentration was detected above the cleanup level at MW-1A in spring 2004 (1,300 µg/L). As of fall 2007 there are 5 wells with concentrations above the cleanup level with the maximum occurring at AMW-12A (31 µg/L); 3 of the 5 wells appear to be fluctuating near the cleanup level. During this reporting period TCE concentrations exceeding the cleanup level were detected only in "A" level wells, the water table (shallowest) well in each well cluster. TCE did not exceed the criterion in samples from any of the deeper "B" or "C" wells.

Proximal wells. As of fall 2007 there were 4 of 8 wells sampled that exceeded the cleanup level for chromium. The maximum was detected at well MW-4B (1,240 µg/L). Concentrations in MW-4B have remained fairly consistent and the well continues to contain some of the highest concentrations of chromium at the site. Wells MW-4B and MW-2A have chromium concentrations significantly above the cleanup level and are located on the Boomsnub property in the vicinity of the soil removal activities in 1994. Additional efforts are needed to enhance the removal of chromium from OU-1 in the groundwater. During the reporting period there were several instances where an extraction well was turned on and there was an initial increase of TCE contaminant concentration. This is a common response when wells are turned on. The maximum TCE concentration was detected in fall 2004 at MW-10B (340 µg/L) following a treatment pipeline relocation about 200 feet upgradient that required shutdown of the system in the area. As of fall 2007 the maximum TCE concentration was detected at MW-10B (29 µg/L).

Intermediate wells. In general, chromium and TCE concentrations are the highest in the extraction wells. Four of the 12 wells sampled in fall 2007 had chromium concentrations above the clean-up level and were also extraction wells: MW-14C (123 µg/L), MW-18D (243 µg/L), MW-19D (266 µg/L), and MW-20D (143 µg/L). Chromium concentrations in MW-14C have been decreasing steadily since spring 2002, MW-18D since fall 2003, and MW-20D since spring 2003. However, well MW-19D has shown only a slight decrease in chromium concentration since fall 2003. During the reporting period there were several instances where an extraction well was turned on and there was an initial increase of TCE contaminant concentration. This occurred at AMW-59, MW-18E, and MW-14C during the reporting period. The maximum TCE concentration was detected in fall 2003 at well MW-18E (610 µg/L). Recent TCE results at MW-18E have shown no reduction in TCE concentrations over the past five years. TCE increased significantly from 5.1 µg/L in fall 2006 to 330 µg/L in fall 2007 at well AMW-18, the current maximum TCE concentration. Until 2006, TCE concentrations in this well had never exceeded the cleanup level. A verification sample was obtained to check this anomalous result and TCE was detected at a concentration of 410 µg/L. The source and extent of TCE contamination detected in AMW-18 is currently being investigated. The aforementioned trends in TCE and chromium concentrations raise concern because the values are not readily decreasing compared to the rest of the plume. Performance may be compromised in the intermediate wells area and will likely require long term monitoring optimization of groundwater monitoring. Long term monitoring tools and techniques can be found in the "Roadmap to Long-Term Monitoring Optimization", EPA 542-R-05-003 (USEPA May 2005).

Church of God wells. The highest chromium concentrations in the plume have been detected in AMW-27 and AMW-61. These wells are screened in the silt layer at the base of the alluvial aquifer. Extraction wells at the site have not been effective at removing contaminants in the silt layer. Well AMW-27 is an extraction well; however, the pumping rate is limited to about 2 gpm due to the soil type. Other wells in this geographic group are screened in the sand above this silt layer and exhibit lower chromium concentrations relative to AMW-27. Chromium and TCE concentrations are generally the highest in extraction wells than in monitoring wells. Three of the 10 samples collected in fall 2007 had chromium concentrations above the clean-up level with a max of 289 µg/L at AMW-27. Four of the 10 samples collected in fall 2007 had TCE concentrations above the clean-up level with a max of 33 µg/L at AMW-27.

Toe-of-Plume wells (including *Sentinel* and *Other toe wells*). Chromium concentrations in groundwater samples collected from Sentinel wells have remained consistently below the cleanup level. TCE has never been detected in the *Sentinel wells*. MW-41 is one of the *Other toe wells*. It was temporarily turned off in February-March 2005 and again in July-August 2005 to allow the concentrations to stabilize. The TCE and chromium concentrations rebounded to above the cleanup levels each time the well was turned off. Under pumping conditions, chromium was not detected at concentrations above the cleanup criterion in wells sampled in this area during 2005. In spring 2006 results at MW-41 were above the cleanup criteria for chromium and TCE (165 µg/L and 6.2 µg/L, respectively). After *in-situ* treatment in fall 2006 the chromium and TCE concentrations were non-detect. TCE concentrations in MW-35 have been below the cleanup level since Summer 2004 but increased to 5.5 µg/L, in spring 2007 and remained above the cleanup level in fall 2007 (7.1 µg/L). A portion of the system is shutdown in this area due to low contaminant recovery in extraction wells.

Troutdale aquifer wells. Chromium was not detected above the cleanup level in any of the samples collected during the reporting period. TCE was detected above the cleanup level in AMW-24 (17 µg/L), MW-33 (9.6 µg/L), and the private well (8.3 µg/L) during the fall 2007 event. These concentrations are similar to those reported for the past several years.

Site Inspection

A site visit and inspection was conducted on April 9, 2008 to gather information about the site's status. The review team visually inspected and documented the conditions of the site, the remedy, and the surrounding area for inclusion into the second five-year review. Representatives of the EPA, USACE, and EA were present for the site inspection. For additional details regarding the site inspection and findings, including site photographs of select features and a roster of attendees, see the Site Inspection Trip Report (Attachment 5) and Site Inspection Checklist (Attachment 6).

For the sake of time, only a few of the wells were inspected and all were in good condition. The wells inspected were: extraction well MW-26D located near the Church of God (installed by EPA), extraction well PW-1B located near the treatment compound (installed by Boomsnub), and well AMW-27 located just south of MW-26D near the Church of God (installed by Linde or BOC Gases).

Access to the OU-1 and OU-2 sites are restricted by an aluminum chain-link fence topped with barbed wire around the entire site. OU-1 has a locked gate that was opened by EA personnel prior to our arrival. All personnel on site are required to sign in at the site trailer. The OU-2 property located east of OU-1 is owned by Linde and sits behind an automated gate that is operated by Linde personnel.

There were two acts of vandalism that were discussed during the site visit. One act occurred at MW-35 where about 24 feet of wire was cut and removed from the well after it was shutdown and the cover to an electrical panel was removed. Well MW-35 was not secure because it was a monitoring well that was converted to a temporary extraction well to assist in plume capture. The configuration at well MW-35 and the subsequent vandalism are anomalies as all permanent extraction wells are secured inside vaults requiring unique tools to open. The second act of vandalism was at containment vault 3 (CV-3). The manhole lid had standard 3/4 inch bolts holding the lid down. The manhole lid was off and the bolts were missing. Nothing was removed from the vault. Both acts of vandalism had little impact to the remedy and do not constitute a remedial deficiency.

Development has occurred in areas where OU3 wells exist and were coordinated with site activities to minimize the impacts to system components and operations. Currently the County wants to develop neighboring property just east of the school, the owner of the Chapman property at the toe of the plume would like to develop his property, and there is some discussion of developing the open field west of the Boomsnub property. Development of the property east of the school would not affect the extraction system since the system does not encroach on this

land. Development of the Chapman property would not affect the extraction system at the toe of the plume because that portion of the system is shutdown due to low contaminant recovery in extraction wells. There is on-going in-situ treatment of the one hot spot located in this area. Development of the open field west of the Boomsnub property would require moving about 450 feet of piping. The observed and planned developments will not impact the protectiveness of the remedy.

EA mentioned OU-1 may still be a contaminant source because the soil removal only went to the water table and well MW-2A, located within the soil removal area, has the highest chromium contamination. An evaluation is needed on the best way to handle why the groundwater chromium concentration within OU-1 are stable.

Interviews

Interviews were performed by telephone. Parties were identified for the interviews based on the following criteria:

- Parties adjacent to the site or effected by site related contaminants
- Public entities/utilities effected by operation of the remedy
- Interested and concerned citizens or citizen groups

Parties identified for interviews included:

Steve Prather	Clark County Public Utilities
Mohsen Kourehdar	Washington State Department of Ecology
Ila Stanek	West Hazel Dell Neighborhood Association
Dan Huevel	Adjacent Property Owner

Attempts to contact neighboring businesses GL&V Cellico, Church of God, and Advanced Plastic Products Inc. were unsuccessful; representatives of these adjacent properties were therefore not interviewed. Interview summaries are provided as Attachment 7. Interviewees were asked about their overall impression of the site, community concerns, and whether they felt well informed about site activities and progress. Overall, interviewees expressed few concerns with regard to system operation. However, some felt communications could be improved. The following recommendations and suggestions were made:

- Clark County Public Utilities should be informed on a quarterly basis about progress and groundwater data pertaining to Troutdale wells.

- Increase the distribution list of newsletters or fact sheets to incorporate more of the Hazel Dell community. The contaminated groundwater plume impacts regional development and these developments impact the entire community, not just citizens in the immediate area of the plume.

It may be beneficial to evaluate community outreach mechanisms, consider improving web-based outreach, and providing additional fact sheets.

VII. Technical Assessment

Question A: Is the remedy functioning as intended by the decision documents?
Answer: Yes

The current remedy including the soil removal in OU-1, IWS and SVE in OU-2, and groundwater extraction and treatment in OU-3 is generally functioning as intended by the ROD. The current state of each ROD objective and any indicators of remedy problems are described below.

The ROD for OU-1 and OU-3, dated February 2000, established the following remedial action objectives (RAOs) for the Boomsnub soil OU (OU-1):

- **Prevent hexavalent chromium in soils from serving as an uncontrolled, ongoing source of contamination to the downgradient groundwater plume.** Soil removal actions were completed in 1994 and 2001 to remove most lead and chromium-contaminated soils that were considered accessible and a source for groundwater contamination. The principal threat waste, hexavalent chromium in soils, was mostly addressed in the 1994 soil removal action by EPA. The selected remedy included excavation of the highest contaminant concentrations. Soil cleanup levels were set at 400 mg/kg total chromium (8 mg/kg hexavalent chromium) and 1,000 mg/kg lead. The volume of contaminated soil remaining beneath the onsite treatment system building was estimated at approximately 185 cy. EPA agreed that cleanup of lead- and chromium-contaminated soils will occur if and when the location of the groundwater treatment building is moved or if the site use is changed in the future. The remaining chromium and VOC contamination in site-wide ground water will be addressed by continued operation of the ground-water pump and treat system, and other actions which may be implemented as part of the contingency remedy provisions in the ROD. Chromium concentrations in a majority of groundwater monitoring wells on the Boomsnub property are notably above the cleanup level while the edge of the plume has not migrated down gradient. Additional efforts are needed to enhance the removal of chromium from OU-1 in the groundwater. The remedy satisfied the statutory preference for treatment as a principal element of the remedy (i.e., reduce the toxicity, mobility, or volume of hexavalent chromium in soils comprising principal threats through treatment and treatment of ground water).

- **Prevent future workers from being exposed to lead and chromium in soils above industrial cleanup standards.** Most known and accessible contaminated soils at the site have been addressed through soil excavation, removal, and replacement with clean soil to a depth of at least 15 feet below ground surface and the site is fenced to prevent access. There remains a defined quantity of soil above lead and chrome cleanup levels directly below the treatment plant. The physical structure of the treatment plant limits exposure to these soils.

The remedy anticipates removal of contaminated soils that are present through a depth of 15 ft below ground surface after the decommissioning of the site-wide groundwater treatment plant. Institutional controls in the form of access restrictions include fencing, locked gate, and signage. All personnel on site are required to sign in at the site trailer. Trespassing and vandalism reportedly are not recurring issues of concern for the site. Deed restrictions to limit future use of the Boomsnub property and to prevent soil contamination below 15 feet in depth from being disturbed without appropriate precautions have not been formally recorded. This is an unresolved recommendation from the last five-year review. EPA is aware of this deficiency.

The BOC Gases OU (OU-2) is being addressed under a September 2001 Action Memorandum. IWS and SVE were identified for source control for OU-2. The operating objectives for OU-2 include the following:

- **Remove VOCs from the vadose zone that may be acting as the source to groundwater.** The SVE treatment system became operational in February 2004. The system removed significant quantities of VOCs from the soil and was subsequently turned off in February 2008 after removal rates reached asymptotic conditions.

- **Remove VOCs from the groundwater on the western portion of the Linde property.** The IWS treatment system became operational in February 2004. Since starting IWS operations, TCE concentrations have decreased significantly in all monitoring wells across the VOC source area. The termination of the IWS system has begun by terminating treatment in various wells. As individual IWS wells are shut down, the associated airflow is re-directed to the IWS wells remaining in operation. System optimization continues to concentrate treatment in the center of the source area. Currently, 4 of the 9 wells continue operating to treat the remaining hot spot in the OU-2 groundwater.

- **Halt off-property migration of VOCs in groundwater.** The site-wide groundwater extraction and treatment system is compatible with the IWS and SVE systems. Long-term compliance monitoring for contaminated groundwater is required to assess the operational efficiency of the pump and treat system and monitor groundwater contaminant migration. Effluent discharge to the infiltration gallery causes a noticeable increase to the hydraulic gradient magnitude across the Linde property. Impacts appear to be primarily limited to the OU-2 source area treatment wells and, to a lesser extent, the proximal wells. Even so, the extraction system continues to provide containment for the TCE plume preventing further migration within the alluvial aquifer. TCE concentrations in groundwater are decreasing across the site.

The remedy for the Site-wide Groundwater OU assumes implementation of, and is compatible with, the IWS and SVE alternative identified for source control at OU-2. The ROD for OU-1 and OU-3 identified the remedy for OU-3 as continued groundwater extraction and treatment until groundwater cleanup levels are achieved throughout the groundwater plume. The remediation goals include the reduction of hexavalent chromium in groundwater to 80 µg/L and the reduction of TCE to 5 µg/L. The ROD established the following remedial action objectives (RAOs) for OU-3 groundwater remediation:

- **Prevent further impacts to the Alluvial aquifer.** Groundwater monitoring results indicate that the current pumping scenario is generally maintaining control of the plume and that overall concentrations for both chromium and TCE are on a decreasing trend. The possible exception to maintaining control of the plume is at well AMW-18 where a dramatic increase in TCE was recently observed. The cause of this increase is being investigated, but it suggests either a loss of hydraulic control in this area or an as yet undiscovered source of TCE. It is too early to know whether the increase of TCE contamination at AMW-18 will further impact the Alluvial aquifer. Until 2006, TCE concentrations in this well had never exceeded the cleanup level. Post-ROD monitoring data indicated significant reduction in the plumes' contaminant concentrations and areal extent. Significant mass removal has been achieved. The groundwater plume of dissolved chromium and TCE was found to extend from the site approximately 4,000 ft in a west-northwest direction from the Boomsnub and Linde properties. Currently the new toe of plume is located east of the Church of God building; approximately 2,500 ft in a west-northwest direction from the Boomsnub and Linde properties.

