State of Hawaii
2025
Ambient Air Monitoring Network 5-Year Assessment

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State of Hawaii
Department of Health
Environmental Management Division
Clean Air Branch

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Abbreviations and Definitions

AADT	Annual Average Daily Traffic
AQMS	Air Quality Monitoring Section
BAM	Met-One Beta-Attenuation Monitor
CAB	Clean Air Branch
CBSA	Core-based Statistical Area
CFR	Code of Federal Regulations
CIP	Campbell Industrial Park (Oahu)
CO	Carbon monoxide gas
DBEDT	State of Hawaii Department of Economic Development and Tourism
DOH	Hawaii State Department of Health
DRR	Data Requirements Rule
ECA	Emissions Control Area (MARPOL)
EPA (R9)	United States Environmental Protection Agency (Region 9)
FEM	Federal Equivalent Method
FRM	Federal Reference Method
H_2S	Hydrogen sulfide gas
HCl	Hydrogen chloride gas
HF	Hydrogen fluoride gas
HECO	Hawaiian Electric Company
HVNP	Hawaii Volcanoes National Park
IMPROVE	Integrated Monitoring of Protected Visual Environments
LERZ	Lower East Rift Zone of Kilauea Volcano
MARPOL	International Convention for the Prevention of Pollution from Ships
MSA	U. S. Census Bureau, Metropolitan Statistical Area
NAAQS	National Ambient Air Quality Standards
NCore	National Core Multi-pollutant Monitoring Stations
NEI	National Emissions Inventory (2014)
NO_2	Nitrogen dioxide gas
NPS	U. S. National Park Service
O_3	Ozone
OMB	U. S. Office of Management and Budget
Pb	Lead
$PM_{2.5}$	Particulate matter less than or equal to 2.5 microns in aerodynamic diameter
PM_{10}	Particulate matter less than or equal to 10 microns in aerodynamic diameter
PGV	Puna Geothermal Venture
PSD	Prevention of Significant Deterioration
ppb	Parts per billion, a measurement unit for gases
ppm	Parts per million; a measurement unit for gases
PWEI	Population Weighted Emissions Index, an EPA calculation that triggers SO_2 monitoring
SLAMS	State and Local Air Monitoring Stations
SO_2	Sulfur dioxide gas
SPMS	Special Purpose Monitoring Stations
TPD	Tons per day
TPY	Tons per year
vog	Haze due to volcanic emissions
WD	Wind direction
WS	Wind speed
$\mu g/m^3$	micrograms per cubic meter of air; a measurement unit for particulate matter

I. Executive Summary

A. Purpose of Assessment

40 Code of Federal Regulations (CFR) Part 58 requires that a network assessment of the air quality surveillance system be conducted once every five years to determine if the network is effective and efficient in meeting monitoring objectives, whether new sites are needed, or existing sites or monitors can be terminated and whether there are new technologies that can be incorporated.

Conducted once every five years, with the first one completed in 2010, the assessment provides a more robust and comprehensive conceptualization of the current and future needs of the state's air surveillance network. The annual network plan consequently applies, resources allowing, the recommendations and decisions resulting from the assessment.

B. Ambient Air Monitoring Networks

The State of Hawaii Department of Health (DOH) currently operates sixteen (16) ambient air monitoring stations across four major islands, including one designated as an NCore station. On Maui, the Kahului station is equipped with a $PM_{2.5}$ monitor. DOH is also considering the future addition of a gas monitoring station on Maui to support population-based air quality monitoring.

In addition to the DOH network, ambient air monitoring is conducted by private industry and the U.S. National Park Service (NPS). The state's regulatory monitoring is further supplemented by low-cost air quality sensors. Data from all of these sources are publicly available and enhance the overall understanding of air quality conditions in Hawaii.

The main air surveillance concerns in the state include:

- Sulfur dioxide (SO_2) and sulfate aerosols ($PM_{2.5}$) from future Kilauea volcano eruptions;
- Hydrogen sulfide (H_2S) emissions from geothermal energy production and exploration;
- Agricultural activities and commercial/industrial/residential development on all four islands;
- Implementing new monitoring as required by revisions or additions to the National Ambient Air Quality Standards (NAAQS) as well as revisions and additions to 40 CFR 58;
- Cruise ship emissions on the island of Kauai.

C. Summary of 2025 Findings

The biggest challenge for the program is that compliance with new monitoring requirements as well as meeting the state's monitoring priorities are outpacing funding and resources. The necessity of doing more with less was one of the principal considerations when planning the future of the state's air monitoring

network. Where allowed, DOH will partner with the private sector to accomplish monitoring goals.

Prioritization of Pollutants

DOH analyzed historical data from the monitoring network on a pollutant-by-pollutant basis to determine a priority ranking of each of the criteria pollutants. The ranking was based on each pollutant's average percentage of the NAAQS, whether the trend increased or decreased and its relative importance in meeting the state's monitoring objectives and goals. Based on those factors, the priority ranking was determined to be:

1. $PM_{2.5}$
2. SO_2
3. Nitrogen dioxide (NO_2)
4. Ozone (O_3)
5. Coarse particles (PM_{10})
6. Carbon Monoxide (CO)

Findings

In planning the future of the air monitoring network, DOH considered factors such as climate, topography, population characteristics, and the location of emission sources.

Key findings and recommendations include:

- The current monitoring network generally meets the state's air quality objectives and complies with minimum federal requirements.
- The major eruption of Kilauea volcano's Lower East Rift Zone (LERZ) on Hawaii Island, which began in May 2018 and ended in August 2018, significantly increased the need for air monitoring in that region. In response, DOH established six (6) additional monitoring stations.
- Lava from the LERZ eruption destroyed the Puna E station, which had been monitoring for potential H_2S emissions from the Puna Geothermal Venture (PGV) power plant. DOH collaborated with the Leilani Community Association to install a replacement H_2S monitor at their community center. SO_2 is also monitored at this location, although the probe siting does not meet all criteria specified in 40 CFR Part 50.
- The state has completed at least three years of data collection at two SO_2 monitoring stations established in early 2017, as required by EPA's SO_2 Data Requirements Rule (DRR). EPA has approved the shutdown of both stations.
- At this time, no new monitoring is needed except to potentially meet future EPA requirements, such as near-road NO_2 monitoring if population thresholds are reached.

Specific Recommendations:

- Combine and upgrade the Kapolei NCore/SLAMS monitoring station.
- Prepare to establish a near-road NO_2 monitoring station if the Urban Honolulu Metropolitan Statistical Area (MSA) reaches a population of one million.
- Install a 10-meter meteorological tower at the Sand Island station to improve characterization of O_3 formation from sources in downtown Honolulu.
- Continue cruise ship-related monitoring on Kauai. Data from the Niumalu station show significant SO_2 reductions; consider relocating the station, if resources permit, to a population center such as Lihue or Kapaa, which are designated as micropolitan statistical areas.
- Continue operation of the two $PM_{2.5}$ monitoring stations in Kihei and Kahului. When resources allow, consider adding continuous monitoring for CO, NO_2, and SO_2 on Maui.
- Maintain the nine SO_2 and $PM_{2.5}$ volcanic emissions monitoring stations on Hawaii Island.
- Continue H_2S monitoring in Puna for emissions associated with geothermal energy production and exploration.
- Supplement the regulatory network with temporary monitoring devices, including low-cost air quality sensors.
- Modify the designation of the Hilo $PM_{2.5}$, Kona $PM_{2.5}$, and Pahala SO_2 stations from Special Purpose Monitoring Stations (SPMS) to State and Local Air Monitoring Stations (SLAMS) effective January 1, 2026.

II. Introduction

In the CFR, EPA promulgated a requirement for all states to conduct and submit a network assessment once every five years [40 CFR 58.10(e)].

"*The state, or where applicable local, agency shall perform and submit to the EPA Regional Administrator an assessment of the air quality surveillance system every 5 years to determine, at a minimum, if the network meets the monitoring objectives defined in appendix D to this part, whether new sites are needed, whether existing sites are no longer needed and can be terminated, and whether new technologies are appropriate for incorporation into the ambient air monitoring network. The network assessment must consider the ability of existing and proposed sites to support air quality characterization for areas with relatively high populations of susceptible individuals (e.g., children with asthma), and, for any sites that are being proposed for discontinuance, the effect on data users other than the agency itself, such as nearby States and Tribes or health effects studies. For $PM_{2.5}$, the assessment also must identify needed changes to population-oriented sites. The State, or where applicable local, agency must submit a copy of this 5-year assessment, along with a revised annual network plan, to the Regional Administrator. The first assessment is due July 1, 2010.*"

Elements evaluated in the assessment include community concerns, location of asthma corridors, population shifts and emissions inventory. The assessment allows decision-makers to ensure that the current and future air surveillance network is established and operated efficiently and effectively to meet the state's environmental goals.

Ambient air data is used for a variety of purposes including:

- NAAQS compliance;
- Providing near real-time air quality information to the public;
- Permit modeling;
- Pollutant trend analysis;
- Health studies;
- Forecasting;
- Source monitoring; and,
- Evaluating the effects of emissions controls.

Questions asked during the assessment included:

- Are the current monitoring objectives being met or should the objectives be modified?
- Based on trend evaluation, what is the priority ranking by pollutant and by station?
- Are there areas that are underserved based on population and health statistics?
- Are there monitors or stations that could/should be discontinued or moved?
- Are there new technologies that can be used to optimize, streamline, or enable the network to operate more efficiently?
- Are there hot spot areas that would benefit from the deployment of temporary or mobile monitoring?
- How can resources be used most efficiently and effectively?

III. Overview of Networks

A. Ambient Air Monitoring Networks

DOH currently operates sixteen (16) ambient air monitoring stations on four of the major islands, including the NCore station. The Kahului, Maui station currently operates one $PM_{2.5}$ monitor. A gas monitoring station for population-based monitoring is being considered for Maui in the future. Lead (Pb) monitoring was discontinued on December 31, 2018 with EPA approval.

Ambient air monitoring is also being conducted by private industry and the U.S. National Park Service (NPS). Data from these networks are publicly available and supplements the data being collected by DOH.

The main air surveillance concerns in the state include:

- SO_2 and sulfate aerosols ($PM_{2.5}$) from Kilauea volcano eruptions;

- H_2S emissions from geothermal energy production and exploration;
- Agricultural activities and commercial/industrial/residential development on the island of Maui;
- Implementing new monitoring as required by revisions or additions to the NAAQS as well as revisions and additions to 40 CFR 58;
- Cruise ship emissions on the island of Kauai.

B. Current Air Monitoring in the State of Hawaii

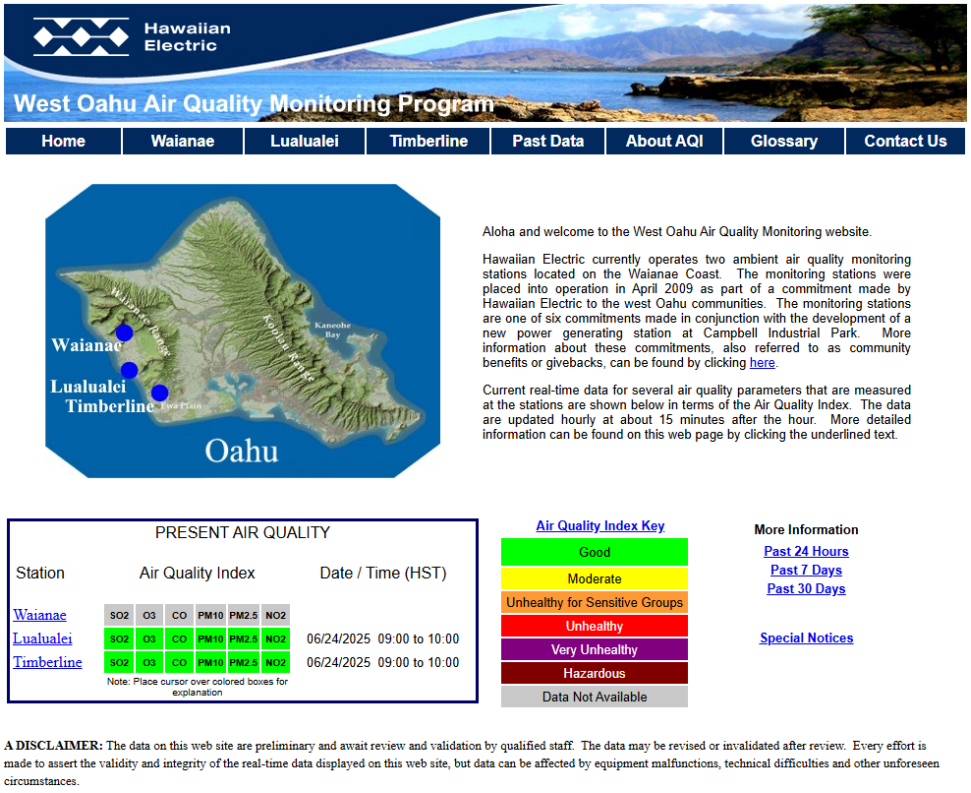
DOH currently operates 16 monitoring stations on four islands. There are two MSAs in the state: Urban Honolulu (hereafter called Oahu), which encompasses the island of Oahu; and the Kahului-Wailuku-Lahaina MSA (hereafter called Maui) covering the County of Maui. There are also two Micropolitan Statistical Areas: Hilo (Hawaii County) and Kapaa (Kauai County). The state's network meets or exceeds the minimum monitoring requirements in 40 CFR 58 Appendix D. The air quality data from the monitoring stations can be found at https://air.doh.hawaii.gov/home/map.

