

Air Monitoring Equipment and Legislation

Technology, Washington Law, and Community Monitoring Efforts

Citizens for Safe Water and Air - Port Townsend

PORT TOWNSEND, WA

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This is a factual summary prepared for the Thriving Earth Exchange sulfur pollution assessment team. It summarizes research compiled on air monitoring equipment, other community air monitoring efforts, and the Washington State legislative landscape relevant to air pollution monitoring and enforcement. It presents information only; it does not make recommendations about how this information might apply to any specific project or next step.

1. Equipment and Measurement Technology

Consumer-Grade Total Volatile Organic Compound (TVOC) Sensors

Cost range: approximately \$200 to \$300. Examples include AirThings and the PurpleAir Zen, which added a general gas sensor (Bosch BME688) alongside its particulate sensor. These sensors use metal oxide sensing technology, which registers a combined Total Volatile Organic Compound (TVOC) reading and cannot distinguish one compound from another. Readings can be affected by humidity, temperature, and background sources such as vegetation.

Particulate Matter (PM2.5/PM10) Sensors

Cost range: approximately \$140 to \$350 per unit. PurpleAir is the most widely used brand in community monitoring networks. Independent testing by the South Coast Air Quality Management District's Air Quality Sensor Performance Evaluation Center found PurpleAir's PA-II model had the highest correlation with reference-grade instruments among 19 low-cost particulate matter sensors tested. PurpleAir sensors are documented to overestimate particulate matter concentrations during high-pollution events (such as wildfire smoke) by up to a factor of two without a correction factor applied.

Professional Compound-Specific Real-Time Monitors

Cost range: approximately \$1,000 to \$2,500 per unit for a base monitor plus one gas-specific sensor head (examples include sulfur dioxide, hydrogen sulfide, or volatile organic compound heads). The Aeroqual Series 500 is one example, used by air quality professionals and environmental health and safety managers, and can be configured for handheld or wall-mounted semi-fixed use. Monitoring multiple compound classes simultaneously at one location requires either swapping sensor heads or purchasing multiple heads.

Passive Sampling for Compound-Specific Laboratory Analysis

Passive thermal desorption tubes (a widely used brand is Markes International) collect air samples via diffusion over a set period, commonly one week, without requiring power, pumps, or calibration in the field. Samples are shipped to a laboratory for analysis by Thermal Desorption Gas Chromatography With Mass Spectrometry (TD-GC-MS), which identifies and quantifies individual compounds. This method is the basis for United States Environmental Protection Agency (EPA) Method 325, used for refinery fenceline benzene monitoring, and typically requires two-week passive monitoring periods under that method. A single sampler network of 100 to 200 units has been described in industry literature as deployable across a city or region.

Laboratory Analysis Costs

Costs vary by method and were documented from multiple commercial environmental laboratories.

- Passive badge or tube samples analyzed by Gas Chromatography With Flame Ionization Detection (GC/FID): \$160 to \$468 per sample. One laboratory's pricing caps at \$468 per sample regardless of how many of up to 28 compounds are requested on a single sample.
- Canister-based samples analyzed under United States Environmental Protection Agency (EPA) Method TO-15: \$650 to \$936 per sample, including field collection, transport, and reporting in one documented Seattle-area quote.

Fenceline-Specific Technology

The United States Environmental Protection Agency (EPA) has developed the SPod, a solar-powered, portable, lower-cost sensor system designed for deployment at industrial facility fencelines to detect fugitive volatile organic compound emissions. In December 2019, the United States Environmental Protection Agency (EPA) conducted a 21-day collocation study of prototype volatile organic compound sensors near a chemical facility in Louisville, Kentucky. The study found relative percent differences of 13 percent to 95 percent between same-manufacturer sensor units without correction; applying the United States Environmental Protection Agency (EPA)'s own fenceline-style baseline correction algorithm improved unit-to-unit precision to within approximately plus or minus 30 percent in most cases.

Calibration Methodology

A peer-reviewed 2026 study of a low-cost air quality sensor network in the New York City metropolitan area documented a Network Calibration Approach: a single keystone low-cost sensor package was collocated alongside regulatory reference-grade instruments at a New York State Department of Environmental Conservation monitoring site for 16 months. Data from that collocation period was used to train a calibration model, which was then applied across all sensor packages in the wider network. The approach was found to compensate for sensor degradation and drift over time.