  As of February 2006, treated water is discharged to the infiltration gallery on the Linde property. Treated water was discharged to the Vancouver municipal wastewater treatment facility. The effluent currently meets the interim discharge standards that are based on the pre-2005 groundwater treatment system average of 24 µg/L chromium and 3 µg/L TCE in the discharge going to the municipal wastewater treatment facility. The interim discharge standards for the plant were established based on actual plant data rather than other standards, such as MCLs or MTCA Method A or B for groundwater. The initial and operating discharge standards are or will be more stringent than MCLs or MTCA Method A or B. The Operations and Maintenance (O&M) manual states the operating discharge standards will be established based on data collected between startup of the upgraded treatment system and the end of one year or one resin cycle, whichever is longer. The maximum allowable concentration of TCE and chromium in the effluent will be established as two standard deviations over the mean effluent concentration for the monitoring period. Based on information available at the time of the ESD, the operating discharge standards are expected to be approximately 8 µg/L for chromium and 2 µg/L for TCE. The upgraded system has operated more than two years and the end of one resin cycle is not in the foreseeable future. The existing effluent data set should be large enough to provide a mean effluent concentration that is statistically sound. Permanent discharge standards still need to be established.

- **Restore impacted groundwater to drinking water standards (MCLs or MTCA B standards).** The ROD estimated groundwater treatment would operate for 30 years until site-wide groundwater reached cleanup levels. The new flow and transport model concluded in 2004 that at 160 gpm the site could be remediated in a time frame considerably less than the 30 years predicted by the groundwater model used by the ROD. The plume has shrunk significantly since this prediction was made in 2004.

- **Prevent ingestion of contaminated groundwater above federal and state drinking water standards.** A recent area-wide well survey indicates none of the private wells within the

area of groundwater contamination are currently being used for drinking water. Those residents whose wells have been affected by the groundwater contamination in the Alluvial aquifer or within the path of the groundwater contaminant plume are connected to the municipal water system. The closest Clark Public Utilities (CPU) water supply well in the Upper Troutdale formation is within 2,400 feet downgradient of the TCE contaminant. Site-related contamination has not been found in this well. Long-term compliance monitoring for contaminated groundwater is required to assess the operational efficiency of the pump and treat system and monitor groundwater contaminant migration.

ICs exist in the form of public notice during operation of the groundwater pump and treat system, accomplished by providing affected property owners a copy of biannual groundwater quality sampling data for their property for all contaminants exceeding cleanup standards. The ESD enhanced institutional control requirements to protect the remedy constructed at the site. As a result, easement agreements were executed to grant a right of access over the properties for the purposes of implementing, facilitating and monitoring the environmental cleanup and remediation activities. Restrictive covenants were executed as an effort to prevent persons from using the properties in any manner that would interfere with or adversely affect the implementation, integrity, or protectiveness of the environmental cleanup and remediation activities for as long as these activities are being performed. Additionally, persons are prohibited from installing groundwater well(s) and using groundwater beneath the properties for potable purposes for as long as environmental cleanup and remediation activities are being performed. The general public has no right of access to the properties. Linde has already recorded a number of easements from property owners whose properties are affected by remedy implementation and they are actively negotiating easements from those property owners with whom they have not yet reached an agreement. The next five-year review should determine if this approach is successful. The Washington Administrative Code (WAC) states that all wells shall not be located within certain minimum distances of known or potential sources of contamination (WAC 173-160-171). The minimum set-back distance for water wells other than for public water supply is 100 feet from all potential sources of contamination, except for solid waste landfills.

- **Prevent impacts to the upper Troutdale aquifer and the public drinking water supply by reducing contamination in the Alluvial aquifer.** Groundwater monitoring results indicate overall concentrations for both chromium and TCE are on a decreasing trend. Post-ROD monitoring data indicates significant reduction in the plumes' contaminant concentrations. Though detected at low concentrations the chromium and TCE concentrations have seeped into the Upper Troutdale aquifer. Chromium was not detected above the cleanup level in any of the Troutdale samples collected over the past five years. TCE continues to be detected above the cleanup level in two monitoring wells and one private well screened in the Troutdale aquifer. The concentrations have been relatively consistent over the past 5 years and so this is not thought to represent a plume that is migrating or expanding. Additional monitoring wells have been installed in the Troutdale aquifer to improve the knowledge of contaminant distribution in the Troutdale.

Recently, two areas have shown no contamination reduction in the Alluvial aquifer. Proximal wells MW-4B and MW-2A have chromium concentrations significantly above the

cleanup level and are located on the Boomsnub property in the vicinity of the soil removal activities in 1994. Additional efforts are needed to enhance the removal of chromium from OU-1 in the groundwater. It may be valuable to determine if there is an ongoing source to groundwater on the Boomsnub property. If a source is present, alternative treatments to reduce the concentrations of chromium in the area should be evaluated. There was a significant increase of TCE in intermediate well AMW-18, which was historically below cleanup levels. The cause of this increase is currently being investigated, but past and present data suggests it is a detached plume from an old upgradient source of TCE, or possibly a loss of hydraulic control in this area Current modeling indicates that this plume will be captured downgradient by the existing extraction and treatment system

Once in place, the ICs in OU-3 will address all areas of site-related contamination that are above unlimited use and unrestricted exposure (UU/UE) levels, including the newly identified increase of TCE in intermediate well AMW-18. WAC 173-160-171 states the minimum set-back distance for proposed water wells other than for public water supply is 100 feet from all potential sources of contamination, except for solid waste landfills. The well survey conducted in 2005 showed two properties downgradient of the source area that were potentially being used as potable water supplies. Linde worked with the affected property owners to provide an alternative long-term water supply. Currently, no one is using the water for drinking, but in order to remain protective, the easement agreements and restrictive covenants need to be implemented. The lack of ICs on the Boomsnub property does not affect current protectiveness because site access restrictions in the form of fencing, locked gate, and signage minimize the potential for exposure of the general public to site conditions. However, since cleanup was only to industrial standards, deed restrictions to limit future use of the Boomsnub property need to be in place in order for the remedy to remain protective. Public notice about the site and ICs has been effective by providing affected property owners a copy of biannual groundwater quality sampling data for their property for all contaminants exceeding cleanup standards. Based on the inspection of the site and relevant off-site areas, the existing ICs are preventing exposure. If fully implemented the ICs are expected to be and remain protective.

Question B: Are the exposure assumptions, toxicity data, cleanup levels, and remedial action objectives (RAOs) used at the time of the remedy still valid?

Answer: Yes

Changes in Standards and To Be Considered. Applicable or relevant and appropriate requirements (ARARs) cited in the ROD were reviewed to evaluate changes in the ARARs since the last five-year review. A summary table is presented in Attachment 3. There have been no changes in regulatory standards since the first five-year review.

For purposes of this review EPA considered whether there have been changes in promulgated standards identified as ARARs, the basis for cleanup levels, or new toxicity information which call into question the protectiveness of the remedy. For TCE, the groundwater cleanup level selected in the 2000 Record of Decision is based on the MCL of 5.0 µg/L, which according to that ROD equated to an excess cancer risk of 1.26×10^{-6}. In addition to Federal drinking water standards, Washington State's Model Toxic Control Act (MTCA) groundwater cleanup

standards were identified as ARARs. The MTCA Method B cleanup number calculated at that time to pose an excess cancer risk of $1x10^{-6}$ was 3.98 µg/L, based on an oral cancer slope factor of 0.011 per mg/kg-day. Based on those calculations and WAC section 173-340-720 (7)(b), the MCL was deemed to be sufficiently protective and was selected as the groundwater cleanup standard.

However, since that time EPA and others have been re-evaluating cancer risks associated with inhalation and ingestion of TCE. The value for TCE that was originally used in remedy selection for this site has been withdrawn by EPA and a new value has yet to be included in the Integrated Risk Information System (IRIS) database. In October 2004 the Washington State Department of Ecology (Ecology) updated its guidance for calculating risk levels for TCE under Washington State's Model Toxic Control Act to include a more protective cancer slope factor for ingestion and inhalation of trichloroethene (TCE). The slope factor recommended in the Ecology guidance, 0.4 per mg/kg-day, is the high end (most protective) of the slope factor range provided in *Trichloroethylene Health Risk Assessment: Synthesis and Characterization (External Review Draft)* (U.S. EPA, 2001) and has until recently also been recommended for use by EPA Region 10. Based on new scientific information, EPA Region 10 now recommends the midpoint, 0.089 per mg/kg-day, of the slope factor range in EPA, 2001 be used as an interim value until EPA provides toxicity values on the IRIS database or other information becomes available to suggest a different value would be more appropriate. Ecology is considering adopting the midpoint for use under MTCA.

Using the cancer potency factor of 0.4 per mg/kg-day recommended by Ecology since 2004, the MTCA Method B groundwater cleanup level that equates to an estimated excess cancer risk of $1x10^{-6}$ is 0.11 ug/L (so 1.1 ug/L would equate to 1x10-5 and 11.0 would equate to 1x10-4). Applying the slope factor of 0.4 per mg/kg-day, the risk at the MCL would be approximately $5x10^{-5}$ (and using the newly recommended slope factor of 0.089 the risk at the MCL would equate to $1x10^{-5}$), which falls within the acceptable risk range of 10^{-4} to 10^{-6} so based on NCP requirements, cleanup to that standard remains protective. However, if a slope factor is used or adopted that is more protective than the one available at the time of the ROD there is some question whether cleanup to the MCL would meet ARARs (specifically the MTCA Method B requirements for cleanup levels based on applicable laws such as MCLs to be adjusted downward if they pose excess cancer risk greater than 1 x 10^{-5} or an HI greater than 1, and for site cleanup goals not to exceed a cumulative excess cancer risk for all contaminants of $1x10^{-5}$), the time to achieve cleanup goals could be longer than currently anticipated, and the air pathway may also warrant reconsideration.

EPA expects to complete its own review of the carcinogenicity of TCE by late 2010.
Given these uncertainties, EPA has determined no changes in cleanup levels or RAOs are warranted at this time, however the remedy should continue to operate and the TCE cleanup goals should be re-evaluated for protectiveness and compliance with ARARs when TCE toxicity values are published in IRIS or before the next five-year review, whichever is sooner.

Changes in Exposure Pathways, Toxicity and Other Contaminant Characteristics.
The ROD described current and future land uses and identified likely exposure pathways; the descriptions are accurate for the site conditions at the time of this review. The potential risk due

to the intrusion of VOCs into indoor air was not explicitly recognized as a significant pathway at the time that the ROD was prepared. The Phase 2 Site Evaluation did assess whether there are potential unacceptable risks associated with current and potential future human exposures to site COCs intruding into the indoor air of the control room on site. The results from the screening level risk evaluation using indoor air modeling showed that the incremental cancer risk was 2.3 x 10^{-5}. For the more site-specific tier 2 risk evaluation, the incremental cancer risk was 2.5 x 10^{-6}. Since the risks associated with exposure to TCE in indoor air were lower than $1x10^{-4}$, which is the upper end of Superfund's range of acceptable risks, it is unlikely that exposure will result in significant health risk. There have been no changes in the physical conditions of the site that would lead to reconsideration.

While cleanup levels are unchanged and still considered to be protective, there was an ESD that allowed a change in the discharge, for which temporary conservative discharge standards were established. This change did not call into question the validity of cleanup levels and RAOs.

Revisions to the toxicity values for 1,1-dichloroethylene (1,1-DCE) indicate a lower risk from exposure than previously considered (see Attachment 4). Since the EA, the oral reference dose increased from 0.009 mg/kg-day to the current 0.05 mg/kg-day signifying a lower risk from exposure. Furthermore, cancer slope factors were removed from the IRIS database because 1,1-DCE showed equivocal evidence of carcinogenicity by the oral route of exposure and the weight-of-evidence was not sufficient to justify deriving an inhalation unit risk. Under the 1999 draft revised guidelines for carcinogen risk assessment, EPA concludes 1,1-DCE exhibits suggestive evidence of carcinogenicity but not sufficient evidence to assess human carcinogenic potential. These changes do not affect the protectiveness of the groundwater remedy.

Changes in Land Use. There have been no changes in the physical conditions of the site that would affect the protectiveness of the remedy.

Remedial Action Objectives. The RAOs from the ROD are still valid for the site.

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

Answer: No. There is no other information that calls into question the protectiveness of the remedy or causes change to institutional controls

Technical Assessment Summary

According to the data reviewed and information obtained from the site inspection, the remedy is functioning as intended by the ROD as amended by the ESD. There have been no changes in the ARARs, standards or To Be Considered that should affect the protectiveness of the remedy. The remedy is still protective of human health and the environment. There is no other information that calls into question the protectiveness of the remedy.

VIII. Issues

This section addresses issues that, either currently or in the future, prevent the source and groundwater RAs from being protective.

Table 5 – Issues of the 2008 Five-Year Review

Issue	Affects Protectiveness? (Y or N)	
	Current	Future
Deed restrictions to limit future use of the Boomsnub property have not been formally recorded	N	Y
Obtain easements and restrictive covenants from property owners affected by the remedy in order to grant a right of access for remediation activities and prevent persons from using the property in a way that would adversely affect the remediation	N	Y
Significant increase of TCE in well AMW-18, historically below cleanup level	N	Y
Optimization of the long-term monitoring program is needed	N	Y

IX. Recommendations and Follow-up Actions

Table 6 lists recommendations and follow-up actions for each issue identified in Table 5.

