

Sampling and Analysis Plan

SensOR Site Selection and Installation

January 2023



**Laboratory and
Environmental
Assessment Division**
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DEQ is a leader in restoring, maintaining and enhancing the quality of Oregon's air, land and water.



State of Oregon
**Department of
Environmental
Quality**

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Version 1.0

This Sampling and Analysis Plan was prepared by:

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Project Approvals

Prepared By: *Daniel Johnson* Date: 01/12/2023
Daniel Johnson (Jan 12, 2023 11:10 PST)
Daniel Johnson, DEQ Air Quality
Monitoring Specialist

Reviewed By: *Benjamin Hamilton* Date: 01/12/2023
Benjamin Hamilton, DEQ Quality
Assurance Officer

Approved By: *Anthony Barnack* Date: 01/12/2023
Anthony Barnack (Jan 12, 2023 10:51 PST)
Anthony Barnack, DEQ Project
Manager

1. Project Management

1.1. Distribution List

The following personnel will be emailed regarding all aspects of this sampling and analysis plan (SAP). Deviations from this SAP must be communicated in writing (e-mail is acceptable) to all individuals identified in Table 1. Final reports from the DEQ Laboratory will be emailed and mailed to the project manager, regional monitoring coordinator and laboratory monitoring coordinator/data manager.

Table 1. Distribution List

Name	Phone	Email
Daniel Johnson, DEQ Project Manager	971-806-5323	Daniel.Johnson@deq.Oregon.Gov
Sara Krepps, DEQ Lab QAO	503-956-9363	Sara.Krepps@deq.Oregon.Gov
Benjamin Hamilton, DEQ Field QAO	503-839-6551	Benjamin.T.Hamilton@deq.oregon.gov
Kathleen Schuckman, DEQ AQ Data Lead	503-509-6383	Kathleen.Schuckman@deq.Oregon.gov
Zach Koch, DEQ AQ PM2.5 Lead	971-806-3161	Zach.Koch@deq.Oregon.gov
Anthony Barnack, DEQ AQ Lead Worker	971-806-2223	Anthony.Barnack@deq.Oregon.gov
Tom Roick, DEQ AQ Monitoring Manager	503-593-2705	Tom.Roick@deq.Oregon.gov

To track the time and expenses spent on this project DEQ personnel must use the **Q-Time number** 46226.

1.2. Project/Task Organization

Sampling Organization: Oregon DEQ Laboratory and Environmental Assessment Program
7202 NE Evergreen Parkway,
Suite 150
Hillsboro, Oregon 97124
Ph: 503-693-5700
Contact: Daniel Johnson

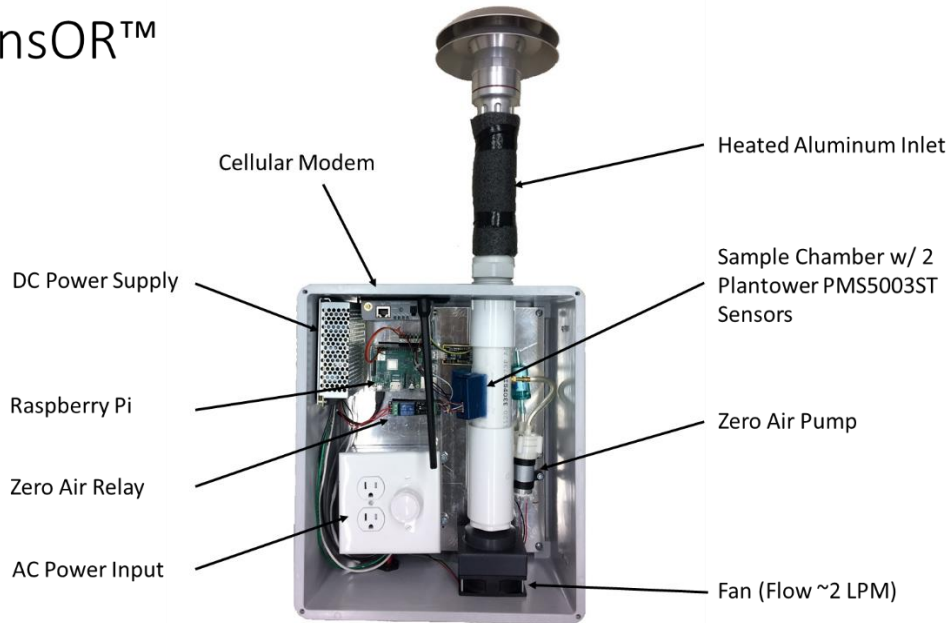
Analytical Organization: Realtime data, no lab analysis required.

