Hayden Island Air Sampling for Volatile Organic Compounds and Hydrogen Sulfide

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State of Oregon
Department of Environmental Quality

State of Oregon Department of Environmental Quality

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This report summarizes the 2016 data from hydrogen sulfide (H_2S) and volatile organic compound (VOC) monitoring locations in the Hayden Island area of North Portland.

Key Findings

- No H_2S detected at 20 separate locations around Hayden Island.
- DEQ did not identify any odorous VOC compounds. All VOC samples collected were below their odor thresholds where odor thresholds are available. DEQ gathered odor thresholds from a variety of sources, including U.S. EPA's 1992 publication "Reference Guide To Odor Thresholds For Hazardous Air Pollutants Listed In The Clean Air Act Amendments Of 1990," as well as documents from the Occupational Safety and Health Administration, Centers for Disease Control and National Institute for Occupational Safety and Health.
- VOC concentrations were generally higher in "grab" samples collected during odor events. 12-hour and 24-hour samples collected over a longer period had concentrations often below grab sample results, and a non-odor event sample yielded the lowest concentration for several compounds that may be associated with emissions from petroleum recycling, including benzene, ethylbenzene, n-hexane, and toluene.
- Comparison of VOC concentrations to urban background values from Portland and other cities, show some VOCs detected above the 90th percentile of urban concentrations and some were below these urban concentrations.
- When compared to health-based concentrations, the VOCs detected on Hayden Island were less than health-based comparison values for short-term exposure where comparison values are available. Air monitoring and sampling on Hayden Island identified acrolein, benzene, ethylbenzene, and carbon tetrachloride above their health-based comparison values for long-term exposure. Even though they exceed the long-term health-based values these VOC's are within the range of urban background concentrations detected in the Portland metro region.

Background

In September 2015, the U.S. Environmental Protection Agency (EPA) provided resources to the Oregon Department of Environmental Quality (DEQ) to assist with air quality monitoring on and around Hayden Island due to an increase in citizen complaints and concerns of emissions and odors emitted from two used oil re-refineries in north Portland, American Petroleum Environment Services (APES) and Oil Re-Refining Company, Inc. (ORRCO). EPA concluded (EPA Technical Direction Document 15-09-0003) that no chemical compounds were present in quantities that would pose immediate or serious harm to the health and wellness of the residents in the area. EPA recommended DEQ conduct additional air monitoring to verify EPA's initial results and further identify the presence of any chemical compound(s) being emitted that may cause long term health effects to residents or odors. Through the issuance of a joint 114-information request letter, DEQ and EPA required APES and ORRCO monitor emissions and odors from their facilities and submit a variety of operational records to DEQ and EPA for evaluation of plant site operations. Attachment A provides information regarding the most significant sources of VOCs.

In 2016, DEQ performed additional investigations and air quality monitoring near Hayden Island. DEQ collected air samples to determine levels of H_2S and VOC near Hayden Island. The sampling objective was to determine if emissions from APES and ORRCO were posing a risk to human health and causing elevated pollutant levels in the ambient air when compared to similar urban areas.

Air Sampling

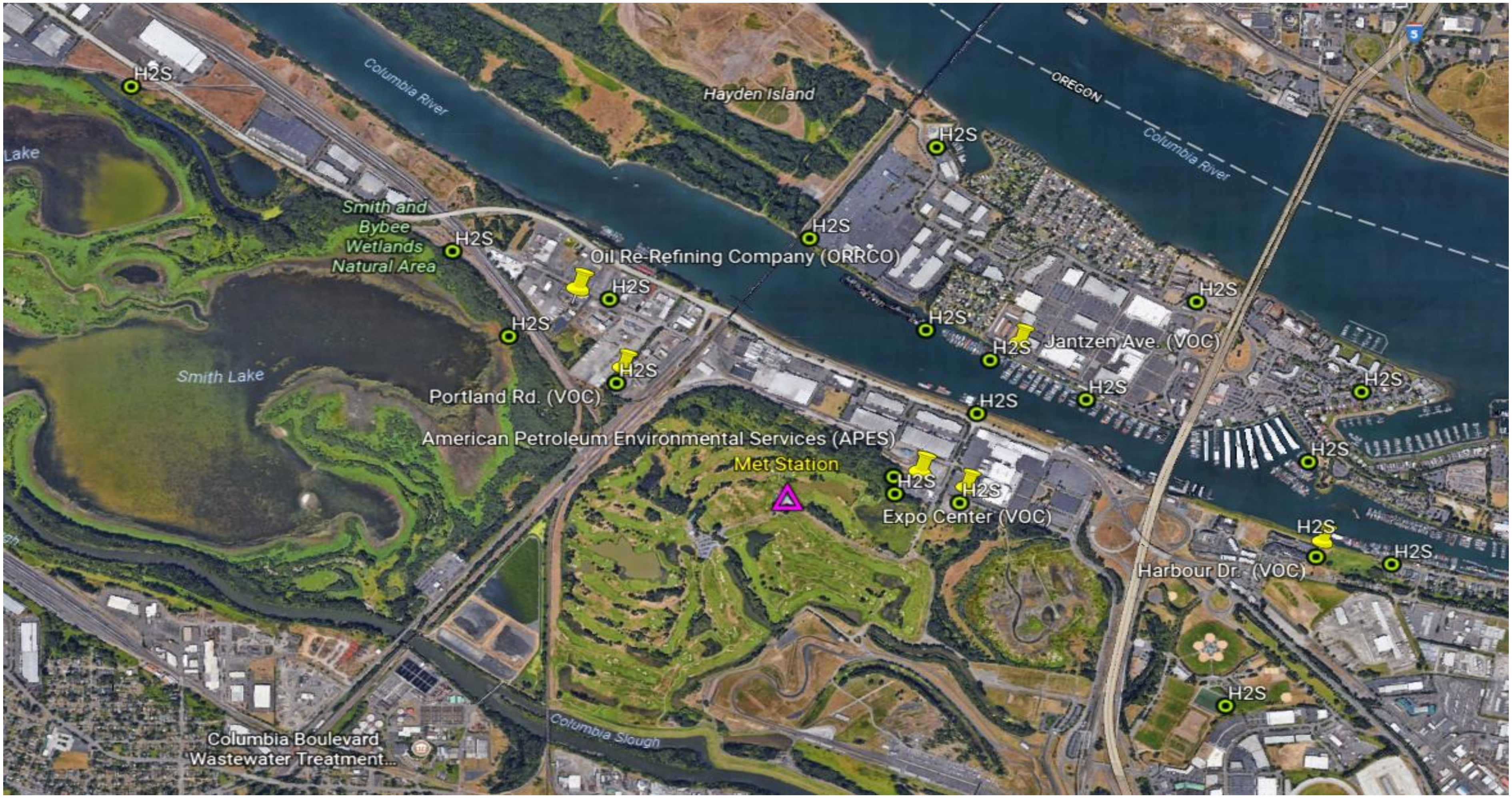
DEQ positioned passive samplers on and around Hayden Island to determine if H_2S was present in detectable concentrations in the ambient air. H_2S samplers collected data at 20 separate locations over an eight-day period, replacing the sampling medium at all 20 locations every 48 hours. Each location retained one sorbent sampler for the entire eight-day period (see Figure 1).