Table 6 – Recommended Follow-Up Actions

Issue	Recommendations/ Follow-Up Actions	Party Responsible	Oversight Agency	Planned Completion Date
Deed restrictions to limit future use of the Boomsnub property have not been formally recorded	Record deed restrictions to maintain industrial land use of the property and prevent disturbing soil below 15 feet	EPA	EPA	March 2010
Obtain easements and restrictive covenants from property owners affected by the remedy in order to grant a right of access for remediation activities and prevent persons from using the property in a way that would adversely affect the remediation	Continue to work on obtaining easements, access agreements, and restrictive covenants for properties above the plume	Linde	EPA	October 2010
Significant increase of TCE in well AMW-18, historically below cleanup level	Start to investigate the source and extent of TCE contamination detected in AMW-18	Linde	EPA	December 2008

Issue	Recommendations/ Follow-Up Actions	Party Responsible	Oversight Agency	Planned Completion Date
Optimization of the long-term monitoring program is needed	Conduct Long Term Monitoring Optimization of groundwater monitoring prior to the next five-year review using tools and techniques outlined in EPA 542-R-05-003. Continue system optimization to restore groundwater to drinking water quality within a 30 year time frame	Linde	EPA	July 2010

X. Protectiveness Statement(s)

The soil remedy (Operable Unit 1) is expected to be protective of human health and the environment upon completion, and in the interim, exposure pathways that could result in unacceptable risks are being controlled. Most known and accessible contaminated soils at the site have been addressed through soil excavation, removal, and replacement with clean soil to a depth of at least 15 feet below ground surface and the site is fenced to prevent access. There remains a defined quantity of soil above lead and chrome cleanup levels directly below the treatment plant. The physical structure of the treatment plant limits exposure to these soils. The remedy anticipates removal of contaminated soils that are present through a depth of 15 ft below ground surface after the decommissioning of the site-wide groundwater treatment plant.

The remedy for the BOC gases property (Operable Unit 2) is expected to be protective of human health and the environment upon completion, and in the interim, exposure pathways that could result in unacceptable risks are being controlled. Extraction and treatment systems are providing containment of the TCE plume and TCE concentrations in groundwater are decreasing across the site. No one is drinking the contaminated water and Institutional Controls are being implemented to ensure no one drinks the water before cleanup goals are achieved.

The site-wide groundwater remedy (Operable Unit 3) is expected to be protective of human health and the environment upon attainment of the groundwater cleanup goals. In the interim, exposure pathways that could result in unacceptable risks are being controlled. The extraction and treatment system is functioning as intended, no one is drinking the contaminated water and Institutional Controls are being implemented to ensure no one drinks the water before cleanup goals are achieved.

XI. Next Review

The next five-year review for the Boomsnub/Airco Superfund Site is required by September 2013, five years from the date of this review.

Figures

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Figure 1

Site Location Map

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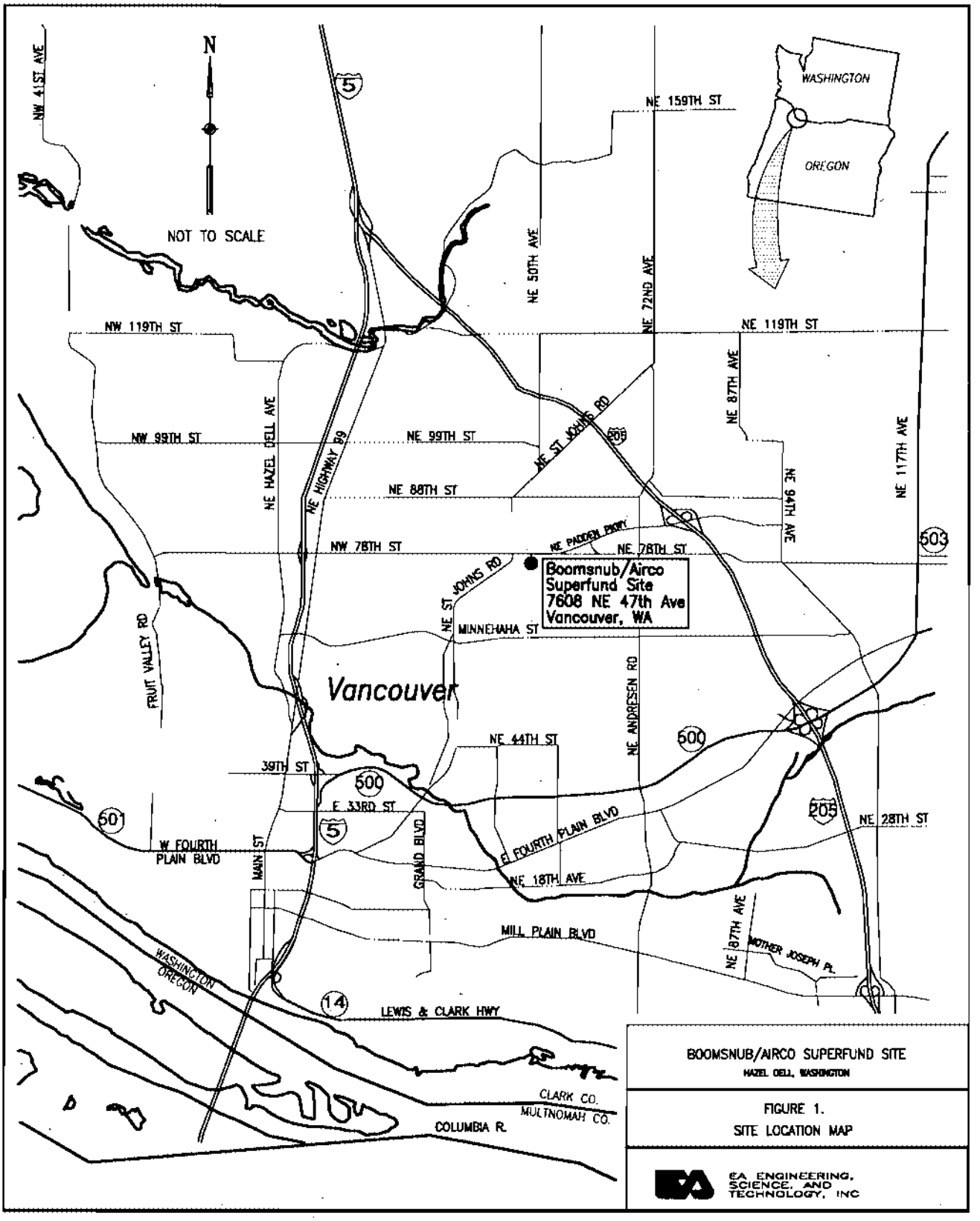

BOOMSNUB/AIRCO SUPERFUND SITE
HAZEL DELL, WASHINGTON

FIGURE 1.
SITE LOCATION MAP

EA ENGINEERING, SCIENCE, AND TECHNOLOGY, INC

F:\Projects\14495.05 SOC GW Monitoring\Fiscal Year 2008\0310 2007 Annual Report\Figures\Fig1.dwg, 3/12/2008 2:10:47 PM, lwood

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Figure 2

Monitoring and Extraction Well Network

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LEGEND
N
BOOMSNUB/AIRCO SUPERFUND SITE
Figure 2 - Monitoring and Extraction Well Network
EA ENGINEERING, SCIENCE, AND TECHNOLOGY, INC.

Figure 3

Groundwater Treatment Process Flow

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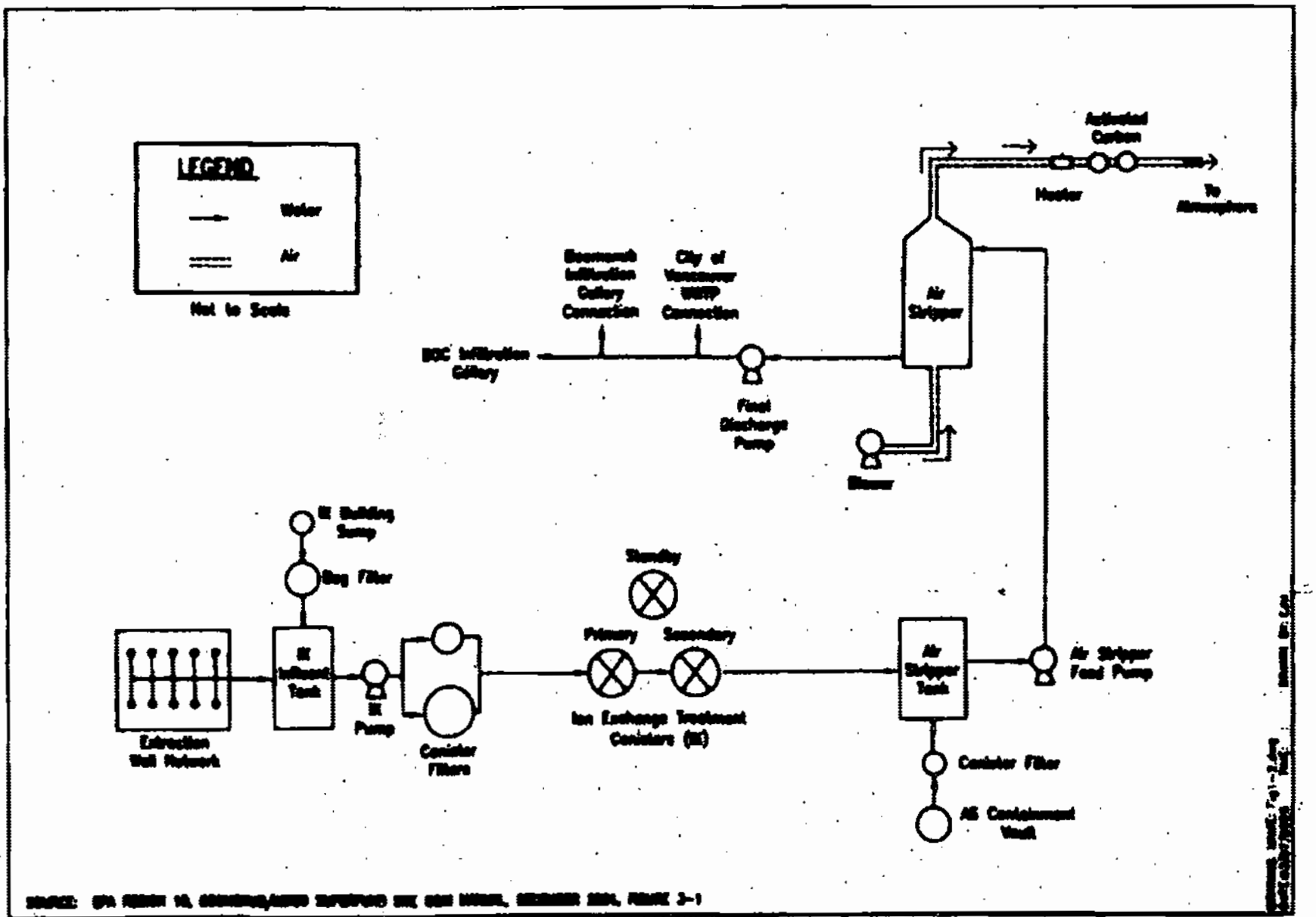

Figure 3 - Groundwater Treatment Process Flow

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Figure 4

Chromium Plume Map, 1995 vs 2007

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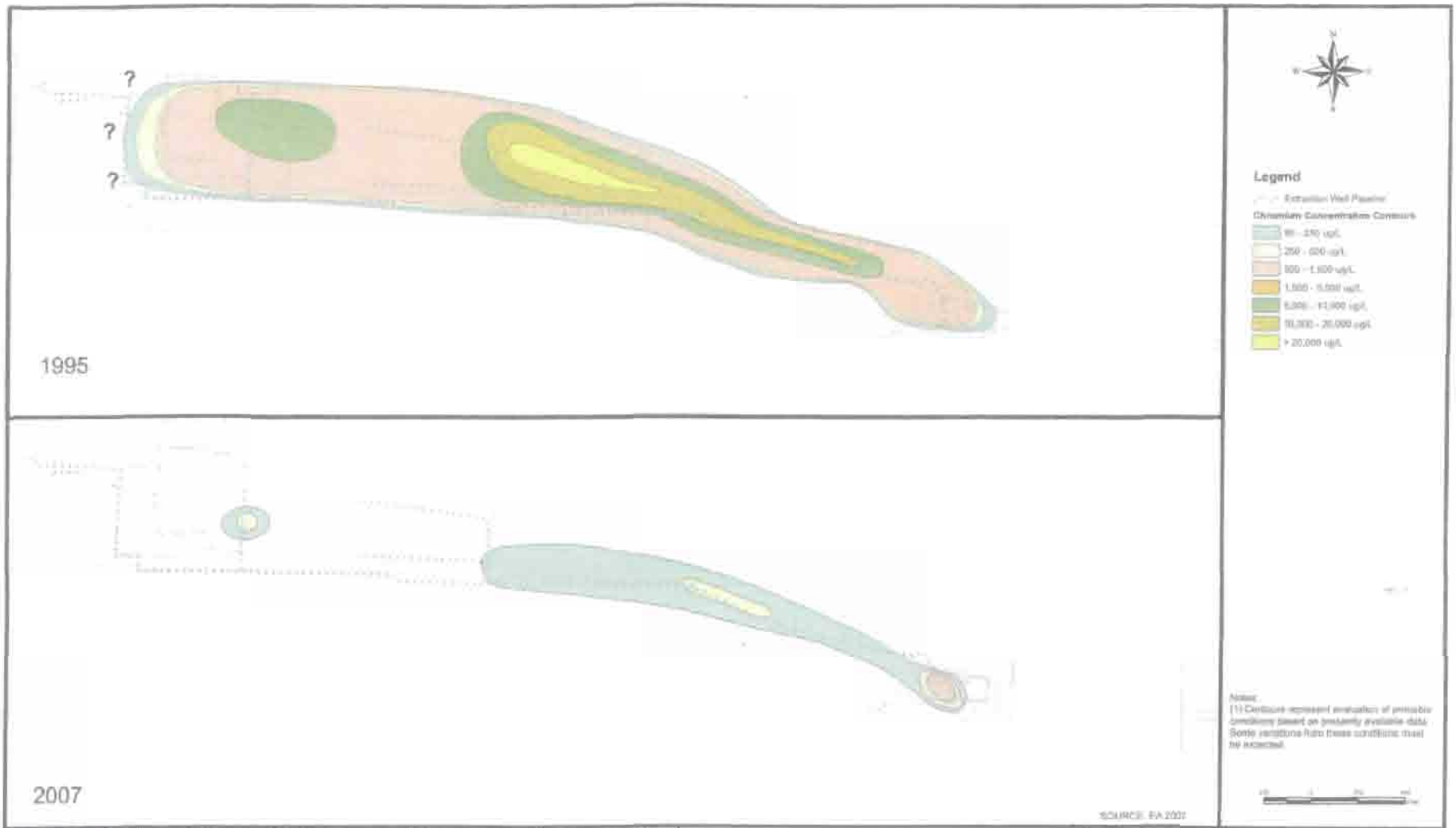

