Ecology Review Draft
Vapor Intrusion Assessment
Boeing Auburn Facility
Auburn, Washington

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Prepared for

The Boeing Company
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TABLE OF CONTENTS

FIGURES

TABLES

APPENDICES

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LIST OF ABBREVIATIONS AND ACRONYMS

cis-1,2-DCE	cis-1,2-dichloroethene
CLARC	Cleanup Levels and Risk Calculation
CUL	Cleanup levels
Ecology	Washington State Department of Ecology
EPA	U.S. Environmental Protection Agency
HVAC	Heating, ventilating, and air conditioning
IRIS	Integrated Risk Information System
MTCA	Model Toxics Control Act
PCE	Tetrachloroethene
RI	Remedial investigation
SL	Screening level
TCE	Trichloroethene
VAF	Vapor attenuation factor
VC	Vinyl chloride
VOC	Volatile organic compound
µg/L	Micrograms per liter
$\mu g/m^3$	Micrograms per cubic meter

1.0 INTRODUCTION

This document presents a vapor intrusion assessment as part of an additional remedial investigation (RI) task associated with the Boeing Company's (Boeing) Auburn Fabrication Division property (site) located at 700 15th Street Southwest in Auburn, Washington (Figure 1). Boeing is currently undergoing corrective action at the site. Corrective action requirements are documented in an Agreed Order (Order; No. DE 01HWTRNR-3345) dated August 14, 2002 and a First Amended Agreed Order (Order) dated February 21, 2006, both with the Washington State Department of Ecology (Ecology). The Order includes a requirement to conduct an RI.

Boeing has been implementing RI activities in phases to characterize the nature and extent of two low-concentration trichloroethene (TCE) groundwater plumes (the Area 1 plume and the western plume). Both plumes appear to originate from within the current Boeing property (on site) or the former Boeing property (i.e., the AMB property that was historically the location of Boeing Building 17-05) and have moved downgradient with natural groundwater flow toward the north-northwest. The source of the Area 1 plume is associated with a historical release from a TCE degreaser that operated in former Building 17-05 (Landau Associates 2009). The source of the western plume has not yet been identified and additional onsite investigation is being planned. The purpose of this assessment is to further evaluate risks associated with the vapor intrusion migration pathway for volatile organic compounds (VOCs) associated with the two TCE plumes. Vapor intrusion migration was evaluated at one onsite building and four offsite buildings as part of this RI task.

The primary VOC of concern in groundwater plumes originating at the site is TCE. TCE has been detected in shallow groundwater, soil, and soil gas both on site and off site. Other related VOCs of interest include tetrachloroethene (PCE) and vinyl chloride (VC). PCE has been detected in shallow groundwater, soil, and soil gas. VC has only been detected in shallow groundwater and soil gas. Although PCE and VC are present at the site, they are detected at lower concentrations and at a more limited areal extent relative to TCE. Cis-1,2-dichloroethene (cis-1,2-DCE) is also regularly detected in shallow groundwater within both the Area 1 and western plumes.

Evaluation of potential vapor intrusion pathways is typically a multiphase process. Initial phases include characterization of VOCs in shallow groundwater and soil. Later phases, if necessary, include soil gas and indoor air characterization. The investigation needed to support this vapor intrusion assessment included soil gas and indoor air sampling. The samples were collected at buildings that are above or near areas where VOCs have been previously detected at concentrations of potential concern (i.e., at concentrations exceeding medium-specific screening levels protective of MTCA air cleanup levels) in shallow groundwater or soil gas samples. Sampling was conducted in accordance with the

Agency Review Draft Work Plan, Vapor Intrusion Assessment (Work Plan; Landau Associates 2012), with some modifications based on subsequent communications with Ecology (2012a). This report presents the results of the soil gas and indoor air sampling, an evaluation of compliance with applicable Model Toxics Control Act (MTCA) cleanup levels (CULs) and screening levels (SLs), and recommendations for next steps to evaluate the cause of any detected concentrations exceeding applicable CULs or SLs.

2.0 CLEANUP LEVELS AND SCREENING LEVELS

The five buildings included in this investigation serve different purposes and are used by different types of receptor groups (e.g., recreational pre-adults, commercial office workers, industrial workers, etc.). However, air CULs have been established using standard MTCA Method B equations for all buildings for the purposes of this vapor intrusion assessment. MTCA Method B CULs are protective of unrestricted land use and are based on a residential continuous exposure scenario. It is noted that alternative air CULs (for Building 17-07, which qualifies for industrial CUL applicability) or remediation levels (for buildings in which current worker-based risk levels may be lower than those used to establish MTCA Method B CULs) may be appropriate for use at the site; however, the nature of data collected in this investigation support the simplified, conservative use of standard MTCA Method B air cleanup levels as a benchmark for decision making in this vapor intrusion assessment.

The remainder of this section provides background regarding the development and status of air CULs and soil gas SLs used in this vapor intrusion assessment.

2.1 AIR CLEANUP LEVELS

A MTCA CUL is established to set a benchmark – expressed as a chemical concentration – which defines the point at which "contamination no longer poses an unacceptable threat to human health and the environment" (Ecology 2007). MTCA CULs are established to be protective of current and potential future site use based on specific conditions related to the nature of the site and the types of potential exposure:

- MTCA Method A CULs may be used for sites that are "relatively straightforward or involve only a few hazardous substances."
- MTCA Method B CULs may be used at any site and are protective of any possible exposure scenario for adults and children, providing for "unrestricted land use."
- MTCA Method C CULs may be used at industrial sites and are protective of adult industrial workers.

For the purposes of this vapor intrusion assessment, standard MTCA Method B air CULs have been used for evaluating the extent to which air concentrations impacted by site-related contamination are protective of human health and the environment. The air CULs also establish the compliance endpoint that is used to calculate soil gas SLs protective of the vapor intrusion (i.e., soil gas-to-indoor air migration) pathway.

Ecology maintains the Cleanup Levels and Risk Calculation (CLARC) database, as a service to staff and the public, to facilitate easy reference to CULs calculated using standard MTCA methods. It is

not exhaustive and the information contained therein is secondary to the CUL calculation procedures established under MTCA. While MTCA is an enforceable state regulation, "CLARC cannot be relied on to create rights, substantive or procedural, enforceable by any party in litigation with the State of Washington" (Ecology website 2012).

An example of a scenario in which the CLARC database may contain information that is not consistent with the MTCA regulation is the period of time between publication of new toxicity values in the U.S. Environmental Protection Agency's (EPA) "integrated risk information system" (IRIS) database [which is the preferred source of toxicity data for the purposes of establishing MTCA CULs, per WAC 173-340-708(7)(d) and WAC 173-340-708(8)(b)] and Ecology's review and incorporation of that new data into the CLARC database. Such is the present case for TCE, which was updated in the IRIS database on September 28, 2011, and PCE, which was updated in the IRIS database on February 10, 2012. In the absence of Ecology-promulgated air CULs for TCE and PCE, Ecology has identified "anticipated" CULs for these constituents (Ecology 2012b). Although these CULs are the most recent values recommended by Ecology, they must still be considered preliminary values until finalized by Ecology; however, Ecology has recommended the use of these anticipated CULs in this vapor intrusion assessment in the absence of updated values in the CLARC database at the time of preparation of this report.

CULs are based on acceptable risk levels established under the MTCA regulation. MTCA Method B CULs are based on an acceptable cancer risk of 1E-06 or a non-cancer hazard quotient (HQ) of 1, whichever is more protective. Table 1 presents the MTCA Method B air CULs used in this vapor intrusion assessment and identifies the basis by which those CULs were developed.

2.2 SOIL GAS SCREENING LEVELS

Soil gas is functionally considered an intermediary environmental medium under the MTCA regulations. In most cases, it is neither an exposure medium (i.e., human receptors do not directly inhale soil gas), nor a primary source medium (i.e., most environmental releases first contaminate soil or groundwater directly, and that contamination may subsequently volatilize and cause contamination of soil gas). As such, MTCA does not promulgate CULs for soil gas but it does require that soil and groundwater concentrations be protective of soil gas that could migrate into buildings at concentrations that pose a threat to human health or the environment.

To facilitate the determination that soil gas concentrations are protective of indoor air (i.e., that vapor intrusion will not result in concentrations that exceed air CULs), Ecology is in the process of developing soil gas SLs as part of an overall framework for evaluating the vapor intrusion pathway. The initial publication describing that framework is a draft guidance document (Ecology 2009); however, the

final guidance document is likely to incorporate updated chemical toxicity information and new recommendations based on ongoing vapor intrusion studies by EPA.

Soil gas SLs are tied to the protection of indoor air through the use of a vapor attenuation factor (VAF), which is the ratio of the indoor air concentration of a chemical to the soil gas concentration directly beneath the foundation slab of the same building. Although Ecology's draft vapor intrusion guidance document recommends using a VAF of 0.1 to account for reductions in chemical concentrations as VOCs migrate from sub-slab soil gas into indoor air (Ecology 2009), a recently finalized EPA evaluation concluded that a VAF of 0.03 is conservative[1] for characterizing the migration of chlorinated VOCs from sub-slab soil gas to indoor air (EPA 2012). Based on discussions with Ecology, a VAF of 0.03 is used to derive the soil gas SLs for the purposes of this vapor intrusion assessment (Jones 2012).

Soil gas SLs used in this vapor intrusion assessment are all tied to the protection of MTCA Method B air CULs for unrestricted land use. Table 2 presents the soil gas SLs used in this vapor intrusion assessment and identifies the basis by which those SLs were developed.

[1] The recommended VAF of 0.03 is conservative (i.e., will tend to overestimate risks) due to several factors related to the EPA study and specific application to the Facility. The first factor noted below is simply a function of statistics; the others are related to the differences between buildings included in the EPA study and those included in this vapor intrusion assessment. The value is an upper-bounds estimate – the 95th percentile of all sites and all chlorinated VOCs in the database – that is expected to overestimate the actual VAF 95 percent of the time for sites with similar characteristics to those included in the database used in the EPA study. The EPA evaluation is based on residential buildings, not industrial or commercial buildings. Industrial and commercial buildings (like those included in this vapor intrusion assessment) tend to be designed and operated in such a way that vapor intrusion impacts are less than those observed in residential buildings (e.g., industrial and commercial buildings tend to have higher air exchange rates and thicker foundation slabs). EPA's recommended VAF (0.03) is based on residences with basements, which is more conservative than the 95th percentile VAF (0.01) based on residences with slab-on-grade foundations; none of the buildings in this vapor intrusion assessment have basements (though some have limited-access sub-grade areas), so the recommended VAF would also tend to overestimate risks based on foundation design.

3.0 INVESTIGATION RESULTS

Five buildings were included in the investigation to support the vapor intrusion assessment: the AMB building (former Boeing Building 17-05 location), Building 17-07, Fana West (the westernmost Fana office building), the YMCA building, and the Junior Achievement building. Of the five buildings, Building 17-07 is the only building located at the site; the other four buildings are located off site to the north or northwest. The locations of all five buildings are shown on Figure 2.

Indoor air samples and ambient air samples were collected from three of the buildings: AMB, Building 17-07, and Fana West. A second ambient air sample was collected upwind of the property AMB building at the request of the AMB property manager. Sub-slab soil gas samples were collected from the remaining two buildings: YMCA and Junior Achievement. The basis for sample type selection at each building is described in detail in the Work Plan, and summarized briefly below:

- AMB – Boeing does not own and operate the AMB building. It was determined that indoor air sampling (a less invasive type of sampling than sub-slab soil gas sampling) would be conducted to reduce disturbances to AMB operations.
- Fana West – Boeing leases office space on the ground floor of the Fana West building. Like AMB, it was determined that indoor air sampling would be conducted to minimize disturbance.
- Building 17-07 – Sub-slab soil gas concentrations have been well characterized at Building 17-07 in past phases of the RI. Chemicals of concern had been detected at concentrations considered to have the potential for presenting vapor intrusion risks to indoor air; therefore, it was appropriate to propose indoor air sampling to verify whether indoor air has been affected by vapor intrusion.
- YMCA – Boeing received permission from the YMCA building manager to conduct sub-slab soil gas sampling at three locations in the building. Sub-slab sampling was conducted to identify the potential for vapor intrusion (which was perceived to be low at this location due to distance from the groundwater plume).
- Junior Achievement –Boeing received permission from the Junior Achievement building manager to conduct sub-slab soil gas sampling at one location in the building. Sub-slab sampling was conducted to identify the potential for vapor intrusion (which was perceived to be low at this location due to distance from the groundwater plume).

The remainder of this section summarizes the results of sampling conducted as part of this investigation. Indoor air sampling data, and the associated ambient air background sampling data, are presented in Table 3. Sub-slab soil gas sampling data are presented in Table 4. Laboratory reports are included in Appendix A.

3.1 AMB

Two indoor air samples were collected from offices in the AMB building: one from an office near the entrance at the northwest corner of the building (IA08-20120229) and one from a shipping room office along the east side of the building (IA09-20120229). Each indoor air sample was collected in a 6-liter Summa canister located on the top of a desk in the office space to approximate the breathing zone height of a seated office worker.

Two ambient air samples were collected at the AMB building to represent background conditions: one on the roof (AA04-20120229), immediately adjacent to the roof access hatch (general roof access is restricted at the AMB building so the sample could not be positioned immediately adjacent to an HVAC intake), and one approximately 5 feet above ground level at the property boundary south of the AMB building (AA03-20120229). The ambient air sample at the roof location was selected to represent air quality conditions at the rooftop heating, ventilation, and air conditioning (HVAC) system intake. The ground-level ambient air sample was collected for general informational purposes only.

The indoor and ambient air sample locations at the AMB building are shown on Figure 3. A summary of field documentation regarding sample collection at each location is presented in Table 5. Photos of the AMB building sample locations are included in Appendix B.

Neither of the two background ambient air samples contained VOCs at detectable levels. Based on these sampling results, it is expected that significant concentrations of chlorinated VOCs in ambient air were not drawn into the AMB building through the HVAC system at the time of sampling.

The sole chemical detection in indoor air was of PCE in sample IA09-20120229 at a concentration of 0.372 micrograms per cubic meter ($\mu g/m^3$), which is well below the anticipated MTCA Method B air CUL (8.8 $\mu g/m^3$). All of the laboratory reporting limits for non-detect results were lower than the applicable CULs; therefore, the data quality allows for a demonstration that the reported data complies with MTCA Method B air CULs in the AMB building.

3.2 FANA WEST

Two indoor air samples were collected from offices in the Fana West building, both from the first floor of the western wing of the building, which is leased by Boeing. The west wing of the building is nearest to the groundwater sample in which TCE was previously detected at the maximum concentration in this area [8.6 micrograms per liter ($\mu g/L$) at AGW177-29]. One indoor air sample was collected from an office on the north side of the west wing (IA01-20120228) and one from the west side of the west wing (IA02-20120228). Each sample was collected in a 6-liter Summa canister located on the top of a desk in the office space to approximate the breathing zone height of a seated office worker.

One ambient air sample was collected from the roof of the Fana West building, just beneath an actively circulating HVAC intake vent (AA01-20120228). The ambient air sample at the roof location was selected to represent background air quality conditions at the rooftop HVAC system intake.

The indoor and ambient air sample locations at the Fana West building are shown on Figure 4. A summary of field documentation regarding sample collection at each location is presented in Table 5. Photos of the Fana West building sample locations are included in Appendix B.

The background ambient air sample did not contain VOCs at detectable levels. Based on these sampling results, it is expected that significant concentrations of chlorinated VOCs in ambient air were not drawn into the Fana West building through the HVAC system at the time of sampling.

The sole chemical detection in indoor air at the Fana West building was of PCE in sample IA01-20120228 at a concentration of 918 $\mu g/m^3$, which exceeds the MTCA Method B air CUL (8.8 $\mu g/m^3$). None of the other chlorinated VOCs were detected in this sample; however, laboratory reporting limits in this sample were elevated due to sample dilution to accommodate the high PCE concentration. All of the laboratory reporting limits for non-detect results in sample IA02-20120228 were lower than the applicable CULs; therefore, the data quality allows for a demonstration that the reported data complies with MTCA Method B air CULs in the office on the west side of the Fana West building. Further review of the data in sample IA01-20120228 is provided in Section 4.0.

3.3 BUILDING 17-07

Five indoor air samples were collected from work spaces in Building 17-07. All five sample locations (IA03-20120229, IA04-20120229 and blind field duplicate IA99-20120229, IA05-20120229, IA06-20120229, and IA07-20120229) were selected based on proximity to elevated sub-slab soil gas concentrations from a previous investigation. Indoor air sample [IA04-20120229, including a blind field duplicate (IA99-20120229) from the same location] was collected from the immediate vicinity of the former degreaser to evaluate whether off-gassing from potentially contaminated concrete presents a risk to workers in the building. Also, the highest TCE concentration found in soil gas was collected in the immediate area of the former degreaser. Each indoor air sample was collected in a 6-liter Summa canister located on the top of a desk or table in the work space to approximate the breathing zone height of a seated industrial work station employee.

One ambient air sample was collected from the roof of Building 17-07, near an actively circulating HVAC intake vent, to represent background conditions (AA02-20120229). The ambient air sample at the roof location was selected to represent air quality conditions at the rooftop HVAC system intake.

The indoor and ambient air sample locations at Building 17-07 are shown on Figure 5. A summary of field documentation regarding sample collection at each location is presented in Table 5. Photos of the Building 17-07 sample locations are included in Appendix B.

The background ambient air sample did not contain VOCs at detectable levels. Based on these sampling results, it is expected that significant concentrations of chlorinated VOCs in ambient air were not drawn into Building 17-07 through the HVAC system at the time of sampling.

Chlorinated VOCs were not detected in any of the indoor air samples from Building 17-07. All of the laboratory reporting limits for non-detect results were lower than the applicable CULs; therefore, the data quality allows for a demonstration that the reported data complies with MTCA Method B air CULs in Building 17-07.

3.4 YMCA

Three sub-slab soil gas samples (SSV45-20120228, SSV46-20120228, and SSV47-20120228) were collected from beneath the foundation slab at the YMCA building. The sampling locations were selected in the southern portion of the building's footprint, nearest the upgradient contamination. All samples passed the field-based leak test with no helium detected in gas pumped through the sample tubing. Laboratory analytical results confirmed that helium was not detected in any of the samples (Appendix A).

The sub-slab soil gas sample locations at the YMCA building are shown on Figure 6. A summary of field documentation regarding sample collection at each location is presented in Table 5. Photos of the YMCA sample locations are included in Appendix A.

Chlorinated VOCs were not detected in any of the sub-slab soil gas samples from the YMCA building. All of the laboratory reporting limits for non-detect results were lower than the applicable SLs; therefore, the data quality allows for a demonstration that the reported data complies with soil gas SLs protective of indoor air (based on MTCA Method B air CULs) in the YMCA building.

3.5 JUNIOR ACHIEVEMENT

One sub-slab soil gas sample (SSV48-20120228) was collected from beneath the foundation slab at the Junior Achievement building. The sampling location was selected in the southern portion of the building's footprint, nearest the upgradient contamination. The sample passed the field-based leak test with no helium detected in gas pumped through the sample tubing. Laboratory analytical results confirmed that helium was not detected in the sample.

The sub-slab soil gas sample location at the Junior Achievement building is shown on Figure 7. A summary of field documentation regarding sample collection at each location is presented in Table 5. A photo of the Junior Achievement sample location is included in Appendix A.

Chlorinated VOCs were not detected in the sub-slab soil gas sample from the Junior Achievement building. All of the laboratory reporting limits for non-detect results were lower than the applicable SLs; therefore, the data quality allows for a demonstration that the reported data complies with soil gas SLs protective of indoor air (based on MTCA Method B air CULs) in the Junior Achievement building.

4.0 DATA EVALUATION – VAPOR INTRUSION ASSESSMENT

For adequately characterized sites, Ecology's draft vapor intrusion guidance document (Ecology 2009) provides "off ramps" from further evaluation when sub-slab soil gas or indoor air concentrations are demonstrated to be in compliance with applicable CULs and SLs. Based on data collected during previous investigations, Boeing and Ecology collaboratively selected the 13 new sampling locations used in this vapor intrusion assessment (nine indoor air samples and four sub-slab soil gas samples, plus four additional samples to identify background ambient air concentrations). To the extent that the sampling results demonstrated compliance with applicable indoor air CULs and sub-slab soil gas SLs, this investigation would be considered adequate to evaluate vapor intrusion risks at the five buildings included in the investigation. However, exceedances of CULs or SLs may trigger a requirement for further evaluation of the vapor intrusion pathway.

MTCA Method B air CULs, or related SLs for sub-slab soil gas, were exceeded in only 1 of 13 samples collected and analyzed to evaluate the potential vapor intrusion impacts associated with subsurface contamination. Samples in four of the five buildings - AMB, Building 17-07, YMCA, and Junior Achievement - demonstrated compliance with applicable CULs and SLs. Of the 11 samples collected from those four buildings, only one chemical of concern was detected and only at one location. Specifically, PCE was detected in one sample at the AMB building, at a concentration well below the MTCA Method B air CUL. These data support the conclusion that vapor intrusion does not present an unacceptable risk at the AMB building, Building 17-07, the YMCA building, and the Junior Achievement building.

The sole exceedance of a CUL in this investigation occurred in sample IA01-20120228 in an office at the Fana West building: PCE was detected in indoor air at a concentration of 918 $\mu g/m^3$, exceeding the anticipated MTCA Method B air CUL of 8.8 $\mu g/m^3$. Elevated concentrations of chlorinated VOCs in indoor air were not expected at the Fana West building based on previous groundwater sampling results. PCE was not detected in the background ambient air sample at the Fana West building; therefore, the PCE detected in the indoor air sample did not appear to be related to ambient air. The PCE detection is expected to have been caused by one of two potential sources: vapor intrusion from subsurface contamination or other background sources associated with indoor use of chemical products. The data collected to date in the Fana West area suggest that indoor use of chemical products is the likely source of the detected concentration of PCE, not vapor intrusion related to shallow groundwater contamination. Supporting details are presented below:

- The elevated concentration of PCE in indoor air was detected in an area where PCE in shallow groundwater has been detected at only very low concentrations (ranging from non-detect to 0.12 µg/L; Figure 8).
  - The anticipated PCE groundwater SL protective of the vapor intrusion pathway is 22 µg/L[2]. In other words, shallow groundwater concentrations of 22 µg/L are expected to be protective of an anticipated MTCA Method B air CUL of 8.8 µg/m^3. Detected groundwater concentrations (up to 0.12 µg/L) below the anticipated SL are not expected to contribute to indoor air concentrations of the magnitude detected in sample IA01-20120228).
  - Even in the absence of attenuation factors, a PCE concentration of 0.12 µg/L in groundwater, the maximum detected in the vicinity of the Fana West building, could not produce an air concentration of 918 µg/m^3 under equilibrium conditions.
  - TCE is detected at higher concentrations than PCE in shallow groundwater near the Fana West building (Figure 9; a maximum of 8.6 µg/L TCE in comparison to the maximum of 0.12 µg/L PCE). If groundwater contamination were the source of detected indoor air concentrations at the Fana West building, it would be expected that TCE concentrations in indoor air would be higher than PCE concentrations. Instead, TCE was not detected in any of the indoor air samples from the Fana West building.
  - Based on these considerations, it is impractical to consider groundwater as the likely source of detected PCE in sample IA01-20120228.
- Boeing did not have any known operations in this area that would have used chemicals of concern; therefore, groundwater plume migration – not soil contamination – is anticipated to be the primary driver for vapor intrusion risks in the Fana West building area. Soil contamination is not expected to be significant due to the lack of historical Boeing operations in this area[3].
- PCE is a common indoor air pollutant. Products used in an office setting that may contain PCE include adhesives, lubricants, carpet cleaners, laser toner aide, paint/graffiti removers, and water repellents (HHS website 2012). In addition, clothing worn after recent dry cleaning can continue to off-gas significant concentrations of PCE.

Although the available data suggests that vapor intrusion is not the cause of the detected PCE concentration in indoor air at the Fana West building, the exceedance of the MTCA Method B air CUL does warrant further investigation to confirm that hypothesis. Recommendations regarding further evaluation are included in Section 6.0.

[2] Calculated in accordance with the equation in Footnote 80 of Table B-1 in Ecology's draft vapor intrusion guidance document (Ecology 2009).

[3] Although neither soil nor groundwater contamination are suspected of contributing to the PCE concentration detected in indoor air at the Fana West building, underground utilities in the vicinity of Fana West are presented on Figure 10 as a basis for identifying potential preferential pathways in the event that data collected in the future suggests the potential for a complete and significant vapor intrusion pathway at this building.

5.0 UNCERTAINTY ASSESSMENT

Complete characterization of chemical concentrations at a site is, in some cases, impractical (e.g., sampling all of the soil at a site would not only be cost prohibitive, but would also lead to functionally excavating the entire site) and in other cases impossible (e.g., indoor air conditions change daily based on a complex array of variable and the concentrations detected in indoor air one day are highly unlikely to be identical to concentrations detected on a subsequent day). Instead, a number of samples are collected in an effort to characterize "representative" conditions at the site. In any sampling program, there is inherently some uncertainty as to whether actual site conditions are adequately represented by the samples collected.