DEQ determined sampling locations based on air toxics emissions points at APES and ORRCO, complaint location information collected through DEQ's citizen complaint database, wind direction based on a meteorological station (met), and previous sampling locations used by EPA as well as the knowledge and experience of DEQ's Air Quality Department and Laboratory.

DEQ also sampled for the presence of VOCs. VOC sampling occurred on Hayden Island using 6-Liter fused-silica-lined canisters. DEQ conducted three types of sampling for VOCs, grab samples, 12-hr samples, and a 24-hour sample. To increase the probability of sample collection during an odor event, DEQ accepted the assistance offered from a Hayden Island resident to conduct grab sampling during odor events. Grab sampling involves a person (in this case, the Hayden Island resident) opening the inlet valve of a negative pressure canister, causing an influx of ambient air into the canister. The valve remains open for approximately 30 seconds before the sampler manually closes it. DEQ collected 24-hour samples in tandem with the grab samples to compare short-term VOC concentrations with dispersed VOC concentrations. The samples collected on Hayden Island were analyzed at DEQ's laboratory in Hillsboro, Oregon.

The resident collected seven grab samples on Hayden Island. One 24-hour sample was collected on May 28, coinciding with an odor event. DEQ collected two grab samples during odor events on June16 and July 3. During the same period, DEQ collected two 12-hour samples near APES and ORRCO. DEQ sampled for background pollutant concentrations on Hayden Island by conducting sampling when no odors were present.

Figure 1 Map of H_2S and VOC sampling locations.



Hydrogen Sulfide (H2S) Results

DEQ's laboratory did not detect H_2S above the reporting limit in any of the samples tested from all 20 locations. H_2S was detected in all analyzed laboratory quality control samples, ensuring the chemistry of the method is valid.

Volatile Organic Compound (VOC) Results

DEQ followed analytical procedures to measure concentrations of VOC's that are a subset of the 187 hazardous air pollutants (HAP's) outlined in Title III of the Clean Air Act (CAA) Amendments adopted in 1990. Table 1 below shows data from eleven VOC samples collected on Hayden Island, including a non-odor event background sample, 12-hour samples, 24-hour samples, and grab samples. Table 2 below displays a comparison of the 12-hour and 24-hour VOC samples compared to health-based concentrations, urban background concentrations, and odor thresholds. DEQ calculated 90^{th} percentile urban background concentrations for VOCs using data from Portland and similar urban areas within the United States.

Grab samples collected during odor events yielded increased levels of VOC concentrations. 12-hour and 24-hour samples collected had concentrations often below grab sample results. A non-odor event sample yielded the lowest concentration for several compounds that may be associated with emissions from petroleum recycling, including benzene, ethylbenzene, n-hexane, and toluene. Comparison of VOC concentrations to urban values based on data from Portland and other cities, show some VOC's were above the 90^{th} percentile of urban background and some below these urban concentrations.

Compared to known odor thresholds, in all cases VOCs concentrations were present at levels less than known odor thresholds. DEQ did not identify compounds associated with odors.

Comparison to Health Based Concentrations

Oregon's air toxics benchmarks assist DEQ in identifying, evaluating, and addressing air toxics problems. For cancer causing chemicals, Oregon air toxics benchmarks are based on concentration levels that would result in an increased cancer risk of one-in-a-million, assuming a lifetime of exposure. For chemicals with no cancer risk, benchmark levels are the pollutant concentrations an individual can breathe in a lifetime without developing an increased cancer risk. Ambient Benchmark Concentrations (ABC's) for 52 air toxics of concern in Oregon are derived from consensus recommendations from the Air Toxics Scientific Advisory Committee, a panel of experts who provide accurate scientific information and advice to Oregon's Air Toxics Program. Benchmark concentrations were developed to protect the health of Oregon's most sensitive populations and provide consistent health-based goals as DEQ develops strategies to reduce air toxics.

In 2017, Oregon developed Short-term Guideline Concentrations (SGCs) to evaluate potential acute toxic effects. DEQ and Oregon Health Authority (OHA) developed proposed SGCs. OHA employs full time toxicologists to assist agencies in evaluating potential acute health risks from short-term exposures to ambient concentrations of air toxics (for exposures ranging from 24 hours to several days or weeks).

For chemicals lacking ABCs and SGCs, potential health risks were evaluated using alternate health-based comparison values for acute and chronic health effects developed by federal and state agencies. For some chemicals, there is not sufficient toxicity or health-based comparison values to evaluate potential health risks. Another point of reference to evaluate concentrations detected near APES and ORRCO is typical urban background concentrations detected in cities across the country.

Grab samples represent a momentary exposure, so DEQ and Oregon Health Authority compared 12-hour and 24-hour samples to health-based values.

All VOCs detected in the samples collected near APES and ORRCO were below available health-based comparison values for short-term exposure. Some VOCs were detected above the health-based values for long-term exposure including acrolein, benzene, ethylbenzene, and carbon tetrachloride. Even though they exceed the long-term health-based values these VOCs are within the range of urban background concentrations.

Table 1 VOC Results. Grab samples are GS. Non-detect (ND) values indicate that the concentration of the compound was below the detection limit of the measuring device. All values in the table below have units of µg/m^3. *Values are below the Method Reporting Limit (MRL) and the lowest calibrations standard, therefore are reported as estimates.