EA Engineering, Science, and Technology, Inc.	PROJECT MGR: DMI	DESIGNED BY: BAM	DATE: JANUARY 2008	FILE No: [illegible]	BOOMSNUB/AIRCO SUPERFUND SITE HAZEL DELL, WASHINGTON
	CHECKED BY: GAH	DRAWN BY: WCM	PROJECT No.: 14668.09	SCALE: AS SHOWN	Figure 4 - Chromium Plume Map 1995 vs 2007

Figure 5

TCE Plume Map, 1995 vs 2007

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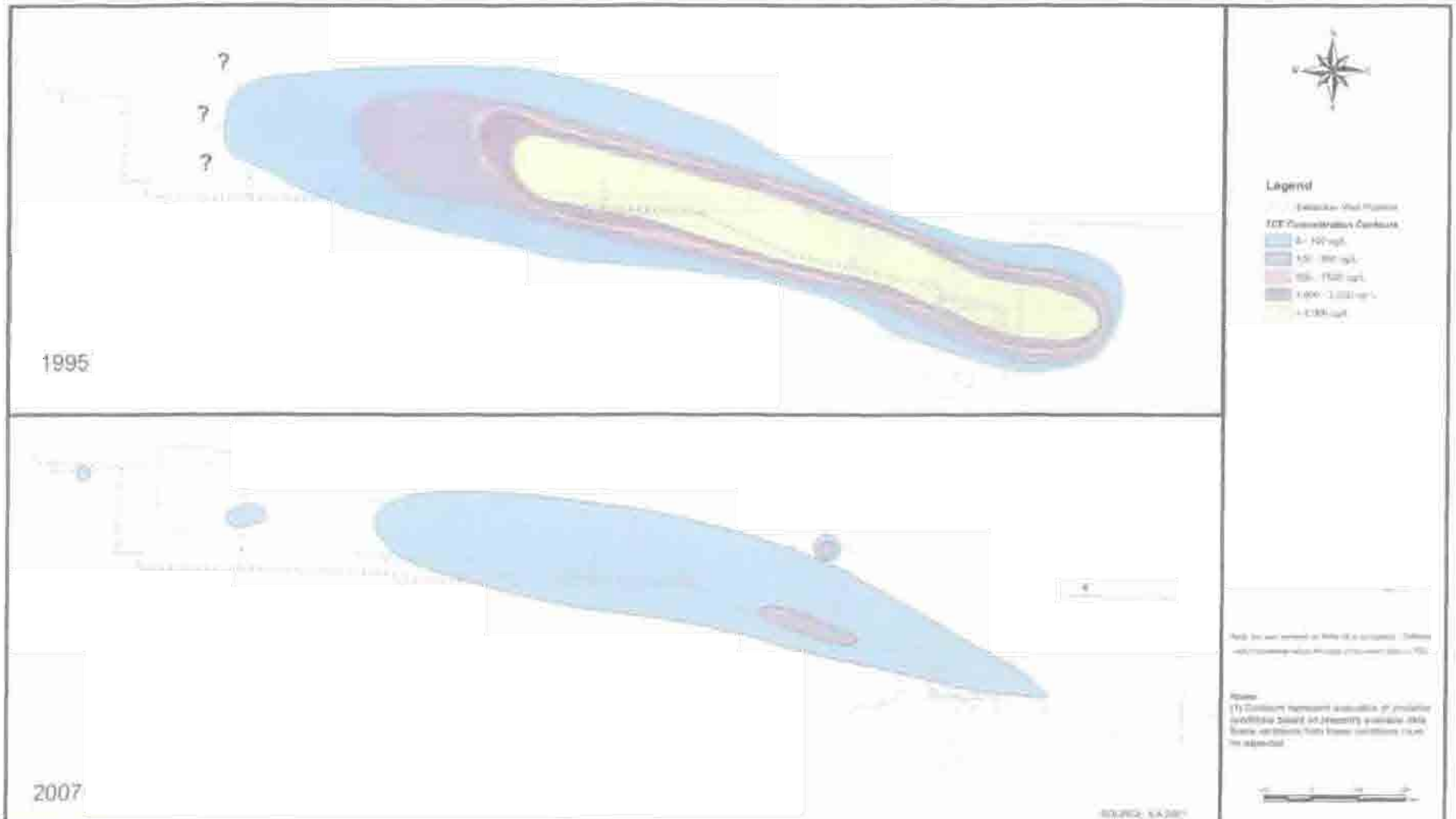

PROJECT MGR	DESIGNED BY	DATE		BOOMSNUB/AIRCO SUPERFUND SITE HAZEL DELL, WASHINGTON	Figure 5 - TCE Plume Map 1995 vs 2007
CHECKED BY	DRAWN BY	PROJECT No.	SCALE		

Figure 6

OU-2 Removal Action - Pounds of TCE Removed by Soil Vapor Extraction

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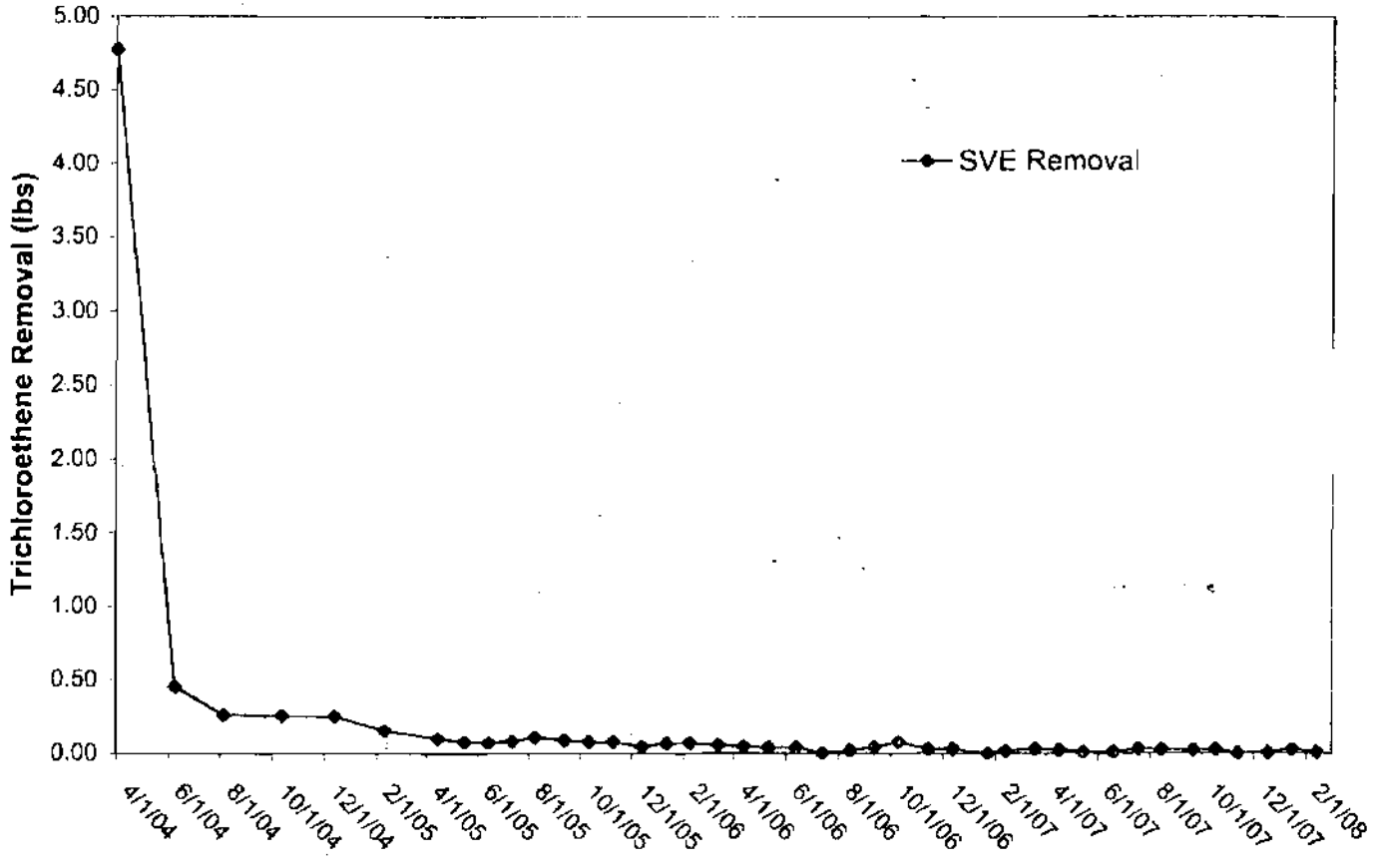
Figure 6 - OU-2 Removal Action - Pounds of TCE Removed by Soil Vapor Extraction



Note: Rebound testing completed February 2008. SVE operations terminated on 3/3/2008.

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Figure 7

OU-3 Cumulative Total Removal Over Time

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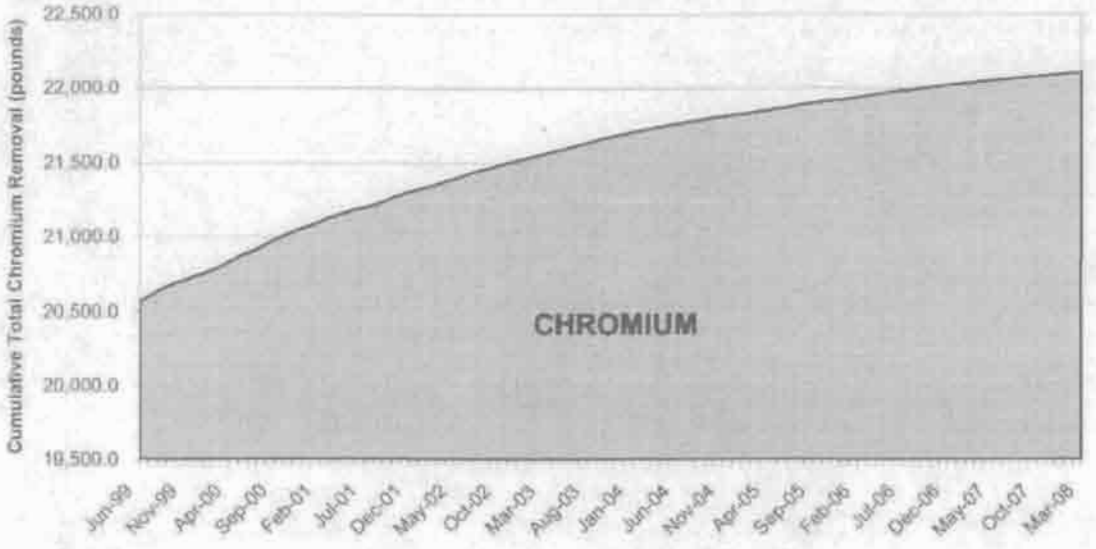
Figure 7 - OU-3 Cumulative Total Removal Over Time



