DEPARTMENT OF HEALTH & HUMAN SERVICES

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May 6, 2016

Re: Exposures to Chemicals in Ambient Air, Jantzen Beach Area, North Portland, Oregon (Letter Health Consult)

Dear Ms. Sifuentes and Dr. Douglas,

At the request of Oregon Health Authority (OHA) in mid-March and later by Multnomah County Health Department (MCHD), the Agency for Toxic Substances and Disease Registry (ATSDR) assessed the potential health risks to residents from exposure to chemicals emitted into ambient air near two oil re-refineries at Jantzen Beach, located in North Portland, Multnomah County, Oregon. ATSDR first became involved at the request of the U.S. Environmental Protection Agency's (EPA's) Office of Compliance and Enforcement in late-September 2015. EPA asked for help addressing complaints from residents on Hayden Island reporting more than mild health effects from odors and or chemicals coming from industries in North Portland. ATSDR has spoken to several community members about their complaints and has followed activities around the site since that time.

The lead regulatory agency, Oregon Department of Environmental Quality (ODEQ), with EPA's support, has been working in the community and with the facilities to identify the source and type of emissions in the ambient air. Since October 2015, OHA, MCHD, and ATSDR have been working together to stay current on activities and provide input to environmental agencies during weekly interagency coordination meetings. ATSDR's role is and will continue to be as advisors to our state and local health and environmental partners to provide them with a public health perspective on the need to identify, quantify, and reduce emissions; encouraging comprehensive ambient air monitoring; and understanding community needs.

Based on an evaluation of EPA's real-time air monitoring results, ATSDR concludes that during four events some contaminants present at levels of potential health concern; but, the information on chemical concentration and duration during air monitoring events had significant limitations. The limitations included high detection limits, the inability to identify specific compounds, and instrumentation problems. Therefore, the real-time monitoring results should be considered preliminary and interpreted with caution. Overall ATSDR concludes:

- Based on a review of ODEQ complaints, residents from Hayden Island and North Portland communities are experiencing strong odors with some frequency (i.e., more than every other week and up to five times a week). People reported that odors were sometimes, but not always, similar to those they smell near oil recycling facilities in North Portland. Not enough information is available to determine the emission source or sources that are causing reported health effects.
- During the two months of monitoring, the levels of hydrogen sulfide measured during the eight events did not last long enough to be poisonous (acutely toxic) or life-threatening. Four of the events were at or above levels that may cause people to have transient health effects such as headaches or dizziness. People with asthma or other respiratory conditions may experience increased frequency of symptoms if exposed to the levels observed. Sulfur dioxide levels, a breakdown product of hydrogen sulfide, were not measured. The source of hydrogen sulfide is unclear and may be confounded by a running boat motor near one of the air monitors.
- Long-term averages of hydrogen sulfide concentrations in the area are not available to compare to chronic health-based criteria.
- Volatile organic compounds (VOCs), organic substances that easily become a vapor or gas from samples taken for a short amount of time, were not at levels that present an immediate health risk. The two months of test results only provided total VOC levels, not specific chemicals; therefore, long-term data are not sufficient to evaluate the possibility of long-term effects. Semi-volatile organic compounds (SVOCs) and sulfur-containing organic compounds were not measured.
- Chlorine gas was detected in two events with hand-held monitors. Levels measured for one of the events exceeded short-term health-based criteria. However, instrumentation problems and being unable to identify the location and duration of the event prevents us from coming to conclusions at this point. A comparison to short-term or long-term health-based criteria cannot be made until the extent of chlorine present in the area is better characterized.
- Based on data collected thus far, ATSDR cannot determine what chemical(s) might be causing the short-, intermediate- or long-term health effects the community is concerned about. Hydrogen sulfide, sulfur dioxide, chlorine, particulates, VOCs, SVOCs, and sulfur containing hydrocarbons were not measured long enough or accurately enough to determine potential health risks. There are multiple sources of contaminants.

ATSDR recommends that ODEQ, with EPA support, ensure that:

- Short- and long-term ambient air monitoring be performed in the Jantzen Beach/Hayden Island area, so that agencies have more information about the chemicals that residents are

being exposed to and if they are at levels where health effects may occur. More information is needed about hydrogen sulfide, sulfur dioxide, chlorine, particulates, VOCs, SVOCs, and sulfur-containing hydrocarbons may be contributing to odors.
- Oil re-refineries and other facilities in the area operate under updated and accurate permits and in a manner consistent with all applicable state and federal regulations, and if needed, install additional controls to protect public health.
- More comprehensive information be provided about what chemicals area industries are emitting and, where possible, impose reduction measures to minimize health impacts on nearby communities.

ATSDR also recommends that residents:

- Try to prevent airborne chemicals from entering their homes and air out homes after odor events pass (see suggestions in the recommendation section).
- Consider a citizen-science approach that submits all odor events, odor characterization, and self-reported health effects to ODEQ's hotline (1-888-997-7888) or online complaint system http://www.deq.state.or.us/complaints/). For personal information, keep an odor diary and relay information to ODEQ as needed. More information on environmental odors is available at http://www.atsdr.cdc.gov/odors/index.html.

Lastly, ATSDR recommends that OHA and MCHD:

- Work with ODEQ to ensure that the complaint system is capturing information about odor events, types of odors, and self-reported health effects.

The rest of this letter contains background on the Jantzen Beach area (area sources of air pollution, community complaints, sampling effort, and screening process); results of monitoring and screening; and supporting information for ATSDR conclusions and recommendations.

Background

The Oregon Department of Environmental Quality (ODEQ), with EPA's support, is working with two industrial facilities, American Petroleum Environmental Services, Inc. (APES) and Oil Re-Refining Company (ORRCO) through regulatory processes to minimize air emissions.[1] These two facilities are in an industrial area of North Portland with many potential sources of nuisance odors and hazardous air pollutants. There are major industrial and transportation corridors near the site. ATSDR staff visited the site in early February 2016 and toured the greater area around and near these facilities. ATSDR staff experienced odors similar to those reported by the community in the vicinity of both facilities.

[1] ODEQ's North Portland Odors website: http://www.deq.state.or.us/nwr/northportland.htm

APES recycles or re-refines on-specification used oil, including petroleum-based and synthetic oils, which have impurities such as dirt, metal scrapings, water, or chemicals. Historical processes conducted at this site involved mixing, blending, and refining various types of oil, off-specification fuels, and oily waters to produce refined fuel oil. Unrelated to current activities, APES, formerly owned by Harbor Oil, Inc., was listed on the EPA's national priorities list (NPL) of Superfund Sites. Contaminants at the site included metals, polycyclic aromatic hydrocarbons, petroleum hydrocarbons, polychlorinated biphenyls (PCBs), dichlorodiphenyltrichloroethane (DDT), and some VOCs (including trichloroethylene). Ambient air was not considered as an exposure pathway of concern and air data were not collected during the remedial investigation. In 2004, OHA's Public Health Division and ATSDR concluded that exposure to off-site contaminants found in the drainage area and wetlands adjacent to Force Lake (see Figure 1) was not anticipated to result in adverse health effects (ODHS and ATSDR 2004).[2] OHA has posted an advisory sign on Force Lake advising against entering or eating fish from the lake. EPA determined that the site did not pose an unacceptable risk to the public. In 2013, the Record of Decision under the Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA) did not recommend further cleanup action (EPA 2013).[3] ODEQ did not agree with EPA's decision.