Compound	GS Background 6/25	24 hr 4/30	12 hr ORRCO 5/1	12 hr APES 5/1	GS 5/28	24 hr 5/28	GS 6/9	GS1 6/16	GS2 6/16	GS 7/3	GS 7/31
1,2,4-Trimethylbenzene	0.536	1.042	1.696	2.222	2.379	4.066	2.463	1.465	1.077	1.834	1.195
1,2-Dimethylbenzene	0.336*	0.569	0.964	1.507	0.942	1.103	1.485	0.591	0.612	0.890	0.643
1,3,5-Trimethylbenzene	0.288*	0.271*	0.506*	0.629	0.551	1.008	0.551	0.391*	0.391*	0.467*	0.432*
1,3-Butadiene	ND	ND	0.117*	ND	0.109*	ND	0.095*	ND	ND	ND	ND
1,4-Dichlorobenzene	ND	ND	ND	ND	0.326*	0.340*	ND	ND	ND	ND	ND
1,4-Dimethylbenzene + 1,3-Dimethylbenzene	0.729*	1.381	2.683	4.068	2.605	2.761	4.602	1.415	1.402	2.748	1.819
2-Butanone (MEK)	0.422*	0.991	0.902	1.079	0.935	1.103	2.763	0.448*	0.495*	0.908	0.846
4-Ethyltoluene	ND	ND	ND	0.605*	0.536*	0.959*	0.590*	ND	ND	ND	ND
Acetone	4.252	5.440	4.870	4.323	6.628	5.440	11.188	2.874	4.323	3.611	3.516
Acetonitrile	0.274*	0.181*	0.104*	0.149*	0.248*	0.218*	0.343	0.238*	0.571	0.287*	0.157*
Acrolein	0.152*	0.214*	0.271	0.218*	0.243	0.200*	0.232	0.179*	0.211*	0.196*	0.537
Acrylonitrile	ND	ND	ND	ND	0.143*	ND	0.121*	ND	ND	0.121*	ND
Benzene	0.160*	0.345	0.530	0.594	1.154	0.495	1.032	0.336	0.336	0.451	0.367
Benzyl chloride	ND	ND	ND	ND	ND	0.275*	ND	ND	ND	ND	ND
Carbon tetrachloride	0.619	0.628	0.487	0.527	0.500	0.512	0.493	0.561	0.581	0.539	0.482
Chloroform	0.275*	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Chloromethane	1.183	1.295	1.074	0.743	1.086	1.233	1.101	1.640	1.448	1.024	0.624
Cyclohexane	ND	0.244*	0.998	0.644	1.404	0.406	1.194	0.485	0.465	0.657	0.413
Dichlorodifluoromethane (Freon 12)	2.576	2.824	2.393	1.647	2.250	2.517	2.458	3.051	2.908	2.428	1.592
Ethylbenzene	0.272*	0.364*	0.686	0.977	0.695	0.643	1.151	0.460	0.447	0.686	0.530
Isopropanol	0.479*	0.273*	ND	0.420*	1.482	0.917	1.050	0.361*	0.681	0.322*	0.342*
Methylene chloride	0.545	0.493	0.531	0.597	0.396	0.386	0.750	0.660	0.743	0.382	0.186
n-Heptane	ND	0.334*	0.656	0.533	1.254	0.504	1.689	0.402*	0.422	1.238	0.643
n-Hexane	0.215*	0.402	0.927	0.754	2.196	0.656	1.921	0.779	0.761	1.600	0.694
Styrene	0.228*	ND	0.332*	0.354*	0.329*	0.230*	0.302*	0.219*	0.235*	0.313*	0.218*
Tetrachloroethylene	ND	ND	0.157*	ND	0.165*	ND	0.621*	ND	ND	ND	ND
Tetrahydrofuran	ND	ND	ND	ND	1.251	3.018	8.214	ND	ND	2.574	ND
Toluene	1.023	1.702	6.854	5.843	6.911	3.483	9.214	2.332	2.416	5.545	3.674
Trichlorofluoromethane (Freon 11)	2.054	2.314	2.092	1.410	1.954	2.061	1.962	2.061	2.069	1.801	1.165
Trichlotrifluoroethane (Freon 113)	0.211*	0.210*	0.187*	0.217*	0.181*	0.189*	0.204*	0.215*	0.217*	0.189*	ND

Table 2 Comparison to Health-based Concentrations, Urban Background, and Odor Thresholds. All values in units of ug/m^3.

Compound	Health-based Comparison Value for Short-term Exposures	Health-based Comparison Value for Chronic Exposures	Urban Background	Odor Threshold	24 hr 4/30	12 hr ORRCO 5/1	12 hr APES 5/1	Above health based concentration for short-term exposures?	Above health based concentration for chronic exposures?	Above odor threshold?	Above urban background?
1,2,4-Trimethylbenzene		60[B]	0.4	30	1.042	1.696	2.222	NA	no	no	yes
1,2-Dimethylbenzene			1	N/A	0.569	0.964	1.507	NA	NA	NA	yes
1,3,5-Trimethylbenzene		60[B]	0.1	30	0.271*	0.506*	0.629	NA	no	no	yes
1,3-Butadiene	2[B]	0.03[A]	0.3	220	ND	0.117*	ND	no	no	no	no
1,4-Dichlorobenzene	12000[E]	0.09[A]	0.06	730	ND	ND	ND	no	no	no	no
1,4-Dimethylbenzene + 1,3-Dimethylbenzene			4	N/A	1.381	2.683	4.068	NA	NA	NA	yes
2-Butanone (MEK)	5000[D]	5000[B]	0.8	N/A	0.991	0.902	1.079	no	no	NA	yes
4-Ethyltoluene			0.1	N/A	ND	ND	0.605*	NA	NA	NA	no
Acetone	62000[D]	31000[C]	5	940	5.44	4.87	4.323	no	no	no	yes
Acetonitrile		60[B]	0.8	N/A	0.181*	0.104*	0.149*	NA	no	NA	no
Acrolein	6.9[E]	0.02[A]	0.7	8.3	0.214*	0.271	0.218*	no	yes	no	no
Acrylonitrile	220[E]	0.01[A]	0.3	3400	ND	ND	ND	no	no	no	no
Benzene	29[E]	0.13[A]	1.5	1500	0.345	0.53	0.594	no	yes	no	no
Benzyl chloride		240[F]	0.05	N/A	ND	ND	ND	NA	no	NA	no
Carbon tetrachloride	190[E]	0.07[A]	0.7	10580	0.628	0.487	0.527	no	yes	no	no
Chloroform	490[E]	98[A]	0.3	500	ND	ND	ND	no	no	no	no
Chloromethane		100[C]	0.8	<21000	1.295	1.074	0.743	NA	no	no	yes
Cyclohexane		6000[B]	0.1	N/A	0.244*	0.998	0.644	NA	no	NA	yes
Dichlorodifluoromethane (Freon 12)			0.6	N/A	2.824	2.393	1.647	NA	NA	NA	yes
Ethylbenzene	22000[E]	0.4[A]	2	26	0.364*	0.686	0.977	no	yes	no	no
Isopropanol		3200[F]	1	N/A	0.273*	ND	0.420*	NA	no	NA	no
Methylene chloride	2100[E]	2.1[A]	2	4100	0.493	0.531	0.597	no	no	no	no
n-Heptane			0.1	N/A	0.334*	0.656	0.533	NA	NA	NA	yes
n-Hexane		7000[A]	3	5300	0.402	0.927	0.754	NA	no	no	no
Styrene	21000[D]	850[C]	0.5	12	ND	0.332*	0.354*	no	no	no	no
Tetrachloroethylene		35[A]	0.3	5200	ND	0.157*	ND	NA	no	no	no
Tetrahydrofuran		2000[B]	0.1	N/A	ND	ND	ND	NA	no	NA	no
Toluene	7500[E]	400[A]	9	98	1.702	6.854	5.843	no	no	no	no
Trichlorofluoromethane (Freon 11)			0.3	N/A	2.314	2.092	1.41	NA	NA	NA	yes
Trichlotrifluoroethane (Freon 113)			0.09	N/A	0.210*	0.187*	0.217*	NA	NA	NA	no

[A] Oregon Ambient Benchmark Concentration (ABC)
[B] EPA Reference Concentration (RfC)
[C] ATSDR chronic Minimal Risk Level (MRL)
[D] Oregon Short-term Guideline Concentration (SGC)
[E] ATSDR acute or intermediate Minimal Risk Level (MRL)
[F] California OEHHA Reference Exposure Level (REL)

APES and ORRCO Sorbent Tube Sampling

On April 5, 2016 and May 25, 2016, DEQ and EPA issued joint 114 information request letter(s) to APES and ORRCO, requiring them to test, monitor, record, and submit product sampling results and operational parameters outlined in the letters. Item 5 of the information request required APES and ORRCO to develop and submit to DEQ and EPA for approval, an emission monitoring plan to measure concentrations of sulfur dioxide, benzene, chloroform, naphthalene, 1-4 dioxane, chlorine gas, mercaptans, hydrocarbons, carbon monoxide, nitrogen oxides, carbonyl sulfide, and carbon disulfide, from all pollutant emission points exhausting to ambient air, twice monthly, using a Matheson-Kitagawa Toxic Gas Detection System (sampling system), or similar device.