2. Other Community Air Monitoring Efforts

Clean Air Methow (Washington State)

A Washington nonprofit, Methow Valley Citizens Council, operates the Clean Air Ambassador Program, launched in 2018. As of spring 2022, it included 35 or more volunteer hosts operating PurpleAir particulate matter sensors across the Methow and Okanogan Valleys, a rural area spanning

approximately 60 miles. The program explicitly collocates its low-cost sensors with the Washington State Department of Ecology's own reference-grade nephelometers in Twisp and Winthrop, and with a federal reference monitor in Omak, to develop a correction factor comparing the low-cost sensor readings against those instruments.

THRIVEair (Philadelphia, Pennsylvania)

A partnership between the environmental justice organization Philly Thrive and Drexel University public health scientists, conducted June 2023 through June 2024, near the former Philadelphia Energy Solutions refinery site. The project monitored 37 volatile organic compounds, including benzene, using passive thermal desorption tubes mounted 8 to 10 feet up on utility poles. Nine sites were monitored weekly; 11 additional sites were monitored on a rotating seasonal basis.

Quality control included field and laboratory blanks every two weeks, a duplicate co-located sample each week, and one site co-located with a government reference monitor. Samples were analyzed at a university laboratory using thermal desorption gas chromatography with mass spectrometry. Funding sources included a National Institute of Environmental Health Sciences research grant, Drexel University pilot funding, and a peace engineering fellowship; a Philly Thrive youth member was hired and paid as a field technician.

Average benzene concentration across stationary sites over the one-year period was 1.32 micrograms per cubic meter, with a range of 0.30 to 9.04 micrograms per cubic meter. When a specific site recorded an elevated one-week average, project members brought the finding directly to the site's redeveloper, Hilco Redevelopment Partners. The company had no legal obligation to respond, but began its own ongoing benzene monitoring at that location using a comparable sampling protocol, and has continued to share that data with the THRIVEair project on a weekly basis.

Philly Thrive's own public materials list the THRIVEair partnership as a named achievement, described as having "succeeded in putting air monitors up across South Philly." Separately, and documented independently of the monitoring project itself: in October 2024, the site's redeveloper released a Community Benefits Commitment pledging \$10 million toward community investment. Philly Thrive publicly characterized the negotiating process as non-transparent, and stated that the resulting document was a non-binding pledge rather than a legally enforceable community benefits agreement.

The organization's legal counsel stated publicly that the developer could modify or retract the document at its own discretion. Benzene monitoring and a binding cleanup standard, priorities Philly Thrive had sought, were not included as enforceable terms in the final commitment.

Paramount, California (South Coast Air Quality Management District)

In 2013, residents reported persistent metallic odors to the South Coast Air Quality Management District (SCAQMD). Initial screening measurements found elevated levels of nickel and hexavalent chromium. This led to expanded monitoring, including a partnership between the South Coast Air Quality Management District (SCAQMD) and the California Air Resources Board (CARB) specifically monitoring hexavalent chromium levels near schools in the area. According to the South Coast Air Quality Management District (SCAQMD)'s own published materials, monitoring data was used to identify emission sources, and the agency worked with local industry to reduce emissions through operational changes.

This program's outcomes led to the creation of a broader institutional effort, the Community Air Toxics Initiative, operating across the South Coast Air Basin.

California Assembly Bill 617 (Community Air Protection Program)

A California state law creating a formal process for community involvement in designing air monitoring plans, with the stated goal of connecting monitoring data to required local emissions reduction measures. In Imperial County, near the United States-Mexico border, a community air monitoring network's data was documented as having directly informed the state's implementation of Assembly Bill 617 in that county, resulting in mandated activities and additional funding for the local air district, including a requirement to develop local emissions reduction measures with community input.

A separate, peer-reviewed academic analysis of Assembly Bill 617's implementation in Richmond, California, examined whether new community air monitoring data was connected to actual emissions-reduction strategies in that jurisdiction's plan documents. That analysis found that most monitoring data was not used and was rarely connected to resulting regulatory or policy change.