ORRCO is another business in the Jantzen Beach area that recycles used oils, oily waters, oily solids, used oil filters, spent antifreeze, and other materials. In addition to an ODEQ air permit, the facility also holds a solid waste permit (Metro) to accept petroleum contaminated soil, oily wastes, and vegetable based fats, oils, and greases. Under a permit from the City of Portland, ORRCO processes wastewater. The site is involved with the ODEQ Cleanup Program because soil, surface water, groundwater, and sediment at the site contains metals, VOCs, and SVOCs. The site Record of Decision required that soil in areas with high contamination be removed (ODEQ 2011).[4] In 2013, EPA ordered ORRCO to properly dispose of PCB-contaminated oil by 2016.[5] In 2010, ORRCO collected, transported, stored and processed more than 150,000 gallons of used oil containing PCBs in violation of federal requirements, but has resolved the problem. During all of these previous activities, ambient air was not considered an exposure pathway of concern and air data were not collected.

The Jantzen Beach/Hayden Island site is an area in North Portland that has residential, industrial, commercial, and recreational areas. EPA defined the site to be bounded by Vancouver, Washington to the north, Interstate-5 to the east, Columbia Slough to the south, and Smith Lake to the west. Hayden Island, lies to the north across a channel of the Columbia River. In addition

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[2] OHA-DHS and ATSDR 2004. Public Health Assessment – Final Version, Harbor Oil, Multnomah County, Oregon. Oregon Health Authority Department of Human Services and Agency for Toxic Substances and Disease Registry.

[3] U.S. EPA. 2013. Harbor Oil Superfund Site, Portland Oregon, Record of Decision ORD071803985 June 28, 2013. U.S. Environmental Protection Agency,

[4] ODEQ 2011. Record of Decision remedial action alternative for Merit Oil/Fuel Processors Inc. [aka ORRCO] ECSI 673. June 2011. Oregon Department of Environmental Quality.

[5] U.S. EPA. 2013. Press Release – Portland oil re-refining company ordered to safely dispose PCB-contaminated oil or pay penalty. Released 04/13/2013

to the facilities discussed above, other activities in the area could generate air pollution including several facilities along North Suttle Road, Marine Drive and Force Avenue. The City of Portland's sanitary sewer system has a line that travels along Force Avenue and a pump station nearby. Another potential source of pollution is local transportation emissions including automobiles, trucks, and vessels. In addition, significant rail-to-truck material transfer occurs including flammable liquids, oxidizing substances, organic peroxides, corrosive substances, and petroleum-based products.

Community Complaints

Since mid-August 2015, residents near the Jantzen Beach/Hayden Island area, have complained to public agencies about chemical odors and health effects over the past eight months. Complaints have been received by ODEQ, OHA, MCHD, the Oregon Emergency Response System, U.S. Coast Guard's National Response Center, EPA, and ATSDR. ODEQ provided ATSDR their systematical collection of phone and online complaints by community members.[6] In a review of these complaints, 61 people complained 145 times from August 15, 2015 to April 27, 2016. Complaints sometimes occur several times within a week. According to EPA compliance staff, odor complaints occurred approximately one-third of the days during this time. The longest gap with no complaints was during early to mid-March. Over 82% of the complaints characterize smells similar to petroleum, oil, fuel (diesel and gasoline), an auto parts store, axle grease, asphalt, propane, or a refinery. Approximately 10% of the complaints characterize smells like natural gas, sulfur, sulfur dioxide, rotten eggs, or garbage. The remaining complaints range from acidic to caustic chemicals, styrene, burning rubber, or other unknown chemicals. In addition to the ODEQ database, agencies received a number of complaints about strong odors affecting the ability to play and continue youth soccer games at nearby Kellye Point Park on Sunday April 17, 2016.

All 145 complaints refer to experiencing a bad odor and approximately 45% of all the complaints refer to one or more health effects and or decrease in quality of life. Reported symptoms included:

- Irritation (29%) to the throat/mouth (burning, sore, taste of smell), eyes (burning and watering), and nasal passages (bloody sinuses at the extreme).
- Headaches (26%).
- Decreased sleep (woke up or couldn't go back to sleep because of smell (23%)
- Nausea (18%).
- Respiratory symptoms (11%) that include coughing, hurting to breathe, difficult to breathe, and asthma (needing an inhaler).
- Dizziness (3%).

[6] Bivins. 2016. Personal Communication: Email correspondence from Louis Bivins at DEQ to Rhonda Kaetzel at ATSDR. April 27, 2016.

In addition to smelling odors and experiencing health effects, 13% of complainants report a decrease in quality of life. Examples, in order of frequency, include reduced time outside, reduced exercise time, reduced work time (had to leave or stop early), and physical distress.

According to EPA's Environmental Justice Screening tool,[7] the tract is 82nd percentile statewide and the 67th percentile nationwide for ozone pollution. In addition the tract is 82nd percentile statewide and the 66th percentile nationwide for particulate matter measured at 2.5 micrometers and higher.

Air Monitoring and Sampling

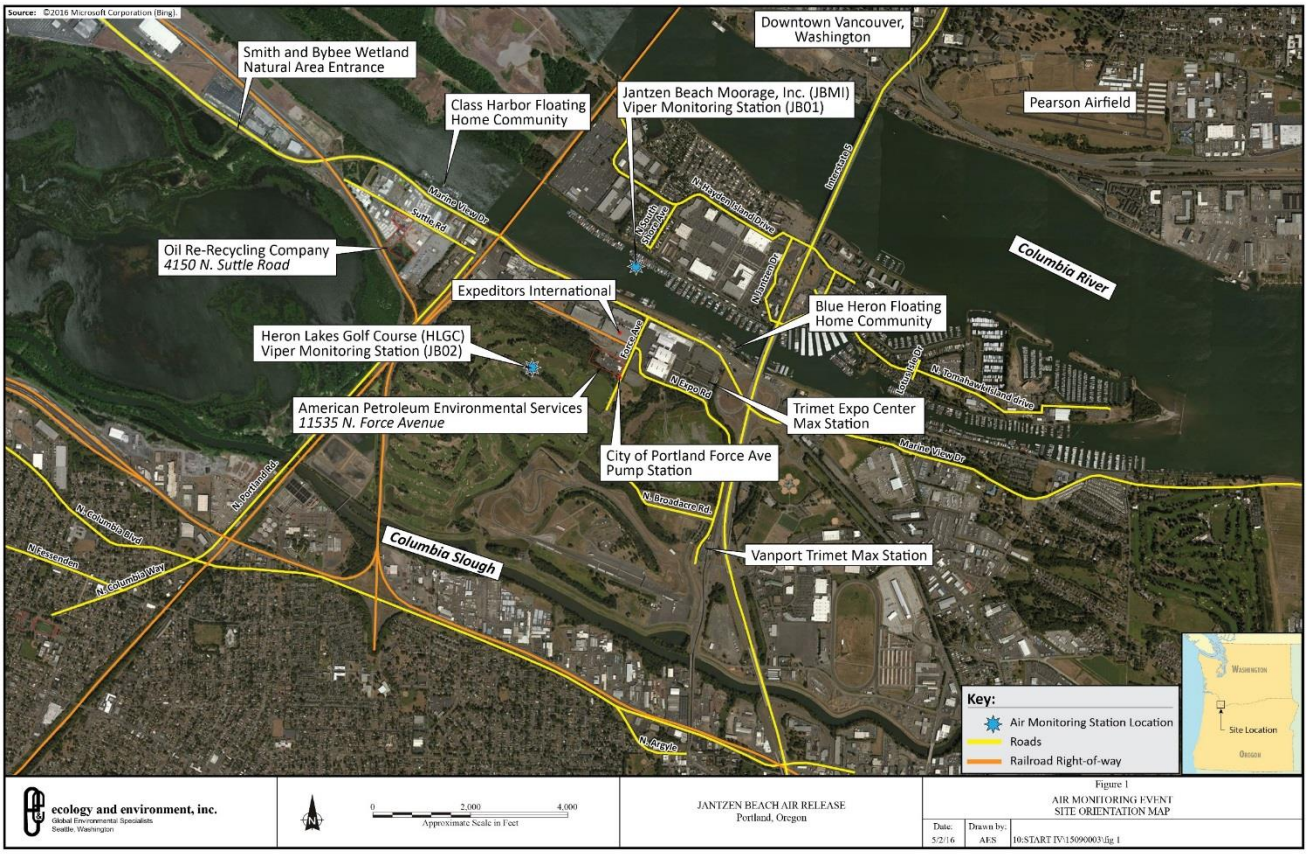
In September 2015, EPA responded to complaints by conducting the "Jantzen Beach Air Monitoring Investigation" in order to qualitatively understand the source, magnitude and frequency of chemicals in the air. EPA contractors began monitoring for total VOCs and gases with hand-held photoionization detectors. EPA then installed stationary continuous air monitors at two locations: 1) Jantzen Beach Moorage, a houseboat community located on Hayden Island (JB01) across the river channel from Jantzen Beach and 2) Heron Lakes Golf Course located off Force Avenue (JB02) southeast of APES (Figure 1). The monitors collected information from November 11, 2015 to January 8, 2016.

