Phase I Vapor Intrusion Summary (Summer-Fall 2013)
City of Algona
Algona, Washington

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Prepared for

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INTRODUCTION

Volatile[1] organic compounds (VOCs) related to industrial manufacturing have been found in shallow groundwater in the northern Algona residential neighborhood (northern Algona). It is believed that the VOCs originated from The Boeing Company's manufacturing facility (Boeing facility) located at 700 15th Street SW, Auburn, Washington. Boeing is actively investigating the presence of the VOCs in northern Algona as part of a larger remedial investigation (RI). The RI will define where any contamination is, how far it has moved, and identify the most effective way to clean it up. The RI is overseen and directed by the Washington State Department of Ecology (Ecology) under a Washington State law called the Model Toxics Control Act. The location of northern Algona and the Boeing facility are shown on Figure 1.

As part of the RI activities in northern Algona, Boeing is evaluating potential risks to human health related to VOCs in shallow groundwater (near the ground surface). If human health is found to be at risk due to VOC contamination from Boeing's facility, Boeing will be responsible for reducing the contamination to a level that is protective of human health. Boeing collected samples from shallow groundwater and compared the levels of chemicals in those samples to levels that Ecology determined protective of human health. The results from this sampling are summarized in the section below titled "Algona Shallow Groundwater Data."

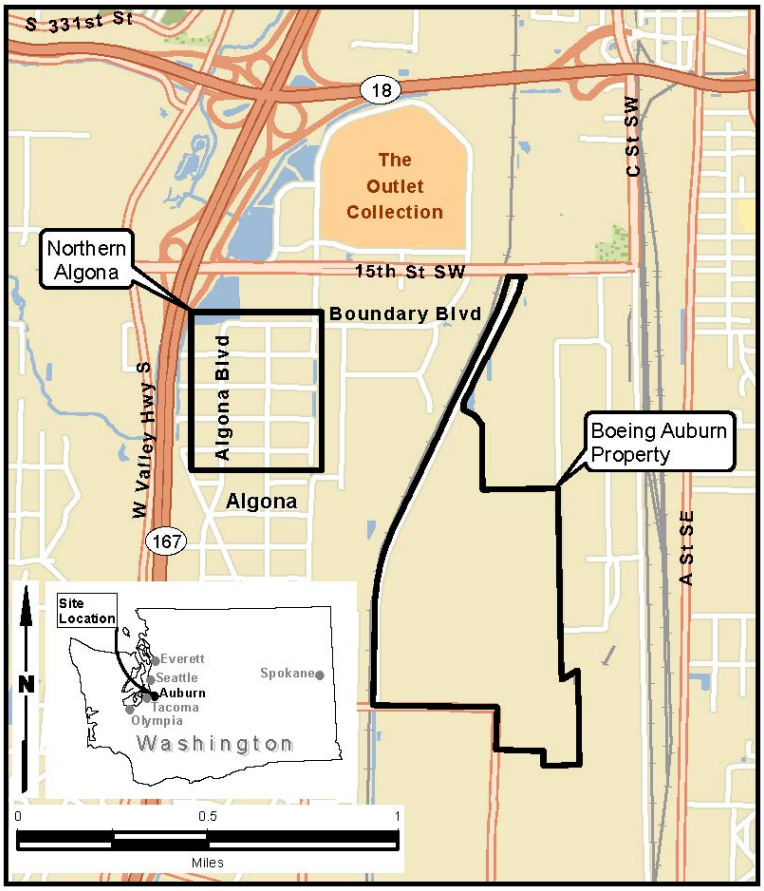

Figure 1: Area Map

One way that VOCs in shallow groundwater can impact human health is through vapor intrusion. Vapor intrusion occurs when chemicals in the groundwater move as vapor upward through the soil and

[1] These compounds are called "volatile" because VOCs can evaporate under normal atmospheric conditions.

into indoor air. The recent discovery of VOCs in shallow groundwater (approximately 5 to 10 feet below the ground surface) in northeastern Algona has led to a vapor intrusion assessment (or study).

The first phase of the study (summer sampling) began in the summer of 2013 and concluded in early fall of 2013; the study area is shown on Figure 2. Figure 2 shows where VOC concentrations in shallow groundwater are high enough to potentially impact indoor air through vapor intrusion. This area is slightly different from the area in Figure 3 because different concentration criteria were used in each figure, depending on the objective of the map.

The second phase of the study (winter sampling) will begin in the first quarter of 2014. The results from the second phase will help determine if vapor intrusion occurs when groundwater is closer to the ground surface and will verify the results from the first phase of sampling. This summary report provides background information on vapor intrusion, explains why the study is occurring, provides information on sampling, and shares the results from the first phase of the vapor intrusion study.