In addition to DOH ambient air monitoring stations, there are other private as well as federal air monitoring stations operating within the state. These include:

Hawaiian Electric Company (HECO) West Oahu Air Monitoring Network

In April 2009, HECO (Oahu's only electrical utility provider) began operating three ambient air monitoring stations along the Waianae coast of Oahu. This was part of a commitment to the west Oahu communities for the development and operation of a new power generation station in the nearby Campbell Industrial Park (CIP). All three stations monitor for CO, SO_2, NO_2, O_3 and $PM_{2.5}$ as well as wind speed (WS), wind direction (WD), ambient temperature and precipitation. Data from the three stations are publicly available on their website at www.westoahuair.com.

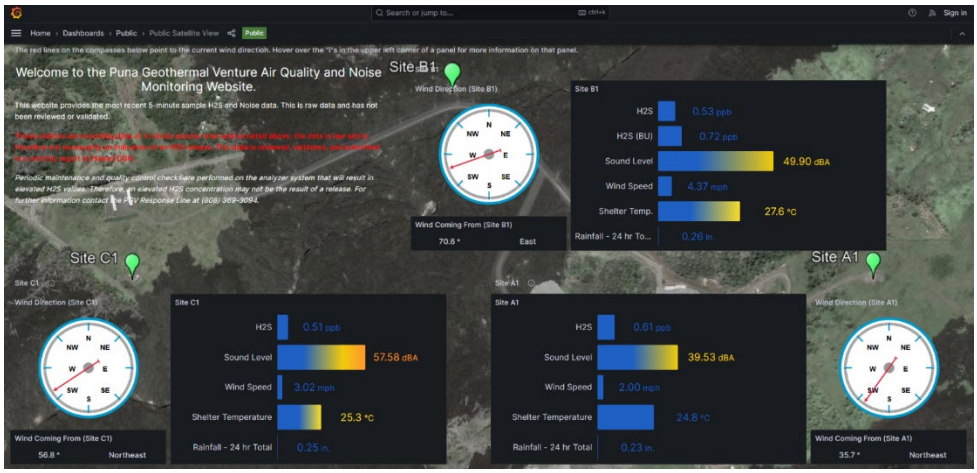
Figure 1. HECO Website



Puna Geothermal Ventures (PGV)

PGV operates a geothermal energy production facility on the island of Hawaii. As a condition of their non-covered source permit, the facility is required to operate and maintain three perimeter stations for the continuous monitoring of hydrogen sulfide gas (H_2S) as well as wind speed and direction. The three original stations that were being operated by PGV were buried by the lava flow resulting from the 2018 Kilauea volcano's LERZ eruption. Three new stations were constructed and are now operating at different locations along the perimeter the plant. The most recent 5-minute H_2S data is publicly available on the PGV webpage at http://72.235.6.171:3000/d/8F9xTc8Mk/public-satellite-view?orgId=1&refresh=30s.

Figure 2. PGV Website



National Park Service (NPS)

The NPS operates and maintains the two Integrated Monitoring of Protected Visual Environments (IMPROVE) stations in the state. Hawaii has two Class I visibility areas: Haleakala National Park on Maui and Volcanoes National Park on Hawaii (HVNP). Until 2018, there were two stations in HVNP that continuously monitored the SO_2 emissions from the Kilauea volcano; the two stations were destroyed by earthquakes near the summit. Air quality data and webcam can be found at https://www.nps.gov/subjects/air/webcams.htm?site=havo.

Figure 3. NPS Webcam

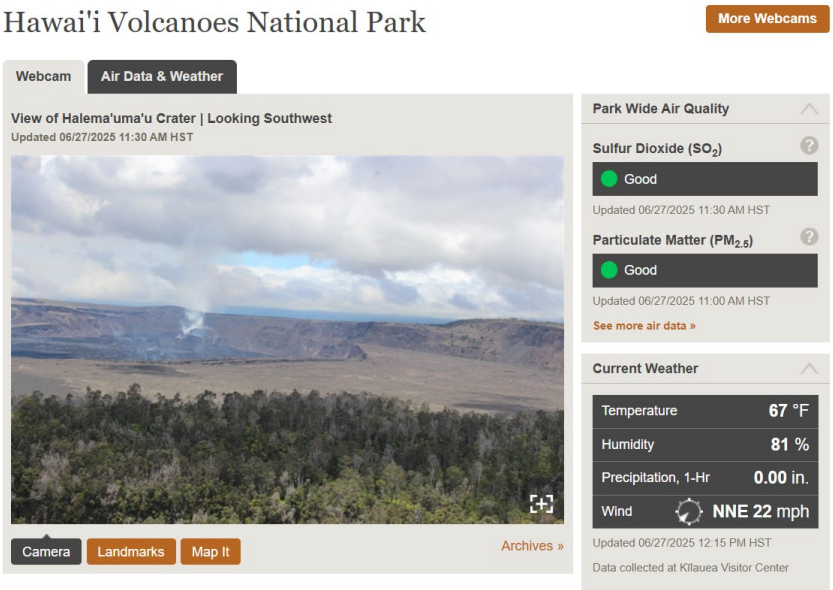


Table 1 lists the various monitoring stations in the state and the Figure 1 map shows the location of each station listed in the table. Table 2 shows the monitor and station network summary. Figures 4-10 show the locations of stations by pollutant.

Table 1. Air Monitoring in the State of Hawaii – 2025

Entity	Location of Monitoring	Program	Parameters
DOH	Honolulu, Oahu	SLAMS	SO_2, CO, $PM_{2.5}$, PM_{10}
	Kapolei, Oahu	SLAMS/NCore	SO_2, CO, NO_2, $PM_{2.5}$, PM_{10}, $PM_{10-2.5}$, O_3, NOy, $PM_{2.5}$ spec.
	Pearl City, Oahu[1]	SLAMS	$PM_{2.5}$, PM_{10}
	Sand Island, Oahu	SLAMS	$PM_{2.5}$, O_3
	Kahe, Oahu[2]	SLAMS/DRR	SO_2
	Waiau, Oahu[3]	SPMS	SO_2
	Kihei, Maui[4]	SLAMS	$PM_{2.5}$
	Kahului, Maui	SPMS	$PM_{2.5}$
	Niumalu, Kauai[5]	SPMS	SO_2, NO_2, $PM_{2.5}$
	Hilo, Hawaii	SLAMS/SPMS	SO_2, $PM_{2.5}$
	Kona, Hawaii	SLAMS/SPMS	SO_2, $PM_{2.5}$
	Mt. View, Hawaii	SPMS	SO_2, $PM_{2.5}$
	Ocean View, Hawaii	SPMS	SO_2, $PM_{2.5}$
	Pahala, Hawaii	SPMS	SO_2, $PM_{2.5}$
	Leilani (Puna), Hawaii	SPMS	SO_2, H_2S
	Honaunau, Hawaii[6]	SPMS	$PM_{2.5}$
	Kailua-Kona, Hawaii	SPMS	$PM_{2.5}$
	Keaau, Hawaii	SPMS	SO_2, $PM_{2.5}$
	Naalehu, Hawaii	SPMS	SO_2, $PM_{2.5}$
	Waikoloa, Hawaii	SPMS	SO_2, $PM_{2.5}$
HECO	Waianae, Oahu[7]	West Oahu Air	SO_2, CO, NO_2, O_3, $PM_{2.5}$
	Lualualei, Oahu	West Oahu Air	SO_2, CO, NO_2, O_3, $PM_{2.5}$
	Timberline, Oahu	West Oahu Air	SO_2, CO, NO_2, O_3, $PM_{2.5}$
PGV	Pahoa, Hawaii (A-1)	PGV	H_2S
	Pahoa, Hawaii (B-1)	PGV	H_2S
	Pahoa, Hawaii (C-1)	PGV	H_2S
NPS	Haleakala National Park, Maui	IMPROVE	$PM_{2.5}$ spec.
	HVNP	IMPROVE	$PM_{2.5}$ spec.

[1] Pearl City station was discontinued on April 6, 2022.
[2] Kahe station was discontinued on September 30, 2024.
[3] Waiau station was discontinued on December 31, 2021.
[4] Kihei $PM_{2.5}$ was discontinued on March 30, 2022, and restarted on August 22, 2023 as SPM emergency response to wildfire.
[5] NO_2 and $PM_{2.5}$ was discontinued at Niumalu on March 31, 2022. SO_2 data collection stopped August 28, 2024 and resumed on April 22, 2025.
[6] Honaunau station was discontinued on January 5, 2022.
[7] Waianae station was shut down on November 6, 2019 for relocation to a new site.