The stationary monitors used by EPA contained multiple types of chemical detectors including photoionization, flame ionization, electrochemical, and catalytic detectors. These monitors reported detections of total VOCs; hydrogen sulfide, chlorine, ammonia, oxygen, and carbon monoxide gases; and the lower explosive limit of flammable gases. EPA tried to collect sulfur dioxide levels, but the instrumentation malfunctioned. EPA added a Viper automated data transmission and warning system. Viper is a wireless system that broadcasts real-time data from the instrument through cellular networks. When total VOC levels were detected above a certain threshold (100 ppb), the Viper system alerted personnel to more closely investigate site conditions. The threshold was set to 100 parts per billion (ppb), a level protective of long-term health effects from exposure to benzene, one of the more toxic compounds present in urban air. Later, this was increased to 150 ppb.

In addition to the real-time monitoring system, EPA collected short-term air samples for laboratory analysis using Summa canisters on two days that odors when detected by people. On December 22, 2015 two 1-hr samples were collected at Heron Lakes Golf Course (JBO2) and Force Lake/Delta Park. On December 27, 2015 three 4-minute grab samples were collected at Jantzen Beach Moorage (JBO1), upwind and downwind of APES on Force Avenue. These sample collections did not correlate with times of highest total VOCs recorded by the Viper System.

[7] https://www.epa.gov/ejscreen (Email from Julie Sifuentes (OHA) to Rhonda Kaetzel (ATSDR) April 28, 2016

Figure 1. Location of sampling during EPA's Jantzen Beach air investigation (November 2015 to January 2106), North Portland, Oregon.



Source: U.S EPA 2016

Screening and Risk Evaluation Methods

Even though data is preliminary and has limitations, especially the real-time air monitoring data, ATSDR performed a preliminary evaluation to assess the potential for public health impacts. ATSDR compared chemical concentrations and durations to short-term health-based screening values. Until data are collected over longer periods of time, ATSDR and/or OHA will wait until long-term data are available to evaluate long-term health effects.

ATSDR screened the air data with their Acute Minimal Risk Levels (Acute MRLs)[8] and Emergency Response Planning Guidelines (ERPGs)[9] developed by the American Industrial Hygiene Association. ATSDR also used the most conservative of EPA's Acute Exposure Guideline Levels (AEGLs).[10] AEGLs are applicable to emergency exposures ranging from 10 minutes to 8 hours. ATSDR used the 8-hour AEGLs are the most conservative and used. For short-duration exposures, the Acute MRL, ERPG-1, and AEGL-1 are protective of health effects for the general public and sensitive populations.

Results and Discussion

ATSDR reviewed EPA's data report on the air monitoring[11] and sampling results.[12] EPAs report identified a number of limitations that impact the ability to address public health concerns. The real-time monitoring data collected using the Viper system required a significant amount of post-processing. Background levels, interference effects, cross-sensitivity, sensor detection limits, sensor repeatability, and error effects severely constrain thee accuracy of the data (see Limitations section). However, the data are useful in understanding overall trends and can inform future sampling efforts. Because of these uncertainties, ATSDR is not able to definitively evaluate the data for public health impacts. The data report indicates that levels of hydrogen sulfide, chlorine, and VOCs were elevated for brief amounts of time. Attachment 1 to this letter shows the screening analysis of levels measured and health-based comparison values.

Hydrogen Sulfide Gas

Hydrogen sulfide was measured during eight events at four different locations (see Table 1). Events occurred for different durations at different times ranging from 1:00 pm to 2:00 am. Hydrogen sulfide levels ranged from 0.6–5 (parts per million (ppm) or 840–7000 µg/m^3). The reported durations of events ranged from less than one minute up to 68 minutes. Only levels

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[8] Acute Minimal Risk Levels (MRLs). An Acute MRL is designed to protect the most sensitive people to chemically-induced effects. They are to be used for short exposures lasting minutes up to 14 days. An acute MRL is an estimate of the daily exposure to a hazardous substance that is likely to be without appreciable risk of adverse non cancer health effects. Exposure to a level above the MRL does not mean that adverse effects will occur but that they could occur.

[9] Emergency Response Planning Guidelines (ERPGs): If exposed for up to one hour at levels below ERPG-1, most people will not experience health effects (including mild transient effects). If exposed for up to one hour at levels below ERPG- 2 most people will not experience irreversible or other serious health effect. If exposed for up to one hour at levels below ERPG-3, most people will not experience life-threatening health effects.

[10] Acute Exposure Guideline Levels (AEGLs): Exposure above the AEGL-1 may result in notable discomfort or irritation in the general population, including sensitive individuals. Effects are transient after the exposure stops. Exposure above the AEGL-2 may result in irreversible or other serious long-lasting adverse health effects or an impaired ability to escape the exposure. Exposures above the AEGL-3 may result in life-threatening adverse health effects or death.

[11] Ecology and Environment. 2016a. Trip report for Jantzen Beach air testing, technical direction document 15-09-0003. Dated May 2, 2016.

[12] Ecology & Environment, Inc. 2016b,c. Organic data quality assurance review, Jantzen Beach Air release site and attached excel file for ALS Lab Project ID P1505593 dated January 6, 2016 (E&E 2016b) and Lab Project P1505613 (E&E 2016c) dated January 8, 2016.

above 0.5 ppm were reported, so the events may have lasted longer. These concentrations were screened with comparison values based on durations similar to the event. The detection limit (0.5 ppm) was higher than the Acute MRL[13] (0.07 ppm, 98 µg/m^3) and the ERPG-1 (0.1 ppm, 140 µg/m^3). By not capturing levels below 0.5 ppm, ATSDR cannot determine how long the events occurred. Four of the events, three at the golf course and one at the Jantzen Beach Moorage, lasted less than one minute; though higher than the screening values, the limited duration of exposure reduces concern. At least three of the events lasting longer than 10 minutes were associated with a boat motor running approximately 20–30 feet away. Assuming the data are representative, exposure to the higher levels of hydrogen sulfide found in the recent sampling may lead to increased frequency or worsening of respiratory problems for people with conditions such as asthma. Exposures may also cause eye nose and throat irritation, headache, and fatigue. ATSDR did not expect the levels of hydrogen sulfide detected to cause more serious health effects. More information on hydrogen sulfide properties, prevalence, and health effects can be found in the attachments (Attachment 2).