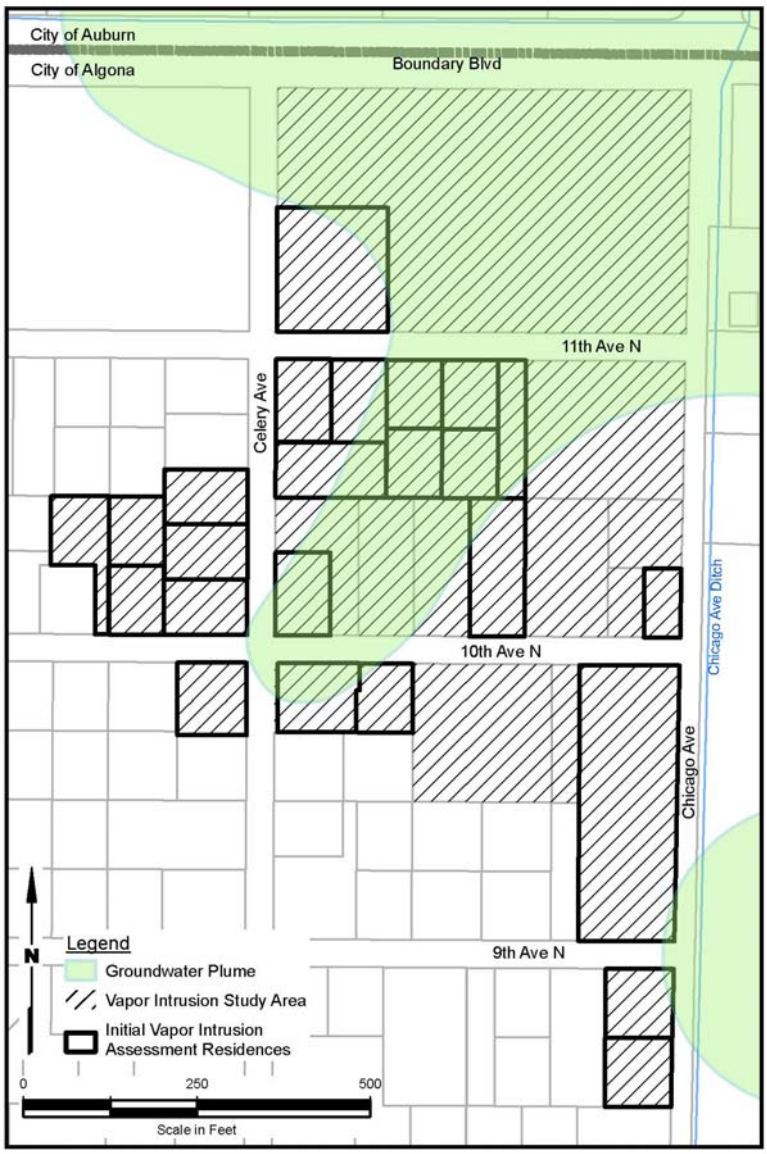

Figure 2: Residential Vapor Intrusion Study Area

BACKGROUND

A VOC called trichloroethene (TCE)[2] was historically used and stored at the Boeing facility. The chemical was used as early as the 1960s and as late as the mid-1980s. During its use at the facility, some of the TCE leaked into the groundwater.

TCE belongs to a group of VOCs called "chlorinated solvents" and can naturally break down into other chemicals, including: cis-1,2-dichloroethene (cis-1,2-DCE), trans-1,2-dichloroethene (trans-1,2-DCE), and vinyl chloride. The breakdown products listed above were included in the sampling.

The area of TCE-impacted groundwater is called a plume and the plume usually moves with the natural flow of groundwater. Groundwater beneath the Boeing Auburn facility flows to the northwest, so the shallow plume is moving to the northwest toward areas that include northern Algona. The location of the groundwater plume is determined by collecting groundwater samples at permanent sampling points (monitoring wells) or at temporary sampling points (borings). The plume has three dimensions, which means concentrations of the chemicals can vary with depth below the ground surface. Chemicals that are close to the surface, such as chemicals in shallow groundwater, are most likely to impact the air above ground. Figure 3 shows the approximate area of the shallow groundwater plume, based on the most recent complete set of groundwater samples.