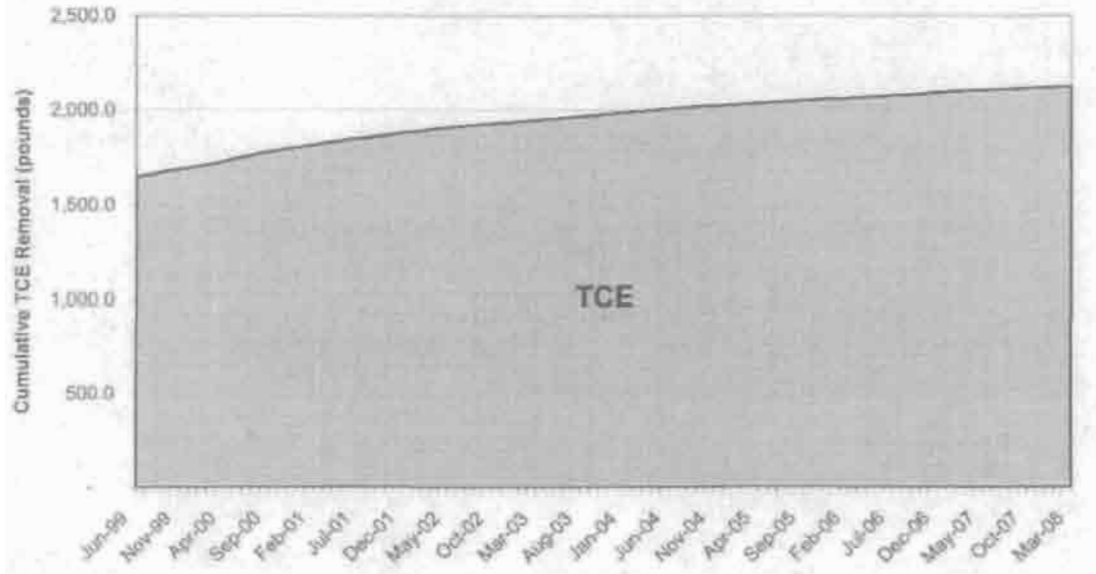


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Figure 8

Alluvial Aquifer Groundwater Contours, Fall 2007

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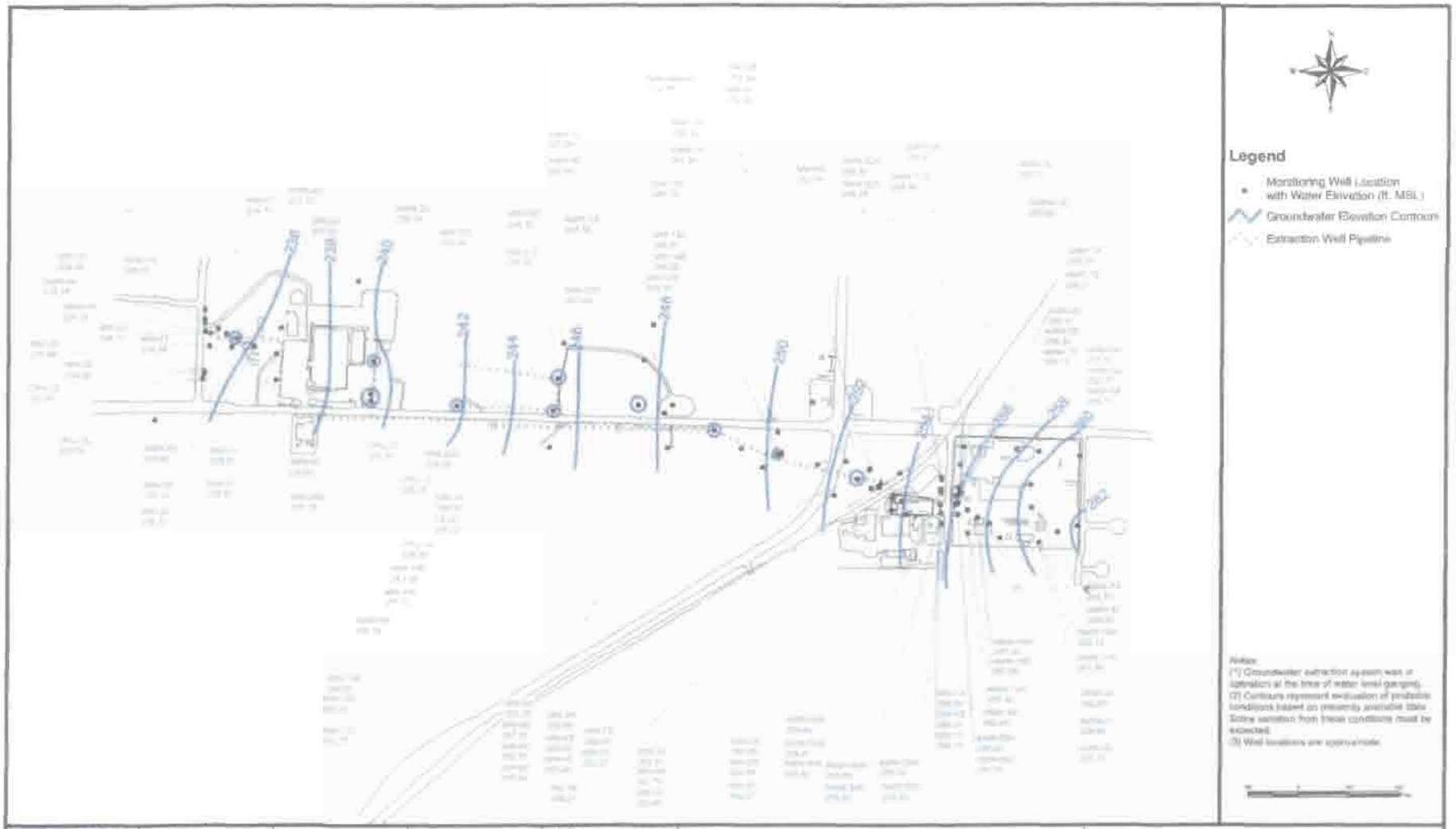

EA Engineering, Science, and Technology, Inc.	PROJECT MGR: CMR	DESIGNED BY: BSM	DATE: DECEMBER 2007	FILE No. Q:\PROJECTS\2005\BOOMSOCS\ARCO\DWG\ALL GW FALL07 FIG.MXD	BOOMSNUB/AIRCO SUPERFUND SITE HAZEL DELL, WASHINGTON
	CHECKED BY: DAH	DRAWN BY: WCM	PROJECT No: 14465.28	SCALE: AS SHOWN	

FIGURE 8
ALLUVIAL AQUIFER GROUNDWATER CONTOURS, FALL 2007

Figure 9

Troutdale Aquifer Groundwater Contours, Fall 2007

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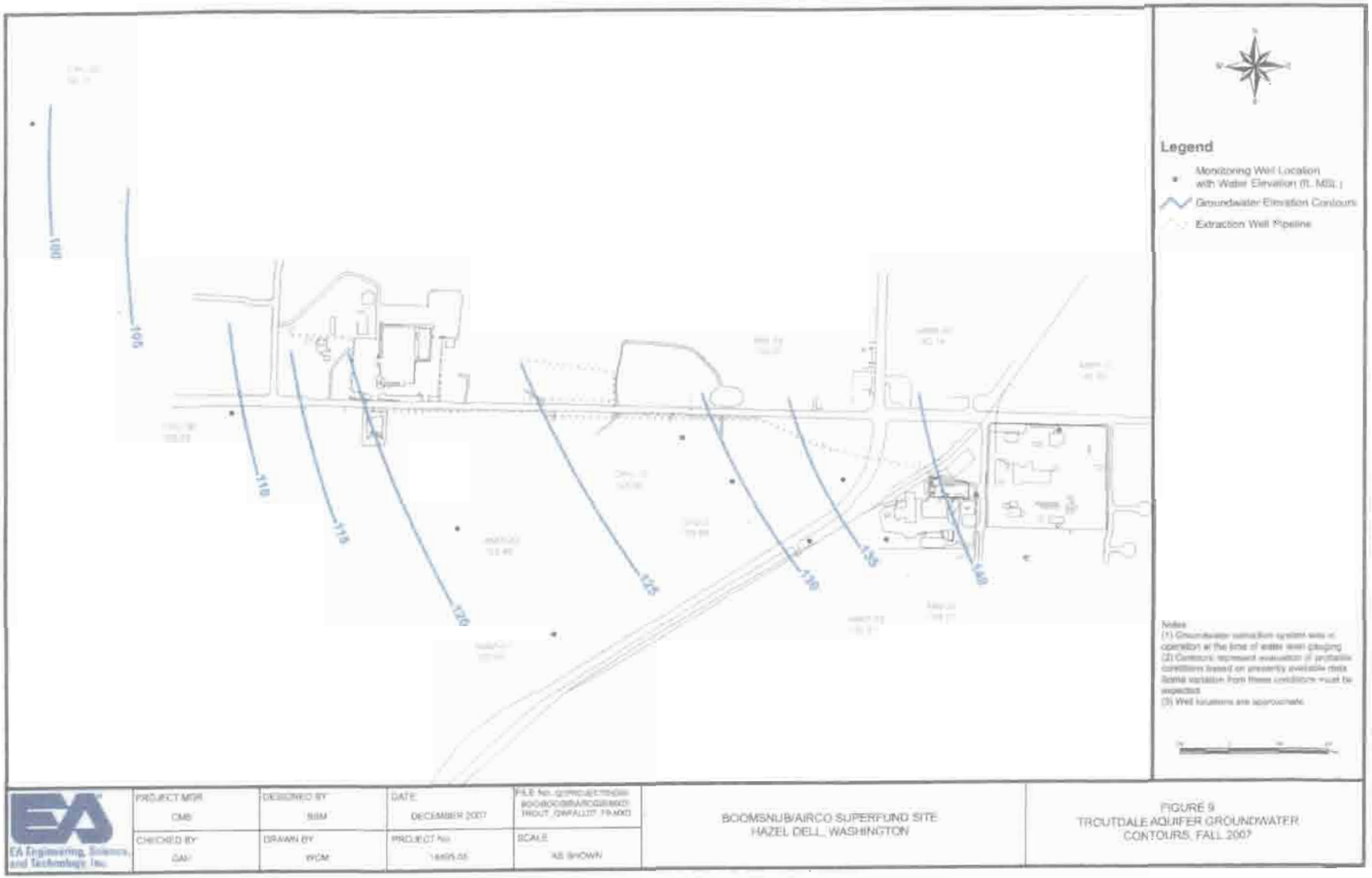

EA Engineering, Science, and Technology, Inc.	PROJECT MGR: CMB	DESIGNED BY: SSM	DATE: DECEMBER 2007	FILE No. Q:\PROJECTS\BOOMSNUB\AIRCO\SUPERFUND\TROUT_GWFALL07_FIGURE9	BOOMSNUB/AIRCO SUPERFUND SITE HAZEL DELL, WASHINGTON	FIGURE 9 TROUTDALE AQUIFER GROUNDWATER CONTOURS, FALL 2007
	CHECKED BY: DAH	DRAWN BY: WCM	PROJECT No.: 14655.05	SCALE: AS SHOWN		

Figure 10

Areas of Contamination with Overlay of Real Estate Parcel Numbers

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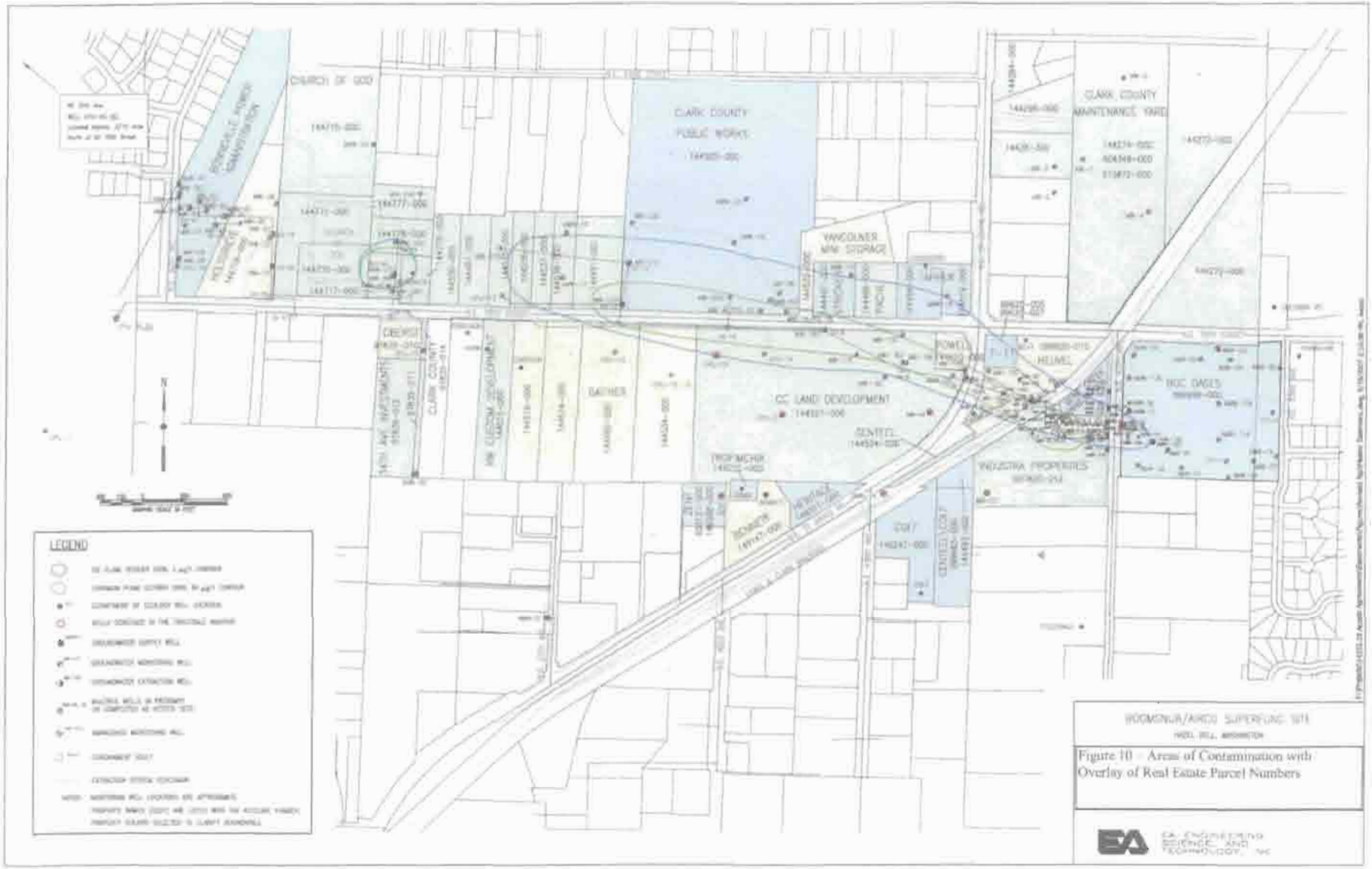

WOODWARD/ARCO SUPERFUND SITE

Figure 10 – Areas of Contamination with Overlay of Real Estate Parcel Numbers

EA ENGINEERING SCIENCE AND TECHNOLOGY, INC

Attachment 1

List of Documents Reviewed

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LIST OF DOCUMENTS REVIEWED

City of Vancouver Permit No.: 2004-04

EA July 1998, Draft Streamlined Ecological Risk Evaluation, BOC Gases Vancouver, Washington

EA May 2000, Final Phase 2 Site Evaluation Report, BOC Gases

EA Aug 2003, Spring 2003 Semi-Annual Groundwater Sampling Report, Boomsnub/Airco Superfund Site

EA Jan 2004, Fall 2003 Semi-Annual Groundwater Sampling Report, Boomsnub/Airco Superfund Site

EA Mar 2004, Groundwater Modeling Technical Memo No. 1 - Assessment of the Extraction System Capture Zone - Toe-of-Plume Region, Boomsnub/Airco Superfund Site

EA Apr 2004, Annual Status Report for the Boomsnub/Airco Superfund Site

EA May 2004, Groundwater Modeling Technical Memorandum No. 2, Revision 1 - Assessment of the Extraction System Capture Zone, Boomsnub/Airco Superfund Site,

EA Aug 2004, Spring 2004 Semi-Annual Groundwater Sampling Report, Boomsnub/Airco Superfund Site

EA Feb 2005, Fall 2004 Semi-Annual Groundwater Sampling Report, Boomsnub/Airco Superfund Site

EA Sep 2005, Spring 2005 Semi-Annual Groundwater Sampling Report, Boomsnub/Airco Superfund Site

EA Oct 2005, Annual Status Report for the Boomsnub/Airco Superfund Site

EA Feb 2006, Fall 2005 Semi-Annual Groundwater Sampling Report, Boomsnub/Airco Superfund Site

EA Apr 2006, Annual Status Report for the Boomsnub/Airco Superfund Site

EA Aug 2006, Spring 2006 Semi-Annual Groundwater Sampling Report, Boomsnub/Airco Superfund Site

EA Jan 2007, Fall 2006 Semi-Annual Groundwater Sampling Report, Boomsnub/Airco Superfund Site

LIST OF DOCUMENTS REVIEWED, Continued

EA March 2007, Draft Long Term Monitoring Plan, Boomsnub/ Airco Superfund Site

EA Apr 2007, Annual Status Report for the Boomsnub/Airco Superfund Site

EA Aug 2007, Draft Operation and Maintenance Manual: Groundwater Extraction and Treatment System, Boomsnub

EA Aug 2007, Spring 2007 Semi-Annual Groundwater Sampling Report, Boomsnub/Airco Superfund Site

EA Sep 2007, Draft Closure Plan: Operable Units 2 and 3, Boomsnub

EA Apr 2008, Annual Status Report for the Boomsnub/Airco Superfund Site

EA Jan 2008, Fall 2007 Semi-Annual Groundwater Sampling Report, Boomsnub/Airco Superfund Site

Easement Agreement and Restrictive Covenant Regarding Environmental Remediation_ Lot 3 Subdivision, Short Plats Volume, 'I' Page 956 (Vancouver Mini Storage, LLC)

Easement Agreement and Restrictive Covenant Regarding Environmental Remediation_ 1 Volume, 1 Page, 81 Section, 12 Township, Range 2, 1 East (Heritage Development, LLC)

Easement Agreement and Restrictive Covenant Regarding Environmental Remediation_ 12 Township, 2 Range, 1 East (C.C. Land Development LLC and Equishare Development LLC)

Easement Agreement and Restrictive Covenant Regarding Environmental Remediation_ NE 1/4 Section 12, T 2 North, R 1 East, WM (Bennett property)

Easement Agreement and Restrictive Covenant Regarding Environmental Remediation_ NE 1/4 Section 12, Township 2 North, Range 1 East, WM (The BOC Group)

Easement Agreement and Restrictive Covenant Regarding Environmental Remediation_ NE 1/4 Section of 12, T 2 North, R 1 East, WM (Huevel Enterprises, LLC)

Easement Agreement and Restrictive Covenant Regarding Environmental Remediation_ Section 12 Township, 2 north Range, 1 East (Powell Distributing Company, Inc.)