Emission Monitoring Plan

The joint 114 information letters DEQ and EPA issued to ORRCO and APES required them to conduct sorbent tube sampling for the pollutants listed in Table 1 of this document, on the following emission points:

ORRCO

Equipment	Function
Dehydrators 9 & 10	Heats used oil removing water and light end fuel products
Boiler	Provides steam to the facility for a variety of operations
Scrubber	Removes VOC's from exhaust streams
Condenser	Condenses water and light ends recovered from the used oil cooking process

APES

Equipment	Function
Carbon scrubber	Removes VOC's from emission streams
Hot oil heaters (front plant and back plant)	Provide heat to the re-refining process
Cook tanks 1-4	Heats used oil to remove water and light ends

How Sorbent Tubes Work

The sampling system consists of a mechanical hand pump and a detector tube corresponding to specific pollutants. Operation of the sampling system is a three-step process; (1) breaking off the end of a fresh detector tube, (2) inserting the tube into the pump inlet, and (3) retracting the pump handle. When the pump handle is released, the sampling system draws a 100 cubic centimeters (cc) sample through the sorbent tube. The sorbent tube(s) contain a chemical agent that reacts to the sample gas if the pollutant is present. The sample gas will stain the reagents if the pollutant concentration is present in quantities corresponding to or greater than the minimum concentration value of the sorbent tube. The length of the stain is an estimated concentration of the pollutant, indicated by the corresponding ppm values printed on the sorbent tubes. Sorbent tube analysis offer many practical applications ranging from on-the-spot pollutant measurements, day-to-day checks, and screenings, to quality control in a laboratory.

Conclusions from Sorbent Tube Sampling

Due to the subjective nature of the sampling system and interpretation of results, sorbent tube analysis is not a reliable regulatory tool to determine compliance or quantify ground level pollutant concentrations. The measurement value associated with the sorbent tube sample is an estimate of the actual pollutant concentration. Fluctuating pollutant concentrations in the sample gas stream and sampling methodology may affect accuracy of the sample.

DEQ and EPA required APES and ORRCO to record the sorbent tube sampling results in an approved spreadsheet and submit to DEQ and EPA twice monthly. The sampling results will assist in developing operational parameters that APES and ORRCO must comply with when conducting stack testing to verify the thermal oxidizer's emissions factors and control efficiency. The letters issued to APES and ORRCO required them to submit high definition photographs of each sorbent tube before and after each sample to document and verify their results. Attachments B and C contain the sorbent tube sampling results.

Next Steps

Air Quality Permitting

On December 27, 2016, DEQ entered into a Mutual Agreement and Final Order (MAO) with APES requiring them to install a natural gas thermal oxidizer to reduce VOC emissions by at least 97%. The MAO also requires APES to stack test the thermal oxidizer to verify the minimum 97% VOC control efficiency and validate emission factors used to calculate emissions. DEQ is currently reviewing comments received for the proposed renewal and modification of APES' Standard Air Contaminant Discharge Permit and expects to make a final determination on the proposed permit this summer.

On June 5, 2017, DEQ entered into an MAO with ORRCO, allowing them to the upgrading their cook tank VOC capture device (bubble condenser) to more efficient tube-and-shell condensers. ORRCO is required to install a thermal oxidizer with a 97% destruction efficiency as part of their Standard Air Contaminant Discharge permit renewal and modification application. DEQ is drafting a modified and renewed air quality permit for ORRCO and will schedule a public hearing requesting public comment on the draft permit before making a final determination.

Future Air Quality Monitoring

In spring of 2017, DEQ completed a prioritization of future monitoring efforts to equitably prioritize the use of air quality monitoring resources for community full air toxics monitoring. Air toxics monitoring stations collect meteorological data and samples ambient air to determine the concentration of criteria pollutants and over 100 ambient air toxics, including metals, volatile organic compounds, carbonyls, polycyclic aromatic hydrocarbons, and particulate matter. DEQ will evaluate additional monitoring needs in Portland North Harbor based on this prioritization. DEQ will implement future monitoring efforts as identified on the prioritized list. The monitoring prioritization list is available at http://www.oregon.gov/deq/aq/air-toxics/Pages/default.aspx

Attachment A

Compound information
ORRCO and APES recycle used oil products via vacuum distillation. APES further refines their product by separating out different "cuts" of oil with a wiped-film evaporator. Emissions of air toxics such as benzene, ethylbenzene, n-hexane and toluene, as well as hydrogen sulfide are known byproducts of used oil re-recycling.

The table below provides information regarding the most significant sources of VOCs. The table below shows 17 of the 30 compounds with detectable concentrations at Hayden Island and are included in EPA's list of 187 hazardous air pollutants (HAPs).

Compound	Most Significant Sources
1,3-butadiene	1,3-butadiene comes from incomplete combustion of fuels from cars and trucks, and off-road engines like lawn mowers and boats. Additional sources include petroleum-refining, production of rubber and plastics, forest fires and cigarette smoke.
1,4-Dichlorobenzene	1,4-Dichlorobenzene is used as a fumigant to control moths, molds, and mildew. It also is used as a disinfectant in waste containers and restrooms and is the characteristic smell associated with urinal cakes.
2-Butanone (MEK)	2-Butanone is a manufactured chemical but it is also present in the environment from natural sources. 2-Butanone is produced in large quantities. Nearly half of its use is in paints and other coatings because it will quickly evaporate into the air and it dissolves many substances. It is also used in glues and as a cleaning agent.
Acetonitrile	Acetonitrile is predominantly used as a solvent in the manufacture of pharmaceuticals, for spinning fibers and for casting and molding of plastic materials, in lithium batteries, for the extraction of fatty acids from animal and vegetable oils, and in chemical laboratories for the detection of materials such as pesticide residues. Acetonitrile is also used in dyeing textiles and in coating compositions as a stabilizer for chlorinated solvents and in perfume production as a chemical intermediate.
Acrolein	Acrolein enters the air mainly from wood burning, structural (house and building) fires and construction. Tobacco smoke is another source of acrolein.
Acrylonitrile	Acrylonitrile is used to make other chemicals such as plastics, synthetic rubber, and acrylic fibers. A mixture of acrylonitrile and carbon tetrachloride was used as a pesticide in the past. However, all pesticide uses of this chemical have stopped.
Benzene	Benzene is formed from both natural processes and human activities. Benzene is found in emissions from cars and trucks, wood smoke, evaporation from service stations and industrial solvents. Tobacco smoke contains benzene.
Benzyl chloride	Benzyl chloride is used as a chemical intermediate in the manufacture of certain dyes and pharmaceutical, perfume and flavor products. It also is used as a photographic developer. Benzyl chloride can be used in the