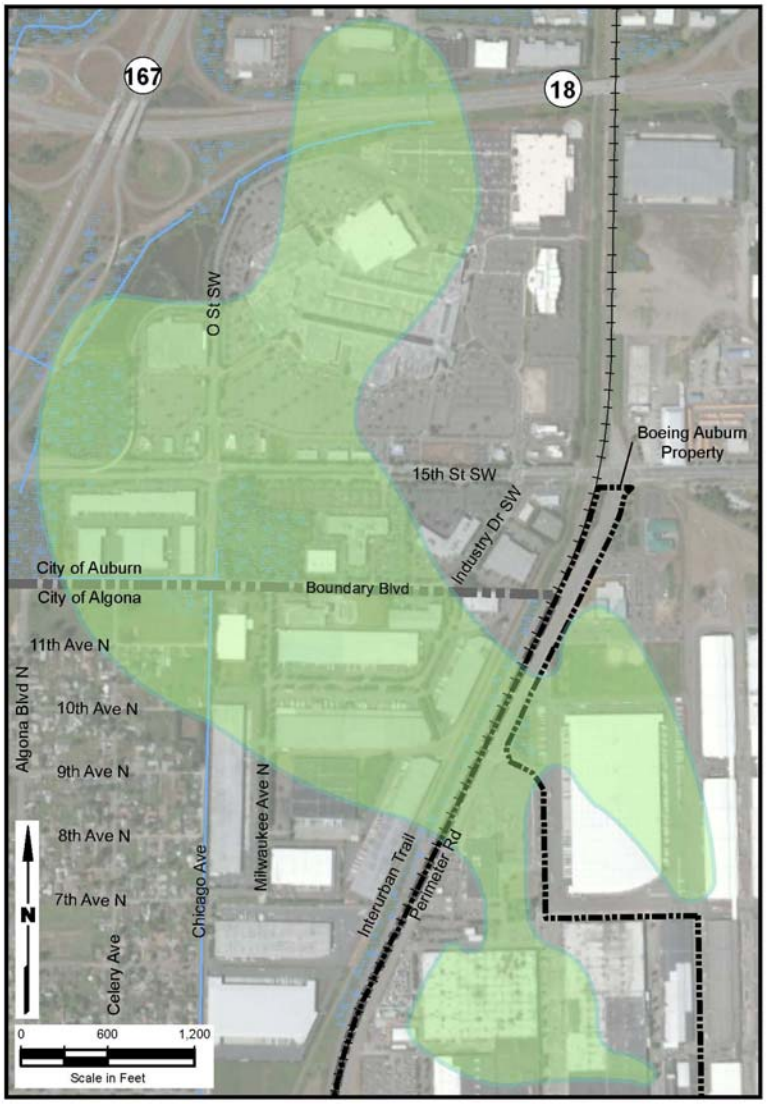

Figure 3: Shallow Zone TCE Plume

[2] A detailed summary of TCE was published by the Agency for Toxic Substances and Disease Registry (ATSDR): http://www.atsdr.cdc.gov/ToxProfiles/tp.asp?id=173&tid=30. Trichloroethylene and trichloroethene are the same chemical.

In December 2012, two shallow groundwater monitoring wells were installed in northern Algona. Samples taken from these two wells determined that TCE and its breakdown chemicals were present in the shallow groundwater and that the concentrations of TCE and vinyl chloride exceeded screening criteria set by Ecology.[3] The sample results were shared with Ecology and the City of Algona in January 2013. The City of Algona worked with Ecology, the Washington State Department of Health (DOH), and Boeing to organize a public meeting for the citizens of Algona where the results would be explained. The public meeting was held in mid-February 2013.

In order to further understand the extent of shallow groundwater contamination in northern Algona, the next step of the investigation was to collect multiple shallow groundwater samples covering northern Algona. To expedite the data collection process, borings were used instead of installing monitoring wells. The borings were drilled and sampled in April 2013. The sample results were used to determine the area where vapor intrusion could occur in homes, also called the "study area." The results of the April 2013 groundwater sampling investigation and the vapor intrusion assessment study area were presented to City of Algona officials and their technical consultant, ICF International (ICF), for review. The first phase of the Algona vapor intrusion study began in June 2013. Ecology hosted public meetings in February and June 2013 to speak with community members and to address their concerns.

VAPOR INTRUSION – WHAT IS IT?

When a chemical is released and comes in contact with groundwater, that chemical can travel with the natural flow of groundwater. Some types of chemicals, such as VOCs, can easily evaporate and become vapors, meaning the chemical leaves the shallowest groundwater and enters air between the soil particles. These vapors can travel through the soil and enter buildings directly above the location of the chemical; this is called vapor intrusion. Once in a building, the vapors can potentially affect air quality and the health of the building's occupants. Figure 4 shows the steps that chemicals must take for vapor intrusion to occur in a home, from groundwater to indoor air.

[3] In November 2012, Ecology formally set the project's residential vapor intrusion screening levels for shallow groundwater. These screening levels were developed consistent with the U.S. Environmental Protection Agency's standards and the Washington State Model Toxics Control Act. They are used to indicate if chemical concentrations in shallow groundwater could result in potentially harmful levels in indoor air from vapor intrusion.