Table 2. Monitor and Station Network Summary

Site Name	Site ID	City, Island	Site Start Date	Latitude Longitude	Location Setting	Monitor Type	Measurement Scale	Monitoring Objective	Pollutant /Method	Assigned Value from Assessment	Straw for Optimization
Honolulu	150031001	Honolulu, Oahu	January 1, 1972	21.30758 -157.85542	Urban	SLAMS	Neighborhood	Population Exposure	$PM_{2.5}$ Continuous	Credible - Supports AQI	Keep
						SLAMS	Neighborhood	Population Exposure	PM_{10} Continuous	Critical - PM_{10} Design Value	Keep
						SLAMS	Neighborhood	Population Exposure	SO_2	Credible - Supports AQI	Keep
						SLAMS	Middle	Maximum Concentration	CO	Credible	Keep
Kapolei/ NCore	150030010	Kapolei, Oahu	July 29, 2002	21.32374 -158.08861	Urban	SLAMS	Neighborhood	Population Exposure	NO_2	Critical - NO_2 Design Value	Keep
						SLAMS/NCore	Neighborhood	Population Exposure	$PM_{2.5}$ Continuous	Critical - NCore	Keep
						SLAMS	Neighborhood	Population Exposure	PM_{10}	Critical - PM_{10} Design Value	Keep
						SLAMS/NCore	Neighborhood	Population Exposure	$PM_{10-2.5}$	Critical - NCore	Keep
						SLAMS/NCore	Neighborhood	Population Exposure	CO Trace	Critical - NCore	Keep
						SLAMS/NCore	Neighborhood	Population Exposure	SO_2 Trace	Critical - NCore	Keep
						SLAMS/NCore	Neighborhood	Population Exposure	O_3	Critical - NCore	Keep
						SLAMS/NCore	Neighborhood	Population Exposure	NO/NO_y	Critical - NCore	Keep
						SLAMS/NCore	Collocated	Collocation Requirement	$PM_{2.5}$ FRM Collocated	Critical - Collocation	Keep
						SLAMS/NCore	Neighborhood	Population Exposure	$PM_{2.5}$ FRM Speciation	Critical - NCore	Keep
Sand Island	150031004	Honolulu, Oahu	January 1, 1980	21.39283 -157.87117	Urban	SLAMS	Collocated	Transport	$PM_{2.5}$ FRM Collocated	Critical - Collocation	Keep
						SLAMS	Urban	Transport	$PM_{2.5}$ Continuous	Credible - Supports AQI	Keep
						SLAMS	Urban	Maximum Concentration	O_3	Critical - O_3 Design Value	Keep
Kihei	150090006	Kihei, Maui	January 1, 2024	20.780997 -156.44637	Suburban	SPMS	Neighborhood	Source/ Population Exposure	$PM_{2.5}$ Continuous	Credible - Supports AQI	Keep
Kahului	150090025	Kahului, Maui	January 13, 2015	20.869444 -156.492417	Suburban	SPMS	Neighborhood	Population Exposure	$PM_{2.5}$ Continuous	Credible - Supports AQI	Keep
Niumalu	150070007	Lihue, Kauai	April 1, 2011	21.9495 -159.365	Suburban	SPMS	Neighborhood	Source	SO_2	Credible – Monitors Source	Keep
Hilo	150011006	Hilo, Hawaii	January 1, 2009	19.71756 -155.11053	Suburban	SPMS	Neighborhood	Source/ Population Exposure	$PM_{2.5}$ Continuous	Credible - Supports AQI	Keep
						SLAMS	Neighborhood	Source/ Population Exposure	SO_2	Critical - SO_2 Design Value	Keep
Kona	150011012	Kona, Hawaii	January 1, 2009	19.50978 -155.91342	Suburban	SPMS	Neighborhood	Source/ Population Exposure	$PM_{2.5}$ Continuous	Critical - $PM_{2.5}$ Source Impact	Keep
						SLAMS	Neighborhood	Source/ Population Exposure	SO_2	Credible - Supports AQI	Keep
Leilani	150012035	Pahoa, Hawaii	June 1, 2021	19.465658 -154.914561	Rural	SPMS	Neighborhood	Source	SO_2	Credible - Supports AQI	Keep
						SPMS	Neighborhood	Source	H_2S	Credible - Monitors source	Keep
Mountain View	150012023	Mountain View, Hawaii	December 8, 2010	19.57002 -155.08046	Suburban	SPMS	Neighborhood	Source/ Population Exposure	$PM_{2.5}$ Continuous	Credible - Supports AQI	Keep
						SPMS	Neighborhood	Source/ Population Exposure	SO_2	Credible - Supports AQI	Keep
Ocean View	150012020	Ocean View, Hawaii	April 1, 2010	19.11756 -155.77814	Rural	SPMS	Neighborhood	Source/ Welfare	$PM_{2.5}$ Continuous	Credible - Supports AQI	Keep
						SPMS	Neighborhood	Source/ Maximum Concentration	SO_2	Critical - High SO_2 Concentrations	Keep
Pahala	150012016	Pahala, Hawaii	August 10, 2007	19.2039 -155.48018	Rural	SPMS	Neighborhood	Source/ Welfare	$PM_{2.5}$ Continuous	Credible - Supports AQI	Keep
						SPMS	Neighborhood	Source/ Maximum Concentration	SO_2	Critical - High SO_2 Concentrations	Keep

Site Name	Site ID	City, Island	Site Start Date	Latitude Longitude	Location Setting	Monitor Type	Measurement Scale	Monitoring Objective	Pollutant /Method	Assigned Value from Assessment	Straw for Optimization
Kailua-Kona	150013034	Kailua-Kona, Hawaii	November 15, 2018	19.618158 -155.971242	Suburban	SPMS	Neighborhood	Source/ Population Exposure	$PM_{2.5}$ Continuous	Credible - Supports AQI	Keep
Keaau	150013027	Keaau, Hawaii	June 30, 2022	19.605424 -155.051379	Suburban	SPMS	Neighborhood	Source/ Welfare	$PM_{2.5}$ Continuous	Credible - Supports AQI	Keep
						SPMS	Neighborhood	Source/ Welfare	SO_2	Credible - Supports AQI	Keep
Naalehu	150013033	Naalehu, Hawaii	September 6, 2018	19.060656 -155.579167	Rural	SPMS	Neighborhood	Source/ Population Exposure	$PM_{2.5}$ Continuous	Credible - Supports AQI	Keep
						SPMS	Neighborhood	Source/ Population Exposure	SO_2	Credible - Supports AQI	Keep
Waikoloa	150012021	Waikoloa, Hawaii	August 4, 2021	19.977467 -155.798067	Rural	SPMS	Neighborhood	Source/ Population Exposure	$PM_{2.5}$ Continuous	Credible - Supports AQI	Keep
						SPMS	Neighborhood	Source/ Population Exposure	SO_2	Credible - Supports AQI	Keep

