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PUGET SOUND CLEAN AIR AGENCY

Everett/Marysville Integrated Regional Odor Monitoring Program

Contract No. 2013007-0-CON

Regional Odor Monitoring Program – Annual Report - Deliverable T

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PROJECT: Everett/Marysville Integrated Regional Odor Monitoring Program

Puget Sound Clean Air Angency
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EXECUTIVE SUMMARY

The Puget Sound Clean Air Agency (PSCAA) is responsible for protecting and enhancing the air quality in King, Kitsap, Pierce and Snohomish counties in Washington State and as part of its compliance and enforcement work, responds to odor issues in communities. The PSCAA's goal of the project was to gain a greater understanding about odors in the community, identify factors that contribute to those odors and develop solutions to minimize those impacts. The project had three parts:

- Regional Odor Monitoring System
- Community Odor Observer Committee
- Ambient Odor Monitoring

The regional odor monitoring system consists of odor sensing devices, called eNoses that have been installed at selected odor sources in the region to measure real-time odor concentrations. Odor emissions from several facilities were quantified either directly using eNoses or field odor measurements. The physical parameters for each odor source were characterized. This information, along with local meteorological data and land use characteristics was entered into an air dispersion model to assess the potential odor impacts on the surrounding community.

The community odor observer committee is made up of volunteers from the community who are helping by gathering information about the odors they perceive during their day-to-day activities. Odor observers use cards or online forms to report odor character, intensity and hedonic tone.

The three ambient odor monitors are eNoses placed in residential locations. These eNoses were not calibrated to respond to any particular type of odor. The combined data of community observations and ambient eNoses can help to better understand what is impacting the community and identify solutions.

The project, initiated in September 2012, was completed in November 2013 after 1 year of odor monitoring in the community.

The PSCAA retained Odotech to design, install and operate an integrated community odor monitoring program in the Everett/Marysville area. The OdoWatch® system provided the platform for managing the information that would be needed to complete the regional assessment. The regional odor monitoring project for the Everett / Marysville area was an ambitious undertaking. To apply this system across multiple facilities using two meteorological stations that can be linked to ambient air eNoses and community odor observations was a technical challenge.

The findings of the study are summarized below:

- Odor is multifaceted and impacts need to be described with respect to the frequency, intensity, duration and character. By combining source monitoring, odor modeling, and community odor observations, this study was able to define each of these qualities. Source monitoring and modeling defined the frequency and intensity of odor impacts. The community odor observations defined the characteristics and duration of odor events.

- The meteorological data from the two stations, Cedar Grove and Marysville, show a high percentage of calm conditions (wind speeds less than 1 meter per second, 2.2 miles per hour), 64 and 55 percent, respectively. This greatly affects how odor emissions disperse throughout the Snohomish River valley. Of the odor observations reported, 94 percent occurred during calm conditions.

- Dispersion modeling remains the best approach to characterize the relationship between odor emission source and ambient odor impact. It defines the magnitude of the impact and frequency of exceedance, two key characteristics of odor.

- The residential and suburban areas of Everett, Marysville and Tulalip area are impacted by Cedar Grove compost facility, Everett Wastewater Treatment Plant, and Marysville Wastewater Treatment Plant.

- Other sources characterized in the study did have odor plume profiles that extended beyond the plant property boundary. These impacts may be noticeable along roadways or public areas, but the impact in residential areas is limited.

- The observations from the community odor committee provided valued input to the character of odors in the study area and confirmed the impacts from the regional odor monitoring system.

- Sources that agreed to install eNoses at their facilities had the opportunity to access the OdoWatch system for their sites and monitor the odor emissions and impacts. Sources that agreed to have samples collected from their sites, gained knowledge about the odor concentrations from their operations.

- The eNoses located in the ambient air did not provide information that either correlated with odor observations or impacts from the regional odor monitoring program.

Note to reader

The information, analysis and recommendations are to be used solely for the intent presented in the report. The information, conclusions, estimations, results and recommendations are based on : i) the information available and accessible during the production of the document, ii) data obtained from external sources, and iii) the conditions, estimations, scenarios and hypotheses as stated in the report.

The recommendations included in the present document are based on the objectives and deliverables agreed upon between the client and Odotech. Other impacts that are not included or discussed in the study could exist, such as and not limited to: changes in the emission rates of other contaminants, impacts on the processes and their capacity, impacts on the operational and capital costs, impacts on human resources requirements, and social impacts.

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GLOSSARY, ACRONYMS AND UNITS

Term / Acronym / Unit	Definition
CFM	Cubic feet per minute.
eNose	Electronic nose.
GPRS	General Packet Radio Service.
Odor episode	For purposes of this study, odor episodes are considered to occur when 3 observations or more are received for the same day by the participants of the odor observer committee.
Odor event	For purposes of this study, odor events are considered to occur when an odor concentration recorded at an ambient eNose (OdoCheck) is above the percentile 99.9.
Odor concentration	Number of odor units in 1 m^3 of gas or number of dilutions (with unscented air) necessary to obtain a mixture for which the odor is perceived by 50 % of a jury (in OU/m^3).
OU/m^3	Odor units per cubic meter. Odor concentration unit measurement. 1 OU/m^3 corresponds to the level at which 50% of the population can start detecting an odor in an odorless environment.
$OU/m^2/s$	Odor unit per square meter per second. Odor emission rate per surface unit for surface sources.
OW	OdoWatch
PSCAA	Puget Sound Clean Air Agency
Source	Atmospheric emission source.
US EPA	United States Environmental Protection Agency.
WS	Weather station.
WWTP	Wastewater Treatment Plant

1 BACKGROUND

The Puget Sound Clean Air Agency (PSCAA) is responsible for protecting and enhancing the air quality in King, Kitsap, Pierce and Snohomish counties in Washington State and as part of its compliance and enforcement work, responds to odor issues in communities. In a coordinated effort to understand the nature of odors in the Everett and Marysville area of Washington State, the PSCAA and others in this region conducted a technology-based community odor monitoring project to gain more information regarding odors in this area.

The PSCAA's interest is to gain more information about odors in the community and identify, develop and implement solutions. The PSCAA retained Odotech to design, install and operate an integrated community odor monitoring program in the Everett/Marysville area. The community odor monitoring project was intended to provide real time information about various odors in the community. The project had three parts:

- Regional Odor Monitoring System
- Community Odor Observer Committee
- Ambient Odor Monitoring

The regional odor monitoring system consists of odor sensing devices, called eNoses, which have been installed at selected odor sources in the region to measure real-time odor concentrations. Odor emissions from several facilities were quantified either directly using eNoses or field odor measurements. The physical parameters for each odor source were characterized. This information, along with local meteorological data and land use characteristics was entered into an air dispersion model to assess the potential odor impacts on the surrounding community.

The community odor observer committee is made up of volunteers from the community who are helping by gathering information about the odors they perceive during their day-to-day activities. Odor observers use cards or online forms to report odor character, intensity and hedonic tone.

The three ambient odor monitors are eNoses placed in residential locations. These eNoses are not calibrated to respond to any particular type of odor. The combined data of community observations and ambient eNoses can help to better understand what is impacting the community and identify solutions.

The project, initiated in September 2012, was completed in November 2013 after 1 year of odor monitoring in the community. Figure 1-1 shows the extent of the regional odor monitoring study area. The study area includes Everett, Marysville, Tulalip and Lake Stevens, as outlined in yellow in the figure. The red dots show where some of the potential odor sources are located. The blue dots show where the potential odor sources are monitored by eNoses. The green dots are the ambient eNose locations. This report summarizes the data collected during the course of the project and presents the major statistics and conclusions.

Figure 1-1 Regional Odor Monitoring Study Area

2 GOALS AND OBJECTIVES

The PSCAA's goal of the project was to gain a greater understanding about odors in the community, identify factors that contribute to those odors and develop solutions to minimize those impacts. The community odor monitoring project was intended to provide near real-time information about various odors in the community, allowing the community to learn more about any odors they experience and providing information to the facilities about odors so they can take actions to reduce their emissions.

Odotech designed, installed and operated the integrated regional odor monitoring program in the Everett/Marysville area. The volunteer members of the community odor observer committee were trained by Odotech to understand the characteristics of odors and report their observations to a central website. Odotech provided PSCAA with various project deliverables to document the progress of the study and provide interim information. The deliverables provided to PSCAA throughout the course of the study are listed in Annex C.

2.1 Regional Odor Monitoring System

The regional odor monitoring system provided a comprehensive assessment of odor impacts from potential odor sources in the study area through continuous monitoring using the eNose or through discrete odor samples taken at various locations. These measured odor concentrations were entered into a dispersion model along with representative meteorological data to predict odor plumes. The plumes provide a graphic representation of how the odor emissions from the various facilities impact the surrounding communities.

The objectives of the regional odor monitoring system were to:

- Provide a comprehensive inventory of potential odor sources from municipal and industrial facilities and fugitive emissions.
- Characterize the odor emissions from each of the sources in the inventory with continuously monitoring eNose, or from the direct measurement of odors from the source using dynamic olfactometric methods.
- Collect local meteorological data from two monitoring locations in the study area.
- Enter the collected information into a dispersion modeling system to obtain near real-time (every four minutes) odor plume predictions.
- Provide information to facilities about odors so they can take actions to reduce their emissions.

2.2 Community Odor Observer Committee

The odor committee relies on voluntary participants from the local population to report odor observations to complement the predicted odor impacts from the regional odor monitoring program.

The objectives of the community odor monitoring project were:

- Provide real time information about various odors in the community
- Allow the community to learn more about any odors they experience
- Enable faster responses and a better flow of information
- Understand factually the situation

Volunteers were selected through a series of tests and trained to identify specific odors that may exist within the olfactory landscape of the area. Observers reported their odor observations providing factual and quantitative data which can then be correlated with the other measurements.

2.3 Ambient Odor Monitoring

Of the six eNoses purchased for the project, three were placed on or near odor sources. It was the intent to place the other three at, on or near an odor source, but agreements with participating facilities were not reached. Because of this, three eNoses were available for use for ambient monitoring of odor concentrations. Although not part of the original study plan, the placement of eNoses in residential locations seemed like a reasonable use of eNoses that were not installed at a potential odor emission source. The continuous reporting of ambient odor concentrations by the ambient eNoses was intended to complement the odor observations made by the committee members.

2.4 PSCAA Nuisance Regulation

One way the PSCAA deals with odors is through its nuisance rule, Regulation I, Section 9.11. A copy of nuisance regulation is in Annex A. As part of the design of this project, the PSCAA did not intend to directly use any of the data collected as part of this project for enforcement purposes. This was intended to help encourage participation of municipal and industrial facilities in the study.

3 ODOWATCH AND ENOSES

OdoWatch® System combines a half-dozen pieces of software and technology to help create a detailed and accurate picture of the odor emissions from a site, as shown in Figure 3-1. First, a series of electronic noses or eNoses can analyze the air for odors, using a sensor matrix that mimics the behavior of the human nose. The eNoses are positioned near the odor sources of the site and measure the odor continuously. The odor data from the eNoses and the local weather data are sent to the pre-configured OdoWatch® software, which models the atmospheric dispersion and then generates a map of the odor plume, overlaid onto a map of the site and the surrounding area. OdoWatch® is calibrated to recognize and quantify (in odor units) the odors of each site.

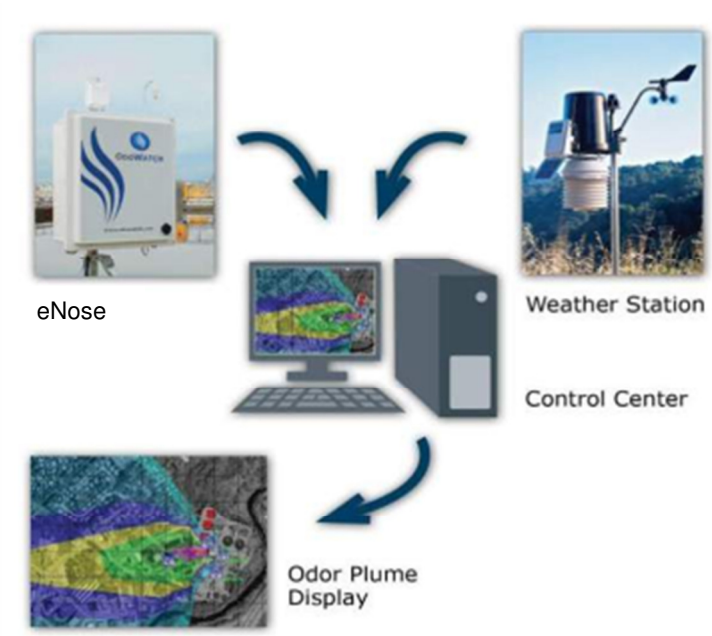

Figure 3-1 : OdoWatch System

This approach offers a series of unique advantages over less comprehensive odor detection techniques. Not only do the eNoses provide quantifiable measurements of odor levels at one given location, but the system can use atmospheric dispersion modeling to show the full extent and intensity of an odor plume. An odor monitoring system like OdoWatch® combines automatic central monitoring of odor emissions with a clear display showing odor concentration that incorporates current weather data and is updated every 4 minutes.

For this project, two meteorological stations were installed: one on Smith Island at Cedar Grove and one at the Marysville air quality monitoring station near the Totem Middle School in Marysville. The meteorological data were continuously collected, averaged

over a 4-minute period and entered into the dispersion model within the OdoWatch® software.

The OdoWatch® System is the main platform from which other products are derived. In this project, Odotech has also used the OdoScan and OdoCheck systems. The OdoScan system refers to an OdoWatch® system with the modeling of odor sources with fixed emission rate and real-time weather data. There are no eNoses providing real-time odor measurements. The fixed odor emission rates were based on odor samples collected from the source or a similar source and quantified using dynamic olfactometry. For sources where a representative odor sample could not be collected, a value was obtained from published literature.

The OdoCheck consists of an eNose not coupled with real-time modeling. The eNose can measure a specific source or, as it is the case in this project, react to odors present in ambient air.

One unique aspect of this project was that instead of having a computer stationed at each of the sites to collect eNose or meteorological data, the OdoWatch® software was on a “cloud” based server, a server accessed through the internet. The eNose and meteorological data were transmitted to the “cloud” based server using cellular communication protocols. This allowed for the sharing of data between the different OdoWatch® platforms.

4 REGIONAL ODOR MONITORING SYSTEM

The regional odor monitoring system uses the OdoWatch® continuous odor measurement and monitoring system in an integrated network to assess fate of odors across the Everett/Marysville area. During the audit phase of this project, a total of 10 suitable locations for eNoses were determined on six different facilities: Cedar Grove Composting, Everett WWTP, Lake Stevens WWTP, CEMEX Asphalt Plant, Granite Construction and Marysville WWTP. The chosen locations present either a high possible variation of emissions or a high level of odorous emissions (Deliverable A - Audit Report).

Among these facilities, Cedar Grove Composting, Everett WWTP, Lake Stevens WWTP and CEMEX Asphalt Plant agreed to participate in the regional odor monitoring project. Cedar Grove already has four functioning eNoses installed at their facility. As part of this project, Odotech installed one eNose at each of the other three facilities in February 2013 to monitor their major source of odors from each facility.

4.1 SYSTEM OVERVIEW AND CONFIGURATION

The regional odor monitoring system designed by Odotech includes:

- 2 weather stations: Marysville (GPRS) and Cedar Grove
- 3 ambient odor monitors (eNoses located in ambient air) (GPRS)
- 1 eNose (GPRS) at Lake Stevens WWTP
- 1 eNose (GPRS) at Everett WWTP
- 1 eNose (GPRS) at CEMEX (with a door detector)
- 6 OdoWatch systems (cloud). 3 individual OdoWatch systems (1 per participating facility) + 2 OdoWatch systems for fixed sources + 1 OdoWatch system replicating the data from Cedar Grove
- 1 main OdoWatch visualization interface (Agency's OdoWatch)

Figure 4-1 presents an overview of the regional odor monitoring system and how each component interacts with each other.

The eNoses are designed to monitor air concentrations and, through a correlation with a sampled odor concentration, provides an odor concentration averaged every 4 minutes. Odor samples were taken for each monitored source and used for the calibration of the eNose. Olfactometric analyses were performed by St. Croix Sensory located in Stillwater, Minnesota, a third-party odor laboratory selected by PSCAA.

A weather station was installed at the Marysville air quality monitoring station to allow for the meteorological data acquisition for modeling purposes in OdoWatch. The data from the Cedar Grove Composting facility is also used to model sources on Smith's Island.

Odor sources that were identified during the audit phase of the project but that were not monitored in real-time by an eNose were assigned an odor emission rate based on samples from a similar source in the area or from values obtained from similar facilities (Odotech database or literature) and reasonable operational parameters such as operating hours. Odor samples were taken at several facilities around the region: Lakes Stevens WWTP, Everett WWTP, Cedar Grove, Pacific Topsoil, CEMEX and at low tide.

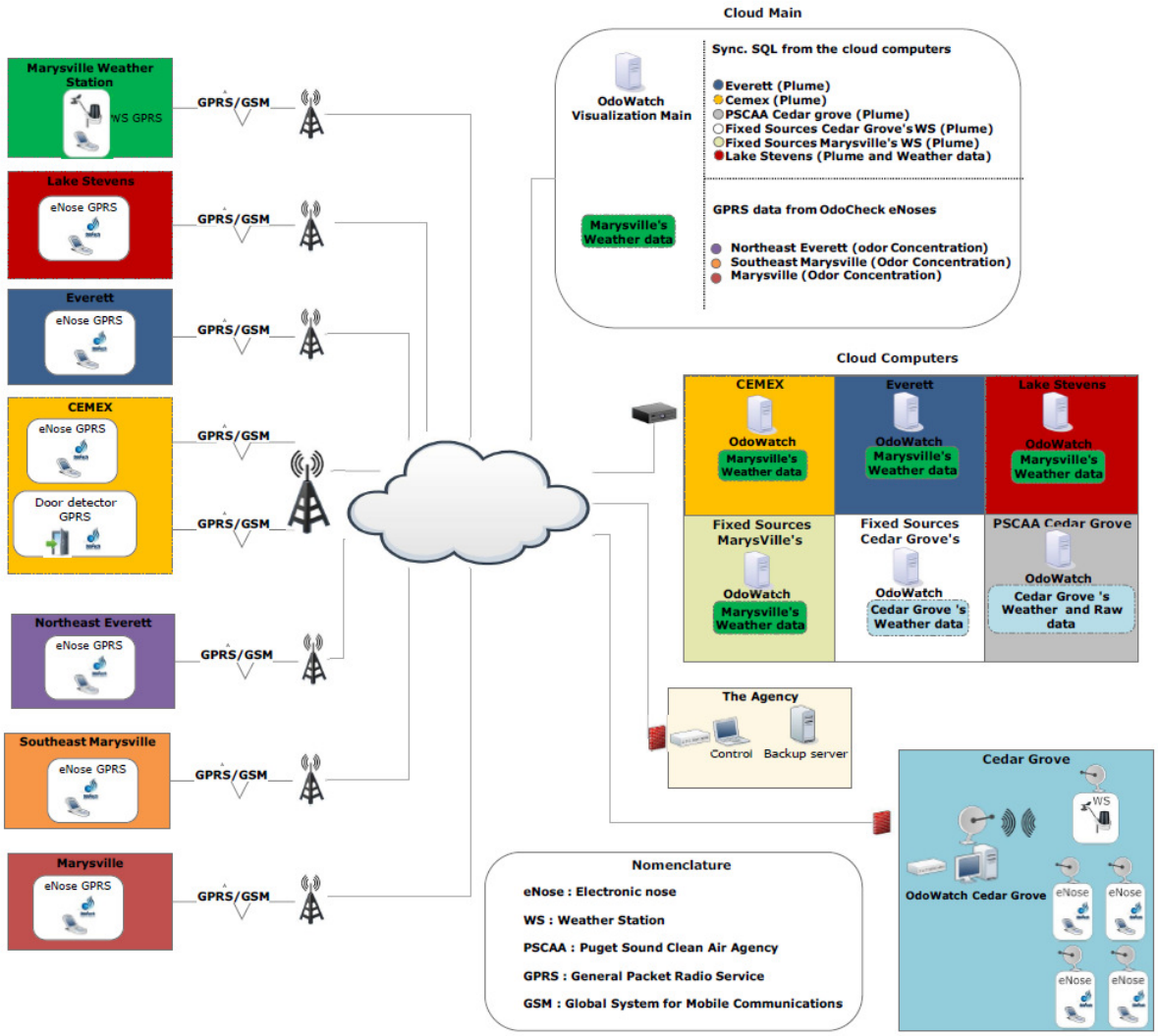

Figure 4-1 : Regional Odor Monitoring System Overview

The data from the eNoses and meteorological stations are transmitted to a “cloud” based server, a server accessed through the internet using cellular communication protocols, general packet radio service (GPRS). Six OdoWatch® platforms were created to receive the transmitted data and share the data across the different platforms. The OdoWatch® platforms allow those facilities that installed eNoses on their sites to access the OdoWatch® interface for the platform specific to their site. Two platforms were created using either the Marysville or Cedar Grove meteorological data for those facilities whose emissions are based on fixed emission rates. One platform is a mirror of the OdoWatch system installed at the Cedar Grove compost facility.