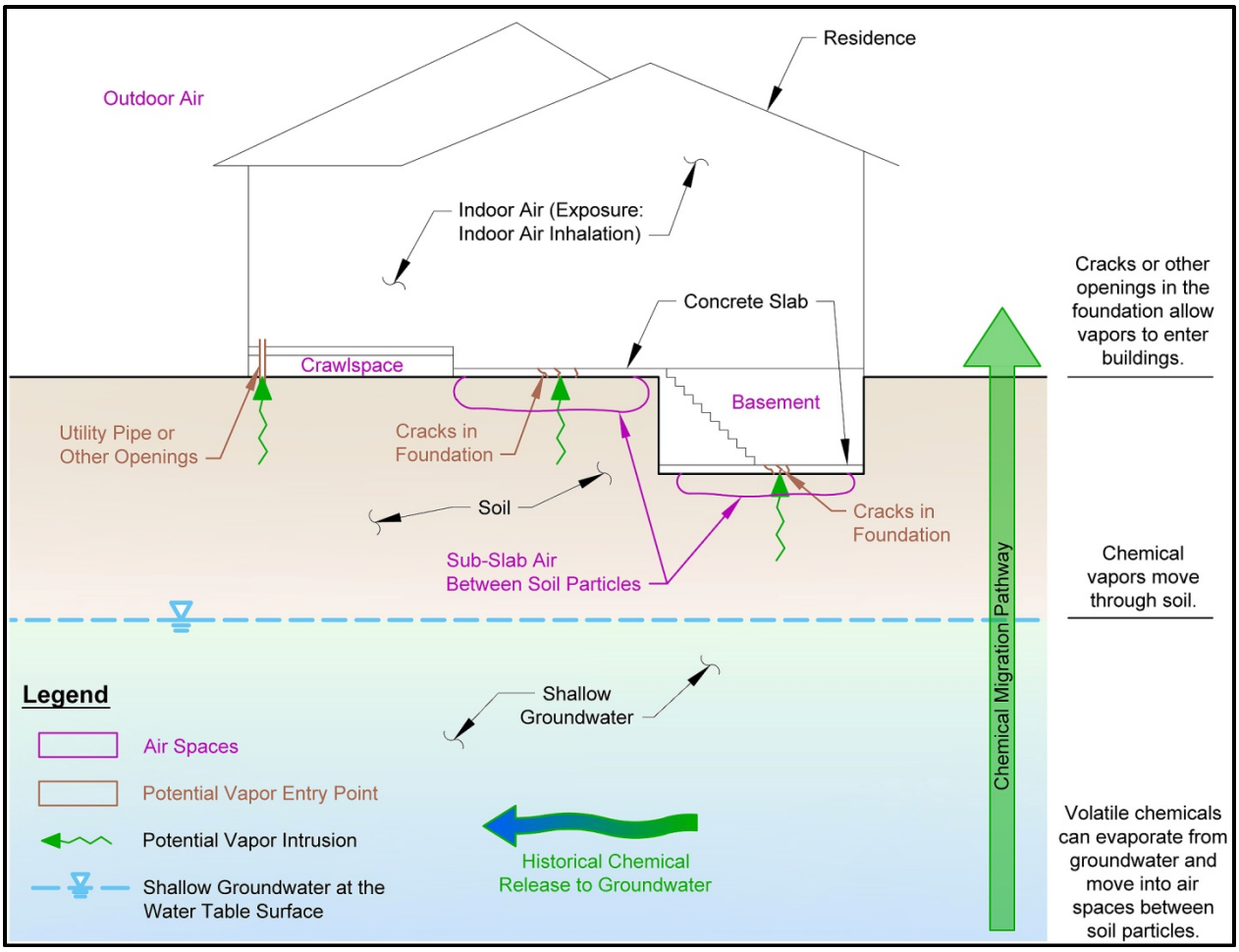

Figure 4: Vapor Intrusion Conceptual Model

How vapors can enter a building varies based on the building's foundation. The chance that the vapors will enter the building also varies based on the condition of the foundation. For example, cracks in a building's slab may allow vapors to enter a building more easily. In homes with crawlspaces, vapors may enter through the crawlspace.

ALGONA SHALLOW GROUNDWATER DATA

The April 2013 groundwater investigation included collection of 49 samples at the top of the water table throughout northern Algona. The samples were tested for VOCs, including TCE and its breakdown products (trans-1,2-DCE, cis-1,2-DCE, and vinyl chloride). The chemical concentration data were compared to Ecology-approved groundwater preliminary concern levels (PCLs).[4] These PCLs are

[4] The PCLs are currently being used in Algona instead of the residential vapor intrusion screening levels for shallow groundwater because groundwater in Algona is very close to the ground surface. The PCLs are more protective of human health than the screening levels.

chemical-specific, health-protective values that represent the concentrations above which shallow groundwater could theoretically result in unacceptable VOC concentrations in indoor air through vapor intrusion. A number of exposure elements are factored into calculating these PCLs, which are designed to err on the side of caution to ensure protection of human health.

A vapor intrusion study area was identified in northeastern Algona because TCE and its breakdown products were found in shallow groundwater. The vapor intrusion study area was defined where at least one chemical was detected at a concentration greater than its PCL. The location of the vapor intrusion study area is shown on Figure 2.

ALGONA VAPOR INTRUSION STUDY AREA

The study includes areas near wells or borings where VOCs were detected in higher amounts than the PCLs. DOH and Ecology requested that a few additional homes be included in the study area because the homes appeared to have basements (an uncommon feature in Algona home construction) and were relatively close to a boring where chemicals were detected in shallow groundwater. There were 24 homes identified on the properties within the study area (see Figure 2).[5] These households were offered vapor intrusion sampling, paid for by Boeing and conducted by Boeing's consultant (Landau Associates), to determine if vapor intrusion was occurring in the home.

BUILDING SURVEY VISITS

Before vapor intrusion-related air sampling could start at a home, a building survey was completed. The purpose of the building survey was to gather information about the building's foundation and construction, identify potential background sources that could impact the air sample results (explained in the next section, Vapor Intrusion Sampling), collect relevant information about the occupants, identify potential sampling locations, and describe the sampling process to the residents. A representative from Landau Associates and a representative from Ecology or Ecology's consultant, Aspect Consulting, attended each building survey. The City of Algona's environmental technical consultant, ICF, attended building surveys at the residents' request. A work plan for each individual home was then created based on the building survey. The work plans were reviewed by Ecology, DOH, and ICF.

Although only 14 of the 24 homes chose to participate in the sampling, the homes that were sampled included a variety of types from all sections of the study area, including:

- Manufactured home with crawlspace and attached slab-on-grade garage

[5] There were initially 23 homes. An additional home was constructed during the study period, bringing the total to 24 homes.

- Manufactured home with a crawlspace
- Stick-built home with slab-on-grade foundation or attached garage
- Stick-built home with a crawlspace
- Stick-built home with a basement.

VAPOR INTRUSION SAMPLING

Once each home's work plan was approved by Ecology, air sampling was done to evaluate if chemical vapors from groundwater were entering the home. This can be difficult to evaluate, as these chemicals are also found in common household products such as paints, solvents, and cleaning products. These interfering household products, called background sources, can release chemical vapors as well, which can impact the air samples collected and affect indoor air quality even if vapor intrusion is not occurring. Residents were asked to remove such products from their homes at least 48 hours prior to sampling, with assistance from Landau Associates if desired, and were asked to refrain from using them during the sampling period.