Easement for Tract No. VK-22 (Portion of Holtgrieve property)

Easement for Sewer Line, Tax Parcel No. 0099631-0000 (Boomsnub property)

Easement for Groundwater Extraction System, Tax Parcel No. 099632-000 (Seine Creek Properties Co., Inc.)

Land Use Agreement No. 960067 Amendment No. 6 (Bonneville Power Administration)

Technical Memorandum: Sale of Chapman Property and Future Development Plans, Parcel No. 144718-000

USEPA Sep 1997, Boomsnub/Airco Superfund Site Record of Decision, OU-2

LIST OF DOCUMENTS REVIEWED, Continued

USEPA Feb 2000, Boomsnub/Airco Superfund Site Record of Decision, OU-1

USEPA Sep 2003, Five-Year Review Report for Boomsnub/Airco Superfund Site

USEPA Aug 2006, Boomsnub/Airco Superfund Site Explanation of Significant Differences

USEPA May 2005, Roadmap to Long-Term Monitoring Optimization, EPA 542-R-05-003

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Attachment 2

Extraction and Monitoring Well Groupings

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Extraction and Monitoring Well Groupings							
Grouping	**AMW**		**MW**		**Other Wells**		
Upgradient	AMW-6A	AMW-10A					
	AMW-7A	AMW-11A					
	AMW-8A	*AMW-5A*					
	AMW-9A	*AMW-21*					
TCE Source	AMW-1A	AMW-26	MW-1A				
	AMW-1B	AMW-52A	MW-1B				
	AMW-1C	AMW-52C	MW-1C				
	AMW-2A	AMW-53A					
	AMW-2B	AMW-53B					
	RAMW-2C	AMW-53C					
	AMW-3A	AMW-54A					
	AMW-4A	AMW-54C					
	AMW-12A	AMW-55A					
	AMW-13A	AMW-55C					
	AMW-19A	AMW-56A					
	AMW-19B	AMW-56C					
		AMW-20					
Proximal	AMW-58		MW-2A	MW-6C	PW-1B		
			MW-2B	MW-6D	*EC-1*		
			MW-2C	MW-7B			
			MW-3A	MW-7C			
			MW-3B	MW-8B			
			MW-3C	MW-9B			
			MW-4A	MW-9C			
			MW-4B	MW-10B			
			MW-4B Shed	MW-10C			
			MW-4C	MW-12C			
			MW-6A	MW-13C			
			MW-6B				
Intermediate	AMW-16	AMW-22	MW-14C	MW-18E	CPU-14		
	AMW-17		MW-14E	MW-19D			
	AMW-18		MW-15E	MW-20D			
	AMW-59		MW-16E	MW-40			
	AMW-60		MW-17E	*MW-38*			
			MW-18D	*MW-39*			
Church of God	AMW-14	*AMW-15*	MW-21D	MW-26D	CPU-12		
	AMW-27	*AMW-23*	MW-22D	MW-27D	CPU-13		
	AMW-61		MW-23D	MW-49	*CPU-15*		
			MW-25D	*MW-24D*			
Toe of Plume:							
Sentinel	AMW-43	AMW-45	MW-30	*MW-28*	CPU-16		
	AMW-44		MW-47	*MW-29*			
Other Toe	AMW-42		MW-31	MW-46			
Wells	AMW-63		MW-35	MW-48			
			MW-37	*MW-32*			
			MW-41	*MW-36*			
Troutdale	AMW-24	AMW-50	MW-33		GWSW-1*	CPU-2	Bennett
	AMW-25	AMW-51	MW-34		GWSW-2*	CPU-3D	
		AMW-62				CPU-10	

Note: * BOC Supply Wells

AMW wells were installed by BOC, US Environmental Protection Agency, or Washington Department of Ecology

CPU wells were installed by Central Public Utilities; MW wells were installed by others

Not all of the wells listed on this table are regularly sampled

Assume that italicized wells have been removed from service since the last five year review

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Attachment 3

ARARs Review Summary

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ARARs Review Summary, Boomsnub Site

Medium	Source/ARAR	Applicable or Relevant and Appropriate	Requirement Synopsis	Initial Comment on Application	Current ARAR Evaluation
Chemical-Specific ARARs					
Groundwater/ Soil	Model Toxics Control Act; Selection of Cleanup Actions, WAC 173-340-360; Institutional Controls, WAC 173-340-440; Use of Method B Cleanup Levels, WAC 173-340-705; Groundwater Cleanup Standards, WAC 173-340-720; Soil Cleanup Standards, WAC 173-340-740 and 173-340-745	Applicable	MTCA describes the order of preference for cleanup technologies and use of permanent solutions; use of institutional controls where active cleanup measures will not attain MTCA cleanup levels; and the determination of groundwater and soil cleanup levels.	Groundwater at the Site is a potential source of drinking water and contaminated soils remain onsite.	This is still applicable. Groundwater is still a potential source of drinking water and contaminated soils remain onsite.
Groundwater	Safe Drinking Water Act, National Primary Drinking Water Regulations, 40 CFR 141; Public Water Supplies, WAC 246-290	Relevant and appropriate	Requirements applicable to public water systems. Establish "maximum contaminant levels" (MCLs), the maximum permissible level of a contaminant in water which is delivered to users of a public water system. MCLs are health-based standards.	Alluvial and Troutdale aquifers are used as drinking water supplies. Groundwater cleanup goals for this site include restoring the groundwater to drinking water standards. These standards will be met by the remedy.	This is still relevant and appropriate. The Alluvial and Troutdale aquifers are still being used as drinking water supplies.
All	22 CCR §66261.24(B)	Applicable	Establishes methods for determining hazardous waste classifications and sets characteristic of toxicity level for PCE	For determining waste classifications	This is still applicable. The treatment systems currently in place produce some hazardous waste.
Contaminated	RCRA, Subtitle C, 42	Applicable	Requires generators	These spent media are	This is still applicable.

Medium	Source/ARAR	Applicable or Relevant and Appropriate	Requirement Synopsis	Initial Comment on Application	Current ARAR Evaluation
resin/Spent carbon/ contaminated soil/	USC §6921, et seq.; 40 CFR Part 261; 40 CFR 262 Subparts A, B, C, and D; 40 CFR 264 Subparts I and J; Washington State Dangerous Waste Regulations, WAC 173-303-0707, 173-303-170 to -200, 173-303-360		to properly designate, characterize, and dispose hazardous waste	to be properly managed and disposed as hazardous waste.	The treatment systems currently use resin and carbon filter units. Future remediation of soil will require proper handling and disposal.
Action-Specific ARARs					
Air	Clean Air Act, 42 USC §7401, et seq; Washington Emission Standards and Controls for Emitting Volatile Organic Compounds, WAC 173-490	Applicable	These establish emission standards for specific VOC source emissions.	An air permit with the local clean air agency incorporates these standards for the air stripping system and granular activated carbon units.	This is still applicable. The remedial actions, using air stripping and granular activated carbon, are still occurring.
Air	Washington General Regulations for Air Pollution Sources, WAC 173-400; Southwest Washington Air Pollution Control Agency Regulations 400 and 490	Applicable	This prescribes treatment and control requirements for air emissions.	For controlling air emissions from the air stripping system and activated carbon units. An air permit with the local clean air agency incorporates these standards	This is still applicable. The remedial actions, using air stripping and granular activated carbon, are still occurring.
Air	Washington Ambient Air Quality Standards for Particulate Matter, WAC 173-470;	Applicable	This identifies suspended particulate standards	For excavation activities associated with soil removal at the Boomsnub Soil OU.	This is still applicable. Soil removal may occur in the future.
Groundwater	Clean Water Act, 33 U.S.C. 1317; 40 CFR 403.5; Washington Water Pollution Control Act, RCW 90.48; Washington Water Resources Act, RCW	Potentially applicable	These regulations pertain to the off-site disposal of treated groundwater. 40 CFR 403.5 prohibits discharges of pollutants into	EPA has a permit to discharge treated groundwater to the City of Vancouver's wastewater treatment system and meets the requirement of the	This is still potentially applicable. The EPA now discharges treated groundwater into an infiltration gallery on the BOC/Linde Gases property, which is

Medium	Source/ARAR	Applicable or Relevant and Appropriate	Requirement Synopsis	Initial Comment on Application	Current ARAR Evaluation
	90.54; Washington Grant of Authority Sewerage Systems, WAC 173-208		publicly owned treatment works that pass through the facility without treatment or that interfere with the treatment works.	permit.	technically now on-site. EPA monitors the groundwater in the vicinity of the infiltration gallery to monitor whether this discharge may contribute to the overall plume.
Groundwater	Pollution Disclosure Act of 1971, RCW 90.52.040	Applicable	This requires that wastes are to be provided with all known, available, and reasonable methods of treatment prior to their discharge or entry into waters of the state.	Contaminated groundwater will be treated, using ion exchange and air stripping, prior to discharge to the City of Vancouver sanitary sewer.	This is still applicable. The contaminated groundwater is treated, using ion exchange and air stripping, prior to discharge to the infiltration gallery located on the BOC/Linde Gases property.
Contaminated resin/spent carbon/ contaminated soil	U.S. Department of Transportation, 49 CFR Parts 171-180; Washington Transportation of Hazardous Waste Materials, WAC 446-50	Applicable	These establish regulations for transportation of hazardous materials.	Transportation of resin, spent carbon, and contaminated soil (if hazardous) to an off-site disposal facility is anticipated. EPA will meet these requirements during cleanup activities.	This is still applicable. Resin, spent carbon, and potentially contaminated soil are wastes that require transportation and disposal.
Groundwater	Washington Water Well Construction Act, RCW 18.104; Washington Minimum Standards for Construction and Maintenance of Wells, WAC 173-160	Applicable	These specify requirements for well construction and abandonment intended to protect groundwater from contamination.	The construction of additional monitoring and extraction wells and the abandonment of any wells will occur and comply with these standards.	This is still applicable. Portions of the extraction system have been shut down and may require abandonment. Also, additional extraction and monitoring wells may be constructed to optimize the existing extraction system.
Non-hazardous waste	Washington Solid Waste Management-Reduction	Applicable	These establish requirements for the	The disposal of non-hazardous waste	This is still applicable. All non-hazardous waste

Medium	Source/ARAR	Applicable or Relevant and Appropriate	Requirement Synopsis	Initial Comment on Application	Current ARAR Evaluation
	& Recycling Act, RCW 70.95; Washington Minimum Functional Standards for Solid Waste Handling, WAC 173-304		disposal of non-hazardous waste, where all non-hazardous waste generated will be disposed of off-site.	generated is off-site thereby complying with these regulations.	generate is disposed off-site.
Location-specific ARARs					
Wetlands	Executive Order 11990, Executive Order of Protection of Wetlands	Applicable	Requires EPA to avoid long and short tem adverse impacts associated with the destruction or modification of wetlands and avoid direct or indirect support of new construction in wetlands whenever there is a practicable alternative.	Portions of the extraction system are either within or adjacent to a seasonal wetland located south of NE 78ths Street.	This is still applicable. Continued O&M and/or upgrading of the extraction system is necessary to achieve control of and cleanup of the groundwater contamination.
Migratory Birds	Migratory Bird Treaty Act of 1918, 16 USC 703-712	Applicable	This protects migratory birds and their feathers, nests, and eggs.	The site may be in the pathway of migratory birds especially during construction activities at the Boomsnub Soil OU where these activities may be conducted in proximity to trees or other potential migratory bird habitat.	This is still applicable. The current treatment system is located on the Boomsnub Soil OU. Any future work to address this OU may potentially impact migratory birds.
To Be Considereds (TBCs)					
Soil	Natural Background Soil Metals Concentrations in Washington State, Ecology Publication 94-115	TBC	This is state guidance document provides county-specific background concentrations for	It will be considered when comparing site-specific soil concentrations to cleanup standards.	This is still a TBC. Background concentrations should be considered during any potential future soil

Medium	Source/ARAR	Applicable or Relevant and Appropriate	Requirement Synopsis	Initial Comment on Application	Current ARAR Evaluation
			inorganic chemicals		remedial actions
Soil	Ecology Statistical Guidance for Ecology Program Managers, August 1992, Ecology Publication 92-54	TBC	This provides guidance for statistical evaluation of sampling data when determining whether MTCA cleanup standards have been achieved.	EPA will determine the particular application of this guidance for use at the Boomsnub Soil OU.	This is still a TBC. Statistical evaluation of data may be applied for both groundwater and soil data.