Each platform has an interface which allows the user to connect to the OdoWatch® software. The OdoWatch® software collects, tracks and records the data received. The

odor concentrations monitored by eNoses, meteorological data input, odor plume profiles and alert messages are presented graphically. It allows the user to understand the status of the OdoWatch® system.

A key component of the OdoWatch® software is the dispersion model which characterizes the fate of odors between the point of release at the emission source and the point of impact at the downwind receptors. The AERMOD dispersion model is the preferred model for characterizing plume impacts in the near field. The odor impacts predicted by the AERMOD model are displayed as odor concentrations in color coded plume profiles. The lowest concentration shown is 1 OU/m^3. A more detailed discussion of the inputs to the AERMOD dispersion model is presented in Annex B.

Figure 4-2 graphically present the flow of information from the eNose measurement to the creation of a plume on the OdoWatch interface.

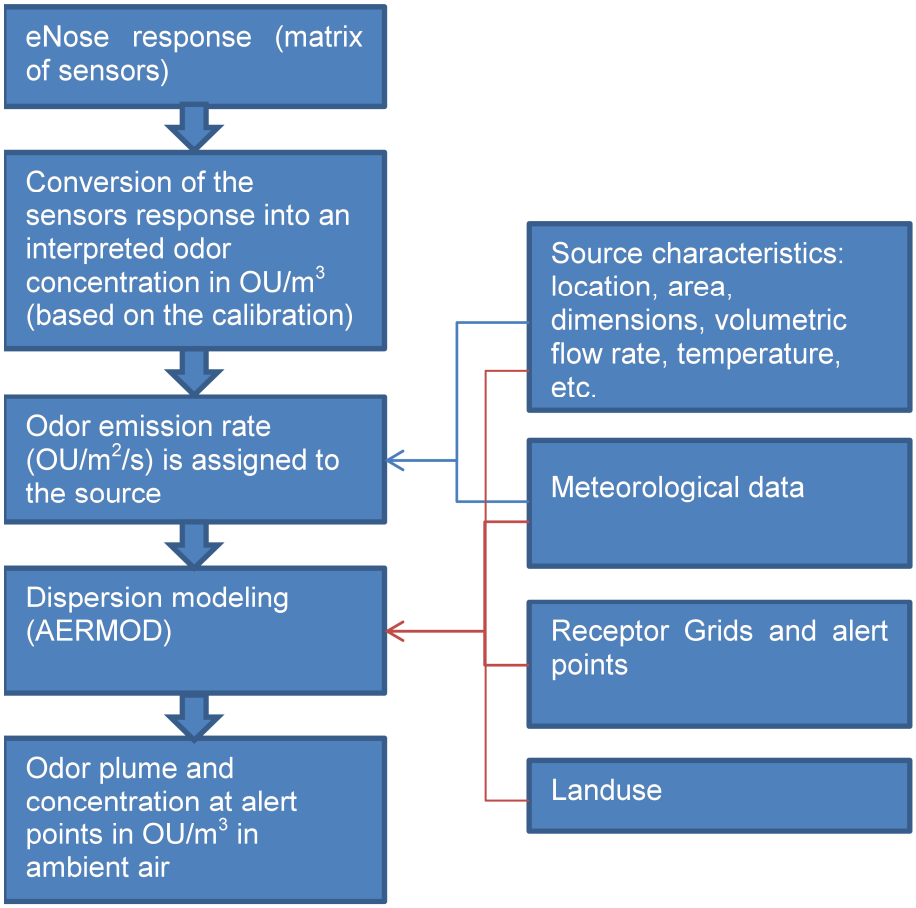

Figure 4-2: Overview of the Odor Plume Creation Process

The graphical odor plume profiles created in each of the six OdoWatch® platforms are communicated to the OdoWatch® Visualization platform (PSCAA's OdoWatch). This

allows all the odor plume profiles to be presented in a single view. Odor concentrations from the ambient eNoses are also captured on the PSCAA's OdoWatch platform.

4.2 METEOROLOGICAL DATA

Real time meteorological data are processed by the OdoWatch interface to determine the direction of the odor plume, characterize the turbulent intensity of the ambient environment and predict the odor concentrations at the critical downwind receptors. The meteorological station at Cedar Grove Compost Facility is part of the Cedar Grove OdoWatch system (installed before and independent from this project). The meteorological data from this station is used for the dispersion modeling in the OdoWatch systems for those facilities located on Smith Island.

A second meteorological station was installed at the Marysville Totem Middle School. An assessment of potential locations for the second meteorological station considered the technical and logistical requirements related to the siting of the station. This station acquired the meteorological parameters required for the dispersion modeling of sources located in Marysville including the Marysville wastewater treatment plant, CEMEX asphalt plant and the Everett and Lake Stevens wastewater treatment plants.

Figure 4-3 presents the wind roses for the odor monitoring period from March 26th 2013 to November 30th, 2013. Table 4-1 presents basic statistics for each weather dataset.

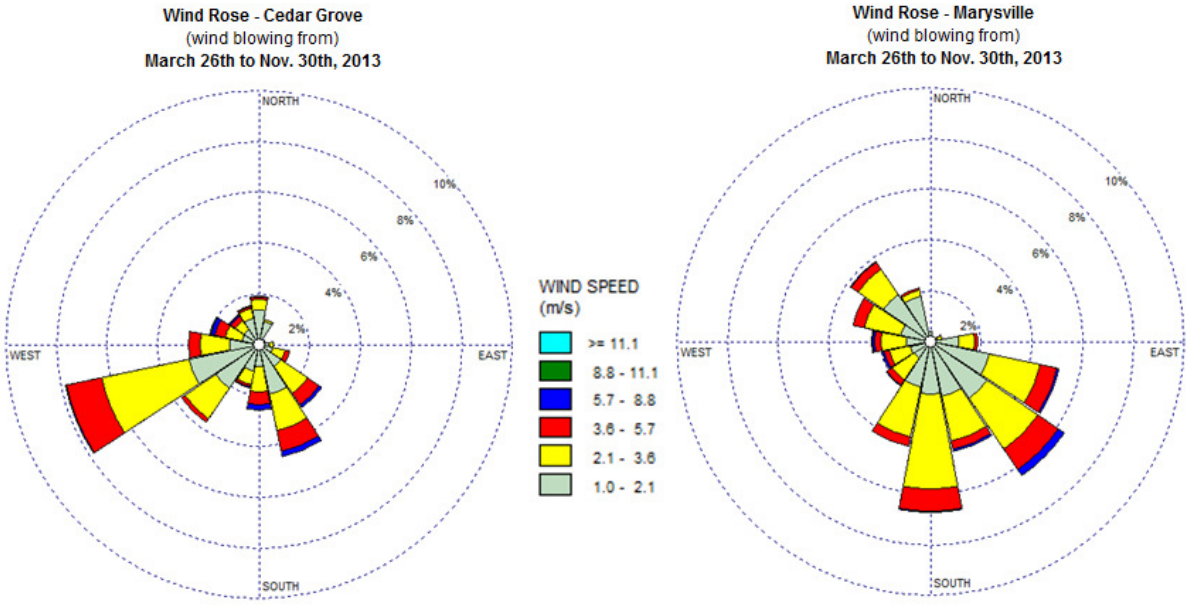

Figure 4-3 : Wind Roses for Cedar Grove and Marysville Locations

The prevailing wind for Cedar Grove station is from the west-southwest. The south-southeast is the second most frequent wind direction. This is as true for light winds (1 to 2 m/s) as it is for the stronger winds. Winds from the northwest are much less frequent and almost no winds from the northeast are observed.

The prevailing wind direction for the Marysville station is from the south with the southeast wind being the next most frequent, but the range of wind directions from east-southeast to south-southwest makes up most of the observed winds. Light winds also predominately come from this direction. However, the wind directions from the north-northwest to northwest are more significant at the Marysville station than the Cedar Grove station. Little to no wind directions from the northeast are observed.

The average and maximum wind speeds for the two stations are similar. The number of calm hours (wind speed of 1 m/s or less) makes up more than half of the observed wind speeds. This is critically important for the dispersion of odors. During calm periods, odors can accumulate in the Snohomish River basin before they transport out of the valley as the winds pick up. The wind direction can be quite variable during calm periods, swinging through several wind direction sectors in a short period of time. It is difficult to characterize plume profiles during calm periods using a dispersion model.

The air temperatures (average, maximum and minimum) for both stations are similar. Marysville is slightly warmer on average with a higher maximum temperature and lower minimum temperature.

Table 4-1 : Weather Conditions - Statistics

(4 minutes average)	Cedar Grove	Marysville
Number of complete data :	89558	82629
% Missing/incomplete :	0.5%	8.2%
% Calms (< 1 m/s) :	63.7%	54.5%
Prevailing wind :	WSW	S and SE
Average wind speed (m/s) :	1.0	1.2
Maximum speed (m/s) :	12.1	13.0
Wind speed std. Dev. (m/s) :	1.2	1.4
Average Temperature (°C) :	13.0	13.5
Maximum Temperature (°C) :	27.1	33.0
Minimum Temperature (°C) :	-3.3	-5.3

4.3 ODOR CONCENTRATIONS MEASURED (ENOSES)

Selected odor sources on 4 facilities were monitored by an eNose installed on or near the odor source. Three eNoses were installed as part of the community odor monitoring project on three facilities: CEMEX, Everett wastewater treatment plant (WWTP) and Lake Stevens WWTP. The Cedar Grove composting facility already had four (4) eNoses in place prior to the community odor monitoring project. The eNose located in Lake Stevens WWTP monitors the odors from the headworks. The eNose at Everett WWTP monitors the odors from the two main ponds called AC1 and AC2 which are used for the oxidation of raw wastewater. The eNose at CEMEX monitors the odors from the asphalt processing building. The Cedar Grove composting facility already had four (4) eNoses in place prior to the community odor monitoring project. Three of these eNoses are

monitoring respectively phases 1, 2 and 3 of the composting process. A fourth one is located inside the grinder building.

The signal for the sensors in the eNose are interpreted, based on a calibration established with odor samples and olfactometric lab measurements from the sources, and an odor concentration is assigned by the OdoWatch software. The eNose responses are collected every minute and averaged every 4 minutes.

Table 4-2 and Table 4-3 present the basic statistics extracted from the eNoses recording from March 26th to November 30th 2013. For each eNose, the average odor concentration, the values of percentile 98 and percentile 99.9, the maximum, date and time of the maximum and the percentage of data available are presented. A percentile is a measure used in statistics indicating the percentage below which a given measurement in a group of measurements falls. For example, the 98th percentile is the value below which 98 percent of the measures may be found. Another interpretation would be that 2% of the data are above the value of percentile 98. The maximum represents the highest value recorded in any 4-minute period. The maximum can be high due to extreme, rare, and transient meteorological conditions or process upset influencing the measurements. The percentile 99.9 represents the quasi-maximum concentration without a few of the extreme peak responses.

Table 4-2 : eNoses Statistics

	Lake Stevens (Headworks)	**CEMEX (Asphalt Processing Building)**	**Everett (AC1 & AC2*)**
Average (OU/m^3)	187	88	14
98th percentile (OU/m^3)	256	228	21
99.9th percentile (OU/m^3)	284	764	37
Maximum (OU/m^3)	379	3300	308
Date and time of maximum	October 7, 2013 12:11	October 8, 2013 13:39	May 17, 2013 12:15
Percent Data Capture	81.0%	86.2%	74.8%

* Ponds AC1 and AC2 are the main zone for the oxidation of raw wastewater.

Table 4-3 : eNoses Statistics from Odor Sources at Cedar Grove

	Cedar Grove (Phase 1)	Cedar Grove (Phase 2)	Cedar Grove (Phase 3)	Cedar Grove (Grinder Building) (2)
Average (OU/m^3)	280	77	27	272
98th percentile (OU/m^3)	351	98	136	1058
99.9th percentile (OU/m^3)	465	144	3126	1837
Maximum (OU/m^3)	1056	322	4312 (1) (4294)	5116
Date and time of maximum	October 13, 2013 00:02	April 29, 2013 14:04	Multiple (1) July 24, 2013 20:43	November 25, 2013 08:02
Percent Data Capture	99.2%	99.3%	98.6%	99.2%

(1) 4312 OU/m^3 is the maximum odor concentration interpreted based on the calibration range applied to this eNose. The date and time of the 2nd highest value is provided.

(2) The eNose located in the grinder building measures the odor concentration inside the building and is not linked to a modeled source. The air from the building is treated by a biofilter before being released to the atmosphere.

Over the course of the project, data were available between 74.8 and 99.3% of the time depending on the eNose. Hardware issues were encountered for eNoses at CEMEX, Lakes Stevens and Everett WWTP. The lower data capture for the facilities in Table 4-2 reflects the technical challenges in implementing a communications solution to the internet communication approach for the project.

The distribution of odor concentrations as measured continuously by the eNoses shows that the maximum emissions presented in Tables 4-2 and 4-3 are very infrequent. The statistical peak (99.9 percentile) is much lower than the maximum value and comparable to the 98 percentile value. The variation in emissions at the CEMEX plant is due to the variable nature of the operation, where asphalt is prepared in batches and loaded onto truck. Odor concentrations from Cedar Grove Phase 3 are also quite stable with average concentrations of 27 OU/m^3, but with rare sudden peaks of brief intervals to a 99.9 percentile value of 3126 OU/m^3. The cause for the variation from the Phase 3 odor concentrations is not known. The eNose was responding to something in that area, but it may or may not have been related to the Phase 3 piles. When the peaks did occur, they lasted for a relatively short period of time, about 15 minutes.

4.4 ODOR EMISSION RATES FOR MODELED SOURCES

The regional odor monitoring system includes 64 sources located on 15 facilities, including the sea shore (low tide). Each source has to be assigned an odor emission rate in order to model their impact on their surrounding communities. Sources that were sampled were associated with an odor emission rate based on similarity with a sampled

source or were assigned an odor emission rate based on the literature or emission factors.

Table 4-4 presents the number of sources modeled with fixed odor emission rates and the total modeled odor emission rate in OU/s for each facility. The odor emission rate in OU/s is determined by the odor concentration assigned to each source and the source characteristics including volumetric flow rate for stacks (point sources) and area for surface sources. Deliverable N described the characterization of each odor emission source.

A total of six (6) surface sources on four (4) facilities were monitored by an eNose and modeled as part of this project. For these sources, the odor concentration measured by the eNose every 4 minutes was used in conjunction with the weather conditions and the source characteristics (location with respect to the eNose, area) to determine an odor emission rate per unit of surface ($OU/m^2/s$). The modeled odor emission rate in OU/s is then determined by the odor emission rate per unit of surface multiplied by the area of the source. Table 4-5 presents the total number of sources modeled (including sources modeled with fixed odor emission rate) and the number of sources modeled with variable measurements from the eNoses for each facility that had an OdoWatch system in place. For each of these facilities the total odor emission rate is variable depending on the eNoses measurement and the odor emission rate calculation done by the OdoWatch.

Table 4-6 presents the average odor emission rates, the values of percentile 98 and percentile 99.9, the maximum, date and time of the maximum and the percentage of data available for each source followed by an eNose. Table 4-6 also indicates the range of odor emission rate in OU/s for each sources monitored by an eNose over the course of the project. The relationship between the odor concentration (OU/m^3) as measured by the eNose and odor flux rate ($OU/m^2/s$) is nonlinear and is a function of the meteorological conditions as illustrated in Figure 4-2: wind direction which determines whether the measurements at the eNoses are upwind, cross-wind or downwind of the source and other meteorological parameters (wind speed, temperature, and solar radiation) determine the dispersion environment which defines the relationship between the measured odor concentration and the estimated odor emission rate. The flux rate is then dependent on the physical characteristics of the odor emission source including surface area of the source, air flow through the source, if applicable, and process changes (loading or digestion rates). Because the flux rate is dependent on the meteorological parameters that vary every 4 minutes, the flux rate will have greater variation than the associated eNose odor concentration.

Table 4-4 : Maximum Odor Emission Rate per Facility – Fixed Emission Rates

Facility	Type of Odors	Number of Odor Sources Modeled	Modeled Total Odor Emission Rate (OU/s)
Buse Timber & Sales	Composting, Fresh Waste and Woodchips	5	5 919
Dunlap Towing	Woodchips	1	3 703
Everett Bark	Beauty Bark	1	4 192
Granite Construction	Oil and Asphalt	5 (including 3 trucks)	1 666
Hansen Boat	Solvent	1	703
Lake Stevens (Old WWTP)	Wastewater Processing	1	1 971
Marysville WWTP	Sewer, Wastewater Processing and Wastewater Sludge	6	43 167
Miller Shingle	Woodchips	3	14 396
Pacific Topsoil	Beauty Bark, Compost and Woodchips	6	3 445
(Natural) Sea Shore	Low tide	1	44 579
Tulalip Landfill	Biogas	6 (6 vents)	1
Willis Enterprises, Inc.	Woodchips	3	5 871

Table 4-5 : Maximum Odor Emission Rate per Facility – Monitored by eNoses

Facility	Type of Odors	Number of Odor Sources Modeled	Number of Odor Sources Monitored by an eNose	Modeled Odor Emission Rate (OU/s) (see Table 4-6)	Maximum Odor Emission Rate for the Period (OU/s)
Cedar Grove Composting	Compost, Composting, Fresh Waste, Sewer and Woodchips	19	3 (1)	8984 + variable	249,457 (2)
CEMEX	Oil and Asphalt	5 (including 3 trucks)	1	2205 + variable	2404
Everett Public Works WWTP	Composting, Sewer, Wastewater Processing and Wastewater Sludge	5	1	3787 + variable	237,168
Lake Stevens (New WWTP)	Biogas, Composting, Sewer, Wastewater Processing and Wastewater Sludge	4	1	2407 + variable	2820

(1) The eNose located in the grinder building measures the odor concentration inside the building and is not linked to a modeled source. The air from the building is treated by a biofilter before being released to the atmosphere. Only the biofilter is modeled and counted within the 19 sources.

(2) Potential maximum odor emission rate based on the maximum for each source, but the maximum odor emission rate for each source did not occur at the same time.