Cherokee Concerned Citizens (Pascagoula, Mississippi)

A community organization in a neighborhood adjacent to an industrial park containing an oil refinery, a shipbuilding yard, and a federal Superfund site. The group combined low-cost air sensor deployment with simultaneous resident-reported symptom and odor logs, intended to document a correlation between measured pollution events and community-experienced health symptoms and odors, for use in the organization's advocacy with regulatory agencies.

United States Environmental Protection Agency (EPA) Support Programs

The United States Environmental Protection Agency (EPA)'s Air Sensor Toolbox provides published guidance for community groups on sensor selection, calibration, data interpretation, and communication of results. It was developed in part through a documented collaboration with two North Carolina groups, Clean Air Carolina and the Eastern Band of Cherokee Indians, and separately through a partnership with the Ironbound Community Corporation in Newark, New Jersey.

The United States Environmental Protection Agency (EPA)'s Enhanced Air Quality Monitoring for Communities program has issued grants in two tiers: "Small Grants" of \$25,000 to \$100,000 and larger "Large Grants," specifically for community-led air sensor network projects, along with a published Guide to Leveraging Low-Cost Sensors for Air Quality Monitoring.

3. Washington State Legislative and Regulatory Landscape

Healthy Environment for All (HEAL) Act

Passed as Senate Bill 5141 in 2021. Creates a statewide framework requiring seven state agencies (Health, Agriculture, Commerce, Ecology, Natural Resources, Transportation, and Puget Sound Partnership) to incorporate environmental justice considerations into strategic plans, develop community engagement plans, and conduct environmental justice assessments for certain significant agency actions.

The law is procedural: it requires agencies to assess and document cumulative environmental health impacts and community engagement, but does not itself grant agencies new authority to deny permits or mandate emissions reductions based on those assessments. The law directs 40 percent of covered agencies' environmental-benefit expenditures toward vulnerable populations and overburdened communities.

Climate Commitment Act (CCA)

Also passed in 2021. Establishes a cap-and-invest program for greenhouse gas emissions. A section of the law directs the Washington State Department of Ecology to identify overburdened communities, construct an air monitoring network in those communities, and identify the sources responsible for the greatest levels of criteria air pollutants in each. The law mandates that at least 35 percent of Climate Commitment Act investments serve overburdened communities, with an additional 10 percent for Tribal Nation-supported projects.

SensWA Air Monitoring Network

Established under the Climate Commitment Act's overburdened communities provision. The Washington State Department of Ecology has identified 16 specific overburdened communities statewide, using the Washington Environmental Health Disparities Map and the United States Environmental Protection Agency (EPA)'s EJScreen demographic index as primary selection criteria, alongside factors including historical redlining, health care access, and known health disparities.

The 16 identified communities are: South King County, South Seattle, Spokane and Spokane Valley, South and East Tacoma, Tri-Cities to Wallula, Vancouver, Everett, East Yakima, Lower Yakima Valley, North Seattle and Shoreline, Wenatchee and East Wenatchee, Ellensburg, Northeast Puyallup, Moxee Valley, Mattawa, and George and West Grant County. Jefferson County and Port Townsend are not among the 16 identified communities.

Ecology's most recent report on this program found that residents of the 16 identified communities live, on average, 2.4 years less than residents of the rest of Washington State due to health conditions linked to air pollution, and separately estimated approximately 430 adult deaths associated with fine particulate matter exposure within these communities.

Cumulative Risk Burden (CURB) Pollution Act

Legislation sponsored by Representative Sharlett Mena (D-Tacoma) and supported by the Front and Centered coalition. First introduced in the 2024 legislative session as House Bill 2070; did not pass. As originally drafted, the bill would have required permitting agencies to conduct a cumulative impact analysis for proposed projects in already-overburdened communities, and would have granted agencies authority to deny permits for projects that would add unacceptable levels of pollution to those communities, including specific authority to deny air pollution permits ranking 9 or 10 on the Washington Environmental Health Disparities Map.

