Clallam County Saturation Study Plan

Olympic Region Clean Air Agency

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Overview

The primary purpose of ORCAA's ambient air monitoring network is to evaluate the highest levels of pollution to which a majority of the population in each county is routinely exposed. Secondly, the network is used to help determine the major contributors to local pollution. Beginning in January 2013, ORCAA will install 4 additional, temporary, ambient air quality monitors in Clallam County. The goal of this year long saturation study is to evaluate Clallam County's ambient air quality for PM2.5 and to determine where the permanent air monitor(s) should be placed.

ORCAA currently operates one nephelometer at Stevens Middle School. This monitor was moved from downtown Port Angeles in 1998 following a PM10 saturation study conducted during the winter of 1996/97. Data from this study revealed that Stevens Middle School was in a region where PM10 concentrations were as high, or higher, than those measured at the other eight locations. During the winter, PM2.5 typically accounts for 94% of the PM10 (Figure 1), and therefore results from the study were likely valid for PM2.5 as well as PM10. This may not be the true in the summer, when PM2.5 is less than 70% of the PM10. This seasonal difference is due to increased wood burning in winter, from which emissions are nearly all PM2.5, and the increase in dust emissions during the dry summer months when there is more roadwork and construction; dust particles are generally larger than PM2.5.

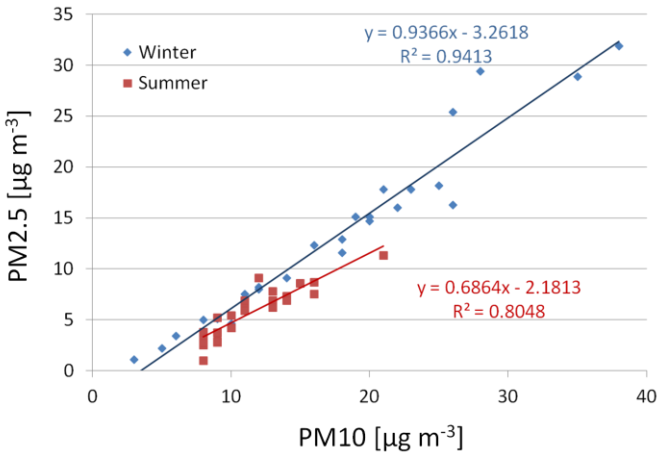


Figure 1.) Comparison of PM10 with PM2.5 for winter (blue) and summer (red). Data were collected in Lacey, WA 1999.

Since the '96/'97 saturation study, there have been major alterations in source emissions - Rayonier and K-Ply have since closed - and it is reasonable to expect that variability in neighborhood scale air quality may likewise have changed. Additional adjustments in emissions around Port Angeles will occur when Nippon replaces its #8 biomass boiler with a new boiler (expected to begin operation in late summer of 2013). Relative to the average annual emissions between 2003 and 2009, Nippon's emissions are expected to change as follows: reduce PM2.5 by 64%, reduce SO_2 by 6%, and increase NO_x by 38%. SO_2 and NO_x are considered precursor gases to fine particulate and thus are relevant to the PM2.5

monitoring program. These emission changes are a result of the control technologies that will be implemented in the new boiler.

The 2013 Clallam County saturation study will monitor both PM2.5 and PM10 at four locations in Clallam County to capture seasonal and spatial variability in air quality. Air monitors will be installed by ORCAA staff working collaboratively with student interns from Peninsula College and/or Huxley Environmental College. Student interns will be responsible for the weekly maintenance of each site with oversight by ORCAA monitoring staff, who will visit the sites monthly. Results will establish whether or not data collected at Stevens Middle School represent air quality in the region and help determine the most ideal place to maintain a permanent air monitor(s).

Siting

ORCAA considers a number of factors when choosing sites for saturation studies. Criteria include, but are not limited to, population density, local sources, predominant wind direction, and previous locations where industrial toxins from emissions have been found in ground soil.

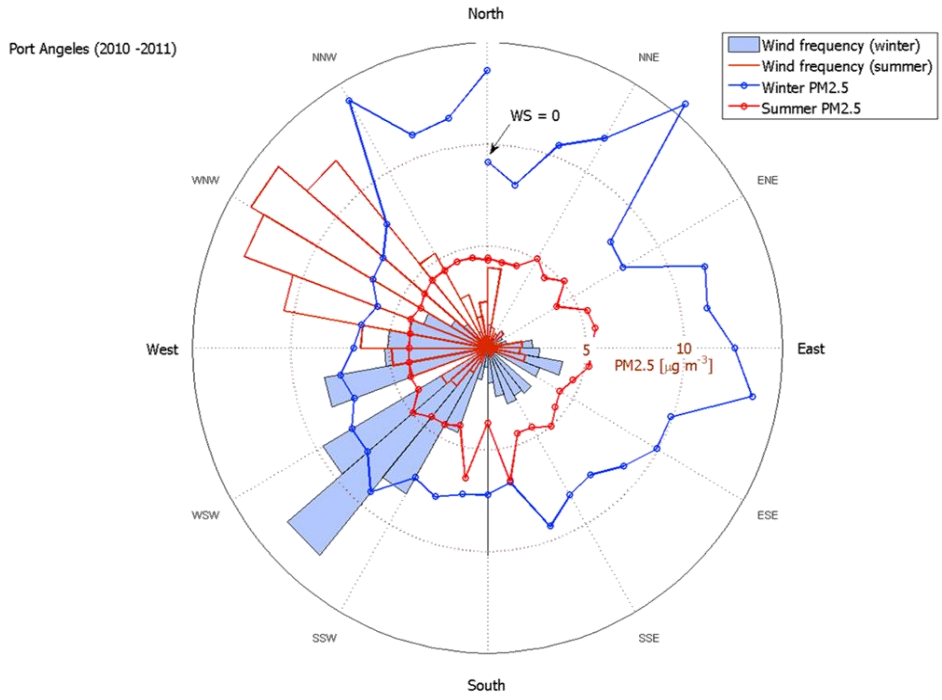


Figure 2.) Wind rose centered on Steven's Middle School, Port Angeles and PM2.5 concentrations corresponding to each direction for both summer and winter.

Prevailing winds relative to the emission sources are an important indicator of where air pollution will be transported. A wind rose made from hourly wind direction data for 2010 and 2011, and separated into winter and summer months, is superposed over the average PM2.5 concentrations that were measured at Stevens Middle School and correspond to each wind direction (Figure 2). The

aforementioned figure shows that the prevailing winds are northwesterly in summer and southwesterly in the winter, indicating that at all seasons urban and industrial pollution will generally be pushed eastward. In both winter and summer, PM2.5 measured at Stevens Middle School increases by about 30 to 40% when the winds blow from the east (downtown PA) and the north-northeast (industrial waterfront and port).

A Washington Department of Ecology 2009 study, that analyzed dioxin levels in ground soil in and around Port Angeles, showed the highest levels of dioxins were found in downtown and locations directly east (Figure 3). In looking at chemical fingerprints of these toxins, the study was able to separate out those regions most likely contaminated by Rayonier and showed that the highest concentration of these dioxins were concentrated immediately to the southeast and southwest of the mill (Figure 4). The only major air pollution source still operating in Port Angeles is Nippon and we used the map of toxic equivalent (TEQ) concentrations as a proxy for where the PM may impact surface air quality. To do this, we have taken the contours of the TEQ map isolated to Rayonier emissions (Figure 4) and superposed them over the current operating location of Nippon (Figure 5). It is possible that coastal shape and topography will create different wind patterns in the immediate vicinity, so we expand these lobes to encompass more of the region that may experience impacts. Since Nippon will be burning primarily untreated wood, and since the new boiler will include highly efficient combustion and particulate controls, it is important to clarify that emissions should not contain dioxins at levels as were seen with Rayonier. These TEQ data are used only to determine where particulate emissions may impact air quality in the community.

Figure 3.) Map of TEQ (Toxic Equivalent for dioxins) concentrations found in Port Angeles soils. *(WA-DOE & Gregory L Glass, Rayonier Mill Off-Property Soil Dioxin Study: Final Data Summary Technical Memorandum, February 2009)*

Based on predominant wind directions relative to pollution sources, locations of populated neighborhoods, and the overall dioxin concentrations from all pollutions sources, locations near downtown and directly east of Port Angeles are logical choices for placing the temporary monitors.

We will also be placing a monitor in Sequim, the second largest population center in Clallam County. In context with the monitors in Port Angeles, a monitor in Sequim will allow us to determine the extent of PM2.5 transported downwind from Port Angeles, local influences on air quality, and whether a permanent ambient air monitor in is warranted.

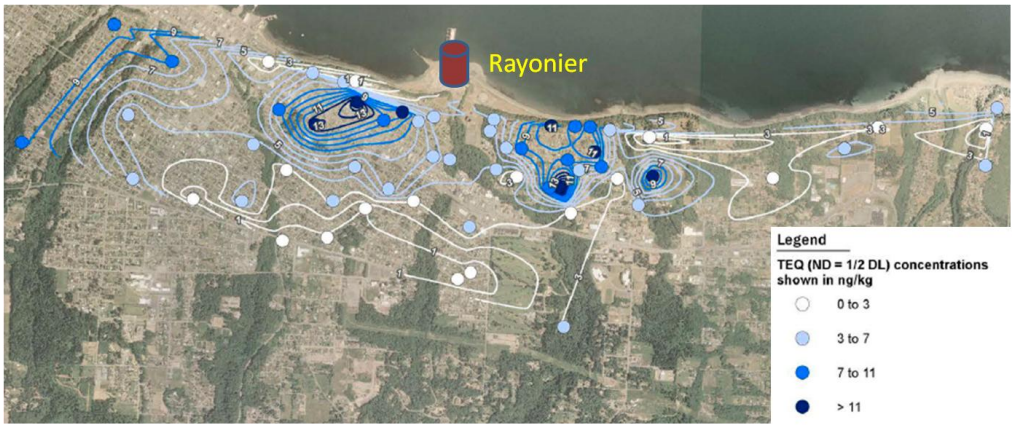


Figure 4.) Map of TEQ (Toxic Equivalent for dioxins) concentrations that match the Rayonier emission profile *(WA-DOE & Gregory L Glass, Rayonier Mill Off-Property Soil Dioxin Study: Final Data Summary Technical Memorandum, February 2009)*

Figure 5.) TEQ contours from Figure 4 superposed over Nippon

All of the temporary monitors will be sited in accordance with criteria outlined by EPA and WA-DOE for the ambient air monitoring network. These criteria are as follows:

Physical requirements:

1. The distance from the nearest traffic lane to the probe inlet is based on average daily traffic (ADT) counts. The probe inlet must be positioned a minimum of 10 meters from the nearest traffic lane per 1000 vehicles ADT. Average daily traffic counts for most roadways in Washington can be found at http://www.wsdot.wa.gov/mapsdata/tdo/annualtrafficreport.htm
2. To keep impacts from windblown dust to a minimum, probe inlets should not be located above barren ground and should be located at least one quarter mile from potential sources of dust.
3. Avoid areas with excessive smoke from local combustion sources (e.g. within 100 feet from chimneys or other emission sources).
4. There must be no obstructions that would limit the sampler's ability to collect aerosols representing the regional area.
5. An open horizontal arc of at least 270 degrees must surround the sampler inlet with prevailing winds entering the arc. Any obstructions within this arc must be twice the distance from the sampler inlet as entering the arc and twice the distance from the sampler inlet as they are tall.
6. The probe inlet must be located between 2 and 15 meters above ground level.
7. The probe inlet must be at least 1 meter away from any supporting structure.
8. The probe inlet must be at least 10 meters from the drip line of trees.
9. It is recommended that the probe inlet not be positioned next to a wall. If there is no other option then the probe inlet must be at least 2 meters from the wall and have a minimum of 180 degrees of open sample pathway.

Figure 6.) Ambient Air Monitoring station

Other Considerations

Physical Space:

Monitoring equipment requires a space approximately 6'X6'x6'. Figure 6 shows a typical air monitoring station

Access: We need to have access to the location Monday thru Friday from 7 am to 5:30 pm.

Communications: The location should have internet access with a static IP address with a 110 volt outlet.

Air Probe: In addition to the equipment listed above, ORCAA must install an air line and probe to sample outside air. Rooftop access with a mount point for the probe and conduit is best (Figure 6).

Definite Sites

Stevens Middle School – This is where the permanent air monitor for Clallam County has been located since December, 1998. This site is in a neighborhood southwest of downtown Port Angeles, west and south of 101, northeast of Port Angeles Hardwood and Interfor (wood-fired boilers), and almost due south of Nippon (oil and wood-fired boilers).

Potential Sites

City of Port Angeles Fire Department is located downtown on 5th St, about 12 blocks from the waterfront. The surrounding area is both residential and commercial. It is near Highway 101 and S. Lincoln. However, the air probe can be located sufficiently far to comply with current siting criteria. ORCAA has an open dialog with the relevant parties for equipment placement.

We are interested in Helen Haller Elementary or the adjacent middle school in Sequim and have requested permission to install a monitor here. ORCAA has an open dialog with the relevant parties for equipment placement.

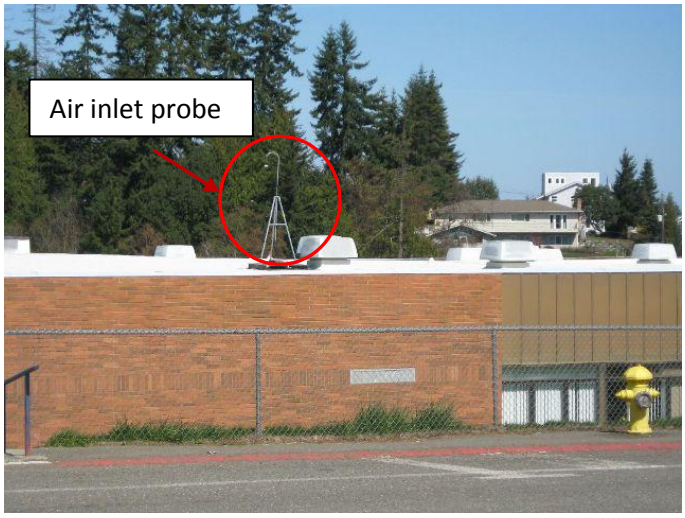
We are discussing installation options with relevant parties at the North Olympic Library in Port Angeles and trying to determine if the right infrastructure exists there for an ambient air monitoring site.

We are looking to install a monitor in Gales Addition, but have not yet found a suitable location.

Other places of interest:

Olympic Medical Center

Site Images



Stevens Middle School

Port Angeles Fire Station

Helen Haller Elementary, Sequim

Air Monitoring Instruments

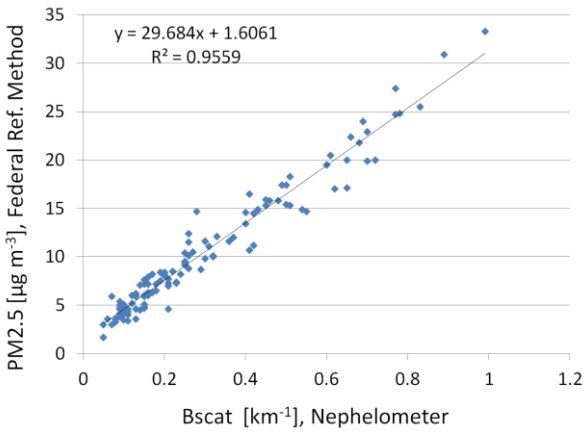


Figure 7.) Correlation between nephelometer and gravimetric PM2.5 measurements in Port Angeles (1999 – 2001)

ORCAA's current PM2.5 monitoring network is comprised of seven nephelometers, with one operating in each county and an additional monitor in Clallam County, which is a federally funded NCore site.

Nephelometers directly measure the amount of light that is scattered by particles in an air stream. A uniformly directed beam of light is directed through the sample cell and a detector set at 90° to the initial beam detects the light that is scattered off the particles. The units are given as 'Bscat.' ORCAA, along with many other clean air agencies and research groups, have correlated the nephelometer to direct gravimetric measurements of PM10 and

PM2.5. These groups and agencies found a very high correlation between Bscat and particle mass concentration (Figure 7). Direct mass measurements of PM2.5 are limited in that they provide only 24 hour averages of PM2.5 concentration once every 3rd or 6th day of the month and are generally cost prohibitive, whereas the nephelometers measure real-time concentrations at a temporal resolution of 1 data-point per minute and allow us to resolve diurnal and weekly variability in pollution levels. These patterns provide insight as to the primary sources of the pollution. Based on the high degree of correlation between nephelometers and the direct mass measurements, nephelometers were accepted by EPA and WA-DOE as a valid federal equivalence method (FEM) for monitoring PM2.5.

During the saturation study ORCAA will be using Optical Particle Counters (OPC) manufactured by MetOne. These instruments also make optically based measurements and operate very similarly to the nephelometers with an important difference. The detector scans through a series of eight voltages and provides number of particles in each size range from 0.3 microns (µm) and larger, to 10 µm and larger. These data are highly correlated to the nephelometers and can be used as a proxy for PM2.5 (Figure 8). The MetOne OPC also provides near-real time data. These instruments will also show when coarse particles, indicative of fugitive dust, are high relative to the fine particle concentration.

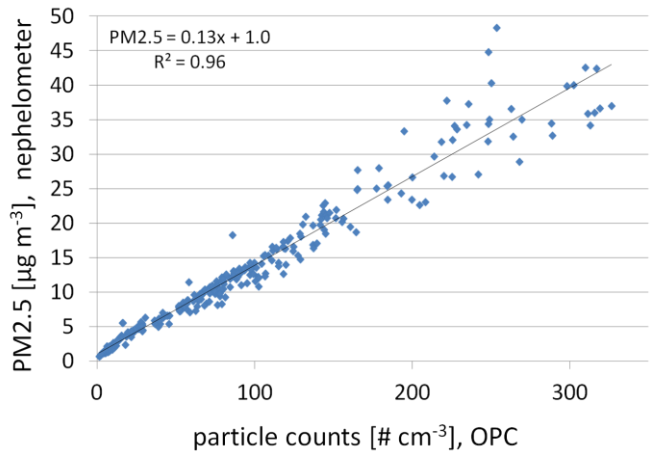


Figure 8.) Correlation between OPC particle counts and nephelometer derived PM2.5

In addition to the MetOne OPC, ORCAA plans to install two aethalometers in Clallam County during the saturation study. Initially, one will be placed at Stevens Middle School and one in Sequim, however if data collected during the course of the study indicate that the aethalometer would better serve in one of the other locations, it will be moved. The aethalometer measures the blackness of the ambient particles and indicates not only the amount of soot in the air, but also whether it is primarily from fossil fuel combustion, or biomass combustion. It cannot tell the difference between wood burned in a residential fireplace and wood burned in an industrial facility.

Expected Results

Data from the four sites in this study will be compared to one another to determine:

a.) the degree of correlation in temporal variability in the different areas being measured
b.) at which sites are the highest levels of PM2.5 regularly seen and how does the data correlate with wind direction and seasonal factors.

c.) what are the relative contributions to combustion derived aerosol from diesel trucks and from biomass burning (residential and industrial)
d.) to what neighborhood and regional source activities do the data correspond
e.) which site(s) generally represents the air quality of all four sites best

Budget

1st YEAR EXPENSES	**$27,090**	FY2013 (11-15-2012 to 07-2013)
Equipment	$21,947	
Operation/Maint.	$5,144	

ANNUAL EXPENSES	**$12,906**	FY2014
Equipment	$1,304	
Operation/Maint.	$11,602	