In addition to uncertainties associated with characterization of a site, there are several other types of uncertainty involved in an evaluation of whether environmental conditions at a site lead to unacceptable levels of risk. Consideration of those uncertainties is valuable context for understanding how uncertainty may affect the conclusions drawn from an evaluation of the data. In a vapor intrusion assessment, the null hypothesis is that subsurface conditions are sufficiently clean that the vapor intrusion pathway does not present an unacceptable level of risk to indoor receptors. For this null hypothesis, it is possible that one of two correct conclusions may be drawn from the data:

1. The null hypothesis is correctly accepted. Indoor air impacts, if any, are low enough that risk levels are considered acceptable.
2. The null hypothesis is correctly rejected and the alternative hypothesis is accepted. Indoor air impacts present an unacceptable level of risk.

However, it's also possible that one of two errors may be made in drawing conclusions from the data (EPA 2009):

1. A "Type I" error is a "false positive" in which the null hypothesis (i.e., the vapor intrusion pathway does not produce an unacceptable level of risk) is falsely rejected. In other words, it is erroneously concluded that unacceptable risks are present when a site is, in fact, acceptably clean.
2. A "Type II" error is a "false negative" in which the null hypothesis (i.e., the vapor intrusion pathway does not produce an unacceptable level of risk) is falsely accepted. In other words, it is erroneously concluded that a site is acceptably clean when, in fact, the related risks exceed acceptable levels.

This section identifies several of the uncertainties in this vapor intrusion assessment. Although it is not an exhaustive list of uncertainties in this evaluation, it does identify those that are considered to have the greatest influence on decisions made based on the data collected.

5.1 REPRESENTATIVE SAMPLING

This investigation was conducted to collect sufficient data to evaluate whether vapor intrusion presents an unacceptable level of risk at and downgradient of the site. Sampling programs are typically designed to balance the risk of a Type I error with the risk of a Type II error. Although there may be significant costs associated with each type of error, environmental sampling programs are typically designed to provide a much greater probability that a Type I error will occur than a Type II error. This sampling design tendency is based on the premise that it is more acceptable to incur a higher-than-required cost of environmental cleanup than to incur a higher-than-acceptable level of risk to human health and the environment.

In this investigation, the buildings to be included in the sampling program were selected based on one of two premises: 1) data collected from previous investigations had VOCs concentrations that exceeded conservative screening levels protective of vapor intrusion (i.e., indicating that further investigation is warranted under Ecology guidance); and 2) sensitive populations (e.g., children) were known to use a building located at the periphery of the area in which vapor intrusion might be expected to have any level of impact. By focusing on areas of highest known chemical concentration, the sampling program was designed to identify the greatest potential risks by biasing the sampling results toward detection of the highest anticipated concentrations of VOCs in indoor air. In addition, by focusing on buildings with the most sensitive receptor populations, the sampling program was designed to identify whether smaller concentrations – if present – result in greater risk levels to populations more susceptible to the effects of chemical exposure.

Data collected in this investigation are likely to underestimate the true maximum concentrations in indoor air and soil gas at the site – statistically it is very unlikely that the true maximum has been detected by any one discrete sample at the site – however, the data are likely to overestimate the average concentrations because they have been collected from areas where the greatest impacts are expected. The preponderance of data collected in this investigation demonstrates that indoor air and sub-slab soil gas concentrations are consistently nondetect or well below applicable CULs or SLs. It is unlikely that additional sampling in these same areas would produce data leading to a different conclusion regarding the potential risks associated with the vapor intrusion pathway.

The site has been subject to thorough environmental investigation during the course of the RI. The source and extent of the Area 1 plume are well defined; discovery of new contamination in this area is considered unlikely. The source of the western plume has not yet been confirmed and there is some uncertainty regarding the full extent of the leading edge of the plume. This uncertainty is being addressed

by ongoing investigation work. If results of ongoing investigations warrant further consideration of the vapor intrusion pathway, further evaluation will be considered.

5.2 MODELING

Potential impacts to indoor air are projected by applying a VAF to detected concentrations of VOCs in sub-slab soil gas. The VAF is a single, simplified estimate of attenuation that results from several different factors involved in the vapor intrusion migration pathway. Site-specific factors including slab thickness, slab crack characteristics, building air exchange rates, chemical characteristics, soil temperature and others combine to create a complex environment that affects the extent to which VOC concentrations decrease as contamination travels from soil gas to indoor air. Application of a VAF as a single, simplified estimate of the effects of that complex migration pathway introduces significant uncertainty regarding the accuracy of indoor air concentrations projected from detected sub-slab soil gas concentrations.

Although the degree of uncertainty introduced by use of a VAF to project indoor air concentrations is large, that uncertainty is heavily biased toward the overestimation of potential risks associated with the vapor intrusion pathway. Ongoing research in the field continues to result in more refined VAF values (i.e., the recommended values for VAFs are expected to change over time as more data becomes available); however, the underlying assumptions behind the selection of recommended values are consistently conservative. Some of the most significant factors leading to the conservative nature of the VAF used in this evaluation are described below:

- In an effort to reduce the probability of a site being declared "clean" when the true risks actually exceed acceptable levels, EPA selected an upper-bounds estimate – the 95th percentile of all sites and all chlorinated VOCs in their database – as the recommended VAF. In other words, the recommended VAF is expected to be greater than the actual VAF 95 percent of the time for sites with characteristics similar to those included in the database.
- The EPA evaluation is based on residential buildings, not industrial or commercial buildings. Industrial and commercial buildings (like those investigated in this vapor intrusion assessment) tend to be designed and operated in such a way that vapor intrusion impacts are less than those observed in residential buildings (e.g., industrial and commercial buildings tend to have higher air exchange rates and thicker foundation slabs). Application of a VAF determined to be protective of a residential building is expected to be even more protective of industrial or commercial buildings.
- EPA's recommended VAF (0.03) is based on residences with basements, which is more conservative than the 95th percentile VAF (0.01) based on residences with slab-on-grade foundations. None of the buildings in this vapor intrusion assessment have basements (though some have limited-access sub-grade areas), so use of the recommended VAF would tend to overestimate risks based on foundation design.

As the uncertainties associated with modeling indoor air concentrations are consistently chosen to overestimate potential vapor intrusion risks, these uncertainties do not warrant more detailed consideration as long as the evaluation concludes that vapor intrusion does not present unacceptable levels of risk. In other words, if it can be conservatively demonstrated that existing conditions are protective of human health and the environment, then there is no need to consider whether the conservative assumptions are so conservative that they grossly overestimate risks, leading to a nearly certain occurrence of a Type I error.

5.3 VAPOR INTRUSION AND OTHER BACKGROUND SOURCES

PCE was the sole chemical detected in this investigation. It was not detected in the sub-slab soil gas samples and it was only detected in two indoor air samples. Co-located sub-slab soil gas samples were not located with the indoor air samples; therefore, the conclusions drawn from detected indoor air concentrations have great uncertainty with respect to the potential for those concentrations to be the result of vapor intrusion rather than other "background" sources of indoor air contamination. As previously described, PCE is an ingredient in several consumer products commonly used in office settings: adhesives, lubricants, carpet cleaners, laser toner aide, paint/graffiti removers, and water repellents (HHS website 2012).

Based on data collected to date, it does not appear that vapor intrusion caused the detected PCE concentration in indoor air sample IA01-20120228 at the Fana West building. However, the absence of co-located sub-slab soil gas data at that location introduces uncertainty regarding the source of the detected concentration because sub-slab soil gas data is not available to definitively conclude that subsurface conditions are not conducive to vapor intrusion impacts at the level of the concentration detected in indoor air. This uncertainty will be addressed by additional sampling proposed in the recommendations of this report.

5.4 CHEMICAL MASKING DUE TO ELEVATED REPORTING LIMITS

When laboratory reporting limits are greater than CULs or SLs that provide a benchmark for decision making, it is possible that non-detect results – if they actually represent concentrations less than the laboratory reporting limit but greater than the CUL or SL – can mask unacceptable levels of risk. Of the nine indoor air samples and four sub-slab soil gas samples analyzed in this investigation, only one sample had reporting limits that exceeded the applicable CULs or SLs: IA01-20120228 in the Fana West building. The elevated reporting limits for TCE, cis-1,2-DCE and VC were caused by sample dilution to accommodate the high concentration of PCE in the sample (918 $\mu g/m^3$). Although the raised reporting

limits in that sample introduce some uncertainty to this evaluation, that uncertainty is somewhat mitigated by the following factors:

- Based on data from the remaining 12 samples, TCE, cis-1,2-DCE and VC were not detected above reporting limits in any other location included in the investigation
- If the other VOCs (TCE, cis-1,2-DCE and VC) were present in sample IA01-20120228 at their respective reporting limits, PCE would still be the primary risk driver at this location.

The data collected to date suggest that the PCE concentration detected in the Fana West building may be caused by the use of chemical products inside the building rather than vapor intrusion. If additional sampling proposed in the recommendations section of this report confirms that hypothesis, then the potential masking of other chlorinated VOCs in this one sample will not be considered an uncertainty that warrants further action. If, however, the additional sampling confirms that vapor intrusion should be further evaluated at the Fana West building, then the potential masking of other chlorinated VOCs will be addressed in future sampling efforts.

5.5 CLEANUP AND SCREENING LEVELS

The value representing each specific CUL or SL is a function of an assumed exposure scenario and the toxicity of a particular chemical. Uncertainties associated with chemical toxicity factors and assumed exposure scenarios are identified below.

5.5.1 TOXICITY FACTORS

Toxicity factors quantify the extent to which a chemical presents a cancer risk or a non-cancer hazard as a function of the chemical "dose" to which a person is exposed. Government databases contain toxicity factors for hundreds of chemical substances and those databases are updated and added to on a regular basis, as new data becomes available regarding chemical toxicity. Although the development of toxicity factors is a complex science, uncertainties associated with them can generally be included in one of two categories: 1) uncertainty as to whether a chemical actually causes a cancer or non-cancer health effect, and 2) uncertainty regarding the extent to which a chemical causes a cancer or non-cancer health effect.

Three of the four chemicals of concern – TCE, PCE and VC – are classified as "known" or "likely" human carcinogens by the inhalation pathway. There is strong evidence supporting the conclusion that non-cancer health effects also result from exposure to these three chemicals. The uncertainty associated with the characterization of TCE, PCE and VC as chemicals that cause cancer and non-cancer health effects is considered to be low. A significant amount of new data would be required to

refute the conclusions previously drawn regarding the cause-and-effect nature of exposure to these chemicals.

There are no published inhalation toxicity factors for the fourth chemical, cis-1,2-DCE. EPA reports that there is "inadequate information to assess the carcinogenic potential" or to derive a non-cancer inhalation toxicity factor for cis-1,2-DCE (EPA website 2012). There is a greater degree of uncertainty associated with the lack of toxicity factors for cis-1,2-DCE. If future research leads to the conclusion that cis-1,2-DCE does, in fact, contribute to cancer or non-cancer health effects, then those effects would not have been adequately considered in this evaluation. That uncertainty is currently mitigated by the fact that cis-1,2-DCE was not detected in any of the indoor air or sub-slab soil gas samples collected in this investigation.

Toxicity factors are updated as new studies are performed, reviewed, and validated by the scientific community. There is, then, inherent uncertainty in the application of any toxicity factor because the factor may change when new data is available in the future. That uncertainty is understood and it is generally accepted that decisions will be made based on published toxicity factors at the time an evaluation of risk is conducted. At the present time, however, toxicity factors for two of the four chemicals of concern for the site (TCE and PCE) were recently updated in the EPA IRIS database and Ecology is still determining how EPA's update will affect final CULs under the MTCA regulation. To mitigate that uncertainty, Ecology has provided to Boeing a basis for calculating "anticipated" MTCA Method B cleanup levels using the toxicity factors that it expects will be incorporated into its CLARC database (Ecology 2012b). Although there is some uncertainty as to whether these toxicity factors (and the MTCA Method B CULs derived from them) will change prior to incorporation into the CLARC database, it is expected that any changes will not be significant enough to change the conclusions of this vapor intrusion assessment. If Ecology's recommendation regarding the use of new toxicity factors for TCE and PCE changes significantly in the near future, then this assumption should be revisited at that time.

5.5.2 EXPOSURE SCENARIOS

An exposure scenario assumes that a particular type of receptor (e.g., a human adult or child) will be exposed to a contaminated environmental medium (e.g., indoor air) at a given frequency (e.g., 24 hours per day, 365 days per year) for a particular duration (e.g., 30 years). An assumed exposure scenario will rarely characterize the actual exposure scenario of a specific individual, and it is not intended to. It is, instead, intended to be protective of a population, or general type, of individuals and is designed to be conservative. An exposure scenario will not generally be a conservative representation (i.e., inclusive) of

every individual exposure scenario within a particular population, but it is intended to be inclusive of the vast majority of individual exposure scenarios likely to be experienced by the general population. In other words, an assumed residential scenario is designed to be a conservative representation of the vast majority of individual residential receptors; an assumed industrial exposure scenario is designed to be a conservative representation of the vast majority of individual industrial receptors; etc.

For the purposes of this vapor intrusion assessment, a standard "unrestricted land use" (i.e., one that allows for continuous, full-time residential exposure) exposure scenario was used to derive MTCA Method B air CULs. None of the buildings investigated for this vapor intrusion assessment are used for residential purposes: some are used for educational purposes, others for recreational purposes, and still others for commercial or industrial purposes. The calculated CULs and SLs based on unrestricted land use introduce uncertainty with respect to estimating the actual risks to human receptors using these buildings. However, for all building uses at the site, the factors that contribute to the uncertainty of those risks lead to an overestimate of risks and will contribute to the likelihood that a Type I error (i.e., erroneously concluding that unacceptable risks are present when a site is, in fact, acceptably clean) will occur, not a Type II error. Therefore, these uncertainties do not warrant more detailed consideration as long as the evaluation concludes that vapor intrusion does not present unacceptable levels of risk.

5.6 SEASONAL AND TEMPORAL EFFECTS

Seasonal and temporal variations are known to have an impact on indoor air and soil gas sampling. Seasonal operation of building HVAC systems affects the flow of soil gas toward and into building structures. Sampling during the winter season tends to yield the maximum vapor intrusion impacts when the building is depressurized with respect to the subsurface. The investigation to support the vapor intrusion assessment was conducted February 2012, during the winter heating season. It is expected that the scheduling of this sampling event would result in an assessment of higher-than-average potential vapor intrusion impacts. Therefore, the uncertainty with respect to seasonal variability is considered low.

Uncertainty in soil gas concentrations stems from environmental variables such as heavy rainfall events or barometric pressure fluctuations. Even if the sampling occurs indoors, ambient conditions outside the building may be affected by the environment. However, the magnitude of potential effects is not well characterized. Weather conditions at the site were approximated using historical weather station data from Seattle-Tacoma International Airport during the sampling event (Weather Underground website 2012). The following bulleted list qualifies the anticipated impact on data quality in the context of an EPA (2007) study on the impacts that temporal effects may have on soil gas sampling:

- Temperature – The average daily temperature for February 29 was 38 °F. Temperatures rose steadily during morning hours to reach daily maximum temperatures (41 °F) in the afternoon. EPA (2007) has concluded that any potential correlation between ambient temperature and soil gas concentration is not strong enough to warrant concern in soil gas investigations. Temperature is not expected to have a significant effect on the data collected during the investigation.
- Precipitation – No precipitation occurred during soil gas sampling the morning of February 29; however, 0.03 inches of rain fell in the afternoon. EPA (2007) found that there were no measurable effects to soil gas concentrations following precipitation events of up to 0.244 inches of water (the maximum observed during EPA's study period). Precipitation is not expected to have an appreciable effect on the data collected during the investigation.
- Barometric Pressure – The barometric pressure rose from a minimum of 999 millibars at the beginning of the sampling period (approximately 9:00 am) to a maximum of 1000 millibars at the end of the sampling period (approximately 12:00 pm) on February 29. EPA (2007) found that multi-day barometric pressure changes over a range of 15 millibars (the maximum observed during EPA's study period) had no noticeable effect on soil vapor concentrations. Barometric pressure fluctuations in the range observed are not expected to have a potential effect on the data collected during the investigation.

Environmental conditions during the sampling event were conducive to an effective vapor intrusion sampling event. Temporal variables most likely to introduce uncertainty to a soil gas sampling event were stable and well within ranges found to have no measureable impacts in a related EPA study.

6.0 RECOMMENDATIONS

As discussed in Section 4.0, the sampling results for four of the buildings – AMB, Building 17-07, YMCA, and Junior Achievement – support a recommendation for no further action with respect to vapor intrusion risks. Indoor air or sub-slab soil gas concentrations were less than applicable CULs and SLs, leading to the conclusion that vapor intrusion does not present unacceptable risks at those buildings.

PCE was detected in one indoor air sample at the Fana West building at a concentration (918 $\mu g/m^3$) that exceeds the anticipated MTCA Method B air CUL (8.8 $\mu g/m^3$). Vapor intrusion is not expected to be the source of the detected concentration; however, additional sampling is recommended to test that hypothesis. Due to a lack of chemical detections in a sample from a nearby office in the same wing of the Fana West building, the concentration detected in sample IA01-20120228 may have been caused by a localized event (e.g., spot-application of a fabric cleaner) rather than a more wide-spread chemical release (e.g., carpet cleaning in the office space). The following supplemental sampling is proposed to test the hypothesis that the detected PCE concentration is not related to vapor intrusion impacts:

- Follow-up indoor air sampling from the same location at which PCE was previously detected at a concentration of 918 $\mu g/m^3$. The sample will be collected in a manner consistent with the procedures described in the Work Plan and analyzed for TCE, PCE, VC, and cis-1,2-DCE by Method TO-15 SIM.
- Sub-slab soil gas sampling co-located with the follow-up indoor air sample. The sample will be collected in a manner consistent with the procedures described in the Work Plan and analyzed for TCE, PCE, VC, and cis-1,2-DCE by Method TO-15.
- Additional sample volume will be collected from each of the two proposed sampling locations: the indoor air sample and the co-located sub-slab soil gas sample. The additional sample volumes will be drawn through sample cartridges prepared by the University of Oklahoma and submitted to the University of Oklahoma for compound-specific isotope analysis (CSIA) to evaluate the isotope ratios for carbon ($\delta^{13}C$) and chlorine ($\delta^{37}Cl$) in PCE. The CSIA will be performed only if PCE is detected at concentrations exceeding applicable CULs or SLs in either the indoor air or the sub-slab soil gas sample.

A decision-making flow chart for interpreting results from the proposed sampling event is presented on Figure 11.

7.0 USE OF THIS REPORT

This vapor intrusion assessment has been prepared for the exclusive use of The Boeing Company for specific application to the Boeing Auburn remedial investigation. No other party is entitled to rely on the information, conclusions, and recommendations included in this document without the express written consent of Landau Associates. Further, the reuse of information, conclusions, and recommendations provided herein for extensions of the project or for any other project, without review and authorization by Landau Associates, shall be at the user's sole risk. Landau Associates warrants that within the limitations of scope, schedule, and budget, our services have been provided in a manner consistent with that level of care and skill ordinarily exercised by members of the profession currently practicing in the same locality under similar conditions as this project. We make no other warranty, either express or implied.

This document has been prepared under the supervision and direction of the following key staff.

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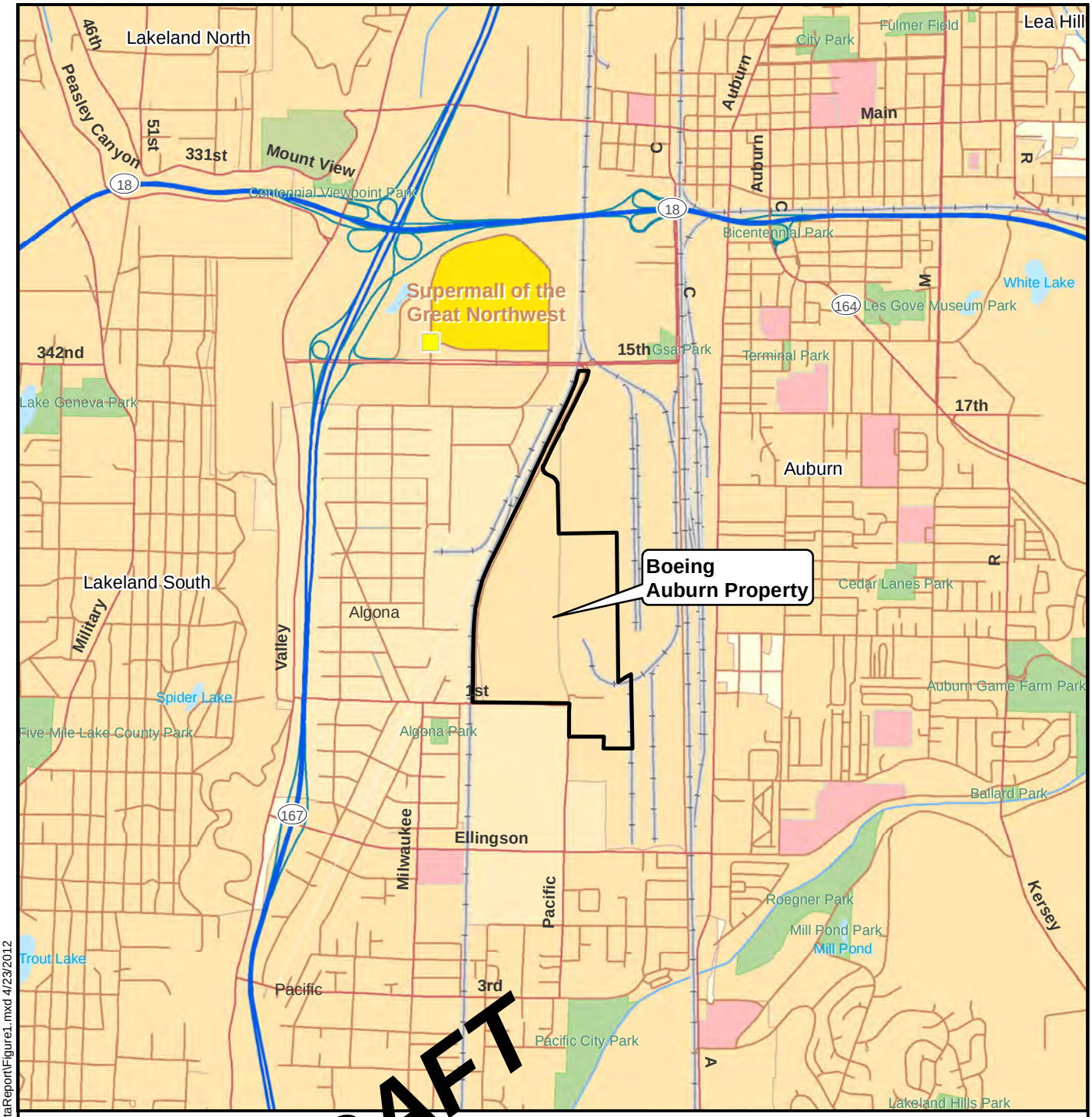

Data Source: ESRI 2008

V:\025\164\090\950\VaporIntrusionAssessment2012DataReport\Figure1.mxd 4/23/2012

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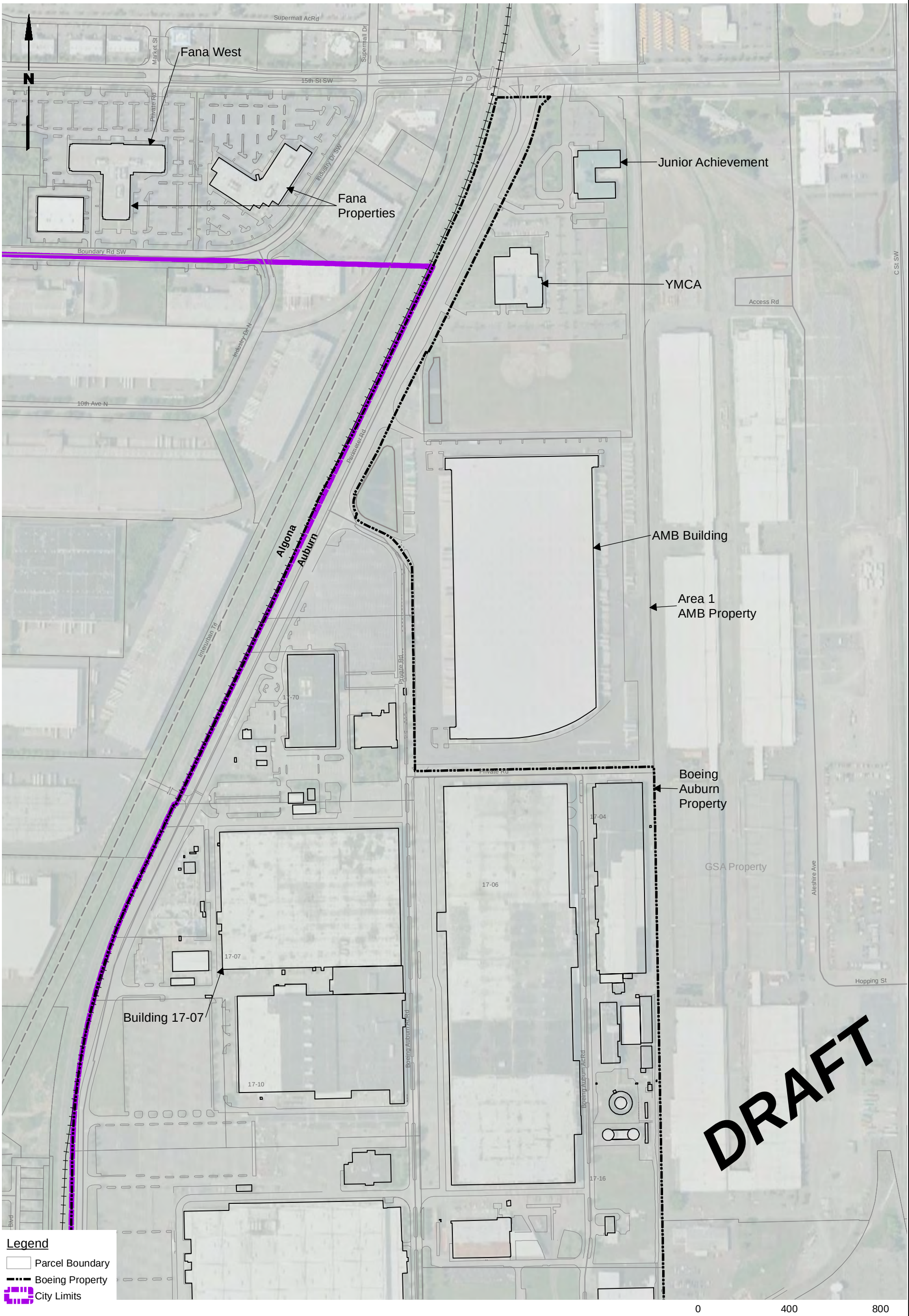
Boeing Auburn Auburn, Washington	**Vicinity Map**	Figure 1

V:\025\164\090\950\VaporIntrusionAssessment2012DataReport\Figure_2_SampleBldgLocs.mxd 4/20/2012 NAD 1983 HARN StatePlane Washington North FIPS 4601 Feet



Legend

- Parcel Boundary
- Boeing Property
- City Limits

Notes

1. Black and white reproduction of this color original may reduce its effectiveness and lead to incorrect interpretation.