Air samples were collected over 24 hours using Summa canisters (Figure 5). Summa canisters are stainless steel vacuum canisters that collect air at a set rate. The number of samples at a home varied based on building type (illustrated on Figure 4), but a typical set of air samples included:

Figure 5: 6-liter Summa canister

- A sample from air in the crawlspace or basement, if present. Of the types of air samples collected, crawlspace or basement air samples are closest to shallow groundwater.
- An indoor air sample from a commonly occupied first floor room. If multiple first-floor rooms are commonly occupied, an indoor air sample was collected from each commonly occupied room. Additional samples were sometimes collected from upper-level floors at a resident's request; however, collecting samples from the first floor is more important as vapors must travel through the first floor rooms to arrive at the upper level rooms.
- An ambient (outdoor) air sample to determine if there was an outdoor source of contaminants during sampling. Chemical use outside of the home, or at nearby businesses or homes, can release vapors into the ambient air. The ambient air can then enter a home and affect indoor air quality even if vapor intrusion is not occurring. Placement of the ambient air sample location was based on the observed wind direction at the start of sampling and placed upwind of the home.

If the building had a concrete slab, a sub-slab vapor sample may have been collected. Sub-slab vapor sampling helps determine if vapors are accumulating beneath the slab of a building. Sub-slab vapor sampling involves collection of a vapor sample from the air spaces between the soil particles beneath a concrete slab and is collected in the same type of sample container as air samples. Similar to crawlspace

air samples, sub-slab vapor samples are collected closer to shallow groundwater than indoor air samples. The sub-slab vapor sample takes approximately 30 minutes to collect and can be collected only if conditions are appropriate (i.e., groundwater levels are not too high).

Samples collected using Summa canisters were analyzed for TCE and related breakdown chemicals trans-1,2-DCE, cis-1,2-DCE,[6] and vinyl chloride. The results are the average concentrations of the chemicals over the sample period.

A select number of homes were sampled for TCE in indoor air and crawlspace air with Radiello® samplers (Figure 6) in addition to Summa canisters. DOH asked that Boeing use the Radiello samplers at a small number of homes (three or four) in areas where the nearest well or boring sample detected TCE at a concentration greater than the PCL. The Radiello samplers are a type of passive diffusive sampler, meaning the TCE passes through a membrane and is absorbed by special media that can be analyzed by laboratory instruments. This sample technology allows a sample to be collected over 21 days and the results are the average concentrations of TCE over 3 weeks.

Figure 6: Passive Diffusive Radiello Sampler

RESULTS AND WHAT THEY MEAN

Homeowners and/or tenants (if applicable) of the 14 sampled homes received their results accompanied by a letter describing what the results meant for their home approximately 1 month after the last sample was collected. A summary of the results from all 14 homes is provided in Table 1.

Laboratory analyses have a minimum concentration that the laboratory instruments can detect; these are called laboratory detection limits. The detection limits must be lower than all applicable screening criteria. The laboratory met this requirement.

Air sampling results were compared to indoor air action levels (IAALs). IAALs are health-based levels above which a chemical may pose a health concern if a person was exposed to it for a certain period of time. If chemicals are detected at levels greater than their IAAL, it means further action may need to be taken at the home if vapor intrusion is the cause. Additional testing is often needed to

[6] There are currently no known health risks associated with inhaling cis-1,2-DCE, but its presence in indoor air is a useful indicator that it may be present in underlying groundwater.

determine the source of a chemical detected in indoor air. If chemicals are detected at levels below their IAAL, they are considered safe.

There are two types of IAALs: short-term exposure and long-term exposure. Detections higher than a short-term exposure limit require immediate action because there could be immediate health risks to certain individuals. Detections higher than a long-term exposure limit but lower than a short-term exposure limit indicate that there are no immediate health risks, but action is required if they are related to vapor intrusion.

Of the 14 homes tested, 9 had no detected concentrations of any of the chemicals of concern. 5 homes had one or more detections. Three of the five homes had TCE only in the living space; one home had it only in the crawlspace; and one had it in both.

Vapor intrusion has not been determined to be the cause of any of the detections. These findings are described below:

- One home had TCE detections in three samples: two indoor air samples and one ambient air sample. TCE concentrations in all samples were below the IAALs, so there is no health risk and no action was needed to reduce exposure in the home. The highest concentration of TCE was found in the ambient air sample. Based on the test results, it was determined that the TCE detected in the indoor air samples was coming from outdoor air. With Ecology approval, an additional ambient air sample was collected approximately 1 month later to attempt to determine the source of the initial outdoor air detection. TCE was not detected in the second ambient air sample, which suggests that the initial detection was due to an isolated incident where a nearby business or home was using a product containing TCE at the time of sampling. **These results indicate that vapor intrusion is not occurring at this home.**
- One home had TCE detected in the initial 24-hour sample collected from the crawlspace. The detection was below the health-based action level (IAAL) and there were no detections in the indoor air samples, so no action was needed to reduce exposure in the home. TCE was not detected in a Radiello (21-day) sample collected at the same location. With Ecology approval, repeat sampling using Summa canisters was done to confirm the results of the initial 24-hour sample. No chemicals of concern were found in any of the samples during repeat sampling, including the crawlspace sample. **These results indicate that, at this time, vapor intrusion is not occurring at this home.**
- One home had TCE detections in two samples: the indoor air Radiello sampler and the crawlspace Radiello sampler. At this time, the source of the detections is unknown. There were no detections in the sub-slab vapor sample or the 24-hour samples. Additionally, the concentrations of the detected chemicals are below the IAALs, so there is no health risk. **These results indicate that vapor intrusion is not likely the source of the detections.**
- One home had TCE detected in one of its indoor air samples. The detection was below the IAAL, so there is no health risk and no action was needed to reduce exposure in the home. The crawlspace sample did not contain TCE, which indicates vapor intrusion was not the source of the detection. The resident reported that several activities were recently conducted in the home that involved VOC chemicals; therefore, these activities are the most likely source of the TCE detection. **These results indicate that vapor intrusion is not occurring at this home.**