Other Gases

In addition to hydrogen sulfide, the continuous and handheld monitors also measured for oxygen, carbon monoxide, ammonia, and chlorine. Oxygen, carbon monoxide, and ammonia did not exceed health-based criteria and are not pollutants of concern. Chlorine gas was detected during two events while EPA personnel were driving around with hand held monitors. During the afternoon of September 11th, chlorine was detected at 0.05 ppm northwest of Force Lake and at the east end of Suttle Road. These levels were below ATSDR's acute MRL (0.06 ppm) and AIHA's ERPG-1 (1 ppm)[14] for chlorine. Between noon and 4:45 pm, EPA detected chlorine gas at between zero and 0.6 ppm on December 7, while driving over a broad area from Suttle Avenue (near ORRCO), near the Heron Lakes Golf Course, along Force Avenue over to Hayden Island then returning to the Marine Drive pullout near the Expo center. Levels exceeded the acute MRL, but not the ERPG-1. Because the exact location, peak concentration, and duration of these levels were not recorded, ATSDR cannot determine if a short-term transient health effect could occur. Should exposure to low levels of chlorine occur, the irritant effects could exacerbate respiratory effects from other air pollutants such as hydrogen sulfide. More information on chlorine properties, prevalence, and health effects can be found in the attachments (Attachment 2).

Volatile Organic Compounds

During the 60 days of continuous monitoring, there were 41 days when the monitors did not detect or reported very low concentrations of total VOCs consistent with urban background levels. In addition to the continuous monitors, VOCs (analyzed by EPA method TO-15) were collected in Summa canisters during 1-hr and 4-min durations (E&E 2016b, c) on two different

[13] ATSDR. Toxicological profiles for hydrogen sulfide (2014) and chlorine (2010).

[14] American Industrial Hygiene Association. 2015. Current ERPG/WEEL guidance

days when odors were present in December (see results in Tables 2 and 3).[15] While validated data is available for these samples it should be noted that: 1) these data represent very short time frames, but not long exposures over time and should not be compared to chronic health comparison values, 2) the limited sample number and locations means that values could be higher or lower than what is represented, and so more data are needed to reach more definitive conclusions, 3) these are only VOCs measured under method TO-15; but unstable sulfhydryl compounds or semi-volatile compounds were not measured for, and 4) the samples were not collected during peak events and therefore may not include compounds present during peak events. ATSDR screened VOCs with acute MRL, ERPG, and AEGL health-based comparison values if available (Table 4). None of the chemicals detected exceeded short-term health-based comparison values.

Limitations

There are always, in any air monitoring endeavor, challenges and limitations. The preliminary data collected by EPA provide a snapshot of information that can help inform future, more precise and thorough monitoring. EPA collected a large volume of air data with a continuous multi-monitor, some data manually with hand held monitors, and some from samples analyzed in a laboratory.

Real-time collection of information can determine general types and durations of many air contamination events at all hours and be able to immediately inform EPA to investigate and if possible, take a more precise and definitive sample(s) for laboratory analysis. Locating the monitor within a boat moorage represent community exposures, but allowed for residential sources such as boat motors and possibly sewage transfer vents to influence the hydrogen sulfide levels. However, both the continuous monitor and hand held monitors had a number of limitations including:

- Varying baseline of background levels
- Inability to identify specific air contaminants
- Interference effects from humidity, temperature, changes in air pressure.
- Cross-sensitivity (detecting a chemical other than the one intending to be measured)
- Changing detection limits of the sensor(s)
- Laboratory and real-time monitoring instrument detection limits higher than level that health-based screening values
- Sensor repeatability (multiple sensors giving very different results)
- Accuracy of event duration and intra-event variability
- Restrictions in access to monitor locations within the area of most health complaints

[15] Ecology & Environment, Inc. 2016b,c. Organic data quality assurance review, Jantzen Beach Air release site and attached excel file for ALS Lab Project ID P1505593 dated January 6, 2016 (E&E 2016b) and Lab Project P1505613 (E&E 2016c) dated January 8, 2016.

Other issues include inability to tell how long an event lasted (event continued but contamination concentration exceeded the instrument's upper detection limit), inability to average concentrations over time, and a limited number of locations. The laboratory sample quality was acceptable; these samples were taken for a short duration, outside of the highest peak time, and in a limited number of locations. These data are not necessarily representative of long-term conditions.

Conclusions

ATSDR concludes that residents in the Jantzen Beach area are experiencing strong odors with a frequency of every other week up to five times a week. These odors are sometimes, but not always, reported to be similar to those reported near the oil re-refineries. About 45% of the complaints were accompanied by reported health effects. Not enough information is available to determine what chemical people are smelling or responding to.

ATSDR concludes the levels of hydrogen sulfide measured on eight occasions did not last long enough to be poisonous (acutely toxic) or life-threatening; however, during four of these occasions, people may have breathed levels of hydrogen sulfide that lasted long enough to result in health effects. The source of hydrogen sulfide is unclear and may have been confounded by a boat monitor near one of the monitors. Assuming the data are representative, exposure to higher levels of hydrogen sulfide during the recent sampling may have led to increased frequency or worsening of respiratory problems for people with conditions such as asthma. Exposures may also cause eye nose and throat irritation, headache, and fatigue. ATSDR does not expect the levels of hydrogen sulfide detected to cause more serious health effects. During the majority of the sampling, hydrogen sulfide levels were not detected; however it may have been present at lower levels than the instrument were able to analytically "see." Because of the instrument's high detection limit used to measure hydrogen sulfide, events may have lasted longer than reported.

ATSDR concludes that organic substances that easily become a vapor or gas from samples taken for a short amount of time, were not at levels that present an immediate health risk. During the 60 days of continuous monitoring, EPA did not detect or reported very low concentrations of total VOCs two thirds of the time (41 days). The test results only provided total VOC levels, not specific chemicals; therefore, long-term data are not sufficient to evaluate the possibility of long-term effects. The short-term samples may not be representative of conditions in the community. Semi-volatile organic compounds (SVOCs) and sulfur-containing organic compounds were not measured.

ATSDR cannot determine if chlorine gas, detected during two events, occurred in a residential location or for long enough to result in transient health effects. Chlorine gas was detected during two events with hand-held monitors while driving in the area. Levels measured for one of the events exceeded short-term health based criteria. ATSDR was not able to determine the location, duration, and peak concentrations of these events and so they should be interpreted with caution. A comparison to short-term or long-term health-based criteria cannot

be made until the extent of chlorine present in the area is better characterized. The source of chlorine gas has not been identified and may not be from the oil re-recycling facilities.

ATSDR cannot determine if community members are breathing other chemical(s) at levels that pose short-term, intermediate, or long-term health effects. At this time, not enough information about identity of specific chemicals, levels in the air, or frequency and duration of exposure is available to estimate exposures to volatile and semi-volatile organic compounds, sulfur dioxide, particulate matter, and other hydrocarbons with sulfur such as mercaptans.