Compound	Most Significant Sources
	manufacture of synthetic tannins and as a gum inhibitor in petrol. Benzyl chloride has been used as an irritant gas in chemical warfare.
Carbon tetrachloride	Carbon tetrachloride is a manufactured chemical that does not occur naturally. It was used in the production of refrigeration fluid and propellants for aerosol cans, as a pesticide, as a cleaning fluid and degreasing agent, in fire extinguishers and in spot removers. Because of its harmful effects, these uses are now banned and it is only used in some industrial applications.
Chloroform	In the past, chloroform was used as an inhaled anesthetic during surgery, but it is not used that way today. Chloroform is used to make other chemicals and is formed in small amounts when chlorine is added to water.
Chloromethane (methyl chloride)	Methyl chloride is used mainly in the production of silicones where it is used to make methylate silicon. It also is used in the production of agricultural chemicals, methylcellulose, quaternary amines, and butyl rubber and for miscellaneous uses including tetramethyl lead. Methyl chloride was used widely in refrigerators in the past, but generally, this use has been taken over by newer chemicals such as Freon.
Ethylbenzene	The main sources of ethylbenzene in the Portland area are gasoline engines, gasoline evaporation, and painting operations. Ethylbenzene also is used in the production of styrene (used to make polystyrene plastic).
Methylene chloride	Methylene chloride does not occur naturally in the environment. Methylene chloride is used as an industrial solvent and as a paint stripper. It also may be found in some aerosol and pesticide products and is used in the manufacture of photographic film.
n-Hexane	*n*-Hexane is a chemical made from crude oil. Pure *n*-Hexane is used in laboratories. Most of the *n*-Hexane used in industry is mixed with similar chemicals called solvents. The major use for solvents containing n-Hexane is to extract vegetable oils from crops such as soybeans. These solvents are also used as cleaning agents in the printing, textile, furniture, and shoemaking industries. Certain kinds of special glues used in the roofing and shoe and leather industries also contain n-Hexane. Several consumer products contain *n*-Hexane, such as gasoline, quick-drying glues used in various hobbies, and rubber cement.
Styrene	Styrene is primarily a synthetic chemical. It often contains other chemicals that give it a sharp, unpleasant smell. Billions of pounds are produced each year to make products such as rubber, plastic, insulation, fiberglass, pipes, automobile parts, food containers, and carpet backing. Most of these products contain styrene linked together in a long chain (polystyrene) as well as unlinked styrene. Low levels of styrene also occur naturally in a variety of foods such as fruits, vegetables, nuts, beverages, and meats.
Tetrachloroethylene (PERC)	Tetrachloroethylene is a manufactured chemical that is widely used for dry cleaning of fabrics and for metal degreasing. It also is used to make other chemicals and is used in some consumer products.
Toluene	Toluene occurs naturally in crude oil and in the tolu tree. It also is

Compound	Most Significant Sources
	produced in the process of making gasoline and other fuels from crude oil and making coke from coal. Toluene is used in making paints, paint thinners, fingernail polish, lacquers, adhesives, and rubber and in some printing and leather tanning processes.

* Significant source information from ATSDR, USEPA, and DEQ's PATS

Attachment B: ORRCO Sorbent Tube Analysis

**All units displayed in parts per million (ppm)*

Dates	H2S	SO2	Ben- zene	Chloro-form	Naphtha- lene	1,4 - Dioxane	Chlorine Gas	Mercap- tans	Ethyl Mercap- tan	Methyl Mercap- tan	CO	NO_x	Hydro- carbons	Carbon Disulfide	Carbonyl Sulfide
Back Plant Hot Oil Heater															
5/27/2016	ND	ND	ND	N/A	N/A	ND	ND	-	-	-	-	-	-	-	-
5/31/2016	ND	-	ND	N/A	N/A	1000	ND	-	-	-	-	-	-	-	-
6/7/2016	ND	10	15	ND	ND	ND	ND	N/A	-	-	N/A	N/A	N/A	-	-
7/7/2016	20	10	ND	ND	ND	ND	10 to 15	5	ND	1000	50	15	ND	50	NA
7/11/2016	20	10	ND	70 to 100	ND	ND	16	0.1	ND	100	40	15	ND	50	-
7/20/2016	ND	10	ND	150 to 200	30 to 50	ND	10	0 to 0.5	ND	100	50	0.5 to 1.0	50	50	60
7/27/2016	ND	10	ND	200	ND	ND	10	5	ND	25	50	15	50	50	60
8/5/2016	ND	10	ND	100 to 150	ND	ND	ND	5	ND	0	50	10 to 15	ND	50	ND
8/10/2016	-	10	ND	100 to 150	ND	ND	ND	5	5	1000	50	15	ND	50	40 to 50

Dates	H2S	SO2	Ben- zene	Chloro-form	Naphtha- lene	1,4 - Dioxane	Chlorine Gas	Mercap- tans	Ethyl Mercap- tan	Methyl Mercap- tan	CO	NO_x	Hydro- carbons	Carbon Disulfide	Carbonyl Sulfide
8/17/2016	-	10	ND	70 to 100	20 to 30	ND	10 to 15	5	ND	No Tubes	50	10 to 15	0 to 50	10	10 to 20
8/22/2016	ND	10	ND	70 to 100	ND	100 to 200	ND	.5 to 1	ND	0	50	0 to 0.5	ND	50	no sampling, out of tubes
8/29/2016	ND	0	ND	ND	40	ND	ND	ND	ND	ND	50	ND	ND	50	50
9/8/2016	ND	10	ND	70 to 100	10 to 20	100 to 200	ND	5	ND	1000	60	15	ND	50	10 to 20
9/14/2016	ND	10	ND	0 to 70	ND	ND	ND	5	ND	1000	50	10 to 15	ND	50	20 to 30
9/21/2016	-	10	ND	70 to 100	ND	ND	5 to 10	5	ND	1000	50	10 to 15	ND	50	60
9/30/2016	-	10	ND	70 to 100	ND	ND	10	5	ND	1000	50	3 to 5	ND	50	60
samples	12	15	16	16	14	16	16	14	16	16	14	14	14	13	16
detects	1	12	1	11	4	3	6	12	1	9	13	10	3	13	9
range	0.5 to 40	0.25 to 10	0.1 to 75	70 to 500	10 to 100	20 to 500	1 to 40	0.5 to 5	2.5 to 80	5 to 140	1 to 50	0.5 to 30	50 to 1400	2 to 50	5 to 60
Boiler															
5/31/2016	ND	ND	ND	ND	-	25	ND	-	-	-	-	-	-	-	-
samples	1	1	1	1	-	1	1	-	-	-	-	-	-	-	-
detects	ND	ND	ND	ND	-	1	ND	-	-	-	-	-	-	-	-