1.3. Problem Definition/Background

Oregon has had an increase in wildfire smoke intrusions across the state causing community members to desire more real time air quality PM2.5 health information. In 2017, DEQ had approximately 35 air monitoring sites located mostly in areas that had high populations or high PM2.5 winter concentrations. Other areas, like the coast or very rural communities, had no air monitors. In the 2017-2019 biennium, the Oregon legislature funded the addition of 30 new PM2.5 air quality monitoring sites to be dispersed throughout Oregon to fill in some of these gaps. DEQ developed its SensOR™ as a low-cost alternative to other methods of measuring PM2.5 so that we could deploy more monitors with available resources. To decide on locations for the new SensORs, DEQ conducted a site search, reaching out to interested parties for comment. The result split the 30 monitors evenly between the three DEQ regions. This included permanent monitoring on the coast for the first time in decades. Finding actual sites and placing the additional 30 monitors took approximately two years to complete.

DEQ's Air Quality Monitoring section designed the SensOR™ to provide real-time PM_{2.5} data for public information in a manner similar to the state's existing network of Nephelometers. It features a small footprint, simplified setup and installation, low power consumption, and secure cellular communication in a weatherproof enclosure. (See figure 1)

SensOR™



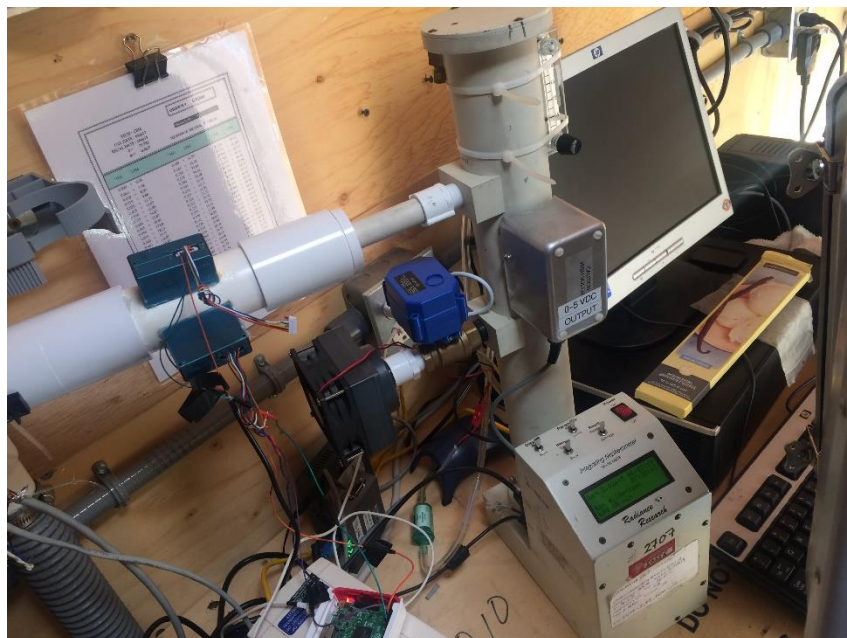
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Plantower 5003ST optical particulate sensor

Following a catastrophic 2020 wildfire season, the 2021 legislature funded the installation of 20 additional PM_{2.5} AQI sites to expand wildfire smoke monitoring. The SensOR™ will be used to populate these new sites.

The purpose of this SAP is to outline how the additional 20 sites will be selected, define the quality assurance process for the SensORs, and describe the final data to be shared with the public. The SAP uses Oregon DEQ's Criteria Pollutant Quality Assurance Project Plan as a reference.