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Attachment 4

Toxicity Review Summary

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Toxicity Data

COC		Reference Dose (oral) (mg/kg-day)	Reference Dose (inhalation) (mg/kg-day)	Slope Factor (oral) $(mg/kg\text{-}day)^{-1}$	Slope Factor (Inhalation) $(mg/kg\text{-}day)^{-1}$	Source
Tetrachlorethene	1998 HHERA	0.01	0.01	0.052	0.002	IRIS/R-t-R PRGs/NCEA
	Current Info	0.01	-	-	-	IRIS
Trichloroethene	1998 HHERA	0.006	0.006	0.011	0.006	NCEA
	Current Info	-	-	- / 0.013	- / 0.007	IRIS/CalEPA
1,2-Dichloroethene	1998 HHERA	0.01	0.01	-	-	HEAST
	Current Info	-	-	- /0.047	- / 0.72	IRIS/ CalEPA
1,1-Dichloroethene	1998 HHERA	0.009	0.009	0.6	0.18	IRIS
	Current Info	0.05	0.2 mg/m^3 RfC	-	-	IRIS
Carbon Tetrachloride	1998 HHERA	0.0007	0.00057	0.13	0.053	NCEA/IRIS
	Current Info	0.0007	-	0.13/0.15	0.053/0.15	IRIS/CalEPA
Bromodichloro-methane	1998 HHERA	0.012	0.02	0.1	0.062	R-t-R PRGs/IRIS
	Current Info	0.02	-	0.062/ 0.13	- / 0.13	IRIS/CalEPA
Dibromochloro-methane	1998 HHERA	0.02	0.02	0.084	0.084	R-t-R PRGs/IRIS
	Current Info	0.02	-	0.84/0.094	- / 0.094	IRIS/ CalEPA
Hexavalent Chromium	1998 HHERA	0.0005	0.000008	-	290	IRIS/EPA R10
	Current Info	0.003	0.0001 mg/m^3 RfC	- /-	290/ 510	IRIS/ CalEPA
1,2-dibromo-3-Chloropropane	1998 HHERA	0.000057	0.000057	1.4	0.0024	HEAST
	Current Info	- /-	0.002 mg/m^3 RfC /-	- /7	- / 7	IRIS/CalEPA
Hexachlorobutadiene	1998 HHERA	0.0002	0.0002	0.078	0.077	IRIS
	Current Info	- / -	- / -	0.078/ 0.013	- / 0.007	IRIS/ CalEPA

HHERA = Human Health and Ecological Risk Assessment; IRIS = Integrated Risk Information System; CalEPA = California EPA; HEAST = Health Evaluation Assessment Summary Tables, NCEA = National Criteria Environmental Assessment Office; R-t-R PRGs = Route-to-Route Extrapolation as indicated in EPA Region IX PRG; RfC = reference concentration.

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Attachment 5

Site Visit / Trip Report, with Photographs

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TRIP REPORT
BOOMSNUB/AIRCO SUPERFUND SITE, VANCOUVER, WA
(EPA ID: WAD009624453)

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1. INTRODUCTION:

a. Date of Visit: 9 April 2008

b. Location: Vancouver, Clark County, Washington

c. Purpose: A site visit was conducted to provide information about the site's status and to visually inspect and document the conditions of the remedy, the site, and the surrounding area for inclusion into the second Five-Year Review Report.

d. Travelers:

Marlowe Laubach	USACE Seattle District	(206) 764-4480
Emile Pitre	USACE Seattle District	(206) 766-6442

e. Contacts:

Claire Hong	USEPA Region 10 Remedial Project Manager (RPM)	(206) 553-1813
Bernie Zavala	USEPA Region 10 Hydrogeologist	(206) 553-1562
Glenn Hayman	EA Engineering, Science and Technology	(425) 451-7400
Jil Frain	EA Engineering, Science and Technology	(425) 451-7400
Rick Read	EA Engineering, Science and Technology	(360) 737-2867

2. SUMMARY:

On 9 April 2008, Marlowe Laubach and Emile Pitre (USACE team) arrived at the Boomsnub site at on NE 78th St at approximately 0900 hrs. The weather was cloudy with a temperature of 45°F.

The USACE team met with others in attendance at the site visit which began at approximately 0915 hrs. Those participants in attendance are listed in paragraphs 1.d and 1.e above. Mr. Hayman, Ms. Frain, and Mr. Read were representing EA Engineering, Science and Technology (EA), the consulting firm which operates the groundwater treatment system and performs groundwater monitoring for Boomsnub. After introductions were made, Mr. Hayman provided a brief site history with input by others and site walk with narrative (See Section 3, DISCUSSION, for details). The site visit concluded at approximately 1200 hrs.

The USACE team returned to Seattle that afternoon with Ms. Hong.

3. DISCUSSION:

The trip was made to complete the formal site inspection and associated Site Inspection Checklist, an important component of the Five Year Review. Furthermore, the site visit was helpful

in providing the USACE technical team the opportunity to become more familiar with the site and its relationship to the surrounding properties.

Boomsnub/Airco is a USEPA-led CERCLA site in which a five-year review is being conducted, with technical assistance provided by the Seattle District USACE. The physical remedies that have occurred on site dating back to 1990 include building demolition, soil excavation and off site disposal (including excavation dewatering and treatment), groundwater treatment, periodic groundwater monitoring, and access restrictions including fencing, locked gate, signage, and deed restrictions. Documents are maintained in the offices of USEPA Region 10.

There are three operable units identified at the site. OU-1 is the Boomsnub soil, OU-2 is the Airco/BOC Gases/Linde soil, and OU-3 is the site-wide groundwater. Access to the OU-1 and OU-2 sites are restricted by an aluminum chain-link fence topped with barbed wire around the entire site. OU-1 has a locked gate that was opened by EA personnel prior to our arrival. All personnel on site are required to sign in at the site trailer. The OU-2 property located east of OU-1 is owned by Linde and sits behind an automated gate that is operated by Linde personnel. Linde produces nitrogen, oxygen, argon and stores and distributes specialty gases such as hydrogen, acetylene, and helium. Visitors were required to sign in, wear hard hats and a visitors badge for the duration of the site walk on Linde property. We were escorted at all times by EA personnel familiar with evacuation procedures and the layout of the Linde property.

The remedy at OU-1 included building demolition and subsequent excavation and backfill of contaminated soils. The current features within the fenced site at OU-1 are the site trailer and the OU-3 groundwater treatment system that includes, but not limited to, an air stripping system (photo 1), a granular activated carbon (GAC) system (photo 2) and a building to house the ion exchange system (photos 2 and 3). The only intended access point is the front gate at the fence line along NE 47th Avenue. Signage is in place near the front gate identifying the area as a Superfund Site. Trespassing and vandalism reportedly are not recurring issues of concern for the site.

The source control measures at OU-2 includes in-situ well stripping and soil vapor extraction. The current features within the fenced site at OU-2 are the Linde production, storage, and distribution facilities. Features pertaining to the Boomsnub site include several wells used for in-situ well stripping and soil vapor extraction (SVE), a GAC system (photo 4), two small trailers housing the extraction systems (photos 4 and 5), and the BOC infiltration gallery. The only intended access point is the front gate at the fence line along NE 78th Street.

The SVE system was shutdown at the end of February 2008 due to low recovery rates (photo 6). The in-well stripping system has 4 wells currently operating (photo 7). Each extraction system has a corresponding trailer to house the equipment, so at the time of this site visit only one of the trailers was operational.

There are several monitoring and extraction wells that make up the groundwater network for OU-3. Extraction wells at the toe of the plume were shutdown because groundwater concentrations in neighboring wells are below the cleanup goals for the contaminants of concern (COCs), with exception of one area. The exception is currently undergoing in-situ treatment to reduce concentrations of the COCs to below the cleanup goals. There are over 85 groundwater monitoring

wells and 24 extraction wells in the groundwater network. For the sake of time, only a few of the wells were inspected and all were in good condition. The wells inspected were: extraction well MW-26D located near the Church of God (photo 8, installed by EPA), extraction well PW-1B located near the treatment compound (photo 9, installed by Boomsnub), and well AMW-27 located just south of MW-26D near the Church of God (photo 10, installed by Linde or BOC Gases).

There were two acts of vandalism that were discussed during the site visit. One act occurred at MW-35 where about 24 feet of wire was cut and removed from the well after it was shutdown and the cover to an electrical panel was removed (photo 11). The wire was probably sold for the copper content due to the current high price of copper. Well MW-35 was not secure because it was a monitoring well that was converted to a temporary extraction well to assist in plume capture. The configuration at well MW-35 and the subsequent vandalism are anomalies as all permanent extraction wells are secured inside vaults requiring unique tools to open. There is signage near MW-35 that warns against digging, but no signage exists that would deter someone from taking wire (photo 12). The second act of vandalism was at containment vault 3 (CV-3). The manhole lid had standard 3/4 inch bolts holding the lid down. The manhole lid was off and the bolts were missing. Nothing was removed from the vault. Both acts of vandalism had little impact to the remedy and do not constitute a remedial deficiency.

There is currently no waste stream generated from the site other than purge water from the semi-annual groundwater sampling. No drums present during the site inspection.

Development has occurred in areas where OU3 wells exist and were coordinated with site activities to minimize the impacts to system components and operations. For example, in 2006, a school was built requiring soil regrading and infrastructure installation that affected several flush mount wells. The BOC Gases local contractor provided communication with the development contractor to assure that wells in the vicinity of the construction would not be adversely affected. Currently the County wants to develop neighboring property just east of the school, the owner of the Chapman property at the toe of the plume would like to develop his property, and there is some discussion of developing the open field west of the Boomsnub property. Development of the property east of the school would not affect the extraction system since the system does not encroach on this land. Development of the Chapman property would not affect the extraction system at the toe of the plume because that portion of the system is shutdown due to low contaminant recovery in extraction wells. There is on-going in-situ treatment of the one hot spot located in this area. Development of the open field west of the Boomsnub property would require moving about 450 feet of piping.

The contractor mentioned OU-1 may still be a contaminant source because the soil removal only went to the water table and well MW-2A, located within the soil removal area, has the highest chromium contamination. Additional excavation may be required to remove this potential source.

Recommendations from the remedial systems evaluation were implemented. There were two recommendations from the first five year review that have not been implemented:

- Record deed restrictions for the Boomsnub property to limit future use of the property.
- Upon decommissioning, demolition and removal of the existing groundwater treatment facilities remove soils exceeding cleanup levels known to exist below site facilities to a

depth of 15 feet for off site disposal in accordance with the conditions identified in the ROD.

4. RECOMMENDATIONS:

The USACE Seattle District will incorporate the information obtained from the site visit into the second Five-Year Review Report, and will also assist the USEPA Region 10 in incorporating the site visit details into the Site Inspection Checklist.

Emile Pitre
Chemical Engineer
CENWS-EC-TB-ET

Photo 1: OU-3 Air Stripping System

Photo 2: OU-3 GAC system and building housing ion exchange system

Photo 3: OU-3 Ion exchange system

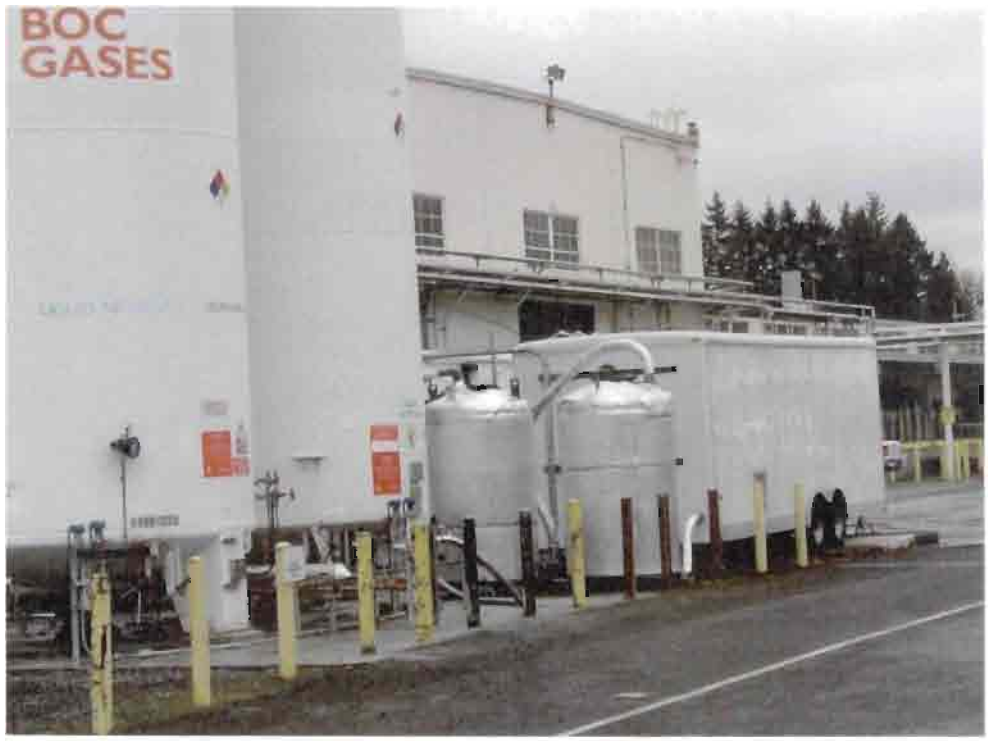

Photo 4: OU-2 GAC system and trailers housing extraction systems

Photo 5: Inside the trailer housing the OU-2 extraction system

Photo 6: SVE well setup

Photo 7: In-well stripping setup

Photo 8: Extraction well MW-26D

Photo 9: Extraction well PW-1B

Photo 10: Extraction well AMW-27

Photo 11: Electric Panel removed near MW-35

Photo 12: Warning Signage

Site Inspection Team Roster

Boomsnub/Airco Superfund Site
Second Five-Year Review
Site Inspection – April 9, 2008

Name	Title	Affiliation	Phone No.
Claire Hong	Remedial Project Manager	USEPA, Region 10	(206) 553-1813
Bernie Zavala	Hydrogeologist	USEPA, Region 10	(206) 553-1562
Glenn Hayman	Senior Hydrogeologist	EA Engineering, Science, and Technology	(925) 899-5216
Jil Frain	Environmental Engineer	EA Engineering, Science, and Technology	(425) 451-7400
Richard Read	Site Operations Manager	EA Engineering, Science, and Technology	(360) 737-2867
Marlowe Laubach	Environmental Engineering & Technology Section	US Army Corps of Engineers, Seattle District	(206) 764-4480
Emile Pitre	Environmental Engineering & Technology Section	US Army Corps of Engineers, Seattle District	(206) 766-6442

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Attachment 6

Site Inspection Checklist

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Site Inspection Checklist

I. SITE INFORMATION	
Site name: Boomsnub / Airco Superfund Site	**Date of inspection: 09 April 2008**
Location and Region: Vancouver, WA Region 10	**EPA ID: WAD009624453**
Agency, office, or company leading the five-year review: US Environmental Protection Agency	**Weather/temperature: Cloudy / 45° F**

Remedy Includes: (Check all that apply)

- ☐ Landfill cover/containment
- ☐ Access controls
- ☒ Institutional controls
- ☒ Groundwater pump and treatment
- ☐ Surface water collection and treatment
- ☒ Other: Soil Excavation and Disposal
- ☐ 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** Richard Read (Name) — Site Operations Manager (Title) — 4/9/08 (Date)
   Interviewed ☒ at site ☐ at office ☐ by phone Phone no.
   Problems, suggestions; ☒ Report attached

2. **O&M staff** Glenn Hayman (Name) — Senior Hydrogeologist (Title) — 4/9/08 (Date)
   Interviewed ☒ at site ☐ at office ☐ by phone Phone no.
   Problems, suggestions; ☒ Report attached

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

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

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

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

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

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

No interviews were conducted except that site inspection participants were questioned during the site walk.

Adjacent property owners and local regulatory authorities will be interviewed by phone at a later date.

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

1. **O&M Documents**
   - ☒ O&M manual — ☒ Readily available — ☒ Up to date — ☐ N/A
   - ☒ As-built drawings — ☒ Readily available — ☒ Up to date — ☐ N/A
   - ☒ Maintenance logs — ☒ Readily available — ☒ Up to date — ☐ N/A

   Remarks

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
☐ Other _____

2. **O&M Cost Records**

☐ Readily available ☒ Up to date
☐ Funding mechanism/agreement in place
Original O&M cost estimate _____ ☐ Breakdown attached

Total annual cost by 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: Site on front gate stating "Superfund Site". Signs that warn against digging near the extraction pipeline

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) self-reporting

Frequency as needed

Responsible party/agency EPA / EA

	Name	Title	Date	Phone no.
Contact	Claire Hong	EPA RPM	7/3/08	206-553-1813
Contact	Glenn Hayman	Senior Hydrogeologist	7/3/08	425-451-7400

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

D. General

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

Remarks: At MW-35 about 24 feet of wire was cut and removed from the well after it was shutdown and the cover to an electrical panel was removed. Manhole lid was off and bolts were missing at CV-3

2. **Land use changes on site** ☒ N/A

Remarks

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

Remarks: Development continues to occur on nearby off site property. A school was built east of the Church of God since the last FYR.

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
   Areal extent _____ Depth _____
   Remarks _____

2. **Cracks** ☐ Location shown on site map ☐ Cracking not evident
   Lengths _____ Widths _____ Depths _____
   Remarks _____

3. **Erosion** ☐ Location shown on site map ☐ Erosion not evident
   Areal extent _____ Depth _____
   Remarks _____

4. **Holes** ☐ Location shown on site map ☐ Holes not evident
   Areal extent _____ Depth _____
   Remarks _____

5. **Vegetative Cover** ☐ Grass ☐ Cover properly established ☐ No signs of stress
   G Trees/Shrubs (indicate size and locations on a diagram)
   Remarks _____

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

7. **Bulges** ☐ Location shown on site map ☐ Bulges not evident
   Areal extent _____ Height _____
   Remarks _____

8. **Wet Areas/Water Damage** ☐ Wet areas/water damage not evident

☐ Wet areas	☐ Location shown on site map	Areal extent
☐ Ponding	☐ Location shown on site map	Areal extent
☐ Seeps	☐ Location shown on site map	Areal extent
☐ Soft subgrade	☐ Location shown on site map	Areal extent

Remarks

9. **Slope Instability** ☐ Slides ☐ Location shown on site map ☐ No evidence of slope instability
Areal extent
Remarks

B. Benches ☐ Applicable ☒ N/A

(Horizontally constructed mounds of earth placed across a steep landfill side slope to interrupt the slope in order to slow down the velocity of surface runoff and intercept and convey the runoff to a lined channel.)

1. **Flows Bypass Bench** ☐ Location shown on site map ☐ N/A or okay
Remarks

2. **Bench Breached** ☐ Location shown on site map ☐ N/A or okay
Remarks

3. **Bench Overtopped** ☐ Location shown on site map ☐ N/A or okay
Remarks

C. Letdown Channels ☐ Applicable ☒ N/A

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

1. **Settlement** ☐ Location shown on site map ☐ No evidence of settlement
Areal extent Depth
Remarks

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

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

4. **Undercutting** ☐ Location shown on site map ☐ No evidence of undercutting
Areal extent_____ Depth_____
Remarks_____

5. **Obstructions** Type_____ ☐ No obstructions
☐ Location shown on site map Areal extent_____
Size_____
Remarks_____

6. **Excessive Vegetative Growth** Type
☐ No evidence of excessive growth
☐ Vegetation in channels does not obstruct flow
☐ Location shown on site map Areal extent_____
Remarks_____

D. Cover Penetrations ☐ Applicable ☒ N/A

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

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

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

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

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

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

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

2. **Gas Collection Wells, Manifolds and Piping**
   ☒ Good condition ☐ Needs Maintenance
   Remarks _____

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

F. Cover Drainage Layer ☐ Applicable ☒ N/A

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

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

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

1. **Siltation** Areal extent _____ Depth _____ ☐ N/A
   ☐ Siltation not evident
   Remarks _____

2. **Erosion** Areal extent _____ Depth _____
   ☐ Erosion not evident
   Remarks _____

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

4. **Dam** ☐ Functioning ☐ N/A
   Remarks _____

H. Retaining Walls ☐ Applicable ☒ N/A

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

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

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

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

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

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

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

VIII. VERTICAL BARRIER WALLS ☐ Applicable ☒ N/A

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

2. **Performance Monitoring** Type of monitoring_____
   ☐ Performance not monitored
   Frequency _____ ☐ Evidence of breaching
   Head differential_____
   Remarks_____

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

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

1. **Pumps, Wellhead Plumbing, and Electrical**
   ☒ Good condition ☐ All required wells properly 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 76,000,000 gallons
   - ☐ 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

D. 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 which are not covered above, attach an inspection sheet describing the physical nature and condition of any facility associated with the remedy. An example would be soil vapor extraction.

XI. OVERALL OBSERVATIONS

A. Implementation of the Remedy

Describe issues and observations relating to whether the remedy is effective and functioning as designed. Begin with a brief statement of what the remedy is to accomplish (i.e., to contain contaminant plume, minimize infiltration and gas emission, etc.).
The overall objective of the soil removal in OU-1 was to remove accessible soil contaminated with total chromium and total lead above remediation and cleanup levels. All soil to a depth of 15 feet not covered by permanent structures was considered accessible soil. The contractor believes there may still be a contaminant source below 15 feet because well MW-2A has the highest chromium concentrations and is located near the soil removal. The overall objective of the OU-2 systems is to remove VOCs from the vadose zone that may be acting as a source to groundwater, remove VOCs from groundwater on the western portion of the Linde property, and halt the off-property migration of VOCs in groundwater. The purpose of the OU-3 groundwater extraction and treatment system is to reduce further contaminant migration within the alluvial aquifer, continue mass removal activities and reduce contaminant migration into the Troutdale aquifer. The remediation systems continue to meet operational objectives. Generally, the extraction system continues to provide containment for both plumes, but there may be an exception at well AMW-18 where a dramatic increase in TCE was recently observed. Although the cause of this increase has yet to be investigated, it suggests either a loss of hydraulic control in this area or an as yet undiscovered source of TCE. The groundwater monitoring results continue to show overall downward trends for both TCE and chromium concentrations across the site.

B. Adequacy of O&M

Describe issues and observations related to the implementation and scope of O&M procedures. In particular, discuss their relationship to the current and long-term protectiveness of the remedy.
There is some uncertainty with regard to the long-term ability of the remedy to remain protective of drinking water supplies in the area. Monitoring of the Troutdale aquifer continues and depending on results, the network may need to be expanded. Property development slated for late fall 2008 will impact the pumping system and pipeline configuration. Pipeline modifications should be sequenced to minimize the amount of down time for the extraction system.

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. No potential issues identified

D.	Opportunities for Optimization
	Describe possible opportunities for optimization in monitoring tasks or the operation of the remedy. Continue optimization of the in-well stripping system. System optimization continues to concentrate treatment in the center of the source area. Continue adjusting pumping rates in extraction wells to increase treatment volume and optimize removal of contaminants. Also continue to adjust extraction well flow rates to optimize capture in new toe-of-plume area.

Attachment 7

Interview Reports

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Five-Year Review Interview Record

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

Interview Type: *Telephone* Visit Other: Mail

Location of Visit:

Date: 13-Jun-08 **Time:** 1530

Interviewer: Emile Pitre **Title:** Chem. Eng. **Organization:** USACE

Individual Contacted

Name: Mohsen Kourehdar **Title:** Former Site Manager **Organization:** Department of Ecology

Telephone: 360-407-6256 **Address:** 300 Desmond Drive SE
Lacey, WA 98503

Summary of Converstation

1) What is your overall impression of the project?

Project is going well. One unexpected pocket of contamination was found and reported in the quarterly report dated March 2008. Well AMW-18 had TCE concentrations over 400 ug/L. The contractor is planning to conduct push probe sampling to investigate the source and extent.

2) What affects have site operations (cleanup) had on the surrounding community?

Have not heard anything from citizens. DOE usually receives concerns via phone calls

3) Are you aware of any community concerns regarding the site or it's operation?
If so, please summarize your concerns.

No

4) Do you feel well informed about the site's activities and progress?

Yes. Receives reports and used to be attend meetings. Does not feel the need to participate in meetings anymore as the reports are sufficient

5) Do you have any comments, suggestions, or recommendations regarding the site's management or operation?

Not at this time

Five-Year Review Interview Record

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

Interview Type: ***Telephone*** Visit Other: Mail

Location of Visit:

Date: 13-Jun-08 **Time:** 1545

Interviewer:	Emile Pitre	**Title:**	Chem. Eng.	**Organization:**	USACE

Individual Contacted

Name:	Steve Prather	**Title:**	Water Quality Resource Manager	**Organization:**	Clark Public Utilities
Telephone:	360-992-8023	**Address:**	1200 Fort Vancouver Way Vancouver, WA 98663		

Summary of Converstation

1) What is your overall impression of the project?

Progress is slow. Seems like it's a long process to remediate the TCE and chromium. plimes. Progress has been much faster since EPA took over the responsibilities.

2) What affects have site operations (cleanup) had on the surrounding community?

CPU receives a dozen calls each year from neighbors wanting to know if their water is safe to drink. These neighbors are connected to the municipal water supply. Neighbors are told their supply aquifer is deeper then the contamination so the water is clean. Most of the concerned citizens are on the mailing list to keep them informed, but they still call for reassurance

3) Are you aware of any community concerns regarding the site or it's operation?
If so, please summarize your concerns.

No

4) Do you feel well informed about the site's activities and progress?

Communications could be better. A quarterly call from EPA would be nice to keep CPU informed. Over the last 15 years they have seen increased contaminant concentrations in the Troutdale aquifer

5) Do you have any comments, suggestions, or recommendations regarding the site's management or operation?

None, other than what was previously provided.

Five-Year Review Interview Record

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

Interview Type: *Telephone* Visit Other: Mail

Location of Visit:

Date: 13-Jun-08 **Time:** 1600

Interviewer:	Emile Pitre	**Title:**	Chem. Eng.	**Organization:**	USACE

Individual Contacted

Name:	Ila Stanek	**Title:**	President	**Organization:**	West Hazel Dell Neighborhood Association
Telephone:	360-573-7378	**Address:**			

Summary of Converstation

1) What is your overall impression of the project?

Can't see a lot of progress because the problem is invisible

2) What affects have site operations (cleanup) had on the surrounding community?

Have not seen huge problems. Have observed the occasional trucks in the area that are usually associated with increased traffic

3) Are you aware of any community concerns regarding the site or it's operation?
If so, please summarize your concerns.

No. Can't tell what they are doing at the site. Noticeable activity in the area when traffic is heavy

4) Do you feel well informed about the site's activities and progress?

No. Get more information on the owner's estate then on the cleanup. Not aware of the five-year review.

5) Do you have any comments, suggestions, or recommendations regarding the site's management or operation?

Good if all of Hazel Dell was informed of the site progress. The contaminated groundwater plume impacts regional development and these developments impact the entire community, not just citizens in the immediate area of the contamination.

Five-Year Review Interview Record

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

Interview Type: ***Telephone*** Visit Other: Mail

Location of Visit:

Date: 16-Jun-08 **Time:** 0950

Interviewer: Emile Pitre **Title:** Chem. Eng. **Organization:** USACE

Individual Contacted

Name: Dan Huevel **Title:** Adjacent Property Owner **Organization:**

Telephone: 503-282-4276 **Address:**

Summary of Converstation

1) What is your overall impression of the project?

The project is well managed.

2) What affects have site operations (cleanup) had on the surrounding community?

Easement agreement in place to allow EA on the property. EA has always been respectful of the property and they are good to work with.

3) Are you aware of any community concerns regarding the site or it's operation?
If so, please summarize your concerns.

No.

4) Do you feel well informed about the site's activities and progress?

Yes, receives quarterly test reports

5) Do you have any comments, suggestions, or recommendations regarding the site's management or operation?

Recommend continuing with the same management company, EA. Impressed with their operation.

Attachment 8

Advertisement for Notice of FYR, Boomsnub/Airco Superfund Site

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EPA Reviewing Boomsnub-AIRCO Superfund Site Cleanup in Vancouver

The U.S. Environmental Protection Agency (EPA) is doing the second Five-Year Review of the Boomsnub-AIRCO Superfund Site, located at 7608 NE 47th Street in Hazel Dell, Washington. The site is approximately two miles east of Interstate 5 and one mile west of Interstate 205, near NE 78th Street and NE 47th Avenue.

This review provides a routine check-up to make sure that the soil and groundwater cleanup conducted following the 2000 Record of Decision continues to protect human health and the environment. The cleanup included removing contaminated soil and modifying and operating a groundwater treatment system that removes and contains chromium and volatile organic compounds from groundwater beneath the site.

The Boomsnub-AIRCO site includes a former chrome-plating facility and the currently operating Linde Vancouver gas manufacturing plant. The site was added to the EPA National Priorities List (NPL) in 1995.

How you can Get Involved:

EPA welcomes your participation during our review taking place through September 2008. If you have information that may be helpful to EPA, please contact Claire Hong, EPA Project Manager at 206-553-1813 or *hong.claire@epa.gov*

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