Dates	H2S	SO2	Ben- zene	Chloro-form	Naphtha- lene	1,4 - Dioxane	Chlorine Gas	Mercap- tans	Ethyl Mercap- tan	Methyl Mercap- tan	CO	NO_x	Hydro- carbons	Carbon Disulfide	Carbonyl Sulfide
range	0.5 to 40	0.25 to 10	0.1 to 75	70 to 500	10 to 100	20 to 500	1 to 40	0.5 to 5	2.5 to 80	5 to 140	1 to 50	0.5 to 30	50 to 1400	2 to 50	5 to 60
Cook Tanks															
5/23/2016	ND	Yes	-	-	-	-	ND	-	-	-	-	-	-	-	-
5/31/2016	ND	ND	ND	ND	-	50	ND	-	-	-	-	-	-	-	-
6/3/2016	ND	ND	ND	ND	-	ND	ND	-	-	-	-	-	-	-	-
samples	3	3	2	2	-	2	3	-	-	-	-	-	-	-	-
detects	ND	ND	ND	ND	-	1	ND	-	-	-	-	-	-	-	-
range	0.5 to 40	0.25 to 10	0.1 to 75	70 to 500	10 to 100	20 to 500	1 to 40	0.5 to 5	2.5 to 80	5 to 140	1 to 50	0.5 to 30	50 to 1400	2 to 50	5 to 60
Emergency Scrubber Stack															
5/27/2016	N/A	N/A	ND	N/A	N/A	N/A	N/A	-	-	-	-	-	-	-	-
5/31/2016	N/A	-	ND	N/A	N/A	N/A	N/A	-	-	-	-	-	-	-	-
6/7/2016	N/A	N/A	ND	N/A	N/A	N/A	N/A	N/A	-	-	N/A	N/A	N/A	-	-
8/4/2016	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
8/11/2016	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
samples	2	2	5	2	2	2	2	2	2	2	2	2	2	2	2
detects	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
range	0.5 to 40	0.25 to 10	0.1 to 75	70 to 500	10 to 100	20 to 500	1 to 40	0.5 to 5	2.5 to 80	5 to 140	1 to 50	0.5 to 30	50 to 1400	2 to 50	5 to 60
Front Plant Condenser Stack															
5/27/2016	ND	ND	ND	N/A	N/A	ND	ND	-	-	-	-	-	-	-	-
5/31/2016	ND	ND	15	ND	-	ND	ND	-	-	-	-	-	-	-	-
5/31/2016	ND	-	ND	N/A	N/A	300	3.5	-	-	-	-	-	-	-	-

Dates	H2S	SO2	Ben- zene	Chloro-form	Naphtha- lene	1,4 - Dioxane	Chlorine Gas	Mercap- tans	Ethyl Mercap- tan	Methyl Mercap- tan	CO	NO_x	Hydro- carbons	Carbon Disulfide	Carbonyl Sulfide
6/7/2016	20	ND	ND	ND	ND	ND	40	N/A	-	-	N/A	N/A	N/A	-	-
7/5/2016	20	0.5 to 0	14	500	ND	1000	40	ND	80	1000	20	ND	1400	50	60
7/11/2016	20	-	3	150	400	ND	10	54	80	1000	20	ND	400	50	-
7/18/2016	20	10	15	150	400	1000	40	5	80	1000	20 to 30	ND	1400	50	60
7/18/2016	20	10	15	150	400	1000	40	5	80	1000	20 to 30	ND	1400	50	60
7/25/2016	20	4 to 5	.5 to 1	500	400	1000	40	5	80	1000	50	ND	1400	50	60
8/3/2016	20	20	1 to 2	500	unclear	1000	40	5	80	100	50	11	1400	2 to 3	5
8/9/2016	20	ND	15	500	400	50	ND	.5 to 1	80	1000	3	ND	ND	2 to 5	ND
8/15/2016	ND	5 to 7	1	60	30 to 60	600	40	ND	80	*	50	ND	*	50	60
8/23/2016	10 to 11	0	0	100	10	100	25	ND	80	50	20 to 30	ND	1400	50	10
8/31/2016	20	10	15	200 to 250	ND	1000	40	5	80	1000	50	1	400	50	6
9/7/2016	20	4 to 5	15	0 to 70	400	ND	40	2 to 3	80	1000	50	ND	400	ND	50
9/12/2016	20	10	15	500	400	ND	40	2 to 3	80	1000	50	ND	400	ND	50
9/19/2016	-	0 to 1	15	50	*	ND	40	5	80	1000	50	ND	400	50	60

Dates	H2S	SO2	Ben- zene	Chloro-form	Naphtha- lene	1,4 - Dioxane	Chlorine Gas	Mercap- tans	Ethyl Mercap- tan	Methyl Mercap- tan	CO	NO_x	Hydro- carbons	Carbon Disulfide	Carbonyl Sulfide
9/28/2016	-	3	15	500	400	*	40	5	80	1000	50	15	1400	50	60
samples	16	16	18	16	14	18	18	15	14	13	14	14	14	14	13
detects	12	11	14	12	10	10	15	11	14	12	13	3	12	12	12
range	0.5 to 40	0.25 to 10	0.1 to 75	70 to 500	10 to 100	20 to 500	1 to 40	0.5 to 5	2.5 to 80	5 to 140	1 to 50	0.5 to 30	50 to 1400	2 to 50	5 to 60
Front Plant Hot Oil Heater															
5/27/2016	ND	0.5	ND	N/A	N/A	ND	ND	-	-	-	-	-	-	-	-
5/31/2016	ND	-	ND	N/A	N/A	1000	ND	-	-	-	-	-	-	-	-
6/7/2016	ND	10	ND	ND	ND	ND	N/A	N/A	-	-	N/A	N/A	N/A	-	-
7/12/2016	ND	10	1	0 to 70	400	ND	5 to 10	5	1000	NA	50	10	ND	50	-
7/26/2016	ND	10	ND	200	10 to 20	50 to 100	10	50	1000	ND	5	3	50	50	50
8/4/2016	ND	10	ND	70 to 100	10 to 20	100 to 200	10	0 to .5	ND	ND	50	10 to 15	50	50	20 to 30
8/9/2016	ND	10	ND	100 to 150	20	ND	5 to 10	5	ND	1000	50	3 to 5	ND	50	40 to 50
8/16/2016	ND	10	ND	0 to 70	20 to 30	1000	10	5	ND	1000	50	10 to 15	ND	50	50 to 60
8/30/2016	ND	10	ND	ND	10	90	10 to 15	ND	ND	ND	50	ND	ND	50	40
9/7/2016	ND	10	ND	0 to 70	20	100	10	5	ND	1000	60	10 to 15	ND	50	50

Dates	H2S	SO2	Ben- zene	Chloro-form	Naphtha- lene	1,4 - Dioxane	Chlorine Gas	Mercap- tans	Ethyl Mercap- tan	Methyl Mercap- tan	CO	NO_x	Hydro- carbons	Carbon Disulfide	Carbonyl Sulfide
9/13/2016	ND	10	ND	ND	ND	ND	10 to 15	5	80	1000	50	.5 to 1	ND	50	10
9/20/2016	-	ND	ND	70 to 100	ND	ND	6 to 10	10	50	ND	50	10 to 15	ND	50	40 to 50
9/29/2016	-	10	ND	ND	ND	ND	10	5	ND	1000	50	10	ND	50	60
samples	11	12	13	11	11	13	13	10	10	9	10	10	10	10	9
detects	ND	10	1	7	7	6	11	6	4	5	8	9	1	10	9
range	0.5 to 40	0.25 to 10	0.1 to 75	70 to 500	10 to 100	20 to 500	1 to 40	0.5 to 5	2.5 to 80	5 to 140	1 to 50	0.5 to 30	50 to 1400	2 to 50	5 to 60
IT Farm Scrubber Stack															
6/3/2016	ND	ND	ND	ND	-	ND	3	-	-	-	-	-	-	-	-
6/14/2016	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
6/14/2016	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
6/14/2016	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
6/14/2016	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
7/7/2016	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
7/18/2016	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
8/11/2016	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
9/29/2016	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
samples	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
detects	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
range	0.5 to 40	0.25 to 10	0.1 to 75	70 to 500	10 to 100	20 to 500	1 to 40	0.5 to 5	2.5 to 80	5 to 140	1 to 50	0.5 to 30	50 to 1400	2 to 50	5 to 60

Attachment C: APES Sorbent Tube Analysis

**All units displayed in parts per million (ppm)*

Date	H2S	SO2	Ben- zene	Chloro- form	Naphtha- lene	1,4 - Dioxane	Chlorine Gas	Mercap- tans	Ethyl Mercap- tan	Methyl Mercap- tan	CO	NO_x	Hydro- carbons	Carbon Disulfide	Carbonyl Sulfide
Back Plant Hot Oil Heater															
5/27/2016	ND	ND	ND	N/A	N/A	ND	ND	-	-	-	-	-	-	-	-
5/31/2016	ND	-	ND	N/A	N/A	1000	ND	-	-	-	-	-	-	-	-
6/7/2016	ND	10	15	ND	ND	ND	ND	N/A	-	-	N/A	N/A	N/A	-	-
7/7/2016	20	10	ND	ND	ND	ND	10 to 15	5	ND	1000	50	15	ND	50	NA
7/11/2016	20	10	ND	70 to 100	ND	ND	16	0.1	ND	100	40	15	ND	50	-
7/20/2016	ND	10	ND	150 to 200	30 to 50	ND	10	0 to 0.5	ND	100	50	0.5 to 1.0	50	50	60
7/27/2016	ND	10	ND	200	ND	ND	10	5	ND	25	50	15	50	50	60
8/5/2016	ND	10	ND	100 to 150	ND	ND	ND	5	ND	ND	50	10 to 15	ND	50	ND
8/10/2016	-	10	ND	100 to 150	ND	ND	ND	5	5	1000	50	15	ND	50	40 to 50

Date	H2S	SO2	Ben- zene	Chloro- form	Naphtha- lene	1,4 - Dioxane	Chlorine Gas	Mercap- tans	Ethyl Mercap- tan	Methyl Mercap- tan	CO	NO_x	Hydro- carbons	Carbon Disulfide	Carbonyl Sulfide
8/17/2016	-	10	ND	70 to 100	20 to 30	ND	10 to 15	5	ND	No Tubes	50	10 to 15	0 to 50	10	10 to 20
8/22/2016	ND	10	ND	70 to 100	ND	100 to 200	ND	.5 to 1	ND	ND	50	0 to 0.5	ND	50	no sampling, out of tubes
8/29/2016	ND	0	ND	0	40	ND	ND	ND	ND	0	50	0	ND	50	50
9/8/2016	ND	10	ND	70 to 100	10 to 20	100 to 200	ND	5	ND	1000	60	15	ND	50	10 to 20
9/14/2016	ND	10	ND	0 to 70	ND	ND	ND	5	ND	1000	50	10 to 15	ND	50	20 to 30
9/21/2016	-	10	ND	70 to 100	ND	ND	5 to 10	5	ND	1000	50	10 to 15	ND	50	60
9/30/2016	-	10	ND	70 to 100	ND	ND	10	5	ND	1000	50	3 to 5	ND	50	60
samples	12	15	16	16	14	16	16	14	16	16	14	14	14	13	16
detects	1	12	1	11	4	3	6	12	1	9	13	10	3	13	9
range	0.5 to 40	0.25 to 10	0.1 to 75	70 to 500	10 to 100	20 to 500	1 to 40	0.5 to 5	2.5 to 80	5 to 140	1 to 50	0.5 to 30	50 to 1400	2 to 50	5 to 60
Boiler															
5/31/2016	ND	ND	ND	ND	-	25	ND	-	-	-	-	-	-	-	-
samples	1	1	1	1	-	1	1	-	-	-	-	-	-	-	-
detects	ND	ND	ND	ND	-	1	ND	-	-	-	-	-	-	-	-

Date	H2S	SO2	Ben- zene	Chloro- form	Naphtha- lene	1,4 - Dioxane	Chlorine Gas	Mercap- tans	Ethyl Mercap- tan	Methyl Mercap- tan	CO	NO_x	Hydro- carbons	Carbon Disulfide	Carbonyl Sulfide
range	0.5 to 40	0.25 to 10	0.1 to 75	70 to 500	10 to 100	20 to 500	1 to 40	0.5 to 5	2.5 to 80	5 to 140	1 to 50	0.5 to 30	50 to 1400	2 to 50	5 to 60
Cook Tanks															
5/23/2016	ND	Yes	-	-	-	-	ND	-	-	-	-	-	-	-	-
5/31/2016	ND	ND	ND	ND	-	50	ND	-	-	-	-	-	-	-	-
6/3/2016	ND	ND	ND	ND	-	ND	ND	-	-	-	-	-	-	-	-
samples	3	3	2	2	-	2	3	-	-	-	-	-	-	-	-
detects	ND	?	ND	ND	-	1	ND	-	-	-	-	-	-	-	-
range	0.5 to 40	0.25 to 10	0.1 to 75	70 to 500	10 to 100	20 to 500	1 to 40	0.5 to 5	2.5 to 80	5 to 140	1 to 50	0.5 to 30	50 to 1400	2 to 50	5 to 60
Emergency Scrubber Stack															
5/27/2016	N/A	N/A	ND	N/A	N/A	N/A	N/A	-	-	-	-	-	-	-	-
5/31/2016	N/A	-	ND	N/A	N/A	N/A	N/A	-	-	-	-	-	-	-	-
6/7/2016	N/A	N/A	ND	N/A	N/A	N/A	N/A	N/A	-	-	N/A	N/A	N/A	-	-
8/4/2016	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
8/11/2016	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
samples	2	2	5	2	2	2	2	2	2	2	2	2	2	2	2
detects	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
range	0.5 to 40	0.25 to 10	0.1 to 75	70 to 500	10 to 100	20 to 500	1 to 40	0.5 to 5	2.5 to 80	5 to 140	1 to 50	0.5 to 30	50 to 1400	2 to 50	5 to 60
Front Plant Condenser Stack															
5/27/2016	ND	ND	ND	N/A	N/A	ND	ND	-	-	-	-	-	-	-	-
5/31/2016	ND	ND	15	ND	-	ND	ND	-	-	-	-	-	-	-	-
5/31/2016	ND	-	ND	N/A	N/A	300	3.5	-	-	-	-	-	-	-	-

Date	H2S	SO2	Ben- zene	Chloro- form	Naphtha- lene	1,4 - Dioxane	Chlorine Gas	Mercap- tans	Ethyl Mercap- tan	Methyl Mercap- tan	CO	NO_x	Hydro- carbons	Carbon Disulfide	Carbonyl Sulfide
6/7/2016	20	ND	ND	ND	ND	ND	40	N/A	-	-	N/A	N/A	N/A	-	-
7/5/2016	20	0.5 to 0	14	500	ND	1000	40	ND	80	1000	20	ND	1400	50	60
7/11/2016	20	-	3	150	400	ND	10	54	80	1000	20	ND	400	50	-
7/18/2016	20	10	15	150	400	1000	40	5	80	1000	20 to 30	ND	1400	50	60
7/18/2016	20	10	15	150	400	1000	40	5	80	1000	20 to 30	ND	1400	50	60
7/25/2016	20	4 to 5	.5 to 1	500	400	1000	40	5	80	1000	50	ND	1400	50	60
8/3/2016	20	20	1 to 2	500	unclear	1000	40	5	80	100	50	11	1400	2 to 3	5
8/9/2016	20	ND	15	500	400	50	0	.5 to 1	80	1000	3	ND	0	2 to 5	ND
8/15/2016	ND	5 to 7	1	60	30 to 60	600	40	ND	80	*	50	ND	*	50	60
8/23/2016	10 to 11	ND	0	100	10	100	25	ND	80	50	20 to 30	ND	1400	50	10
8/31/2016	20	10	15	200 to 250	ND	1000	40	5	80	1000	50	1	400	50	6
9/7/2016	20	4 to 5	15	0 to 70	400	ND	40	2 to 3	80	1000	50	ND	400	ND	50
9/12/2016	20	10	15	500	400	ND	40	2 to 3	80	1000	50	ND	400	ND	50
9/19/2016	-	0 to 1	15	50	*	ND	40	5	80	1000	50	ND	400	50	60

Date	H2S	SO2	Ben- zene	Chloro- form	Naphtha- lene	1,4 - Dioxane	Chlorine Gas	Mercap- tans	Ethyl Mercap- tan	Methyl Mercap- tan	CO	NO_x	Hydro- carbons	Carbon Disulfide	Carbonyl Sulfide
9/28/2016	-	3	15	500	400	*	40	5	80	1000	50	15	1400	50	60
samples	16	16	18	16	14	18	18	15	14	13	14	14	14	14	13
detects	12	11	14	12	10	10	15	11	14	12	13	3	12	12	12
range	0.5 to 40	0.25 to 10	0.1 to 75	70 to 500	10 to 100	20 to 500	1 to 40	0.5 to 5	2.5 to 80	5 to 140	1 to 50	0.5 to 30	50 to 1400	2 to 50	5 to 60
Front Plant Hot Oil Heater															
5/27/2016	ND	0.5	ND	N/A	N/A	ND	ND	-	-	-	-	-	-	-	-
5/31/2016	ND	-	ND	N/A	N/A	1000	ND	-	-	-	-	-	-	-	-
6/7/2016	ND	10	ND	ND	ND	ND	N/A	N/A	-	-	N/A	N/A	N/A	-	-
7/12/2016	ND	10	1	0 to 70	400	ND	5 to 10	5	1000	NA	50	10	ND	50	-
7/26/2016	ND	10	ND	200	10 to 20	50 to 100	10	50	1000	ND	5	3	50	50	50
8/4/2016	ND	10	ND	70 to 100	10 to 20	100 to 200	10	0 to .5	ND	ND	50	10 to 15	50	50	20 to 30
8/9/2016	ND	10	ND	100 to 150	20	ND	5 to 10	5	ND	1000	50	3 to 5	ND	50	40 to 50
8/16/2016	ND	10	ND	0 to 70	20 to 30	1000	10	5	ND	1000	50	10 to 15	ND	50	50 to 60
8/30/2016	ND	10	ND	ND	10	90	10 to 15	ND	ND	ND	50	ND	ND	50	40
9/7/2016	ND	10	ND	0 to 70	20	100	10	5	ND	1000	60	10 to 15	ND	50	50

Date	H2S	SO2	Ben- zene	Chloro- form	Naphtha- lene	1,4 - Dioxane	Chlorine Gas	Mercap- tans	Ethyl Mercap- tan	Methyl Mercap- tan	CO	NO_x	Hydro- carbons	Carbon Disulfide	Carbonyl Sulfide
9/13/2016	ND	10	ND	ND	ND	ND	10 to 15	5	80	1000	50	.5 to 1	ND	50	10
9/20/2016	-	ND	ND	70 to 100	ND	ND	6 to 10	10	50	ND	50	10 to 15	ND	50	40 to 50
9/29/2016	-	10	ND	ND	ND	ND	10	5	ND	1000	50	10	ND	50	60
samples	11	12	13	11	11	13	13	10	10	9	10	10	10	10	9
detects	ND	10	1	7	7	6	11	6	4	5	8	9	1	10	9
range	0.5 to 40	0.25 to 10	0.1 to 75	70 to 500	10 to 100	20 to 500	1 to 40	0.5 to 5	2.5 to 80	5 to 140	1 to 50	0.5 to 30	50 to 1400	2 to 50	5 to 60
IT Farm Scrubber Stack															
6/3/2016	ND	ND	ND	ND	-	ND	3	-	-	-	-	-	-	-	-
6/14/2016	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
6/14/2016	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
6/14/2016	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
6/14/2016	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
7/7/2016	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
7/18/2016	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
8/11/2016	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
9/29/2016	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
samples	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
detects	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
range	0.5 to 40	0.25 to 10	0.1 to 75	70 to 500	10 to 100	20 to 500	1 to 40	0.5 to 5	2.5 to 80	5 to 140	1 to 50	0.5 to 30	50 to 1400	2 to 50	5 to 60