Recommendations and Next Steps

ATSDR recommends that short- and long-term ambient air monitoring be performed in communities affected by strong odors in the Jantzen Beach area. Until emissions are better understood, agencies should work together to find resources for ambient air monitoring. This monitoring should cover two objectives: 1) to determine which chemicals communities are exposed to; and 2) to provide information to the community about exposures and potential health effects. ODEQ is planning to monitor for hydrogen sulfide and VOCs in ambient air; however, other chemicals not previously measured may also be present. Long-term ambient air monitoring plans for hydrogen sulfide, VOCs, SVOCs, particulate matter, sulfur dioxide, and other sulfhydryl hydrocarbons are necessary before intermediate and chronic exposures can be evaluated. ATSDR and OHA are available to provide input on relevant data quality objectives to determine potential health effects as this information becomes available.

ATSDR recommends that ODEQ, with EPA support, work to ensure that both APES, ORRCO, and other facilities operate under updated and accurate permits with the maximum controls possible. Having these facilities and others in the area working under current air permits including all applicable federal and state rules and authorities is important in controlling and reducing emissions that may have adverse public health impacts. Given current uncertainty in the contributing chemicals, ATSDRs recommend DEQ incorporate future findings in its permitting strategy to reduce all identified pollutants.

ATSDR recommends that ODEQ, with EPA support, work to understand what chemicals are being emitted from APES, ORRCO, and other facilities so that emissions from these facilities be reduced, where possible, in order to minimize adverse public health impacts to nearby communities. Since there are other sources of air emissions in the area, it is important to understand what chemicals are being released from these facilities. Source testing and ambient air monitoring, as appropriate, can inform decisions on actions that may best be used to reduce adverse impacts to nearby communities.

ATSDR recommends that community members try to prevent airborne chemicals from entering their homes. During odor events, slowing down entry of airborne chemicals into living spaces by closing windows and doors can reduce outdoor air coming into homes, thereby reducing exposures. Likewise, after odor events, it is important to open windows and doors and circulate indoor air to dilute any chemicals left in the home.

ATSDR recommends that community members keep an odor diary and/or submit complaints regularly into ODEQ's complaint system. Residents should consider a citizen, science-based approach by submitting all odor events, smell characterization, and self-perceived health complaints to ODEQ's hotline or online complaint system. For personal information, recording these events will provide important information to agencies for identifying patterns of releases and working with facilities. It also documents effects on the community. More information on odors in a community can be found at http://www.atsdr.cdc.gov/odors/index.html.

ATSDR recommends that ODEQ continue to collect complaint information. OHA and MCHD should work with ODEQ and affected communities to ensure that the complaint systems are capturing information about odor events, types of odors, and self-reported health effects. Public agencies should work with ODEQ and affected communities improve the complaint system

ATSDR will continue to work with OHA and Multnomah County Health to communicate health concerns to environmental agencies and to the public. If you have further questions, do not hesitate to contact me at 1-206-553-0530 or rkaetzel@cdc.gov.

Sincerely,

Rhonda Kaetzel, PhD, DABT
Regional Director / Toxicologist
Agency for Toxic Substances and Disease Registry

Cc: Scott Downey, EPA, Office of Air Compliance and Enforcement
Wally Moon, EPA, Office of Environmental Cleanup
Julie Wroble, EPA, Office of Environmental Assessment
Gerald Ebersol, Oregon Department of Environmental Quality, Air Program

Attachments 1: Tables
Attachment 2: Properties and health effects of hydrogen sulfide and chlorine gas
Attachment 3: Proposed citizen odor complaint log

Attachment 1 – Screening Tables

Table 1. Screening of hydrogen sulfide events measured during EPA's Jantzen Beach Air Investigation (November 2015 to January 2016) with short-term health-based comparison values (µg/m^3).

Location	Date	Time	Duration (minutes)	Concentration (µg/m^3)	Exceed Acute MRL? (up to 14 days)	Exceed ERPG-1? (up to 60 min)	Exceed AEGL-1? (up to 8 hours)	Exceed ERPG-2? (up to 60 min)	Exceed ERPG-3 (up to 60 min)
					98	140	460	42000	140000
Force Avenue	11/3	22:56	18	840–2000	Yes	Yes	Yes	No	No
Jantzen Beach Moorage	11/24	14:06	13	840–4300	Yes	Yes	Yes	No	No
Jantzen Beach Moorage	12/1	13:04	10	840–3300	Yes	Yes	Yes	No	No
Heron Golf Course	12/7	16:37	<1	1100	No	No	No	No	No
Heron Golf Course	12/7	21:27	<1	980	No	No	No	No	No
Heron Golf Course	12/8	14:39	<1	2000	No	No	No	No	No
Jantzen Beach Moorage	12/30	14:34	68	1800–7000	Yes	Yes	Yes	No	No
Jantzen Beach Moorage	1/8	14:20	~1	1100	No	No	No	No	No

Notes: Source: Ecology and Environment. 2016a. Trip report for Jantzen Beach air testing, technical direction document 15-09-0003. Dated May 2, 2016. .
Yellow highlights exceed acute short term health-based criteria.

AEGL Acute Emergency Guideline Levels. AEGL-1: Exposure above the AEGL-1 may result in notable discomfort or irritation in the general population, including sensitive individuals. Effects are transient after the exposure stops.

ERPG Emergency Response Planning Guidelines developed by the American Industrial Hygienists Association for exposures to the general public. ERPG-1: If exposed for up to one hour at levels below ERPG-1, nearly all people will not experience mild transient health effects. ERPG-2: If exposed for up to one hour at levels below ERPG- 2 nearly all people will not experience irreversible or other serious health effect. ERPG-3: If exposed for up to one hour at levels below ERPG-3, nearly all people will not will not experience life-threatening health effects.

EPA U.S. Environmental Protection Agency

MRL Minimal Risk Level developed by the Agency for Toxic Substances and Disease Registry, U.S. Health and Human Services. If exposed below this level no adverse health effects are expected.

Table 2. Description of discrete air samples taken with Summa Canister (6L)

Sample Number	Location	Date, Time, and Duration	Comment
15121001	Heron Lakes Golf Course (JB02)	12/22, 09:50, 1-hour	Odor began dissipating before collection; 60-790 ppb (JB02 prior to sampling); 4000-5000 ppb (hand held monitor, 10:30-10:50am, end of sampling)
15121002	Force Lake and Delta Park	12/22, 10:00, 1-hour	Sewer-like odor; began dissipating before collection. 0 ppb (hand held monitor)
15121003	Trip blank	12/22	
15121011	Jantzen Beach Moorage (JB01)	12/27, 15:38, 3 minute grab	Propane/burnt oil odor. 150-300 ppb (handheld monitor); 1-28 ppb (JB01)
15121012	Trip Blank	12/27	
15121013	Middle of Force Avenue and Delta Park (Downwind of APES.	12/27, 18:35, 3-minute grab	Acrid/oily odor with strange taste; propane-like odor at times. 350 ppb (handheld monitor)
15121014	South End of Force Avenue (upwind of APES)	12/27, 18:42, 3-minute grab	Propane-/burnt oil-like odor. 50 ppm (hand held monitor)

Notes: Source: Ecology and Environment. 2016a. Trip report for Jantzen Beach air testing, technical direction document 15-09-0003. Dated May 2, 2016.

Table 3. Complete list of volatile organic compounds measured in 1-hour and 4-minute grab samples during EPA's Jantzen Beach Air Investigation (November 2015 to January 2016) (µg/m3).