- One home had TCE detected in one of its indoor air samples. The detection was below the short-term IAAL but exceeded the long-term IAAL, which means there are no immediate health risks. TCE was not detected in the sample collected from the basement, indicating that the indoor air detection was not from vapor intrusion. Because the detection exceeded the long-term IAAL, additional sampling was needed to confirm the detection was not from vapor intrusion:
  - Conditions during the initial sampling visits prevented collection of a sub-slab vapor sample. An additional visit was made approximately 2 weeks later, during a period of dry weather, and a sub-slab vapor sample was collected at that time. No chemicals of concern were detected in the sub-slab vapor sample, further indicating that vapor intrusion was not the source of the indoor air detection.
  - With Ecology approval, a second round of sampling was completed at the home approximately 1 week after the sub-slab vapor sampling visit. The second round of sampling included an additional sample in the basement directly below the room where the TCE was initially detected. There were no detections of TCE in the second round of sampling. **Taken together, these results indicate that vapor intrusion is not occurring at this home.**

Based on the first phase of vapor intrusion sampling, results from all homes indicate that no action is needed to reduce exposure in any home. Should action become necessary based on future sampling, a mitigation plan has been approved by Ecology and Boeing is ready to take immediate action.

Overall, these results indicate that vapor intrusion is not currently occurring at homes in the study area. A second phase of testing will be offered to the initial 24 homes this winter to determine if indoor air conditions change when groundwater is closer to the ground surface. The study area will be evaluated by Boeing and Ecology again after a second phase of sampling is completed. Based on the results so far, Ecology and Boeing do not anticipate that it will be necessary to test additional homes outside of the study area.

CONCLUSIONS

Historical activities at the Boeing facility resulted in a release of TCE to shallow groundwater. TCE and breakdown chemicals in shallow groundwater have the potential to impact indoor air quality and human health through vapor intrusion. A study area with 24 homes was identified in northern Algona and the first phase of sampling was offered to determine if vapor intrusion was occurring. A total of 14 homes in the study area agreed to participate in the first phase of sampling. Based on the sampling results, vapor intrusion does not appear to be a health concern at this time and the study area does not need to be expanded for the second phase. The same 24 homes will be offered the second phase of sampling starting in the first quarter of 2014 to determine if vapor intrusion is occurring during winter conditions.

Boeing submitted a work plan to Ecology proposing installation of additional monitoring wells based on the results from the April 2013 groundwater investigation. Ecology is currently reviewing this

work plan and, if approved, new wells will be installed. These wells will help Boeing monitor VOC concentrations at the water table on a quarterly basis.

Current information on the groundwater study and the vapor intrusion study is available on Ecology's website: https://fortress.wa.gov/ecy/gsp/Sitepage.aspx?csid=5049. An updated report will be released after the second phase of sampling is concluded.