0 400 800

Scale in Feet

Base map source: Geometrix 2003; Aerial Photo Source: I3_Imagery_Prime_World_2D; Parcel Data Source: King County GIS 2010

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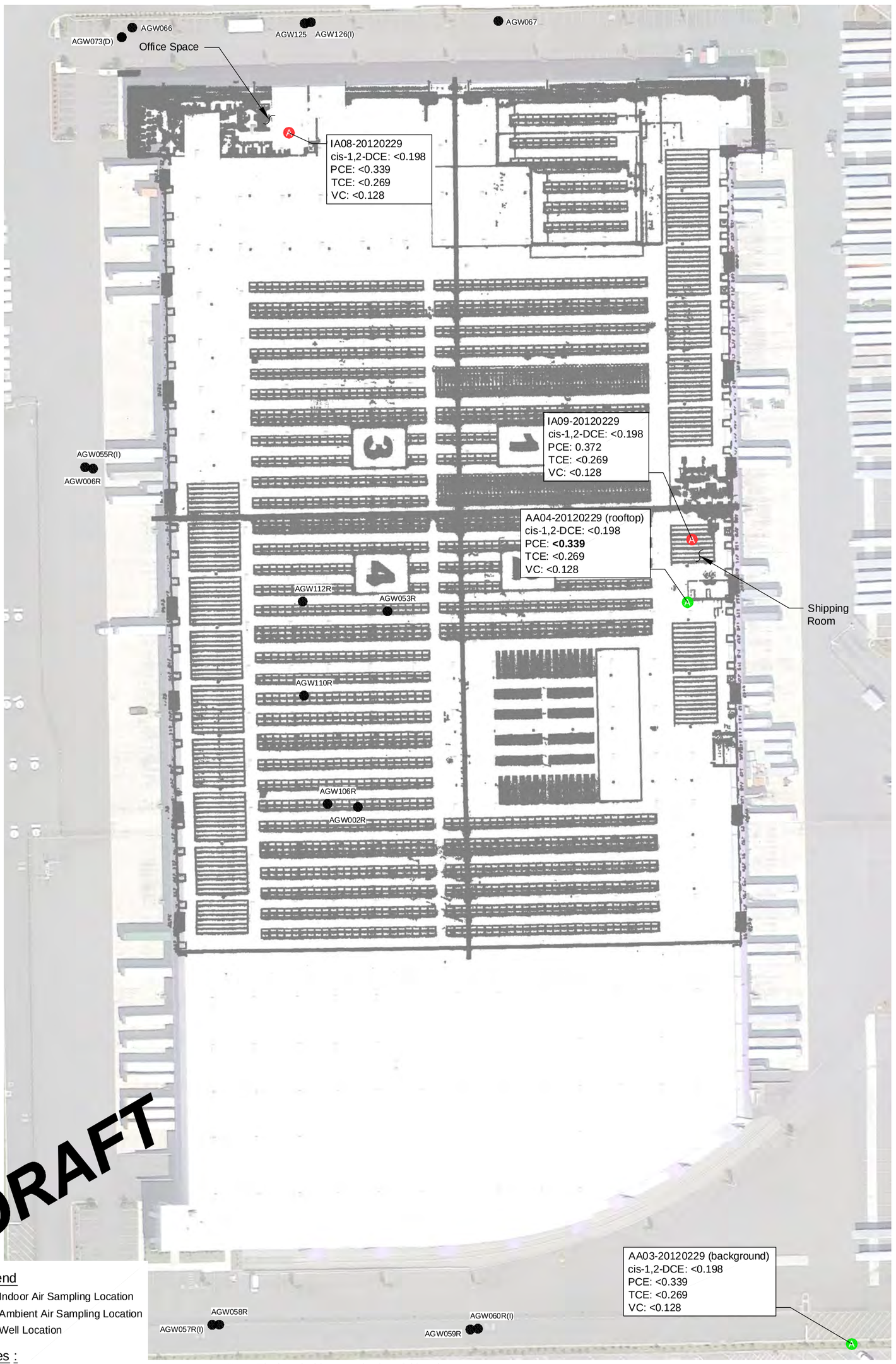
Boeing Auburn Auburn, Washington	**Vapor Intrusion Assessment Sample Building Locations**	Figure 2



Legend

- Indoor Air Sampling Location
- Ambient Air Sampling Location
- Well Location

Notes :

1. All concentrations expressed in units of micrograms per cubic meter (µg/m ^{3}).
2. <0.2 = Compound not detected at indicated reporting limits.
3. Black and white reproduction of this color original may reduce its effectiveness and lead to incorrect interpretation.

0 100 200
Scale in Feet

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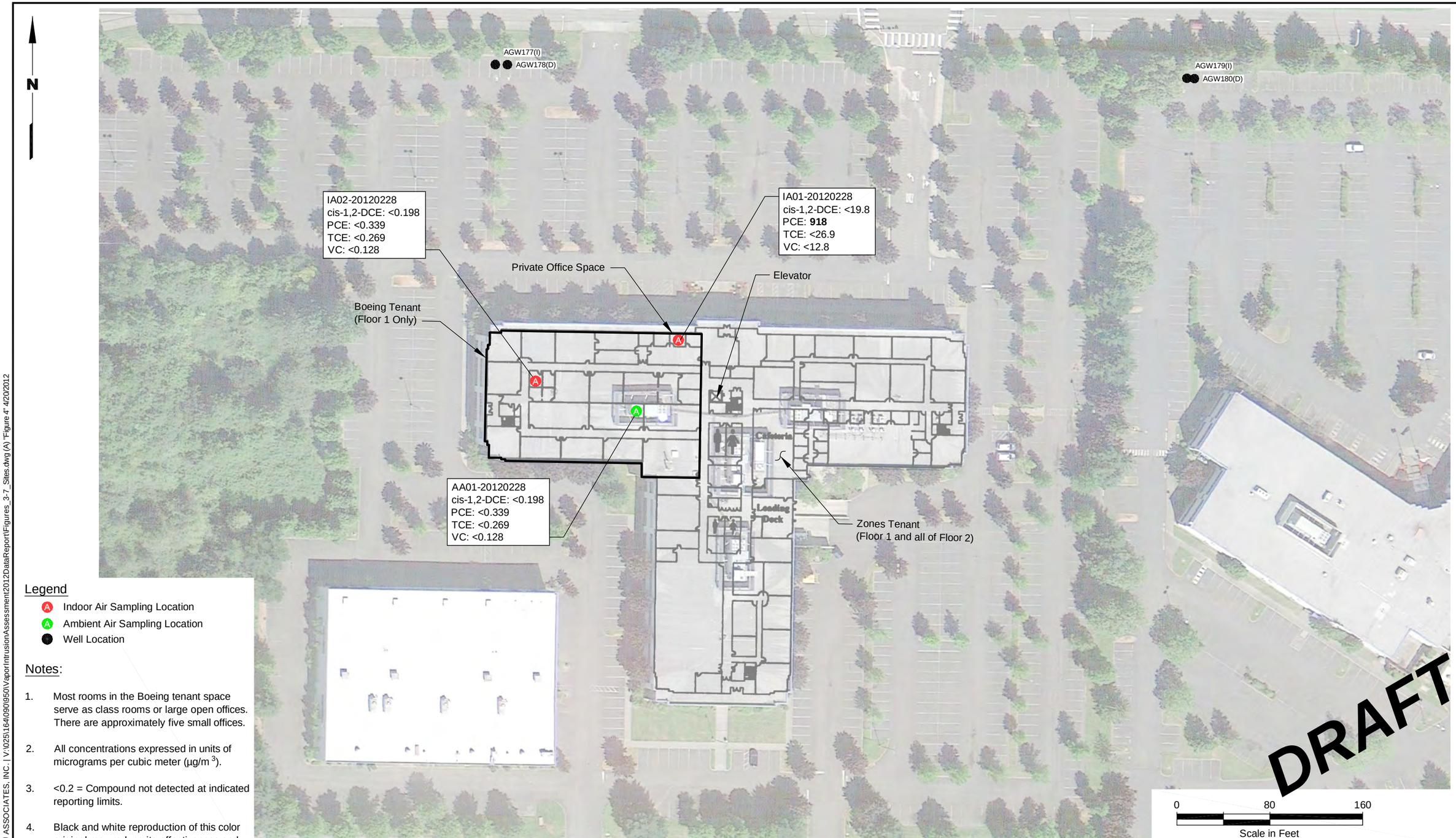
Boeing Auburn
Auburn, Washington

AMB
Air Sampling Results

Figure
3



Legend

- Indoor Air Sampling Location
- Ambient Air Sampling Location
- Well Location

Notes:

1. Most rooms in the Boeing tenant space serve as class rooms or large open offices. There are approximately five small offices.
2. All concentrations expressed in units of micrograms per cubic meter ($\mu g/m^3$).
3. <0.2 = Compound not detected at indicated reporting limits.
4. Black and white reproduction of this color original may reduce its effectiveness and lead to incorrect interpretation.

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Boeing Auburn Auburn, Washington	**Fana West** **Air Sampling Results**	Figure 4

N

EE DD CC BB AA A B C D E F G H J K

1 2 3 4 5 6 7 8 9 10 11

AGW156(I)
AGW131
AGW029
AGW034(D)
AGW025
AGW155(I)
AGW024
AGW079
AGW164(I)
AGW165
AGW037
AGW026
AGW050
AGW049
AGW048
AGW047
AGW028
AGW163(I)

Conference Room at Column E-2

IA03-20120229
cis-1,2-DCE: <0.198
PCE: <0.339
TCE: <0.269
VC: <0.128

Offices near Column BB-5

IA07-20120229
cis-1,2-DCE: <0.198
PCE: <0.339
TCE: <0.269
VC: <0.128

Sheffield Modulab
at Column B-9

IA06-20120229
cis-1,2-DCE: <0.198
PCE: <0.339
TCE: <0.269
VC: <0.128

AA02-20120229 (rooftop)
cis-1,2-DCE: <0.198
PCE: <0.339
TCE: <0.269
VC: <0.128

Open Floor Work
Space at Column D-9

Former Vapor
Degreaser (SWMU S-13)

IA04-20120229
cis-1,2-DCE: <0.198
PCE: <0.339
TCE: <0.269
VC: <0.128

IA05-20120229
cis-1,2-DCE: <0.198
PCE: <0.339
TCE: <0.269
VC: <0.128

Tankline Area

DRAFT

Legend

- Indoor Air Sampling Location
- Ambient Air Sampling Location
- Well Location

Notes :

1. All concentrations expressed in units of micrograms per cubic meter (µg/m ^{3}).
2. <0.2 = Compound not detected at indicated reporting limits.
3. Black and white reproduction of this color original may reduce its effectiveness and lead to incorrect interpretation.

0 80 160
Scale in Feet

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Boeing Auburn
Auburn, Washington

Building 17-07
Air Sampling Results

Figure
5

Legend

- Sub-Slab Soil Gas Sampling Location
- Well Location

N

Notes :

1. All concentrations expressed in units of micrograms per cubic meter (µg/m ^{3}).
2. <0.2 = Compound not detected at indicated reporting limits.
3. Black and white reproduction of this color original may reduce its effectiveness and lead to incorrect interpretation.

AGW064

SSV48-20120229
cis-1,2-DCE: <2
PCE: <3.4
TCE: <2.7
VC: <1.3

Main Entrance

Boiler Room

Aquatic Center

Open Office and Storage Space

SSV46-20120229
cis-1,2-DCE: <2
PCE: <3.4
TCE: <2.7
VC: <1.3

AGW069

AGV

Storage Room

SSV47-20120229
cis-1,2-DCE: <2
PCE: <3.4
TCE: <2.7
VC: <1.3

Crawl Space and Beneath Base of Pool

Entrance to Crawl Space

AGW140(I)

AGW136 AGW137(I) AGW138(D)

AGW139(I)

DRAFT

0 50 100
Scale in Feet

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Boeing Auburn Auburn, Washington	**YMCA Sub-Slab Soil Gas Sampling Results**	Figure **6**

Legend

V Sub-Slab Soil Gas Sampling Location

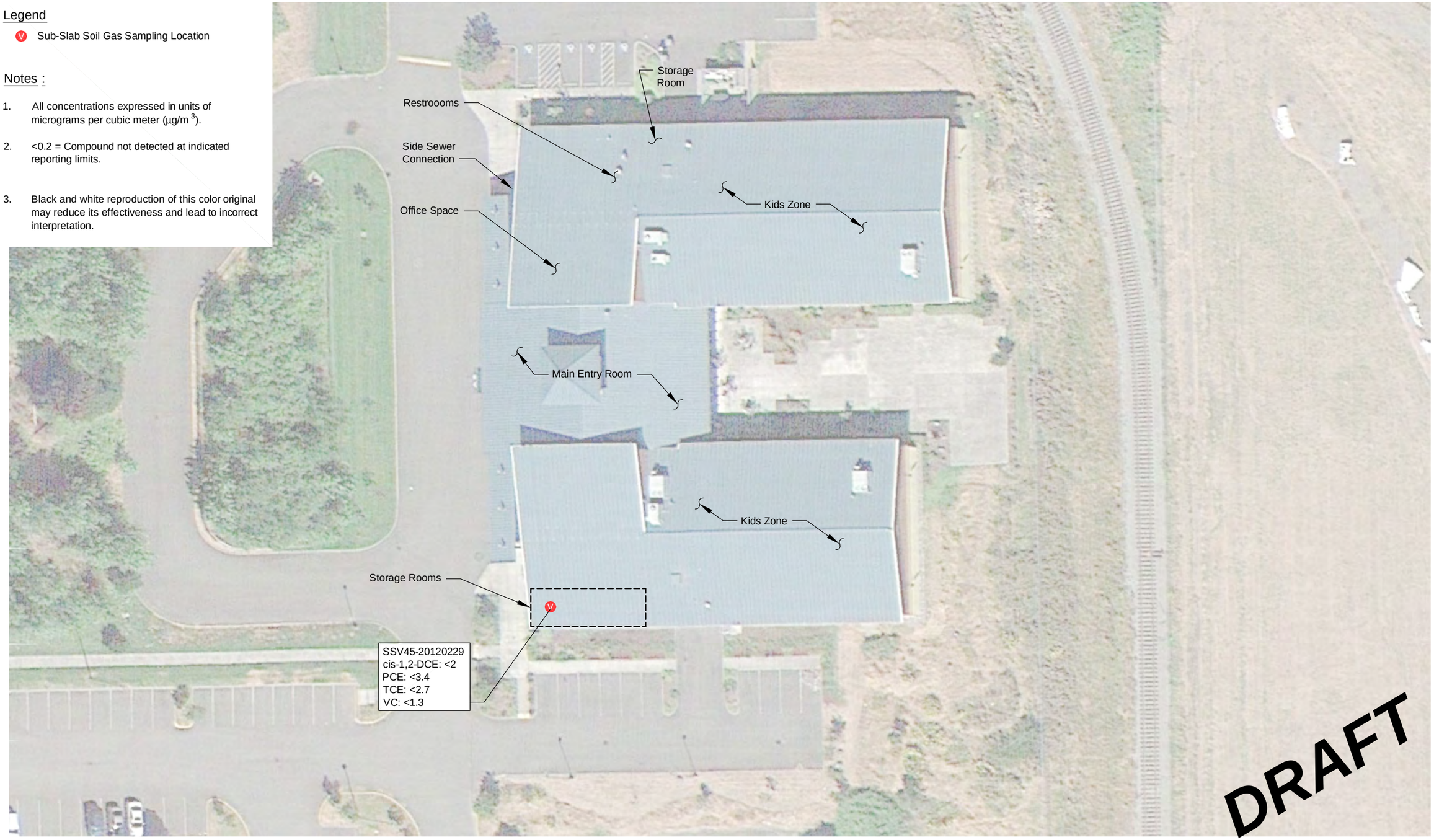
N

Notes :

1. All concentrations expressed in units of micrograms per cubic meter (µg/m ^{3}).

2. <0.2 = Compound not detected at indicated reporting limits.

3. Black and white reproduction of this color original may reduce its effectiveness and lead to incorrect interpretation.



0 40 80

Scale in Feet

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Boeing Auburn Auburn, Washington	**Junior Achievement Sub-Slab Soil Gas Sampling Results**	Figure 7

AGW208(M)
(21' - <0.02)
(29' - 0.021)

AGW177-29
(0.072)

AGW168-29
(0.085)

Fana West

Boundary Rd SW

15th St SW

15th St SW

Private Rd

Market St

AGW209(M)
(20' - <0.02)
(30' - <0.02)

Supermall Acrd

AGW170-28
(0.12)

AGW179-30
(<0.02)

Industry Dr N

Industry Dr SW

Fana

AGW210(M)
(20' - <0.02)
(30' - <0.02)

DRAFT

Notes

1. All concentrations shown in µg/L.
2. <0.02 = Compound not detected at indicated reporting limits.
3. Monitoring wells AGW208, AGW209, and AGW210 are multilevel (M) wells with up to seven screens. The first two screens (typically at 20 ft and 30 ft below ground surface) are considered shallow.
4. Black and white reproduction of this color original may reduce its effectiveness and lead to incorrect interpretation.

Legend

- Monitoring Well Location
- Borehole Grab Sample Location
- Last PCE Detection => 5.0 µg/L
- Last PCE Detection = 2.4-5.0 µg/L
- Last PCE Detection = 0.5-2.4 µg/L
- Last PCE Detection = < 0.5 µg/L
- Non-Detect

N

0 150 300

Scale in Feet

Base map source: Geometrix 2003; Aerial Photo Source: I3_Imagery_Prime_World_2D; Parcel Data Source: King County GIS 2010

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Boeing Auburn
Auburn, Washington

Shallow Groundwater
PCE Concentrations
(Fana West; May-Dec 2011)

Figure
8

V:\0251\5164\1090\950\VaporIntrusionAssessment2012DataReport\Figure_08_PCE.mxd 4/20/2012 NAD 1983 StatePlane Washington North FIPS 4601 Feet

V:\025\164\090\950\VaporIntrusionAssessment2012DataReport\Figure_09_TCE.mxd 4/20/2012 NAD 1983 StatePlane Washington North FIPS 4601 Feet

AGW208(M)
(21' - 1.6)
(29' - 5.5)

AGW177-29
(8.6)

AGW168-29
(3)

Boundary Rd SW

15th St SW

15th St SW

Fana West

Private Rd

Market St

Supermall Ac Rd

AGW209(M)
(20' - <0.2)
(30' - <0.2)

AGW170-28
(3.6)

AGW179-30
(<0.2)

Industry Dr N

Industry Dr SW

Fana

AGW210(M)
(20' - <0.2)
(30' - <0.2)

DRAFT

Notes

1. All concentrations shown in µg/L.
2. <0.2 = Compound not detected at indicated reporting limits.
3. Monitoring wells AGW208, AGW209, and AGW210 are multilevel (M) wells with up to seven screens. The first two screens (typically at 20 ft and 30 ft below ground surface) are considered shallow.
4. Black and white reproduction of this color original may reduce its effectiveness and lead to incorrect interpretation.

Legend

- Monitoring Well Location
- Borehole Grab Sample Location
- Last TCE Detection => 5.0 µg/L
- Last TCE Detection = 2.4-5.0 µg/L
- Last TCE Detection = 0.5-2.4 µg/L
- Last TCE Detection = < 0.5 µg/L
- Non-Detect

N

0 150 300

Scale in Feet

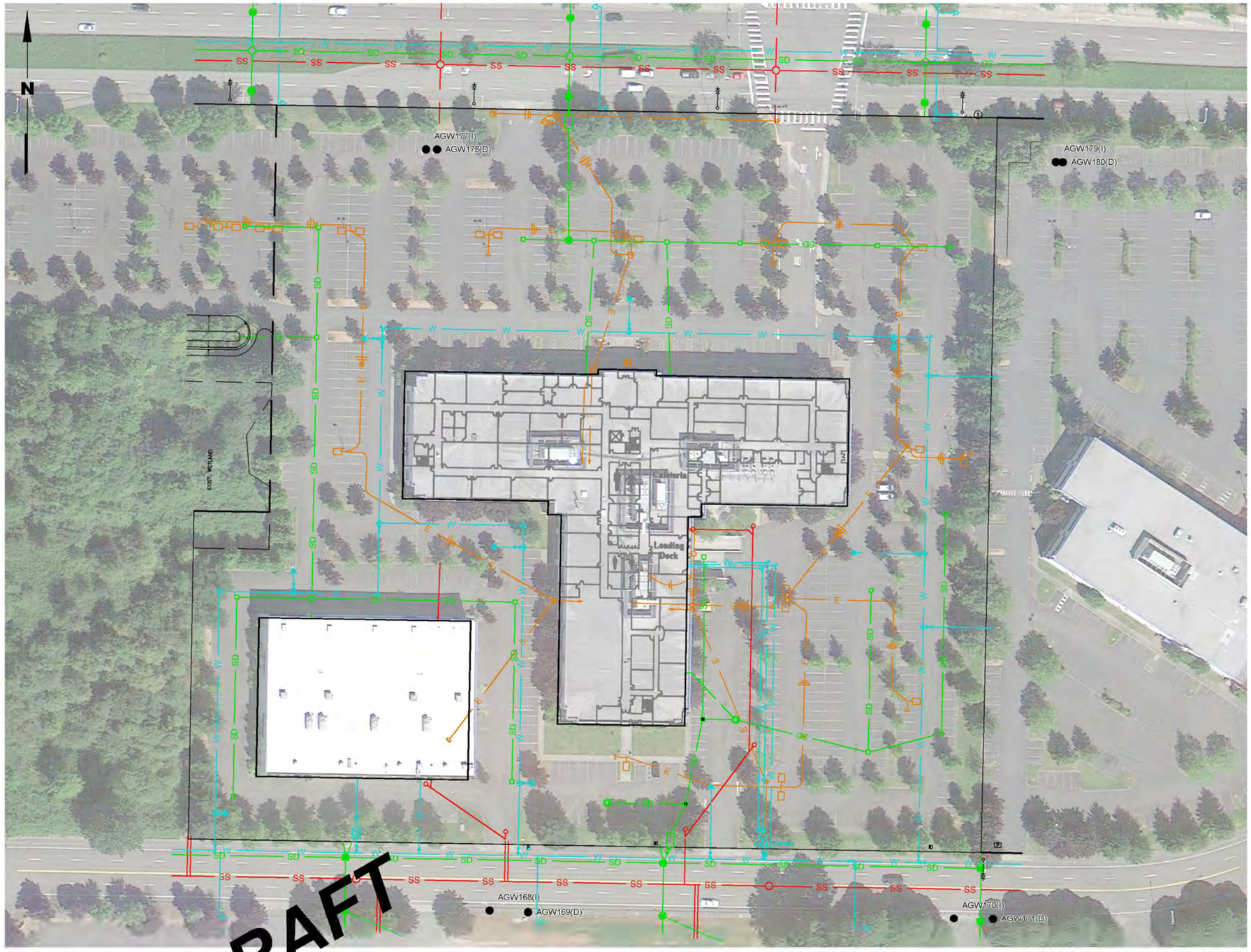
Base map source: Geometrix 2003; Aerial Photo Source: I3_Imagery_Prime_World_2D; Parcel Data Source: King County GIS 2010

LANDAU ASSOCIATES

Boeing Auburn
Auburn, Washington

Shallow Groundwater TCE Concentrations (Fana West; May-Dec 2011)

Figure 9



Legend

AGW180 ●	Well Location and Designation
E	Electrical Power (Assumed Depth: >2 ft)
SD	Storm Drain Pipe (Depth: Approx. 2-4 ft)
SS	Sanitary Sewer Pipe (Depth: Approx. 9-10 ft)
W	Water Pipe (Depth: Undetermined)

Note

1. Black and white reproduction of this color original may reduce its effectiveness and lead to incorrect interpretation.

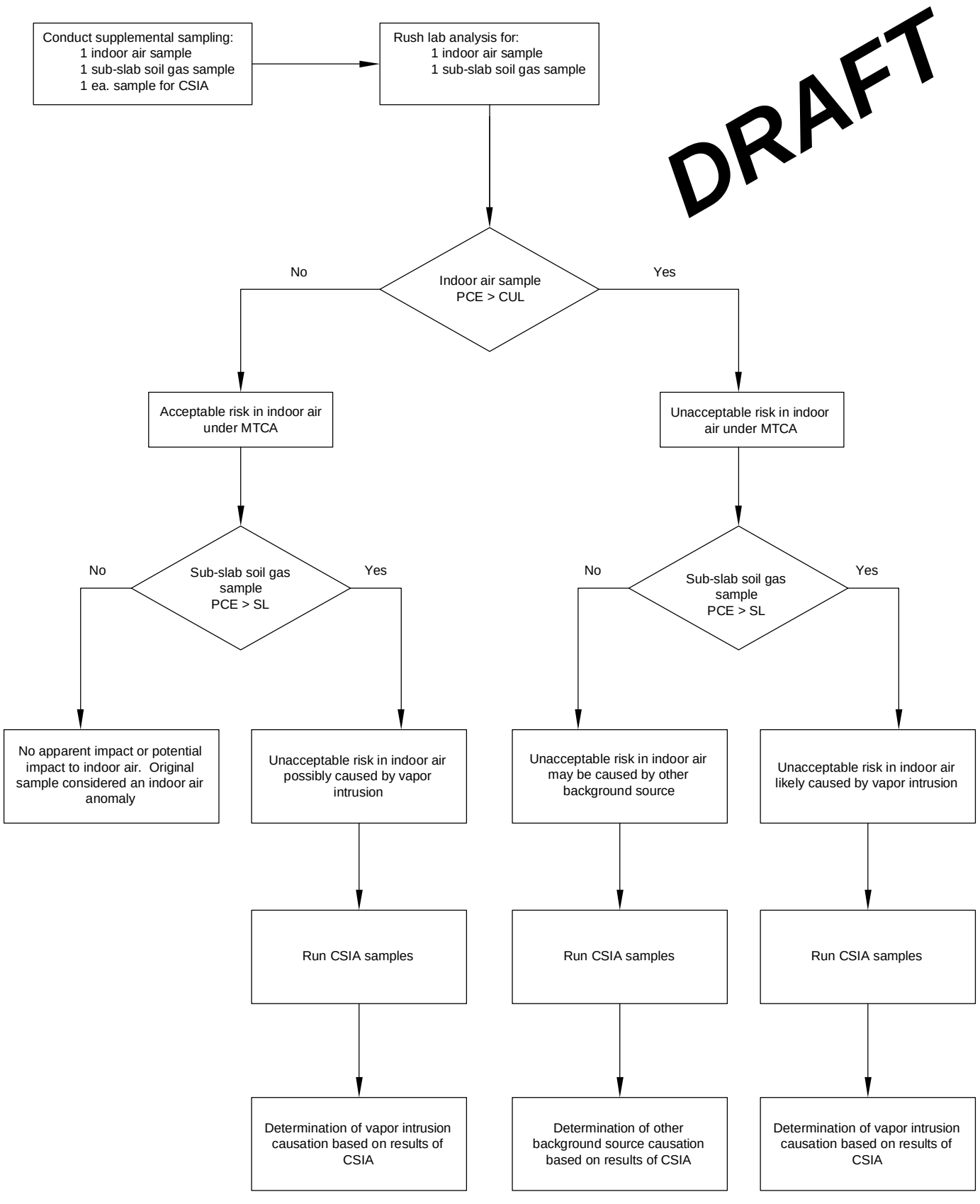
Source: Boeing Facilities Department 1991; Google Earth Professional 2011

DRAFT

0 100 200
Scale in Feet

LANDAU ASSOCIATES

Boeing Auburn Auburn, Washington	**Fana West Utilities Layout**	Figure 10



LANDAU ASSOCIATES

Boeing Auburn
Auburn, Washington

Supplemental Sampling Decision Flowchart

Figure 11

TABLE 1
INDOOR AIR CLEANUP LEVELS
VAPOR INTRUSION ASSESSMENT
BOEING AUBURN

Chemical of Concern	MTCA Method B Standard Formula Value - Air (carcinogenic)	Note	MTCA Method B Standard Formula Value - Air (non-carcinogenic)	Note	MTCA Method B Air Cleanup Level	Basis (a)	Review of CUL Compliance Requirements for Sites with Multiple Chemicals of Concern (b)
cis-1,2-Dichloroethene	NA	(c)	NA	(c)	NA		NA
Tetrachloroethene	8.8	(d)	18	(e)	8.8	C	HQ @ CUL = 0.49
Trichloroethene	0.37	(f)	0.91	(g)	0.37	C	HQ @ CUL = 0.41
Vinyl Chloride	0.28	(h)	46	(i)	0.28	C	HQ @ CUL = 0.01
							HI (ΣHQ) = 0.90

All concentrations are expressed in units of micrograms per cubic meter ($\mu g/m^3$).

C = Carcinogenic effect (as a basis for selecting the MTCA Method B air cleanup level)
CUL = Cleanup level
HI = Hazard index (equal to the sum of individual hazard quotients)
HQ = Hazard quotient
NA = Not available

Notes:

a. The MTCA Method B air CUL was selected as the lower (i.e., more restrictive) of the two standard formula values: for carcinogenic and non-carcinogenic effects.

b. MTCA requires that, if necessary, CULs be adjusted to ensure that cumulative risks do not exceed acceptable levels (risk of 1E-05 and HI of 1). For sites with ten or fewer chemicals of concern, as is the case at Boeing Auburn, cumulative risks will not exceed 1E-05 for carcinogenic effects based on individual CULs correlated to a risk level of 1E-06; therefore, no further consideration was given in this evaluation to reducing CULs to be protective of cumulative carcinogenic risks. To evaluate whether concentrations of individual chemicals of concern at their respective CULs (protective of carcinogenic risk) would yield a cumulative HI greater than 1, the ratio of the carcinogenic CUL to the non-carcinogenic standard formula value was used to calculate the corresponding HQ for each chemical of concern at its CUL. Those ratios were summed to derive the HI, which is less than 1 for the Boeing Auburn site, demonstrating that cumulative risks for all chemicals of concern in the vapor intrusion will be less than acceptable levels without CUL adjustment.

c. Although there is currently no established MTCA cleanup level for cis-1,2-DCE in air, samples were analyzed for cis-1,2-DCE in the event that the data might be helpful for considering the extent to which biodegradation may be occurring.

d. Toxicity values for tetrachloroethene have been updated in EPA's IRIS database, but not yet in Ecology's CLARC database. "Anticipated" MTCA Method B air CUL for carcinogenic effects at a risk of 1E-06 (Equation 750-2), based on a CPFi of 1E-03 as recommended by Ecology (2012b).

e. Toxicity values for tetrachloroethene have been updated in EPA's IRIS database, but not yet in Ecology's CLARC database. "Anticipated" MTCA Method B air CUL for non-carcinogenic effects at a hazard quotient of 1 (Equation 750-1), based on an RfDi of 1.14E-02 as recommended by Ecology (2012b).

f. Toxicity values for trichloroethene have been updated in EPA's IRIS database, but not yet in Ecology's CLARC database. "Anticipated" MTCA Method B air CUL for carcinogenic effects at a risk of 1E-06 (Equation 750-2), based on a CPFi of 2.36E-02 as recommended by Ecology (2012b).

g. Toxicity values for trichloroethene have been updated in EPA's IRIS database, but not yet in Ecology's CLARC database. "Anticipated" MTCA Method B air CUL for non-carcinogenic effects at a hazard quotient of 1 (Equation 750-1), based on an RfDi of 5.7E-04 as recommended by Ecology (2012b).

h. Standard MTCA Method B air CUL for carcinogenic effects at a risk of 1E-06 (Equation 750-2), as reported in the CLARC database (Ecology website 2012).

i. Standard MTCA Method B air CUL for non-carcinogenic effects at a hazard quotient of 1 (Equation 750-1), as reported in the CLARC database (Ecology website 2012).

TABLE 2
SUB-SLAB SOIL GAS SCREENING LEVELS
VAPOR INTRUSION ASSESSMENT
BOEING AUBURN

Chemical of Concern	MTCA Method B Air Cleanup Level	Basis (a)	Vapor Attenuation Factor (b)	Soil Gas Screening Level (c)
cis-1,2-Dichloroethene	NA		0.03	NA
Tetrachloroethene	8.8	C	0.03	290
Trichloroethene	0.37	C	0.03	12
Vinyl Chloride	0.28	C	0.03	9.3

All concentrations are expressed in units of micrograms per cubic meter ($\mu g/m^3$).

C = Carcinogenic effect (as a basis for selecting the MTCA Method B air cleanup level)
CUL = Cleanup level
NA = Not available
SL = Screening level
VAF = Vapor attenuation factor

Notes:

a. The MTCA Method B air CUL was selected as the lower (i.e., more restrictive) of the two standard formula values: for carcinogenic and non-carcinogenic effects. Refer to Table 1.

b. The vapor attenuation factor is the newly-recommended value for attenuation of chlorinated VOCs between sub-slab soil gas and indoor air based on a recent EPA evaluation (EPA 2012; Jones 2012).

c. Soil gas SLs are calculated by dividing the MTCA Method B air CUL by the VAF (SL = CUL/VAF).

TABLE 3
INDOOR AIR SAMPLING RESULTS
VAPOR INTRUSION ASSESSMENT
BOEING AUBURN

Chemical of Concern	MTCA Method B Air Cleanup Level	Basis (a)	AMB IA08-20120229 BNW66 40968		AMB IA09-20120229 BNW66 40968		AMB (Background) (b) AA03-20120229 BNW66 40968		AMB (Rooftop) (c) AA04-20120229 BNW66 40968		Fana IA01-20120228 BNW66 40967		Fana IA02-20120228 BNW66 40967		Fana (Rooftop) (c) AA01-20120228 BNW66 40967	
cis-1,2-Dichloroethene	NA		0.198	U	0.198	U	0.198	U	0.198	U	19.8	U	0.198	U	0.198	U
Tetrachloroethene	8.8	C	0.339	U	**0.372**		0.339	U	0.339	U	**918**		0.339	U	0.339	U
Trichloroethene	0.37	C	0.269	U	0.269	U	0.269	U	0.269	U	26.9	U	0.269	U	0.269	U
Vinyl Chloride	0.28	C	0.128	U	0.128	U	0.128	U	0.128	U	12.8	U	0.128	U	0.128	U

TABLE 3
INDOOR AIR SAMPLING RESULTS
VAPOR INTRUSION ASSESSMENT
BOEING AUBURN

Chemical of Concern	MTCA Method B Air Cleanup Level	Basis (a)	Bldg 17-07 IA03-20120229 BNW66 40968		Bldg 17-07 IA04-20120229 BNW66 40968		Bldg 17-07 IA99-20120229-DUP (d) BNW66 40968		Bldg 17-07 IA05-20120229 BNW66 40968		Bldg 17-07 IA06-20120229 BNW66 40968		Bldg 17-07 IA07-20120229 BNW66 40968		Bldg 17-07 (Rooftop) (c) AA02-20120229 BNW66 40968	
cis-1,2-Dichloroethene	NA		0.198	U	0.198	U	0.198	U	0.198	U	0.198	U	0.198	U	0.198	U
Tetrachloroethene	8.8	C	0.339	U	0.339	U	0.339	U	0.339	U	0.339	U	0.339	U	0.339	U
Trichloroethene	0.37	C	0.269	U	0.269	U	0.269	U	0.269	U	0.269	U	0.269	U	0.269	U
Vinyl Chloride	0.28	C	0.128	U	0.128	U	0.128	U	0.128	U	0.128	U	0.128	U	0.128	U

All concentrations are expressed in units of micrograms per cubic meter ($\mu g/m^3$).

C = Carcinogenic effect (as a basis for selecting the MTCA Method B air cleanup level)
CUL = Cleanup level
NA = Not available
U = Indicates the compound was undetected at the reported concentration.
Bold = Detected compound
Box = Exceedance of screening level

Notes:

a. The MTCA Method B air CUL was selected as the lower (i.e., more restrictive) of the two standard formula values: for carcinogenic and non-carcinogenic effects. Refer to Table 1.
b. At the AMB building, an extra ambient air sample was collected from the breathing zone near ground level at the request of the building's manager.
c. Rooftop samples were collected from a point near the HVAC system intake point at each of the three buildings in which indoor air samples were collected. The rooftop samples represent background ambient air concentrations entering the building and not impacted by vapor intrusion.
d. Sample IA99 is a field duplicate sample of IA04 in Building 17-07.

TABLE 4
SUB-SLAB SOIL GAS SAMPLING RESULTS
VAPOR INTRUSION ASSESSMENT
BOEING AUBURN

Chemical of Concern	Soil Gas Screening Level	Basis (a)	YMCA SSV46-20120229 BNW67 02/29/2012	YMCA SSV47-20120229 BNW67 02/29/2012	YMCA SSV48-20120229 BNW67 02/29/2012	JA SSV45-20120229 BNW67 02/29/2012
cis-1,2-Dichloroethene	NA		2 U	2 U	2 U	2 U
Tetrachloroethene	290	MTCA B	3.4 U	3.4 U	3.4 U	3.4 U
Trichloroethene	12	MTCA B	2.7 U	2.7 U	2.7 U	2.7 U
Vinyl Chloride	9.3	MTCA B	1.3 U	1.3 U	1.3 U	1.3 U

All concentrations are expressed in units of micrograms per cubic meter ($\mu g/m^3$).

MTCA B = MTCA Method B air cleanup level
CUL = Cleanup level
NA = Not available
U = Indicates the compound was undetected at the reported concentration.
Bold = Detected compound (none)
Box = Exceedance of screening level (none)

Note:
a. The soil gas SLs are based on protection of the MTCA Method B air CUL (carcinogenic effects). Refer to Table 2.

TABLE 5
FIELD RECORD SUMMARY
VAPOR INTRUSION ASSESSMENT
BOEING AUBURN

Sample ID	Sample Type	Building	Sample Collection Time Start	Sample Collection Time End	Sample Canister Vacuum Pressure (in. Hg) Start	Sample Canister Vacuum Pressure (in. Hg) End	Location Description and Other Notes
IA01-20120228	Indoor Air	Fana West	6:35	16:43	30	4	Private Office
IA02-20120228	Indoor Air	Fana West	6:37	16:28	30	3	Private Office
IA03-20120229	Indoor Air	Building 17-07	7:10	16:40	27.5	0	Conference room at Column E-2. Chlorox disinfecting wipes noted on table; scent indicated recent use in room. Scent still noted at end of day.
IA04-20120229	Indoor Air	Building 17-07	7:23	16:35	28	1	Tankline room, north of former vapor degreaser. Duplicate sample collected.
IA05-20120229	Indoor Air	Building 17-07	7:04	16:34	29	4	Open floor work space at Column D-9
IA06-20120229	Indoor Air	Building 17-07	7:39	16:37	30	4	Sheffield Modulab at Column B-7
IA07-20120229	Indoor Air	Building 17-07	7:43	16:45	29.5	4.5	Office near Column BB-5
IA08-20120229	Indoor Air	AMB	9:24	17:56	26.5	4	Front office.
IA09-20120229	Indoor Air	AMB	9:34	19:37	27.5	14	Shipping room office
AA01-20120228	Ambient Air	Fana West	6:45	16:53	30	1	Due to concerns about the integrity of the first Summa canister, a second canister was also used for sample collection at this location. The second Summa canister was used for sample analysis. HVAC inlet vent was circulating during sample setup, but not during takedown. Wind W to NW.
AA02-20120229	Ambient Air	Building 17-07	8:09	17:20	25	1	Rooftop. HVAC intake operating at time of sample set up. Wind W to NW.
AA03-20120229	Ambient Air	AMB	10:53	20:28	30	5	Upwind, attached to fence. Wind W to NW.
AA04-20120229	Ambient Air	AMB	9:45	18:25	28.5	5.5	Rooftop, code 1569 to get key to roof, need escort since dangerous. Wind W to NW.
SSV45-20120229	Soil Gas	Junior Achievement	9:08	9:36	29	5	PID=0.9, concrete slab thickness=5in, He reading from shroud=64E3
SSV46-20120229	Soil Gas	YMCA	10:07	10:40	27	5	Under pool, PID=0, concrete slab thickness=10in, He reading from shroud=71E3
SSV47-20120229	Soil Gas	YMCA	11:27	11:50	29.9	5	Maintenance room, PID=1.9, concrete slab thickness=12in, He reading from shroud=46E3
SSV48-20120229	Soil Gas	YMCA	10:57	11:16	25	5	Boiler room, PID=1, concrete slab thickness=5in, He in shroud=42E3

APPENDIX A

Laboratory Data Reports

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2425 New Holland Pike, PO Box 12425, Lancaster, PA 17605-2425 • 717-656-2300 Fax: 717-656-2681 • www.lancasterlabs.com

Analysis Report

ANALYTICAL RESULTS

Prepared by:

Lancaster Laboratories
2425 New Holland Pike
Lancaster, PA 17605-2425

Prepared for:

The Boeing Company
PO Box 3707 MC 9U4-26
Seattle WA 98124

March 26, 2012

Project: Boeing Auburn

Submittal Date: 03/05/2012
Group Number: 1292966
SDG: BNW66
PO Number: 0025164.090.930
State of Sample Origin: WA

Client Sample Description	Lancaster Labs (LLI) #
IA03-20120229 SC# 138 NA Air	6566115
IA04-20120229 SC# 880 NA Air	6566116
IA05-20120229 SC# 537 NA Air	6566117
IA06-20120229 SC# 180 NA Air	6566118
IA07-20120229 SC# 1106 NA Air	6566119
IA08-20120229 SC# 135 NA Air	6566120
IA09-20120229 SC# 1089 NA Air	6566121
IA99-20120229 SC# 872 NA Air	6566122
AA02-20120229 SC# 067 NA Air	6566123
AA03-20120229 SC# 831 NA Air	6566124
AA04-20120229 SC# 819 NA Air	6566125
AA01-20120228 SC# 835 NA Air	6566126
IA02-20120228 SC# 882 NA Air	6566127
IA01-20120228 SC# 161 NA Air	6566128

The specific methodologies used in obtaining the enclosed analytical results are indicated on the Laboratory Sample Analysis Record.

ELECTRONIC COPY TO	Landau	Attn: Terry McGourty
ELECTRONIC COPY TO	The Boeing Company	Attn: Jim Bet
ELECTRONIC COPY TO	Landau	Attn: Jennifer Wynkoop
ELECTRONIC	Landau	Attn: Eric Weber

2425 New Holland Pike, PO Box 12425, Lancaster, PA 17605-2425 • 717-656-2300 Fax: 717-656-2681 • www.lancasterlabs.com

COPY TO		
ELECTRONIC	Landau	Attn: Sarah Weeks
COPY TO		
1 COPY TO	Data Package Group	
ELECTRONIC	Landau	Attn: Chip Halbert
COPY TO		
ELECTRONIC	Landau	Attn: Lauren McIntire
COPY TO		

Respectfully Submitted,

Elizabeth A. Leonhardt
Senior Specialist Group Leader

(510) 232-8894

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Analysis Report

Sample Description: IA03-20120229 SC# 138 NA Air
Boeing Auburn

LLI Sample # AQ 6566115
LLI Group # 1292966
Account # 13419

Project Name: Boeing Auburn

Collected: 02/29/2012 07:10 by LM
through 02/29/2012 16:40
Submitted: 03/05/2012 08:30
Reported: 03/26/2012 21:52

The Boeing Company
PO Box 3707 MC 9U4-26
Seattle WA 98124

BAIA3 SDG#: BNW66-01

CAT No.	Analysis Name	CAS Number	As Received Final Result	LOQ	As Received Final Result	LOQ	DF
Volatiles in Air EPA TO-15 using SIM			ppb(v)	ppb(v)	ug/m3	ug/m3	
07345	cis-1,2-Dichloroethene	156-59-2	< 0.0500	0.0500	< 0.198	0.198	1
07345	Tetrachloroethene	127-18-4	< 0.0500	0.0500	< 0.339	0.339	1
07345	Trichloroethene	79-01-6	< 0.0500	0.0500	< 0.269	0.269	1
07345	Vinyl Chloride	75-01-4	< 0.0500	0.0500	< 0.128	0.128	1

LOQ = Limit of Quantitation

General Sample Comments

State of Washington Lab Certification No. C259

All QC is compliant unless otherwise noted. Please refer to the Quality Control Summary for overall QC performance data and associated samples.

Laboratory Sample Analysis Record

CAT No.	Analysis Name	Method	Trial#	Batch#	Analysis Date and Time	Analyst	Dilution Factor
07345	VC, PCE, TCE, c-1,2DCE TO15SIM	EPA TO-15 using SIM	1	C1208230AA	03/22/2012 23:27	Michael A Ziegler	1

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Analysis Report

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Sample Description: IA04-20120229 SC# 880 NA Air
Boeing Auburn

LLI Sample # AQ 6566116
LLI Group # 1292966
Account # 13419

Project Name: Boeing Auburn

Collected: 02/29/2012 07:23 by LM
through 02/29/2012 16:35
Submitted: 03/05/2012 08:30
Reported: 03/26/2012 21:52

The Boeing Company
PO Box 3707 MC 9U4-26
Seattle WA 98124

BAIA4 SDG#: BNW66-02

CAT No.	Analysis Name	CAS Number	As Received Final Result	LOQ	As Received Final Result	LOQ	DF
Volatiles in Air EPA TO-15 using SIM			ppb(v)	ppb(v)	ug/m3	ug/m3	
07345	cis-1,2-Dichloroethene	156-59-2	< 0.0500	0.0500	< 0.198	0.198	1
07345	Tetrachloroethene	127-18-4	< 0.0500	0.0500	< 0.339	0.339	1
07345	Trichloroethene	79-01-6	< 0.0500	0.0500	< 0.269	0.269	1
07345	Vinyl Chloride	75-01-4	< 0.0500	0.0500	< 0.128	0.128	1

LOQ = Limit of Quantitation

General Sample Comments

State of Washington Lab Certification No. C259

All QC is compliant unless otherwise noted. Please refer to the Quality Control Summary for overall QC performance data and associated samples.

Laboratory Sample Analysis Record

CAT No.	Analysis Name	Method	Trial#	Batch#	Analysis Date and Time	Analyst	Dilution Factor
07345	VC, PCE, TCE, c-1,2DCE TO15SIM	EPA TO-15 using SIM	1	C1208230AA	03/23/2012 00:15	Michael A Ziegler	1

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Analysis Report

Sample Description: IA05-20120229 SC# 537 NA Air
Boeing Auburn

LLI Sample # AQ 6566117
LLI Group # 1292966
Account # 13419

Project Name: Boeing Auburn

Collected: 02/29/2012 07:04 by LM
through 02/29/2012 16:34
Submitted: 03/05/2012 08:30
Reported: 03/26/2012 21:52

The Boeing Company
PO Box 3707 MC 9U4-26
Seattle WA 98124

BAIA5 SDG#: BNW66-03

CAT No.	Analysis Name	CAS Number	As Received Final Result	LOQ	As Received Final Result	LOQ	DF
Volatiles in Air EPA TO-15 using SIM			ppb(v)	ppb(v)	ug/m3	ug/m3	
07345	cis-1,2-Dichloroethene	156-59-2	< 0.0500	0.0500	< 0.198	0.198	1
07345	Tetrachloroethene	127-18-4	< 0.0500	0.0500	< 0.339	0.339	1
07345	Trichloroethene	79-01-6	< 0.0500	0.0500	< 0.269	0.269	1
07345	Vinyl Chloride	75-01-4	< 0.0500	0.0500	< 0.128	0.128	1

LOQ = Limit of Quantitation

General Sample Comments

State of Washington Lab Certification No. C259

All QC is compliant unless otherwise noted. Please refer to the Quality Control Summary for overall QC performance data and associated samples.

Laboratory Sample Analysis Record

CAT No.	Analysis Name	Method	Trial#	Batch#	Analysis Date and Time	Analyst	Dilution Factor
07345	VC, PCE, TCE, c-1,2DCE TO15SIM	EPA TO-15 using SIM	1	C1208230AA	03/23/2012 01:05	Michael A Ziegler	1

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Analysis Report

Sample Description: IA06-20120229 SC# 180 NA Air
Boeing Auburn

LLI Sample # AQ 6566118
LLI Group # 1292966
Account # 13419

Project Name: Boeing Auburn

Collected: 02/29/2012 07:39 by LM
through 02/29/2012 16:37
Submitted: 03/05/2012 08:30
Reported: 03/26/2012 21:52

The Boeing Company
PO Box 3707 MC 9U4-26
Seattle WA 98124

BAIA6 SDG#: BNW66-04

CAT No.	Analysis Name	CAS Number	As Received Final Result	LOQ	As Received Final Result	LOQ	DF
Volatiles in Air EPA TO-15 using SIM			ppb(v)	ppb(v)	ug/m3	ug/m3	
07345	cis-1,2-Dichloroethene	156-59-2	< 0.0500	0.0500	< 0.198	0.198	1
07345	Tetrachloroethene	127-18-4	< 0.0500	0.0500	< 0.339	0.339	1
07345	Trichloroethene	79-01-6	< 0.0500	0.0500	< 0.269	0.269	1
07345	Vinyl Chloride	75-01-4	< 0.0500	0.0500	< 0.128	0.128	1

LOQ = Limit of Quantitation

General Sample Comments

State of Washington Lab Certification No. C259

All QC is compliant unless otherwise noted. Please refer to the Quality Control Summary for overall QC performance data and associated samples.

Laboratory Sample Analysis Record

CAT No.	Analysis Name	Method	Trial#	Batch#	Analysis Date and Time	Analyst	Dilution Factor
07345	VC, PCE, TCE, c-1,2DCE TO15SIM	EPA TO-15 using SIM	1	C1208230AA	03/23/2012 02:00	Michael A Ziegler	1

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Analysis Report

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Sample Description: IA07-20120229 SC# 1106 NA Air
Boeing Auburn

LLI Sample # AQ 6566119
LLI Group # 1292966
Account # 13419

Project Name: Boeing Auburn

Collected: 02/29/2012 07:43 by LM
through 02/29/2012 16:45
Submitted: 03/05/2012 08:30
Reported: 03/26/2012 21:52

The Boeing Company
PO Box 3707 MC 9U4-26
Seattle WA 98124

BAIA7 SDG#: BNW66-05

CAT No.	Analysis Name	CAS Number	As Received Final Result	LOQ	As Received Final Result	LOQ	DF
Volatiles in Air EPA TO-15 using SIM			ppb(v)	ppb(v)	ug/m3	ug/m3	
07345	cis-1,2-Dichloroethene	156-59-2	< 0.0500	0.0500	< 0.198	0.198	1
07345	Tetrachloroethene	127-18-4	< 0.0500	0.0500	< 0.339	0.339	1
07345	Trichloroethene	79-01-6	< 0.0500	0.0500	< 0.269	0.269	1
07345	Vinyl Chloride	75-01-4	< 0.0500	0.0500	< 0.128	0.128	1

LOQ = Limit of Quantitation

General Sample Comments

State of Washington Lab Certification No. C259

All QC is compliant unless otherwise noted. Please refer to the Quality Control Summary for overall QC performance data and associated samples.

Laboratory Sample Analysis Record

CAT No.	Analysis Name	Method	Trial#	Batch#	Analysis Date and Time	Analyst	Dilution Factor
07345	VC, PCE, TCE, c-1,2DCE TO15SIM	EPA TO-15 using SIM	1	C1208230AB	03/23/2012 12:58	Jeffrey B Smith	1

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Analysis Report

Sample Description: IA08-20120229 SC# 135 NA Air
Boeing Auburn

LLI Sample # AQ 6566120
LLI Group # 1292966
Account # 13419

Project Name: Boeing Auburn

Collected: 02/29/2012 09:24 by LM
through 02/29/2012 17:56
Submitted: 03/05/2012 08:30
Reported: 03/26/2012 21:52

The Boeing Company
PO Box 3707 MC 9U4-26
Seattle WA 98124

BAIA8 SDG#: BNW66-06

CAT No.	Analysis Name	CAS Number	As Received Final Result	LOQ	As Received Final Result	LOQ	DF
Volatiles in Air EPA TO-15 using SIM			ppb(v)	ppb(v)	ug/m3	ug/m3	
07345	cis-1,2-Dichloroethene	156-59-2	< 0.0500	0.0500	< 0.198	0.198	1
07345	Tetrachloroethene	127-18-4	< 0.0500	0.0500	< 0.339	0.339	1
07345	Trichloroethene	79-01-6	< 0.0500	0.0500	< 0.269	0.269	1
07345	Vinyl Chloride	75-01-4	< 0.0500	0.0500	< 0.128	0.128	1

LOQ = Limit of Quantitation

General Sample Comments

State of Washington Lab Certification No. C259

All QC is compliant unless otherwise noted. Please refer to the Quality Control Summary for overall QC performance data and associated samples.

Laboratory Sample Analysis Record

CAT No.	Analysis Name	Method	Trial#	Batch#	Analysis Date and Time	Analyst	Dilution Factor
07345	VC, PCE, TCE, c-1,2DCE TO15SIM	EPA TO-15 using SIM	1	C1208230AB	03/23/2012 13:45	Jeffrey B Smith	1

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Analysis Report

Sample Description: IA09-20120229 SC# 1089 NA Air
Boeing Auburn

LLI Sample # AQ 6566121
LLI Group # 1292966
Account # 13419

Project Name: Boeing Auburn

Collected: 02/29/2012 09:34 by LM
through 02/29/2012 19:37
Submitted: 03/05/2012 08:30
Reported: 03/26/2012 21:52

The Boeing Company
PO Box 3707 MC 9U4-26
Seattle WA 98124

BAIA9 SDG#: BNW66-07

CAT No.	Analysis Name	CAS Number	As Received Final Result	LOQ	As Received Final Result	LOQ	DF
Volatiles in Air EPA TO-15 using SIM			ppb(v)	ppb(v)	ug/m3	ug/m3	
07345	cis-1,2-Dichloroethene	156-59-2	< 0.0500	0.0500	< 0.198	0.198	1
07345	**Tetrachloroethene**	127-18-4	**0.0549**	0.0500	**0.372**	0.339	1
07345	Trichloroethene	79-01-6	< 0.0500	0.0500	< 0.269	0.269	1
07345	Vinyl Chloride	75-01-4	< 0.0500	0.0500	< 0.128	0.128	1

LOQ = Limit of Quantitation

General Sample Comments

State of Washington Lab Certification No. C259

All QC is compliant unless otherwise noted. Please refer to the Quality Control Summary for overall QC performance data and associated samples.

Laboratory Sample Analysis Record

CAT No.	Analysis Name	Method	Trial#	Batch#	Analysis Date and Time	Analyst	Dilution Factor
07345	VC, PCE, TCE, c-1,2DCE TO15SIM	EPA TO-15 using SIM	1	C1208230AB	03/23/2012 14:33	Jeffrey B Smith	1

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Analysis Report

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Sample Description: IA99-20120229 SC# 872 NA Air
Boeing Auburn

LLI Sample # AQ 6566122
LLI Group # 1292966
Account # 13419

Project Name: Boeing Auburn

Collected: 02/29/2012 07:33 by LM
through 02/29/2012 16:43
Submitted: 03/05/2012 08:30
Reported: 03/26/2012 21:52

The Boeing Company
PO Box 3707 MC 9U4-26
Seattle WA 98124

BAI99 SDG#: BNW66-08

CAT No.	Analysis Name	CAS Number	As Received Final Result	LOQ	As Received Final Result	LOQ	DF
Volatiles in Air EPA TO-15 using SIM			ppb(v)	ppb(v)	ug/m3	ug/m3	
07345	cis-1,2-Dichloroethene	156-59-2	< 0.0500	0.0500	< 0.198	0.198	1
07345	Tetrachloroethene	127-18-4	< 0.0500	0.0500	< 0.339	0.339	1
07345	Trichloroethene	79-01-6	< 0.0500	0.0500	< 0.269	0.269	1
07345	Vinyl Chloride	75-01-4	< 0.0500	0.0500	< 0.128	0.128	1

LOQ = Limit of Quantitation

General Sample Comments

State of Washington Lab Certification No. C259

All QC is compliant unless otherwise noted. Please refer to the Quality Control Summary for overall QC performance data and associated samples.

Laboratory Sample Analysis Record

CAT No.	Analysis Name	Method	Trial#	Batch#	Analysis Date and Time	Analyst	Dilution Factor
07345	VC, PCE, TCE, c-1,2DCE TO15SIM	EPA TO-15 using SIM	1	C1208230AB	03/23/2012 15:21	Jeffrey B Smith	1

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Analysis Report

Sample Description: AA02-20120229 SC# 067 NA Air
Boeing Auburn

LLI Sample # AQ 6566123
LLI Group # 1292966
Account # 13419

Project Name: Boeing Auburn

Collected: 02/29/2012 08:09 by LM
through 02/29/2012 17:20
Submitted: 03/05/2012 08:30
Reported: 03/26/2012 21:52

The Boeing Company
PO Box 3707 MC 9U4-26
Seattle WA 98124

BAAA2 SDG#: BNW66-09

CAT No.	Analysis Name	CAS Number	As Received Final Result	LOQ	As Received Final Result	LOQ	DF
Volatiles in Air EPA TO-15 using SIM			ppb(v)	ppb(v)	ug/m3	ug/m3	
07345	cis-1,2-Dichloroethene	156-59-2	< 0.0500	0.0500	< 0.198	0.198	1
07345	Tetrachloroethene	127-18-4	< 0.0500	0.0500	< 0.339	0.339	1
07345	Trichloroethene	79-01-6	< 0.0500	0.0500	< 0.269	0.269	1
07345	Vinyl Chloride	75-01-4	< 0.0500	0.0500	< 0.128	0.128	1

LOQ = Limit of Quantitation

General Sample Comments

State of Washington Lab Certification No. C259

All QC is compliant unless otherwise noted. Please refer to the Quality Control Summary for overall QC performance data and associated samples.

Laboratory Sample Analysis Record

CAT No.	Analysis Name	Method	Trial#	Batch#	Analysis Date and Time	Analyst	Dilution Factor
07345	VC, PCE, TCE, c-1,2DCE TO15SIM	EPA TO-15 using SIM	1	C1208230AB	03/23/2012 16:08	Jeffrey B Smith	1

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Analysis Report

Sample Description: AA03-20120229 SC# 831 NA Air
Boeing Auburn

LLI Sample # AQ 6566124
LLI Group # 1292966
Account # 13419

Project Name: Boeing Auburn

Collected: 02/29/2012 10:53 by LM
through 02/29/2012 20:28
Submitted: 03/05/2012 08:30
Reported: 03/26/2012 21:52

The Boeing Company
PO Box 3707 MC 9U4-26
Seattle WA 98124

BAAA3 SDG#: BNW66-10

CAT No.	Analysis Name	CAS Number	As Received Final Result	LOQ	As Received Final Result	LOQ	DF
Volatiles in Air EPA TO-15 using SIM			ppb(v)	ppb(v)	ug/m3	ug/m3	
07345	cis-1,2-Dichloroethene	156-59-2	< 0.0500	0.0500	< 0.198	0.198	1
07345	Tetrachloroethene	127-18-4	< 0.0500	0.0500	< 0.339	0.339	1
07345	Trichloroethene	79-01-6	< 0.0500	0.0500	< 0.269	0.269	1
07345	Vinyl Chloride	75-01-4	< 0.0500	0.0500	< 0.128	0.128	1

LOQ = Limit of Quantitation

General Sample Comments

State of Washington Lab Certification No. C259

All QC is compliant unless otherwise noted. Please refer to the Quality Control Summary for overall QC performance data and associated samples.

Laboratory Sample Analysis Record

CAT No.	Analysis Name	Method	Trial#	Batch#	Analysis Date and Time	Analyst	Dilution Factor
07345	VC, PCE, TCE, c-1,2DCE TO15SIM	EPA TO-15 using SIM	1	C1208230AB	03/23/2012 16:56	Jeffrey B Smith	1

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Analysis Report

Sample Description: AA04-20120229 SC# 819 NA Air
Boeing Auburn

LLI Sample # AQ 6566125
LLI Group # 1292966
Account # 13419

Project Name: Boeing Auburn

Collected: 02/29/2012 09:45 by LM
through 02/29/2012 18:25
Submitted: 03/05/2012 08:30
Reported: 03/26/2012 21:52

The Boeing Company
PO Box 3707 MC 9U4-26
Seattle WA 98124

BAAA4 SDG#: BNW66-11

CAT No.	Analysis Name	CAS Number	As Received Final Result	LOQ	As Received Final Result	LOQ	DF
Volatiles in Air EPA TO-15 using SIM			ppb(v)	ppb(v)	ug/m3	ug/m3	
07345	cis-1,2-Dichloroethene	156-59-2	< 0.0500	0.0500	< 0.198	0.198	1
07345	Tetrachloroethene	127-18-4	< 0.0500	0.0500	< 0.339	0.339	1
07345	Trichloroethene	79-01-6	< 0.0500	0.0500	< 0.269	0.269	1
07345	Vinyl Chloride	75-01-4	< 0.0500	0.0500	< 0.128	0.128	1

LOQ = Limit of Quantitation

General Sample Comments

State of Washington Lab Certification No. C259

All QC is compliant unless otherwise noted. Please refer to the Quality Control Summary for overall QC performance data and associated samples.

Laboratory Sample Analysis Record

CAT No.	Analysis Name	Method	Trial#	Batch#	Analysis Date and Time	Analyst	Dilution Factor
07345	VC, PCE, TCE, c-1,2DCE TO15SIM	EPA TO-15 using SIM	1	C1208230AB	03/23/2012 17:44	Jeffrey B Smith	1

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Analysis Report

Sample Description: AA01-20120228 SC# 835 NA Air
Boeing Auburn

LLI Sample # AQ 6566126
LLI Group # 1292966
Account # 13419

Project Name: Boeing Auburn

Collected: 02/28/2012 07:09 by LM
through 02/28/2012 16:54
Submitted: 03/05/2012 08:30
Reported: 03/26/2012 21:52

The Boeing Company
PO Box 3707 MC 9U4-26
Seattle WA 98124

BAAA1 SDG#: BNW66-12

CAT No.	Analysis Name	CAS Number	As Received Final Result	LOQ	As Received Final Result	LOQ	DF
Volatiles in Air EPA TO-15 using SIM			ppb(v)	ppb(v)	ug/m3	ug/m3	
07345	cis-1,2-Dichloroethene	156-59-2	< 0.0500	0.0500	< 0.198	0.198	1
07345	Tetrachloroethene	127-18-4	< 0.0500	0.0500	< 0.339	0.339	1
07345	Trichloroethene	79-01-6	< 0.0500	0.0500	< 0.269	0.269	1
07345	Vinyl Chloride	75-01-4	< 0.0500	0.0500	< 0.128	0.128	1

LOQ = Limit of Quantitation

General Sample Comments

State of Washington Lab Certification No. C259

All QC is compliant unless otherwise noted. Please refer to the Quality Control Summary for overall QC performance data and associated samples.

Laboratory Sample Analysis Record

CAT No.	Analysis Name	Method	Trial#	Batch#	Analysis Date and Time	Analyst	Dilution Factor
07345	VC, PCE, TCE, c-1,2DCE TO15SIM	EPA TO-15 using SIM	1	C1208230AB	03/23/2012 18:32	Jeffrey B Smith	1

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Analysis Report

Sample Description: IA02-20120228 SC# 882 NA Air
Boeing Auburn

LLI Sample # AQ 6566127
LLI Group # 1292966
Account # 13419

Project Name: Boeing Auburn

Collected: 02/28/2012 06:37 by LM
through 02/28/2012 16:28
Submitted: 03/05/2012 08:30
Reported: 03/26/2012 21:52

The Boeing Company
PO Box 3707 MC 9U4-26
Seattle WA 98124

BAIA2 SDG#: BNW66-13

CAT No.	Analysis Name	CAS Number	As Received Final Result	LOQ	As Received Final Result	LOQ	DF
Volatiles in Air EPA TO-15 using SIM			ppb(v)	ppb(v)	ug/m3	ug/m3	
07345	cis-1,2-Dichloroethene	156-59-2	< 0.0500	0.0500	< 0.198	0.198	1
07345	Tetrachloroethene	127-18-4	< 0.0500	0.0500	< 0.339	0.339	1
07345	Trichloroethene	79-01-6	< 0.0500	0.0500	< 0.269	0.269	1
07345	Vinyl Chloride	75-01-4	< 0.0500	0.0500	< 0.128	0.128	1

LOQ = Limit of Quantitation

General Sample Comments

State of Washington Lab Certification No. C259

All QC is compliant unless otherwise noted. Please refer to the Quality Control Summary for overall QC performance data and associated samples.

Laboratory Sample Analysis Record

CAT No.	Analysis Name	Method	Trial#	Batch#	Analysis Date and Time	Analyst	Dilution Factor
07345	VC, PCE, TCE, c-1,2DCE TO15SIM	EPA TO-15 using SIM	1	C1208230AB	03/23/2012 19:20	Jeffrey B Smith	1

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Analysis Report

Sample Description: IA01-20120228 SC# 161 NA Air
Boeing Auburn

LLI Sample # AQ 6566128
LLI Group # 1292966
Account # 13419

Project Name: Boeing Auburn

Collected: 02/28/2012 06:35 by LM
through 02/28/2012 16:43
Submitted: 03/05/2012 08:30
Reported: 03/26/2012 21:52

The Boeing Company
PO Box 3707 MC 9U4-26
Seattle WA 98124

BAIA1 SDG#: BNW66-14*

CAT No.	Analysis Name	CAS Number	As Received Final Result	LOQ	As Received Final Result	LOQ	DF
Volatiles in Air EPA TO-15 using SIM			ppb(v)	ppb(v)	ug/m3	ug/m3	
07345	cis-1,2-Dichloroethene	156-59-2	< 5.00	5.00	< 19.8	19.8	100
07345	**Tetrachloroethene**	127-18-4	**135**	50.0	**918**	339	1000
07345	Trichloroethene	79-01-6	< 5.00	5.00	< 26.9	26.9	100
07345	Vinyl Chloride	75-01-4	< 5.00	5.00	< 12.8	12.8	100

Reporting limits were raised due to interference from the sample matrix.

LOQ = Limit of Quantitation

General Sample Comments

State of Washington Lab Certification No. C259

All QC is compliant unless otherwise noted. Please refer to the Quality Control Summary for overall QC performance data and associated samples.

Laboratory Sample Analysis Record

CAT No.	Analysis Name	Method	Trial#	Batch#	Analysis Date and Time	Analyst	Dilution Factor
07345	VC, PCE, TCE, c-1,2DCE TO15SIM	EPA TO-15 using SIM	1	C1208230AB	03/23/2012 20:07	Jeffrey B Smith	1000
07345	VC, PCE, TCE, c-1,2DCE TO15SIM	EPA TO-15 using SIM	1	C1208230AC	03/24/2012 15:22	Michael A Ziegler	100

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Quality Control Summary

Client Name: The Boeing Company Group Number: 1292966
Reported: 03/26/12 at 09:52 PM

Matrix QC may not be reported if insufficient sample or site-specific QC samples were not submitted. In these situations, to demonstrate precision and accuracy at a batch level, a LCS/LCSD was performed, unless otherwise specified in the method.

All Inorganic Initial Calibration and Continuing Calibration Blanks met acceptable method criteria unless otherwise noted on the Analysis Report.

Laboratory Compliance Quality Control

Analysis Name	Blank Result	Blank LOQ	Report Units	LCS %REC	LCSD %REC	LCS/LCSD Limits	RPD	RPD Max
Batch number: C1208230AA	Sample number(s): 6566115-6566118							
cis-1,2-Dichloroethene	< 0.0500	0.0500	ppb(v)	96	93	56-134	4	25
Tetrachloroethene	< 0.0500	0.0500	ppb(v)	85	85	70-130	1	25
Trichloroethene	< 0.0500	0.0500	ppb(v)	92	92	70-130	0	25
Vinyl Chloride	< 0.0500	0.0500	ppb(v)	110	103	50-159	7	25
Batch number: C1208230AB	Sample number(s): 6566119-6566128							
cis-1,2-Dichloroethene	< 0.0500	0.0500	ppb(v)	96	93	56-134	4	25
Tetrachloroethene	< 0.0500	0.0500	ppb(v)	85	85	70-130	1	25
Trichloroethene	< 0.0500	0.0500	ppb(v)	92	92	70-130	0	25
Vinyl Chloride	< 0.0500	0.0500	ppb(v)	110	103	50-159	7	25
Batch number: C1208230AC	Sample number(s): 6566128							
cis-1,2-Dichloroethene	< 0.0500	0.0500	ppb(v)	96	93	56-134	4	25
Trichloroethene	< 0.0500	0.0500	ppb(v)	92	92	70-130	0	25
Vinyl Chloride	< 0.0500	0.0500	ppb(v)	110	103	50-159	7	25

*- Outside of specification
(1) The result for one or both determinations was less than five times the LOQ.
(2) The unspiked result was more than four times the spike added.

Project Name: Boeing Auburn
LLI Group #: 1292966

General Comments:

See the Laboratory Sample Analysis Record section of the Analysis Report for the method references.

All QC met criteria unless otherwise noted in an Analysis Specific Comment below. Refer to the QC Summary for specific values and acceptance criteria.

Project specific QC samples are not included in this data set

Matrix QC may not be reported if site-specific QC samples were not submitted. In these situations, to demonstrate precision and accuracy at a batch level, a LCS/LCSD was performed, unless otherwise specified in the method.

Surrogate recoveries (if applicable) which are outside of the QC window are confirmed unless attributed to a dilution or otherwise noted in an Analysis Specific Comment below.

The samples were received at the appropriate temperature and in accordance with the chain of custody unless otherwise noted.

Analysis Specific Comments:

EPA TO-15 using SIM, Volatiles in Air

Sample #s: 6566128

Reporting limits were raised due to interference from the sample matrix.

Summa Canister Field Test Data/Chain of Custody

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Acct. # 13419 For Lancaster Laboratories use only Group # 1292966 Sample # 6566115-28

Please print. Instructions on reverse side correspond.

(1) Client Information

Client: Boeing
Account #: [redacted]
Project Name/#: Boeing Auburn / 0025164.090.930
Project Manager: Eric Weber
P.O. #:
Sampler: Lauren McIntire
Quote #:
Name of state where samples were collected: Washington

(3) Turnaround Time Requested (TAT) (circle one)

Standard

Rush (specify) _____

(4) Data Package Required?

Yes No

(5) EDD Required?

Yes No

(2) Sample Identification	Sample Collection Date	Time Start (24 hr clock)	Time Stop (24 hr clock)	Canister Pressure in Field ("Hg) (Start)	Canister Pressure in Field ("Hg) (Stop)	Interior Temp. (F) (Start)	Interior Temp. (F) (Stop)	Flow Reg. ID	Can ID	Can Size (L)	Controller Flowrate (ml/min)	(6) Analyses Requested: EPA TO-15 SIM (PCE, TCE, VC, cis-1,2-DCE)	EPA 18 ☐ MTBE ☐ BTEX	EPA 25 (select range below)	Helium as tracer	O2/CO2	Library Search
IA 03-20120229	2/29/12	0710	1640	27.5	0	—	—	337700	138	6	10	X					
IA 04-20120229		0723	1635	28	1	—	—	329349	880	6							
IA 05-20120229		0704	1634	29	4	—	—	336657	537	6							
IA 06-20120229		0739	1637	30	4	—	—	337492	180	6							
IA 07-20120229		0743	1645	29.5	4.5	—	—	304036	1106	6							
IA 08-20120229		0924	1756	26.5	4	—	—	316942	135	6							
IA 09-20120229		0934	1937	27.5	14	—	—	303934	1089	6							
IA 99-20120229		0733	1643	29	5	—	—	204625	872	6							
AA 02-20120229		0809	1720	25	1	—	—	301670	067	6							
AA 03-20120229		1053	2026	>30	5	—	—	236813	831	6							

(7) Instructions/QC Requirements & Comments

TO-15 SIM for PCE, TCE, VC, & cis-1,2-DCE ONLY

Note: IA09-20120229 ran for 10 hours but due to damaged nickel sample tip; flow was restricted & <6L were collected

EPA 25 (check one) ☐ C1 - C4 ☐ C2 - C10 ☐ C1 - C10 ☐ C4 - C10 (GRO) ☐ C2 - C4

Canisters Shipped by:	Date/Time:	Canisters Received by:	Date/Time (8)
Toni J. Smith	3/2/2012 0830		
Relinquished by:	Date/Time:	Received by:	Date/Time:
Relinquished by:	Date/Time:	Received by:	Date/Time: 3/4/12 0830

Summa Canister Field Test Data/Chain of Custody

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Acct. # 13419 For Lancaster Laboratories use only Group # 1292966 Sample # 6566115-28

Please print. Instructions on reverse side correspond.

(1) Client Information

Client: Boeing
Account #:
Project Name/#: Boeing Auburn / 0025164.090.930
Project Manager: Eric Weber
P.O. #:
Sampler: Lauren McIntire
Quote #:
Name of state where samples were collected: Washington

(3) Turnaround Time Requested (TAT) (circle one)

(Standard)

Rush (specify) _____

(4) Data Package Required?

(Yes) No

(5) EDD Required?