Volatile Organic Compound	December 22, 2015						December 27, 2015							
	1-hr		1-hr		Blank		Grab		Grab		Grab		Blank	
Sample Number	1001		1002		1003		1011		1013		1014		1012	
Acetone	5.9	U	6.5	U	5.0	U	6.0	U	6.3	U	6.0	U	5.0	U
Acetonitrile	0.59	U	0.65	U	0.50	U	0.60	U	0.63	U	0.60	U	0.50	U
Acrolein	2.4	U	2.6	U	2.0	U	2.4	U	2.5	U	2.4	U	2.0	U
Acrylonitrile	0.59	U	0.65	U	0.50	U	0.60	U	0.63	U	0.60	U	0.50	U
Benzene	1.5	U	1.4	U	**0.37**		**3.0**		**0.93**		**0.59**		0.10	U
Benzyl Chloride	0.59	U	0.65	U	0.50	U	0.60	U	0.63	U	0.60	U	0.50	U
Bromodichloromethane	0.12	U	0.13	U	0.10	U	0.12	U	0.13	U	0.12	U	0.10	U
Bromoform	0.59	U	0.65	U	0.50	U	0.60	U	0.63	U	0.60	U	0.50	U
Bromomethane	0.24	U	0.26	U	0.20	U	0.24	U	0.25	U	0.24	U	0.20	U

Volatile Organic Compound	December 22, 2015						December 27, 2015							
	1-hr		1-hr		Blank		Grab		Grab		Grab		Blank	
Sample Number	1001		1002		1003		1011		1013		1014		1012	
Butadiene, 1,3-	0.24	U	0.26	U	0.20	U	0.24	U	0.25	U	0.24	U	0.20	U
Butanone, 2- (MEK)	5.9	U	6.5	U	5.00	U	6.0	U	6.3	U	6.0	U	5.0	U
Butyl Acetate, n-	**1.1**		**1.2**		0.50	U	0.60	U	0.63	U	0.60	U	0.50	U
Carbon Disulfide	5.9	U	6.5	U	5.0	U	6.0	U	6.3	U	6.0	U	5.0	U
Carbon Tetrachloride	**0.42**		**0.44**		0.10	U	**0.45**		**0.46**		**0.46**		0.10	U
Chloro-1-propene, 3- (Allyl Chloride)	0.12	U	0.13	U	0.10	U	0.12	U	0.13	U	0.12	U	0.10	U
Chlorobenzene	0.12	U	0.13	U	0.10	U	0.12	U	0.13	U	0.12	U	0.10	U
Chloroethane	0.24	U	0.26	U	0.20	U	0.24	U	0.25	U	0.24	U	0.20	U
Chloroform	**0.12**		**0.14**		0.10	U	**0.38**		0.13	U	0.12	U	0.10	U
Chloromethane	**0.32**		**0.28**		0.20	U	**0.35**		**0.32**		**0.33**		0.20	U
Cumene	0.59	U	0.65	U	0.50	U	0.60	U	0.63	U	0.60	U	0.50	U
Cyclohexane	1.2	U	1.3	U	1.0	U	**3.7**		1.3	U	1.2	U	1.0	U
Dibromo-3-chloropropane, 1,2-	0.59	U	0.65	U	0.50	U	0.60	U	0.63	U	0.60	U	0.50	U
Dibromochloromethane	0.12	U	0.13	U	0.10	U	0.12	U	0.13	U	0.12	U	0.10	U
Dibromoethane, 1,2-	0.12	U	0.13	U	0.10	U	0.12	U	0.13	U	0.12	U	0.10	U
Dichloro-1,1,2,2-tetrafluoroethane (CFC 114), 1,2-	0.59	U	0.65	U	0.50	U	0.60	U	0.63	U	0.60	U	0.50	U
Dichlorobenzene, 1,2-	0.12	U	0.13	U	0.10	U	0.12	U	0.13	U	0.12	U	0.10	U
Dichlorobenzene, 1,3-	0.12	U	0.13	U	0.10	U	0.12	U	0.13	U	0.12	U	0.10	U
Dichlorobenzene, 1,4-	0.12	U	0.13	U	0.10	U	0.12	U	0.13	U	0.12	U	0.10	U
Dichlorodifluoromethane (CFC 12)	**2.2**		**2.0**		0.50	U	**2.0**		**2.0**		**2.0**		0.50	U
Dichloroethane, 1,1-	0.12	U	0.13	U	0.10	U	0.12	U	0.13	U	0.12	U	0.10	U
Dichloroethane, 1,2-	0.12	U	0.13	U	0.10	U	0.12	U	0.13	U	0.12	U	0.10	U
Dichloroethene, 1,1-	0.12	U	0.13	U	0.10	U	0.12	U	0.13	U	0.12	U	0.10	U
Dichloroethene, cis-1,2-	0.12	U	0.13	U	0.10	U	0.12	U	0.13	U	0.12	U	0.10	U
Dichloroethene, trans-1,2-	0.12	U	0.13	U	0.10	U	0.12	U	0.13	U	0.12	U	0.10	U
Dichloropropane, 1,2-	0.12	U	0.13	U	0.10	U	0.12	U	0.13	U	0.12	U	0.10	U
Dichloropropene, cis-1,3-	0.59	U	0.65	U	0.50	U	0.60	U	0.63	U	0.60	U	0.50	U
Dichloropropene, trans-1,3-	0.59	U	0.65	U	0.50	U	0.60	U	0.63	U	0.60	U	0.50	U

Volatile Organic Compound	December 22, 2015						December 27, 2015							
	1-hr		1-hr		Blank		Grab		Grab		Grab		Blank	
Sample Number	1001		1002		1003		1011		1013		1014		1012	
Dioxane, 1,4-	0.59	U	0.65	U	0.50	U	0.60	U	**0.98**		0.60	U	0.50	U
Ethanol	7.5	U	9.6	U	**7.2**		6.0	U	6.3	U	6.0	U	5.0	U
Ethyl Acetate	1.2	U	10	U	**3.1**		1.2	U	1.3	U	1.2	U	1.0	U
Ethylbenzene	**0.87**		**0.88**		0.50	U	0.60	U	0.63	U	0.60	U	0.50	U
Ethyltoluene, 4-	0.59	U	0.65	U	0.50	U	0.60	U	0.63	U	0.60	U	0.50	U
Heptane, n-	**1.0**		**1.1**		0.50	U	**2.6**		**0.72**		0.60	U	0.50	U
Hexachlorobutadiene	0.59	U	0.65	U	0.50	U	0.60	U	0.63	U	0.60	U	0.50	U
Hexane, n-	1.6	U	1.8	U	**1.3**		**12**		**0.82**		0.60	U	0.50	U
Hexanone, 2-	0.59	U	0.65	U	0.50	U	0.60	U	0.63	U	0.60	U	0.50	U
Limonene, d-	**0.79**		**0.68**		0.50	U	0.60	U	**1.5**		0.60	U	0.50	U
Methyl Methacrylate	1.2	U	1.3	U	1.0	U	1.2	U	1.3	U	1.2	U	1.0	U
Methyl tert-Butyl Ether	0.12	U	0.13	U	0.10	U	0.12	U	0.13	U	0.12	U	0.10	U
Methyl-2-pentanone, 4-	0.59	U	0.65	U	0.50	U	0.60	U	0.63	U	0.60	U	0.50	U
Methylene Chloride	**1.1**		**1.8**		0.50	U	**0.63**		0.63	U	0.60	U	0.50	U
Naphthalene	0.59	U	0.65	U	0.50	U	0.60	U	**0.86**		0.60	U	0.50	U
Nonane, n-	0.59	U	0.65	U	0.50	U	0.60	U	0.63	U	0.60	U	0.50	U
Octane, n-	0.59	U	0.65	U	0.50	U	0.60	U	0.63	U	0.60	U	0.50	U
Pinene, alpha-	**0.75**		0.65	U	0.50	U	0.60	U	0.63	U	0.60	U	0.50	U
Propanol, 2- (Isopropyl Alcohol)	5.9	U	6.5	U	5.0	U	6.0	U	6.3	U	6.0	U	5.0	U
Propene	1.9	U	1.9	U	**0.53**		**1.3**		**1.3**		0.60	U	0.50	U
Propylbenzene, n-	0.59	U	0.65	U	0.50	U	0.60	U	0.63	U	0.60	U	0.50	U
Styrene	0.59	U	0.65	U	0.50	U	0.60	U	0.63	U	0.60	U	0.50	U
Tetrachloroethane, 1,1,2,2-	0.12	U	0.13	U	0.10	U	0.12	U	0.13	U	0.12	U	0.10	U
Tetrachloroethene	**0.19**		**0.20**		0.10	U	**0.12**		0.13	U	0.12	U	0.10	U
Tetrahydrofuran (THF)	0.59	U	0.65	U	0.50	U	0.60	U	0.63	U	0.60	U	0.50	U
Toluene	4.9	U	5.0	U	**4.8**		**5.0**		**3.6**		**0.82**		0.50	U
Trichlorobenzene, 1,2,4-	0.59	U	0.65	U	0.50	U	0.60	U	0.63	U	0.60	U	0.50	U
Trichloroethane, 1,1,1-	0.12	U	0.13	U	0.10	U	0.12	U	0.13	U	0.12	U	0.10	U