TABLE 1
SUMMARY OF RESULTS BY RESIDENCE AND FOUNDATION TYPE
ALGONA RESIDENTIAL VAPOR INTRUSION ASSESMENT
BOEING AUBURN

Sample Type	Location Description	Sample Location	Sample Date (a)	Trichloroethene ($\mu g/m^3$)	cis-1,2-Dichloroethene ($\mu g/m^3$)	trans-1,2-Dichloroethene ($\mu g/m^3$)	Vinyl Chloride ($\mu g/m^3$)	Radiello Trichloroethene ($\mu g/m^3$)
	Concentration Long-term Indoor Air Action Levels (b)			*0.91*	--	*27*	*2.8*	*0.91*
	Concentration Short-term Indoor Air Action Levels (b)			*2.0*	--	--	--	--
Foundation: Slab-on-Grade								
Sub-Slab Vapor	1st Floor TV Room/Kitchen	SSV050	8/13/2013	<0.16	<0.12	<0.60	<0.039	--
Sub-Slab Vapor	1st Floor Bedroom	SSV051	8/13/2013	<0.16	<0.12	<0.61	<0.039	--
Indoor Air	1st Floor TV Room/Kitchen	IA026	8/14/2013	<0.18	<0.13	<0.65	<0.042	<0.048
Indoor Air	1st Floor Bedroom	IA027	8/14/2013	<0.17	<0.13	<0.64	<0.041	<0.048
Indoor Air	1st Floor Office	IA028	8/14/2013	<0.15	<0.11	<0.57	<0.036	<0.048
Ambient Air	Outside	AA012	8/14/2013	<0.17	<0.12	<0.61	<0.040	--
Sub-Slab Vapor	Hallway	SSV057	9/15/2013	<0.42	<0.31	<1.5	<0.099	--
Indoor Air	1st Floor TV Room	IA043	9/14/2013	<0.27	<0.20	<1.0	<0.064	--
Indoor Air	1st Floor Bedroom	IA044	9/14/2013	<0.19	<0.14	<0.69	<0.045	--
Ambient Air	Outside	AA018	9/14/2013	<0.20	<0.14	<0.72	<0.047	--
Sub-Slab Vapor	Garage	SSV054	8/27/2013	<0.16	<0.12	<0.61	<0.039	--
Sub-Slab Vapor	Garage	SSV055	8/27/2013	<0.82	<0.61	<3.0	<0.20	--
Sub-Slab Vapor	Closet	SSV053	8/21/2013	<0.17	<0.12	<0.62	<0.040	--
Indoor Air	1st Floor Bedroom	IA032	8/19/2013	**0.54**	<0.32	<1.6	<0.10	--
Indoor Air	1st Floor Office/Storage	IA033	8/19/2013	**0.81**	<0.14	<0.70	<0.045	--
Ambient Air	Outside	AA014	8/19/2013	**1.1**	<0.13	<0.66	<0.042	--
Ambient Air	Outside	AA022	9/25/2013	<0.16	<0.12	<0.59	<0.038	--
Foundation: Slab-on-Grade & Crawlspace								
Sub-Slab Vapor	1st Floor Bedroom/TV Room	SSV052	8/13/2013	<0.17	<0.12	<0.63	<0.040	--
Crawlspace	Crawlspace	CSA003	8/15/2013	**0.19**	<0.13	<0.66	<0.042	<0.050
Indoor Air	1st Floor Bedroom/TV Room	IA029	8/15/2013	<0.18	<0.14	<0.68	<0.044	<0.050
Indoor Air	2nd Floor TV Room	IA030	8/15/2013	<0.19	<0.14	<0.72	<0.046	<0.050
Indoor Air	3rd Floor Bedroom	IA031	8/15/2013	<0.19	<0.14	<0.69	<0.044	<0.050
Ambient Air	Outside	AA013	8/15/2013	<0.18	<0.13	<0.65	<0.042	--
Sub-Slab Vapor	Garage	SSV059	10/16/2013	<0.15	<0.11	<0.57	<0.036	--
Crawlspace	Crawlspace	CSA009	10/15/2013	<0.17	<0.12	<0.61	<0.040	--
Indoor Air	1st Floor Bedroom/TV Room	IA047	10/15/2013	<0.18	<0.13	<0.65	<0.042	--
Indoor Air	2nd Floor TV Room	IA048	10/15/2013	<0.15	<0.11	<0.54	<0.035	--
Indoor Air	3rd Floor Bedroom	IA055	10/15/2013	<0.17	<0.12	<0.62	<0.040	--
Ambient Air	Outside	AA020	10/15/2013	<0.17	<0.12	<0.61	<0.040	--

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	Concentration Long-term Indoor Air Action Levels (b)			*0.91*	--	*27*	*2.8*	*0.91*
	Concentration Short-term Indoor Air Action Levels (b)			*2.0*	--	--	--	--
Sub-Slab Vapor	Garage	SSV058	9/24/2013	<0.34	<0.25	<1.2	<0.081	--
Crawlspace	Crawlspace	CSA007	9/25/2013	<0.16	<0.12	<0.59	<0.038	**0.055**
Indoor Air	1st Floor TV Room	IA046	9/25/2013	<0.16	<0.12	<0.58	<0.038	**0.18**
Ambient Air	Outside	AA019	9/25/2013	<0.16	<0.12	<0.59	<0.038	--
Sub-Slab Vapor	Garage	SSV056	8/30/2013	<1.6	<1.2	<5.9	<0.38	--
Crawlspace	Crawlspace	CSA005	8/28/2013	<0.16	<0.12	<0.61	<0.039	--
Indoor Air	1st Floor Bedroom	IA036	8/28/2013	<0.19	<0.14	<0.70	<0.045	--
Indoor Air	1st Floor Bedroom	IA037	8/28/2013	<0.18	<0.13	<0.66	<0.043	--
Indoor Air	1st Floor TV Room	IA038	8/28/2013	<0.19	<0.14	<0.71	<0.046	--
Ambient Air	Outside	AA016	8/28/2013	<0.17	<0.12	<0.61	<0.040	--
Foundation: Crawlspace								
Crawlspace	Crawlspace	CSA002	8/5/2013	<0.20	<0.14	<0.72	<0.047	<0.048
Indoor Air	1st Floor TV Room	IA023	8/5/2013	<0.18	<0.13	<0.67	<0.043	<0.048
Indoor Air	1st Floor Bedroom	IA024	8/5/2013	<0.20	<0.14	<0.72	<0.043	<0.048
Indoor Air	2nd Floor Bedroom	IA025	8/5/2013	<0.19	<0.14	<0.69	<0.045	<0.048
Ambient Air	Outside	AA011	8/5/2013	<0.19	<0.14	<0.71	<0.046	--
Crawlspace	Crawlspace	CSA008	9/25/2013	<0.17	<0.13	<0.63	<0.041	<0.052
Indoor Air	1st Floor TV Room	IA049	9/25/2013	<0.17	<0.12	<0.62	<0.040	<0.052
Indoor Air	1st Floor Bedroom	IA050	9/25/2013	<0.19	<0.14	<0.70	<0.045	<0.052
Indoor Air	1st Floor Bedroom	IA051	9/25/2013	<0.17	<0.13	<0.64	<0.041	<0.052
Ambient Air	Outside	AA021	9/25/2013	<0.17	<0.12	<0.62	<0.040	--
Crawlspace	Crawlspace	CSA001	7/29/2013	<0.18	<0.13	<0.67	<0.043	--
Indoor Air	Garage Sump	IA017	7/29/2013	<0.18	<0.13	<0.67	<0.043	--
Indoor Air	1st Floor Bedroom	IA018	7/31/2013	<0.16	<0.12	<0.59	<0.038	--
Indoor Air	1st Floor TV Room	IA019	7/31/2013	**0.30**	<0.15	<0.77	<0.050	--
Ambient Air	Outside	AA008	7/29/2013	<0.16	<0.12	<0.61	<0.039	--
Ambient Air	Outside	AA010	7/31/2013	<0.17	<0.13	<0.63	<0.041	--
Crawlspace	Crawlspace	CSA006	9/11/2013	<0.17	<0.12	<0.63	<0.040	--
Indoor Air	1st Floor TV Room	IA039	9/11/2013	<0.19	<0.14	<0.70	<0.045	--
Indoor Air	1st Floor Bedroom	IA040	9/11/2013	<0.18	<0.14	<0.68	<0.044	--
Indoor Air	1st Floor Bedroom	IA041	9/11/2013	<0.17	<0.12	<0.63	<0.040	--