(Yes) No

(6) Analyses Requested

EPA TO-15 SIM PCE, TCE, VC, cis 1,2 DCE ☐ MTBE ☐ BTEX

EPA 18

EPA 25 (select range below)

Helium as tracer

O2/CO2

Library Search

(2) Sample Identification	Sample Collection Date	Time Start (24 hr clock)	Time Stop (24 hr clock)	Canister Pressure in Field ("Hg) (Start)	Canister Pressure in Field ("Hg) (Stop)	Interior Temp. (F) (Start)	Interior Temp. (F) (Stop)	Flow Reg. ID	Can ID	Can Size (L)	Controller Flowrate (ml/min)	EPA TO-15 SIM PCE, TCE, VC, cis 1,2 DCE	EPA 18	EPA 25 (select range below)	Helium as tracer	O2/CO2	Library Search
AA 04-20120229	2/29/12	0945	1825	28.5	5.5			339240	819	6	10	X					
AA01-20120228	2/28/12	0709	1654	28	1			337710	635	6	10	X					
IA02-20120228	2/28/12	0637	1628	30	3			336737	882	6	10	X					
IA01-20120228	2/28/12	0635	1643	30	4			234836	161	6	10	X					

(7) Instructions/QC Requirements & Comments

TO-15 SIM for PCE, TCE, Vinylchloride, cis 1,2-DCE ONLY

EPA 25 (check one)

☐ C1 - C4 ☐ C2 - C10

☐ C1 - C10 ☐ C4 - C10 (GRO)

☐ C2 - C4

Canisters Shipped by:	Date/Time:	Canisters Received by:	Date/Time (8)
Toni J. Smith	3/2/2012 0830		
Relinquished by:	Date/Time:	Received by:	Date/Time:
Relinquished by:	Date/Time:	Received by:	Date/Time: 3/4/12 0830

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Environmental Sample Administration Receipt Documentation Log

Client/Project: Boeing

Date of Receipt: 3/5/12

Time of Receipt: 0830

Source Code: 50-1

Shipping Container Sealed: (YES) NO

Custody Seal Present * : YES (NO)

* Custody seal was intact unless otherwise noted in the discrepancy section

Package: Chilled (Not Chilled)

Temperature of Shipping Containers							
Cooler #	Thermometer ID	Temperature (°C)	Temp Bottle (TB) or Surface Temp (ST)	Wet Ice (WI) or Dry Ice (DI) or Ice Packs (IP)	Ice Present? Y/N	Loose (L) Bagged Ice (B) or NA	Comments
1							
2							
3							
4							
5							
6							

Number of Trip Blanks received NOT listed on chain of custody: 0

Paperwork Discrepancy/Unpacking Problems:

Rcvd cans #s 891 and 511 w/o samples. - extra cans KMZ 3-5-12

Rcvd 23 flow controllers, 24 pcs. of Swagelok tubing connectors, and 2 sets of Swagelok "T" tubing.

Unpacker Signature/Emp#: Henry Hecht 2316 **Date/Time:** 3/5/12 0940

Issued by Dept. 6042 Management

2174.06

ORIGIN ID: TCMA

UNITED STATES US

SHIP DATE: 02MAR12
ACTWGT: 18.1 LB
CAD: /POS1302
DIMS: 16x16x16 IN

BILL RECIPIENT

TO SAMPLE RECIEVING
LANCASTER LABORATORIES
2425 NEW HOLLAND PIKE

LANCASTER PA 17601
(717) 656-2300
INV:
PO: REF:
DEPT:

FedEx Express

J12101112180125

1 of 11

TRK# 0215 8534 3954 5289

MASTER

MON - 05 MAR A2
PRIORITY OVERNIGHT

TD LNSA

17601
PA-US MDT

ORIGIN ID: TCMA

UNITED STATES US

SHIP DATE: 02MAR12
ACTWGT: 15.0 LB
CAD: /POS1302
DIMS: 16x16x16 IN

BILL RECIPIENT

TO SAMPLE RECIEVING
LANCASTER LABORATORIES
2425 NEW HOLLAND PIKE

LANCASTER PA 17601
(717) 656-2300
INV:
PO: REF:
DEPT:

FedEx Express

J12101112190126

2 of 11

MPS# 0681 7955 4369 8284

Mstr# 8534 3954 5289 0215

MON - 05 MAR A2
PRIORITY OVERNIGHT

TD LNSA

17601
PA-US MDT

ORIGIN ID: TCMA

UNITED STATES US

SHIP DATE: 02MAR12
ACTWGT: 22.0 LB
CAD: /POS1302
DIMS: 16x16x16 IN

BILL RECIPIENT

TO SAMPLE RECIEVING
LANCASTER LABORATORIES
2425 NEW HOLLAND PIKE

LANCASTER PA 17601
(717) 656-2300
INV:
PO:
REF:
DEPT:

FedEx Express

J12101112190125

3 of 11
MPS# 0681 7955 4369 8295
Mstr# 8534 3954 5289

MON - 05 MAR A2
PRIORITY OVERNIGHT

0215

TD LNSA

17601
PA-US MDT

ORIGIN ID: TCMA

UNITED STATES US

SHIP DATE: 02MAR12
ACTWGT: 19.0 LB
CAD: /POS1302
DIMS: 16x16x16 IN

BILL RECIPIENT

TO SAMPLE RECIEVING
LANCASTER LABORATORIES
2425 NEW HOLLAND PIKE

LANCASTER PA 17601
(717) 656-2300
INV:
PO:
REF:
DEPT:

FedEx Express

J12101112190125

4 of 11
MPS# 0681 7955 4369 8300
Mstr# 8534 3954 5289

MON - 05 MAR A2
PRIORITY OVERNIGHT

0215

TD LNSA

17601
PA-US MDT

ORIGIN ID: TCMA

SHIP DATE: 02MAR12
ACTWGT: 19.0 LB
CAD: /POS1302
DIMS: 16x16x16 IN

BILL RECIPIENT

UNITED STATES US

TO SAMPLE RECIEVING
LANCASTER LABORATORIES
2425 NEW HOLLAND PIKE

LANCASTER PA 17601
(717) 656-2300
INV:
PO:
REF:
DEPT:

FedEx Express

5 of 11

MPS# 0681 7955 4369 8310

Mstr# 8534 3954 5289

0215

MON - 05 MAR A2
PRIORITY OVERNIGHT

TD LNSA

17601
PA-US MDT

ORIGIN ID: TCMA

SHIP DATE: 02MAR12
ACTWGT: 19.0 LB
CAD: /POS1302
DIMS: 16x16x16 IN

BILL RECIPIENT

UNITED STATES US

TO SAMPLE RECIEVING
LANCASTER LABORATORIES
2425 NEW HOLLAND PIKE

LANCASTER PA 17601
(717) 656-2300
INV:
PO:
REF:
DEPT:

FedEx Express

6 of 11

MPS# 0681 7955 4369 8321

Mstr# 8534 3954 5289

0215

MON - 05 MAR A2
PRIORITY OVERNIGHT

TD LNSA

17601
PA-US MDT

ORIGIN ID: TCMA

SHIP DATE: 02MAR12
ACTWGT: 21.0 LB
CAD: /POS1302
DIMS: 16x16x16 IN

UNITED STATES US

BILL RECIPIENT

TO SAMPLE RECIEVING
LANCASTER LABORATORIES
2425 NEW HOLLAND PIKE

LANCASTER PA 17601
(717) 656-2300
INV:
PO:
REF:
DEPT:

FedEx Express

J12101112190125

7 of 11
MPS# 0681 7955 4369 8332
Mstr# 8534 3954 5289

MON - 05 MAR A2
PRIORITY OVERNIGHT

0215

TD LNSA

17601
PA-US MDT

ORIGIN ID: TCMA

SHIP DATE: 02MAR12
ACTWGT: 18.0 LB
CAD: /POS1302
DIMS: 16x16x16 IN

UNITED STATES US

BILL RECIPIENT

TO SAMPLE RECIEVING
LANCASTER LABORATORIES
2425 NEW HOLLAND PIKE

LANCASTER PA 17601
(717) 656-2300
INV:
PO:
REF:
DEPT:

FedEx Express

J12101112190125

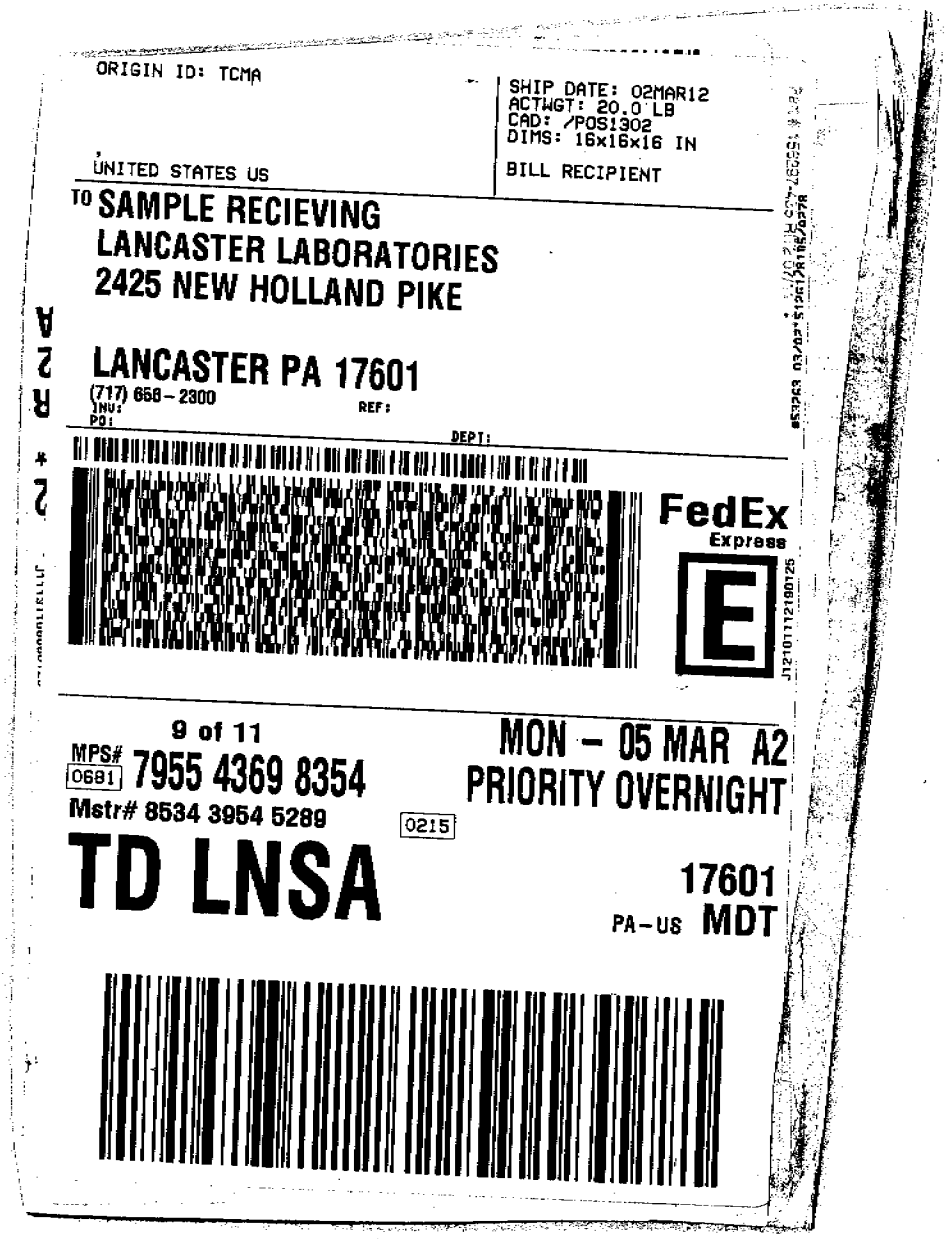
8 of 11
MPS# 0681 7955 4369 8343
Mstr# 8534 3954 5289

MON - 05 MAR A2
PRIORITY OVERNIGHT

0215

TD LNSA

17601
PA-US MDT



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SHIP DATE: 02MAR12
ACTWGT: 20.0 LB
CAD: /POS1302
DIMS: 16x16x16 IN

BILL RECIPIENT

UNITED STATES US

TO SAMPLE RECIEVING
LANCASTER LABORATORIES
2425 NEW HOLLAND PIKE

LANCASTER PA 17601
(717) 656-2300
INV:
PO:
REF:
DEPT:

FedEx Express

J12101112180125

9 of 11

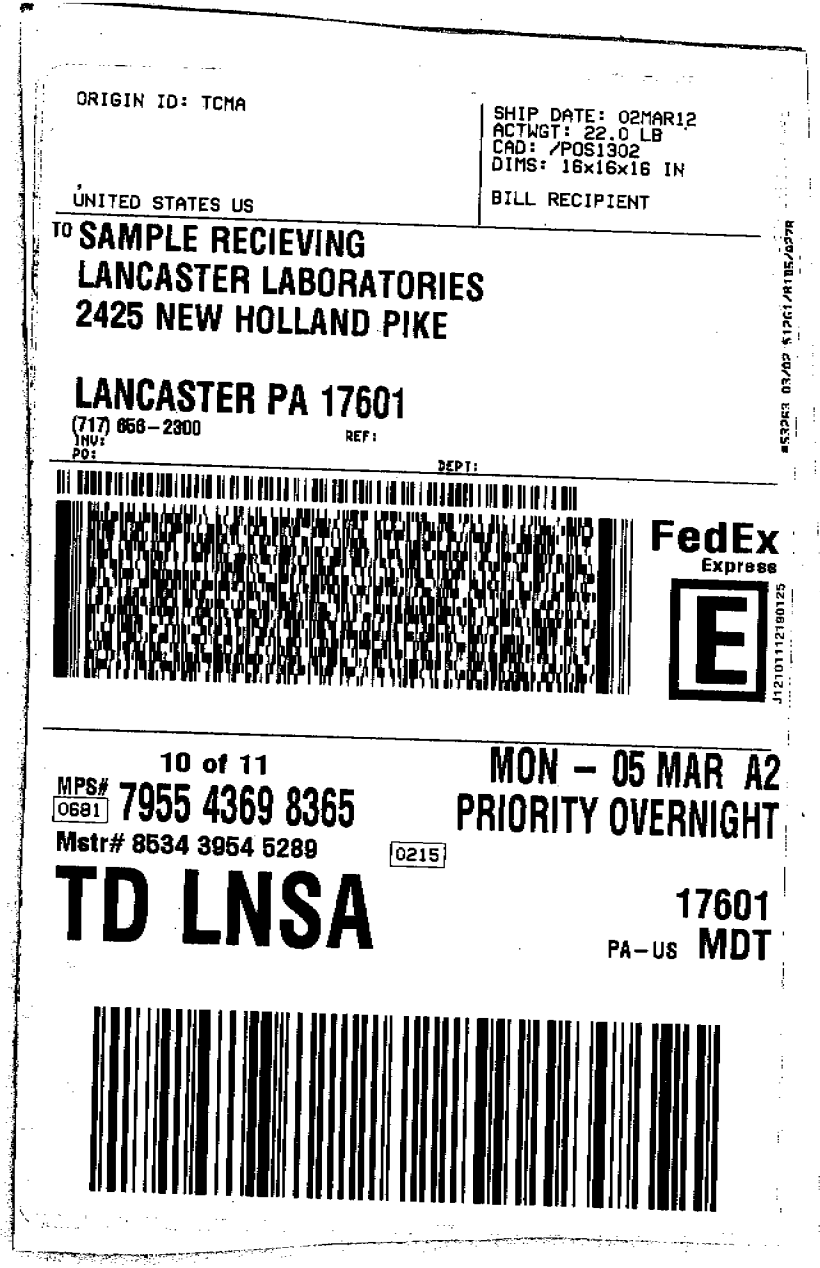
MPS# 0681 7955 4369 8354
Mstr# 8534 3954 5289

0215

MON - 05 MAR A2
PRIORITY OVERNIGHT

TD LNSA

17601
PA-US MDT



ORIGIN ID: TCMA

SHIP DATE: 02MAR12
ACTWGT: 22.0 LB
CAD: /POS1302
DIMS: 16x16x16 IN

BILL RECIPIENT

UNITED STATES US

TO SAMPLE RECIEVING
LANCASTER LABORATORIES
2425 NEW HOLLAND PIKE

LANCASTER PA 17601
(717) 656-2300
INV:
PO:
REF:
DEPT:

FedEx Express

J12101112180125

10 of 11

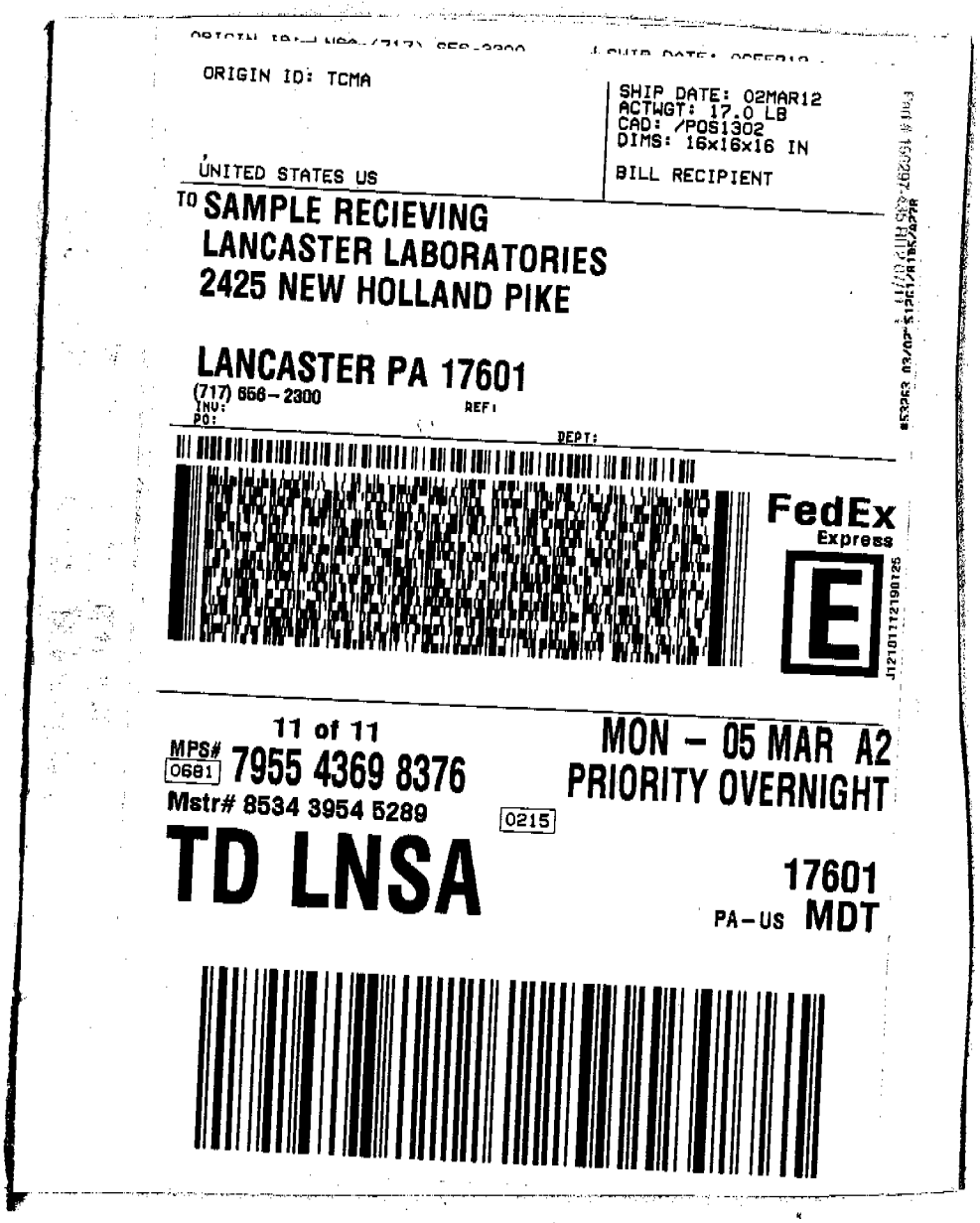
MPS# 0681 7955 4369 8365
Mstr# 8534 3954 5289

0215

MON - 05 MAR A2
PRIORITY OVERNIGHT

TD LNSA

17601
PA-US MDT



ORIGIN ID: TCMA

SHIP DATE: 02MAR12
ACTWGT: 17.0 LB
CAD: /POS1302
DIMS: 16x16x16 IN

UNITED STATES US

BILL RECIPIENT

TO SAMPLE RECIEVING
LANCASTER LABORATORIES
2425 NEW HOLLAND PIKE

LANCASTER PA 17601
(717) 656-2300
INV:
PO: REF:
DEPT:

FedEx Express

11 of 11
MPS# 0681 7955 4369 8376
Mstr# 8534 3954 5289

MON - 05 MAR A2
PRIORITY OVERNIGHT

TD LNSA

0215

17601
PA-US MDT

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Explanation of Symbols and Abbreviations

The following defines common symbols and abbreviations used in reporting technical data:

RL	Reporting Limit	**BMQL**	Below Minimum Quantitation Level
N.D.	none detected	**MPN**	Most Probable Number
TNTC	Too Numerous To Count	**CP Units**	cobalt-chloroplatinate units
IU	International Units	**NTU**	nephelometric turbidity units
umhos/cm	micromhos/cm	**ng**	nanogram(s)
C	degrees Celsius	**F**	degrees Fahrenheit
meq	milliequivalents	**lb.**	pound(s)
g	gram(s)	**kg**	kilogram(s)
µg	microgram(s)	**mg**	milligram(s)
mL	milliliter(s)	**L**	liter(s)
m3	cubic meter(s)	**µL**	microliter(s)
		pg/L	picogram/liter

< less than - The number following the sign is the limit of quantitation, the smallest amount of analyte which can be reliably determined using this specific test.

> greater than

ppm parts per million - One ppm is equivalent to one milligram per kilogram (mg/kg), or one gram per million grams. For aqueous liquids, ppm is usually taken to be equivalent to milligrams per liter (mg/l), because one liter of water has a weight very close to a kilogram. For gases or vapors, one ppm is equivalent to one microliter of gas per liter of gas.

ppb parts per billion

Dry weight basis Results printed under this heading have been adjusted for moisture content. This increases the analyte weight concentration to approximate the value present in a similar sample without moisture. All other results are reported on an as-received basis.

Data Qualifiers:

C – result confirmed by reanalysis.

J - estimated value – The result is ≥ the Method Detection Limit (MDL) and < the Limit of Quantitation (LOQ).

U.S. EPA CLP Data Qualifiers:

Organic Qualifiers		Inorganic Qualifiers	
A	TIC is a possible aldol-condensation product	**B**	Value is <CRDL, but ≥IDL
B	Analyte was also detected in the blank	**E**	Estimated due to interference
C	Pesticide result confirmed by GC/MS	**M**	Duplicate injection precision not met
D	Compound quantitated on a diluted sample	**N**	Spike sample not within control limits
E	Concentration exceeds the calibration range of the instrument	**S**	Method of standard additions (MSA) used for calculation
N	Presumptive evidence of a compound (TICs only)	**U**	Compound was not detected
P	Concentration difference between primary and confirmation columns >25%	**W**	Post digestion spike out of control limits
U	Compound was not detected	*****	Duplicate analysis not within control limits
X,Y,Z	Defined in case narrative	**+**	Correlation coefficient for MSA <0.995

Analytical test results meet all requirements of NELAC unless otherwise noted under the individual analysis.

Measurement uncertainty values, as applicable, are available upon request.

Tests results relate only to the sample tested. Clients should be aware that a critical step in a chemical or microbiological analysis is the collection of the sample. Unless the sample analyzed is truly representative of the bulk of material involved, the test results will be meaningless. If you have questions regarding the proper techniques of collecting samples, please contact us. We cannot be held responsible for sample integrity, however, unless sampling has been performed by a member of our staff. This report shall not be reproduced except in full, without the written approval of the laboratory.

Times are local to the area of activity. Parameters listed in the 40 CFR part 136 Table II as “analyze immediately” are not performed within 15 minutes.

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Analysis Report

ANALYTICAL RESULTS

Prepared by:

Lancaster Laboratories
2425 New Holland Pike
Lancaster, PA 17605-2425

Prepared for:

The Boeing Company
PO Box 3707 MC 9U4-26
Seattle WA 98124

March 28, 2012

Project: Boeing Auburn

Submittal Date: 03/05/2012
Group Number: 1292995
SDG: BNW67
PO Number: 0025164.090.093
State of Sample Origin: WA

Client Sample Description	Lancaster Labs (LLI) #
SSV45-20120229 SC# 542 NA Air	6566208
SSV46-20120229 SC# 196 NA Air	6566209
SSV48-20120229 SC# 122 NA Air	6566210
SSV47-20120229 SC# 525 NA Air	6566211

The specific methodologies used in obtaining the enclosed analytical results are indicated on the Laboratory Sample Analysis Record.

ELECTRONIC COPY TO	Landau	Attn: Terry McGourty
ELECTRONIC COPY TO	The Boeing Company	Attn: Jim Bet
ELECTRONIC COPY TO	Landau	Attn: Jennifer Wynkoop
ELECTRONIC COPY TO	Landau	Attn: Eric Weber
ELECTRONIC COPY TO	Landau	Attn: Sarah Weeks
1 COPY TO	Data Package Group	
ELECTRONIC COPY TO	Landau	Attn: Chip Halbert
ELECTRONIC COPY TO	Landau	Attn: Lauren McIntire

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Respectfully Submitted,

Elizabeth A. Leonhardt
Senior Specialist Group Leader

(510) 232-8894

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Analysis Report

Sample Description: SSV45-20120229 SC# 542 NA Air
Boeing Auburn

LLI Sample # AQ 6566208
LLI Group # 1292995
Account # 13419

Project Name: Boeing Auburn

Collected: 02/29/2012 09:08 by KH
through 02/29/2012 09:36
Submitted: 03/05/2012 08:30
Reported: 03/28/2012 13:38

The Boeing Company
PO Box 3707 MC 9U4-26
Seattle WA 98124

BAV45 SDG#: BNW67-01

CAT No.	Analysis Name	CAS Number	As Received Final Result	LOQ	As Received Final Result	LOQ	DF
Volatiles in Air ASTM D1946			%	%			
10341	Helium as Tracer Gas	7440-59-7	< 1.0	1.0			2
Volatiles in Air EPA TO-15			ug/m3	ug/m3	ppb(v)	ppb(v)	
05298	cis-1,2-Dichloroethene	156-59-2	< 2.0	2.0	< 0.50	0.50	1
05298	Tetrachloroethene	127-18-4	< 3.4	3.4	< 0.50	0.50	1
05298	Trichloroethene	79-01-6	< 2.7	2.7	< 0.50	0.50	1
05298	Vinyl Chloride	75-01-4	< 1.3	1.3	< 0.50	0.50	1

LOQ = Limit of Quantitation

General Sample Comments

State of Washington Lab Certification No. C259

All QC is compliant unless otherwise noted. Please refer to the Quality Control Summary for overall QC performance data and associated samples.

Laboratory Sample Analysis Record

CAT No.	Analysis Name	Method	Trial#	Batch#	Analysis Date and Time	Analyst	Dilution Factor
10341	Helium as Tracer Gas	ASTM D1946	1	12088HE01	03/05/2012 11:51	Jeffrey B Smith	2
05298	TO 15 VOA Ext. List	EPA TO-15	1	D1208730AA	03/27/2012 22:38	Michael A Ziegler	1

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Analysis Report

Sample Description: SSV46-20120229 SC# 196 NA Air
Boeing Auburn

LLI Sample # AQ 6566209
LLI Group # 1292995
Account # 13419

Project Name: Boeing Auburn

Collected: 02/29/2012 10:07 by KH
through 02/29/2012 10:40
Submitted: 03/05/2012 08:30
Reported: 03/28/2012 13:38

The Boeing Company
PO Box 3707 MC 9U4-26
Seattle WA 98124

BAV46 SDG#: BNW67-02

CAT No.	Analysis Name	CAS Number	As Received Final Result	LOQ	As Received Final Result	LOQ	DF
Volatiles in Air ASTM D1946			%	%			
10341	Helium as Tracer Gas	7440-59-7	< 1.0	1.0			2
Volatiles in Air EPA TO-15			ug/m3	ug/m3	ppb(v)	ppb(v)	
05298	cis-1,2-Dichloroethene	156-59-2	< 2.0	2.0	< 0.50	0.50	1
05298	Tetrachloroethene	127-18-4	< 3.4	3.4	< 0.50	0.50	1
05298	Trichloroethene	79-01-6	< 2.7	2.7	< 0.50	0.50	1
05298	Vinyl Chloride	75-01-4	< 1.3	1.3	< 0.50	0.50	1

LOQ = Limit of Quantitation

General Sample Comments

State of Washington Lab Certification No. C259

All QC is compliant unless otherwise noted. Please refer to the Quality Control Summary for overall QC performance data and associated samples.

Laboratory Sample Analysis Record

CAT No.	Analysis Name	Method	Trial#	Batch#	Analysis Date and Time	Analyst	Dilution Factor
10341	Helium as Tracer Gas	ASTM D1946	1	12088HE01	03/28/2012 11:25	Jeffrey B Smith	2
05298	TO 15 VOA Ext. List	EPA TO-15	1	D1208730AA	03/27/2012 23:29	Michael A Ziegler	1

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Analysis Report

Sample Description: SSV48-20120229 SC# 122 NA Air
Boeing Auburn

LLI Sample # AQ 6566210
LLI Group # 1292995
Account # 13419

Project Name: Boeing Auburn

Collected: 02/29/2012 10:57 by KH
through 02/29/2012 11:16
Submitted: 03/05/2012 08:30
Reported: 03/28/2012 13:38

The Boeing Company
PO Box 3707 MC 9U4-26
Seattle WA 98124

BAV48 SDG#: BNW67-03

CAT No.	Analysis Name	CAS Number	As Received Final Result	LOQ	As Received Final Result	LOQ	DF
Volatiles in Air ASTM D1946			%	%			
10341	Helium as Tracer Gas	7440-59-7	< 1.0	1.0			2
Volatiles in Air EPA TO-15			ug/m3	ug/m3	ppb(v)	ppb(v)	
05298	cis-1,2-Dichloroethene	156-59-2	< 2.0	2.0	< 0.50	0.50	1
05298	Tetrachloroethene	127-18-4	< 3.4	3.4	< 0.50	0.50	1
05298	Trichloroethene	79-01-6	< 2.7	2.7	< 0.50	0.50	1
05298	Vinyl Chloride	75-01-4	< 1.3	1.3	< 0.50	0.50	1

LOQ = Limit of Quantitation

General Sample Comments

State of Washington Lab Certification No. C259

All QC is compliant unless otherwise noted. Please refer to the Quality Control Summary for overall QC performance data and associated samples.

Laboratory Sample Analysis Record

CAT No.	Analysis Name	Method	Trial#	Batch#	Analysis Date and Time	Analyst	Dilution Factor
10341	Helium as Tracer Gas	ASTM D1946	1	12088HE01	03/28/2012 11:32	Jeffrey B Smith	2
05298	TO 15 VOA Ext. List	EPA TO-15	1	D1208730AA	03/27/2012 21:02	Michael A Ziegler	1

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Analysis Report

Sample Description: SSV47-20120229 SC# 525 NA Air
Boeing Auburn

LLI Sample # AQ 6566211
LLI Group # 1292995
Account # 13419

Project Name: Boeing Auburn

Collected: 02/29/2012 11:27 by KH
through 02/29/2012 11:50
Submitted: 03/05/2012 08:30
Reported: 03/28/2012 13:38

The Boeing Company
PO Box 3707 MC 9U4-26
Seattle WA 98124

BAV47 SDG#: BNW67-04*

CAT No.	Analysis Name	CAS Number	As Received Final Result	LOQ	As Received Final Result	LOQ	DF
Volatiles in Air ASTM D1946			%	%			
10341	Helium as Tracer Gas	7440-59-7	< 1.0	1.0			2
Volatiles in Air EPA TO-15			ug/m3	ug/m3	ppb(v)	ppb(v)	
05298	cis-1,2-Dichloroethene	156-59-2	< 2.0	2.0	< 0.50	0.50	1
05298	Tetrachloroethene	127-18-4	< 3.4	3.4	< 0.50	0.50	1
05298	Trichloroethene	79-01-6	< 2.7	2.7	< 0.50	0.50	1
05298	Vinyl Chloride	75-01-4	< 1.3	1.3	< 0.50	0.50	1

LOQ = Limit of Quantitation

General Sample Comments

State of Washington Lab Certification No. C259

All QC is compliant unless otherwise noted. Please refer to the Quality Control Summary for overall QC performance data and associated samples.

Laboratory Sample Analysis Record

CAT No.	Analysis Name	Method	Trial#	Batch#	Analysis Date and Time	Analyst	Dilution Factor
10341	Helium as Tracer Gas	ASTM D1946	1	12088HE01	03/28/2012 11:51	Jeffrey B Smith	2
05298	TO 15 VOA Ext. List	EPA TO-15	1	D1208730AA	03/27/2012 21:50	Michael A Ziegler	1

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Quality Control Summary

Client Name: The Boeing Company Group Number: 1292995
Reported: 03/28/12 at 01:38 PM

Matrix QC may not be reported if insufficient sample or site-specific QC samples were not submitted. In these situations, to demonstrate precision and accuracy at a batch level, a LCS/LCSD was performed, unless otherwise specified in the method.

All Inorganic Initial Calibration and Continuing Calibration Blanks met acceptable method criteria unless otherwise noted on the Analysis Report.

Laboratory Compliance Quality Control

Analysis Name	Blank Result	Blank LOQ	Report Units	LCS %REC	LCSD %REC	LCS/LCSD Limits	RPD	RPD Max
Batch number: 12088HE01	Sample number(s): 6566208-6566211							
Helium as Tracer Gas	< 0.50	0.50	%					
Batch number: D1208730AA	Sample number(s): 6566208-6566211							
cis-1,2-Dichloroethene	< 2.0	2.0	ug/m3	83	83	69-120	1	25
Tetrachloroethene	< 3.4	3.4	ug/m3	77	77	70-130	1	25
Trichloroethene	< 2.7	2.7	ug/m3	86	85	70-130	1	25
Vinyl Chloride	< 1.3	1.3	ug/m3	109	110	70-130	1	25

*- Outside of specification
(1) The result for one or both determinations was less than five times the LOQ.
(2) The unspiked result was more than four times the spike added.

Case Narrative

Project Name: Boeing Auburn
LLI Group #: 1292995

General Comments:

See the Laboratory Sample Analysis Record section of the Analysis Report for the method references.

All QC met criteria unless otherwise noted in an Analysis Specific Comment below. Refer to the QC Summary for specific values and acceptance criteria.

Project specific QC samples are not included in this data set

Matrix QC may not be reported if site-specific QC samples were not submitted. In these situations, to demonstrate precision and accuracy at a batch level, a LCS/LCSD was performed, unless otherwise specified in the method.

Surrogate recoveries (if applicable) which are outside of the QC window are confirmed unless attributed to a dilution or otherwise noted in an Analysis Specific Comment below.

The samples were received at the appropriate temperature and in accordance with the chain of custody unless otherwise noted.

Analysis Specific Comments:

No additional comments are necessary.

Summa Canister Field Test Data/Chain of Custody

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Acct. # 13419 For Lancaster Laboratories use only Group # 1292995 Sample # 6566208-11

Please print. Instructions on reverse side correspond.

1 Client Information

Client: Boeing — Account #:

Project Name/#: Boeing Auburn / 025164.090.093

Project Manager: Eric Weber — P.O. #:

Sampler: Kristin Hooper — Quote #:

Name of state where samples were collected: Washington

3 Turnaround Time Requested (TAT) (circle one)

Standard

Rush (specify) _____

4 Data Package Required?

Yes No

5 EDD Required?

Yes No

6 Analyses Requested

EPA TO - 15 Low level 0.5 ppb; EPA 18; ☐ MTBE; ☐ BTEX; EPA 25 (select range below); Helium as tracer TO-3; O2/CO2; Library Search

2 Sample Identification	Sample Collection Date	Time Start (24 hr clock)	Time Stop (24 hr clock)	Canister Pressure in Field ("Hg) (Start)	Canister Pressure in Field ("Hg) (Stop)	Interior Temp. (F) (Start)	Interior Temp. (F) (Stop)	Flow Reg. ID	Can ID	Can Size (L)	Controller Flowrate (ml/min)	EPA TO-15	EPA 18	EPA 25	Helium as tracer	O2/CO2	Library Search
SSV45-20120229	2/29/12	0905	0936	-29	-5			339290	542	6	200	X			X		
SSV46-20120229	2/29/12	1007	1040	-27	-5			338069	196	6	200	X			X		
SSV48-20120229	2/29/12	1057	1116	-25	-5			329594	122	6	200	X			X		
SSV47-20120229	2/29/12	1127	1150	-29.5	-5			252100	525	6	200	X			X		

7 Instructions/QC Requirements & Comments

TO-15 for cis-1,2-DCE, PCE, TCE and VC only

TO-3 for Helium

~~Note: Canisters expire 3/5/12~~

EPA 25 (check one) ☐ C1 - C4 ☐ C2 - C10 ☐ C1 - C10 ☐ C4 - C10 (GRO) ☐ C2 - C4

8

Canisters Shipped by:	Date/Time:	Canisters Received by:	Date/Time
Toni J Smith	3/2/2012 0830		
Relinquished by:	Date/Time:	Received by:	Date/Time:
Relinquished by:	Date/Time:	Received by:	Date/Time: 3/4/12 0830

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Environmental Sample Administration Receipt Documentation Log

Client/Project: Boeing

Date of Receipt: 3/5/12

Time of Receipt: 0830

Source Code: SO-1

Shipping Container Sealed: (YES) NO

Custody Seal Present * : YES (NO)

* Custody seal was intact unless otherwise noted in the discrepancy section

Package: Chilled (Not Chilled)

Temperature of Shipping Containers							
Cooler #	Thermometer ID	Temperature (°C)	Temp Bottle (TB) or Surface Temp (ST)	Wet Ice (WI) or Dry Ice (DI) or Ice Packs (IP)	Ice Present? Y/N	Loose (L) Bagged Ice (B) or NA	Comments
1							
2							
3							
4							
5							
6							

Number of Trip Blanks received NOT listed on chain of custody: 0

Paperwork Discrepancy/Unpacking Problems:

Rcvd cont #s 891 and 511 w/o samples. - extra cans KM2 3-5-12

Rcvd 23 flow controllers, 24 pcs. of Swagelok tubing connectors, and 2 sets of Swagelok "T" tubing.

Unpacker Signature/Emp#: Mary Merkl 2316 **Date/Time:** 3/5/12 0940

Issued by Dept. 6042 Management

2174.06

ORIGIN ID: TCMA

SHIP DATE: 02MAR12
ACTWGT: 18.1 LB
CAD: /POS1302
DIMS: 16x16x16 IN

BILL RECIPIENT

UNITED STATES US

TO SAMPLE RECIEVING
LANCASTER LABORATORIES
2425 NEW HOLLAND PIKE

LANCASTER PA 17601
(717) 656-2300 REF:
INV:
PO: DEPT:

FedEx Express

J12101112190125

1 of 11

MON - 05 MAR A2
PRIORITY OVERNIGHT

TRK# 0215 8534 3954 5289

MASTER

TD LNSA

17601
PA-US MDT

B
584
.08

ORIGIN ID: TCMA

SHIP DATE: 02MAR12
ACTWGT: 15.0 LB
CAD: /POS1302
DIMS: 16x16x16 IN

BILL RECIPIENT

UNITED STATES US

TO SAMPLE RECIEVING
LANCASTER LABORATORIES
2425 NEW HOLLAND PIKE

LANCASTER PA 17601
(717) 656-2300 REF:
INV:
PO: DEPT:

FedEx Express

J12101112190125

2 of 11

MON - 05 MAR A2
PRIORITY OVERNIGHT

MPS# 0681 7955 4369 8284

Mstr# 8534 3954 5289 0215

TD LNSA

17601
PA-US MDT

ORIGIN ID: TCMA

UNITED STATES US

SHIP DATE: 02MAR12
ACTWGT: 22.0 LB
CAD: /POS1302
DIMS: 16x16x16 IN

BILL RECIPIENT

TO SAMPLE RECIEVING
LANCASTER LABORATORIES
2425 NEW HOLLAND PIKE

LANCASTER PA 17601
(717) 656-2300
INV:
PO:
REF:
DEPT:

FedEx Express

J121011121901 25

3 of 11
MPS# 0681 7955 4369 8295
Mstr# 8534 3954 5289

MON - 05 MAR A2
PRIORITY OVERNIGHT

0215

TD LNSA

17601
PA-US MDT

ORIGIN ID: TCMA

UNITED STATES US

SHIP DATE: 02MAR12
ACTWGT: 19.0 LB
CAD: /POS1302
DIMS: 16x16x16 IN

BILL RECIPIENT

TO SAMPLE RECIEVING
LANCASTER LABORATORIES
2425 NEW HOLLAND PIKE

LANCASTER PA 17601
(717) 656-2300
INV:
PO:
REF:
DEPT:

FedEx Express

J121011121901 25

4 of 11
MPS# 0681 7955 4369 8300
Mstr# 8534 3954 5289

MON - 05 MAR A2
PRIORITY OVERNIGHT

0215

TD LNSA

17601
PA-US MDT

ORIGIN ID: TCMA

SHIP DATE: 02MAR12
ACTWGT: 19.0 LB
CAD: /POS1302
DIMS: 16x16x16 IN

BILL RECIPIENT

UNITED STATES US

TO SAMPLE RECIEVING
LANCASTER LABORATORIES
2425 NEW HOLLAND PIKE

LANCASTER PA 17601
(717) 656-2300
INV:
PO:
REF:
DEPT:

FedEx Express

J12101112190125

5 of 11

MPS# 0681 7955 4369 8310

Mstr# 8534 3954 5289

0215

MON - 05 MAR A2
PRIORITY OVERNIGHT

TD LNSA

17601
PA-US MDT

ORIGIN ID: TCMA

SHIP DATE: 02MAR12
ACTWGT: 19.0 LB
CAD: /POS1302
DIMS: 16x16x16 IN

BILL RECIPIENT

UNITED STATES US

TO SAMPLE RECIEVING
LANCASTER LABORATORIES
2425 NEW HOLLAND PIKE

LANCASTER PA 17601
(717) 656-2300
INV:
PO:
REF:
DEPT:

FedEx Express

J12101112190125

6 of 11

MPS# 0681 7955 4369 8321

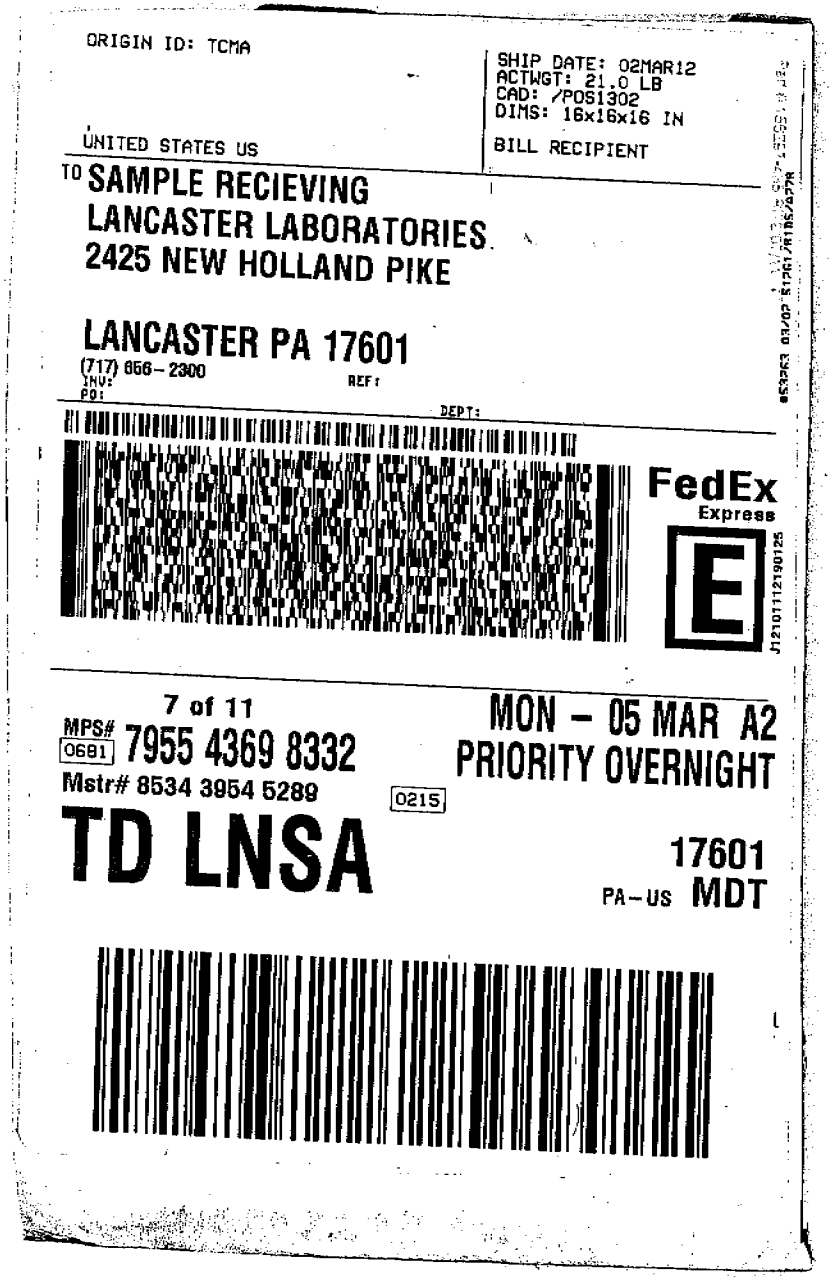
Mstr# 8534 3954 5289

0215

MON - 05 MAR A2
PRIORITY OVERNIGHT

TD LNSA

17601
PA-US MDT



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SHIP DATE: 02MAR12
ACTWGT: 21.0 LB
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DIMS: 16x16x16 IN

BILL RECIPIENT

UNITED STATES US

TO SAMPLE RECIEVING
LANCASTER LABORATORIES
2425 NEW HOLLAND PIKE

LANCASTER PA 17601
(717) 656-2300
INV:
PO:
REF:
DEPT:

FedEx Express

J12101112190125

7 of 11

MPS# 0681 7955 4369 8332
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MON - 05 MAR A2
PRIORITY OVERNIGHT

0215

TD LNSA

17601
PA-US MDT

ORIGIN ID: TCMA

SHIP DATE: 02MAR12
ACTWGT: 18.0 LB
CAD: /POS1302
DIMS: 16x16x16 IN

BILL RECIPIENT

UNITED STATES US

TO SAMPLE RECIEVING
LANCASTER LABORATORIES
2425 NEW HOLLAND PIKE

LANCASTER PA 17601
(717) 656-2300
INV:
PO:
REF:
DEPT:

FedEx Express

J12101112190125

8 of 11

MPS# 0681 7955 4369 8343
Mstr# 8534 3954 5289

MON - 05 MAR A2
PRIORITY OVERNIGHT

0215

TD LNSA

17601
PA-US MDT

ORIGIN ID: TCMA

UNITED STATES US

SHIP DATE: 02MAR12
ACTWGT: 20.0 LB
CAD: /POS1302
DIMS: 16x16x16 IN

BILL RECIPIENT

TO SAMPLE RECIEVING
LANCASTER LABORATORIES
2425 NEW HOLLAND PIKE

LANCASTER PA 17601
(717) 656-2300
THU:
PO:
REF:
DEPT:

FedEx Express

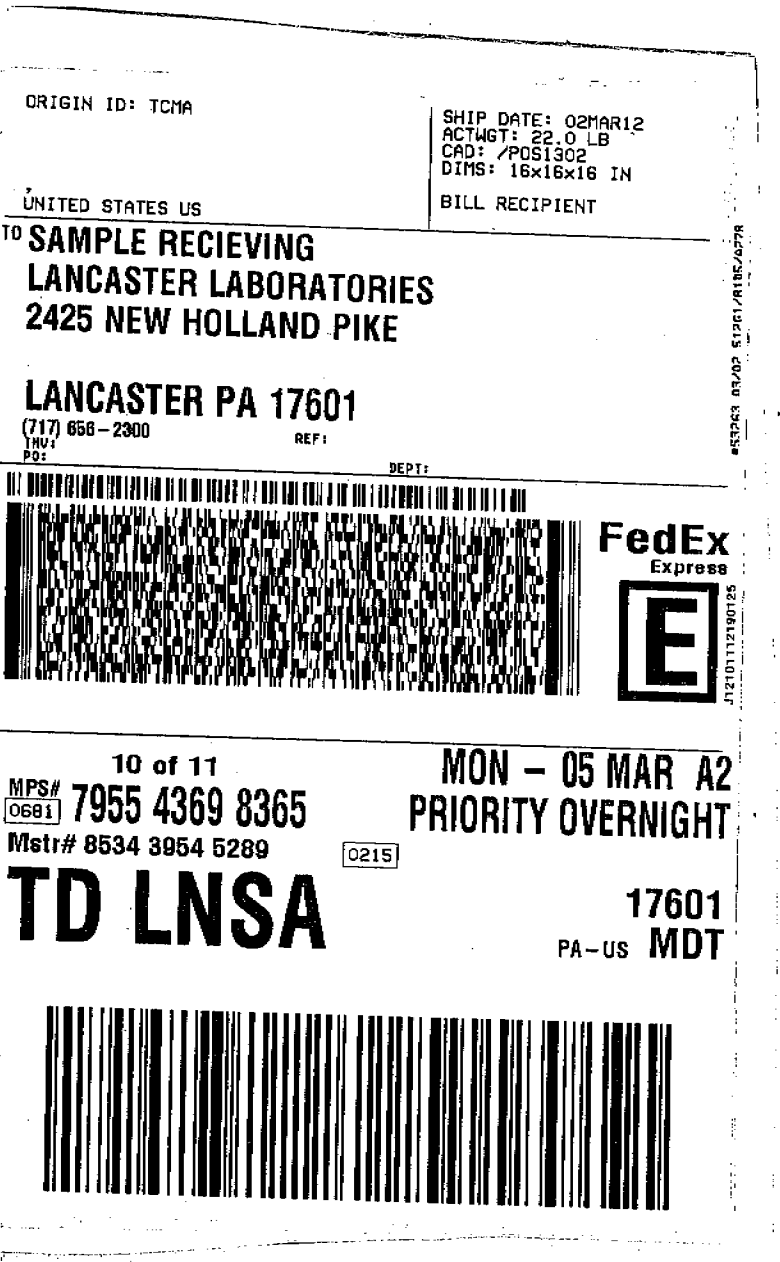
9 of 11
MPS# 0681 7955 4369 8354
Mstr# 8534 3954 5289

MON - 05 MAR A2
PRIORITY OVERNIGHT

0215

TD LNSA

17601
PA-US MDT



ORIGIN ID: TCMA

UNITED STATES US

SHIP DATE: 02MAR12
ACTWGT: 22.0 LB
CAD: /POS1302
DIMS: 16x16x16 IN

BILL RECIPIENT

TO SAMPLE RECIEVING
LANCASTER LABORATORIES
2425 NEW HOLLAND PIKE

LANCASTER PA 17601
(717) 656-2300
THU:
PO:
REF:
DEPT:

FedEx Express

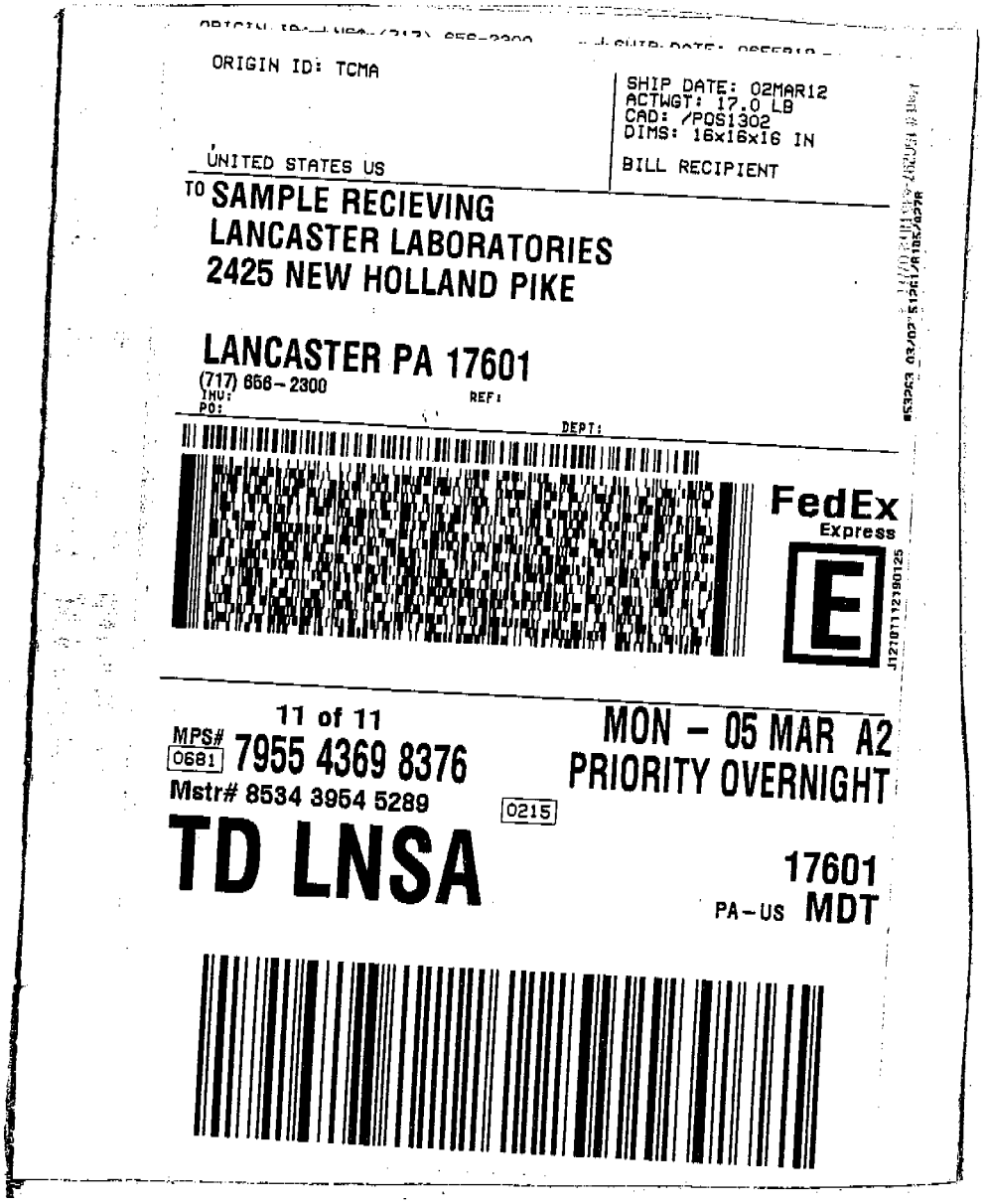
10 of 11
MPS# 0681 7955 4369 8365
Mstr# 8534 3954 5289

MON - 05 MAR A2
PRIORITY OVERNIGHT

0215

TD LNSA

17601
PA-US MDT



ORIGIN ID: TCMA

SHIP DATE: 02MAR12
ACTWGT: 17.0 LB
CAD: /POS1302
DIMS: 16x16x16 IN

UNITED STATES US

BILL RECIPIENT

TO SAMPLE RECIEVING
LANCASTER LABORATORIES
2425 NEW HOLLAND PIKE

LANCASTER PA 17601
(717) 656-2300
INV:
PO:
REF:
DEPT:

FedEx Express

11 of 11
MPS# 0681 7955 4369 8376
Mstr# 8534 3954 5289

MON - 05 MAR A2
PRIORITY OVERNIGHT

0215

TD LNSA

17601
PA-US MDT

eurofins | Lancaster Laboratories

Explanation of Symbols and Abbreviations

The following defines common symbols and abbreviations used in reporting technical data:

RL	Reporting Limit	**BMQL**	Below Minimum Quantitation Level
N.D.	none detected	**MPN**	Most Probable Number
TNTC	Too Numerous To Count	**CP Units**	cobalt-chloroplatinate units
IU	International Units	**NTU**	nephelometric turbidity units
umhos/cm	micromhos/cm	**ng**	nanogram(s)
C	degrees Celsius	**F**	degrees Fahrenheit
meq	milliequivalents	**lb.**	pound(s)
g	gram(s)	**kg**	kilogram(s)
µg	microgram(s)	**mg**	milligram(s)
mL	milliliter(s)	**L**	liter(s)
m3	cubic meter(s)	**µL**	microliter(s)
		pg/L	picogram/liter

< less than - The number following the sign is the limit of quantitation, the smallest amount of analyte which can be reliably determined using this specific test.

> greater than

ppm parts per million - One ppm is equivalent to one milligram per kilogram (mg/kg), or one gram per million grams. For aqueous liquids, ppm is usually taken to be equivalent to milligrams per liter (mg/l), because one liter of water has a weight very close to a kilogram. For gases or vapors, one ppm is equivalent to one microliter of gas per liter of gas.

ppb parts per billion

Dry weight basis Results printed under this heading have been adjusted for moisture content. This increases the analyte weight concentration to approximate the value present in a similar sample without moisture. All other results are reported on an as-received basis.

Data Qualifiers:

C – result confirmed by reanalysis.

J - estimated value – The result is ≥ the Method Detection Limit (MDL) and < the Limit of Quantitation (LOQ).

U.S. EPA CLP Data Qualifiers:

Organic Qualifiers		Inorganic Qualifiers	
A	TIC is a possible aldol-condensation product	**B**	Value is <CRDL, but ≥IDL
B	Analyte was also detected in the blank	**E**	Estimated due to interference
C	Pesticide result confirmed by GC/MS	**M**	Duplicate injection precision not met
D	Compound quantitated on a diluted sample	**N**	Spike sample not within control limits
E	Concentration exceeds the calibration range of the instrument	**S**	Method of standard additions (MSA) used for calculation
N	Presumptive evidence of a compound (TICs only)	**U**	Compound was not detected
P	Concentration difference between primary and confirmation columns >25%	**W**	Post digestion spike out of control limits
U	Compound was not detected	*****	Duplicate analysis not within control limits
X,Y,Z	Defined in case narrative	**+**	Correlation coefficient for MSA <0.995

Analytical test results meet all requirements of NELAC unless otherwise noted under the individual analysis.

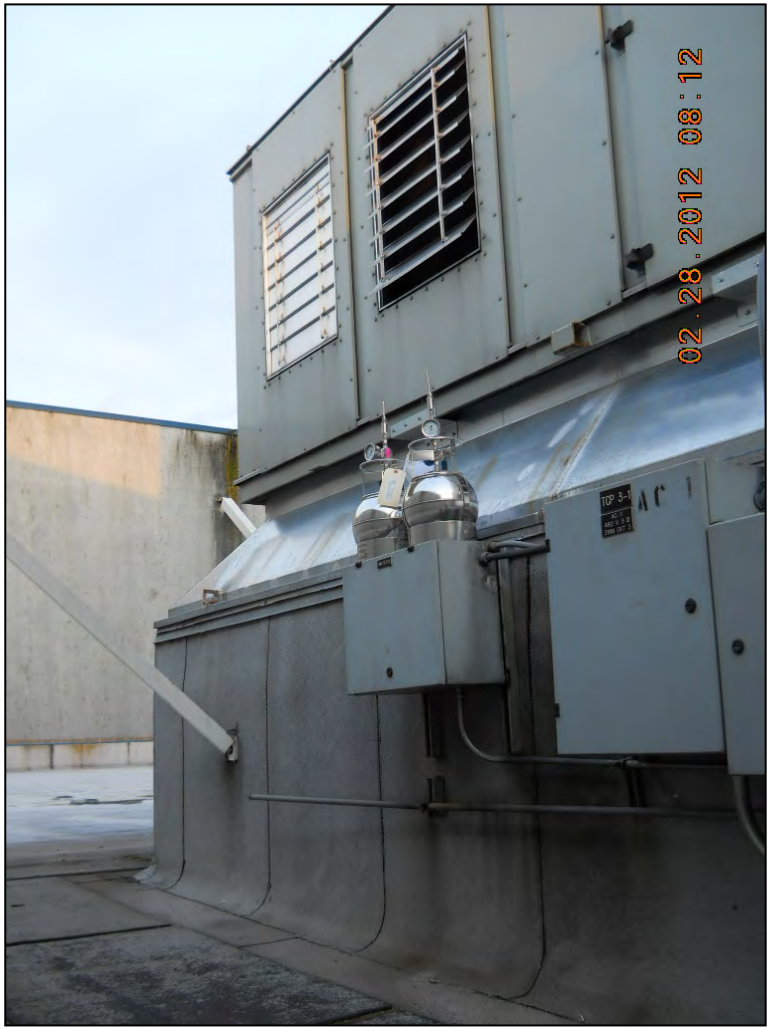
Measurement uncertainty values, as applicable, are available upon request.

Tests results relate only to the sample tested. Clients should be aware that a critical step in a chemical or microbiological analysis is the collection of the sample. Unless the sample analyzed is truly representative of the bulk of material involved, the test results will be meaningless. If you have questions regarding the proper techniques of collecting samples, please contact us. We cannot be held responsible for sample integrity, however, unless sampling has been performed by a member of our staff. This report shall not be reproduced except in full, without the written approval of the laboratory.

Times are local to the area of activity. Parameters listed in the 40 CFR part 136 Table II as “analyze immediately” are not performed within 15 minutes.

APPENDIX B

Sample Location Photos



1. Ambient air sample AA01 at Fana West. Two canisters set due to initial concern about flow controller of first can.

2. Indoor air sample IA01 at Fana West located in an enclosed office space.

LANDAU ASSOCIATES

Boeing Auburn
Auburn, Washington

Vapor Intrusion Sampling Locations

Figure
B-1

3. Indoor air sample IA02 at Fana West located in enclosed office space.

4. Ambient air sample AA02 at Building 17-07 located upwind and adjacent to an air intake.

LANDAU ASSOCIATES

Boeing Auburn
Auburn, Washington

Vapor Intrusion Sampling Locations

Figure
B-2

5. Indoor air sample IA03 at Building 17-07 located in a conference room at Column E-2.

6. Indoor air sample IA04 and duplicate IA99 at Building 17-07 located adjacent to SWMU S-13.

LANDAU ASSOCIATES	Boeing Auburn Auburn, Washington	**Vapor Intrusion Sampling Locations**	Figure B-3

7. Indoor air sample IA05 at Building 17-07 located in an open floor work space near Column D9.

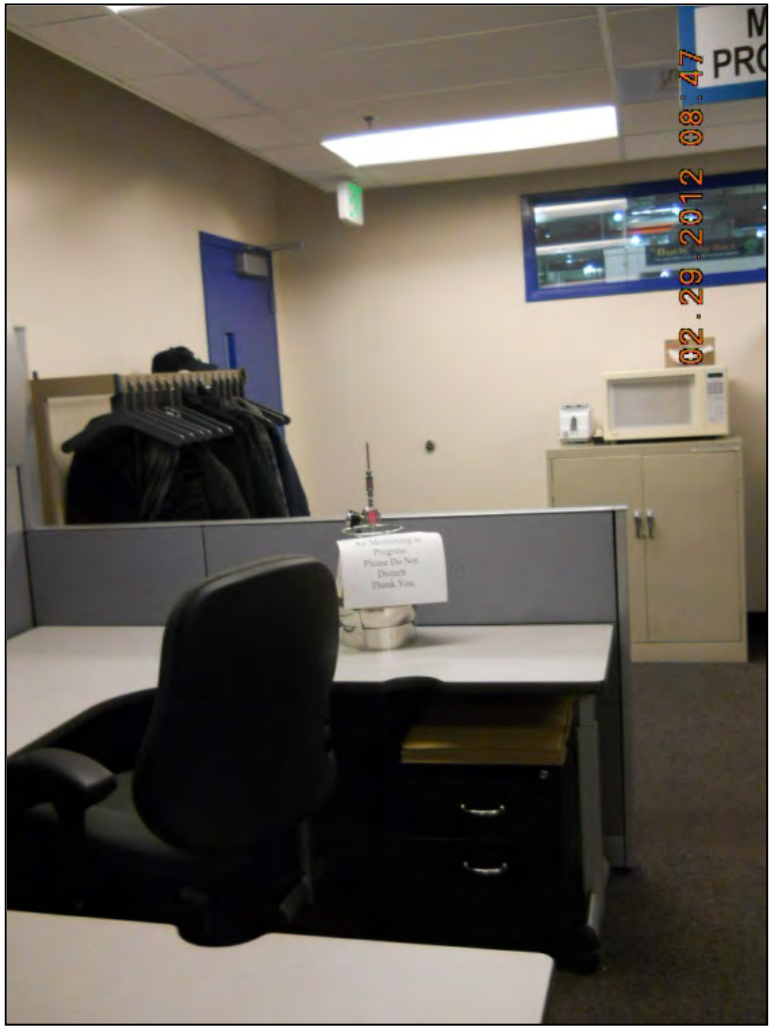
8. Indoor air sample IA06 at Building 17-07 located north of SWMU S-13, in the Sheffield Modulab at Column B9.

LANDAU ASSOCIATES

Boeing Auburn
Auburn, Washington

Vapor Intrusion Sampling Locations

Figure
B-4



9. Indoor air sample IA07 at Building 17-07 located in a room of cubicles near Column BB5.

10. Ambient air background sample AA03 collected upwind of AMB.

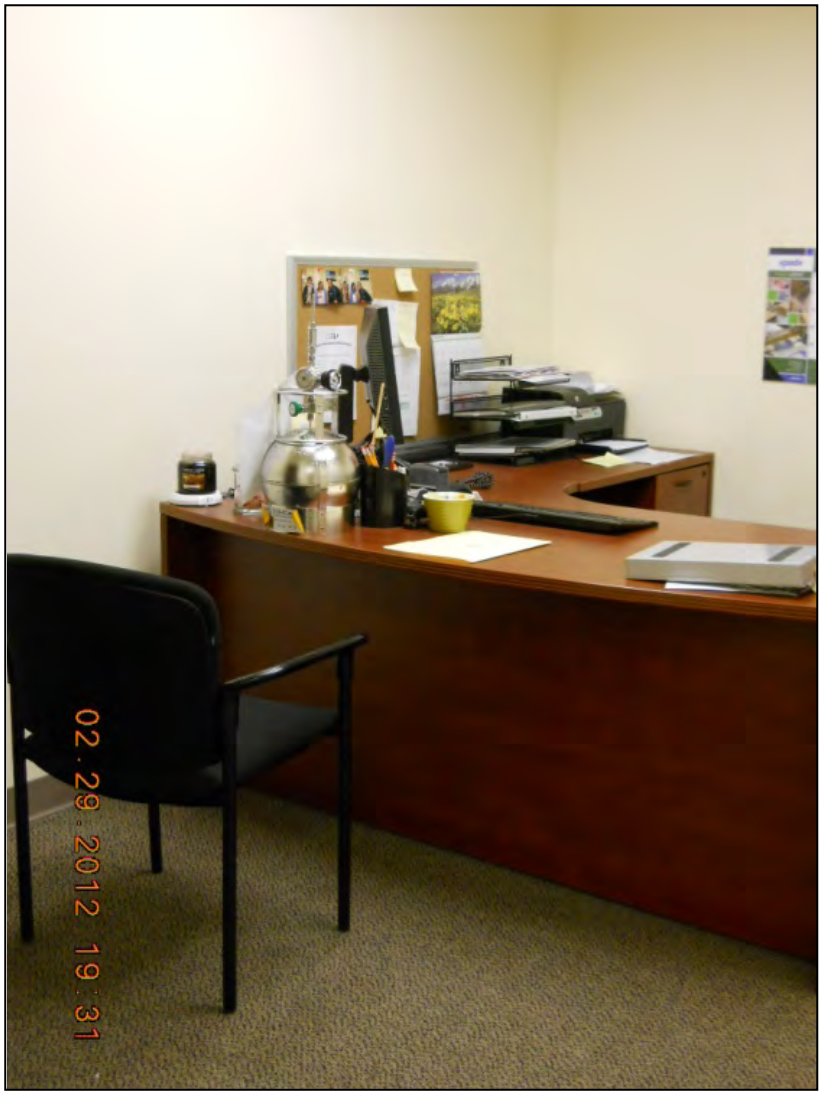
LANDAU ASSOCIATES

Boeing Auburn
Auburn, Washington

Vapor Intrusion Sampling Locations

Figure
B-5

11. Ambient air rooftop sample AA04 at AMB collected from limited rooftop access point.



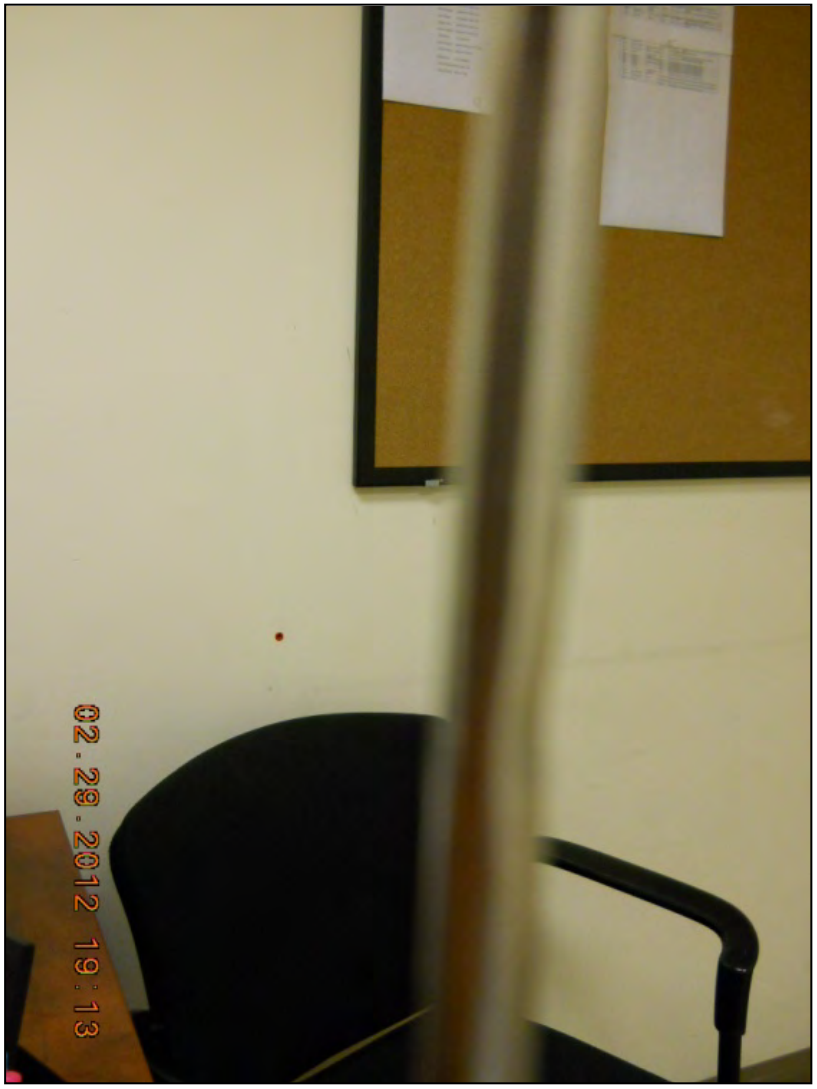
12. Indoor air sample IA08 at AMB collected in enclosed office.

LANDAU ASSOCIATES

Boeing Auburn
Auburn, Washington

Vapor Intrusion Sampling Locations

Figure
B-6



13. Indoor air sample IA09 at AMB collected in shipping room office. Photo shows slightly bent sample tubing.

14. Sub-slab soil vapor (i.e. soil gas) sample SSV45 at Junior Achievement collected in storage room.

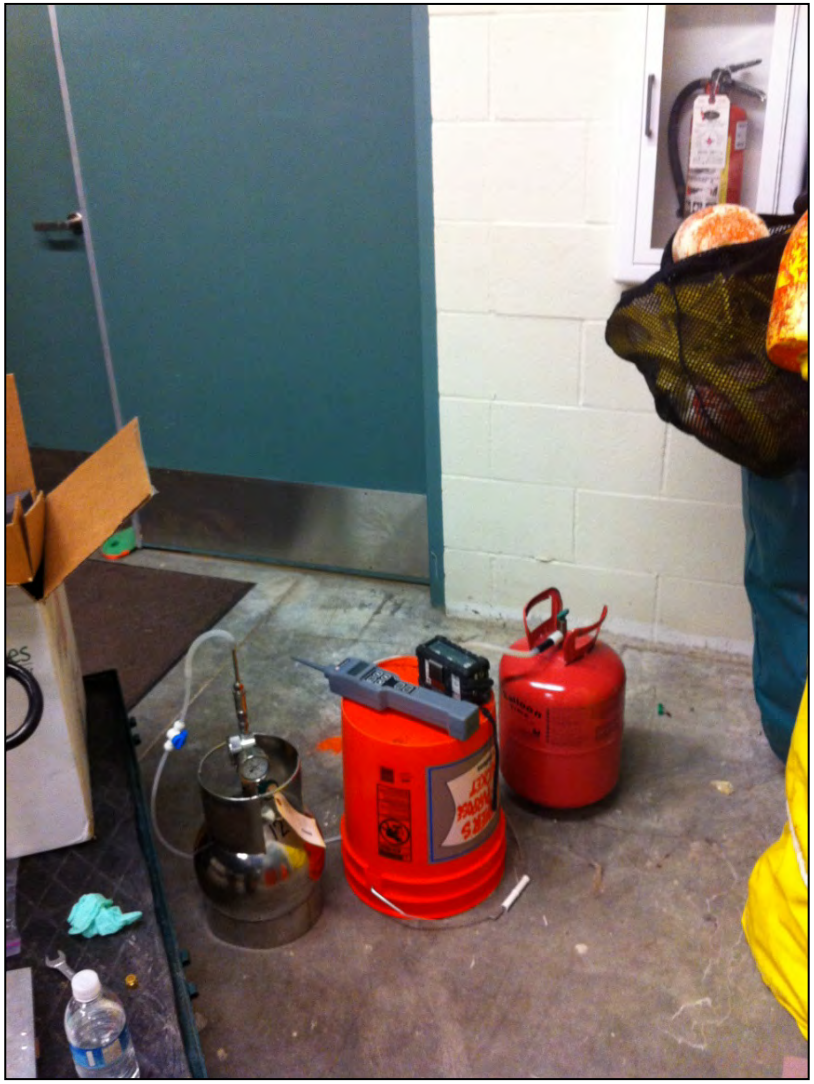
LANDAU ASSOCIATES

Boeing Auburn
Auburn, Washington

Vapor Intrusion Sampling Locations

Figure
B-7

15. Sub-slab soil vapor (i.e. soil gas) sample SSV46 at YMCA collected in crawl space beneath pool.



16. Sub-slab soil vapor (i.e. soil gas) sample SSV47 YMCA collected in boiler room.

LANDAU ASSOCIATES

Boeing Auburn
Auburn, Washington

Vapor Intrusion Sampling Locations

Figure
B-8

17. Sub-slab soil vapor (i.e. soil gas) sample SSV48 at YMCA collected in storage room.