Table 4-6 : Ranges of Odor Emission Rate for Sources Monitored by an eNose

	Lake Stevens (Headworks)	CEMEX (Asphalt Processing Plant)	Everett (AC1 & AC2)	Cedar Grove (Phase 1)	Cedar Grove (Phase 2)	Cedar Grove (Phase 3)
Average Odor Flux Rate ($OU/m^2/s$)	2.36	0.11	0.41	3.81	2.33	0.83
98th percentile ($OU/m^2/s$)	3.81	0.28	1.25	7.69	5.41	3.89
99.9th percentile ($OU/m^2/s$)	4.24	0.92	1.87	7.98	5.97	4.89
Maximum Odor Flux Rate ($OU/m^2/s$)	4.94	4.29	1.92	8.00	6.00	5.00
Date and Time of Maximum	10/07/2013 12:53	10/08/2013 13:40	11/02/2013 15:12	07/22/2013 00:23	08/21/2012 00:05	06/05/2013 17:30
Area (m^2)	84	46	121,405	18,562	8368	8368
Odor Emission Rate (OU/s)	198 to 415	5.1 to 197	49,800 to 233,400	70,700 to 148,500	19,500 to 50,200	6950 to 41,840

The total odor emission rate per facility is only an indicator and may not be proportional to the odor impact of the facility on the neighboring community. The impact of these sources depends on their configuration and physical parameters as well as on the meteorological conditions which dictates the air dispersion of the odors emitted and the distance between the sources and receptors. However, at the facility level, the study provided unique information for operators on the specific emissions of each odor sources and relative ranking. Facilities that installed eNoses were given access to the OdoWatch® system for their site and allowed to see the impact of their facility on the community and make improvements throughout the study. Facilities that allowed us to collect odor samples gained information about the odor from their sources. Source that the study showed impacts can further investigate those impacts and take mitigative action. This information can help prioritize further investigation or odor mitigation initiatives.

4.5 ALERT POINTS

Specific discrete receptors, called Alert Points (AP), allow the dispersion model to predict potential odor impacts at selected locations. (Alert points are established as part of the model and are not actual installations on the ground.) Alert points were added at locations provided by PSCAA and correspond to place where an ambient eNoses or a community odor observer lives. All OdoWatch systems had the same alert points. Each

participating facility had the opportunity to add specific alert points to their site specific OdoWatch platform at their convenience.

A total of nine (9) alert points were selected for this study. Figure 4-4 presents the location of these alert points. Modeled odor concentrations for each alert point are saved in the OdoWatch database. Alert points serve, when thresholds are defined, to indicate to the user if a set threshold has been exceeded at that specific location.

Figure 4-4 : Alert Points in OdoWatch

The AERMOD dispersion model is used to define the fate of odors from the point of release at the emission source to the point of impact at the downwind receptor. The input to the AERMOD dispersion model include the source odor emission rate, physical parameters that define the nature of the release (point or area source) and meteorological data that defines the ability of the atmosphere to disperse the odor plume. The predicted impacts at the downwind receptors are greater closer to the emission source and decrease as the distance from the source increases.

Table 4-7 presents the maximum odor concentration modeled for each alert point from each OdoWatch system. Maximum from each site may not have occurred at the same

time for each alert point. Values in bold indicates odor concentrations above 5 OU/m^3. The value of 5 OU/m^3 is used as the annoyance threshold based on a study conducted for the California Air Resources Board (Mahin, 2003)[1]. The study reviewed six published studies related to recognition, unpleasantness and annoyance associated with a variety of unpleasant odors and concluded that for unpleasant odors the threshold of annoyance is at approximately five times the perception threshold (1 OU/m^3).

Over the course of the study, the model estimated odor concentrations above 5 OU/m^3 at every alert point. Concentrations above 5 OU/m^3 were calculated, at one or more of the alert points for the sources from Everett, fixed sources with Marysville weather station (Marysville WWTP and sea shore), and Cedar Grove. Modeled odor concentrations at alert points from CEMEX, Lake Stevens and from fixed sources with Cedar Grove weather station were less than the perception threshold (< 1 OU/m^3).

Table 4-8 and Table 4-9 respectively present the frequency (percentage of data) of odor concentration above 2 OU/m^3 and 5 OU/m^3 for each alert point from each OdoWatch system. The threshold value of 2 OU/m^3 is twice the perception threshold and would represent the recognition threshold[2]. For every alert points, except the alert point located in NE Marysville, odor concentrations above 2 OU/m^3 were calculated between 0.002% and 8.0% of the time for the sources from Everett, fixed sources with Marysville weather station (Marysville WWTP and sea shore), and Cedar Grove. Only the fixed sources with Marysville weather station affected the alert point located in NE Marysville with odor concentrations above 2 OU/m^3. Odor concentrations from this facility above this threshold were predicted more often (3.3% of the time) at the alert point located at the Marysville weather station. For Everett WWTP, the alert points located in NE Everett and SE Everett were touched by concentrations above 2 OU/m^3 more frequently (1.0% and 6.6% of the time respectively). For Cedar Grove, odor concentrations above 2 OU/m^3 were calculated more frequently for alert points located in Tulalip (2.8%), NE Everett (8.0%) and NW Everett (4.4%).

With the exception of the alert point in SE Everett, the frequency of modeled odor concentration above 5 OU/m^3 represented less than 1% of the concentrations modeled. For the alert point located in SE Everett the modeled odor concentration from the Everett WWTP was above 5 OU/m^3 more frequently. The frequency of odor concentration above 5 OU/m^3 for this alert point reaches 4.3% of the time (242 hours in cumulated time) between March 26th and November 30th, 2013.

With the exception of the alert point in SE Everett, the frequency of modeled odor concentration above 5 OU/m^3 represented less than 1% of the concentrations modeled.

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[1] Mahin, T. 2003. "Measurement and regulation of odors in the USA". Odor Measurement Review, Japan Ministry of the Environment. Pp. 62-68. http://www.env.go.jp/en/air/odor/measure/02_1_4.pdf

2 The definition for the recognition threshold is taken from the US EPA Reference guide to Odor Threshold for Hazardous Air Pollutants Listed in the Clean Air Act Amendments of 1990, 1992 – which refers to Hellman and Small 1974: "recognition threshold are 2 to 10 times higher than the perception threshold".

For the alert point located in SE Everett the modeled odor concentration from the Everett WWTP was above 5 OU/m^3 more frequently. The frequency of odor concentration above 5 OU/m^3 for this alert point reaches 4.3% of the time (242 hours in cumulated time) between March 26th and November 30th, 2013.

Table 4-7: Maximum Modeled Odor Concentration from Each OdoWatch System (Alert Points)

	Maximum Modeled Odor Concentration from each OdoWatch System (OU/m^3)					
Alert Point	**CEMEX**	**Lakes Stevens WWTP (New and old)**	**Everett WWTP**	**Cedar Grove**	**Fixed sources Marysville WS (1)**	**Fixed sources Cedar Grove WS (2)**
SE Marysville	< 1	< 1	4.0	3.1	**8.1**	< 1
Marysville	< 1	< 1	3.4	3.3	**11**	< 1
Marysville Met Station	< 1	< 1	3.8	4.1	**25**	< 1
NE Marysville	< 1	< 1	1.5	1.5	**5.1**	< 1
Northwest Everett	< 1	< 1	**11**	**7.2**	4.4	< 1
Northeast Everett	< 1	< 1	**10**	**7.4**	**5.2**	< 1
SE Everett	< 1	< 1	**40**	2.7	3.5	< 1
SW Everett	< 1	< 1	**9.1**	3.3	3.0	< 1
Tulalip	< 1	< 1	3.5	**7.4**	**5.6**	< 1

(1) Facilities: Marysville WWTP and low tide
(2) Facilities: Buse Timber & Sales, Tulalip Landfill, Dunlap Towing, Everett Bark, Granite Construction, Hansen Boat, Miller Shingle, Pacific Topsoil, Willis Enterprises, Inc.

* Values in bold indicates odor concentrations above 5 OU/m^3.

Table 4-8: Frequency of Modeled Odor Concentration Above 2 OU/m^3 from Each OdoWatch System (Alert Points)

	Frequency of Modeled Odor Concentration above 2 OU/m^3 from each OdoWatch System (OU/m^3)					
Alert Point	**CEMEX**	**Lakes Stevens WWTP**	**Everett WWTP**	**Cedar Grove**	**Fixed sources Marysville WS**	**Fixed sources Cedar Grove WS**
SE Marysville	-	-	0.05% (38 data)	0.15% (131 data)	0.04% (31 data)	-
Marysville	-	-	0.01% (9 data)	0.26% (235 data)	0.9% (725 data)	-
Marysville Met Station	-	-	0.01% (6 data)	0.95% (849 data)	3.3% (2744 data)	-
NE Marysville	-	-	-	-	0.01% (9 data)	-
Northwest Everett	-	-	0.88% (739 data)	4.4% (3900 data)	0.02% (16 data)	-
Northeast Everett	-	-	1.0 % (844 data)	8.0% (7102 data)	0.01% (12 data)	-
SE Everett	-	-	6.6% (5513 data)	0.24% (214 data)	0.03% (28 data)	-
SW Everett	-	-	0.89% (748 data)	0.95% (848 data)	0.002% (2 data)	-
Tulalip	-	-	0.03% (23 data)	2.8% (2471 data)	0.004% (3 data)	-

Table 4-9: Frequency of Modeled Odor Concentration Above 5 OU/m^3 from Each OdoWatch System (Alert Points)

	Frequency of Modeled Odor Concentration above 5 OU/m^3 from each OdoWatch System (OU/m^3)					
Alert Point	**CEMEX**	**Lakes Stevens WWTP**	**Everett WWTP**	**Cedar Grove**	**Fixed sources Marysville WS**	**Fixed sources Cedar Grove WS**
SE Marysville	-	-	-	-	0.01% (11 data)	-
Marysville	-	-	-	-	0.02% (15 data)	-
Marysville Met Station	-	-	-	-	0.93% (779 data)	-
NE Marysville	-	-	-	-	0.001% (1 data)	-
Northwest Everett	-	-	0.08% (67 data)	0.65% (573 data)	-	-
Northeast Everett	-	-	0.06% (54 data)	0.76% (674 data)	0.005% (4 data)	-
SE Everett	-	-	4.3% (3625 data)	-	-	-
SW Everett	-	-	0.08% (67 data)	-	-	-
Tulalip	-	-	-	0.48% (427 data)	0.001% (1 data)	-

5 AMBIENT ENOSES (ODOCHECK)

Three (3) eNoses were installed in July 2013 as ambient odor monitors (OdoCheck) in residential locations selected by PSCAA around the Everett/Marysville area.

The three locations were:

- At the air quality monitoring site at the Totem Middle School in Marysville.
- In a private backyard near Sunnyside Boulevard in Southeast Marysville.
- In a private backyard near Skyline Drive in Northeast Everett.

Figure 5-1 shows the locations of the ambient eNoses. They started acquiring data on July 15th, 2013.

Figure 5-1: OdoCheck Locations

Using an eNose to respond to odors in the ambient air is not the recommended use for an OdoCheck system. In a more typical application, an OdoCheck system would be placed on an odor source and calibrated to the types of odors from that source. The odor concentrations provided by the OdoCheck are not connected to a dispersion modeling algorithm as would be the case in an OdoWatch system, instead the measured odor concentrations are reported to the operator who can interpret the data and make

adjustments to the process, if necessary. It is also possible to have the OdoCheck automatically trigger an alarm or process action if measured odor concentration exceeds a set threshold.

Of the six eNoses purchased for the project, three were placed on or near odor sources. It was the intent to place the other three at, on or near an odor source, but an agreement with considered facilities was not reached. The preliminary audit recommended that two eNoses be installed at the Marysville Wastewater Treatment Plant and one eNose be installed at the Granite Construction asphalt batch plant. The City of Marysville and Granite Construction chose not to participate in the project. Instead of leaving the eNoses unused, PSCAA requested that they be placed at locations within the study area to measure odors in the ambient air.

These ambient eNoses are not calibrated to monitor a specific odor and may react to any odor in their vicinity (pleasant or unpleasant). A mathematical calibration is done based on the sensor's response over the course of a few days to a few weeks to ambient air concentrations at their location. An analysis of the data collected allows establishing a correlation between the electrical signal from the eNose and a relative response in OU/m^3. **The results provided by these systems should be interpreted more in terms of relative variation than in terms of actual value of odor concentration**.

As with the eNoses placed at individual sources, the responses from the ambient eNoses are collected every minute and averaged every 4 minutes. The data is transmitted via cellular communication protocols to the main OdoWatch visualization platform.

Figure 5-2 shows the frequency distribution of the relative responses recorded for each ambient eNose. Most of the relative responses (88.3%) are between 5 and 20 OU/m^3. From this simple graphical representation, three different data profiles are evident. The southeast Marysville OdoCheck shows a profile that is skewed toward the lower responses (5 to 10 OU/m^3). The profile for the northeast Everett OdoCheck is more broadly distributed, showing a greater number of lower and higher responses than the other distributions. The Marysville OdoCheck show a distribution skewed toward higher relative responses (10 to 20 OU/m^3).

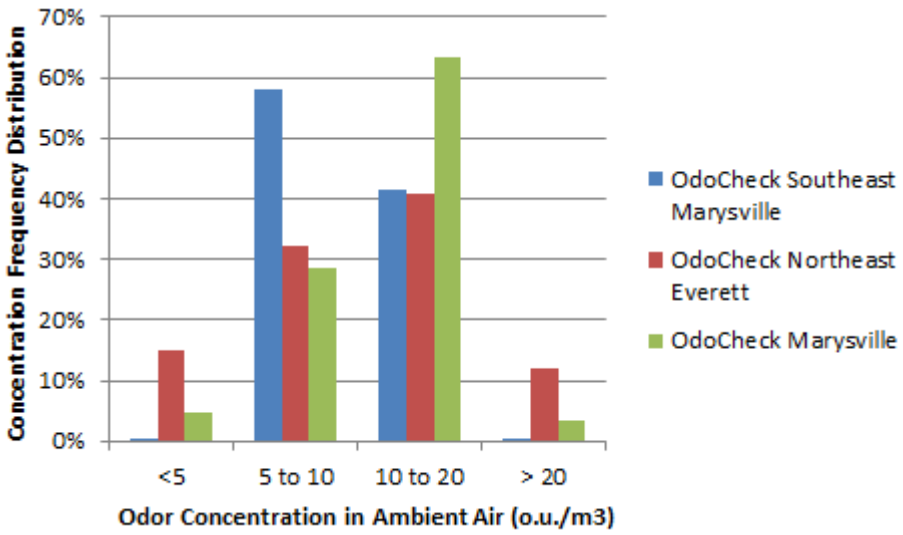

Figure 5-2 : OdoCheck – Relative Responses Frequency Distribution

The statistical treatment of the relative responses reported by the ambient eNoses (OdoCheck) is presented in Table 5-1. The data capture for all three eNoses was 92% or greater. The reported responses from the OdoCheck in Marysville show a consistent distribution of values. There is a reasonable progression from the average, 98 percentile, 99.9 percentile to the maximum value. For the OdoCheck in Southeast Marysville and Northeast Everett, the maximum values are much higher that might be suggested by the average, 98 percentile, and 99.9 percentile values. It is impossible to know to what the eNose was responding. The wind direction at the time the values were reported did not align with any of the odor sources in the study.

Table 5-1 : OdoCheck Statistics

	OdoCheck Marysville	OdoCheck Southeast Marysville	OdoCheck Northeast Everett
Average (OU/m^3)	12	10	11
98^{th} percentile (OU/m^3)	22	18	31
99.9^{th} percentile (OU/m^3)	27	26	50
Maximum (OU/m^3)	32	330	211
Date and time of maximum	November 15, 2013 18:13	November 11, 2013 07:26	September 5, 2013 11:59
Percent Data Capture	96%	96%	92%

Additional observations from the data collected for each OdoCheck systems are noted below.

For the OdoCheck in Marysville, data collected show more variation in November 2013 than between July and October 2013. Higher relative responses were observed:

- between 10am and 4pm, 6pm and midnight;
- when the wind prevailed from the ESE and SE and also from SW, NW and SSW;
- peaks (responses above 99.9 percentile – see Table 5-1) were identified on November 3rd, 8th, 14th to 19th 2013.

For the OdoCheck in Southeast Marysville, data collected show more variation or events in July 2013. Higher relative responses were observed:

- in the early morning (7:00 to 9:00) and early evening (19:00);
- when the wind prevailed from the N to E;
- peaks (responses above the 99.9percentile) were recorded on July 15th, 24th, 26th and 27th, August 4th and 29th, September 26th, and November 11th and 19th, 2013.

For the OdoCheck in Northeast Everett data collected shows higher variation in September and November 2013. Higher relative responses were observed:

- at night, mid-day and late afternoon;
- when the wind prevailed from the E to SW ;
- peaks (responses above the 99.9percentile) were recorded on August 11th, September 5th and November 29th and 30th, 2013.
- under low wind speed conditions between 0 and 2 m/s.

Table 5-2 summarises periods where the relative responses were above percentile 99.9 for each OdoCheck. Some lasted only one measurement (i.e. one measurement above the percentile 99.9 value for that OdoCheck) and other lasted for several measurements. Some peak responses are marked with an asterisk indicating that the peaks showed a marked increase in the value measured compared to the value obtained before or after it. For the other peak responses, the increase was gradual (slight increase to exceed the percentile 99.9 value) based on the previous and following measurements.

The peak responses recorded at each OdoCheck were crosschecked with the observation data from the odor committee (see Section 6). Only two of the three OdoCheck systems (Northeast Everett and Southeast Marysville) are located near an odor observer committee member residence. During each peak response, no observation from a committee member was received. Several of these peaks occurred in November 2013 and no observation was received during that period. Odor observations were received for July 24th in the morning (between 9:30 and 11:23 AM) from Marysville and in the evening for Everett (9:25 to 11:42 PM) but the time frames do not coincide with the peak responses recorded for the OdoCheck in Southeast Marysville which occurred from 00:17 to 02:00 AM. Similarly, an odor observation was received on July 27th in Marysville around 8:55 PM. The OdoCheck events that day were recorded at 02:31 and 04:51 AM.

Table 5-2: OdoCheck - Specific Peak Responses

OdoCheck	Date & Time	Prevailing Wind	Wind Speed (m/s)	Maximum Odor Concentration
Marysville	11/03/2013, 10:36, 10:40 and 10:56	SE - SSE	1.3 – 1.6	27 to 30
	11/08/2013, 10:28, 10:44, 10:52, 11:32 and 12:36	SE - SSE	2.2 – 2.9	27 to 28
	11/13/2013, 13:32 and 14:13	SSW	1.6 – 2.2	27
	11/13/2013, 16:09	ESE	0	27
	11/14/2013, 23:37 to 23:53	ESE - SE	0 – 0.2	27
	11/15/2013, intermittent btw 15:09 and 15:49	ESE - SE	3.1 – 4.2	27 to 31
	11/15/2013, intermittent btw 18:09 and 19:09	ESE - SE	3.0 – 4.2	27 to 32
	11/15/2013, intermittent btw 18:09 and 20:18	ESE - SE	2.7 - 4.7	27 to 32
	11/15/2013, 21:02 to 21:06	SW	1.8 – 2.7	28 to 30
	11/16/2013, 08:18	SE	0.9	27
	11/16/2013, intermittent btw 12:18 and 13:22	ESE - SE	1.3 – 2.5	27 to 28
	11/18/2013, intermittent btw 18:45 and 20:13 and btw 23:25 and 00:27 (11/19/2013)	ESE - SE	2.2 – 3.6	28 to 30 *
	11/18/2013, intermittent btw 23:25 and 00:27 (11/19/2013)	ESE - SE	5.1 – 6.1	27 to 28 *
	11/19/2013, 06:11 to 06:15	NW	0.2	27
Southeast Marysville	07/15/2013, 19:54	WNW	2.7	35
	07/24/2013, 00:17 to 02:00	NNW to NNE	0 – 1.6	29 to 30
	07/26/2013, 16:11 to 16:15	SW	4.0	28 to 29
	07/26/2013, 19:03 to 19:51	WSW to WNW	1.3 to 3.6	26 to 28
	07/26/2013, 23:07 to 23:47	NNW to NNE	0 to 1.0	26 to 27
	07/27/2013, 02:31	WSW	0	28 *
	07/27/2013, 04:51	N	0	28 *
	08/04/2013, 19:15	W	0	26 *
	08/29/2013, 08:19	SSE	0.6	29 *
	09/26/2013, 18:53	S	0	143 *
	11/11/2013, 07:26	N	0.7	330 *
	11/11/2013, 08:54	N	0	28 *
	11/19/2013, 07:19	N	1.1	43 *
Northeast Everett	08/11/2013, 17:36	S	1.0	98 *
	09/05/2013, 11:47 to 11:59	S to SW	1.6 – 2.0	190 to 211 *
	11/29/2013 23:47 to 11/30/2013 02:39	E to SSE	0 - 2.0	49 to 51

* Sudden increase and decrease.

Figure 5-3 graphically presents the odor variation for each OdoCheck. Each graph shows the maximum and average odor concentrations according to wind direction (from which the wind is blowing from) as provided by the Marysville weather station. The

average for each wind direction sector is shown in burgundy color in the center of the graph. The maximum value for each wind direction sector is shown in blue. For the NE Everett OdoCheck the 1st peaks have been removed to better show the normal tendency. These peaks were representative of only one measurements and do not reflect the normal tendency. Similarly, for SE Marysville OdoCheck, the 1st peaks from the North and the South have been removed.

Slightly higher concentrations were recorded at the Marysville OdoCheck when the winds were blowing from the SSE, SE and ESE. Higher odor concentrations were recorded when the winds were blowing from the E to SSE for the Northeast Everett OdoCheck and from the North-West quadrant for the Southeast Marysville OdoCheck.

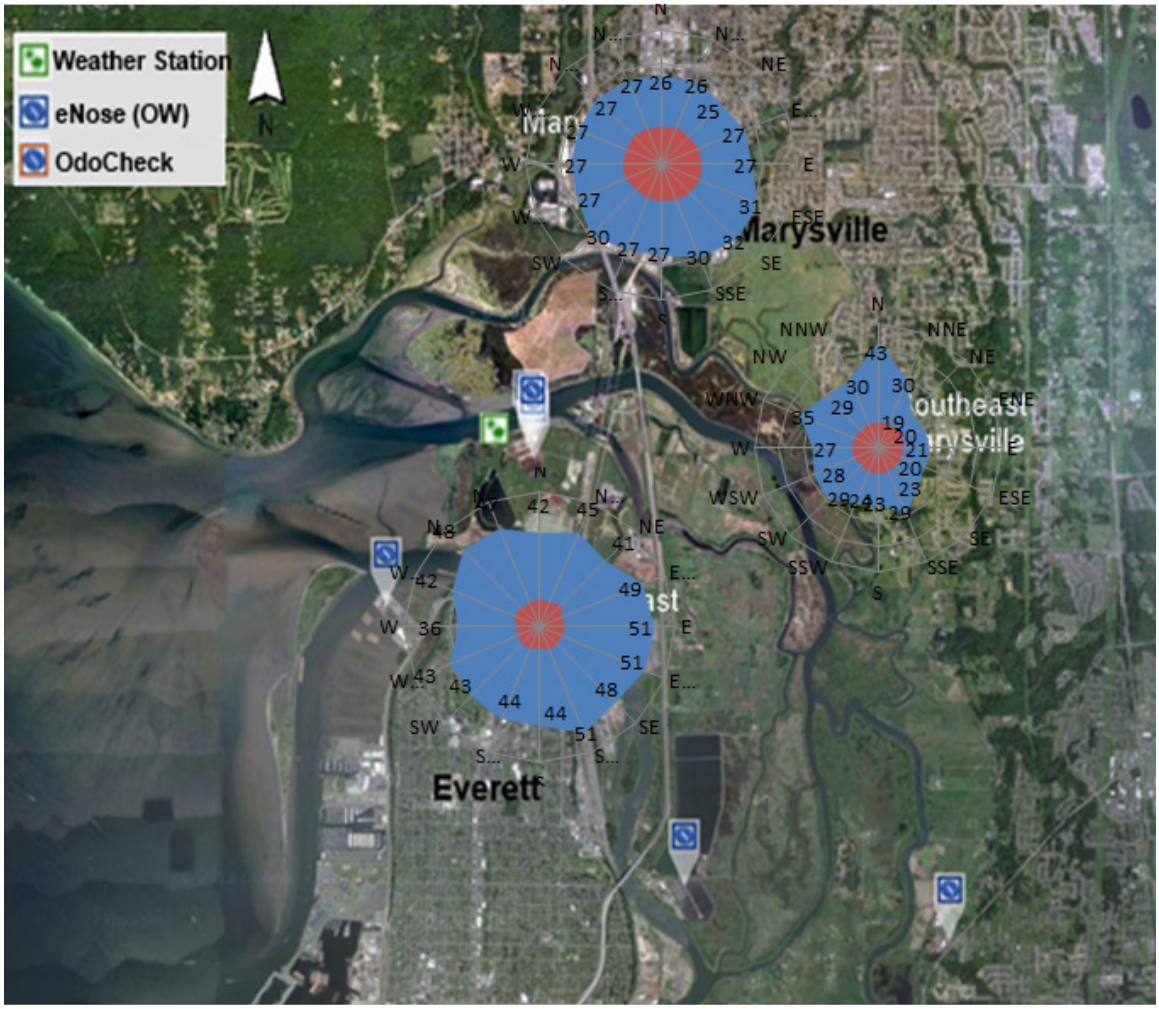

Figure 5-3: OdoCheck - Odor Variation per Wind Direction (Marysville)

It is not possible to reconcile the observation data from the odor committee and the three ambient air eNoses because it was not at the same locations. Only two of the three ambient air eNoses are located near the homes of odor observers. Odor observations were not limited to their homes and could be made anywhere the observer travels. The peak response from the ambient eNoses did not correspond to any reported odor observations. Odor observations that were reported had above average responses from the ambient air eNoses. Ambient eNoses may respond to any odor (it is not possible interpret the response as an offensive odor intensity).

Further, the peak and average responses of the ambient air eNoses when sorted by wind direction sector did not show any orientation toward odor sources identified in the study. If the ambient eNoses could have been placed closer to the potential odor source and calibrated to the odors from that source, more meaningful data might have been obtained.

6 COMMUNITY ODOR OBSERVER COMMITTEE

The odor committee relies on voluntary participants from the local community to report odor observations to provide proactive data. This approach fosters a constructive dialog between the stakeholders and neighbors. Volunteers were selected through a series of tests and trained to identify specific odors that may exist within the olfactory landscape of the area. Observers reported their odor observations providing factual and quantitative data which can then be correlated with the other measurements.

6.1 VOLUNTEERS, TRAINING AND QUARTERLY MEETINGS

An initial meeting was held on September 12th, 2012 to present the project and inform the community on how they could provide input into the project by participating in the Community Odor Observer Committee.

A total of two (2) training sessions were held on September 25th, 2012 and November 8th, 2012 to give the participants the general information about odors and to provide them with the tools to be able to produce complete odor observations. The participants were selected based on two (2) tests to establish their sensitivity to odors in order to eliminate hyposensitive or hypersensitive candidates. The objective was to ensure that the panel is representative of the population. The participants were also selected on their ability to recognize specific odors from the regions including: composting, fresh wastes, sewer, low tide, wood chips, beauty bark, wastewater, biogas, solvent and asphalt.

Participants had to qualify at least 2 out of the 3 tests performed in order to be accepted as an observer. A total of 16 participants qualified. Amongst the qualified observers, four (4) observers were located in Everett, ten (10) in Marysville (including 2 located at the same address) and 1 in the Tulalip area for a total of 15 observers. Three (3) observers withdrew from participating in the committee during the first quarter. One observer withdrew from participating in the committee during the fourth quarter.

Quarterly meetings were held to update the participants on the status of the project and to present them with the results from their observations. Meetings were held on March 19, 2013, June 13th, 2013 and October 16th, 2013. The last meeting will be held January 22nd, 2014.

6.2 OBSERVATION COLLECTION

Participants were asked to send observations of odor perceived during their day-to-day activities. Observations were submitted by computer to the project website, by wireless handheld device (smart phone or tablet) to the mobile version of the project website or pre-stamped cards. For each observation the participants were asked to indicate the following information:

- Date of the observation;
- Beginning and end time;
- Location of the observation;
- Physical state (healthy or sick);

- Meteorological condition;
- Wind condition;
- Type of odor perceived;
- Intensity of the odor;
- Appreciation of the odor.

Annex D lists all the observations received during the course of this project.

6.3 RESULTS SUMMARY

A total of 161 observations were received between October 2012 and November 2013. Of all observation received, 83% came through the website and 99% were submitted by participants that declared being healthy and thus presenting no congestion that might interfere with smelling. Nine (9) participants provided between 1 and 55 observations during the course of the project.

Figure 6-1 shows the number of odor observations received each month since October 2012. Close to 63% of all observations were received between May and July.

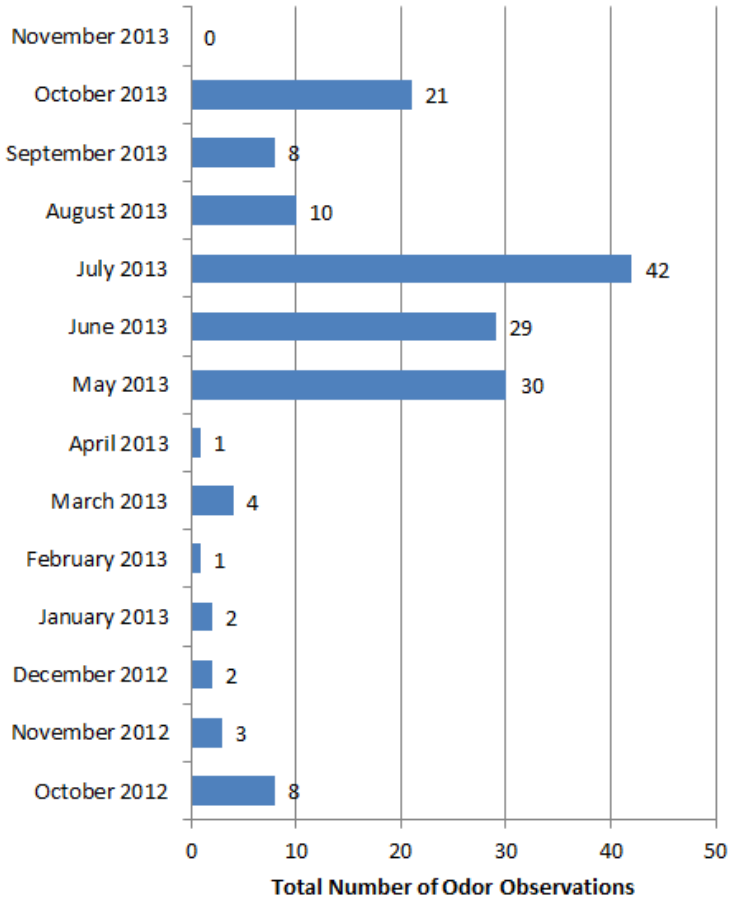

Figure 6-1: Monthly Number of Observation Received

Most of the observations (61%) were reported in the Marysville area and 33% were reported in Everett. Observations were also reported on Smith Island, in Lake Stevens, in Tulalip and on Ebey Island (on Highway 2). Figure 6-2 present the geographical distribution of the odor observations received.

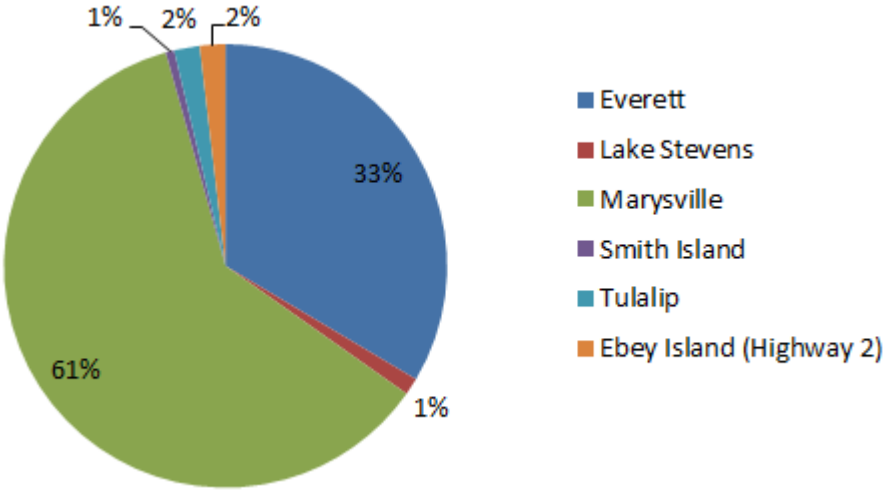

Figure 6-2: Geographical Distribution of Odor Observations

For each observation, the participant could report one or more type of odor perceived. Forty-one (41) observations reported 2 or more types of odor perceived. Figure 6-3 summarizes the type of odor reported. If an observation reported more than one type of odor, each odor reported is counted as one type of odor.

Between October 2012 and November 2013, close to 60% of the odor perceived were attributed to composting and 21% to fresh waste. Other types of odor reported include: asphalt, bark, biogas, finished compost, sewer, solvent, low tide, wood chips and other (dog's pee, perfume, swamp, natural gas, wood burning).

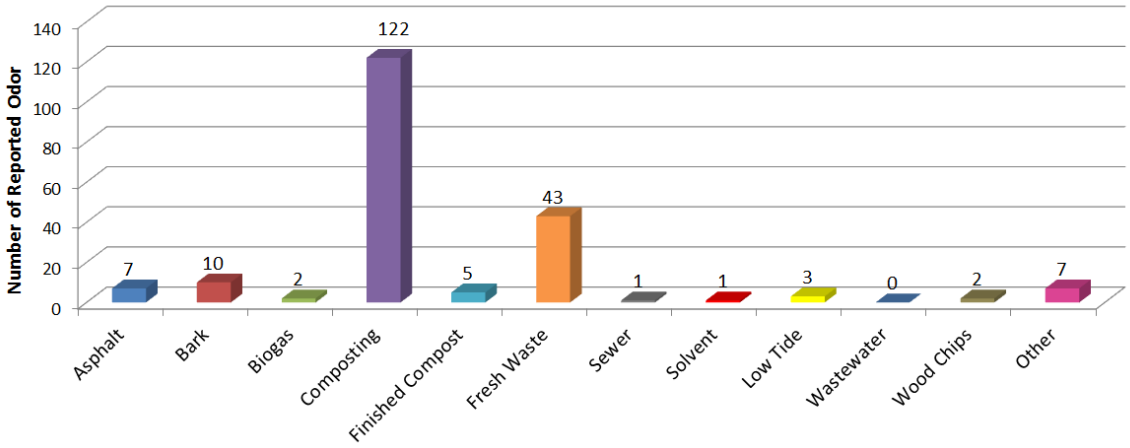

Figure 6-3: Type of Odors Reported

Since odor observations are from volunteers during their day to day activities, observations are more likely to coincide with daytime and evening than nighttime and also reflect the time for which the volunteer remains at the location of the odor perceived. Close to 73% of all observations were between 9AM and 1PM or between 4PM and 10PM. Figure 6-4 shows the numbers of observations per hour of the day. Observations were reported for periods of 0 to 735 minutes (12.25 hours). Only 7 observations out of the 161 received had duration longer than 60 minutes. Close to 88% of all observations reported duration of 30 minutes or less.

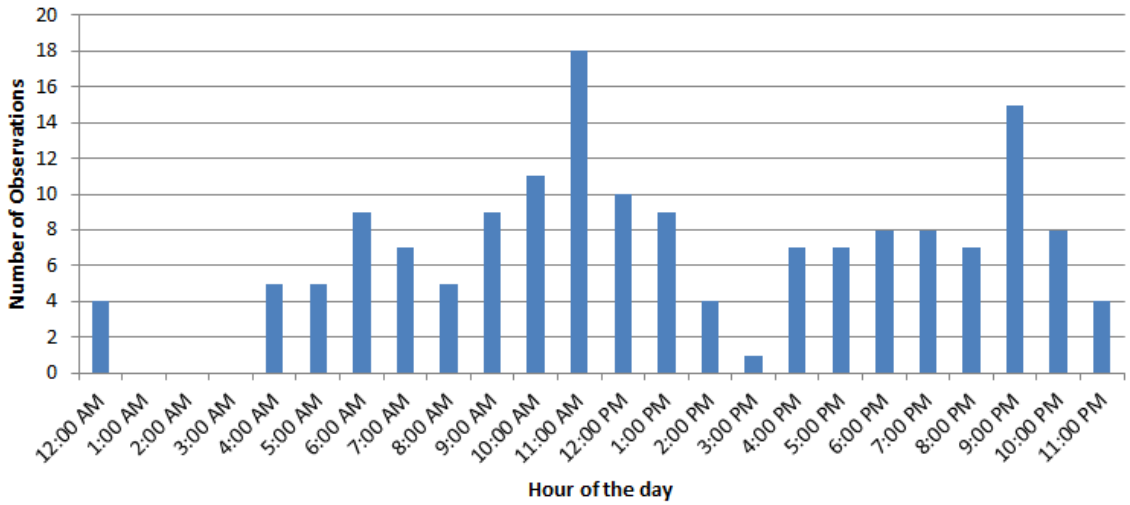

Figure 6-4: Number of Observations per Hour of the Day

Participants were also asked to give the intensity (from very weak to very high) and their appreciation (from very pleasant to very unpleasant) of the odor perceived. Table 6-1 summarizes the intensity reported and the type of odors associated with it. Of all observations, 66% were reported as medium to high intensity. Odor of fresh wastes was associated with intensity ranging from medium to very high. Composting odors were perceived with all levels of intensity from very weak to very high. Bark and low tide were perceived as weak or very weak.

Table 6-1: Odor Intensity Reported

Intensity	Number of Observations	Type of Odors (number of observation)*
Very High	17	Composting (17) and fresh waste (10)
High	46	Composting (42), fresh waste (23), finished compost (1), bark (1)and other (swamp (1) and burning (1))
Medium	61	Asphalt (4), bark (3), biogas (1), composting (45), finished compost (1), fresh waste (10), woodchips (1), sewer (1) and other (perfume (1), natural gas (1), wood burning (1))
Weak	30	Asphalt (3), bark (5), biogas (1), composting (16), finished compost (3), low tide (1) and other (1) (dog's pee)
Very Weak	7	Bark (1), composting (2), low tide (2), solvent (1)

* Observations may report more than one type of odor but only one level of intensity.

Table 6-2 summarizes the appreciation reported and the type of odors associated with it. Of all observations, 88% were reported as unpleasant or very unpleasant. Figure 6-5 represents the appreciation according to each type of odor. Of the composting odors, 69% were reported as unpleasant and 30% were very unpleasant.

Table 6-2: Odor Appreciation Reported

Appreciation	Number of Observations	Type of Odors (number of observation)*
Very Pleasant	0	-
Pleasant	4	Bark (2), low tide (1) and other (perfume (1))
Neutral	15	Asphalt (1), bark (1), composting (1), finished compost (1), woodchips (1), fresh waste (1), solvent (1) and other (wood burning (1))
Unpleasant	102	Asphalt (5), biogas (2), composting (84), fresh waste (27), finished compost (4), low tide (1), sewer (1) and other (burning (1), natural gas (1), dog's pee (1))
Very Unpleasant	40	Asphalt (1), bark (1), composting (37), fresh waste (15) and other (1) (swamp)

* Observations may report more than one type of odor but only one level of appreciation.

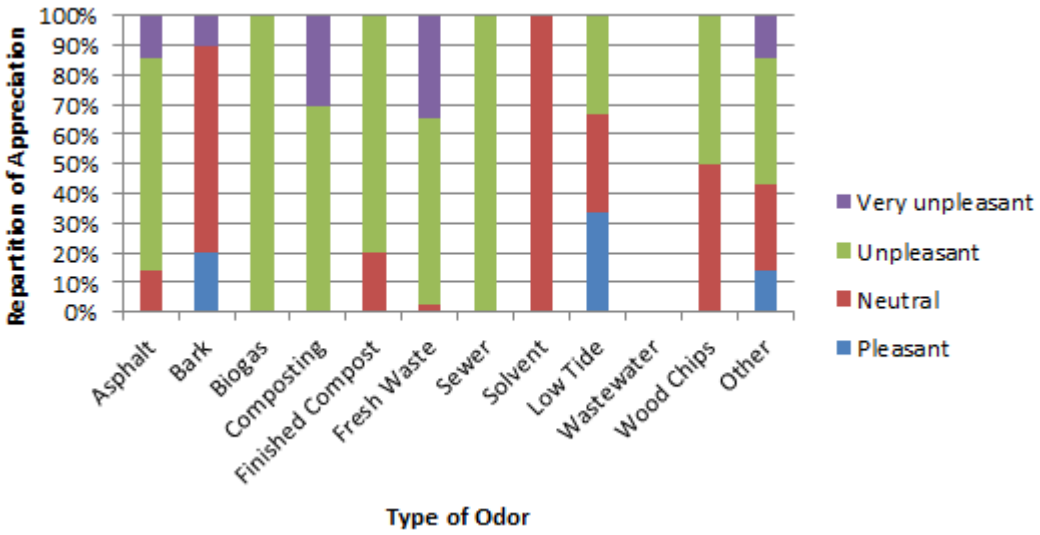

Figure 6-5: Appreciation According to the Type of Odors

The majority of the observations reported calm winds and sunny/clear blue sky conditions. Very few observations were reported when the conditions were windy. Figure 6-6 shows the wind and weather conditions reported by the observer.

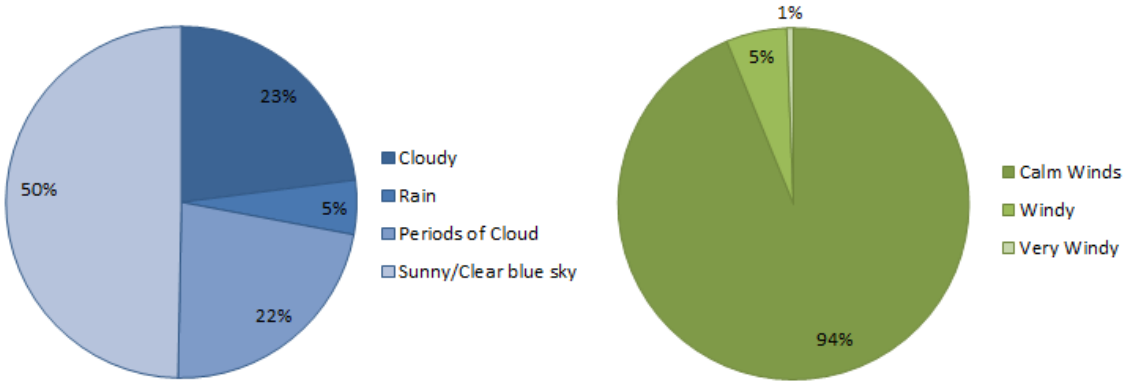

Figure 6-6: Wind and Weather Conditions

For purposes of this study, odor episodes are considered to occur when 3 observations or more are received for the same day. The observation journal (Figure 6-7) shows the number of observation received daily and the odor episodes are shown in red.

Between October 2012 and November 2013, there were sixteen (16) days with three (3) or more observations. Between 3 and 9 observations per day for a total of 70 observations were received during those 16 days. Table 6-3 lists the dates of the odor episodes and the number of observation received as well as the type of odor reported. All odor episodes reported odor of composting except the odor episode of October 16th,

2012 when odors were described as swamp, sewer and low tide. Odors of fresh wastes, finished compost, bark, biogas and asphalt were also reported during odor episodes. The intensity reported varied from very weak to very high and the appreciation reported were from neutral to very unpleasant with the majority being reported as unpleasant (63%).

Table 6-3: Odor Episodes

Date	Number of Observations	Location of the Observations	Type of Odors Reported
October 16th, 2012	3	Marysville	Sewer, swamp and low tide
May 10th, 2013	9	Marysville and Everett	Composting
May 11th, 2013	3	Marysville and Everett	Composting
June 14th, 2013	5	Marysville, Everett and Tulalip	Biogas, composting, fresh waste
June 16th, 2013	3	Marysville	Composting
June 28th, 2013	4	Marysville	Composting
July 1st, 2013	5	Marysville and Everett	Composting, fresh waste and finished compost
July 6th, 2013	3	Everett	Composting, fresh waste
July 9th, 2013	3	Everett	Composting, fresh waste and finished compost
July 16th, 2013	6	Marysville	Composting, fresh waste
July 24th, 2013	5	Marysville and Everett	Composting, fresh waste, bark
July 30th, 2013	3	Marysville	Composting
August 10th, 2013	3	Marysville	Asphalt, composting
September 11th, 2013	3	Marysville	Asphalt, composting, finished compost
October 5th, 2013	5	Marysville	Asphalt, composting
October 18th, 2013	7	Marysville and Everett	Composting, fresh waste

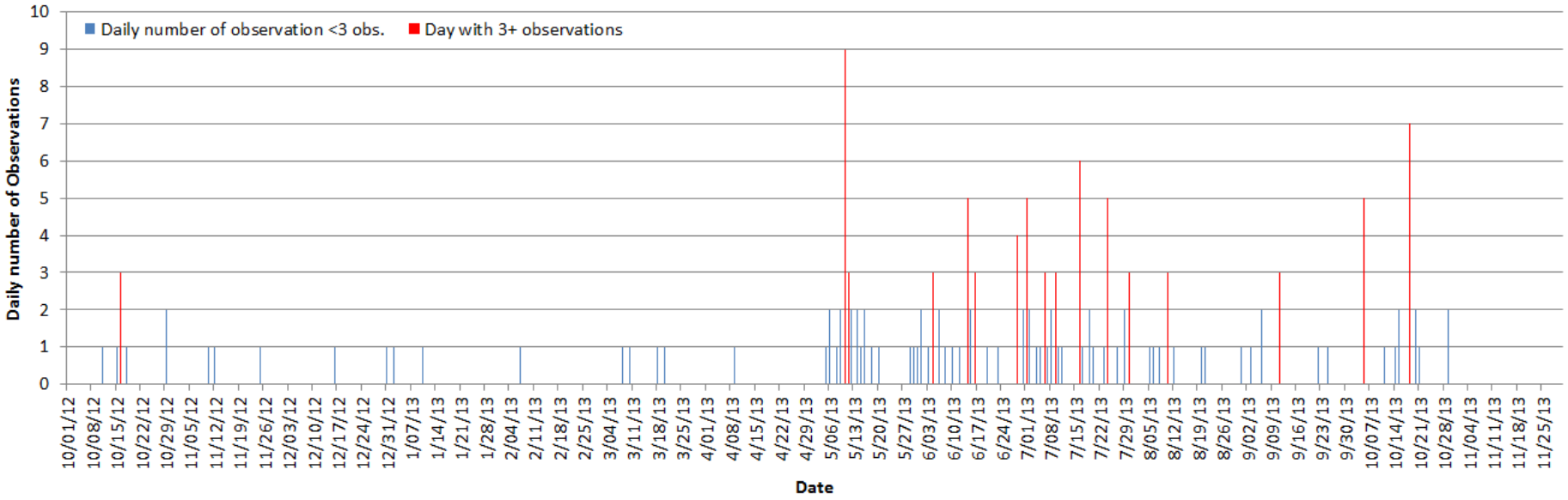

Figure 6-7: Observation Journal – October 2012 to November 2013

6.4 CORRELATION WITH OTHER DATA

The meteorological data and the plumes are available starting March 26, 2013. For each odor observation, the data from the closest weather station for the same period (few minutes earlier and after) and the plumes from the OdoWatch system were analyzed. There were 141 observations received from March 26 to November 30, 2013.

Table 6-4 summarizes the analysis and details can be found in Annex D. For 36% of the observation for which the OdoWatch data are available, the plume prediction correlates with the odor observation received in terms of direction, location and time frame. The plume predictions were indicating odor concentrations mostly below 5 OU/m^3 but did reached between 5 and 10 OU/m^3 for two of those observations reported in September (09/03/2013) and in October 2013 (10/29/2013) in Northeast Everett. The odor character or type of odor was not correlated with the plume since the plume from the OdoWatch provides an odor concentration in terms of OU/m^3 and do not indicate the character of the odor in that plume. Several sources of odors may contribute to a plume in the model and it makes it judgmental to interpret the plume in terms of odor character.

For 24% of the observations, the plume predicted is not exactly contemporaneous with the observation (transient), but may have reached or passed by the location a few moments before the time frame reported. For 14% of the observation, the wind direction reported at either weather stations do not indicated that the odor reported with respect to the location of the observation was coming from one the facility followed during the course of this project.

The remaining 26% of the observations are consistent in terms of wind direction and location, but the plumes predicted by the OdoWatch do not extend far beyond the facilities.

For 82% of the observations reported in Everett and 36% of the observations reported in Marysville, the OdoWatch predicted a plume reaching that location either during the same timeframe or a transient plume (not exactly at the location at the same time). For Marysville, of the observations reported, 33% correlates with the wind direction at the time of the observation, but the OdoWatch predicted no plumes or plumes that did not extend far beyond the facilities.

Table 6-4: Summary of the Correlation between Observation and Plumes Predicted

OdoWatch Plume	Description	Number of Odor Observations	Proportion of Data Available
No data	No data available or before March 26th 2013	21	-
No	There is a plume predicted but not in the vicinity of where the observation was reported.	20	14%
Limited plume	The OdoWatch system predicted a very small plume close to the sources or no plume. The wind direction is consistent with the location of the observation.	37	26%
Transient	A plume was predicted by the OdoWatch that could have reached in the vicinity of the location but not exactly at this time period or not exactly on the location reported.	33	24%
Yes	A plume was predicted when the odor was reported and was reaching the location of the observation	50	36%

Data collection from the ambient eNoses (OdoCheck) started mid-July. For each odor observation, the data from the closest OdoCheck for the same period (few minutes earlier and after) were analyzed. There were 61 observations received after July 15, 2013. For 4 of these observations, no data were available from the OdoCheck.

For the remaining 57 odor observations provided by the committee, none coincide with the odor events recorded at either of the two OdoCheck systems closest to an observer (OdoCheck – see Table 5-2). However, for a few of those observations, higher than the average odor concentrations were recorded by the OdoCheck.

Table 6-5 summarizes the data for those seven (7) observations and the concentration recorded at the OdoCheck. For the other observations, the readings from the OdoCheck were close to their average reading (between 7 and 12 OU/m^3). Table 6-5 also indicates what the OdoWatch predicted during the same period.

Table 6-5: Odor Observations and OdoCheck Measurements

Date and Time of the Observation	Location of the Observations	Type of Odors Reported	Intensity	Odor Concentration in OU/m^3 from the Closest OdoCheck (1)	Wind Condition (Marysville Weather Station)	Wind Condition (Cedar Grove Weather Station)	OdoWatch
08/12/2013, 6:29 to 6:46 AM	Everett	Composting, fresh waste	High	15 (NE Everett)	0.2 to 1.4 m/s, N-NNW	Calm wind, N	Plume – 1 to 3 OU/m^3
09/03/2013, 5:28 to 5:43 AM	Everett	Composting, fresh waste	High	32 (NE Everett)	Calm wind, NNE	Calm wind, N	Plume – 5 to 10 OU/m^3
09/11/2013, 11:35 to 11:36 AM	Marysville	Composting	Weak	14 (SE Marysville)	Calm wind, SE	Calm wind, S	Limited plume
10/05/2013, 9:31 to 9:40 AM	Marysville	Composting	High	15 (Marysville) / 19 (SE Marysville)	Calm wind, SSE to WSW	Calm wind, ESE	Plume – 1 to 5 OU/m^3
10/14/2013, 1:49 to 1:50 PM	Marysville	Composting	Weak	17 (SE Marysville)	0.9 to 1.1 m/s, SSE-S	0.6 to 2.0 m/s, S	Limited plume
10/29/2013, 4:35 to 4:36 PM	Marysville	Composting	Medium	16 (Marysville)	1.6 m/s, S	Calm wind, S	Transient plume
10/29/2013, 4:55 to 4:56 PM	Marysville	Composting	Medium	17 (Marysville) / 13 (SE Marysville)	1.1 to 2.2 m/s, 1.2 SSW-S	Calm wind, S	Plume – 3 to 5 OU/m^3

(1) NE Everett = Northeast Everett OdoCheck; Maryville = Marysville OdoCheck; SE Marysville = Southeast Maryville OdoCheck

7 CONCLUSIONS

The PSCAA retained Odotech to design, install and operate an integrated community odor monitoring program in the Everett/Marysville area. The OdoWatch® system provided the platform for managing the information that would be needed to complete the regional assessment. The OdoWatch® system is designed to monitor odors from multiple sources within a facility, coupled with meteorological data to predict the potential odor impacts on the surrounding community. To apply this system across multiple facilities using two meteorological stations that can be linked to ambient air eNoses and community odor observations was a technical challenge.

The regional odor monitoring project for the Everett / Marysville area was an ambitious undertaking. Such a study is difficult enough if conducted for a criteria pollutant, such as sulfur dioxide or nitrogen dioxide, where the emissions from contributing sources can be easily quantified, impacts can be readily measured and objective standards for compliance are defined. Odors are not a standard air pollutant, it has multiple facets.

Odor is expressed as a concentration using the units OU/m^3 which is defined as the volume of odorous air at its odor threshold divided by the initial sample volume. However, we experience odor as an intensity defined by ranking it on a multi-point scale from weak to very strong. The relationship between odor concentrations and odor intensity is defined by a power law (Stevens Law). Odors have distinct characteristics which make them recognizable. These characteristics can be considered as pleasant or unpleasant, depending on the observer.

Dynamic dilution olfactometry is the method by which odor samples are evaluated. There are standard procedures to follow in carrying out this method. St. Croix Sensory is an odor laboratory that specializes in odor assessment using dynamic olfactometry.

Regional Odor Monitoring System

The Regional Odor Monitoring System part of the project achieved the following objectives:

- A comprehensive inventory was created consisting of 64 potential odor sources located at 15 municipal and industrial facilities including natural odors from the sea shore tidal zone.

- Odor emissions for each of the sources in the inventory were characterized continuously using an eNose or defined using a fixed emission rate. Dynamic olfactometry was used to quantify odor samples collected from sources in the study area and calibrate the eNoses used to measure odors on continuous basis.

- Meteorological data needed as input to the AERMOD dispersion model were collected at two locations. The Cedar Grove meteorological station was used to predict odor plume profiles from sources located on Smith Island. The meteorological station located in Marysville at the PSCAA air quality monitoring

station was used to predict plume profiles from other odor sources in Marysville and throughout the study area.

- The odor emissions data, meteorological data and predicted plume profiles were collected in six OdoWatch platforms located on a “cloud” based server, a server accessed through the internet. A seventh OdoWatch platform collected the graphical plume profiles and provided a means of visualizing all the plumes in the study area. This seventh OdoWatch platform also collected the data from the three ambient eNoses.

- For those facilities who agreed to install an eNose on their major odor source to track the emissions of odors on a continuous basis, access was given to the OdoWatch platform that was specific to their site. This access allowed that facility to track their emissions and project plume profiles.

- For facilities that allowed the study to collect odor samples from their sources, the facilities gained an understanding of the nature of emission from their sites.

Community Odor Observer Committee

Volunteers from the community were needed to act as odor observers. Members of the odor observer committee were trained in the quantification of odors by their character, intensity and hedonic tone (pleasantness or unpleasantness).

The community odor monitoring committee part of the project achieved the following objectives:

- The observations made by the odor committee members were collected on a website which could be accessed by computer or a hand held device, making the data immediately available for comparison to other information collected as part of the study.
- The members of the odor committee participated in the odor training session and were invited to attend the quarterly meetings where the odor observations collected that quarter were reviewed. This allowed for an exchange of information between the committee members and those coordinating the study.
- The community odor observer website included features that allow for messages (Tweets), posting of information as well as collecting odor observations. This allowed PSCAA to share information with the odor committee members.
- Having committee members quantify the date, time, location, character, intensity, hedonic tone of the observed odors along with the weather conditions at the time of the observation, greatly enhances the quality of the information provided.
- Every odor observation submitted was useful to the study and added to the understanding of odors in the region.
- A total of 161 observations were received between October 2012 and November 2013. Close to 63 percent of them were received between May and July 2013.

Approximately 60 percent of the odors perceived were attributed to composting and 21 percent to fresh waste.

- Most observations were between 9AM and 1PM or between 4PM and 10PM and reported duration of 30 minutes or less.
- Observations reported odors as unpleasant or very unpleasant in 88 percent. Of the composting odors, 69 percent were reported as unpleasant and 30 percent were very unpleasant.

Ambient Air eNoses

The ambient eNoses were installed to complement the odor observations provided by the committee members. Although not part of the original study plan, the placement of eNoses in residential locations seemed like a reasonable use of eNoses that were not installed at a potential odor emission source. The three locations were:

- At the air quality monitoring site at the Totem Middle School in Marysville.
- In a private backyard near Sunnyside Boulevard in Southeast Marysville.
- In a private backyard near Skyline Drive in Northeast Everett.

No direct correlation could be drawn from the ambient air eNose responses and the odor observations provided by the committee members. The peak response from the ambient eNoses did not correspond to any reported odor observations, but odor observations that were reported had above average responses from the ambient air eNoses. Ambient eNoses may respond to any odor (it is not possible to interpret the response as an offensive odor intensity). Further, the peak and average responses of the ambient air eNoses, when sorted by wind direction sector did not show any orientation toward odor sources identified in the study.

Regional Consequences

The regional consequences are those that impact the residential and suburban areas of Everett, Marysville, Tulalip and Lake Stevens. One of the over-arching observations about the regional odor monitoring system is the influence of the local meteorology. There is a high percentage of calm conditions, wind speeds less than 1 meter/second (2.2 miles per hour). For the meteorological data collected at the Cedar Grove and Marysville stations, the calm hours occur 63.7 and 54.5 percent, respectively. Of all the observations, 94 percent occurred when the odor observers reported the associated wind speed as calm. Having a high percentage of calm conditions means that wind directions are likely to be quite variable, moving through several wind sectors in a short period of time. Wind speeds and directions are also likely to vary greatly from one location to another, since there is no overall wind field to drive local conditions.

Further, calm conditions prevent the dispersion of odors. Instead of mixing with the ambient air, odors accumulate in the Snohomish River valley and drift into the neighborhoods with little mixing. This leads to observed odor impacts in the early morning or evening when winds speeds are light.

Odors were also observed during the day. The time period with the greatest number of odor observations was 11:00 AM. So, other factors, both operational and meteorological, contribute to off-site odor impacts, not just the breakup of night time stable layers. Odor observers were encouraged to report odors during their normal activities. That odor observers may be out of their home and moving throughout the community may also be a factor for the increased number of odor reports during this time period.

Predicting odor impacts using a dispersion model like AERMOD is also difficult when wind speeds are calm. Most dispersion models assume that the odor plume is moving downwind at a steady speed. This may not be true when wind speeds are light and wind directions are variable.

Having two meteorological stations was helpful in defining some of the variations in wind speed and direction in the study area. Still these two stations could not characterize all the local conditions that would have existed from Marysville and Northeast Everett to Lake Stevens. In a typical OdoWatch system, one meteorological station would be provided for each site.

Observations made by the odor observer committee are confirmed by the location of odor observations with respect to the locations of the plumes predictions from the regional odor monitoring system, and types of odor characteristic reported.

- 36 percent of the observations occurred when an odor plume was at the location of the odor observation.

- 24 percent of the odor observations occurred when an odor plume was predicted in the area of the observation and could have transited the location under light variable wind conditions.

- 26 percent of the time, the predicted plume was in the direction of the odor observation, but did not extend to the location that the observation was made.

- For 82 percent of the observations reported in Everett and 36 percent of the observations reported in Marysville, the OdoWatch predicted a plume reaching that location either during the same timeframe or a transient plume.

Despite the limitations of making dispersion modeling predictions under calm conditions, the confirmation of odor observations with modeling results suggests that both the plume modeling and the odor observations are credible. Even with the limitations associated with modeling calm conditions, dispersion modeling remains the best approach to characterize the relationship between odor emission source and ambient odor impact. It defines the magnitude of the impact and frequency of exceedance, two key characteristics of odor.

The results from the plume modeling show that three facilities have predicted odor impacts that are sufficiently great to be worth attention for their potential impacts in residential and suburban areas - the Cedar Grove compost facility, Everett wastewater treatment plant, and Marysville wastewater treatment plant. These three facilities have modeled maximum odor impacts that would be recognizable in the surrounding

residential areas. The frequencies at which the modeled impacts from these three facilities exceed the arbitrary thresholds of 2 and 5 OU/m^3 are:

- Frequency of impacts greater than 2 OU/m^3,
  - Cedar Grove compost facility – 8.0% at northeast Everett
  - Everett wastewater treatment plant – 6.6% at southeast Everett
  - Marysville wastewater treatment plant – 3.3% at Marysville air quality station
- Frequency of impacts greater than 5 OU/m^3,
  - Cedar Grove compost facility – 0.76% at northeast Everett
  - Everett wastewater treatment plant – 4.3% at southeast Everett
  - Marysville wastewater treatment plant – 0.93% at Marysville air quality station

Sources other than those identified above did have odor plume profiles that extended beyond the plant property boundary. These impacts may be noticeable along roadways or public areas, but the impact in residential areas is limited to less than 1 OU/m^3.

ANNEX A – PSCAA NUISANCE REGULATION

SECTION 9.11 EMISSION OF AIR CONTAMINANT: DETRIMENT TO PERSON OR PROPERTY Adopted 03/13/68 (12)

Revised 06/09/83 (536), 03/11/99 (882)

(a) It shall be unlawful for any person to cause or allow the emission of any air contaminant in sufficient quantities and of such characteristics and duration as is, or is likely to be, injurious to human health, plant or animal life, or property, or which unreasonably interferes with enjoyment of life and property.

(b) With respect to odor, the Agency may take enforcement action under this section if the Control Officer or a duly authorized representative has documented all of the following:

(1) The detection by the Control Officer or a duly authorized representative of an odor at a level 2 or greater, according to the following odor scale:
level 0 – no odor detected;
level 1 – odor barely detected;
level 2 – odor is distinct and definite, any unpleasant characteristics recognizable;
level 3 – odor is objectionable enough or strong enough to cause attempts at avoidance; and
level 4 – odor is so strong that a person does not want to remain present;

(2) An affidavit from a person making a complaint that demonstrates that they have experienced air contaminant emissions in sufficient quantities and of such characteristics and duration so as to unreasonably interfere with their enjoyment of life and property; and

(3) The source of the odor.

(c) Nothing in this Regulation shall be construed to impair any cause of action or legal remedy of any person, or the public for injury or damages arising from the emission of any air contaminant in such place, manner or concentration as to constitute air pollution or a common law nuisance.

ANNEX B – DISPERSION MODELING

The OdoWatch software uses the AERMOD dispersion model to characterize the dispersion of odors from the point of release to the impact at downwind receptors. AERMOD is a steady-state plume dispersion model. It accepts multiple emissions sources and types including point, area and volume sources. AERMOD simulates the transport and dispersion of pollutants in urban or rural environments and in simple or complex terrain. AERMOD is based on an up-to-date characterization of the atmospheric boundary layer.

- AERMOD is recommended by the U.S. EPA for use in demonstrating compliance with ambient air quality standards. (40 CFR 51, Appendix W, 2005).
- AERMOD incorporates the up-to-date characterizations of the atmospheric boundary layer, building cavity and wake effects, and elevated terrain algorithms. (U.S. EPA, 2004)
- AERMOD performance was evaluated against regulatory design concentrations from 28 field studies (U.S. EPA, 2003)

AERMOD is widely used for assessing potential impact from odor sources. Because of the short travel time from the point of release to the point of maximum impact, odor impacts are well represented by AERMOD model. AERMOD is limited when the plume dispersion conditions are not homogeneous. This can occur when wind speeds are light (less than 0.7 m/s or 1.5 mph) and wind directions are variable. Spatially varying wind fields can be caused by large water bodies (oceans or lakes) or complex terrain features.

AERMOD assumes meteorological conditions remain steady-state for each iteration of the model. When a new meteorological observation is input, the prediction for the previous period is ignored and the model estimates impacts for the current period. This makes the modeled plume appear to “jump” from one wind direction to another when meteorological conditions change from one observation to the next. This plume movement does not affect the results, but does lack continuity when a series of model prediction are viewed sequentially.

The AERMOD model uses the regulatory default options as recommended in the EPA Guideline on Air Quality Models as listed below:

- Use stack-tip downwash
- Use default wind profile exponents
- Use default vertical potential temperature gradients

Source parameters

The model is capable of handling multiple sources, including point, volume, and area source types. Line sources may also be modeled as a string of volume sources or as elongated area sources. Several source groups may be specified in a single run, with the source contributions combined for each group. The model contains algorithms for

modeling the effects of aerodynamic downwash due to nearby buildings on point source emissions.
Source emission rates vary for each iteration of the model if the emissions are monitored with an eNose. If a door detector is used to monitor the operation of a source, then the emissions will vary depending on the status of the door detector. If an operational activity is periodic (daytime work hours), this can also be accounted for in the modeling. All other sources are called fixed emission sources with a constant emission rate.

Receptor array

The AERMOD model has considerable flexibility in the specification of receptor locations. The base modeling receptor grid within OdoWatch consists of an evenly spaced Cartesian array that covers the study area. These receptors are used to define the plume profile, as shown in the OdoWatch interface.

Discrete receptors can be placed anywhere in the modeling domain by the user to represent locations of special interest, such as a school, hospital, residential area. These special receptors are called Alert Points and used in OdoWatch to alert operators when the odor impacts are above limits set by the user.

Meteorological Data

The AERMOD model utilizes a file of surface boundary layer parameters and a file of profile variables including wind speed, wind direction, and turbulence parameters. These two types of meteorological inputs are generated by the meteorological preprocessor. For the OdoWatch system the meteorological input data is input with each time step instead of an annual data file.

Output Options

The output for the AERMOD model is stored as graphic files of plume profiles and digital data for the discrete alert points.

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40 CFR 51, Appendix W (2005) Code of Federal Regulations, Title 40 Part 51 Appendix W, "Guideline on Air Quality Models". Federal Register, Volume 70, No. 216, pgs 68218 – 68261, November 9, 2005

U.S. EPA (2004), AERMOD: Description of Model Formulation, Office of Air Quality Planning and Standards, EPA-454/R-03-004, Research Triangle Park, NC, September 2004

U.S. EPA (2003), Comparison of Regulatory Design Concentrations, Office of Air Quality Planning and Standards, EPA-454/R-03-002, Research Triangle Park, NC, June 2003

ANNEX C – LIST OF DELIVERABLES

Deliverable	Title / Description	
A	Audit Report	
B	Meteorology Technical Note	
C	Site Agreements	
D	Source Monitoring Agreements	
E	Coordination Summary	
F	Agenda for Planning Meetings	
G	Community Odor Committee Work Plan	
H	Community Odor Committee Membership Recommendations	
I	Odor Observation Cards	
J	Community Odor Observer Website	
K	Agenda for Planning and Quarterly Meetings	
L	Integrated Odor Monitoring System	
M	Equipment Inspection Materials	
N	Source Characterization Report	
O	Regional Odor Monitoring System Technical Note	
P	Hardware Commissioning Form	
Q	Modeling Recommendation Report	
S	Quarterly Reports	
T	Annual Report	
U	Agenda and minutes of meetings and training	

ANNEX D – ODOR OBSERVATIONS

No.	USER	LAT	LON	DATE	TIME FROM	TIME TO	Q1. Current Physical State	Q2. Weather Condition	Q3. Wind Condition	Q4. Type of Odor Perceived	Q5. Intensity of Odor Perceived	Q6. Odor Appreciation	SOURCE	COMMENTS	- = no data available Wind Direction	Wind Speed (m/s)	Plume	M = Marysville SE_M = Southeast Marysville E = Everett OdoCheck (maximum OU/m3)
1	M7	48.036	-122.152	10/11/12	8:45 AM	9:00 PM	Healthy	Cloudy	Calm Winds	Fresh Waste	Medium	Neutral	Website	Odor appreciation little above "Neutral".	-	-	-	-
2	M4	48.028	-122.145	10/15/12	10:00 AM	10:01 AM	Healthy	Cloudy	Calm Winds	Solvent	Very Weak	Neutral	Card		-	-	-	-
3	M4	47.978	-122.157	10/16/12	12:19 AM	12:20 AM	Healthy	Rain	Windy	Sewer	Medium	Unpleasant	Card	1/2 midway of Hwy 2 Tressel Traveling East (address not found). Home address used: 6404 35th St. NE Marysville WA.	-	-	-	-
4	M4	48.008	-122.131	10/16/12	12:23 AM	12:24 AM	Healthy	Rain	Calm Winds	Other: Swamp.	High	Very Unpleasant	Card	Sunnyside Road by 'Buffalo Farm'.Strong smell of 'skunk'.	-	-	-	-
5	M4	47.989	-122.134	10/16/12	12:21 AM	12:22 AM	Healthy	Rain	Calm Winds	Low Tide	Weak	Neutral	Card	Across from Carleton Farms on Sunnyside.	-	-	-	-
6	M6	48.060	-122.148	10/18/12	5:45 AM	5:46 AM	Healthy	Periods of Cloud	Calm Winds	Bark	Medium	Pleasant	Card	In Q2 (meteorological conditions) the answer is 'periods of cloud'.'No new bark in this area'.	-	-	-	-
7	M4	48.028	-122.145	10/29/12	9:05 PM	9:06 PM	Healthy	Cloudy	Windy	Composting,Wood Chips,	Medium	Unpleasant	Card		-	-	-	-
8	M5	48.028	-122.145	10/29/12	9:05 PM	9:06 PM	Healthy	Cloudy	Windy	Composting	Medium	Unpleasant	Card		-	-	-	-
9	M4	48.028	-122.145	11/10/12	6:05 AM	6:06 AM	Healthy	Cloudy	Calm Winds	Other: Natural gas	Medium	Unpleasant	Card	Foogy. Cold air.	-	-	-	-
10	M4	48.028	-122.145	11/12/12	1:28 PM	1:29 PM	Healthy	Cloudy	Calm Winds	Other: Dog pee.	Weak	Unpleasant	Card	Odor of what smelt like was dog pee in air.	-	-	-	-
11	M2	48.054	-122.151	11/25/12	2:00 PM	2:01 PM	Healthy	Periods of Cloud	Calm Winds	Composting	Medium	Unpleasant	Card	In Q2 (meteorological conditions)the answer is 'periods of cloud'.	-	-	-	-
12	M4	48.028	-122.145	12/16/12	9:00 AM	9:01 AM	Healthy	Rain	Very Windy	Other: None.	Very Weak	Neutral	Card	Commenting due to wet weather. Could not smell anything on the wind.	-	-	-	-
13	T1	48.099	-122.261	12/31/12	10:00 AM	12:00 PM	Healthy	Cloudy	Calm Winds	Tide	Very Weak	Pleasant	Website		-	-	-	-
14	M2	48.054	-122.151	1/02/13	4:10 PM	4:11 PM	Healthy	Sunny/Clear Blue Sky	Calm Winds	Composting	Medium	Unpleasant	Card	Nice way to start the year. The stink from compost from Seattle.	-	-	-	-
15	M4	48.028	-122.145	1/10/13	1:30 PM	1:31 PM	Healthy	Rain	Calm Winds	Other: Fire wood burning	Medium	Neutral	Card	Need more rpt cards.	-	-	-	-
16	E4	48.012	-122.194	2/07/13	8:27 PM	8:38 PM	Healthy	Periods of Cloud	Calm Winds	Composting,Fresh Waste,	High	Unpleasant	Website	This is the first successful use of the form. Thank you.	-	-	-	-
17	M4	47.978	-122.157	3/08/13	12:19 AM	12:20 AM	Healthy	Cloudy	Calm Winds	Fresh Waste	High	Unpleasant	Card	Address of observation: HW2 TresselComments: Traveling in vehicle and could smell it inside.	-	-	-	-
18	M4	47.978	-122.157	3/10/13	11:57 PM	11:58 PM	Healthy	Cloudy	Calm Winds	Fresh Waste	High	Unpleasant	Card	Observation by letter.Address of observation: mid span hwy to Tressel.Comments: odor along Tressel. Could smell odor intense in van.	-	-	-	-
19	E4	48.012	-122.194	3/18/13	8:22 PM	8:30 PM	Healthy	Periods of Cloud	Calm Winds	Composting,Other: fresh c	Medium	Unpleasant	Website	This is a retry for purposes of reporting. Initially this site was not working. The odor is medium to mild unpleasant fresh composting/compost smell.	-	-	-	-
20	M4	47.968	-122.197	3/20/13	5:30 PM	5:30 PM	Healthy	Rain	Calm Winds	Perfuming odor in air	Medium	Pleasant	Website	I was under 41st St. bridge and smelled an odor resembling perfume in the air	-	-	-	-
21	E3	47.996	-122.211	4/09/13	11:55 AM	11:56 AM	Healthy	Cloudy	Calm Winds	Composting	Medium	Neutral	email	Observation received by e-mail on April 9th. 2013.No comments on 'current physical state' (healthy was chosen). 'intensity' (medium was chosen) and 'appreciation' (neutral was chosen)of odor perceived.	SE-ESE	2-3.1	No	-
22	M3	48.053	-122.163	5/05/13	8:55 PM	8:56 PM	Healthy	Sunny/Clear Blue Sky	Calm Winds	Composting	Very High	Very Unpleasant	Card	Very high intensity first 5-10 min and then diminished over time (45 min)when went to bed. so may have been longer.	SSW-S	0.4-1.1	Yes	-
23	E4	48.012	-122.194	5/06/13	9:10 AM	9:12 AM	Healthy	Sunny/Clear Blue Sky	Calm Winds	Composting	Medium	Unpleasant	Website	I can't stay to monitor how long or how intense the odor will become as I have to leave for work.	-	-	Transient	-
24	M3	48.053	-122.163	5/06/13	8:55 PM	9:40 PM	Healthy	Sunny/Clear Blue Sky	Calm Winds	Composting	Medium	Unpleasant	Card	Same time as night before. Weaker intensity. Lasted 45 min. or more. diminished over time.	E-ESE-SE-SSE	0-0.9	Yes	-
25	M3	48.056	-122.149	5/08/13	12:30 PM	12:35 PM	Healthy	Sunny/Clear Blue Sky	Calm Winds	Composting	Weak	Unpleasant	Website	THIS OBSERVATION WAS MADE ON 5/8/2013.Was away from location for 1.5 hours so may have caught the "tail end" of a longer more noxious event.	SSW-S-SW	1.8-2.8	No	-
26	E3	47.999	-122.191	5/09/13	6:00 AM	6:05 AM	Healthy	Cloudy	Calm Winds	Composting	Medium	Very Unpleasant	Website		NW-NNW	0-1.6	Yes	-
27	E4	48.012	-122.194	5/09/13	9:00 AM	9:03 AM	Healthy	Cloudy	Calm Winds	Composting	Weak	Unpleasant	Website	Again cannot stay to evaluate further.	NW-WNW	0-0.7	Yes	-
28	E3	47.996	-122.212	5/10/13	6:28 AM	6:59 AM	Healthy	Sunny/Clear Blue Sky	Calm Winds	Composting	High	Very Unpleasant	Website	the cedar grove stench is back	WNW-NW-NNW-N-NNE	0-1.3	Yes	-
29	M3	48.053	-122.163	5/10/13	11:24 AM	11:25 AM	Healthy	Sunny/Clear Blue Sky	Calm Winds	Composting	Medium	Unpleasant	Website	Info from the comments in observation made on 05/10/2013 at 9:31 AM	SSE-S	2.2-2.9	Transient - very small plume	-
30	M3	48.053	-122.163	5/10/13	10:48 AM	10:49 AM	Healthy	Sunny/Clear Blue Sky	Calm Winds	Composting	High	Unpleasant	Website	Info from comments in observation made on 05/10/2013 at 9:31 AM	S	2.1-2.7	Transient - very small plume	-
31	M3	48.053	-122.163	5/10/13	1:25 PM	1:26 PM	Healthy	Sunny/Clear Blue Sky	Calm Winds	Composting	High	Unpleasant	Website	Info from the comments in observation made on 05/10/2013 at 9:31 AM - Medium/high considered as high	SSW-S-SSE	2.0-3.0	Transient - very small plume	-
32	M3	48.053	-122.163	5/10/13	4:00 PM	4:30 PM	Healthy	Sunny/Clear Blue Sky	Calm Winds	Composting	High	Unpleasant	Website	Info from the comments in observation made on 05/10/2013 at 9:31 AM - Medium/bad considered as High	S-SSE	2.2-3.1	Transient - very small plume	-
33	M3	48.053	-122.163	5/10/13	12:50 PM	12:51 PM	Healthy	Sunny/Clear Blue Sky	Calm Winds	Composting	Very Weak	Unpleasant	Website	Info from the comments in observation made on 05/10/2013 at 9:31 AM	SE-SSE	1.3-1.8	Transient - very small plume	-
34	M3	48.053	-122.163	5/10/13	11:54 AM	11:55 AM	Healthy	Sunny/Clear Blue Sky	Calm Winds	Composting	Very Weak	Unpleasant	Website	Info from the comments in observation made on 05/10/2013 at 9:31 AM	S-SSE	3.1-4.2	Transient - very small plume	-
35	M3	48.053	-122.163	5/10/13	11:47 AM	11:48 AM	Healthy	Sunny/Clear Blue Sky	Calm Winds	Composting	High	Unpleasant	Website	Info from the comments in observation made on 05/10/2013 at 9:31 AM	S-SSE	3.1-4.2	Transient - very small plume	-
36	M3	48.053	-122.163	5/10/13	10:05 AM	10:06 AM	Healthy	Sunny/Clear Blue Sky	Calm Winds	Composting	Weak	Unpleasant	Website	Info from the comments in observation made on 05/10/2013 at 9:31AM	SE-S-SSE	1.0-1.1	Transient - very small plume	-
37	E3	48.038	-122.246	5/11/13	9:03 PM	9:17 PM	Healthy	Periods of Cloud	Calm Winds	Composting	Very High	Very Unpleasant	Website		SSW-SW-WSW-S	0-1.0	No	-
38	E3	47.996	-122.211	5/11/13	7:01 AM	8:04 AM	Healthy	Cloudy	Calm Winds	Composting	Medium	Very Unpleasant	Website	EXACTLY the smell that is present when you drive past Cedar Grove on the flats	NNE-N-NNW-NW-WNW-W-SW-WSW	0-1.1	Yes	-
39	M3	48.056	-122.149	5/11/13	5:20 PM	5:25 PM	Healthy	Sunny/Clear Blue Sky	Calm Winds	Composting	Medium	Unpleasant	Website	OBSERVATION MADE ON 5/11/13 (I DON'T HAVE A COMPUTER AT HOME).	S-SSW	2.1-3	Yes	-
40	E3	48.027	-122.184	5/12/13	9:51 PM	10:00 PM	Healthy	Cloudy	Calm Winds	Bark,Composting,	High	Very Unpleasant	Website	Cedar Grove Compost smell disgusting. Bark smell not nearly as unpleasant.	WSW-SW-SE-E	0.3-0.9	No	-
41	M6	48.060	-122.148	5/12/13	9:47 PM	9:48 PM	Healthy	Periods of Cloud	Calm Winds	Composting	Medium	Unpleasant	Website	Card	WSW-SW	0.4-1	Yes	-

No.	USER	LAT	LON	DATE	TIME FROM	TIME TO	Q1. Current Physical State	Q2. Weather Condition	Q3. Wind Condition	Q4. Type of Odor Perceived	Q5. Intensity of Odor Perceived	Q6. Odor Appreciation	SOURCE	COMMENTS	Wind Direction	Wind Speed (m/s)	Plume	OdoCheck (maximum OU/m3)
42	E4	48.012	-122.194	5/14/13	9:07 PM	9:10 PM	Healthy	Periods of Cloud	Calm Winds	Composting,Fresh Waste,	Very High	Very Unpleasant	Card	odor permeating. stinging eyes	NW-NNW	0-0.4	Transient	-
43	M4	48.028	-122.145	5/14/13	7:14 PM	7:15 PM	Healthy	Sunny/Clear Blue Sky	Calm Winds	Asphalt	Medium	Very Unpleasant	Website		SW-W	0.4-2	Transient ?	-
44	M3	48.054	-122.142	5/15/13	4:20 PM	4:40 PM	Healthy	Sunny/Clear Blue Sky	Windy	Composting	Weak	Unpleasant	Card	OBSERVATION MADE 5/15/13.	SSW-S	3.6-5.4	No	-
45	M6	48.052	-122.176	5/16/13	12:45 PM	12:46 PM	Healthy	Sunny/Clear Blue Sky	Calm Winds	Composting	Medium	Unpleasant	Website	Card - 4th street & State Ave. Marysville	S-SSW	1.8-3.8	No	-
46	M4	48.028	-122.145	5/16/13	9:15 PM	9:16 PM	Healthy	Periods of Cloud	Calm Winds	Finished Compost,Wood C	Medium	Neutral	Card		W	0.4-1.2	Yes	-
47	M3	48.056	-122.149	5/18/13	2:20 PM	2:30 PM	Healthy	Periods of Cloud	Calm Winds	Composting	Weak	Unpleasant	Card	OBSERVATION MADE ON SATURDAY. MAY 18. 2013.	SW-SSW	2.0-3.1	No	-
48	E3	47.995	-122.222	5/20/13	7:00 AM	7:59 AM	Healthy	Periods of Cloud	Windy	Composting	Medium	Very Unpleasant	Website	Same smell as CEdar Grove on 529	NNW-NW-N-NNE	0-1.3	Yes	-
49	E4	48.012	-122.194	5/29/13	5:54 PM	6:11 PM	Healthy	Rain	Calm Winds	Composting,Fresh Waste,	Medium	Unpleasant	Website	pouring rain and Cedar Grove hangs in the air	ENE-NNE-N	0-0.7	Yes	-
50	M3	48.056	-122.149	5/30/13	5:05 PM	5:30 PM	Healthy	Periods of Cloud	Calm Winds	Composting	Medium	Unpleasant	Website	OBSERVATION MADE 5/30/13. MAY HAVE STARTED BEFORE 5:05 P.M.. BUT THAT IS WHEN I RETURNED HOME FROM WORK. WAS WEAK INTENSITY AT THAT TIME BUT BECAME MEDIUM OVER TIME.	S-SSW	2.2-3.7	Transient - very small plume	-
51	E4	48.012	-122.194	5/31/13	7:48 AM	7:57 AM	Healthy	Cloudy	Calm Winds	Composting,Fresh Waste,	Medium	Unpleasant	Website		ENE-NNE	0-0.6	Transient	-
52	E4	48.012	-122.194	6/01/13	11:00 AM	11:10 AM	Healthy	Sunny/Clear Blue Sky	Calm Winds	Composting,Fresh Waste,	High	Unpleasant	Website	Still stinks from earlier - this is just a continuation and will follow all day with periodic updates	SSW-SW-S	0.9-2.7	No plume	-
53	E4	48.012	-122.194	6/01/13	10:20 AM	10:28 AM	Healthy	Sunny/Clear Blue Sky	Calm Winds	Composting	Medium	Unpleasant	WebSite		SSE	0-1.6	No plume	-
54	E4	48.012	-122.194	6/03/13	7:23 AM	7:32 AM	Healthy	Sunny/Clear Blue Sky	Calm Winds	Composting,Fresh Waste,	Medium	Unpleasant	WebSite		NE	0	Transient	-
55	E4	48.012	-122.194	6/04/13	5:02 AM	5:16 AM	Healthy	Cloudy	Calm Winds	Composting,Fresh Waste,	High	Very Unpleasant	WebSite	Hanging in the morning mist; heavy enough to taste	N	0	Yes	-
56	E4	48.012	-122.194	6/04/13	10:35 PM	10:45 PM	Healthy	Sunny/Clear Blue Sky	Calm Winds	Composting	High	Unpleasant	WebSite		NNW-NNE-N	0-1.3	Transient	-
57	E4	48.012	-122.194	6/04/13	8:26 AM	8:43 AM	Healthy	Sunny/Clear Blue Sky	Calm Winds	Composting	Medium	Unpleasant	WebSite		NE-NNE-N-NNW-NW	0-0.6	Yes	-
58	E4	48.012	-122.194	6/06/13	9:39 PM	9:58 PM	Healthy	Periods of Cloud	Calm Winds	Composting,Fresh Waste,	High	Unpleasant	WebSite	This report is for 6/6/2013 - the date locked in for the report cannot be changed and is indicating that this is for 6/7/2013. Someone please fix this.	NW-WNW-N	0.4-2.9	Yes	-
59	E4	48.012	-122.194	6/06/13	10:00 PM	10:22 PM	Healthy	Periods of Cloud	Calm Winds	Composting,Other: fresg c	High	Unpleasant	WebSite	this is the need to close the windows; try not to breathe in the odor because you will taste it	NW-N-NNE-NNW	0-1.3	Yes	-
60	E4	48.012	-122.194	6/08/13	4:56 AM	5:15 AM	Healthy	Periods of Cloud	Calm Winds	Composting,Other: fresh c	Very High	Very Unpleasant	WebSite	Early morning odor is hanging in the mist and dew - I wish there was a place for no wind and no clouds - my reports are usually late at night or early in the morning	NW-NNW-N	0-0.4	Yes	-
61	M3	48.056	-122.149	6/10/13	10:15 AM	11:50 AM	Healthy	Sunny/Clear Blue Sky	Calm Winds	Composting	Medium	Unpleasant	WebSite	OBSERVATION MADE ON 6/10/13. Weak from 10:15 to 10:50. at 10:55 became medium in intensity. from 11:15 to 11:41 nothing. 11:41 to 11:50 medium intensity.	S-SSE-SE	1.2-3.1	No plume	-
62	M3	48.056	-122.149	6/12/13	11:45 AM	12:00 PM	Healthy	Periods of Cloud	Calm Winds	Composting	Medium	Unpleasant	WebSite	OBSERVATION MADE 6/12/13.	S-SSW	2.5-3.1	No plume	-
63	T1	48.099	-122.261	6/14/13	2:30 PM	3:00 PM	Healthy	Periods of Cloud	Calm Winds	Composting	High	Unpleasant	WebSite	This observation was on 6/14. The program seems to not let me choose a date.	S-SSW	2.5-4.9	No	-
64	E4	48.012	-122.194	6/14/13	11:19 PM	11:30 PM	Healthy	Sunny/Clear Blue Sky	Calm Winds	Composting,Fresh Waste,	High	Very Unpleasant	WebSite	This report is 6/14/13 not 6/15 - Please get this fixed. I can't open my windows - thank goodness I decided to install ceiling fans.	N-NNW	0.2-1.3	Yes	-
65	E4	48.012	-122.194	6/14/13	9:36 PM	9:50 PM	Healthy	Sunny/Clear Blue Sky	Calm Winds	Composting	High	Unpleasant	WebSite	wind is very mild	NNW	0.9-2.5	Yes	-
66	M3	48.056	-122.149	6/14/13	11:55 AM	12:15 PM	Healthy	Sunny/Clear Blue Sky	Calm Winds	Biogas	Weak	Unpleasant	Card	OBSERVATION ABOVE FOR 6/14/13.ADDITIONAL OBSERVATIONS:6/15/13: 10:15-10:25 a.m. healthy sunny/clear blue sky calm winds compost medium unpleasant; same as previous.6/16/13: 10:00 a.m. healthy periods of cloud calm winds compost weak unpleasant same as previous except medium intensity.	S-SW-SSW-WNW	0.7-2.2	No plume	-
67	M3	48.053	-122.163	6/14/13	11:55 AM	12:15 PM	Healthy	Sunny/Clear Blue Sky	Calm Winds	Composting	Medium	Unpleasant	Card	From comments made for the observation of June 14th from 11:55 to 12:15	S-SW-SSW-WNW	0.7-2.3	No plume	-
68	E4	48.012	-122.194	6/15/13	4:40 AM	5:13 AM	Healthy	Sunny/Clear Blue Sky	Calm Winds	Composting,Fresh Waste,	High	Unpleasant	WebSite		NNW	0	Yes	-
69	M6	48.052	-122.177	6/15/13	9:30 AM	9:31 AM	Healthy	Sunny/Clear Blue Sky	Calm Winds	Composting	Very High	Very Unpleasant	WebSite	During parade. Very bad for hundreds of people watching parade.	NW-NNW	0.2-1.3	No - Very little plme	-
70	M6	48.060	-122.148	6/16/13	12:00 PM	5:00 PM	Healthy	Sunny/Clear Blue Sky	Windy	Composting	High	Very Unpleasant	WebSite		S-SSW-SSE-SW-	0.7-4.5	No	-
71	M3	48.053	-122.163	6/16/13	10:00 AM	10:01 AM	Healthy	Periods of Cloud	Calm Winds	Composting	Weak	Unpleasant	WebSite	From comments made for the observation of June 14th from 11:55 to 12:15	S-SSE-SSW	1.1-3.1	No plume	-
72	M3	48.053	-122.163	6/16/13	10:45 AM	10:46 AM	Healthy	Periods of Cloud	Calm Winds	Composting	Medium	Unpleasant	WebSite	From comments made for the observation of June 14th from 11:55 to 12:15	SSE-S	3.4-3.8	No plume	-
73	E4	48.012	-122.194	6/20/13	7:08 PM	7:16 PM	Healthy	Rain	Calm Winds	Composting,Fresh Waste,	High	Unpleasant	WebSite	I still can't figure out how the smell can spread and hang in the air when it is raining.	NNW	0.4-1.3	Yes	-
74	E4	48.012	-122.194	6/23/13	12:20 PM	12:26 PM	Healthy	Cloudy	Calm Winds	Composting,Fresh Waste,	Medium	Unpleasant	WebSite	have to close my windows as the stench seeps into the house.	NW-NNW	0-1.2	Very small plume	-
75	M3	48.056	-122.149	6/28/13	9:14 AM	9:22 AM	Healthy	Periods of Cloud	Calm Winds	Composting	Medium	Unpleasant	WebSite		S-SSE	1.3-2	No plume	-
76	M3	48.056	-122.149	6/28/13	9:56 AM	10:12 AM	Healthy	Periods of Cloud	Calm Winds	Composting	Medium	Unpleasant	WebSite		SSE-S	0.2-1.3	No plume	-
77	M3	48.056	-122.149	6/28/13	11:49 AM	11:54 AM	Healthy	Periods of Cloud	Calm Winds	Composting	High	Very Unpleasant	WebSite Smartphone		S-SSW	2-3.1	No plume	-
78	M3	48.056	-122.149	6/28/13	12:55 PM	12:56 PM	Healthy	Periods of Cloud	Calm Winds	Composting	Weak	Unpleasant	WebSite Smartphone		S-SSE-SE	1.1-2.0	No plume	-
79	M3	48.056	-122.149	6/30/13	11:15 AM	11:16 AM	Healthy	Periods of Cloud	Calm Winds	Bark	Weak	Pleasant	WebSite Smartphone	observation made 6/30/13	SSE-S-SE	2.4-3.4	No plume	-
80	M5	48.028	-122.145	6/30/13	10:39 PM	10:39 PM	Healthy	Sunny/Clear Blue Sky	Calm Winds	Finished Compost	Weak	Unpleasant	WebSite	Trying to resend from 6/30/2013	NNE-N	0.9-1.1	Transient	-
81	M4	48.028	-122.145	7/01/13	10:39 PM	10:39 PM	Healthy	Sunny/Clear Blue Sky	Calm Winds	Finished Compost	Weak	Unpleasant	WebSite	Cannot tell how long odor has been happening this evening. Just came outside. 06-30-2013 @22:39 hrs	NW-WNW	1.3-2.9	Transient	-
82	M5	48.028	-122.145	7/01/13	10:40 AM	10:41 AM	Healthy	Sunny/Clear Blue Sky	Calm Winds	Fresh Waste	Medium	Unpleasant	WebSite		SSE	1.3-2.2	No plume	-
83	M3	48.056	-122.149	7/01/13	10:00 AM	10:01 AM	Healthy	Sunny/Clear Blue Sky	Calm Winds	Composting	Weak	Unpleasant	WebSite		ESE-SE	1.9-2.5	No plume	-
84	E4	48.012	-122.194	7/01/13	11:00 PM	11:06 PM	Healthy	Sunny/Clear Blue Sky	Calm Winds	Composting,Fresh Waste,	High	Very Unpleasant	WebSite	It is still 66 degrees outside and even with my windows the temperature in the house is 80. The odor has been ebbing and waning. I hope that I can stand to get by while my window is open.	NW-NNW	1.6-2.7	Yes	-
85	M3	48.056	-122.149	7/01/13	12:11 PM	12:30 PM	Healthy	Sunny/Clear Blue Sky	Calm Winds	Composting	Medium	Unpleasant	WebSite	OBSERVATION ABOVE MADE ON 7/1/13. IT SHOULD BE P.M. RATHER THAN A.M. COULD NOT GET "SLIDER" TO SHOW 12:00 P.M.OBSERVATION SUBMITTED YESTERDAY FOR THAT DATE (7/1/13) HAD WRONG TIME. IT SHOULD BE APPROX. 10:00 A.M. RATHER THAN 10:30 A.M.(NOT SURE OF EXACT TIME).	2.8-4.7	SSE-S	No plume	-
86	E4	48.012	-122.194	7/02/13	9:56 PM	10:05 PM	Healthy	Sunny/Clear Blue Sky	Calm Winds	Composting,Fresh Waste,	Very High	Very Unpleasant	WebSite	wind .09 east/southeast and 2.9 north by northwest	2.7-5.8	NW-NNW	Yes	-
87	E4	48.012	-122.194	7/02/13	9:41 PM	9:57 PM	Healthy	Sunny/Clear Blue Sky	Calm Winds	Composting,Fresh Waste,	Very High	Very Unpleasant	WebSite	Wind .5 - 1.9 mph west by southwest	NNW-NW	2.7-5.4	Yes	-
88	E4	48.012	-122.194	7/04/13	4:28 AM	4:42 AM	Healthy	Sunny/Clear Blue Sky	Calm Winds	Composting,Fresh Waste,	High	Unpleasant	WebSite	My observations this time of morning are only fleeting as I do not get up this time of day expect to let the cat out.	NNW-N	0.1-1.6	Yes	-

No.	USER	LAT	LON	DATE	TIME FROM	TIME TO	Q1. Current Physical State	Q2. Weather Condition	Q3. Wind Condition	Q4. Type of Odor Perceived	Q5. Intensity of Odor Perceived	Q6. Odor Appreciation	SOURCE	COMMENTS	Wind Direction	Wind Speed (m/s)	Plume	OdoCheck (maximum OU/m3)
89	M3	48.056	-122.149	7/05/13	8:57 AM	9:14 AM	Healthy	Sunny/Clear Blue Sky	Calm Winds	Composting	High	Very Unpleasant	WebSite	OBSERVATION ABOVE MADE ON 7/5/13.OTHER OBSERVATIONS:7/7/13: 7:45 PM. HEALTHY. SUNNY/CLEAR BLUE. CALM WINDS. COMPOSTING. WEAK. UNPLEASANT.7/8/13: 10:35 AM - 10:40 AM. HEALTHY. SUNNY/CLEAR BLUE. CALM WINDS. WEAK. COMPOSTING. UNPLEASANT.AND 12:16 PM. HEALTHY. SUNNY/CLEAR BLUE. CALM WINDS. WEAK. BARK? (WASN'T AS UNPLESANT AS OTHERS). NEUTRAL.	ESE-SSE-SE	0-0.4	No plume	-
90	E4	48.012	-122.194	7/06/13	4:23 AM	4:27 AM	Healthy	Sunny/Clear Blue Sky	Calm Winds	Composting,Fresh Waste,	High	Very Unpleasant	WebSite	This was the first of several observations when I opened and closed my door and had to close the window.	NNW	0-0.2	Transient	-
91	E4	48.012	-122.194	7/06/13	5:34 AM	5:42 AM	Healthy	Sunny/Clear Blue Sky	Calm Winds	Composting,Fresh Waste,	High	Unpleasant	WebSite	Still unpleasant; wish I could keep the window open	NNW	0	Transient	-
92	E4	48.012	-122.194	7/06/13	7:17 AM	7:21 AM	Healthy	Sunny/Clear Blue Sky	Calm Winds	Composting,Fresh Waste,	High	Unpleasant	WebSite	this is the last that I am reporting there were several other times but I think that starting at 4:00 and lasting until after 7:00 a.m. is plenty.	N-W	0	Transient	-
93	M3	48.053	-122.163	7/07/13	7:45 PM	7:46 PM	Healthy	Sunny/Clear Blue Sky	Calm Winds	Composting	Weak	Unpleasant	WebSite	From comments on observation posted July 9th. 7/7/13: 7:45 PM. HEALTHY. SUNNY/CLEAR BLUE. CALM WINDS. COMPOSTING. WEAK. UNPLEASANT.	SSE-SE	2.0-2.9	Transient	-
94	M3	48.053	-122.163	7/08/13	10:35 AM	10:40 AM	Healthy	Sunny/Clear Blue Sky	Calm Winds	Composting	Weak	Unpleasant	WebSite	From comments on observation posted July 9th. 7/8/13: 10:35 AM - 10:40 AM. HEALTHY. SUNNY/CLEAR BLUE. CALM WINDS. WEAK. COMPOSTING. UNPLEASANT.	-	-	-	-
95	M3	48.053	-122.163	7/08/13	12:16 PM	12:17 PM	Healthy	Sunny/Clear Blue Sky	Calm Winds	Bark	Weak	Neutral	WebSite	From comments on observation posted July 9th. 7/8/13: 12:16 PM. HEALTHY. SUNNY/CLEAR BLUE. CALM WINDS. WEAK. BARK? (WASN'T AS UNPLESANT AS OTHERS). NEUTRAL.	S-SSW	1.9-2.4	No plume	-
96	E4	48.012	-122.194	7/09/13	4:33 AM	4:44 AM	Healthy	Sunny/Clear Blue Sky	Calm Winds	Composting,Fresh Waste,	Very High	Very Unpleasant	WebSite		N	0	Yes	-
97	E4	48.012	-122.194	7/09/13	5:50 AM	5:58 AM	Healthy	Sunny/Clear Blue Sky	Calm Winds	Composting,Fresh Waste,	Very High	Very Unpleasant	WebSite	windows should be closed	NNW-NW	0	Yes	-
98	E4	48.012	-122.194	7/09/13	10:18 PM	10:27 PM	Healthy	Sunny/Clear Blue Sky	Calm Winds	Composting,Finished Com	High	Unpleasant	WebSite		NW-NNW-N	1.0-2.0	Yes	-
99	E4	48.012	-122.194	7/10/13	6:19 AM	6:26 AM	Healthy	Sunny/Clear Blue Sky	Calm Winds	Composting,Fresh Waste,	High	Unpleasant	WebSite		NNW-NW	0.9-1.3	Yes	-
100	E4	48.012	-122.194	7/11/13	6:33 AM	6:47 AM	Healthy	Sunny/Clear Blue Sky	Calm Winds	Composting,Fresh Waste,	Very High	Very Unpleasant	WebSite		NNW-NW	0-3.1	Yes	-
101	M6	48.060	-122.148	7/16/13	9:30 PM	9:31 PM	Healthy	Sunny/Clear Blue Sky	Calm Winds	Composting	Very High	Unpleasant	Card	The answers to the question 3 et 6 were missing. So we added for the question 3 'Calm Winds' and for the question 6 'Unpleasant'.	S - SSE	0.2 - 1.8	Transient	9 - 12 (M)
102	M4	48.028	-122.145	7/16/13	7:16 PM	7:16 PM	Healthy	Sunny/Clear Blue Sky	Calm Winds	Fresh Waste	Medium	Very Unpleasant	WebSite Smartphone		W - WNW	0.9 - 1.8	Yes	8 - 9 (SE_M)
103	M4	48.028	-122.145	7/16/13	7:18 PM	7:18 PM	Healthy	Sunny/Clear Blue Sky	Calm Winds	Composting	Medium	Very Unpleasant	WebSite Smartphone		W - WNW	0.9 - 1.8	Transient	8 - 9 (SE_M)
104	M4	48.028	-122.145	7/16/13	7:23 PM	7:23 PM	Healthy	Cloudy	Calm Winds	Composting	High	Very Unpleasant	WebSite Smartphone	Reported before sunny but should be cloudy	W - WNW	0.9 - 1.8	Transient	8 - 9 (SE_M)
105	M5	48.028	-122.145	7/16/13	7:20 PM	7:20 PM	Healthy	Cloudy	Calm Winds	Composting	Very High	Very Unpleasant	WebSite Smartphone		W - WNW	0.9 - 1.8	Transient	8 - 9 (SE_M)
106	M5	48.028	-122.145	7/16/13	8:17 PM	8:17 PM	Healthy	Cloudy	Calm Winds	Composting	Very High	Very Unpleasant	WebSite Smartphone	Not sure if you want duration. I reported at 19:20 but it is just hanging around. The e-nose should show it.	WNW	1	Transient	9 (SE_M)
107	M3	48.053	-122.163	7/17/13	11:41 AM	11:48 AM	Healthy	Cloudy	Calm Winds	Bark	Medium	Neutral	WebSite	From comments in observation made July 25th. OTHER OBSERVATION ON OTHER DATES: 7/17/13 @11:41 - 11:48 a.m.: healthy. cloudy. clam winds (a little windy). bark. medium. neutral.	SSE - S - SSW	2.5 - 4.0	No plume	10 (M)
108	M5	48.028	-122.145	7/19/13	5:46 PM	5:46 PM	Healthy	Sunny/Clear Blue Sky	Calm Winds	Composting	Medium	Unpleasant	WebSite Smartphone		WSW-W	2.9-3.7	No plume	8(SE_M)
109	M3	48.053	-122.163	7/19/13	11:32 AM	11:37 AM	Healthy	Sunny/Clear Blue Sky	Calm Winds	Composting	Medium	Unpleasant	WebSite	From comments on observation made July 25th.OTHER OBSERVATION ON OTHER DATES: 7/19/13 @ 11:32 -11:37 a.m.: healthy. sunny/clear blue. calm winds. compost. unpleasant.	S-SSE	1.6-4.0	No plume	8(SE_M)/10(M)
110	M6	48.060	-122.148	7/20/13	11:25 AM	11:26 AM	Healthy	Sunny/Clear Blue Sky	Calm Winds	Biogas	Medium	Unpleasant	Card		S-WSW	0-1.1	No	7(SE_M)/9(M)
111	M4	48.028	-122.145	7/23/13	9:14 PM	9:14 PM	Healthy	Sunny/Clear Blue Sky	Calm Winds	Bark	Very Weak	Neutral	WebSite Smartphone		WSW-WNW-NW	0-0.6	Yes	8(SE_M)
112	E4	48.012	-122.194	7/24/13	9:25 PM	9:57 PM	Healthy	Sunny/Clear Blue Sky	Calm Winds	Composting,Fresh Waste,	Very High	Very Unpleasant	WebSite	No wind; 63 degrees out with 67% humidity. The smell has seeped into the house	N	0.5-3.1	Yes	N/D
113	E4	47.999	-122.191	7/24/13	10:07 PM	10:19 PM	Healthy	Sunny/Clear Blue Sky	Calm Winds	Composting	High	Very Unpleasant	WebSite	still stinks	NW-NNW	0.9-2.0	Yes	N/D
114	E4	47.999	-122.191	7/24/13	11:29 PM	11:42 PM	Healthy	Sunny/Clear Blue Sky	Calm Winds	Composting,Fresh Waste,	Very High	Very Unpleasant	WebSite	and it continues	NNW-N-NNE	0-0.9	Yes	N/D
115	M3	48.056	-122.149	7/24/13	9:30 AM	10:05 AM	Healthy	Sunny/Clear Blue Sky	Calm Winds	Bark	Weak	Neutral	WebSite	ABOVE OBSERVATION MADE ON 7/24/13.Also on same date same odor and other parameters observed at 11:22 a.m.OTHER OBSERVATION ON OTHER DATES:7/17/13 @11:41 - 11:48 a.m.: healthy. cloudy. clam winds (a little windy). bark. medium. neutral.7/19/13 @ 11:32 -11:37 a.m.: healthy. sunny/clear blue. calm winds. compost. unpleasant.	SSE-S-N	0-3.1	No plume	7(SE_M)/10(M)
116	M3	48.053	-122.163	7/24/13	11:22 AM	11:23 AM	Healthy	Sunny/Clear Blue Sky	Calm Winds	Bark	Weak	Neutral	WebSite	From comment on observation made July 25th for July 24th. ABOVE OBSERVATION MADE ON 7/24/13. Also on same date same odor and other parameters observed at 11:22 a.m.	S	2.7-3.1	No plume	8(SE_M)/10(M)
117	M3	48.056	-122.149	7/27/13	8:55 PM	8:56 PM	Healthy	Sunny/Clear Blue Sky	Calm Winds	Composting	Weak	Unpleasant	WebSite	OBSERVATION ABOVE MADE ON 7/27/13.ANOTHER OBSERVATION:7/29/13 @ 11:15 a.m.: healthy. periods of clouds. slight wind. bark. weak. neutral.Same date @ 11:23. same except of medium intensity.	SSW	0	Yes	-
118	M3	48.053	-122.163	7/29/13	11:15 AM	11:16 AM	Healthy	Cloudy	Windy	Bark	Weak	Neutral	WebSite	From comments in observation made for July 27th. OBSERVATIONS MADE 7/29/13: 11:15 a.m.: healthy. cloudy. slight wind. bark. weak. neutral. 11:23 a.m.: same as above but of medium intensity at this time.	S-SW	0.7-0.9	No plume	8(SE_M)/10(M)
119	M3	48.053	-122.163	7/29/13	11:23 AM	11:24 AM	Healthy	Cloudy	Windy	Bark	Medium	Neutral	WebSite	From comments on observation made July 30th for July 27th. ANOTHER OBSERVATION: 7/29/13 @ 11:15 a.m.: healthy. periods of clouds. slight wind. bark. weak. neutral. Same date @ 11:23. same except of medium intensity.	SW-S	0.7-2.2	No plume	8(SE_M)/10(M)
120	M4	48.051	-122.168	7/30/13	6:54 AM	6:55 AM	Healthy	Periods of Cloud	Calm Winds	Composting	Very High	Very Unpleasant	WebSite Smartphone	Driving by third st & 47th ave ne and noticed very strong odor in air of composting	N	0	No	8(SE_M)
121	M6	48.060	-122.148	7/30/13	7:29 PM	7:30 PM	Healthy	Sunny/Clear Blue Sky	Calm Winds	Composting	High	Very Unpleasant	Card		S-SSE	1.8-2.9	No	10(SE_M)/10(M)
122	M3	48.053	-122.163	7/30/13	6:43 PM	6:44 PM	Healthy	Periods of Cloud	Calm Winds	Composting	Medium	Very Unpleasant	Not specified	From comment made on observation for August 5th 2013. ADDITIONAL OBSERVATION ON 7/30/13: 6:43 pm: Healthy. periods of clouds. calm winds. composting. medium intensity. very unpleasant.	S-SSE	1.8-2.10	Transient	10(SE_M)/10(M)

No.	USER	LAT	LON	DATE	TIME FROM	TIME TO	Q1. Current Physical State	Q2. Weather Condition	Q3. Wind Condition	Q4. Type of Odor Perceived	Q5. Intensity of Odor Perceived	Q6. Odor Appreciation	SOURCE	COMMENTS	Wind Direction	Wind Speed (m/s)	Plume	OdoCheck (maximum OU/m3)
123	M3	48.056	-122.149	8/05/13	8:25 PM	8:57 PM	Healthy	Sunny/Clear Blue Sky	Calm Winds	Asphalt	Weak	Unpleasant	WebSite	May have lasted longer. but went in house at "time to."ADDITIONAL OBSERVATION ON 7/30/13:6:43 pm: Healthy. periods of clouds. calm winds. composting. medium intensity. very unpleasant.	E-ESE-ENE	0-0.7	Yes	11(SE_M)/10(M)
124	E3	47.996	-122.211	8/06/13	6:31 AM	8:03 AM	Healthy	Sunny/Clear Blue Sky	Calm Winds	Composting	Medium	Very Unpleasant	WebSite	Cedar Grove Smell	NNW-N-NNE	0-1.8	Yes	10
125	M4	48.028	-122.145	8/08/13	6:11 PM	6:11 PM	Healthy	Cloudy	Calm Winds	Composting	Weak	Unpleasant	WebSite Smartphone	Slight odor in air	WNW-NNW-NW	2.7-1.9	Plume but not quite reaching	11(SE_M)
126	M3	48.056	-122.149	8/10/13	4:00 PM	4:01 PM	Healthy	Periods of Cloud	Calm Winds	Composting	Weak	Unpleasant	WebSite		SSW	2.9-4.0	Transient	12(SE_M)/10(M)
127	M3	48.056	-122.149	8/10/13	3:10 PM	3:11 PM	Healthy	Periods of Cloud	Windy	Asphalt	Weak	Unpleasant	WebSite		S	3.0-4.0	Transient	12(SE_M)/10(M)
128	M3	48.056	-122.149	8/10/13	5:48 PM	5:49 PM	Healthy	Periods of Cloud	Calm Winds	Composting	Medium	Unpleasant	WebSite		S-SSW	0.9-2.2	Yes	12(SE_M)/10(M)
129	E4	48.012	-122.194	8/12/13	6:29 AM	6:46 AM	Healthy	Sunny/Clear Blue Sky	Calm Winds	Composting,Fresh Waste,	High	Unpleasant	WebSite		N-NNW	0.2-1.4	Yes (1-3)	15
130	E4	48.012	-122.194	8/20/13	6:36 AM	6:49 AM	Healthy	Sunny/Clear Blue Sky	Calm Winds	Composting,Fresh Waste,	High	Unpleasant	WebSite		N-NNW-NW	0.3-1.1	Yes	11
131	E4	48.012	-122.194	8/21/13	8:06 AM	8:28 AM	Healthy	Sunny/Clear Blue Sky	Calm Winds	Asphalt	Medium	Neutral	WebSite		WNW-NW-NNW	0.2-1.3	Yes	10
132	M6	48.060	-122.148	8/31/13	10:00 PM	10:01 PM	Healthy	Sunny/Clear Blue Sky	Calm Winds	Other: Burning	High	Unpleasant	Card	Smells like somebody burning garbage 8-31-13 thru 9-01-13 about 10:00 pm each night	ESE	0	Transient	10(SE_M)/10(M)
133	E4	48.012	-122.194	9/03/13	5:28 AM	5:43 AM	Healthy	Cloudy	Calm Winds	Composting,Fresh Waste,	High	Unpleasant	WebSite	I was on vacation 7/26 - 8/12/2013; so reports were few and far between.	NNE	0	Yes (5-10)	32
134	M5	48.028	-122.140	9/06/13	6:49 PM	6:50 PM	Healthy	Cloudy	Calm Winds	Composting	High	Unpleasant	WebSite Smartphone		S	1.1-1.8	No	11
135	M4	48.028	-122.145	9/06/13	6:50 PM	6:50 PM	Healthy	Cloudy	Calm Winds	Composting	Medium	Unpleasant	WebSite Smartphone		S	1.1-1.8	No	11(SE_M)
136	M3	48.053	-122.163	9/11/13	11:35 AM	11:36 AM	Healthy	Sunny/Clear Blue Sky	Calm Winds	Composting	Weak	Unpleasant	WebSite		SE	0	No plume	14(SE_M)/10(M)
137	M3	48.053	-122.163	9/11/13	2:35 PM	2:36 PM	Healthy	Sunny/Clear Blue Sky	Calm Winds	Finished Compost	Weak	Unpleasant	WebSite		SSE-SE	0	No plume	9(SE_M)/10(M)
138	M3	48.053	-122.163	9/11/13	6:52 PM	7:22 PM	Healthy	Sunny/Clear Blue Sky	Calm Winds	Asphalt	Medium	Unpleasant	WebSite	YIKES I SCREWED UP AGAIN!ABOVE IS CORRECT OBSERVATION FOR 6:52 P.M. ASPHALT ODOR EVENT THAT WAS DATED 9/12/13. IT SHOULD HAVE BEEN DATED 9/11/13 FOR A TOTAL OF THREE OBSESRVATIONS THAT DAY: TWO COMPOST (11:35 A.M. AND 2:35 PM) AND ONE ASPHALT (6:52 PM).MY APOLOGIES.	SE	0-1.6	Transient	8(SE_M)/9(M)
139	M4	48.028	-122.140	9/22/13	6:23 PM	6:24 PM	Healthy	Periods of Cloud	Calm Winds	Low Tide	Very Weak	Unpleasant	WebSite Smartphone	Odor in air resembles tidal smell. Very faint	SE	2.2-4.5	No	8(SE_M)
140	E4	48.012	-122.194	9/25/13	7:20 AM	7:40 AM	Healthy	Cloudy	Calm Winds	Composting,Fresh Waste,	Very High	Unpleasant	WebSite	Cedar Grove Compost - when the mist and fog forms Cedar Grove hangs in the air and the stink settles on everything.	NNW-NW	0.2-1.6	Yes	10
141	M3	48.056	-122.149	10/05/13	9:31 AM	9:40 AM	Healthy	Sunny/Clear Blue Sky	Calm Winds	Composting	High	Unpleasant	WebSite	ALL OBSERVATIONS INCLUDING ABOVE. WERE MADE ON 5/10/13. ADDITIONAL EVENTS ON SAME DATE AS FOLLOW:10:05: weak. unpleasant10:48: high. unpleasant11:24: medium. unplesant11:47: high. unpleasant11:54: very weak. unplesant12:50: very weak. unplesant13:25: medium-high. unplesant (SE wind)16:00-16:30: medium-bad. unplesant (E wind)	SSE-S-SSW-WSW	0	Yes (1-5)	19(SE_M)/15(M)
142	M4	48.043	-122.143	10/05/13	1:18 PM	1:19 PM	Healthy	Sunny/Clear Blue Sky	Calm Winds	Composting	Medium	Unpleasant	WebSite Smartphone	Smell it from inside the vehicle	SSW	1.6-2.2	No plume	8(SE_M)
143	M4	48.028	-122.145	10/05/13	1:43 PM	1:43 PM	Healthy	Sunny/Clear Blue Sky	Calm Winds	Asphalt	Weak	Unpleasant	WebSite Smartphone		S	1.3-1.9	No plume	8(SE_M)
144	M5	48.028	-122.145	10/05/13	1:55 PM	1:57 PM	Healthy	Sunny/Clear Blue Sky	Calm Winds	Asphalt	Medium	Unpleasant	WebSite Smartphone		S	1.8-2.9	No plume	8(SE_M)
145	M4	48.052	-122.178	10/05/13	6:00 PM	6:15 PM	Healthy	Periods of Cloud	Calm Winds	Composting	Medium	Unpleasant	WebSite Smartphone		E-ESE	0-0.6	No	8(SE_M)
146	E4	48.012	-122.194	10/11/13	8:50 AM	8:57 AM	Healthy	Cloudy	Calm Winds	Composting,Fresh Waste,	High	Very Unpleasant	WebSite	This is what I love about Cedar Grove - let the fog/mist settle and without wind the stench just hangs and covers everything. The dew is filled with the stench and permeates everything. AND I can't wait to see how long it hangs around as I have to head into work.	NW-NNW	0.3-0.9	Yes (3-5)	8(SE_M)/(M)
147	M3	48.053	-122.163	10/14/13	1:49 PM	1:50 PM	Sick	Periods of Cloud	Calm Winds	Composting	Weak	Unpleasant	WebSite	Sick means sore throat and slightly stuffy nose.	SSE-S	0.9-1.1	No plume	17(SE_M)/10(M)
148	M4	48.061	-122.173	10/15/13	6:36 PM	6:37 PM	Healthy	Cloudy	Calm Winds	Composting	High	Unpleasant	WebSite Smartphone	Strong by value village	SE	0	No	11(SE_M)
149	M3	48.053	-122.163	10/15/13	1:40 PM	1:41 PM	Sick	Periods of Cloud	Calm Winds	Composting	Medium	Unpleasant	WebSite	Sicker than day before observation: headache sore throat stuffy nose.	SE-SSE	1.0-2.2	No plume	8(SE_M)/10(M)
150	E4	48.012	-122.194	10/18/13	9:19 AM	9:26 AM	Healthy	Cloudy	Calm Winds	Composting,Fresh Waste,	Medium	Unpleasant	WebSite	The fog is heavy with a hint of Cedar Grove stench.	NNE	0	Yes (1-3)	9
151	M4	47.683	-122.343	10/18/13	12:23 PM	12:25 PM	Healthy	Cloudy	Calm Winds	Composting	High	Unpleasant	WebSite Smartphone	My son is at home and he called me saying that the elders were very strong along Sunnyside. Nearby 6404 35th street ne Marysville.	SSE	0.7-0.9	No plume	8(SE_M)
152	M3	48.053	-122.163	10/18/13	12:03 PM	12:59 PM	Healthy	Periods of Cloud	Calm Winds	Composting	High	Very Unpleasant	WebSite	This observation really lasted until 1:05 p.m. but couldn't get "slider" for the hour in "time to" field to move beyond 12:00 p.m.	SE-SSE-S	0-1.8	No plume	8(SE_M)/8(M)
153	M3	48.053	-122.163	10/18/13	1:56 PM	2:17 PM	Healthy	Periods of Cloud	Calm Winds	Composting	Medium	Unpleasant	WebSite		SE-SSE	0.8-2.0	No plume	9(SE_M)/10(M)
154	E4	48.012	-122.194	10/18/13	9:21 PM	9:27 PM	Healthy	Cloudy	Calm Winds	Composting,Fresh Waste,	Medium	Unpleasant	WebSite	Mist and fog has settled in and the stink of Cedar Grove is all around and settling on the fence and patio furniture and patio and.....	ESE	0	No - Plume but not in that direction	10
155	E4	48.012	-122.194	10/18/13	10:15 PM	10:17 PM	Healthy	Cloudy	Calm Winds	Composting,Fresh Waste,	High	Unpleasant	WebSite	Fog and mist still hanging and so is the stench of Cedar Grove.	ESE	0	No - Plume but not in that direction	10
156	M3	48.053	-122.163	10/18/13	4:03 PM	4:37 PM	Healthy	Sunny/Clear Blue Sky	Calm Winds	Composting	High	Unpleasant	WebSite	Pretty much stinking up the area to varying degrees between 4:37 p.m. and 7:00 p.m. whenever I was outside (several times).	SE-SSE	1.1-2.0	No - Plume but not in that direction	9(SE_M)/11(M)
157	E3	47.996	-122.211	10/20/13	7:01 AM	10:20 AM	Healthy	Cloudy	Calm Winds	Composting	Medium	Very Unpleasant	WebSite	Cedar Grove stench has been present every morning for at least the past 5 days.	NNW-N-NW-NNE	0	Yes (5-10)	10
158	E4	48.012	-122.194	10/20/13	11:44 AM	11:50 AM	Healthy	Cloudy	Calm Winds	Composting,Fresh Waste,	High	Unpleasant	WebSite	Was in the middle of leaving the house not to return until later in the day. Foggy and compost hanging in the air.	NW-NNW	0	Yes (3-5)	9
159	E3	47.996	-122.211	10/21/13	5:00 PM	5:44 PM	Healthy	Cloudy	Calm Winds	Composting	Weak	Very Unpleasant	WebSite	Cedar Grove Stench-- almost continually present in cloudy humid colder weather.	NE-NNE-N	0	Yes (3-5)	10
160	M3	48.064	-122.148	10/29/13	4:35 PM	4:36 PM	Healthy	Periods of Cloud	Calm Winds	Composting	Medium	Unpleasant	WebSite		S	1.6-	Transient	8(SE_M)/16(M)
161	M3	48.053	-122.163	10/29/13	4:55 PM	4:56 PM	Healthy	Periods of Cloud	Calm Winds	Composting	Medium	Unpleasant	WebSite	Forgot to report this one and another for same date at a different location that I will submit separately.	SSW-S	1.1-2.2	Yes (3-5)	13(SE_M)/17(M)