1.4. Project/Task Description`

DEQ will gather information to help determine where the next 20 PM_{2.5} SensORs should be installed. Information will include:

- Airsheds that don't have monitors or are not otherwise represented by the existing network.
- Counties without monitors, typically these are coastal counties or interior counties with low populations
- Areas commonly impacted by wildfire smoke
- Areas with environmental justice concerns
- Input from agency partners and other interested parties including the Oregon Department of Forestry and Oregon Health Authority.

DEQ and OHA have recently developed an "Airshed Polygon Model" to advise this process, which will be presented tentatively in 2023.

Based on the factors above, DEQ will develop a list of proposed locations, post the proposed list on the web, and provide an opportunity for public comment. DEQ will take public comments into account, make adjustments to the proposed locations as appropriate, and finalize the list. If there are more than 20 locations requested by interested parties, DEQ will maintain a prioritized list of sites for additional monitors as resources allow.

Specific locations within a community or neighborhood will be decided by DEQ Air Quality Monitoring staff using siting criteria including meteorology, topography, emission sources, and availability of infrastructure for a monitor.

1.5. Quality Objectives and Criteria

Monitoring data will be measured, processed, and reported following standard DEQ Laboratory and Environmental Assessment Division (LEAD) procedures. The laboratory’s default analytical QA/QC procedures and criteria will be followed.

The data quality objective is to collect data for Real-time Air Quality Index usages. The data from this network should have accuracy within $\pm 20\%$ from the Federal Reference Method or Federal Equivalent Method. The data quality matrix is shown below.



Application	Pollutants	Precision & Accuracy ²	Examples	Supporting Documentation
Regulatory or compliance monitoring, Air toxics monitoring ³	Ozone, PM2.5, CO, NO ₂ , SO ₂ , Lead, VOCs, HAPs ³	+/- 10%	Filter-based FRM ⁴ sampler, Continuous FEM ⁵ PM monitor, FEM ozone analyzer, EPA laboratory protocols	40 CFR parts 50, 53, and 58, National Air Toxics Trend Station Technical Assistance document
Supplemental monitoring, Special studies, Real-time Air Quality Index	Ozone, PM2.5, H ₂ S, VOCs, Meteorology	+/- 20%	Nephelometer, E-BAM, H ₂ S monitor for odors, Calibrated met station, Sensor-based with quality control and validation	Organization’s approved quality assurance plan or sampling analysis plan
Area and source surveys, Screening; Fenceline monitoring, Personal exposure	Ozone, PM2.5, NO ₂ , VOCs, Meteorology	+/- 30%	Calibrated sensors, Home met station	EPA Air Sensor Toolbox
Information, Education, Community monitoring	Ozone, PM2.5, NO ₂ , CO, VOCs and others	+/- 50%	Low-cost sensors, Personal monitors	South Coast AQMD Air Quality Sensor Performance and Evaluation Center

1 This document is for informational use only. DEQ makes no claim, warranty or guarantee of instrument performance when operated by users for their specific applications.

2 These guidelines are likely to evolve as technology and science advance.

3 Hazardous air pollutants or air toxics

4 Federal Reference Method

5 Federal Equivalent Method

1.6. Documentation and Records

The SensOR data is electronically collected each hour by the Envidas database located at the Hillsboro LEAD offices so there are no Chain of Custody forms. The SensORs are audited quarterly and the audit forms are stored by the laboratory for three years. The audit information is added to the audit database. The data is reviewed by staff for data quality and reasonableness. Changes in the database are saved.

Policies and procedures for the maintenance of LEAD analytical records are described in the LEAD Quality Manual ([DEQ91-LAB-0006-LQM](#)).

2. Data Generation and Acquisition

2.1. Sampling Process Design

The SensOR collects data electronically and transmits the results by cell modem to the LEAD Database.

The locations of the sampling sites will be chosen after consultation with OR DEQ, OHA, other agencies, county, local, and tribal governments, community organizations and interested parties.

Proposed sampling locations are summarized in Table 2 and shown on the map in Figure 2.