Reintroduced in the 2025 legislative session as House Bill 1303 and Senate Bill 5380. By this point, the bill's content had changed substantially: it no longer called for a cumulative impact analysis with permit-denial authority, and instead focused on integrating an environmental justice element into the existing State Environmental Policy Act (SEPA) review process. House Bill 1303 did not advance to a full

House vote in the 2025 session. The Front and Centered coalition has listed the bill again among its stated priorities for the 2026 legislative session.

Sources and Citations

All factual claims in this document are drawn from the following sources, verified during research for this document.

1. Manufacturer product information and independent reviews, AirThings and PurpleAir Zen sensor specifications and pricing.
2. South Coast Air Quality Management District: Air Quality Sensor Performance Evaluation Center, independent testing of low-cost particulate matter sensors, including PurpleAir.
3. Aeroqual: Series 500 handheld air quality monitor product specifications and pricing.
aeroqual.com/products/series-500-handheld-air-quality-monitor
4. United States Environmental Protection Agency: Method 325 (fenceline monitoring of volatile organic compounds using passive diffusive tubes), regulatory method documentation underlying refinery fenceline benzene monitoring requirements.
5. SGS Galson: volatile organic compound laboratory analysis panel pricing.
sgsgalson.com/panel-pricing-voc-price-cap/
6. Commercial environmental laboratory pricing for United States Environmental Protection Agency Method TO-15 canister-based volatile organic compound analysis, multiple sources including a Seattle-area provider.
7. United States Environmental Protection Agency: SPod fenceline sensor system, and a December 2019, 21-day collocation study of prototype volatile organic compound sensors near a chemical facility in Louisville, Kentucky.
8. Peer-reviewed 2026 study of a low-cost air quality sensor network in the New York City metropolitan area documenting a Network Calibration Approach, including collocation with a New York State Department of Environmental Conservation reference-grade monitoring site; specific journal, volume, and full author list not independently confirmed in this session, flagged for verification before use in formal correspondence.
9. Methow Valley Citizens Council: Clean Air Ambassador Program, Methow and Okanogan Valleys, Washington, launched 2018, including collocation of volunteer-operated PurpleAir sensors with Washington State Department of Ecology reference-grade nephelometers in Twisp and Winthrop and a federal reference monitor in Omak.
10. THRIVEair project methodology and results, a partnership between Philly Thrive and Drexel University. Project site: thriveairphilly.com. Underlying methodology reviewed via a preprint manuscript; full peer-reviewed publication status not independently confirmed in this session.
11. Philly Thrive: "Our Victories," phillythrive.org/about-us/our-victories/
12. South Coast Air Quality Management District: published materials on the 2013 Paramount, California hexavalent chromium and nickel monitoring response, the partnership with the California Air Resources Board, and the resulting Community Air Toxics Initiative.
13. California Assembly Bill 617 (Community Air Protection Program) implementation record in Imperial County, California, documenting community air monitoring network data informing local emissions reduction measures and air district funding.
14. Peer-reviewed academic analysis of California Assembly Bill 617 implementation in Richmond, California, examining the connection between new community air monitoring data and resulting regulatory or policy change; specific journal, volume, and full author list not independently confirmed in this session, flagged for verification before use in formal correspondence.

15. Cherokee Concerned Citizens (Pascagoula, Mississippi): community air sensor deployment and resident-reported symptom and odor log methodology, documented in project materials and reporting on the group's advocacy work.
16. United States Environmental Protection Agency: Air Sensor Toolbox, including documented collaboration with Clean Air Carolina, the Eastern Band of Cherokee Indians, and the Ironbound Community Corporation (Newark, New Jersey).
17. United States Environmental Protection Agency: Enhanced Air Quality Monitoring for Communities grant program (Small Grants and Large Grants) and Guide to Leveraging Low-Cost Sensors for Air Quality Monitoring.
18. Washington State Legislature: Healthy Environment for All Act, Senate Bill 5141, 2021. Washington State Department of Ecology summary: ecology.wa.gov/about-us/who-we-are/environmental-justice/heal
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20. Washington State Department of Ecology: SensWA overburdened communities air monitoring network, list of 16 identified communities. ecology.wa.gov/air-climate/climate-commitment-act/overburdened-communities
21. Front and Centered coalition: Cumulative Risk Burden (CURB) Pollution Act legislative history and 2026 priorities. frontandcentered.org/curb-pollution/