Figure 4. Air Monitoring Stations in the State of Hawaii – 2025

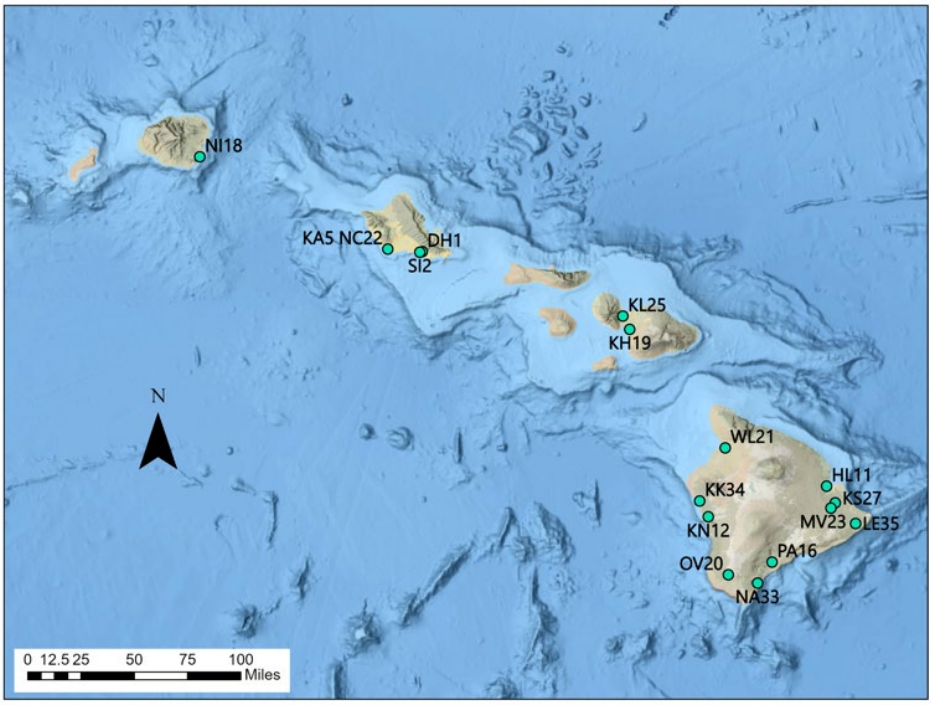


Figure 5. $PM_{2.5}$ Stations

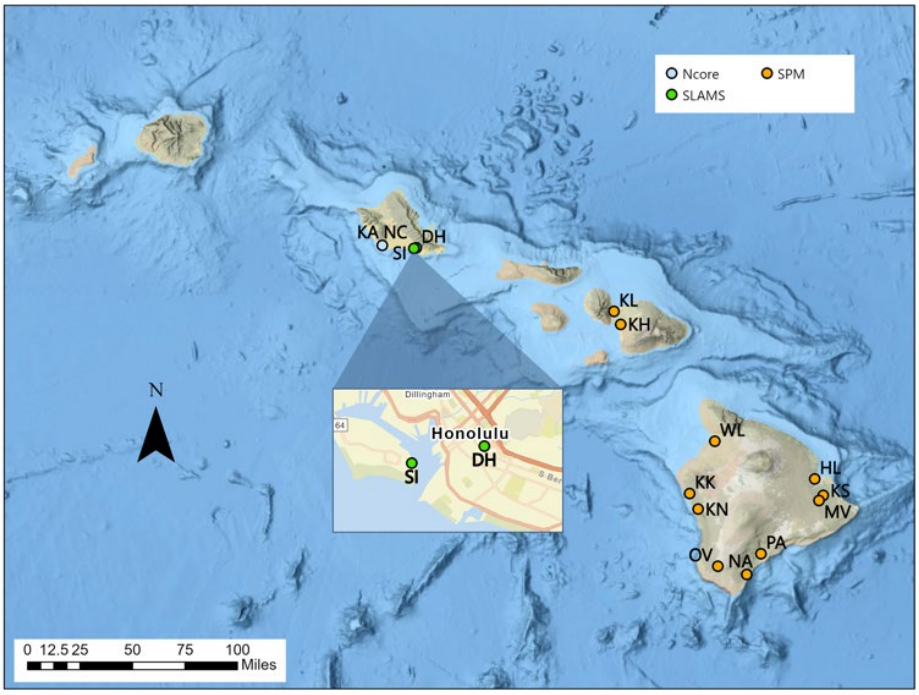


Figure 6. SO_2 Stations

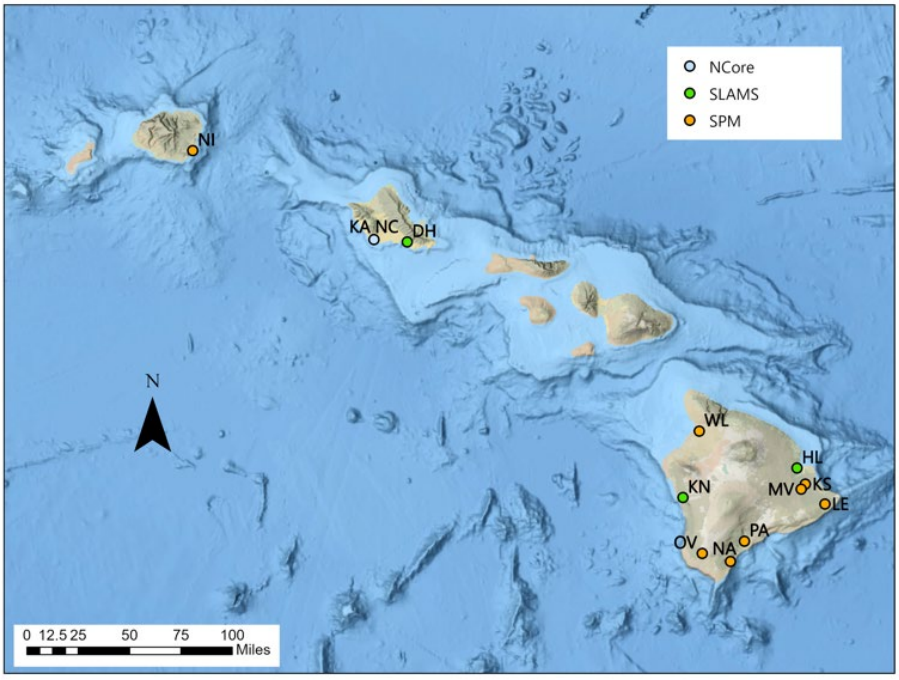


Figure 7. NO_2 Station

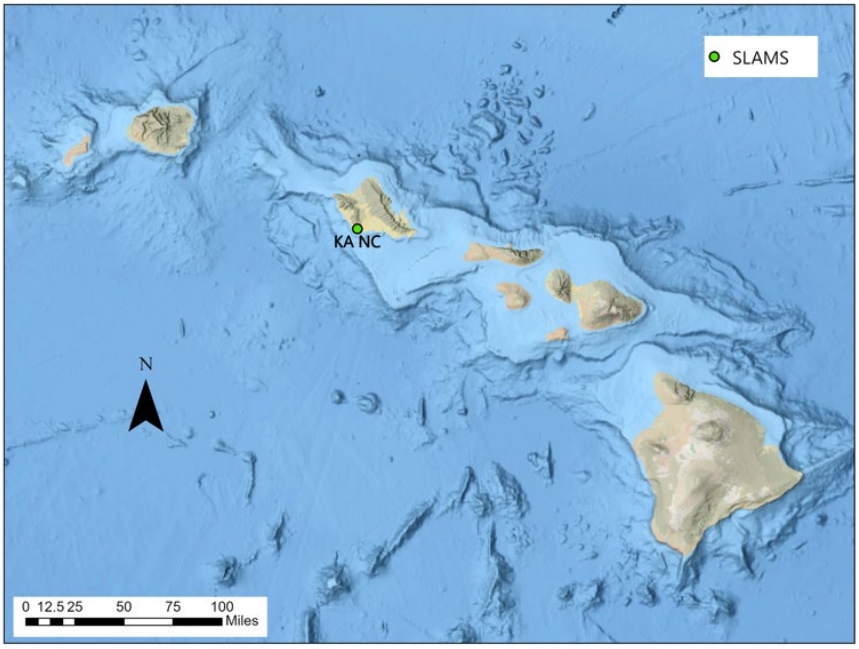


Figure 8. O_3 Stations

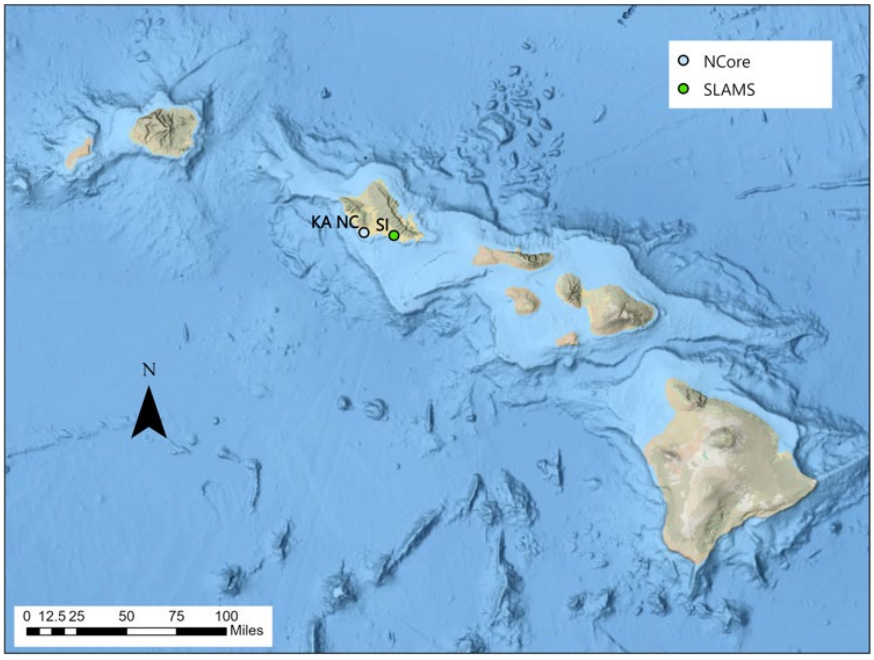


Figure 9. PM_{10} Stations

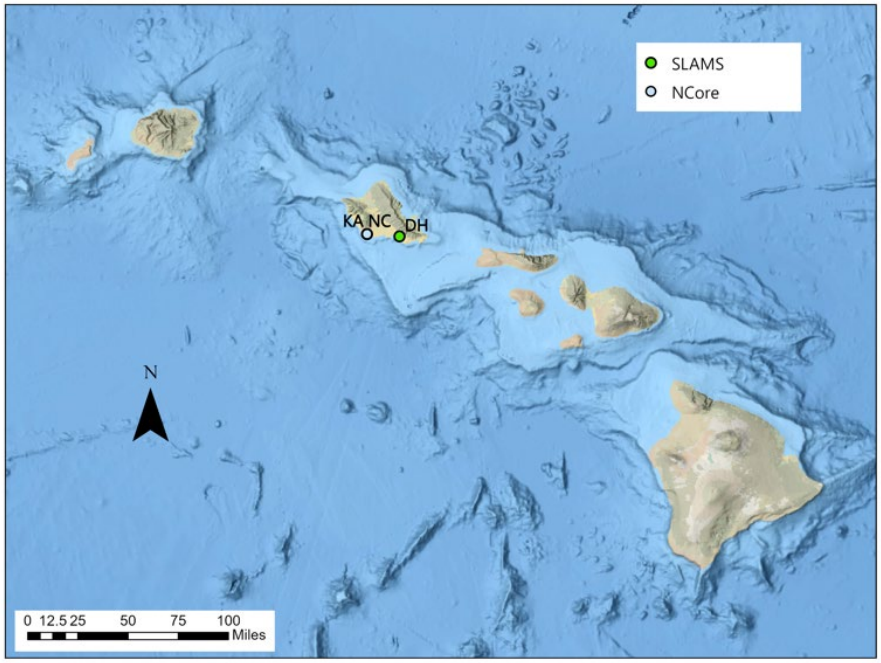
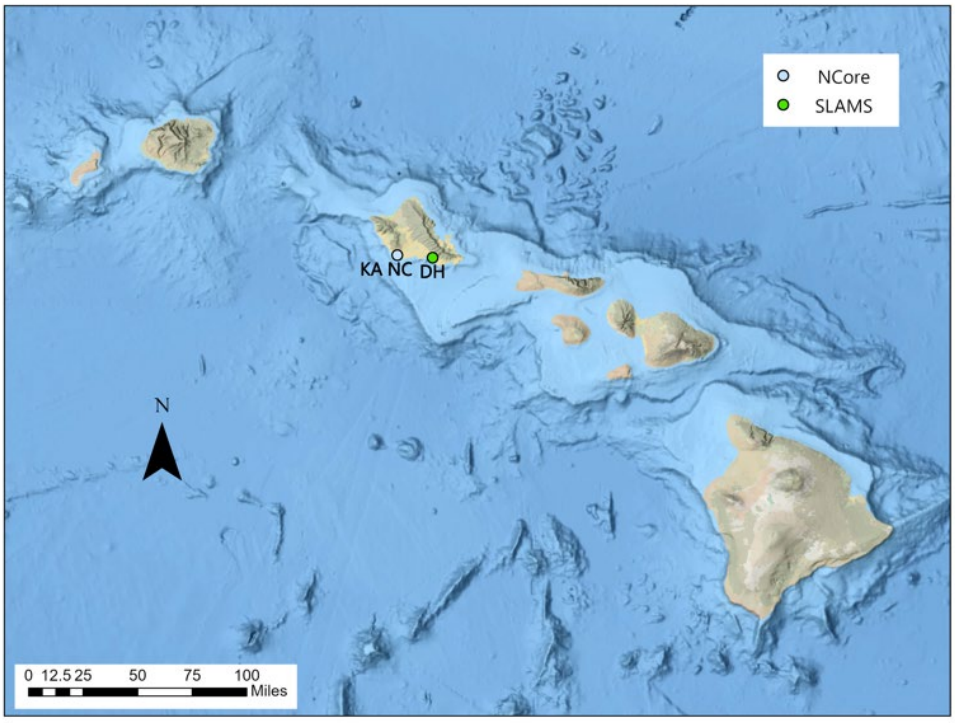


Figure 10. CO Stations



IV. Climate, Topography, and Meteorology

A. Climate

The Hawaiian archipelago is the most isolated populated area in the world. The closest landmass is California, approximately 2,400 miles to the northeast. The climate is predominantly influenced by the surrounding ocean and its tropical latitude location producing relatively mild temperatures and moderate humidity. There are basically two seasons: summer from May through October, and winter from October through April.

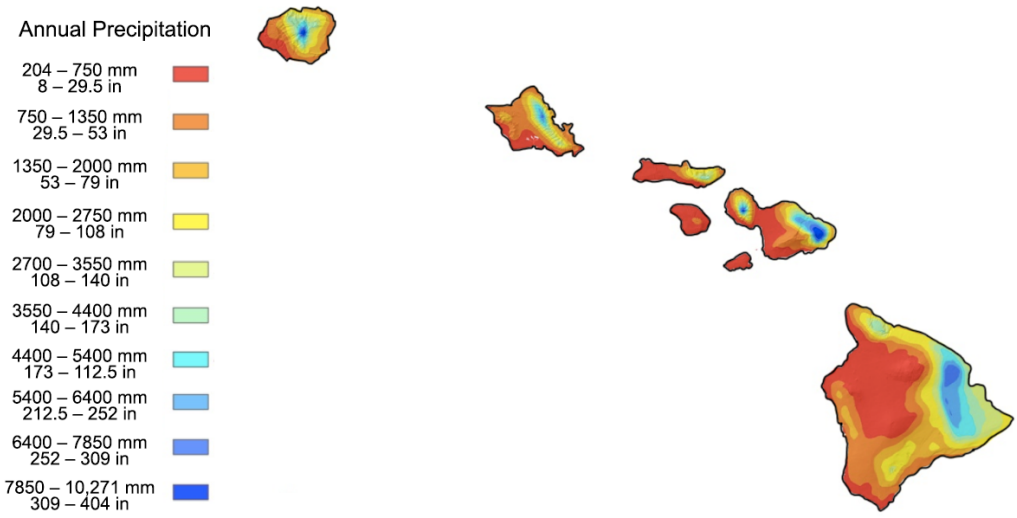
The islands are actually the summits of a volcanic mountain range. The mountain and valley landscapes produce a complex air flow system with wide variability in wind speeds, rainfalls and temperatures. Strong diurnal wind patterns can be found on the southern and western leeward coasts of the islands. This diurnal pattern consists of sea breezes during the afternoon and early evening hours and land breezes at night.

The most dominant climatic attribute affecting the dispersion of air pollutants and allowing for the normally clean air is the nearly persistent trade-wind or northeasterly winds. During the summer months, the trades are prevalent 80 to 95 percent of the time, decreasing in the winter months as cold fronts move through the islands bringing with them southerly winds. During eruptions, emissions from the still active Kilauea volcano on the island of Hawaii can travel up the island chain with these southerly or “Kona” winds. The volcanic emissions, also called “vog” (volcanic smog), may create hazy conditions sometimes as far north as Kauai.

Some of the major climatic regions are:

1. Windward lowlands
   Less than 2,000 feet on the northern to northeastern sides of the islands, these lowlands lie perpendicular to the prevailing trade-winds, is often cloudy with frequent trade showers (see Figure 2) and mild temperature fluctuations.
2. Leeward lowlands:
   Dryer, warmer weather prevails in these areas often with afternoon sea breezes. The exception is the Kona coast on the island of Hawaii which has its own distinctive climate.
3. Kona coast on the island of Hawaii:
   This is the only region where the rainfall is higher in the summer than in the winter. An eddy off the coast caused by the two large mountain peaks of Mauna Kea to the north and Mauna Loa to the south results in the volcanic plume (during eruptions) circling back onto land and allowing the vog to be nearly constant during trade-wind weather. This was a major issue prior and during the Lower East Rift Zone eruption that ended in August 2018. Since then, with little volcanic emissions from an active eruption, the Kona coast has been mostly free of vog.

Figure 11. Rainfall



B. Topography

Each island has unique topographical influences:

Oahu

The most significant factor influencing Oahu's environment is the urban Honolulu setting where tall, dense building structures tend to cause warmer temperatures and turbulent winds within the city center. The impact of city pollution is minimized by the trade-winds that normally blow them out to sea.

Kauai

Being the northern-most major island, Kauai is largely exposed to the northwest frontal systems that bring rain during the winter months. Mt. Waialeale in the center of the island is one of the wettest spots in the world.

Maui

The Maui MSA lies in the interior lowland between the two peaks of Haleakala and the West Maui mountains. The flat valley terrain can result in a night-time inversion layer that may restrict vertical transport of air pollutants.

Hawaii

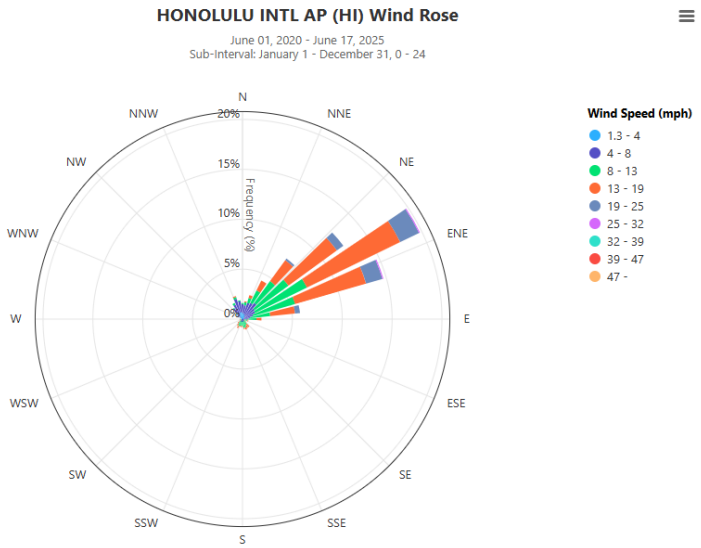
The largest geographical influences are the two mountain peaks of Mauna Kea (13,796 ft.) and Mauna Loa (13,678 ft.). What once was the major influence from the ongoing volcanic activity of the Kilauea volcano ended with the Lower East Rift Zone eruption which stopped in August 2018. The mountain peaks create an eddy effect along the Kona coast that may bring any volcanic plume, which would normally be moved offshore by the trade-winds, back onto land in the form of sulfate aerosols. When the winds turn southerly, as occurs during the winter months with the more frequent cold fronts, the plume can travel directly to the Hilo coast on the eastern side of the island. Because of the relatively short distance between the volcano vents and Hilo, the volcanic plume is mainly detected as SO_2.

Figure 12. Topography

C. Meteorology

The prevailing wind direction blows from the east-northeast (ENE) direction. The ENE winds occur with the highest frequency, reaching up to 20%, while NE and E are moderate. Winds from other directions are minimal. Most common wind speeds range from 8 to 20 mph while higher wind speeds occur less frequently.

Figure 13. Honolulu Wind Rose



D. Monitoring Assessment Findings based on Climate, Topography, and Meteorology

1. Most of the monitoring stations are located on the downwind side of the islands where most of the air pollution is expected.

2. The Kahului station is in the interior lowland of central Maui where there is a potential for restricted transport of air pollutants.
3. The Kona air monitoring station is located to detect sulfate aerosols as $PM_{2.5}$ and the Hilo and Mountain View stations are located to monitor for SO_2 from the volcano when the winds come from a non-prevalent direction.
4. No new or relocated stations or monitors are proposed.

V. Population

There are two MSAs in the state: Oahu and Maui. The two Micropolitan Statistical Areas are Hilo (island of Hawaii) and Kapaa (island of Kauai).

The state's population increased 7.0% from 2010 to 2020 with an estimated decrease of 0.6% from 2020 to 2024. Table 3 summarizes the population totals on each island. The areas with higher poverty rates remained unchanged from the 2010 to the 2020 census. The rates of highest childhood asthma seemed to have change in a few areas on Hawaii Island and Maui since 2015 but remain relatively similar on Oahu and Kauai.

Table 3. State of Hawaii Population Summary

	2020 Population	% Change 2010-2020	% Share of Population	Population (2024 est.)
State	1,455,274	+7.0		1,446,146
Oahu	1,016,507	+6.4	69.8	998,747
Hawaii	200,635	+8.4	13.8	209,790
Maui	164,756	+14.0	11.3	163,688
Kauai	73,296	+9.5	5.0	73,840

Figure 14. State of Hawaii Population: 2020 Census

Figure 15. Hawaii County Population: 2020 Census

Figure 16. Maui County Population: 2020 Census

Figure 17. Oahu County Population: 2020 Census

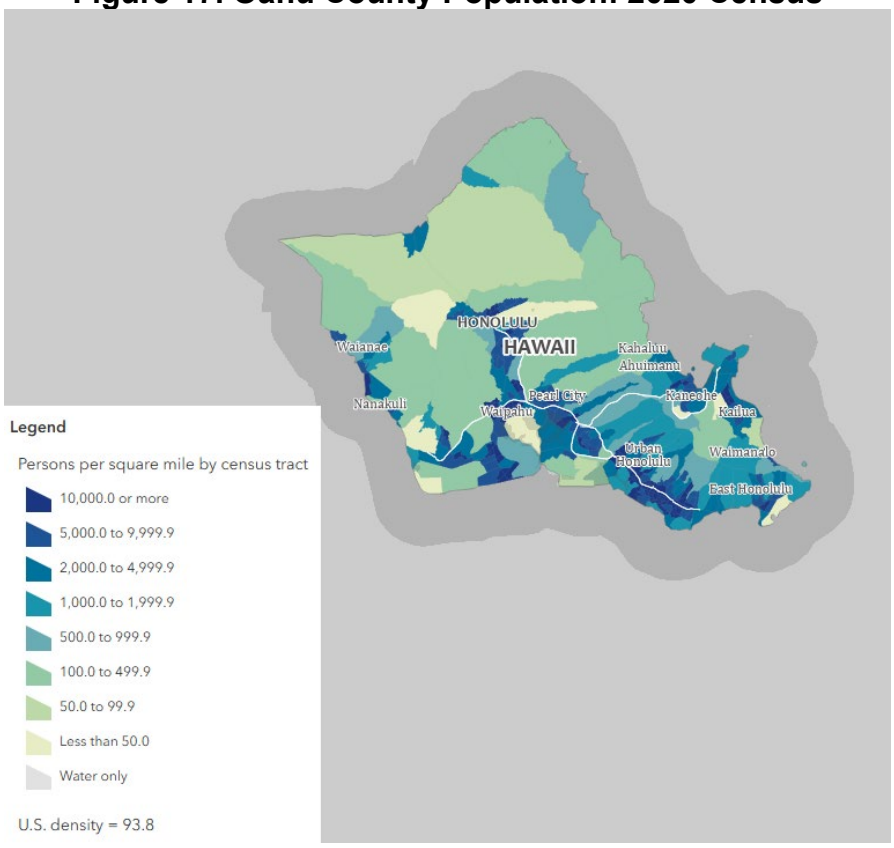


Figure 18. Kauai County Population: 2020 Census

A. Sensitive Populations

The percentage of the state population living below poverty level has slightly increased from 9.3% during the 2016-2020 measurement period to 10.0% during the most recent measurement period of 2019-2023. The largest age group of those living below poverty level is those aged 18-24. The percentage of those living below poverty level has slightly increased for each county since the 2016-2020 measurement period. Hawaii county remains to have the largest percentage of those living below poverty level.

The rate of children with current asthma has fluctuated since 2020. As of 2023, the percentage of children under 18 years of age that currently had asthma was 6.7%. This is an improvement from 2022, which was 9.2%.

Figures 19-22 compare areas of high childhood asthma rates, percent poverty, air monitoring locations, and emissions sources.

Figure 19. Hawaii: % Poverty, Emission Sources, Childhood Asthma

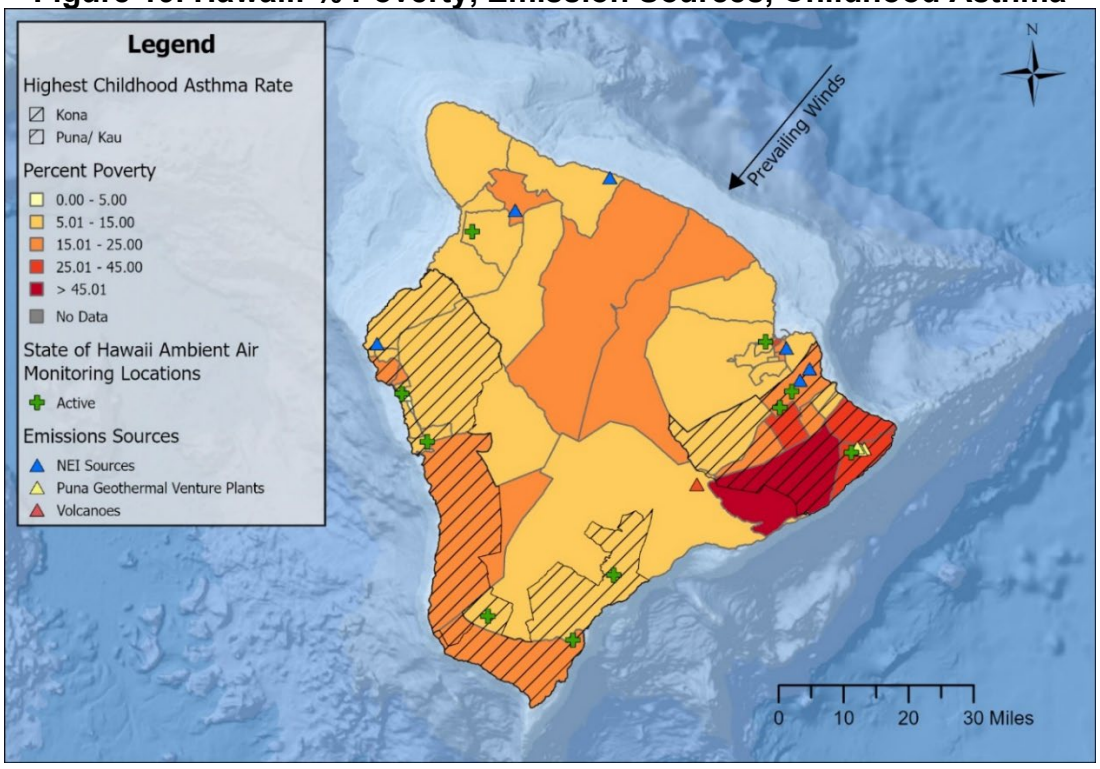


Figure 20. Maui: % Poverty, Emission Sources, Childhood Asthma

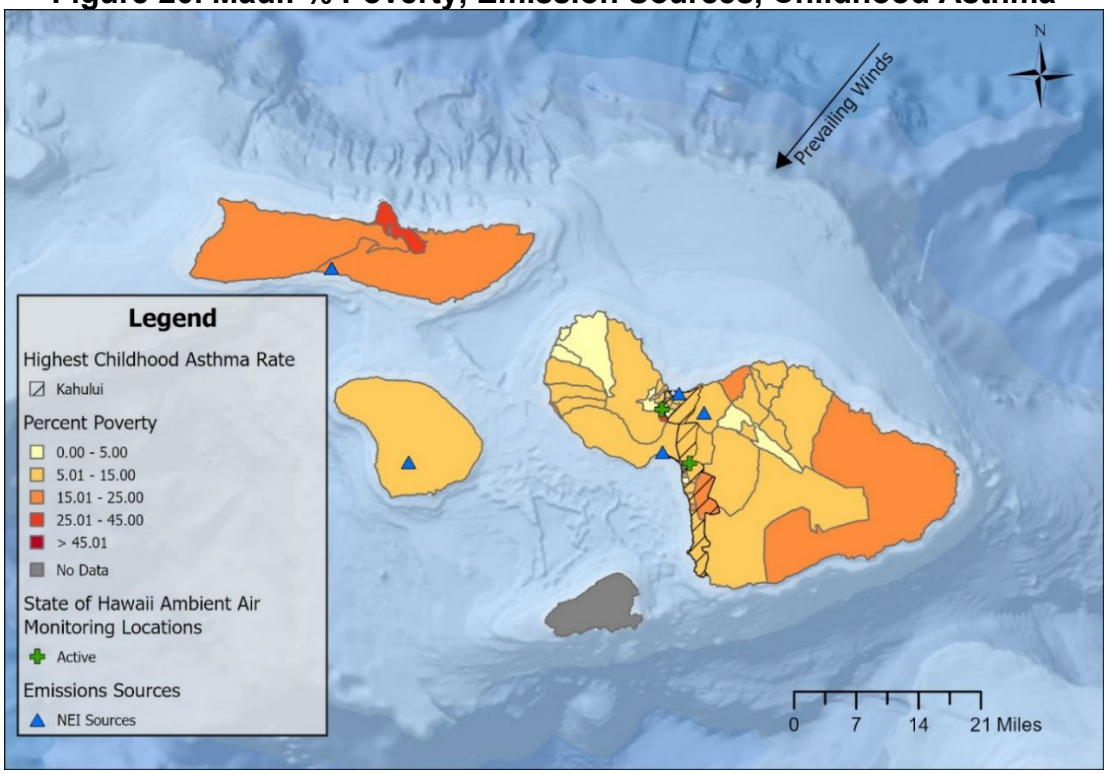


Figure 21. Oahu: % Poverty, Emission Sources, Childhood Asthma

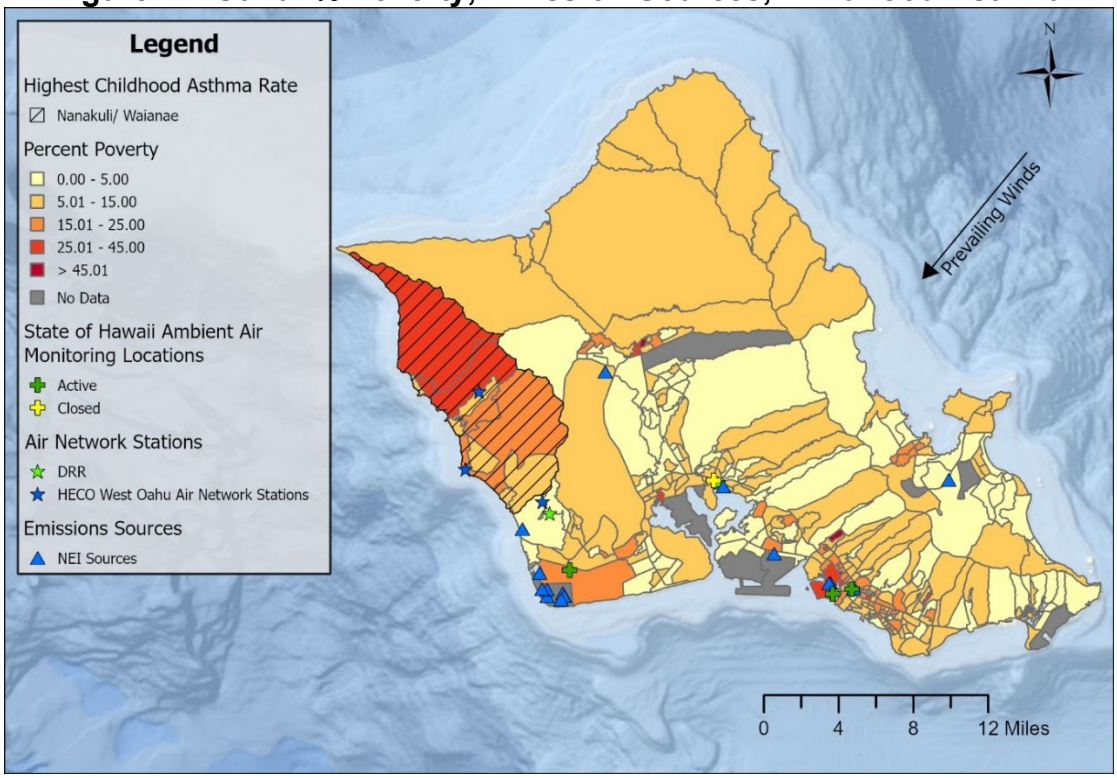
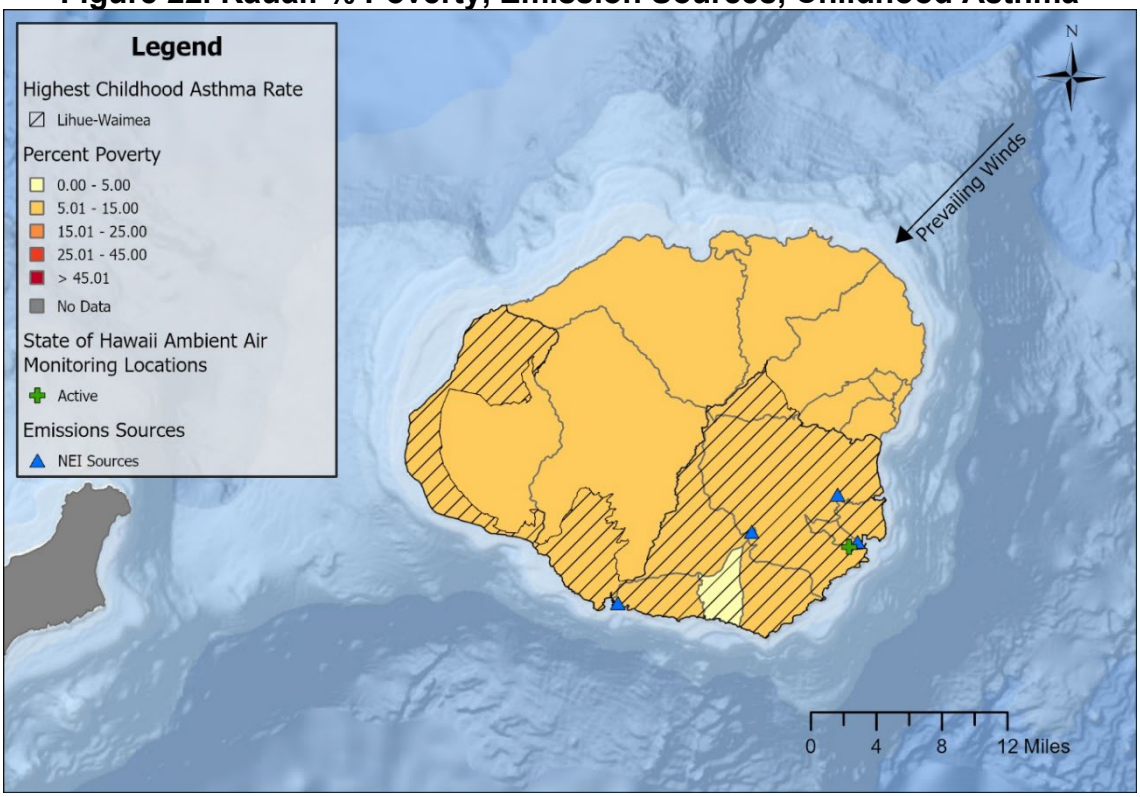


Figure 22. Kauai: % Poverty, Emission Sources, Childhood Asthma



B. Monitoring Assessment Findings based on Population

1. The population of the Oahu MSA reached one million in 2020; however, it does not seem to have stabilized at that number. If the population crosses that threshold again and remains there, more monitoring would be required. CO and $PM_{2.5}$ will need to be added to the near-road monitoring station and an area-wide NO_2 monitor with expected highest concentration may be required.
2. The urbanized areas as well as areas with highest poverty on each island remain relatively unchanged from the 2010 to the 2020 census.
3. The three community monitoring stations owned and operated by HECO are all located along the Waianae coast of Oahu, which is also the area of highest poverty in the Oahu MSA. To conserve resources and prevent duplication of efforts, these three stations will be utilized to meet community concerns for Oahu.
4. No other new or relocated stations or monitors are proposed

V. Emissions

A. Environmental and Health Impacts

Wildfire Impacts

On August 8th, 2023, Maui experienced one of the largest natural disasters in Hawaii's state history. Several quickly spreading wildfires ravaged the town of Lahaina, leaving over 2,200 buildings damaged and 102 people dead. The "drought blanketing swaths" of the archipelago took part in the destructive fires, and the strong winds from Hurricane Dora in the Pacific continued to fuel and fan the flames (CNN source) (Figure 21). Several poles and powerlines were destroyed, leaving over 11,000 customers without power (poweroutage.us). The ash and soot released into the air contained heavy levels of arsenic, lead, antimony, cobalt, and asbestos fibers, posing risk of inhalation and could potentially lead to respiratory and long-term health issues. Hazard advisories were posted for individuals returning to impacted areas where debris removal had not yet been completed.

Figure 23. Lahaina Fire

Figure 24. Dry and Drought Areas

Figure 25. Smoky Air of the Lahaina Fire

Figure 26. Substances Found in Lahaina Fire Ash

Table 1. Summary of monitoring results for select substances (metals, dioxins, PCBs, PAHs, and pesticides) collected by DOH from Lahaina fire ash on November 7 and 8, 2023, in milligrams per kilogram (mg/kg).

Search

Parameter	DOH EAL: Unrestricted Soil[1]	Lab Report 1	Lab Report 2	Lab Report 3
Metals				
Antimony	6.3	**26**	**24**	**26**
Arsenic (bioaccessible)	23	**69**	**62**	**64**
Arsenic (total)	—	297	269	275
Cobalt	4.7	**27.4**	**23**	**25.7**
Copper	630	**1400**	**1970**	**1630**
Lead	200	**383**	**416**	**431**
TEQ Dioxins	0.00024	0.0000939	0.000103	0.0001
Polychlorinated biphenyls (PCBs)	1.2	ND	ND	ND

25 miles away from Lahaina, on that same day, Kula upcountry was also burning. In addition to the wind, invasive plants surrounding the area fueled the fire. At least 19 homes were destroyed, along with dozens of other structures. Similarly, the ash samples from Kula showed unhealthy levels of antimony, arsenic, cobalt, copper, lead, and TEQ Dioxins.

Figure 27. Kula Fire

Figure 28. Substances Found in Kula Fire Ash

Table 2. Summary of monitoring results for select substances (metals, dioxins, PCBs, PAHs, and pesticides) collected by DOH from Kula fire ash on September 21, 2023, in milligrams per kilogram (mg/kg).

Search

Parameter	DOH EAL: Unrestricted Soil[1]	Lab Report 1	Lab Report 2	Lab Report 3
Metals				
Antimony	6.3	**110**	**108**	**96**
Arsenic (bioaccessible)	23	**2689**	**2706**	**2556**
Arsenic (total)	—	3,240	3,260	3,080
Cobalt	4.7	**85.7**	**81.3**	**88.5**
Copper	630	**3240**	**3230**	**2980**
Lead	200	**640**	**769**	**655**
TEQ Dioxins	0.00024	**0.00038**	**0.000395**	**0.000427**
Polychlorinated biphenyls (PCBs)	1.2	—	—	—

Volcanic Impacts

One of the world's most active volcanoes, Kilauea is located on the east side of Hawaii Island and had nearly continuous eruptive activity along the East Rift zone from 1983-2018. There have been several summit eruptions since December 2020. In 2024, eruptions occurred in the Southwest Rift Zone and East Rift Zone. Eruption has been intermittently active at the summit since December 23, 2024, with at least 25 episodes as of June 17, 2025. Air quality at Kilauea is affected by volcanic SO_2 and $PM_{2.5}$. These pollutants at the Hawaii Volcanoes National Park can reach unhealthy levels, particularly affecting those with pre-existing respiratory conditions. Additionally, the volcano emits H_2S, hydrogen chloride (HCl), hydrogen fluoride (HF), mercury, and other harmful gases.

Figure 29. Kilauea Eruption – Episode 16

Episode 16 started on March 31, 2025 at 10:57 pm and lasted for 37 hours. The maximum fountain height was 325 meters, and the approximate volume of lava erupted was 6.0 million cubic meters.

Figure 30. Kilauea Eruption – Episode 19

Episode 19 started on May 1, 2025 at 11:49 am and lasted for 8 hours (fountaining phase). The maximum fountain height was 125 meters, and the approximate volume of lava erupted was 2.8 million cubic meters.

Upon molten rock reaching sea water, dense white clouds known as laze (lava haze) is formed. Laze is made of dense white clouds of steam, small shards of volcanic glass, hydrochloric acid, and other airborne contaminants that are harmful to human health. About the same corrosiveness as diluted battery acid, hydrochloric acid can irritate the skin, eyes, and cause breathing problems.

Figure 31. Laze

Vog is created when the oxygen, water, and other particles in the air reacts with the SO_2 from the eruption. Through this process, sulfuric acid droplets and corrosive acid rain is also created. Depending on the wind direction and speed on a given day, vog and haze can spread throughout the state to the other islands. Like the eruption emissions, vog is a health hazard that can aggravate pre-existing respiratory conditions. Other sensitive groups most likely to experience health impacts of vog include people with cardiovascular disease, older adults, infants and children, and new or expectant mothers. According to USGS, SO_2 gas can irritate the skin and the tissues and mucous membranes of the eyes, nose, and throat, and can penetrate airways. Particles can also penetrate deeper into the lungs and can induce asthmatic symptoms. Physical complaints from vog exposure include headaches, breathing difficulties, increased

susceptibility to respiratory ailments, watery eyes, sore throat, flu-like symptoms, nausea, and fatigue.

Figures 34-37 analyze and compare levels of SO_2 and $PM_{2.5}$ on east and west sides of Hawaii Island from January to April of 2025, marking dates of No Burns and Kilauea eruptions. Figures 38-39 analyze and compare levels of only $PM_{2.5}$ on Oahu and Maui from January to April of 2025 – $PM_{2.5}$ is a more indicative parameter here as elevated SO_2 is usually not seen on these islands from the volcano.

Figure 32. Dense Vog as seen from Hilo Bay in 2005

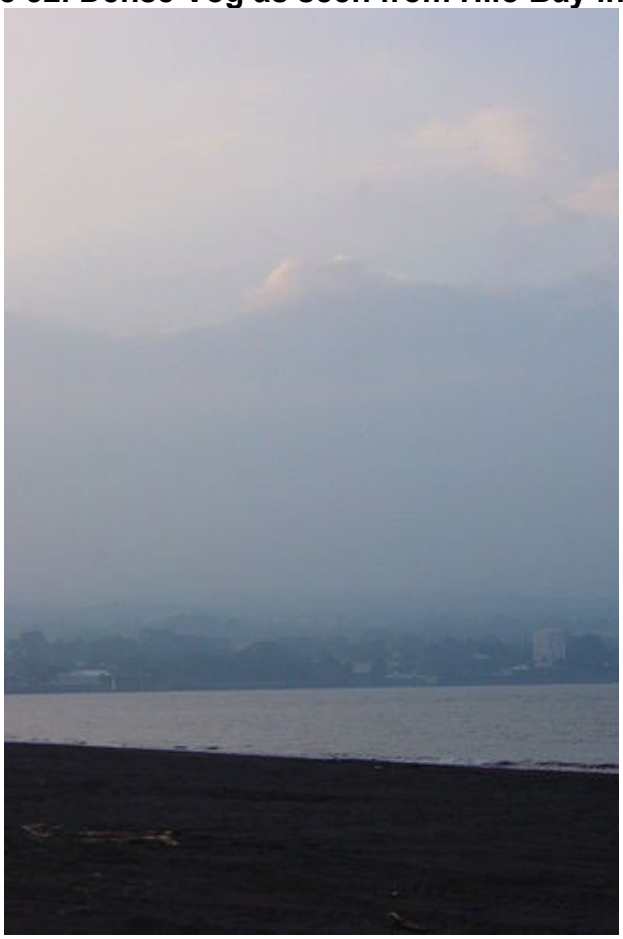


Figure 33. High Levels of Vog Shroud Honolulu in 2008

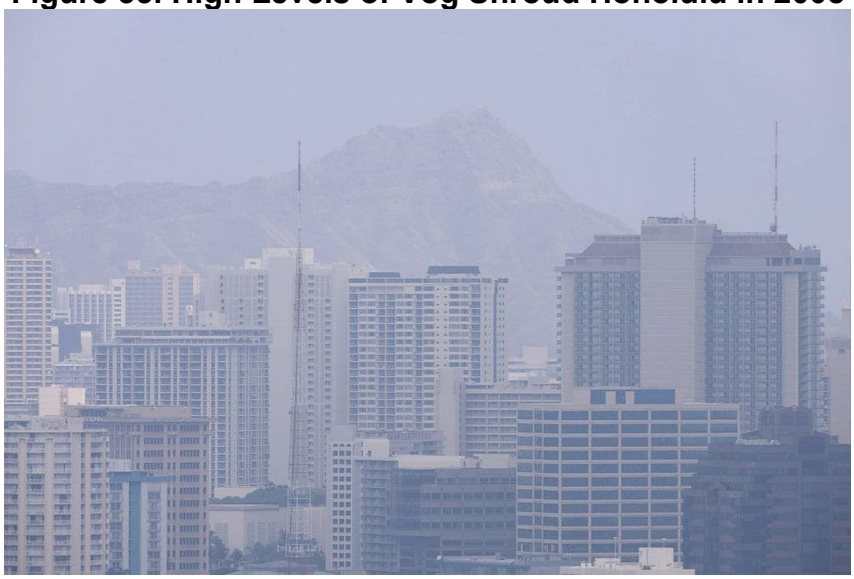


Figure 34. East Hawaii SO_2 1-Hr Daily Maximum January-April 2025

Figure 35. East Hawaii $PM_{2.5}$ 24-Hr Average January-April 2025

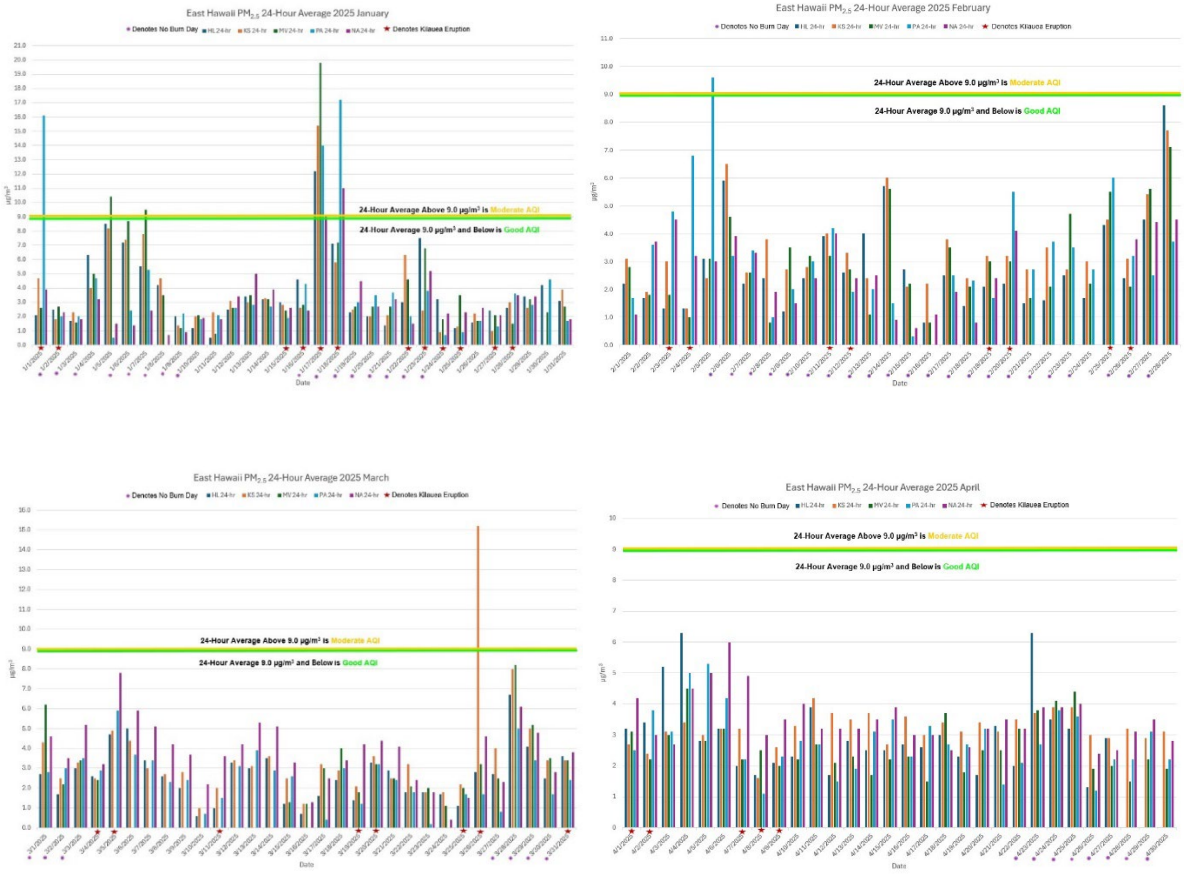


Figure 36. West Hawaii SO_2 1-Hr Daily Maximum January-April 2025

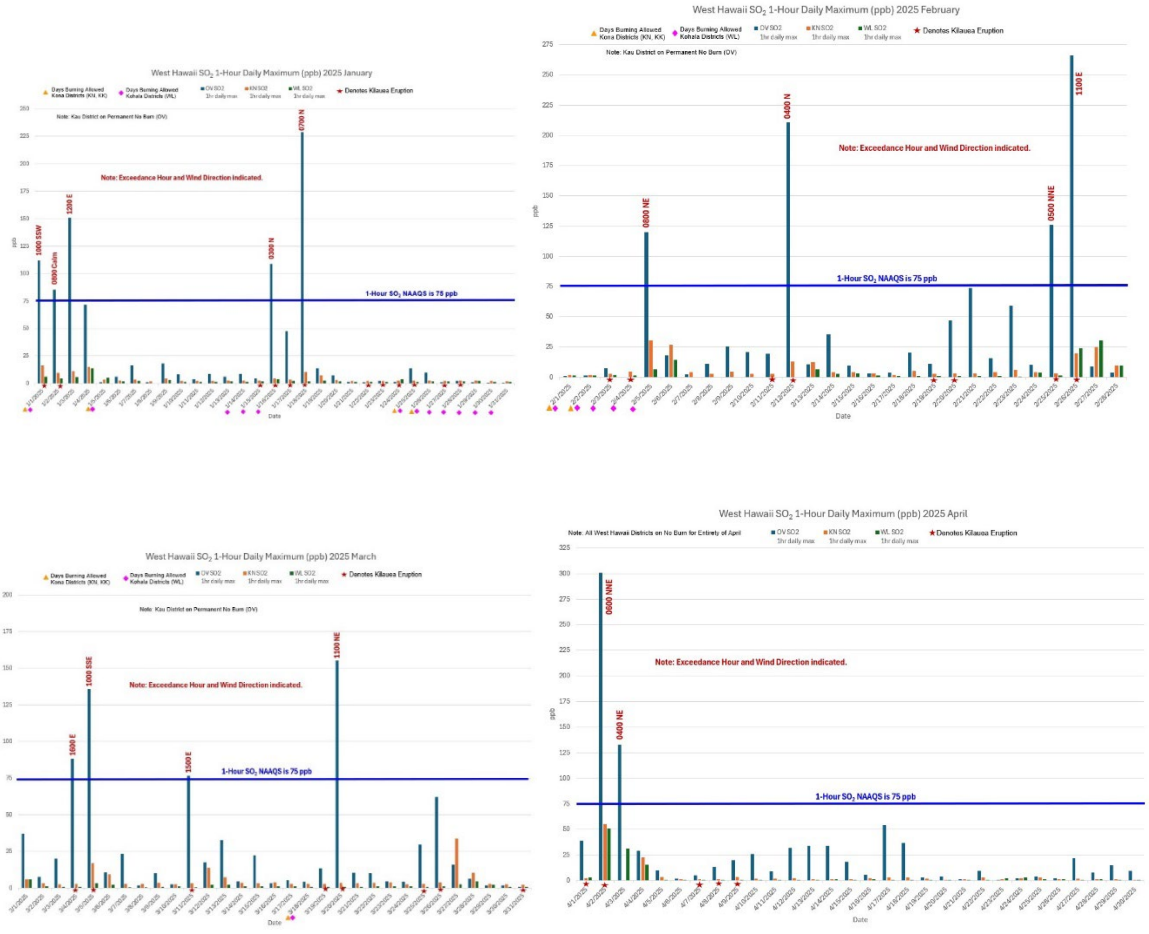


Figure 37. West Hawaii $PM_{2.5}$ 24-Hr Average January-April 2025

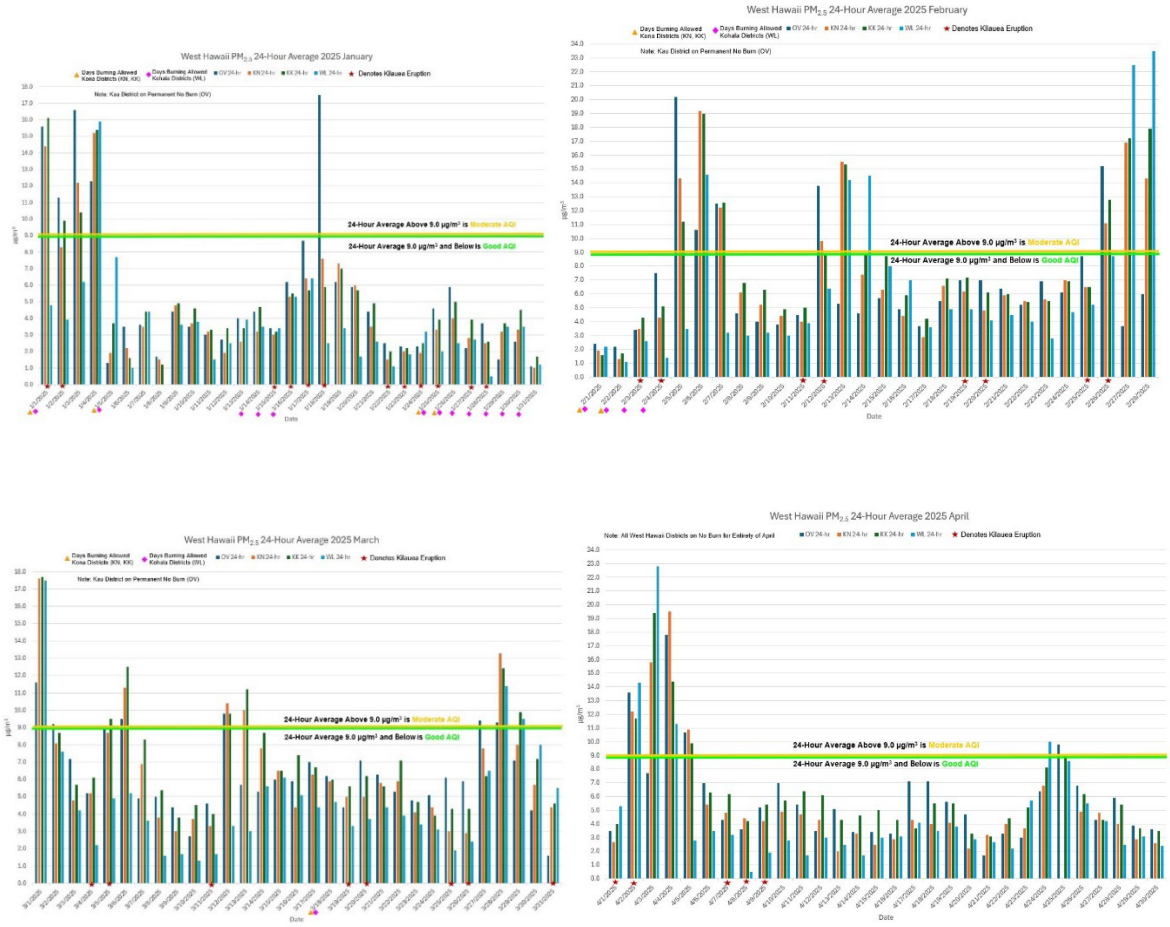


Figure 38. Maui $PM_{2.5}$ 24-Hr Average January-April 2025

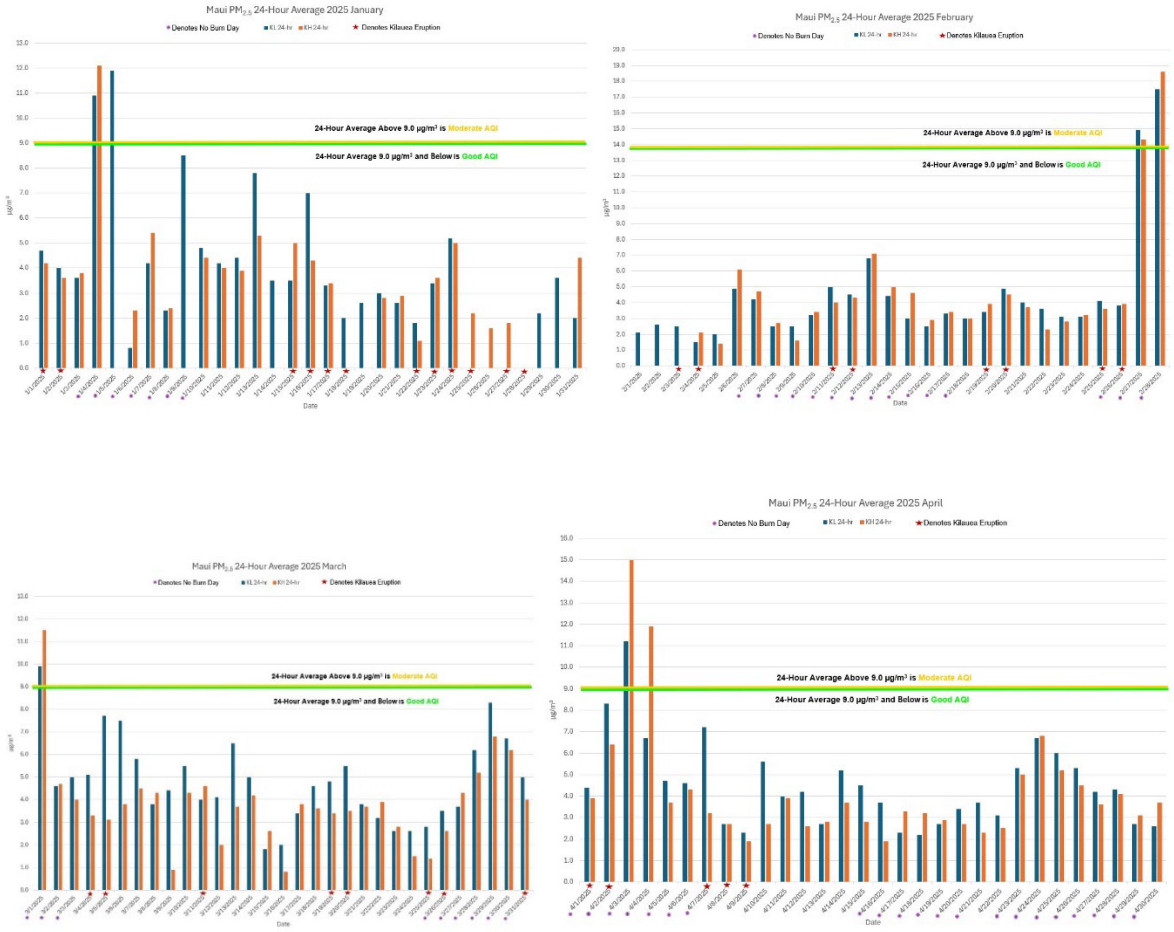


Figure 39. Oahu $PM_{2.5}$ 24-Hr Average January-April 2025

B. Summary of Emissions by Island

- Kauai
  The predominant air pollution concern on this island has been cruise ship emissions from Nawiliwili harbor. The harbor is located in Lihue on the eastern side of the island and the prevailing trade-winds carry the emissions on-shore impacting nearby residential communities.

  An important consideration will be the MARPOL (International Convention for the Prevention of Pollution from Ships) Annex VI treaty. This treaty requires ships to use fuel with lower sulfur content when entering any ECA, which includes a 200 mile radius around the Hawaiian Islands.

  In August 2012, ships were required to use fuel with a sulfur content of not more than 10,000 ppm (1%) when operating within the ECA. Data from the DOH Niumalu station showed a correlating decrease in ambient levels of SO_2. Beginning January 2015, the fuel sulfur limit was further reduced to 1,000 ppm (0.1%). Data from the station again showed a correlating decrease in ambient levels of SO_2.

- Oahu
  Most of the major anthropogenic sources are located on Oahu and concentrated in the CIP area on the southwest side of the island. With 70% of the population residing on 602 square miles of land, mobile source pollution is the greatest on Oahu and will be the site of any future near-road NO_2 station. Additionally, there are three electrical generating facilities (HECO Kahe, HECO Waiau, and Kalaeloa).

- Maui