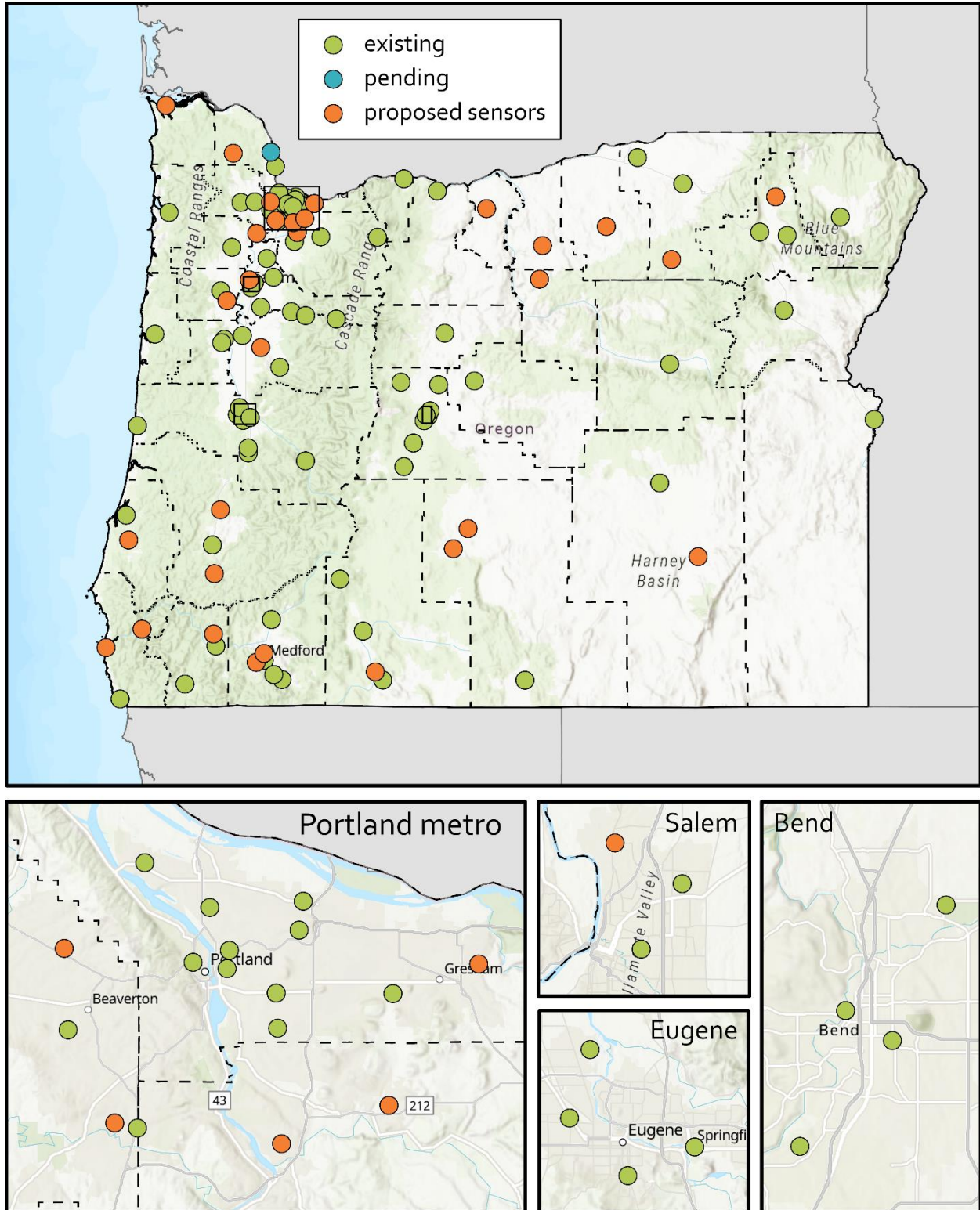
If a Station ID number is not available during QAPP/SAP development, the DEQ Laboratory will generate the unique identifier at the time of sample receipt.