Volatile Organic Compound	December 22, 2015						December 27, 2015							
	1-hr		1-hr		Blank		Grab		Grab		Grab		Blank	
Sample Number	1001		1002		1003		1011		1013		1014		1012	
Trichloroethane, 1,1,2-	0.12	U	0.13	U	0.10	U	0.12	U	0.13	U	0.12	U	0.10	U
Trichloroethene	**0.21**		**0.28**		0.10	U	0.12	U	0.13	U	0.12	U	0.10	U
Trichlorofluoromethane	**1.3**		**1.2**		0.10	U	**1.3**		**1.3**		**1.3**		0.10	U
Trichlorotrifluoroethane	**0.45**		**0.50**		0.10	U	**0.47**		**0.51**		**0.49**		0.10	U
Trimethylbenzene, 1,2,4-	**1.0**		**1.2**		0.50	U	0.60	U	**1.1**		0.60	U	0.50	U
Trimethylbenzene, 1,3,5-	0.59	U	0.65	U	0.50	U	0.60	U	0.63	U	0.60	U	0.50	U
Vinyl Acetate	5.9	U	6.5	U	5.00	U	6.0	U	6.3	U	6.0	U	5.0	U
Vinyl Chloride	0.12	U	0.13	U	0.10	U	0.12	U	0.13	U	0.12	U	0.10	U
Xylene, o-	**1.1**		**1.1**		0.50	U	0.60	U	**0.70**		0.60	U	0.50	U
Xylenes, m,p-	3.1	U	3.1	U	**0.95**		**1.0**		**1.9**		0.60	U	0.50	U

Source: Ecology & Environment, Inc. 2016b,c. Organic data quality assurance review, Jantzen Beach Air release site and attached excel file for ALS Lab Project ID P1505593 dated January 6, 2016 (E&E 2016b) and Lab Project P1505613 (E&E 2016c) dated January 8, 2016.

Notes: Detections in yellow, U=below limit of detection
EPA – U.S. Environmental Protection Agency
MRL- Minimal Risk Level developed by the Agency for Toxic Substances and Disease Registry, U.S. Health and Human Services. If exposed below this level no adverse health effects are expected.

Table 3. Screening of volatile organic compounds detected in 1-hour and 3-minute grab samples during the Jantzen Beach Air Investigation (November 2015 to January 2016) with acute comparison values (µg/m3).

Volatile Organic Compound	December 22, 2016						December 27, 2016								Acute Comparison Values (µg/m3)		Urban Air Annual Average*
	1-hr		1-hr		Blank		Grab		Grab		Grab		Blank				
Sample Number	1001		1002		1003		1011		1013		1014		1012				
Benzene	1.5	U	1.4	U	**0.37**		**3.0**		**0.93**		**0.59**		0.10	U	29 29 160000	MRL AEGL1 ERPG-1	1.6
Butyl Acetate, n-	**1.1**		**1.2**		0.50	U	0.60	U	0.63	U	0.60	U	0.50	U	24000	ERPG-1	
Carbon Tetrachloride	**0.42**		**0.44**		0.10	U	**0.45**		**0.46**		**0.46**		0.10	U	36000 130000	AEGL2 ERPG-1	<0.63
Chloroform	**0.12**		**0.14**		0.10	U	**0.38**		0.13	U	0.12	U	0.10	U	490000 141000 240000	MRL AEGL-2 ERPG-2	<0.49
Chloromethane	**0.32**		**0.28**		0.20	U	**0.35**		**0.32**		**0.33**		0.20	U	1000000 787000	MRL AEGL-	
Cyclohexane	1.2	U	1.3	U	1.0	U	**3.7**		1.3	U	1.2	U	1.0	U	6000000	MRL	
Dichlorodifluoromethane (CFC 12)	**2.2**		**2.0**		0.50	U	**2.0**		**2.0**		**2.0**		0.50	U	NA		
Dioxane, 1,4-	0.59	U	0.65	U	0.50	U	0.60	U	**0.98**		0.60	U	0.50	U	7200	MRL	
Ethanol	7.5	U	9.6	U	**7.2**		6.0	U	6.3	U	6.0	U	5.0	U	1800ppm-	ERPG-1	
Ethyl Acetate	1.2	U	10	U	**3.1**		1.2	U	1.3	U	1.2	U	1.0	U	NA		
Ethylbenzene	**0.87**		**0.88**		0.50	U	0.60	U	0.63	U	0.60	U	0.50	U	22000 140	MRL AEGL-1	
Heptane, n-	**1.0**		**1.1**		0.50	U	**2.6**		**0.72**		0.60	U	0.50	U	NA		
Hexane, n-	1.6	U	1.8	U	**1.3**		**12**		**0.82**		0.60	U	0.50	U	NA		
Limonene, d-	**0.79**		**0.68**		0.50	U	0.60	U	**1.5**		0.60	U	0.50	U	NA		
Methylene Chloride	**1.1**		**1.8**		0.50	U	**0.63**		0.63	U	0.60	U	0.50	U	2100 210 300ppm	MRL AEGL-2 ERPG-1	0.28–1.1
Naphthalene	0.59	U	0.65	U	0.50	U	0.60	U	**0.86**		0.60	U	0.50	U	NA		0.0012–0.0019
Pinene, alpha-	**0.75**		0.65	U	0.50	U	0.60	U	0.63	U	0.60	U	0.50	U	NA		
Propene	1.9	U	1.9	U	**0.53**		**1.3**		**1.3**		0.60	U	0.50	U	NA		
Tetrachloroethene	**0.19**		**0.20**		0.10	U	**0.12**		0.13	U	0.12	U	0.10	U	41	MRL	<0.68