TABLE 1
SUMMARY OF RESULTS BY RESIDENCE AND FOUNDATION TYPE
ALGONA RESIDENTIAL VAPOR INTRUSION ASSESMENT
BOEING AUBURN

Sample Type	Location Description	Sample Location	Sample Date (a)	Trichloroethene ($\mu g/m^3$)	cis-1,2-Dichloroethene ($\mu g/m^3$)	trans-1,2-Dichloroethene ($\mu g/m^3$)	Vinyl Chloride ($\mu g/m^3$)	Radiello Trichloroethene ($\mu g/m^3$)
	Concentration Long-term Indoor Air Action Levels (b)			*0.91*	--	*27*	*2.8*	*0.91*
	Concentration Short-term Indoor Air Action Levels (b)			*2.0*	--	--	--	--
Indoor Air	1st Floor Bedroom	IA042	9/11/2013	<0.18	<0.13	<0.65	<0.042	--
Ambient Air	Outside	AA017	9/11/2013	<0.14	<0.11	<0.54	<0.034	--
Crawlspace	Crawlspace	CSA004	8/22/2013	<0.18	<0.13	<0.66	<0.042	--
Indoor Air	1st Floor TV Room	IA034	8/22/2013	<0.18	<0.13	<0.67	<0.043	--
Indoor Air	1st Floor Bedroom	IA035	8/22/2013	<0.18	<0.14	<0.68	<0.044	--
Ambient Air	Outside	AA015	8/22/2013	<0.21	<0.16	<0.78	<0.050	--
Foundation: Slab-On-Grade & Basement								
Basement	Basement	IA052	9/30/2013	<0.17	<0.13	<0.63	<0.041	--
Indoor Air	2nd Floor Bedroom	IA053	9/30/2013	**1.20**	<0.12	<0.60	<0.039	--
Indoor Air	2nd Floor Bedroom	IA054	9/30/2013	<0.17	<0.13	<0.63	<0.041	--
Ambient Air	Outside	AA023	9/30/2013	<0.18	<0.13	<0.65	<0.042	--
Sub-Slab Vapor	Storage Room	SSV060	10/17/2013	<0.33	<0.24	<1.2	<0.078	--
Basement	Basement	IA056	10/29/2013	<0.17	<0.13	<0.63	<0.041	--
Basement	Basement	IA057	10/29/2013	<0.16	<0.12	<0.6	<0.039	--
Indoor Air	2nd Floor Bedroom	IA058	10/29/2013	<0.18	<0.13	<0.65	<0.042	--
Indoor Air	2nd Floor Bedroom	IA059	10/29/2013	<0.19	<0.14	<0.71	<0.046	--
Ambient Air	Outside	AA024	10/29/2013	<0.15	<0.11	<0.56	<0.036	--
Sub-Slab Vapor	Storage Room	SSV061	10/30/2013	<0.16	<0.12	<0.59	<0.038	--
Indoor Air	Basement Bedroom	IA020	7/31/2013	<0.18	<0.13	<0.67	<0.043	--
Indoor Air	Basement Computer Room	IA021	7/31/2013	<0.18	<0.13	<0.65	<0.042	--
Indoor Air	Basement Sewer Pipe Access	IA022	7/31/2013	<0.18	<0.13	<0.66	<0.042	--
Ambient Air	Outside	AA009	7/31/2013	<0.18	<0.13	<0.65	<0.042	--

-- = Not applicable
< = Indicates the compound was not detected at the reported concentration
Bold = Detected compound
$\mu g/m^3$ = micrograms per cubic meter

(a) Sample Date is the date samples were set up. The Summa canister sample period is 24 hours long, the Radiello® sample period is 21 days long, and the sub-slab vapor sample period is approximately 30 minutes long.

(b) Action levels are protective, health-based concentrations. The actions levels included in this table assume only one chemical was detected. Currenty, there is no health-based concentration for cis-1,2-DCE in air. The short-term action level applies only to TCE.