Table 2. Summary of the proposed sampling locations

Station ID *	Name	County
	Damascus	Clackamas
	Gladstone	Clackamas
	Oregon City	Clackamas
	Seaside/Astoria	Clatsop
	Vernonia	Columbia
	Myrtle Point/Coquille	Coos
	Agness	Curry
	Gold Beach	Curry
	Canyonville	Douglas
	Sutherlin	Douglas
	Condon	Gilliam
	Steens Mtn	Harney
	Central Point	Jackson
	Jacksonville	Jackson
	Merlyn	Josephine
	Klamath Falls (2 nd Monitor)	Klamath
	Christmas Valley	Lake
	Paisley/Silver Lake	Lake
	Lebanon	Linn
	Salem/Keizer	Marion
	Heppner	Morrow
	Downtown Gresham	Multnomah
	Monmouth/Independence	Polk
	Moro	Sherman
	Ukiah	Umatilla
	Elgin	Union
	Beaverton (2 nd Monitor)	Washington
	Tigard	Washington
	Fossil	Wheeler
	Newberg	Yamhill

Figure 2. Map of Oregon Air Quality Monitoring Sites

Oregon Air Quality Monitoring Sites in 2022



2.2. Sampling Methods

The method utilizes optical sensing technology, analogous to the Radiance Nephelometer (DEQ13-LAB-0019-SOP) and is evaluated using the same metrics.

See “*SensOR Standard Operating Procedures, document number DEQ21-LAB-0040-SOP.*”

2.3. Sample Handling and Custody

N/A

2.4. Analytical Methods

N/A

2.5. Quality Control

The method utilizes optical sensing technology, analogous to the Radiance Nephelometer (DEQ13-LAB-0019-SOP) and is evaluated using the same metrics.

See “*SensOR Standard Operating Procedures*” for detailed information.

2.6. Data Management

Data generated will be presented in near real time on [DEQ’s AQI website](#) and Oregon Air mobile apps for [Android](#) and [iOS](#).

The DEQ laboratory will maintain copies of quality control and maintenance reports. Unless otherwise arranged, data generated by the DEQ laboratory will be moved to the LEAD online database following release to the project manager. Data in this database are publicly available.

Once the SensORs are installed, the hourly PM2.5 data will be uploaded to DEQ’s Envidas database [DEQ’s AQI website and Oregon Air mobile apps for Android and iOS](#). The AQI will also be used on the [Oregon Smoke Information](#) blog during wildfire events.

The Air Quality Index is calculated hourly using the [NowCast](#) equation to provide health-based guidance. The data will also be transmitted to EPA’s AIRNow [website](#), [mobile apps](#), and Fire and Smoke map. The data will also be made available from EPA’s AIRNow site as an API for custom applications. After the data goes through DEQ’s quality control process, it will be uploaded to the EPA’s [Air Quality System database](#).

Note that the data from this project is intended for real time air quality informational purposes and is used to inform health agencies and the public about air quality conditions in order to make real time health decisions. The data will also be used to screen for underlying PM2.5 problems that may require additional regulatory monitoring. Finally, the data will be used for trending information and may be presented in DEQ’s [Annual Air Quality Monitoring Annual Report](#) and in the [Wildfire Smoke Trends](#) report.

3. Assessment and Oversight

Overall project assessment and oversight, including field activities, will be the responsibility of the project manager. Laboratory assessment and oversight will be provided DEQ LEAD management and quality assurance officers as defined in the LEAD quality manual or for cause. Any analytical anomalies or delays encountered during laboratory operations will be communicated to the project manager in writing (e-mail is acceptable). The project manager will also be notified in writing of any data quality limitations that may be the result of laboratory operations.

4. Data Validation and Usability

The DEQ Laboratory will provide standard data review, verification, and validation on all analytical data generated by this project. The extent of the data review, verification, and validation is limited to the analytical processes only. However, in the best judgment of the DEQ QAO, any data that may be inaccurate, misleading, or otherwise fails the DEQ laboratory's quality standards due to field or sampling activities will be identified in the final data report. Moreover, this data will be appropriately qualified when transferred to the Laboratory online database. Data quality levels (DQL) will be assigned in accordance with DEQ guidance document *Data Validation and Qualification* ([DEQ09-LAB-0006-QAG](#)). Generally, only DQLs of A, or B will be acceptable for this project unless the basis for the data acceptability is approved and documented by the project manager. All data verification, validation, and assessment activities for project purposes are the responsibility of the project manager.