Volatile Organic Compound	December 22, 2016						December 27, 2016								Acute Comparison Values (µg/m3)		Urban Air Annual Average*
	1-hr		1-hr		Blank		Grab		Grab		Grab		Blank				
Sample Number	1001		1002		1003		1011		1013		1014		1012				
Toluene	4.9	U	5.0	U	**4.8**		**5.0**		**3.6**		**0.82**		0.50	U	7500 50ppm	MRL ERPG-1	2.6–7.3
Trichloroethene	**0.21**		**0.28**		0.10	U	0.12	U	0.13	U	0.12	U	0.10	U	410 100 ppm	AEGL-1 ERPG-1	<0.54
Trichlorofluoromethane	**1.3**		**1.2**		0.10	U	**1.3**		**1.3**		**1.3**		0.10	U	NA		
Trichlorotrifluoroethane	**0.45**		**0.50**		0.10	U	**0.47**		**0.51**		**0.49**		0.10	U	NA		
Trimethylbenzene, 1,2,4-	**1.0**		**1.2**		0.50	U	0.60	U	**1.1**		0.60	U	0.50	U	NA		
Xylene, o-	**1.1**		**1.1**		0.50	U	0.60	U	**0.70**		0.60	U	0.50	U	NA		0.48–1.4
Xylenes, m,p-	3.1	U	3.1	U	**0.95**		**1.0**		**1.9**		0.60	U	0.50	U	8700	MRL	1.2–3.0

Source: Ecology & Environment, Inc. 2016b,c. Organic data quality assurance review, Jantzen Beach Air release site and attached excel file for ALS Lab Project ID P1505593 dated January 6, 2016 (E&E 2016b) and Lab Project P1505613 (E&E 2016c) dated January 8, 2016.
*Portland air toxics community assessment monitoring project, Portland Oregon. Oregon Department of Environmental Quality. 2007.

Notes: No compounds exceeded acute short-term screening levels

AEGL Acute Exposure Guideline levels developed by EPA.

ERPG Emergency Response Planning Guidelines developed by the American Industrial Hygienists Association for exposures to the general public. ERPG-1: If exposed for up to one hour at levels below ERPG-1, nearly all people will not experience mild transient health effects. ERPG-2: If exposed for up to one hour at levels below ERPG- 2 nearly all people will not experience irreversible or other serious health effect. ERPG-3: If exposed for up to one hour at levels below ERPG-3, nearly all people will not will not experience life-threatening health effects.

EPA U.S. Environmental Protection Agency

MRL Minimal Risk Level developed by the Agency for Toxic Substances and Disease Registry, U.S. Health and Human Services. If exposed below this level no adverse health effects are expected.

NA Comparison value not available

U Below level of detection

Attachment 2 – Properties and Health Effects of Hydrogen Sulfide and Chlorine

Hydrogen Sulfide

Hydrogen sulfide (H_2S) is a flammable, colorless gas that smells like rotten eggs. People can smell hydrogen sulfide at low concentrations in air ranging from 0.005 to 0.3 parts of hydrogen sulfide per million parts of air (ppm) (7–420 µg/m^3). Hydrogen sulfide occurs naturally and from human-made processes; it is associated with sewers and manure handling operations. Facilities where hydrogen sulfide is produced, used, or generated include petroleum refineries, natural gas plants, petrochemical plants, coke oven plants, paper mills, viscose rayon manufacturing plants, sulfur production plants, iron smelters, food processing plants, manure treatment facilities, landfills, textile plants, waste water treatment facilities, and tanneries. In urban areas, the concentrations are usually less than 0.001 ppm (1.4 µg/m^3). For more information on hydrogen sulfide see ATSDR's toxicological profile.[16] It can remain in the air for 1 day in the summer to 42 days in the winter and it changes into sulfur dioxide then sulfates in air.

Hydrogen sulfide enters your body primarily through the air you breathe. When you breathe air containing hydrogen sulfide or when it comes in contact with your skin it is absorbed into the blood and distributed through the body. The body rapidly converts it to sulfate which is excreted in the urine. Exposure to low concentration of hydrogen sulfide may cause headaches, poor memory, tiredness, and balance problems. No health effects are expected to occur at or below the ATSDR minimal risk level (MRL) of 0.07 ppm (98 µg/m^3) (ATSDR 2014). The MRL is based on a study that evaluated lung function in people with bronchial asthma requiring medication during a 30 minute exposure.[17] At 2 ppm (~27 times above 0.07 ppm), two of 10 subjects showed changes in airway resistance and specific airway conductance and three of the 10 subjects complained of headaches after the exposure. At slightly higher concentrations (5 ppm for ~30 minutes), normal subjects have shown temporary compromised aerobic metabolism,[18] whereas other studies with normal subjects did not find respiratory or cardiovascular effects when exposed to 5 ppm for ~15 minutes or pulmonary functional changes at exposures up to 10 ppm (14000 µg/m^3) for 15 minutes.[19] Hydrogen sulfide has not been shown to cause cancer in people. There is little information about health effects in children who have been exposed to hydrogen sulfide. They will probably experience effects similar to adults. It is not known if hydrogen sulfide causes birth defects in humans. Animals studies suggest that exposure to low concentrations does not cause birth defects.

[16] ATSDR. 2014. Toxicological profile for hydrogen sulfide.

[17] Jappinen et al. 1990.

[18] Bhambhani et al. 1996b

[19] Bhambhani and Singh 1991 and Bhambhani et al. 1996a

Chlorine Gas

Chlorine is a gas with a very irritating odor. It is unstable and quickly reacts with substances to form other chemicals. Chlorine an important and prevalent chemical used in industry in the production of thousands of products. In air chlorine is broken down by sunlight within a matter of several minutes. Chlorine gas enters your body primarily through the air you breathe. At low concentrations almost all of the chlorine is removed from the air by the upper part of the respiratory airways and only a very small amount may reach your lungs. It reacts with water on the surface of cells in the respiratory tract and forms other compounds that produce irritation. When you breathe air containing chlorine or when it comes in contact with your skin it is absorbed into the blood and distributed through the body. Exposure to low concentration of chlorine may cause irritation of nose and eye irritation, as levels reach 5 ppm throat irritation may occur. No health effects are expected to occur at or below the ATSDR minimal risk level (MRL) of 0.06 ppm or 60 ppb. Several studies exposed subjects at 15, 60 minutes, 2 hours, 4 hours, 8 hours, and up to 3 days at concentrations ranging from 0.1 to 2 ppm.[20] Collectively the studies provide evidence of sensory irritation and transient pulmonary changes occurring in humans exposed to 1ppm chlorine for up to 8 hours a day. The pulmonary changes indicated increased airway resistance and reduced air flow. No such changes were observed in subjects exposed to 0.5 ppm chlorine. Chlorine has not been shown to cause cancer in people. There is little information about health effects in children who have been exposed to chlorine. They will probably experience effects similar to adults. It is not known if chlorine causes birth defects in humans. Animals studies suggest that exposure to low concentrations does not cause birth defects.

[20] ATSDR 2010. Toxicological profile for chlorine.

Attachment 2 – Citizen Odor Log

Jantzen Beach/Hayden Island and North Portland Industrial Area, North Portland, Multnomah County, Oregon

Name: Address: Phone/Email:

Date Odor Detected	Time odor detected (am/pm)	Time odor ended (am/pm)	Where was odor detected (be specific)	What does odor smell like? What is intensity?	Weather (temperature, precipitation)	From where is wind blowing (speed)	Visual or other observations (self-reported health effects)

Direct complaints to Oregon Department of Environmental Quality: Phone 1-888-997-7888 or http://www.deq.state.or.us/complaints/

For more information on odors visit: