

Technical Memorandum

TO: Robert Williams, Oregon Department of Environmental Quality
Michael Gleason, The Boeing Company

FROM: Christine Kimmel, LG, and Brett Borgeson

DATE: April 3, 2017

RE: **Addendum No. 3**
Work Plan Addendum for Remedial Injection Activities
Building 85-105 Coolant Release
Boeing Portland Facility
Gresham, Oregon
Project No. 0025116.117

Introduction

This technical memorandum presents Addendum No. 3 to the original remedial injection work plan (Landau Associates [LAI] 2010) for interim remedial action measures (IRAM) associated with a 2006 release of coolant material within the northwest portion of Building 85-105 at The Boeing Company (Boeing) Facility in Gresham, Oregon (site; Figure 1). The original IRAM work plan (LAI 2007) describes the injection of EHC-O™ oxygen-releasing compound to enhance the remediation of petroleum-based coolant material in the Troutdale Gravel Aquifer (TGA) aerobic biodegradation.

The purpose of this work plan is to describe results of previous injection activities and to submit recommended procedures to conduct the eighth donor injection in the Coolant Release Area. In 2006, diesel-derived coolant material was released from a below grade equipment flume located in the 85-105 building. An investigation was conducted to locate the release and a total of eight monitoring wells (LAI-1 through LAI-8) were installed in the vicinity of the release to characterize potential groundwater impacts. In addition to the eight monitoring wells, groundwater samples were also collected from existing TGA and underlying Upper Troutdale Sandstone Aquifer (TSA) wells to delineate the plume. Results of the investigation indicated that the coolant material was isolated to the TGA and the area near the release and the building footing drain sump. Upon completion of the investigation, five injection wells (IW-1 through IW-5) were installed directly upgradient of the release, see Figure 2.

The first section of this technical memorandum provides a summary of the injection activities completed to date. Subsequent sections present groundwater monitoring results, a description of injection procedures, and an outline of the field activities scheduling and reporting.

Previous Injection Activities and Performance Monitoring

In December 2007, five injection wells (IW-1 through IW-5) were installed directly upgradient of the coolant release area within the 85-105 building (Figure 2). The Oregon Department of Environmental Quality (ODEQ) approved (ODEQ 2007) the interim remedial action plan that detailed the process and procedures for using an oxygen-releasing compound (EHC-O) injected as slurry with water to enhance

the aerobic biodegradation of the petroleum-based contaminant. A total of seven injection events have been conducted beginning in 2008 to reduce the concentrations of diesel- and motor oil-range total petroleum hydrocarbons (TPH-Dx) to below the site-specific cleanup level (1.35 milligrams per liter [mg/L]). The site-specific cleanup level is for total TPH-Dx (sum of diesel-and-motor oil-range hydrocarbons). Below is a summary of the injection events.

Injection Event	EHC-O Donor Material (pounds)	EHC-O and Water Mixture (gallons)
(Pilot Injection) February 2008	850	1,000
September 2008	2,088	2,700
June 2010	2,100	2,800
June 2011	2,000	2,500
April 2012	2,100	2,700
January 2013	2,000	2,500
July 2015	2,000	2,500

Groundwater Monitoring Results

With the exception of well LAI-4, TPH-Dx concentrations in the coolant release area wells are currently below the laboratory reporting limits for the respective carbon ranges, as summarized in Table 1 and as shown on Figure 2. Historically, elevated Total TPH-Dx concentrations at LAI-8 were observed above the site-specific cleanup level; however, that well has been dry since November 2011, therefore, no groundwater samples have been collected.

The highest Total TPH-Dx concentrations have consistently been observed at well LAI-4; therefore, this well is a conservative indicator of treatment progress in the coolant release area. Total TPH-Dx concentrations at LAI-4 have decreased from the initial maximum concentration (31,800 mg/L in August 2006) to 29.1 mg/L (August 2017). The time plot of groundwater analytical results indicates a marked decrease in concentrations prior to bioremediation activities due to free-product recovery efforts (Figure 3). Additional concentration reduction has been achieved through bioremediation injection activities. Commonly, Total TPH-Dx concentrations decrease directly after an injection event followed by periodic rebound; however, concentrations exhibit an overall decline. The periodic and temporary increases in Total TPH-Dx concentration suggest some residual TPH mass in the vicinity of this well. Well LAI-4 is screened on top of a building footing with an associated footing drain. Fluctuations in groundwater flow around the footing and to the drain may result in periodic groundwater contact with residual TPH mass and observed periodic increases in TPH concentrations. Effective treatment in this area is evidenced by the long period of no substantial rebound from early 2012 through early 2015. The time plot of Total TPH-Dx concentrations at well LAI-4, along with the injection events, are shown on Figure 3.

The last injection was completed in July 2015 and the Total TPH-Dx concentration at LAI-4 decreased from 96 mg/L to below the site-specific cleanup level in February 2016 prior to rebounding to 29.1 mg/L in February 2017. The recent increase in Total TPH-Dx concentration indicates an additional

injection is warranted. This additional EHC-O injection will be conducted to treat remaining aqueous-, sorbed-, and/or non-aqueous phase liquid (NAPL)-phase contamination to lower Total TPH-Dx concentrations below the site-specific cleanup level with the goal of minimizing rebound.

Injection Procedures

LAI will conduct an eighth injection of EHC-O slurry to continue treatment of localized, residual TPH impacts to TGA groundwater in the vicinity of well LAI-4. Site activities will be conducted in accordance with the Project Health and Safety Plan (HASP; Attachment 1).

Not all five injection wells are usable for the planned injection. Due to previous injections, the available open slot space in the injection well screens, IW-2 through IW-5, has been reduced due to accumulation of EHC-O particulate in the casing and screens, making these wells unsuitable for future use. EHC-O is composed of calcium peroxide, which can bind together as a hard deposit. Injection well IW-1 has usable well screen to properly accept the EHC-O injection slurry. Monitoring well LAI-4, the focus of remaining treatment, is also injectable. To aggressively target residual TPH mass now detected only at LAI-4, we purpose to inject EHC-O slurry directly to LAI-4 and to upgradient injection well IW-1.

The eighth injection will utilize the same donor material and injection procedures as previous injections; however, the EHC-O mass will be reduced due to the smaller targeted treatment area in the vicinity of LAI-4. A total mass of 1,000 pounds (lbs) of EHC-O will be mixed with potable water and injected in accordance with the injection procedures outlined in the IRAM work plan. The total amount of EHC-O will be mixed into four even batches for injection to wells IW-1 and LAI-4. Each batch of EHC-O slurry will consist of approximately 250 lbs of EHC-O mixed with approximately 550 gallons of potable water for a total of four batches. Two batches will be injected to each well. Both wells will be flushed with 50 gallons of potable water prior to injecting the EHC-O slurry to flush fines from the wells and sand pack to improve the well's ability to accept slurry. As described in the IRAM work plan, an additional 50 to 100 gallons of potable water will be injected following the injection of slurry to flush the wells and minimize buildup and clogging of the well screens.

If injection rates and pressures indicate that either well is not accepting slurry readily, injection at that well may be terminated and the remaining volume of slurry will be injected to the remaining well. If injection of the total mass for both wells proves difficult, any remaining EHC-O will be stored onsite for future use.

Schedule and Reporting

Field activities associated with the eighth EHC-O injection are currently scheduled for late April 2017. Injection activities and the results of the continued performance groundwater monitoring will be summarized in the 2017 annual report. Groundwater quality monitoring at the coolant release area wells will continue to be conducted in accordance with the TGA monitoring plan, wells LAI-4, LAI-7,

and LAI-8 will be monitored on a semiannual basis while the remaining five wells (LAI-1, LAI-2, LAI-3, LAI-5, and LAI-6) will be monitored annually.

* * * * *

This document was prepared by, or under the direct supervision of, the technical professionals noted below.

LANDAU ASSOCIATES, INC.



Brett Borgeson
Project Scientist



Christine B. Kimmel, LG
Associate

BHB/CBK/tam

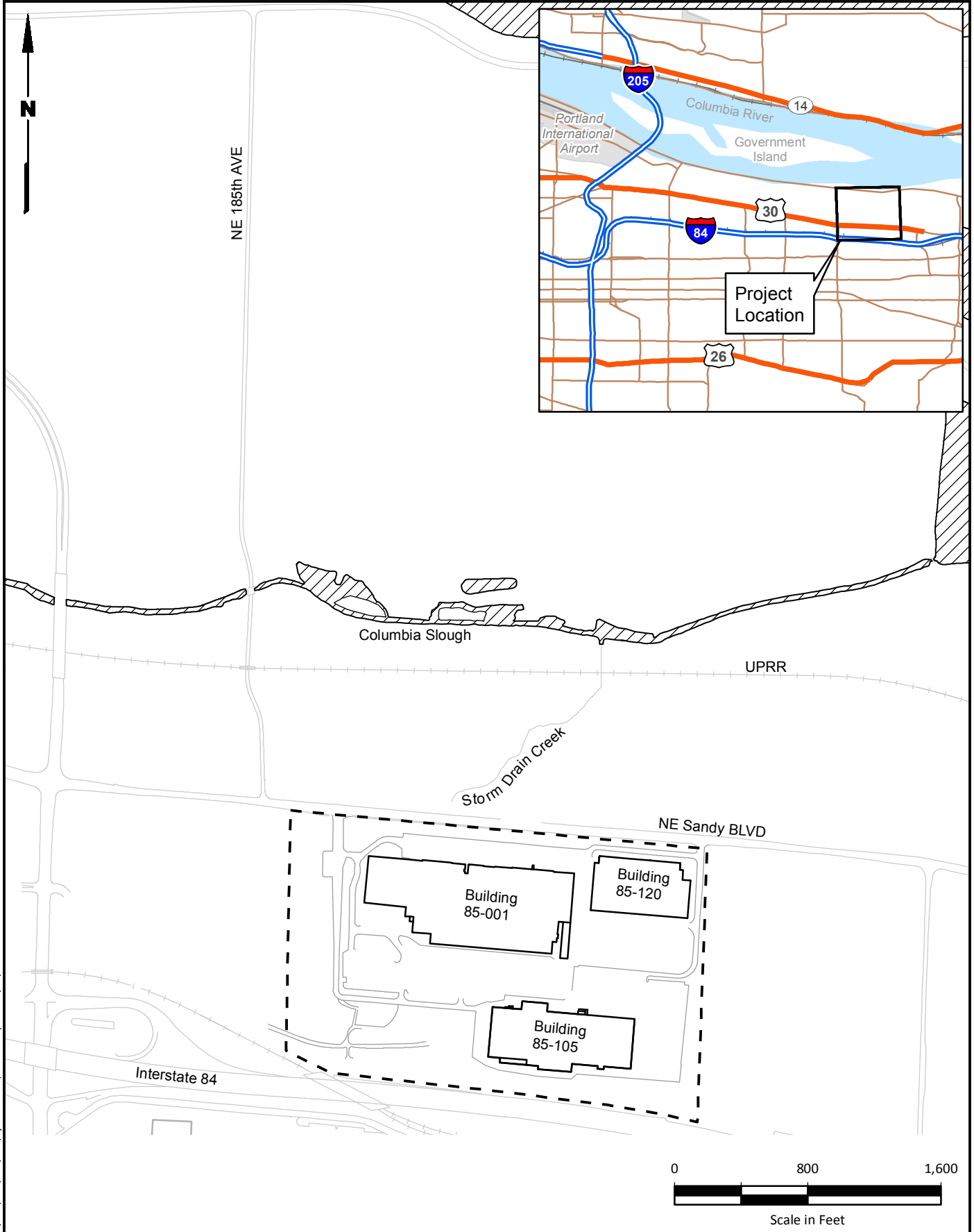
P:\025\116\FileRm\R\TGA\85-105 Coolant Inves\EHC-O WP Adden\2017 Adden\Boeing_Portland_Landau_040317_Remedial Injection Activities WP Adden 3_TM.docx

Attachments:

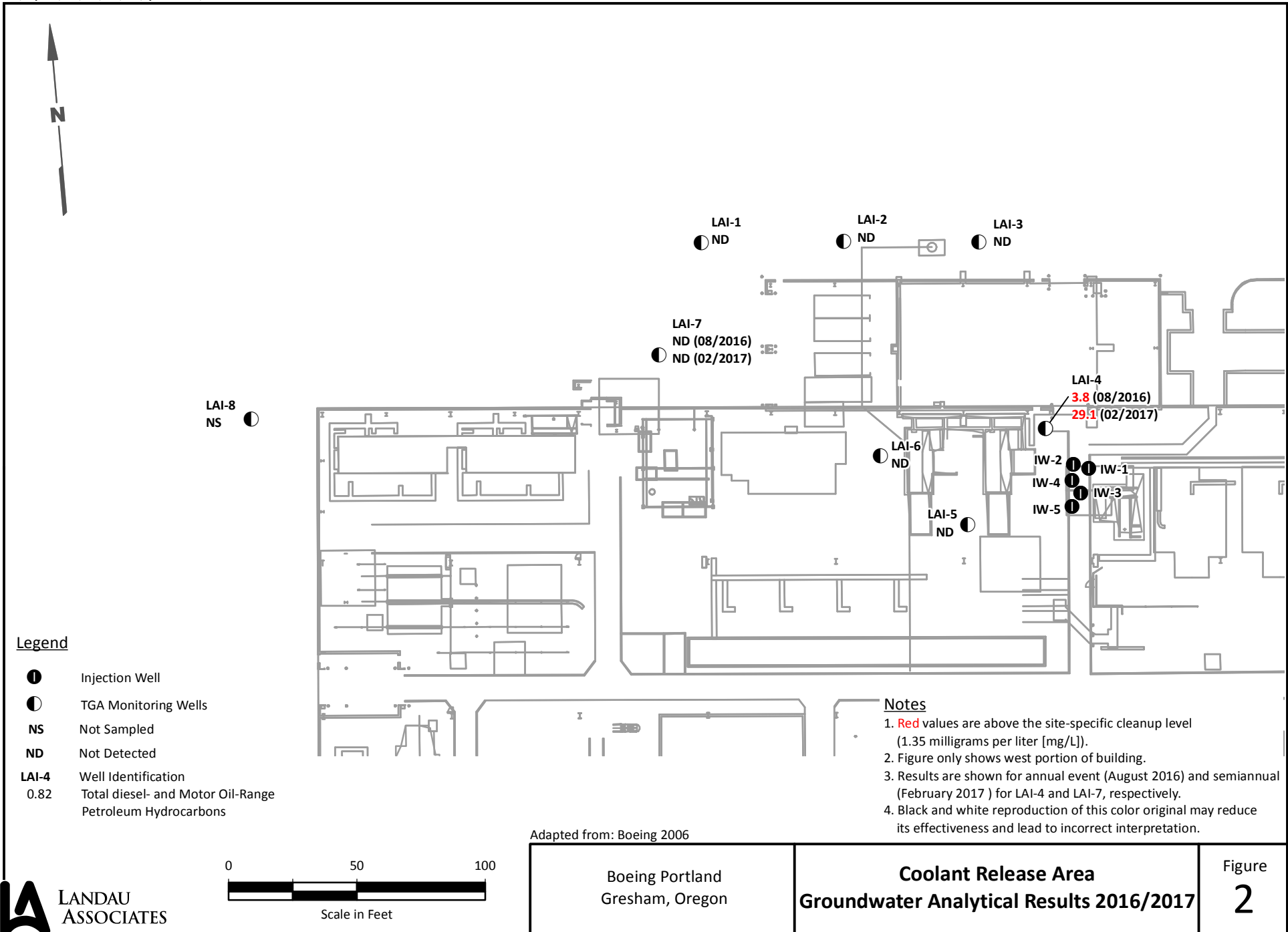
- Figure 1 Boeing Portland Site Map
- Figure 2 Coolant Release Area Groundwater Analytical Results 2016
- Figure 3 Time vs Concentration at Well LAI-4
- Table 1 Groundwater TPH-Dx Analytical Results Coolant Release Investigation
- Attachment 1 Health and Safety Plan

References

- Landau Associates. 2010. Technical Memorandum, Work Plan Addendum for Remedial Injection Activities, Building 85-105 Coolant Release, Boeing of Portland, Portland, Oregon. April 5.
- Landau Associates. 2007. Work Plan, Interim Remedial Action Measure, Building 85-105 Coolant Investigation, Boeing Portland Facility, Gresham, Oregon. Prepared for The Boeing Company. October 9.
- ODEQ. 2007. Email message from Mavis Kent, Oregon Department of Environmental Quality, to Chris Kimmel, Landau Associates. Re: Boeing Building 85-105 IRAM.



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Adapted from: Boeing 2006

Boeing Portland
Gresham, Oregon

**Coolant Release Area
Groundwater Analytical Results 2016/2017**

Figure
2

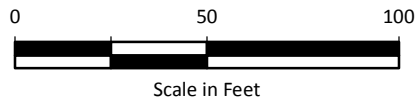


Table 1
Groundwater TPH-Dx Analytical Results
Coolant Release Investigation
Boeing Portland Facility

Sample ID	Sample Date	NWTPH-Dx (mg/L) (a)		
		Diesel	Motor Oil	Total TPH-Dx
LAI-1	9/14/2006	0.252 U	0.504 U	ND
LAI-1	9/27/2006	0.237 U	0.473 U	ND
LAI-1	10/4/2006	0.25 U	0.50 U	ND
LAI-1	10/11/2006	0.25 U	0.50 U	ND
LAI-1	10/17/2006	0.25 U	0.50 U	ND
LAI-1	10/23/2006	0.25 U	0.50 U	ND
LAI-1	11/30/2006	0.25 U	0.50 U	ND
LAI-1	12/19/2006	0.25 U	0.50 U	ND
LAI-1	1/29/2007	0.25 U	0.50 U	ND
LAI-1	2/26/2007	0.25 U	1.6	1.6
LAI-1	3/14/2007	0.25 U	0.50 U	ND
LAI-1	4/4/2007	0.25 U	0.50 U	ND
LAI-1	5/10/2007	0.25 U	0.50 U	ND
LAI-1	6/12/2007	0.25 U	0.50 U	ND
LAI-1	7/11/2007	0.25 U	0.50 U	ND
LAI-1	8/13/2007	0.25 U	0.50 U	ND
LAI-1	9/7/2007	0.25 U	0.50 U	ND
LAI-1	11/9/2007	0.25 U	0.50 U	ND
LAI-1	2/6/2008	0.25 U	0.50 U	ND
LAI-1	5/13/2008	0.25 U	0.84	0.84
LAI-1	8/14/2008	0.25 U	0.90	0.90
LAI-1	11/6/2008	0.25 U	0.50 U	ND
LAI-1	2/4/2009	0.25 U	0.50 U	ND
LAI-1	5/11/2009	0.25 U	0.50 U	ND
LAI-1	8/26/2009	0.25 U	0.50 U	ND
LAI-1	11/9/2009	0.25 U	0.50 U	ND
LAI-1	2/8/2010	0.25 U	0.50 U	ND
LAI-1	5/6/2010	0.25 U	0.5 U	ND
LAI-1	8/10/2010	0.25 U	0.5 U	ND
LAI-1	11/16/2010	0.25 U	0.5 U	ND
LAI-1	2/1/2011	0.25 U	0.5 U	ND
LAI-1	5/3/2011	0.25 U	0.5 U	ND
LAI-1	8/10/2011	0.25 U	0.5 U	ND
LAI-1	11/1/2011	0.25 U	0.5 U	ND
LAI-1	2/6/2012	0.25 U	0.5 U	ND
LAI-1	5/8/2012	0.25 U	0.5 U	ND
LAI-1	8/13/2012	0.25 U	0.5 U	ND
LAI-1	8/20/2013	0.095 UJ	0.2 U	ND
LAI-1	8/18/2014	0.38	2.4	2.78
LAI-1	8/12/2015	0.095 U	0.24 U	ND
LAI-1	8/3/2016	0.095 U	0.24 U	ND
LAI-2	9/14/2006	0.247 U	0.494 U	ND
LAI-2	9/25/2006	0.477	0.473 U	0.477
LAI-2	10/4/2006	0.25 U	0.50 U	ND
LAI-2	10/11/2006	0.25 U	0.50 U	ND
LAI-2	10/17/2006	0.25 U	0.50 U	ND
LAI-2	10/24/2006	0.25 U	0.50 U	ND
LAI-2	11/30/2006	0.25 U	0.50 U	ND
LAI-2	12/19/2006	0.25 U	0.50 U	ND
LAI-2	1/29/2007	0.25 U	0.50 U	ND

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Boeing Portland Facility

Sample ID	Sample Date	NWTPH-Dx (mg/L) (a)		
		Diesel	Motor Oil	Total TPH-Dx
LAI-2	2/26/2007	0.25 U	0.64	0.64
LAI-2	3/12/2007	0.25 U	0.50 U	ND
LAI-2	4/4/2007	0.25 U	0.50 U	ND
LAI-2	5/10/2007	0.25 U	0.50 U	ND
LAI-2	6/12/2007	0.25 U	0.50 U	ND
LAI-2	7/11/2007	0.25 U	0.50 U	ND
LAI-2	8/13/2007	0.25 U	0.81	0.81
LAI-2	9/7/2007	0.25 U	0.81 U	ND
LAI-2	11/9/2007	0.25 U	0.50 U	ND
LAI-2	2/6/2008	0.25 U	0.50 U	ND
LAI-2	5/13/2008	0.25 U	0.50 U	ND
LAI-2	8/15/2008	0.25 U	0.50 U	ND
LAI-2	11/7/2008	0.25 U	0.77	0.77
LAI-2	2/4/2009	0.25 U	1.2	1.2
LAI-2	5/11/2009	0.25 U	0.50 U	ND
LAI-2	8/26/2009	0.25 U	0.50 U	ND
LAI-2	11/9/2009	0.25 U	0.50 U	ND
LAI-2	2/8/2010	1.25 U	1.50 U	ND
LAI-2	5/6/2010	2.25 U	2.50 U	ND
LAI-2	8/10/2010	3.25 U	3.50 U	ND
LAI-2	11/16/2010	4.25 U	4.50 U	ND
LAI-2	2/1/2011	5.25 U	5.50 U	ND
LAI-2	5/3/2011	6.25 U	6.50 U	ND
LAI-2	8/10/2011	7.25 U	7.50 U	ND
LAI-2	11/1/2011	8.25 U	8.50 U	ND
LAI-2	2/6/2012	9.25 U	9.50 U	ND
LAI-2	5/8/2012	10.25 U	10.50 U	ND
LAI-2	8/13/2012	11.25 U	11.50 U	ND
LAI-2	8/20/2013	0.098 UJ	0.24 U	ND
LAI-2	8/18/2014	0.097 U	0.24 U	ND
LAI-2	8/12/2015	0.095 U	0.24 U	ND
LAI-2	8/3/2016	0.10 U	0.25 U	ND
LAI-3	9/14/2006	0.248 U	0.495 U	ND
LAI-3	9/25/2006	0.605	0.473 U	0.605
LAI-3	10/5/2006	0.25 U	0.50 U	ND
LAI-3	10/11/2006	0.25 U	0.50 U	ND
LAI-3	10/17/2006	0.25 U	0.50 U	ND
LAI-3	10/24/2006	0.25 U	0.50 U	ND
LAI-3	11/30/2006	0.25 U	0.50 U	ND
LAI-3	12/19/2006	0.25 U	0.50 U	ND
LAI-3	1/29/2007	0.25 U	0.50 U	ND
LAI-3	2/27/2007	0.25 U	0.54	0.54
LAI-3	3/14/2007	0.25 U	0.50 U	ND
LAI-3	4/4/2007	0.25 U	0.50 U	ND
LAI-3	5/10/2007	0.25 U	0.50 U	ND
LAI-3	6/12/2007	0.25 U	0.50 U	ND
LAI-3	7/11/2007	0.25 U	0.50 U	ND
LAI-3	8/13/2007	0.25 U	0.50 U	ND
LAI-3	9/7/2007	0.25 U	0.50 U	ND
LAI-3	11/9/2007	0.25 U	0.50 U	ND
LAI-3	2/6/2008	0.25 U	0.50 U	ND

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Groundwater TPH-Dx Analytical Results
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Sample ID	Sample Date	NWTPH-Dx (mg/L) (a)		
		Diesel	Motor Oil	Total TPH-Dx
LAI-3	5/13/2008	0.25 U	0.50 U	ND
LAI-3	8/15/2008	0.25 U	0.50 U	ND
LAI-3	11/7/2008	0.25 U	0.50 U	ND
LAI-3	2/4/2009	0.25 U	0.50 U	ND
LAI-3	5/11/2009	0.25 U	0.50 U	ND
LAI-3	8/25/2009	0.25 U	0.50 U	ND
LAI-3	11/9/2009	0.25 U	0.50 U	ND
LAI-3	2/8/2010	0.25 U	0.50 U	ND
LAI-3	5/6/2010	0.25 U	0.50 U	ND
LAI-3	8/10/2010	0.25 U	0.50 U	ND
LAI-3	11/16/2010	0.25 U	0.50 U	ND
LAI-3	2/1/2011	0.25 U	0.50 U	ND
LAI-3	5/3/2011	0.25 U	0.50 U	ND
LAI-3	8/10/2011	0.25 U	0.50 U	ND
LAI-3	11/1/2011	0.25 U	0.50 U	ND
LAI-3	2/6/2012	0.25 U	0.50 U	ND
LAI-3	5/8/2012	0.25 U	0.50 U	ND
LAI-3	8/13/2012	0.25 U	0.50 U	ND
LAI-3	8/20/2013	0.098 UJ	0.24 U	ND
LAI-3	8/18/2014	0.12	0.24 U	0.12
LAI-3	8/12/2015	0.098	0.24 U	0.098
LAI-3	8/3/2016	0.095 U	0.24 U	ND
LAI-4-22	9/12/2006	16,600	15,200	31,800
LAI-4	9/26/2006	913	783	1696
LAI-4	10/5/2006	3600	3900	7500
LAI-4	10/10/2006	8300	9100	17,400
LAI-4	10/16/2006	5700	6000	11,700
LAI-4	10/23/2006	5400	6300	11,700
LAI-4	11/16/2006	630	880	1,510
LAI-4	11/29/2006	130	190	320
LAI-4	12/5/2006	110	160	270
LAI-4	12/20/2006	140	220	360
LAI-4	1/30/2007	51	66	117
LAI-4	2/27/2007	49	64	113
LAI-4	3/12/2007	47	67	114
LAI-4	4/4/2007	92	130	222
LAI-4	5/11/2007	93	140	233
LAI-4	6/13/2007	49	71	120
LAI-4	7/12/2007	43	59	102
LAI-4	8/16/2007	37	53	90
LAI-4	9/7/2007	48	73	121
LAI-4	11/13/2007	53	73	126
LAI-4	2/5/2008	26	36	62
LAI-4	3/25/2008	12	14	26
LAI-4	4/21/2008	20	26	46
LAI-4	5/14/2008	17	24	41
LAI-4	6/24/2008	61	100 U	61
LAI-4	7/14/2008	39	52	91
LAI-4	8/14/2008	15	19	34
LAI-4	9/16/2008	27	31	58
LAI-4	10/28/2008	13	19	32

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Coolant Release Investigation
Boeing Portland Facility

Sample ID	Sample Date	NWTPH-Dx (mg/L) (a)		
		Diesel	Motor Oil	Total TPH-Dx
LAI-4	11/6/2008	24	29	53
LAI-4	12/16/2008	31	34	65
LAI-4	1/29/2009	63	68	131
LAI-4	2/5/2009	46	56	102
LAI-4	3/12/2009	46	47	93
LAI-4	4/14/2009	29	35	64
LAI-4	5/7/2009	15	18	33
LAI-4	6/3/2009	Dry in June 2009		
LAI-4	8/25/2009	Dry in August 2009		
LAI-4	2/8/2010	Dry in February 2010		
LAI-4	3/23/2010	12	14	26
LAI-4	5/5/2010	32	52	84
LAI-4	8/10/2010	11	16	27
LAI-4	11/16/2010	34	49	83
LAI-4	2/1/2011	23	26	49
LAI-4	5/3/2011	28	40	68
LAI-4	8/8/2011	4.3	3.9	8
LAI-4	11/1/2011	26	24	50
LAI-4	2/6/2012	2.2	2.1	4.3
LAI-4	5/8/2012	1.2	1.9	3.1
LAI-4	8/13/2012	1.1	1.1	2.2
LAI-4	2/4/2013	0.95 U	0.24 U	ND
LAI-4	8/20/2013	0.70 J	1.2	1.9
LAI-4	2/24/2014	0.59	1.5	2.1
LAI-4	8/18/2014	1.80	4.1	5.9
LAI-4	2/9/2015	2.0	4.0	6.0
LAI-4	8/12/2015	29.0 J	67 J	96
LAI-4	2/5/2016	0.25	0.57	0.82
LAI-4	8/3/2016	1.20	2.6	3.8
LAI-4	2/6/2017	8.1 J	21	29.1
LAI-5	9/14/2006	0.238 U	0.477 U	ND
LAI-5	9/26/2006	0.238 U	0.475 U	ND
LAI-5	10/5/2006	0.57	0.82	1.39
LAI-5	10/11/2006	0.25 U	0.50 U	ND
LAI-5	10/17/2006	0.25 U	0.50 U	ND
LAI-5	10/24/2006	0.25 U	0.50 U	ND
LAI-5	11/30/2006	0.25 U	0.50 U	ND
LAI-5	12/20/2006	0.25 U	0.50 U	ND
LAI-5	1/30/2007	0.25 U	0.50 U	ND
LAI-5	2/27/2007	0.25 U	0.50 U	ND
LAI-5	3/12/2007	0.25 U	0.50 U	ND
LAI-5	4/4/2007	0.25 U	0.50 U	ND
LAI-5	5/11/2007	0.25 U	0.50	0.50
LAI-5	6/12/2007	0.25 U	0.50 U	ND
LAI-5	7/11/2007	0.25 U	0.50 U	ND
LAI-5	8/14/2007	0.25 U	0.50 U	ND
LAI-5	9/7/2007	0.25 U	0.50 U	ND
LAI-5	11/9/2007	0.25 U	0.50 U	ND
LAI-5	2/6/2008	0.25 U	0.50 U	ND
LAI-5	5/14/2008	0.25 U	0.50 U	ND
LAI-5	8/15/2008	0.25 U	0.50 U	ND

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Coolant Release Investigation
Boeing Portland Facility

Sample ID	Sample Date	NWTPH-Dx (mg/L) (a)		
		Diesel	Motor Oil	Total TPH-Dx
LAI-5	11/7/2008	0.25 U	0.50 U	ND
LAI-5	2/5/2009	0.25 U	0.50 U	ND
LAI-5	5/7/2009	0.25 U	0.50 U	ND
LAI-5	8/25/2009	0.25 U	0.50 U	ND
LAI-5	11/9/2009	0.25 U	0.50 U	ND
LAI-5	2/8/2010	0.25 U	0.50 U	ND
LAI-5	5/5/2010	0.25 U	0.50 U	ND
LAI-5	8/10/2010	0.25 U	0.50 U	ND
LAI-5	11/16/2010	0.25 U	0.50 U	ND
LAI-5	2/1/2011	0.25 U	0.50 U	ND
LAI-5	5/3/2011	0.25 U	0.50 U	ND
LAI-5	8/10/2011	0.25 U	0.50 U	ND
LAI-5	11/1/2011	0.25 U	0.50 U	ND
LAI-5	2/6/2012	0.25 U	0.50 U	ND
LAI-5	5/8/2012	0.25 U	0.50 U	ND
LAI-5	8/13/2012	0.26	0.50 U	0.26
LAI-5	8/20/2013	0.18 J	0.30	0.48
LAI-5	8/18/2014	0.096 U	0.24 U	ND
LAI-5	8/12/2015	0.094 U	0.24 U	ND
LAI-5	8/4/2016	0.097 U	0.24 U	ND
LAI-6	9/14/2006	1.68	0.478 U	1.68
LAI-6	9/26/2006	0.237 UJ	0.474 UJ	ND
LAI-6	10/5/2006	0.25 U	0.50 U	ND
LAI-6	10/11/2006	0.25 U	0.50 U	ND
LAI-6	10/17/2006	0.25 U	0.50 U	ND
LAI-6	10/24/2006	0.25 U	0.50 U	ND
LAI-6	11/30/2006	0.25 U	0.50 U	ND
LAI-6	12/20/2006	0.25 U	0.50 U	ND
LAI-6	1/30/2007	0.25 U	0.50 U	ND
LAI-6	2/27/2007	0.25 U	0.50 U	ND
LAI-6	3/12/2007	0.25 U	0.50 U	ND
LAI-6	4/4/2007	0.25 U	0.50 U	ND
LAI-6	5/11/2007	0.25 U	0.50 U	ND
LAI-6	6/12/2007	0.25 U	0.50 U	ND
LAI-6	7/11/2007	0.25 U	1.5	1.5
LAI-6	8/14/2007	0.25 U	0.50 U	ND
LAI-6	9/7/2007	0.25 U	0.50 U	ND
LAI-6	11/9/2007	0.25 U	0.50 U	ND
LAI-6	2/6/2008	0.25 U	0.50 U	ND
LAI-6	5/14/2008	0.25 U	0.64	0.64
LAI-6	8/15/2008	0.25 U	0.50 U	ND
LAI-6	11/7/2008	0.25 U	0.50 U	ND
LAI-6	2/5/2009	0.25 U	0.50 U	ND
LAI-6	5/7/2009	0.25 U	0.50 U	ND
LAI-6	8/25/2009	0.25 U	0.50 U	ND
LAI-6	11/9/2009	0.25 U	0.50 U	ND
LAI-6	2/8/2010	0.25 U	0.50 U	ND
LAI-6	5/5/2010	0.25 U	0.50 U	ND
LAI-6	8/10/2010	0.25 U	0.50 U	ND
LAI-6	11/16/2010	0.25 U	0.50 U	ND
LAI-6	2/1/2011	0.25 U	0.50 U	ND

Table 1
Groundwater TPH-Dx Analytical Results
Coolant Release Investigation
Boeing Portland Facility

Sample ID	Sample Date	NWTPH-Dx (mg/L) (a)		
		Diesel	Motor Oil	Total TPH-Dx
LAI-6	5/3/2011	0.25 U	0.50 U	ND
LAI-6	8/10/2011	0.25 U	0.50 U	ND
LAI-6	11/1/2011	0.25 U	0.50 U	ND
LAI-6	2/6/2012	No sample collected-well obstructed		
LAI-6	5/8/2012	0.25 U	0.50 U	ND
LAI-6	8/13/2012	0.25 U	0.50 U	ND
LAI-6	8/20/2013	0.098 UJ	0.24 U	ND
LAI-6	8/18/2014	0.096 U	0.24 U	ND
LAI-6	8/12/2015	0.094 UJ	0.24 U	ND
LAI-6	8/4/2016	0.095 U	0.24 U	ND
<hr/>				
LAI-7	9/18/2006	1.66	2.36	4.02
LAI-7	9/26/2006	1.29 J	0.474 UJ	1.29
LAI-7	10/4/2006	0.25 U	1.2	1.2
LAI-7	10/10/2006	0.25 U	0.89	0.89
LAI-7	10/16/2006	0.43	0.67	1.10
LAI-7	10/23/2006	0.68	0.78	1.46
LAI-7	11/16/2006	1.5	2.8	4.3
LAI-7	11/29/2006	0.25 U	0.72	0.72
LAI-7	12/5/2006	0.46	0.70	1.16
LAI-7	12/19/2006	0.25 U	0.77	0.77
LAI-7	1/29/2007	0.25 U	0.50 U	ND
LAI-7	2/26/2007	0.25 U	0.50 U	ND
LAI-7	3/14/2007	0.25 U	0.50 U	ND
LAI-7	4/4/2007	0.25 U	0.50 U	ND
LAI-7	5/10/2007	0.25 U	0.50 U	ND
LAI-7	6/12/2007	0.25 U	0.50 U	ND
LAI-7	7/12/2007	0.25 U	0.50 U	ND
LAI-7	8/13/2007	0.25 U	1.0	1.0
LAI-7	9/7/2007	0.25 U	0.50 U	ND
LAI-7	11/9/2007	0.25 U	1.2	1.2
LAI-7	2/6/2008	0.25 U	1.0	1.0
LAI-7	3/25/2008	0.25 U	0.50 U	ND
LAI-7	4/21/2008	0.54	2.1	2.6
LAI-7	5/13/2008	0.25 U	0.94	0.94
LAI-7	6/24/2008	0.25 U	0.75	0.75
LAI-7	7/14/2008	0.25 U	0.50 U	ND
LAI-7	8/14/2008	0.25 U	0.50 U	ND
LAI-7	9/16/2008	0.25 U	0.72	0.72
LAI-7	10/28/2008	0.25 U	0.50 U	ND
LAI-7	11/6/2008	0.25 U	0.93	0.93
LAI-7	12/16/2009	0.25 U	0.50 U	ND
LAI-7	1/29/2009	0.33	0.50 U	0.33
LAI-7	2/4/2009	0.25 U	0.50 U	ND
LAI-7	3/12/2009	0.25 U	0.50 U	ND
LAI-7	4/14/2009	0.25 U	0.50 U	ND
LAI-7	5/7/2009	0.25 U	0.50 U	ND
LAI-7	6/3/2009	0.25 U	0.88	0.88
LAI-7	7/14/2009	0.25 U	0.50 U	ND
LAI-7	8/25/2009	0.25 U	0.50 U	ND
LAI-7	10/7/2009	0.25 U	0.50 U	ND
LAI-7	11/9/2009	0.25 U	0.50 U	ND

Table 1
Groundwater TPH-Dx Analytical Results
Coolant Release Investigation
Boeing Portland Facility

Sample ID	Sample Date	NWTPH-Dx (mg/L) (a)		
		Diesel	Motor Oil	Total TPH-Dx
LAI-7	2/8/2010	0.25 U	0.50 U	ND
LAI-7	5/5/2010	0.25 U	0.50 U	ND
LAI-7	8/10/2010	0.25 U	0.50 U	ND
LAI-7	11/16/2010	0.25 U	0.50 U	ND
LAI-7	2/1/2011	0.25 U	0.50 U	ND
LAI-7	5/3/2011	0.25 UJ	0.50 UJ	ND
LAI-7	8/8/2011	0.25 U	0.50 U	ND
LAI-7	11/1/2011	0.25 U	0.50 U	ND
LAI-7	2/6/2012	0.25 U	0.50 U	ND
LAI-7	5/8/2012	0.25 U	0.50 U	ND
LAI-7	8/13/2012	0.25 U	0.50 U	ND
LAI-7	2/4/2013	0.097 U	0.24 U	ND
LAI-7	8/22/2013	0.098 UJ	0.25 U	ND
LAI-7	2/24/2014	0.097 U	0.24 U	ND
LAI-7	8/18/2014	0.10 U	0.25 U	ND
LAI-7	2/9/2015	0.10	0.31	0.41
LAI-7	8/12/2015	0.094 U	0.24 U	ND
LAI-7	2/5/2016	0.096 U	0.24 U	ND
LAI-7	8/4/2016	0.095 U	0.24 U	ND
LAI-7	2/6/2017	0.095 UJ	0.24 U	ND
LAI-8	9/18/2006	3.55	0.691	4.24
LAI-8	9/27/2006	5.95	7.69 U	5.95
LAI-8	11/16/2006	1.3	1.6	2.9
LAI-8	11/29/2006	6.6	1.0 U	6.6
LAI-8	12/5/2006	1.1	0.77 U	1.1
LAI-8	12/19/2006	4.0	0.50 U	4.0
LAI-8	1/30/2007	0.32	0.50 U	0.32
LAI-8	4/4/2007	0.49	0.50 U	0.49
LAI-8	5/11/2007	0.66	0.50 U	0.66
LAI-8	6/13/2007	6.2	0.53	6.7
LAI-8	7/12/2007	0.25 U	1.3	1.3
LAI-8	8/13/2007	4.2	0.6	1.3
LAI-8	9/7/2007	0.42	0.50 U	0.42
LAI-8	11/9/2007	1.2	0.50 U	1.2
LAI-8	2/6/2008	0.86	0.57	1.43
LAI-8	5/13/2008	2.3	0.87	3.17
LAI-8	8/14/2008	1.6	4.2	5.8
LAI-8	2/4/2009	0.25	0.50 U	0.25
LAI-8	5/7/2009	1.3	0.50 U	1.3
LAI-8	8/25/2009	3.1	2.60	5.7
LAI-8	11/9/2009	4.7	1.5	6.2
LAI-8	2/8/2010	3.8	0.50 U	3.8
LAI-8	5/5/2010	1.0	0.50 U	1.0
LAI-8	8/10/2010	1.1	0.50 U	1.1
LAI-8	11/16/2010	1.1	0.78	1.9
LAI-8	2/1/2011	1.5	0.50 U	2.0
LAI-8	5/3/2011	2.2 J	1.0 J	3.2
LAI-8	8/10/2011	2.2	0.50 U	2.2
LAI-8	11/1/2011	Dry in November 2011		
LAI-8	2/6/2012	Dry in February 2012		
LAI-8	5/8/2012	Dry in May 2012		

Table 1
Groundwater TPH-Dx Analytical Results
Coolant Release Investigation
Boeing Portland Facility

Sample ID	Sample Date	NWTPH-Dx (mg/L) (a)		
		Diesel	Motor Oil	Total TPH-Dx
LAI-8	8/13/2012		Dry in August 2012	
LAI-8	2/4/2013		Dry in February 2013	
LAI-8	8/22/2013		Dry in August 2013	
LAI-8	2/24/2014		Dry in February 2014	
LAI-8	8/18/2014		Dry in August 2014	
LAI-8	2/9/2015		Dry in February 2015	
LAI-8	8/12/2015		Dry in August 2015	
LAI-8	2/5/2016		Dry in February 2016	
LAI-8	8/4/2016		Dry in August 2016	
LAI-8	2/6/2017		Dry in February 2017	
			Cleanup Level (b)	1.35

Abbreviations/Acronyms:

mg/L = milligrams per liter

ND = Not detected.

NM = Not measured.

NA = Not analyzed.

ODEQ = Oregon Department of Environmental Quality

TPH-Dx = total petroleum hydrocarbons in diesel- and motor oil-range

Notes:

U = The analyte was analyzed for, but was not detected above the level of the reported sample quantitation limit.

UJ = The analyte was analyzed for, but was not detected. The reported quantitation limit is approximate and may be inaccurate or imprecise.

J = The result is an estimated quantity. The associated numerical value is the approximate concentration of the analyte in the sample.

Box = Exceeds site-specific cleanup level.

(a) Samples analyzed after September 27, 2006 had silica gel and acid wash preparation steps conducted.

(b) Site-specific ODEQ Risk-Based cleanup standard based on sum of diesel and motor oil components.

ATTACHMENT 1

Health and Safety Plan

Health and Safety Plan Boeing Portland Gresham, Oregon

March 28, 2008
Revised January 4, 2017

Prepared for
The Boeing Company



130 2nd Avenue South
Edmonds, WA 98020
(425) 778-0907

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FORMS

<u>Form</u>	<u>Title</u>
1	Health and Safety Approval/Sign-off Form
2	Confined Space Entry Permit
3	Dash-Board Safety Card

TABLES

<u>Table</u>	<u>Title</u>
1	Surface Water, Soil, and Groundwater Quality and Site Exposure Assessment

HEALTH AND SAFETY PLAN SUMMARY

SITE NAME:	Boeing of Portland: Troutdale Gravel Aquifer (TGA) and Troutdale Sandstone Aquifer (TSA) Remedies
LOCATION:	19000 NE Sandy Boulevard
CLIENT:	The Boeing Company (Boeing)
TYPE OF FACILITY:	Industrial/Aerospace Manufacturer
LAND USE OF AREA NEAR FACILITY:	Industrial, Commercial, and Residential
SITE ACTIVITIES:	Ongoing remediation of groundwater in two aquifers including: drilling, soil/vapor/groundwater sampling activities, construction oversight, and remedy system operation and maintenance (O&M).
POTENTIAL SITE HAZARDS:	Dermal exposure, incidental ingestion, and/or inhalation of contaminants; heat stress; slips, trips, and falls; work near heavy equipment and machinery; noise; storms; and work near pedestrians.
POTENTIAL SITE CONTAMINANTS:	Volatile organic compounds (VOCs) and diesel-range petroleum hydrocarbons (TPH-Dx).
ROUTES OF ENTRY:	Skin contact with or incidental ingestion of potentially contaminated soil, groundwater, solids; and inhalation of airborne droplets, dusts, or vapors.
PROTECTIVE MEASURES:	Protective clothing (including hard hat, steel-toed boots, safety glasses, nitrile gloves, coveralls); (stand-by) air purifying respirators, Tyvek suits; dust control; and ambient air monitoring equipment.
MONITORING EQUIPMENT:	Photoionization detector (PID) meter and chemical-specific detector tubes.

1.0 INTRODUCTION

This health and safety plan (HASP) presents requirements for remedial activities associated with both the Troutdale Gravel Aquifer (TGA) and the Troutdale Sandstone Aquifer (TSA) groundwater remedy and associated construction support activities. This HASP will be implemented for activities conducted on the Boeing Portland (Boeing) facility and in the local investigation and study areas, except for the Cascade Corporation (Cascade) facility, which will be addressed by separate Cascade health and safety plans.

Health and safety procedures to be used during these activities include descriptions of existing site conditions and organization, safety procedures, criteria for hazard and risk analysis, levels of personal protection and required equipment, air monitoring procedures, emergency response information, and requirements pertaining to training and medical monitoring of onsite personnel.

This HASP applies to Boeing personnel (associated with the site remedies) and Landau Associates (LAI) personnel. Contractors are required to submit a health and safety plan covering general safety for the contractors' specific work on the site, or adopt this plan as their own relative to potential exposure to volatile organic compounds (VOCs). The requirements outlined in this plan are considered the minimum health and safety requirements and are intended to be incorporated by each contractor into their respective health and safety plan. Contractors may choose to apply more stringent health and safety requirements. This plan does not address physical worker safety issues that may be associated with fall prevention, excavation trenching, shoring, hot work, and electrical work, as these activities are covered under the specific contractor HASP. Relevant federal, state, and local standards must be followed for all work related to the TGA corrective measures and TSA remedy implementation and associated construction support activities.

1.1 Site Description

The Boeing Portland facility is located in Gresham, Oregon at 19000 NE Sandy Boulevard as shown on Figure 1. The VOC plume in the TGA has been delineated and characterized through the Resource Conservation and Recovery Act (RCRA) facility investigations (RFI; LAI 1988, 1990, 1991, 1992, 1993, 1995a), and a corrective measures study (CMS; LAI 1995b, 1996) was performed to evaluate corrective measures alternatives and select a preferred corrective measure for remediation of the plume. Based on the CMS, the U.S. Environmental Protection Agency (EPA) issued a Statement of Basis (EPA 1997a) and a Final Decision (EPA 1997b) documenting the preferred corrective measure alternative. A corrective measure implementation was developed to describe the management strategy and present the conceptual design for conducting and implementing the design, construction, operation, maintenance, and monitoring of the selected corrective measure.

The TSA study area is located entirely in East Multnomah County and encompasses the TSA operable unit and surrounding area, including portions of Blue Lake, and Fairview Lake. The VOC plume has been delineated by investigations conducted separately by Boeing and Cascade and jointly as part of

the TSA remedial investigation and feasibility study (EMCON and LAI 1995; LAI and EMCON 1996). Based on these investigations, the boundaries of the TSA study area, established in the Oregon Department of Environmental Quality (ODEQ) Record of Decision (ROD) are: NE 181st Avenue to the west, NE 223rd Avenue to the east, NE Halsey Street to the south, and the Columbia River to the north.

For the purposes of this document, the terms "the site" and "onsite" include the Boeing facility, the TGA offsite investigation area, and the TSA study area.

1.2 Purpose, Applicability, and Adherence

Activities in this HASP include, but are not limited to, oversight of drilling activities (borehole drilling, installing, and decommissioning of wells and or sub-slab vapor pins); collection of groundwater and soil vapor in both wells and sub-slab vapor pins; collecting borehole soil and groundwater samples; oversight of construction related activities for underground piping from extraction wells to the existing groundwater treatment system (GWTS). Construction support may include borehole soil, surface water, groundwater, and air sampling and monitoring during well installation, as well as piping and treatment facilities construction. Monitoring, including periodic groundwater and borehole soil sampling and analysis, occur during the entire period of remediation to track constituent distributions. The health and safety requirements described in this HASP are directed at protecting workers from exposure to organic vapors and potentially contaminated soil, groundwater, and surface water during these activities. These health and safety requirements apply to all personnel, contractors, and others entering locations at the site where invasive remedial activities or sampling are being conducted.

All LAI, Boeing personnel, and visitors must read this plan prior to participation in remediation field activities or site visits of the remediation system. If information presented in this plan is unclear, the reader must contact the Boeing representative (see Section 1.3) for clarification before participating in field activity. Once the information has been read and understood, the individual will sign the health and safety acknowledgment form (Form 1); the signed form be kept in the LAI's project files. After each individual has read this HASP, but before participating in field activities, a training session will be conducted by the contractor to familiarize Boeing personnel and visitors with health and safety requirements at the site.

This HASP has been designed to be flexible to allow unanticipated location-specific problems to be addressed, while providing adequate and suitable worker protection. These requirements may be modified at any time by the Boeing project manager or the designated Boeing representative. Any modification will be presented to the onsite team during a safety briefing and documented.

1.3 Project Organization and Responsibilities

1.3.1 Boeing Project Manager

The current Boeing project manager is Mr. Mike Gleason. Mr. Gleason, or other future Boeing-designated project managers, will have responsibility for project planning and execution relative to environmental affairs and concerns. The project managers will be responsible for making project-level decisions regarding safety rules and operations in consultation with the Boeing Field Engineer and the LAI Project Manager. The project managers may suspend environmental investigations and remedial construction activities, and recommend suspension of other onsite construction activities to the Boeing Portland facility's manager if health and safety issues warrant. Specific responsibilities of the project manager or their designee include monitoring the contractors for compliance with their project-specific health and safety plans according to the terms of the contract.

1.3.2 Boeing Field Engineer

Ms. Jennifer Parsons is the current Boeing Field Engineer. In this capacity, she is the Boeing representative responsible for:

- Monitoring daily activities
- Conducting orientation training for all Boeing personnel before beginning their activities
- Communicating with the project manager regarding investigation and remediation activities and health and safety conditions
- Acting as the project manager's liaison with Boeing site facilities, construction, investigation, and remediation activities representatives.

The Boeing Field Engineer may also be designated as the project health and safety officer (HSO) for Boeing activities onsite. In this capacity, he/she may be assisted by a representative of Boeing's remediation consultant, LAI. The Boeing Field Engineer may not be available during onsite activities and may transfer safety oversight activities to Boeing's remediation consultant, LAI.

1.3.3 Landau Associates Safety Manager

Safety monitoring during site remedial activities will be the responsibility of the Boeing Project Managers, and the designated LAI's Health and Safety Manager. The Landau Associates' Health and Safety Manager, Ms. Christine Kimmel, will prepare safety plans, review safety documentation prior to the start of field activities, and be the primary point of contact in the case of an incident. The LAI Safety Manager will also review contractor safety plans and provide comments, as needed. The Safety Manager will oversee any required safety investigation within 24 hours of an incident, and develop corrective actions (as needed).

1.3.4 Landau Associates Site Safety Officer

The LAI Site Safety Officer, Mr. Brett Borgeson or Ms. Erin Waibel, or equivalent designee, will be present at the site at all times during intrusive site activities related to the monitoring well

installation, soil boring completion, and sampling activities. The LAI Site Safety Officer will review safety documents and conduct work in accordance with the plans. The LAI Site Safety Officer will oversee operation and maintenance (O&M) contractor activities and make observations on safety procedures, any safety concerns will be reported to the LAI Safety Manager.

1.3.5 Contractor Project Health and Safety Officer

Site O&M contractors will designate their own project HSO (CHSO) to be onsite at all times during intrusive and O&M activities. The CHSO be responsible to the Boeing Field Engineer and LAI for enforcing the provisions of their health and safety plan. He/she also monitors the implementation of contractor health and safety plans and notify the project manager, field engineer, and site facilities and contractor representatives of any conditions which may present a danger to personnel in the field or which may require modification of health and safety plans.

Contractor representatives will be present during all intrusive and O&M activities and audit health and safety conditions at the site. The Boeing representative, in coordination with the contractor and CHSO, will:

- Ensure that personnel are aware of health and safety requirements and the potential hazards associated with the work, instructed in safe work practices, and understand the planned procedures for dealing with emergencies.
- Ensure that all required forms are completed.
- Correct any work practices or conditions that may result in injury to personnel or exposure to hazardous substances.
- Require that appropriate personal protective equipment (PPE) is properly used by all onsite personnel.
- Report any deviations from the anticipated conditions described in this document to the project manager or his/her representative.
- Monitor decontamination procedures per Oregon Administrative Rule (OAR)-Occupational Safety and Health Administration (OSHA) 1910-132 and 134 (OSHA 1989a).

1.3.6 Work Area Security

Work areas where intrusive activities (i.e., drilling, excavating/trenching, extraction well cleaning, sampling, and pump replacement) are being conducted will be barricaded and separated from the general public. Ambient air quality monitoring will be conducted when personnel are located inside the secured work area to monitor for PPE protection/action levels. Work areas in and around groundwater extraction well and utility vaults will be barricaded and separated from the general public. Barricades consist of, but not be limited to, caution tape, flags, traffic cones, and traffic barricades. Only personnel who are familiar with the work procedures and have reviewed and signed the HASP acknowledgment form be allowed within the interior of the secured work area. Security in the contractor's work area will be the responsibility of the contractor with Boeing concurrence.

2.0 SAFETY PROCEDURES

Safety must be the concern of every individual involved in project activities. Whether in the office or onsite, properly followed procedures are essential for personal safety and to minimize lost time due to injuries or accidents involving equipment. Potential hazards in the work area include, but are not limited to:

- Exposure to toxic or hazardous chemicals
- Physical hazards from heavy equipment
- Fire and explosion caused by flammable or combustible materials
- Weather stress caused by PPE or weather conditions.

2.1 Chemical Hazards

Volatile organic compounds and diesel-range petroleum hydrocarbons (TPH-Dx) compounds may be present in soil, shallow soil vapor, surface water, and groundwater at the site. The presence of these compounds, some of which are known or suspected human carcinogens, requires the special considerations outlined within these health and safety requirements and each contractor's health and safety plan. This plan identifies the specific compounds of concern and action levels of these compounds at which personal protection must be taken.

2.2 Physical Hazards

Field work near heavy equipment and vehicle operations poses physical hazards. Workers need to be aware of all heavy equipment activity and be ready to avoid moving vehicles. Mobile construction equipment be equipped with backup alarms and all workers be made aware of their use. Only operators of heavy equipment will be allowed to ride and operate the equipment. Relevant federal, state, and local laws and regulations governing construction will be followed. Workers avoid working in areas where heavy machinery is operating in accordance with the Oregon Administrative Rules (OAR) Occupational Safety and Health Administration (OSHA). Safety glasses, ear protection, and highly visible safety vests will be used around operating machinery. Field work in and around groundwater extraction well and utility vaults also pose physical hazards. Workers need to be aware of pedestrians and moving vehicles while working in and around open vaults. Barricades will be placed around the open vault and consist of, but not be limited to, caution tape, flags, traffic cones, and traffic barricades.

2.3 General Safety Requirements

Boeing and contractor personnel have the responsibility for:

- Taking reasonable precautions to prevent injury to themselves and others.
- Performing only those tasks that they believe they can do safely, and immediately reporting the presence of unsafe conditions.

-
- Implementing the health and safety requirements, and reporting a deviation from the procedures to the project manager or the field engineer.
 - Notifying the project manager of special medical problems and ensuring that appropriate onsite personnel are aware of these problems.

The following general safety rules apply:

- All federal and state OSHA regulations related to contaminated sites and construction-related activities including fall prevention, excavation, trenching, shoring, hot work, and electrical work.
- All personnel will conduct themselves in a professional manner at all times.
- All Boeing facilities are tobacco free zones. No smoking or chewing of tobacco will be conducted on Boeing property.
- Working while under the influence of intoxicants, narcotics, or controlled substances is prohibited. The use of any prescription drug will be reported to the project manager.
- Climbing or standing on machinery or equipment is prohibited unless authorized by the project manager or the field engineer and proper fall protection equipment is worn.
- Individuals required to wear respirators will have an updated respirator fit test and will not have beards.
- Contact with contaminated or potentially contaminated material should be avoided. Efforts will be made to stage site activity upwind of equipment, activities, and materials if dust is present.
- No use of phones while operating equipment, vehicles, or walking in areas of the site. Phone use is permitted in identified Safety Zones.
- Eating, drinking, or chewing gum, or any practice that increases the probability of hand-to-mouth transfer and ingestion of material is prohibited inside the designated secured work zones.
- Exchange of PPE will not be allowed.

2.4 Decontamination Procedures

In the case of an emergency, personal decontamination procedures will be speedily implemented, if possible. If a life-threatening injury occurs and the injured person cannot undergo decontamination procedures without incurring additional injuries or risk, he or she will be transported wrapped in plastic sheeting if time allows and if consistent with the injury. The medical facility will be: 1) informed that the injured person has not been decontaminated, and 2) given information regarding the most probable contaminants.

2.4.1 Personal Decontamination

A combination of disposable PPE and non-disposable PPE will be utilized to reduce exposure to contaminated soil, soil vapor, surface water, and groundwater. Disposable PPE will include nitrile

gloves, hearing protection, and Tyvek suits (if conditions warrant). Non-disposable PPE will include steel-toed boots, hard hats, and brightly colored vest or shirt. Disposable PPE be managed as solid waste and stored in a labeled 55-gallon drum. Non-disposable PPE will be routinely washed with hot water and detergent and any obvious signs of contamination be removed with paper toweling prior to conducting the appropriate decontamination process.

All personnel and equipment will undergo appropriate decontamination procedures before leaving the secured work zone. Personal decontamination will be as follows:

Step 1: Wash and rinse outer protective clothing (e.g., boots, and any rain gear).

Step 2: Remove disposable clothing (e.g., Tyvek and outer gloves). Place in marked receptacle.

Step 3: Remove, wash, rinse, and sanitize respirator (if used).

Step 4: Wash hands and face.

Certain parts of contaminated respirators such as the harness assembly or cloth components are difficult to decontaminate. If grossly contaminated, they will be discarded. Rubber components be soaked in soap and water and scrubbed with a brush. Respirators will be sanitized by rinsing in a detergent solution followed by a clear rinse, then hung to dry.

2.4.2 Heavy Equipment Decontamination

All heavy equipment must be thoroughly decontaminated before leaving the secured area or the designated decontamination area (i.e., decontamination pad located in the onsite Remediation Yard). Particular care be taken in decontaminating those parts of heavy equipment that have come into direct contact with soil, such as tracks, tires, shovels, grapples, and scoops.

For wet decontamination procedures, high-pressure water will be used (hot water if necessary). Physical scrubbing with disposable brushes will be used when necessary to loosen materials. Wet decontamination of heavy equipment will be conducted at the decontamination pad located in the remediation yard. Generated waste water will be cycled through the groundwater treatment system prior to discharge at the Storm Drain Creek, which discharges to the Columbia Slough. For dry decontamination procedures, the soil or groundwater will be brushed from the heavy equipment that has come into direct contact with potentially contaminated soil, such as tracts, tires, excavator bucket.

2.4.3 Sampling Equipment Decontamination

Disposable sampling equipment will be deposited in a labeled container and disposed as a solid waste. Non-disposable sampling equipment will be decontaminated between sampling intervals by a tap water andalconox soap mixture wash, followed by a tap water rinse, and a final distilled water rinse. If contamination is still observed, the process will be repeated.

2.5 Disposal of Contaminated Materials

Boeing Portland uses profiles to characterize hazardous waste streams for disposal purposes. These profiles are generated using a combination of process knowledge, manufacturers' safety data sheets (SDSs), and/or analytical test results. Waste is characterized in accordance with 40 CFR, parts 261 through 265, and 49 CFR, parts 78 through 215, and the Waste Characterization Manual maintained separately by Boeing Environmental Affairs. Initial laboratory analysis will be conducted whenever a hazardous waste is unknown. Unknown containerized wastes (label is missing or not legible) will be characterized in accordance with 40 CFR 261, sampled and analyzed per SW 846.

2.5.1 Hold for Analysis

"Hold for Analysis" labels (Boeing form X 24938) are used on containers of hazardous waste when the contents must be analyzed. Anytime a container has unknown contents, or if there are questions about compatibility, the Boeing Portland Environmental Affairs should be notified. Any container of hazardous waste bearing this label cannot be removed until its contents have been analyzed and identified by laboratory personnel or Environmental Affairs. In addition, no waste is to be added or removed from any container bearing this label. This container must also be stored for safe keeping at the hazardous waste storage facility.

2.5.2 Nonhazardous Waste

"Nonhazardous Waste" labels (Boeing form X-26893) are to be used on all containers that are legally defined as nonhazardous.

2.6 Housekeeping

Work areas will be kept clean and orderly at all times. Ordinary refuse will be placed in suitable rubbish or recycle bins. Extraneous materials will be minimized within the exclusion zone to reduce the decontamination load and possibilities for cross contamination. Contractors will not dispose of equipment maintenance waste materials at the site without prior approval of the Boeing project manager or designee.

2.7 Visitors

All visitors related to the ongoing remedy of the TGA and TSA must be cleared by the project manager or designee and will report to Boeing security to register their presence on the site and obtain an appropriate badge. Visitors must bring proof of citizenship to obtain access to the site. Visitors will only be allowed to observe operations and must obey all instructions of the project manager.

2.8 Spill Containment

It is not anticipated that bulk chemicals subject to spillage will be used by LAI's or Contractor personnel on this project with the exception of electron donor material. Donor material will be limited to the planned activities and will temporarily stored in the onsite Remediation Yard. Containers will be

closed to prevent rain water accumulation and will be labeled. Material will be stored either in a plastic lined berm or on the existing decontamination pad to eliminate potential runoff to stormwater system. When working near a storm drain, a protective storm drain cover will be installed to protect from spills or other unwanted material entering the stormwater system. Spill kits are stored onsite and will be delivered to the delineated work area for all intrusive activities to address small releases. Spill kits includes the following items:

- Absorbents – Universal spill pillow and absorbent pads.
- A 1:1:1 mixture of Flor-Dri (or unscented kitty litter), sodium bicarbonate, and sand.
- PPE – Nitrile gloves, heavy neoprene gloves, face shield, Tyvek coveralls and booties.
- Tools for Clean-up – Plastic dust pan and scoop, plastic bags for contaminated PPE, and paper towels.
- A shop vacuum to remove small volumes of liquid.

3.0 HAZARD/RISK ANALYSIS

Site remedy activities have aspects of risks associated with both physical and chemical exposure. Below is a summary of the most common identified risks; however, additional risks can be identified based on changing site conditions.

3.1 Physical Hazard Analysis

3.1.1 Slips/Trips/Falls

Keep work area clear of debris to minimize slips, trips, and falls. Keep engaged in site activities and awareness of body movement. Keep hands free of items to allow for bracing in the event of a slip/trip/fall by storing items in backpack or pockets of safety vest.

3.1.2 Arc Flash and Shock Hazard

Electrical work will be performed by certified electricians only. Arc flash and shock hazard warning labels exist on the GWTS electrical panels in the Control Room (85-118), GWTS building (85-124), and electrical panels located inside the individual extraction well vaults that will inform electricians of the necessary level of PPE required for working on a particular energized system. In 2014, a certified Electrical Engineer conducted a facility-wide Arc Flash Evaluation, which included the GWTS and remedial components.

3.1.3 Fire/Explosion

Although some of the chemical compounds can be explosive or flammable, they are found in relatively low concentrations, making the risk of fire or explosive conditions very unlikely during planned site activities. LAI vehicles will be stocked with an ABC fire extinguisher. If a fire or explosion becomes too large to easily resolve with the fire extinguisher than immediately call the Boeing Emergency Telephone (503) 676-1444).

3.1.4 Jib Crane Safety

The jib crane installed in the GWTS building (85-124) is used for air stripper tray maintenance. Use of the jib crane is an overhead hazard and shall only be operated by qualified contractors. When using the jib crane, proper PPE including a hard hat shall be worn at all times.

3.1.5 Confined Space Entry

A confined space is defined as an area that has limited work space and limited means of access and egress and is not designed for continuous employee occupancy. A permit-required confined space is a confined space that has the potential for any of the following characteristics:

- It contains or potentially contains a hazardous atmosphere.
- It contains a material that has the potential to engulf an entrant.
- It has an internal configuration that can trap or asphyxiate an entrant (such as tapering walls).
- It contains any other recognized serious safety or health hazards.

Due to the potential presence of VOC vapors at the site, extraction vaults are considered permitted confined space. Confined space work anticipated on this project involves work within groundwater extraction well vaults and utility vaults. Each extraction well vault has an exterior label to identify the location as a Confined Space.

Entering confined spaces requires specialized training and procedures outlined by the OSHA (1989b). OSHA issued a general industry standard (29 CFR 1910.146; the standard) to require protection for employees who enter permit-required confined spaces. Prior to each confined space entry, a safety plan and permit will be issued. The plan will identify roles, procedures, identify risks, and provide mitigation and monitoring procedures for each risk. In general, the confined space entry process will include the following steps:

1. Prepare work area (i.e., set up blowers and all ventilation, assess access/egress, and tripod, if necessary).
2. Ensure that all process piping, mechanical and electrical equipment, etc., have been disconnected, purged, blanked-off or tagged and locked, as necessary.
3. Ensure that hot work (e.g., welding, burning, open flames, or spark producing operation) that is to be performed in the confined space has been approved by the site HSO and is indicated on the confined space entry permit and coordinated with Boeing Security for a burn permit.
4. Test confined space atmosphere for oxygen (O₂), lower explosive limit (LEL), carbon monoxide (CO), hydrogen sulfide (H₂S), and VOCs using a calibrated multi-meter and photoionization detector (PID). Collect a 15-minute time-weighted average (TWA). In addition to the main space of occupancy, corners and pockets at both the top and bottom levels of the space should be tested as well.
5. Ventilate confined space for a minimum of 15 minutes while continuously monitoring for O₂, LEL, CO, H₂S, and VOCs. Ventilation will continue throughout confined space entry activities.
6. Fill out permit. Once the permit is complete, post it in a conspicuous location.
7. Don PPE (i.e., Tyvek, Tyvek booties, inner and outer gloves, respirator, rescue harness, etc., as necessary).
8. Conduct confined space entry while continuously monitoring for O₂, LEL, CO, H₂S, and VOCs. One PID and one multi-meter will be used in the immediate vicinity of the entrants. Both meters will be set with appropriate alarm levels, so that alarms are activated when action levels are met or exceeded.
9. If any action level is exceeded during entry, the entrant will immediately evacuate the confined space and the permit will be voided. A new permit will be issued once levels of all monitored constituents are below action levels.
10. Once the work is completed, void and file the permit.

The O&M contractor (Apollo Environmental) is trained in confined space rescue; however, in the event of an incident, Boeing Emergency Dispatch (503 676-1444) will be notified. The Emergency Dispatch will be notified prior to and upon completion of the confined space entry and will be

provided with information related to the type and timing of activities, to ensure proper preparedness for an emergency requiring rescue services.

3.1.5.1 Confined Space Entry General Requirements

General requirements for work in a confined space are listed below:

1. Confined spaces will be identified with a posted sign that reads "DANGER, PERMIT-REQUIRED CONFINED SPACE, DO NOT ENTER."
2. When entrance covers are removed from permit-required confined spaces, the opening will be promptly guarded by a railing, temporary cover, or other temporary barrier.
3. Only personnel trained and knowledgeable in permit-required confined space entry procedures and rescue will be authorized to enter a permit-required confined space or be an attendant.
4. Natural ventilation will be provided for the permit-required confined space prior to initial entry and for the duration of the confined space entry procedure. Positive/forced mechanical ventilation may be required. However, care will be taken to not spread contamination outside of the enclosed area.
5. The contents of any confined space will, where necessary, be removed prior to entry. All sources of ignition must be removed prior to entry.
6. A ladder is required in all confined spaces deeper than the employee's shoulders. The ladder will be secured and not removed until all employees have exited the space.
7. All equipment and hand tools used within permit-required confined space will be intrinsically safe and positively grounded if flammable liquids, gases, or vapors may be contained within the confined space. All power cords will be visually inspected.
8. Hand-held lights and other illumination utilized in permit-required confined spaces will be equipped with guards to prevent contact with the bulb and must be explosion proof.
9. Feed lines to confined spaces will be broken and blanked-out and sources of electrical or mechanical energy, which could activate any area of the confined space, must be identified, tagged, and locked out prior to anyone entering a confined space.
10. Compressed gas cylinders, except cylinders used for self-contained breathing apparatus, will not be taken into confined spaces. Gas hoses will be removed from the space and the supply turned off at the cylinder valve when personnel exit from the confined space.
11. If a permit-required confined space requires respiratory equipment or where rescue may be difficult, safety belts, body harnesses, and lifelines will be used. The outside observer will be provided with the same equipment as those working within the permit space.
12. Only self-contained breathing apparatus of National Institute for Occupational Safety and Health (NIOSH)-approved air line respirators equipped with a 5-minute emergency air supply (egress bottle) will be used in untested confined spaces or in any permit-required confined space with conditions determined to be immediately dangerous to life and health.
13. Where air-moving equipment is used to provide ventilation, chemicals will be removed from the vicinity to prevent introduction into the confined space.
14. Vehicles will not be left running near any confined work space or near air-moving equipment being used for any confined space ventilation.

15. Smoking in any confined space is prohibited.
16. Any deviation from these confined space entry procedures requires the prior permission of the project HSO or project manager.

3.2 Chemical Hazard Analysis

Previous investigations have identified the types and levels of constituents of concern at the site. Documents identified in the references (Section 8.0) were used in assessing site hazards/risks. Maximum reported concentrations and exposure limits are summarized in Table 1.

3.3 Suspected Hazardous Substances

Several VOCs have been detected at the site and are of concern because they may volatilize when exposed to the air column. Table 1 summarizes maximum concentrations of the various constituents found at the site in surface water, soil, soil vapor, and groundwater. The table also shows selected health and safety exposure limits for the identified constituents.

3.3.1 Electron Donor Injections

Currently, two TGA source areas are receiving electron donor material to reduce contaminant levels (Former Vapor Degreaser Source Area and the Coolant Release Area). Donor material for the Former Vapor Degreaser Source Area, located inside the 85-001 building, has consisted of a vegetable grade oil and surfactants to enhance biodegradation of VOCs. The Coolant Release Area, located inside the 85-105 building, has received injections of EHC-O™ oxygen-releasing compound in the 85-105 building to enhance the remediation of TPH-Dx-based coolant material. The potential hazards associated with injections are exposure to toxic or hazardous chemicals, physical hazards from slips and trips working in an active facility, and traffic from facility operations. Proper PPE must be worn at all times.

3.3.2 Exposure

The primary risk of exposure will be through handling potentially contaminated soil and from inhaling VOCs and TPH-Dx released from the soil, soil vapor, and/or groundwater. This risk will be greatly reduced by adherence to the minimum level of protection required by this HASP. Some inhalation and ingestion risk from exposure to contaminants as airborne particulates may exist. Good ventilation, including the possible use of soil wetting techniques, will reduce the exposure risk. Low to moderate exposure hazard is expected during TGA and TSA remedial activities.

3.4 Action Levels for Required Protection

Monitoring ambient air quality using real time instruments will be conducted to identify if action levels have been reached that will require upgrading PPE requirements. Action level are shown on Figure 2. The action levels listed assume sustained readings of 1 minute or more in the breathing zone. The PPE requirement applies to the area within a 30 ft radius of where measured. Justification for the action levels is presented in Section 3.3.

Air monitoring will be performed by the CHSO or their designee to determine necessary levels of respiratory protection. Background readings will be taken 50 ft upwind of site activities. Monitoring for organic vapors will be accomplished using a PID meter.

Monitoring will be conducted in the worker breathing zone at regular intervals during all site work in which airborne contamination may be present. During intrusive activities in these areas, breathing space monitoring will be conducted at least every 15 minutes.

3.5 Justification for Exposure Limits

It is anticipated that most of the project activities will be performed at Level D (modified), and supplemented with air purifying respirators if the action levels identified for Level C are reached.

Action levels for donning respiratory protection will be based on readings taken with a PID supplemented, as appropriate, with chemical-specific detector tubes. The PID detects all ionizable volatile constituents and does not provide reliable readings below 10 parts per million (ppm); therefore, for constituents with permissible exposure limits (PEL) less than 10 ppm, chemical-specific detector tubes must be used to determine if these constituents are present at concentrations below 10 ppm, but above their respective PELs. Exposure to volatile ionizable constituents with PELs greater than 10 ppm will be monitored using the PID; action levels based on this monitoring are specified on Figure 2.

Six potential TGA contaminant source areas were identified based on earlier investigations and current or past facility uses, as shown on Figure 3. Investigations have been conducted within all the source areas, based on these results and with ODEQ approval only the Former Degreaser Source Control Area remains in the Institutional Controls Plan (ICP; LAI 2005).

The ICP provides measures to restrict the potential ingestion of TGA groundwater exceeding the maximum cleanup levels; provides a work protection institutional control to restrict the potential exposure of workers during surface/subsurface disturbances within the Former Degreaser Source Control Area; and provides a restrictive covenant for the facility. The groundwater use institutional control regulates groundwater use in the area by granting the lead agency the authority to review any proposed actions involving the installation of wells or modifications of existing well water use within the dissolved-VOC plume. The worker protection institutional control provides procedures for notification to the lead agency of proposed worker activities within the source areas. Workers shall conduct activities under guidance of an approved health and safety plan, and disposal criteria will be coordinated with the lead agency. Personal protection equipment will be worn according to the action levels designated on Figure 2.

3.6 Level C (Modified) Action Levels

A half-face respirator, equipped with organic vapor and high efficiency particulate cartridges, provides a protection factor of 50 (NIOSH recommendation). Therefore, a half-face respirator may be worn in

concentrations up to 50 times the threshold limit value (TLV) values noted in Table 1. Based on previous investigations, it is not expected that Level C action levels will be exceeded. However, if they are, half-face respirators will be worn.

Normal field conditions (e.g., drilling operations, groundwater sampling) are not expected to exceed the 50 protection factor level, such that Level B protection would be required. However, such conditions may be encountered during large-scale invasive activities such as piping construction excavation (see Section 3.4 above). If conditions are encountered that warrant Level B protection, safety procedures will be revised before beginning or continuing invasive activity.

4.0 PERSONAL SAFETY EQUIPMENT

Equipment required for the various levels of protection expected onsite is listed below.

Level D (Modified):

- Nitrile gloves
- Hard hat
- Safety glasses
- Steel-toe and steel-shank neoprene or rubber boots.

Level C (Modified):

- Level D (modified) equipment.
- Tyvek suit (Saranex or equivalent), water resistant coveralls, or rain gear when direct contact with wet soil and water is encountered.
- Half-face air-purifying respirator equipped with high efficiency air purifying organic vapor and HEPA cartridges. Respirators must be NIOSH approved. Cartridges will be changed daily (if used) or more frequently if directed by the project HSO.

5.0 EMERGENCY RESPONSE PLAN

This emergency response plan outlines the steps necessary for appropriate response to emergency situations. The following summarizes the key emergency response plan procedures for this project. Each Contractor vehicle associated with well installation and soil boring activities will be provided with a Boeing-supplied Dash-Board Safety Card (Form 3), which will summarize the emergency procedures described below.

5.1 Notification and Reporting

The LAI's Health and Safety Manager is to be notified immediately of any emergency situation. If the situation is life-threatening and notification of the LAI's Health and Safety Manager would delay emergency response, site personnel may initiate the appropriate emergency contacts as noted below prior to notifying the LAI's Health and Safety Manager. The LAI's Health and Safety Manager will initiate contacts as follows:

1. Call Boeing Emergency Dispatch (Form 3) and provide the following information:
 - Name and location of person reporting
 - Location of accident/incident
 - Name and affiliation of injured party
 - Description of injuries
 - Status of medical aid effort
 - Details of any chemicals involved
 - Summary of the accident, including the suspected cause and the time it occurred
 - Temporary control measures taken to minimize further risk.

Note: This information is not to be released to parties other than the Landau Associates' Health and Safety Manager, Boeing and City personnel, Contractor personnel, and bona fide emergency response team members.

2. Call the Boeing Project Manager and provide information noted in Item 1 above.
3. Call Landau Associates' Corporate Health and Safety Manager and the Landau Associates' Project Manager with information in Item 1 above.
4. The Landau Associates' Health and Safety Manager will complete a written accident/incident report, using Form 4, within 24 hours, sending copies to Boeing's Project Manager.

Resources to be used in cases of emergency include:

- List of Emergency Contacts: Table 3 includes both the appropriate emergency services and the appropriate project contacts.
- Nearest Phone: Telephones are located inside buildings. Boeing and Landau Associates' site personnel also possess cellular phones.

- **Onsite Emergency Equipment:** An industrial first-aid kit, an ABC type portable fire extinguisher, and an eyewash kit accompany each site vehicle operated by Landau Associates.
- **Offsite Emergency Services:** Phone numbers for offsite emergency services are listed in Table 3. Copies of this table must be located in each vehicle.

5.2 Emergency Facilities and Numbers

Hospital: Legacy Mt. Hood Medical Center
24800 SE Stark Street
Gresham, OR 97030

Emergency: (503) 667-1122

Emergency Route: See Figure 4

Directions: Travel east on Sandy Boulevard to NE 223rd Ave. Turn south (right) onto NE 223rd Ave., and proceed to Stark Street. Turn east (left) onto Stark Street and proceed for approximately 1 mi to Legacy Mt. Hood Medical Center.

Boeing Emergency Telephone: (503) 676-1444 (Fire, ambulance, police, spill reporting)

Boeing Non-Emergency Security: (503) 676-1800

Emergency Contacts:

Boeing Security	(503) 676-1800
Mike Gleason (Boeing Project Manager)	Cell (206) 290-6576
Jennifer Parson (Boeing Field Engineer)	Cell (206) 715-7981
Christine Kimmel (LAI Project Manager)	Cell (206) 786-3801

In the event of an emergency, do the following:

1. Call Boeing Emergency number for help as soon as possible. Give the following information:
 - WHERE the emergency is - use cross streets or landmarks
 - PHONE NUMBER you are calling from
 - WHAT HAPPENED - type of injury
 - HOW MANY persons need help
 - WHAT is being done for the victim(s)
 - YOU HANG UP LAST - let the person you called hang up first.

2. Transport to the hospital will be performed by local emergency response professionals in all cases. If the injury or exposure is not life threatening, decontaminate the individual first. If decontamination is not feasible, wrap the individual in a sheet of plastic prior to transport.
3. Notify the project manager or representative.

5.3 Onsite Emergency Equipment

An industrial first aid kit, a 20-pound type ABC portable fire extinguisher, and an eyewash kit will be maintained by the contractor.

5.4 Offsite Emergency Services

A copy of EMERGENCY FACILITIES AND NUMBERS will be posted next to the contractor telephone identified for emergency use.

5.4.1 Weather-Related Illnesses

Weather-related (hot or cold weather conditions) illnesses can occur at any time when protective clothing is worn. For heat-related illnesses, workers wearing semipermeable or impermeable encapsulating clothing should be monitored when the temperature in the work area is above 70°F (21°C). Heat stress monitoring includes regular checks of heart rate.

Each employee should check his/her pulse rate at the beginning of each break period. The pulse rate should be taken at the wrist for 30 seconds, and multiplied by 2. If the pulse rate exceeds 110 beats per minute, the length of the next work period should be reduced by one-third (the rest period need not be lengthened). A pulse rate in excess of 150 beats per minute may indicate heat exhaustion, although this rate will vary among workers. All personnel will know what their baseline pulse rate is before working in elevated temperatures, so as to monitor themselves. Personnel should follow appropriate guidelines if any personnel exhibit these symptoms:

- Heat Rash – Redness of skin. Frequent rest and change of clothing.
- Heat Cramps – Painful muscle spasms in hands, feet, and/or abdomen. Administer lightly-salted water by mouth, unless there are medical restrictions.
- Heat Exhaustion – Clammy, moist, pale skin, along with dizziness, nausea, rapid pulse, fainting. Remove to cooler area and administer fluids.
- Heat Stroke – Hot dry skin; red, spotted, or bluish; high body temperature of 104° F; mental confusion; loss of consciousness; convulsions; or coma. Immediately cool victim by immersion in cool water. Wrap with wet sheet while fanning; sponge with cool liquid while fanning; treat for shock. DO NOT DELAY TREATMENT. COOL BODY WHILE AWAITING AMBULANCE.

For cold-related illnesses site personnel may be subject to low temperatures, rain, and winds; therefore, proper protective clothing must be worn. Cold stress can be manifested as both hypothermia and frostbite:

- Hypothermia is a cold-induced decrease in the core body temperature that can increase the safety hazards associated with field work activities that require maximum attentiveness and manual dexterity. Hypothermia produces shivering, numbness, drowsiness, muscular weakness, and, if severe enough, death.
- Frostbite results from the constriction of blood vessels in the extremities, and decreasing the supply of warming blood to these areas. This drop in blood supply may result in the formation of ice crystals in the tissues, causing tissue damage. The symptoms of frostbite are white or grayish skin, blisters, or numbness.

If such conditions exist, the following procedures will be carried out to reduce weather-related stress:

- Acclimatization
- Work/rest cycles
- Heat stress monitoring
- Liquids that replace electrolytes/salty foods available during rest
- Use of buddy system.

The LAI's Health and Safety Manager and the CHSO will be trained in monitoring, treating, and recognizing the signs of heat stress. Unless the victim is obviously contaminated, decontamination should be minimized and treatment begun immediately.

5.5 Site Evaluation and Evacuation

The Landau Associates Health and Safety Manager in cooperation with the Boeing representative will be responsible for determining if circumstances exist that require re-evaluation or evacuation.

5.5.1 Withdraw from Work Area

Withdrawal to a safe upwind location will be required under the following circumstances:

- Detection of VOCs or toxic gases at concentrations above action levels for the level of protection being worn.
- Occurrence of a minor accident - field operations resume after first-aid and decontamination procedures have been administered.
- Malfunction or failure of protective equipment, clothing, or respirator.

6.0 TRAINING

Orientation training will be held before beginning work. If appropriate, based on observation of the work area and air monitoring results, the Boeing project manager or the LAI site safety officer may require site personnel to have additional safety training. The initial training will be supplemented, as necessary, in subsequent safety meetings. Orientation training will include:

- Health effects and hazards of the chemicals identified or suspected to be at the site and in the work area.
- Personal protection requirements.
- Personal hygiene (beards, etc.).
- Use, care, maintenance, and fitting of PPE. Training in respiratory equipment use will conform to ANSI Z88.2 and 29 CFR 1910.134 (OSHA 1989a), which establishes the necessity, effectiveness, and limitations of respiratory equipment. Workers with limiting physical disabilities such as respiratory ailments will not be assigned to tasks requiring the use of respirators. Fit testing for respirators will have taken place prior to entry to the project site.
- Decontamination procedures.
- Accepted practices for entry, exit, and activities within specific areas of the site.
- Emergency response procedures.
- Review and assessment of equipment.

Written documentation of training will be maintained and will be available for Boeing review, if necessary.

7.0 ROUTINE HEALTH CARE AND MONITORING

A baseline medical evaluation will be required for all employees, contractors, and subcontractors performing intrusive activities. An annual update exam will be required for employees, contractors, and subcontractors performing intrusive activities regarding the use of respirators for more than 30 days per year or are exposed to air concentrations greater than permissible exposure limits. Follow-up examinations are appropriate if exposures are known or suspected to have occurred. Documentation of medical evaluations (including medical clearance for respirator use) will be maintained by the contractor and will be available to Boeing for inspection for all workers performing intrusive activities.

8.0 REFERENCES

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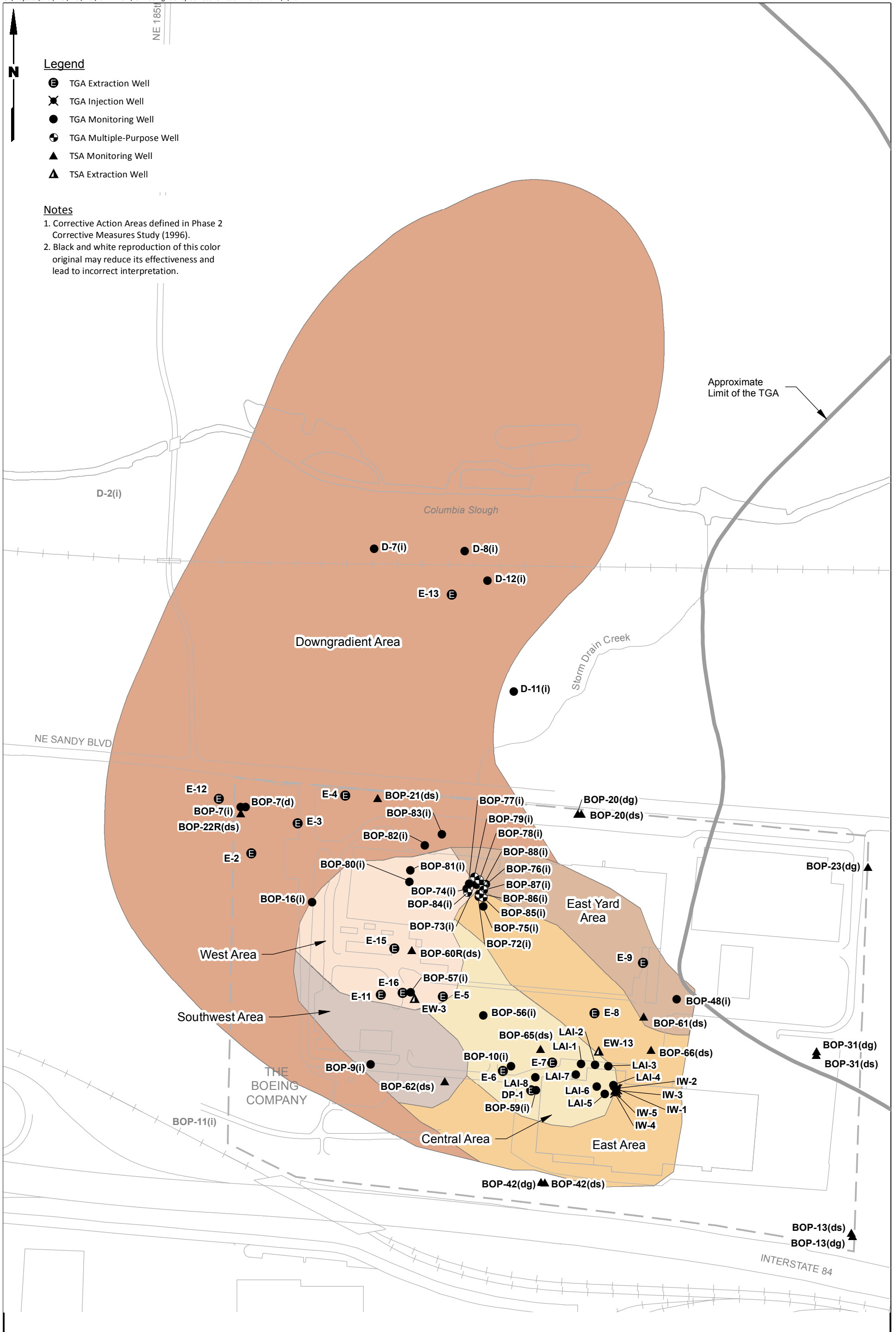
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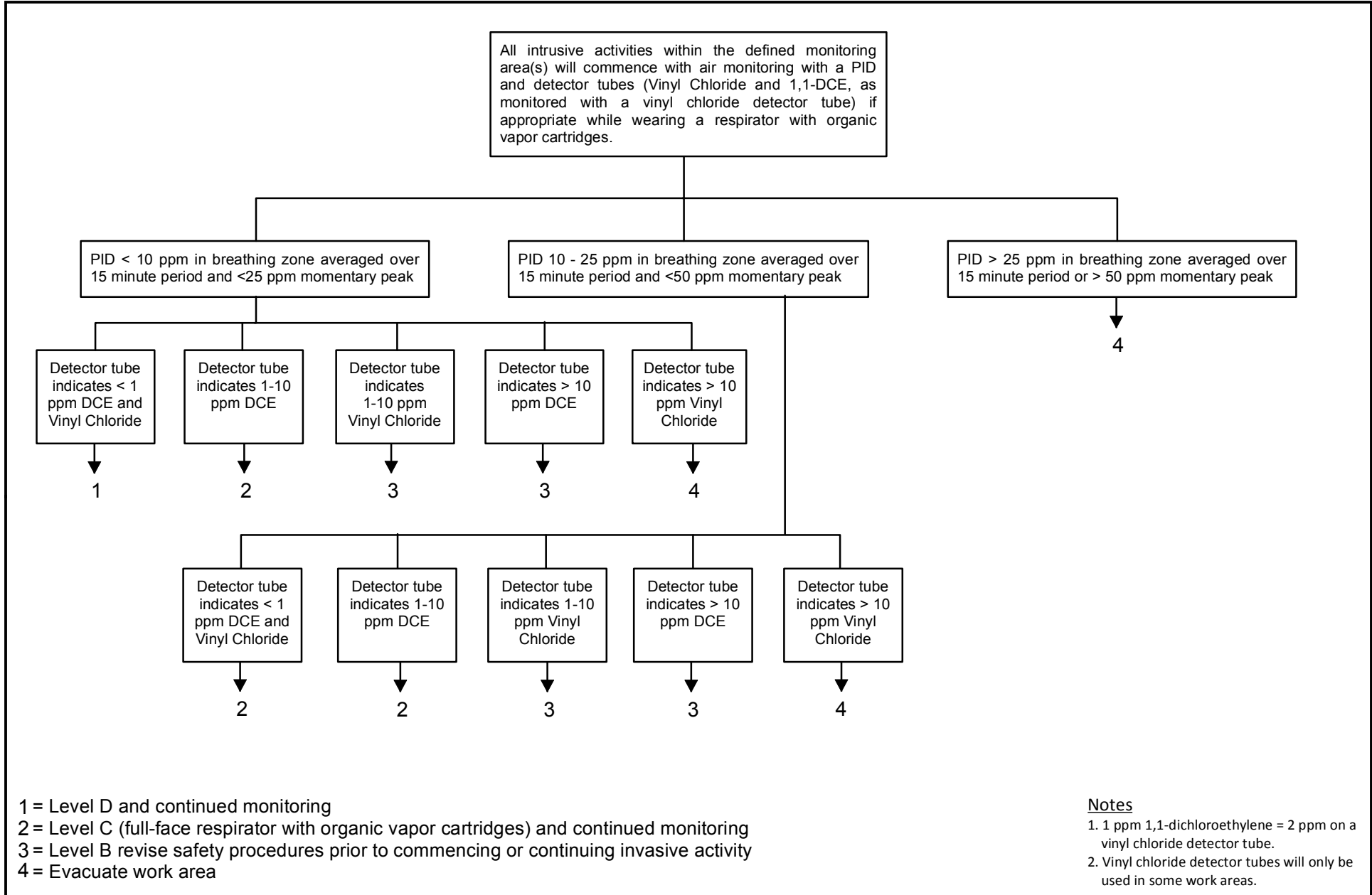


Legend

- ⊖ TGA Extraction Well
- ⊗ TGA Injection Well
- TGA Monitoring Well
- ⊕ TGA Multiple-Purpose Well
- ▲ TSA Monitoring Well
- ▲ TSA Extraction Well

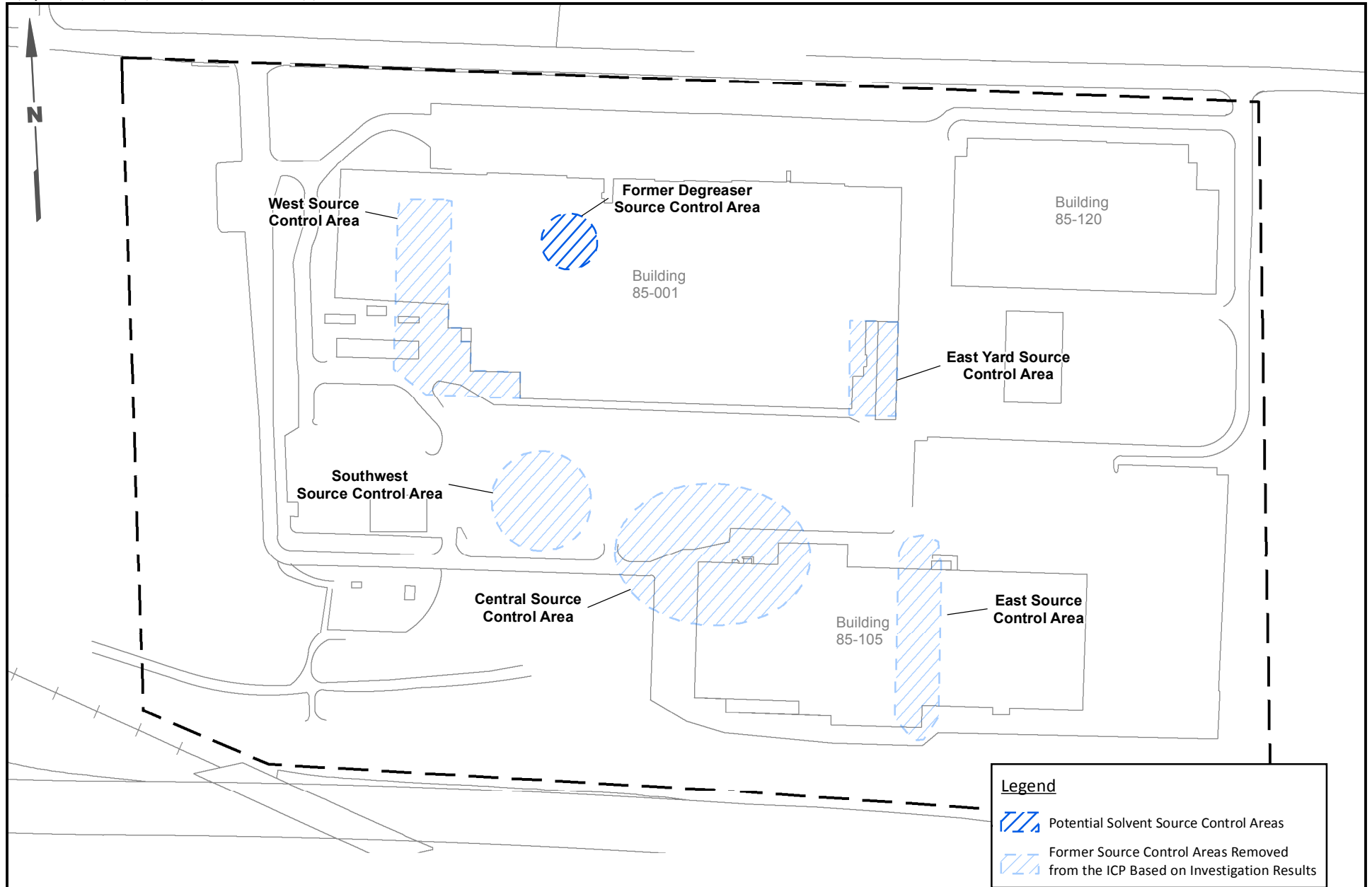
Notes

1. Corrective Action Areas defined in Phase 2 Corrective Measures Study (1996).
2. Black and white reproduction of this color original may reduce its effectiveness and lead to incorrect interpretation.



- 1 = Level D and continued monitoring
- 2 = Level C (full-face respirator with organic vapor cartridges) and continued monitoring
- 3 = Level B revise safety procedures prior to commencing or continuing invasive activity
- 4 = Evacuate work area

- Notes**
- 1. 1 ppm 1,1-dichloroethylene = 2 ppm on a vinyl chloride detector tube.
 - 2. Vinyl chloride detector tubes will only be used in some work areas.





Source: GoogleEarth 2016

**TABLE 1
SURFACE WATER, SOIL, AND GROUNDWATER QUALITY AND SITE EXPOSURE ASSESSMENT**

Chemical Constituent	Maximum Concentration Detected in Environmental Samples (1986 to Present)				Threshold Limit Values (a) Time-Weighted Average (ppm)	Permissible Exposure Limit (b) Time-Weighted Average (ppm)	Immediately Dangerous to Life and Health Concentrations (c) (ppm)	Routes (d)
	Surface Water (ppb)	Soil (ppb)	Soil Vapor (ppbV)	Groundwater (ppb)				
Acetone	23	130		1,100	250	1000	2500	Inh, Ing, Con
Benzene	0.8			32	0.1	1	Ca (e) (500)	Inh, Abs, Ing, Con
Carbon disulfide				110	1 (f)	20 (f)	500	Inh, Abs, Ing, Con
Chloroethane (ethyl chloride)				1,600	1,000	1,000	3,800	Inh, Abs, Ing, Con
Chloroform	1			130	50	50 (g)	Ca (e) (500)	Inh, Abs, Ing, Con
Chloromethane (methyl chloride)				13	25 (f)	25	Ca (e) (2,300)	Inh, Con
1,1-Dichloroethane		780		5,100	100	100	3,000	Inh, Ing, Con
1,1-Dichloroethene		11	3,600	1,800	5	--	--	Inh
1,2-Dichloroethane				10	1	50	Ca (e) (50)	Inh, Ing, Abs, Con
1,2-Dichloroethene (total)	440	20	1,870 (h)	7,187	200	200	1,000	Inh, Ing, Con
1,2-Dichloropropane				17	75	75	Ca (e) (400)	Inh, Abs, Inc, Con
Ethyl benzene		1520		17	100	100	800	Inh, Ing, Con
Freon TF		0.5		890	1,000	1,000	2,000	Inh, Ing, Con
2-Hexanone				10	1 (f)	100	1,600	Inh, Abs, Ing, Con
Methyl ethyl ketone (2-butanone)		47		79	200	200	3,000	Inh, Ing, Con
Methylene chloride	8.2	13		330	25	25	Ca (e) (2,300)	Inh, Abs, Ing, Con
1,1,1,2-Tetrachloroethane				75	1 (f)	5 (f)	Ca (e) (100)	Inh, Abs, Ing, Con
Tetrachloroethene		19	1,300	500	25	100	Ca (e) (150)	Inh, Abs, Ing, Con
Toluene	6.1	1,730		56	100 (f)	200	500	Inh, Abs, Ing, Con
Trichloroethene	440	91	160,000	10,000	50	100	Ca (e) (1,000)	Inh, Abs, Ing, Con
1,1,1-Trichloroethane	1.8	4,670	35,000	39,000	350	350	700	Inh, Abs, Ing, Con
1,1,2-Trichloroethane				17	10 (f)	10 (f)	Ca (e) (100)	Inh, Abs, Ing, Con
Trichlorofluoromethane		44		2.7	1,000 (g)	1,000	2000	Inh, Ing, Con
Vinyl chloride		1,300	440	13	1	1	Ca (e) (ND)	Inh, Con
Xylenes (total)	0.4			250	100	100	900	Inh, Abs, Ing, Con
Diesel		45,600		16,600,000	444 (g)	500	1,100	Inh, Ing, Con
Motor Oil		5,100		15,200,000	444 (g)	500	1,100	Inh, Ing, Con
Total TPH-Dx		45,600		31,800,000	444 (g)	500	1,100	Inh, Ing, Con

ND = Not Determined.
ppb = parts per billion
ppm = parts per million

- (a) Threshold Limit Values and Biological Exposure indices for 1996-1997 (ACGIH 1996).
- (b) Oregon Administrative Rules (OAR 437-02, Subdivision Z, Air Contaminants [State of Oregon 1993]).
- (c) Comptons Concise Chemical Contaminant Services 1997.
- (d) Ing = Ingestion; Inh = Inhalation; Abs = Absorption; Con = Dermal Contact.
- (e) Ca = National Institute of Occupational Safety and Health (NIOSH)-designated potential carcinogen.
- (f) "Skin" = Potential significant contribution to the overall exposure by the cutaneous route.
- (g) Ceiling limit that should not be exceeded.
- (h) Value shown is for cis-1,2-Dichloroethene only

References:

ACGIH. 1996. Threshold Limit Values and Biological Exposure Indices for 1995-1996. American Conference of Governmental Industrial Hygienists.
State of Oregon. 1993. OAR 437, Division 2, General Occupational Safety and Health Rules, Subdivision Z - Toxic and Hazardous Substances.
Oregon Administrative Rules, Oregon Occupational Safety and Health Division.

FORM 1

HEALTH AND SAFETY PLAN APPROVAL/SIGN OFF FORMAT

I have read, understood, and agreed with the information set forth in this Health and Safety Plan (and attachments) and discussed in the Personnel Health and Safety briefing.

_____	_____	_____
Name	Signature	Date
_____	_____	_____
Name	Signature	Date
_____	_____	_____
Name	Signature	Date
_____	_____	_____
Name	Signature	Date
_____	_____	_____
Site Safety Coordinator	Signature	Date
_____	_____	_____
Landau Health and Safety Manager	Signature	Date
_____	_____	_____
Project Manager	Signature	Date

Personnel Health and Safety Briefing Conducted By:

_____	_____	_____
Name	Signature	Date

FORM 2 Confined Space Entry Permit

Facility: _____

Date and time _____

Permit Valid From: _____ To: _____

Specific Entry Location: _____

Purpose of Entry: _____

(specify any additional) _____

Entry Supervisor: _____ Date: _____ Time: _____

Entry Attendant: _____ Date: _____ Time: _____

(entrant may change, use personnel list on following page)

Facility/Proj Manager(s): _____ Date: _____ Time: _____

Emergency Contact Information: (In case of emergency, call in the order listed)

911

911

Potential Chemicals of Concern: (see HASP for more details)

Potential Physical Hazards: (see HASP for more details)

- Equipment hazards (piping and pumps)
- Slips, trips, and falls
- Atmospheric conditions in work area
- Energy sources
- Drowning (if vaults fill with water)

REVIEW THE PLAN, CHECK FOR THE FOLLOWING:

	YES	NO
Entry Plan Attached and Reviewed	<input type="checkbox"/>	<input type="checkbox"/>
Area Secured (barricades, cones, other)	<input type="checkbox"/>	<input type="checkbox"/>
Ventilation Equip. in Place, Operating and Grounded	<input type="checkbox"/>	<input type="checkbox"/>
Communication Equipment Tested (Voice and Visual)	<input type="checkbox"/>	<input type="checkbox"/>
Rescue Equipment In Place	<input type="checkbox"/>	<input type="checkbox"/>
Required PPE Equipment in Place & Available	<input type="checkbox"/>	<input type="checkbox"/>
(Half Face Respirators, PIDs, Hardhat, Steel Toe Boots, Hearing Protection,	<input type="checkbox"/>	<input type="checkbox"/>
Gloves, Eye Protection)	<input type="checkbox"/>	<input type="checkbox"/>
Fire Protection Equipment Available	<input type="checkbox"/>	<input type="checkbox"/>
Standby Personnel Available	<input type="checkbox"/>	<input type="checkbox"/>
Pre-Entry Atmospheric Conditions Within Acceptable Levels	<input type="checkbox"/>	<input type="checkbox"/>
All Personnel Understand PID Action Levels	<input type="checkbox"/>	<input type="checkbox"/>
Entry Conditions Acceptable	<input type="checkbox"/>	<input type="checkbox"/>

**BOEING PORTLAND
1900 NORTHEAST SANDY BLVD., PORTLAND, OREGON
STANDARD WORK PRACTICES**

Health and Safety is **EVERYONE'S** responsibility and **NUMBER ONE PRIORITY**

- Regulatory compliance is **MANDATORY** – No work will begin and/or work will immediately stop unless the answer to the following question is a positive **“YES”** – AM I IN COMPLIANCE WITH ALL REGULATORY, FACILITY, PROJECT, AND HEALTH AND SAFETY REQUIREMENTS?
- All incidents and regulatory inspections must be reported immediately
 - **Incident definition:** Any event condition, or action (including near misses) that affects the safety of personnel, does not follow rules and guidelines for work implementation and regulatory compliance onsite
- Incident examples:
 - Spilled liquid in an uncontrolled environment
 - Working without correct/complete permit in place
 - Performing hot works without a “Hot Works Permit”

Before starting work, **HAVE YOU?** :

1. Reviewed the Health and Safety Plan prior to performing work?
2. Performed a Health and Safety “Tail Gate Meeting” and filled out the sign-in form prior to starting work?
3. Reviewed scope of work documents, permits, and other related items prior to performing work?
4. Provided correct Personal Protective Equipment (PPE) for the work to be performed?

IF YOU ARE UNSURE OF SAFETY PRACTICES FOR THE PARTICULAR WORK INVOLVED – GET CLARIFICATION PRIOR TO STARTING WORK

Working with subcontractors:

- Review Health and Safety Plan with subcontractor
- Review site “Incident Reporting Procedures”
- Perform “Tail Gate Safety Meeting” with subcontractor

SAFETY AND REGULATORY COMPLIANCE IS MY PRIORITY AND I MUST TAKE THE NECESSARY STEPS TO PROVIDE THIS SERVICE

I AM RESPONSIBLE AND I HAVE THE AUTHORITY TO STOP WORK IF THE TASK DOES NOT MEET THE SAFETY AND REGULATORY REQUIREMENTS

**SAFETY DASHBOARD CARD
EMERGENCY AND INCIDENT REPORTING PROCEDURES**

EMERGENCY PHONE NUMBER:

(503) 676-1444 Fire, Ambulance, Police, Spill Reporting

Non Emergency Security Phone Number:

(503) 676-1800 Non emergency security guard house

SITE ADDRESS:

1900 NE SANDY BLVD., PORTLAND, OREGON 97230

WORK LOCATION:

WEST SIDE OF 85-001

IN THE EVENT OF FIRE LINE BREACH:

- **REPORT WEST END FIRE LINE BREACH TO BOEING SECURITY**
- **SECURITY WILL CLOSE**
 - 1) **SECTIONAL VALVE 7 (EAST END OF 85-104)**
 - 2) **SECTIONAL VALVE 8 (NORTH SIDE 85-001 OUTSIDE CAFÉ)**

AN EMERGENCY IS AN UNCONTROLLED SITUATION, AN INJURY THAT IS MAJOR OR LIFE THREATENING, FIRE, OR ANYTHING THAT REQUIRES IMMEDIATE ASSISTANCE.

EMERGENCY REPORTING:

1. Contact the **BOEING PORTLAND** Emergency Response (fire, ambulance, police) at **(503) 676-1444**
2. Follow Incident Reporting procedures listed below

INCIDENT REPORTING:

Respond to the incident and get it under control. Contact the following by e-mail and brief phone message (**MUST DO BOTH**):

Name	Email Address	Phone Number	Position
Michael Gleason	michael.i.gleason@boeing.com	(206) 290-6576 Cell	Boeing Project Manager
Jennifer Parsons	jennifer.a.parsons@boeing.com	(206) 715-7981 Cell	Boeing Field Engineer
John Rusoff	john.w.rusoff@boeing.com	(971) 563-0257 Cell	Boeing Site Focal
Chris Kimmel	ckimmel@landauinc.com	(206) 786-3801 Cell	Consultant Contact
Mark Vealey	Mark.Vealey@ApolloMech.com	(503) 313-9438 Cell	O&M Contractor Contact

When leaving the message state the following:

1. **Date:** The date the incident occurred
2. **Time:** The approximate time the incident occurred
3. **Location:** Where the incident occurred, i.e.; Admin Compound...

When send the email include the following:

1. **Description:** Describe briefly what happened and what it may affect
2. **Time:** The approximate time the incident occurred
3. **Location:** Where the incident occurred, i.e.; Admin Compound...
4. **Description:** Describe briefly what happened and what it may affect

After the incident is under control, the sequence of events will be recorded, including probable cause, people who responded to the incident, the extents of the incident, and relevant dates and times

FROM SITE: 19000 N.E. Sandy Blvd., Gresham, Oregon 97230

TO HOSP: Mt. Hood Medical Center
24800 S.E. Stark Street
Gresham, OR 97030
503-667-1122

1. Go EAST on NE Sandy (US-30 Bypass)
2. Turn RIGHT (south) on NE 207th Avenue
3. Take ramp (left) onto I-84 (US-30) toward I-84/The Dalles
4. Take EXIT 16 and turn RIGHT onto ramp toward 238th Drive/Wood Village
5. Turn RIGHT onto NE 238th Drive
6. 238th Drive becomes NE 242nd Drive
7. Turn LEFT on SE Stark
8. End Mt. Hood Medical Center