  The major concerns for residents on Maui are impacts from the 2023 Lahaina fires. Harmful substances including asbestos, lead, and arsenic may be in the ash and debris, posing risk of inhalation. This can lead to respiratory and long-term health issues. Similarly, ash from the 2023 Kula wildfire was found to have elevated levels of arsenic, lead, and cobalt. Additionally, the mountainous landscape and high wind speeds cause air pollutants to be further spread and impact a larger area, increasing risk of exposure.

  The Lahaina fire debris removal has been completed by USACE and the debris is being transferred to Central Maui Landfill.

  Other concerns include impacts from agricultural activities including agricultural burning, commercial/residential development, and emissions, particularly in areas of rebuilding.

- Hawaii
  What once was the largest emission source in the state was from the still active Kilauea volcano. Air quality at Kilauea is affected by volcanic SO_2 and

$PM_{2.5}$. Vog creates a haze that can aggravate pre-existing respiratory ailments. H_2S, HCl, HF, mercury, and other harmful gases are emitted by the volcano. This source by far generates the greatest air pollution impact statewide when erupting.

Additionally, there are concerns of H_2S emissions as a result of geothermal energy exploration and production, especially for residents in the Puna area.

C. Summary of Emissions by Pollutant

There have not been a significant number of new or relocated major emission sources in the past five years since the 2020 assessment was conducted. Power plants from other islands have become part of top 10 emitters, such as Hawaii's Kanoelehua and Keahole power plants, and Maui's Kahului power plant. Additionally, Mauna Loa Macadamia nut plant showed up as a top 10 PM_{10} and $PM_{2.5}$ emitter. See Figures 54-58.

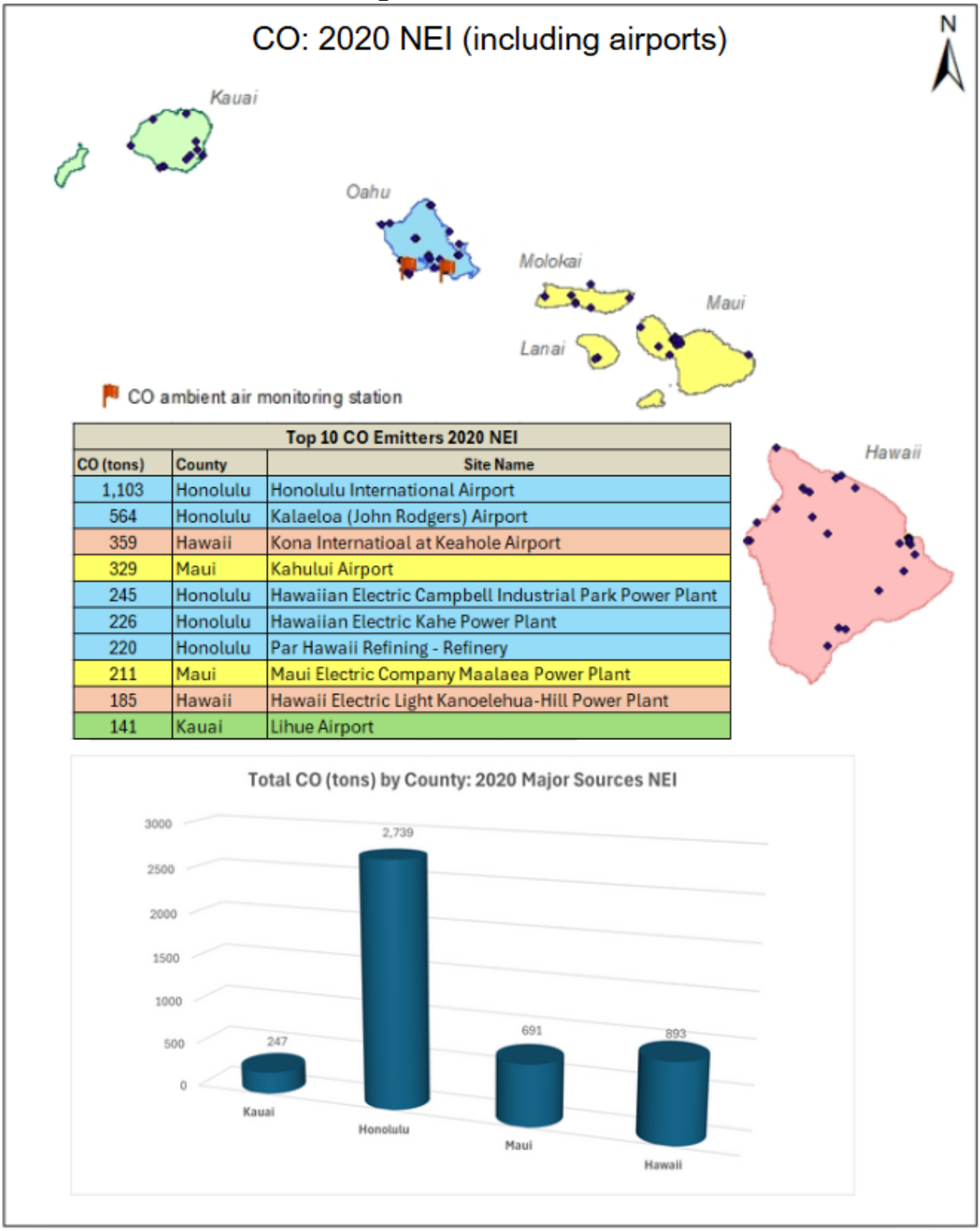
A summary of the criteria pollutant emissions from the 2020 National Emissions Inventory (NEI) is provided in Table 4. As expected, the majority of anthropogenic emissions occur on the island of Oahu where most of the industrial and mobile sources are located.

When only major source emissions are considered, Honolulu International Airport was by far the largest CO emitter, releasing nearly twice the amount as the second-highest emitter. Currently, when all sources are included, Oahu by far has the most CO, primarily from mobile sources. Increases in PM_{10} and $PM_{2.5}$ emissions on Oahu when all sources are considered are primarily due to construction dust.

Table 4. 2020 NEI

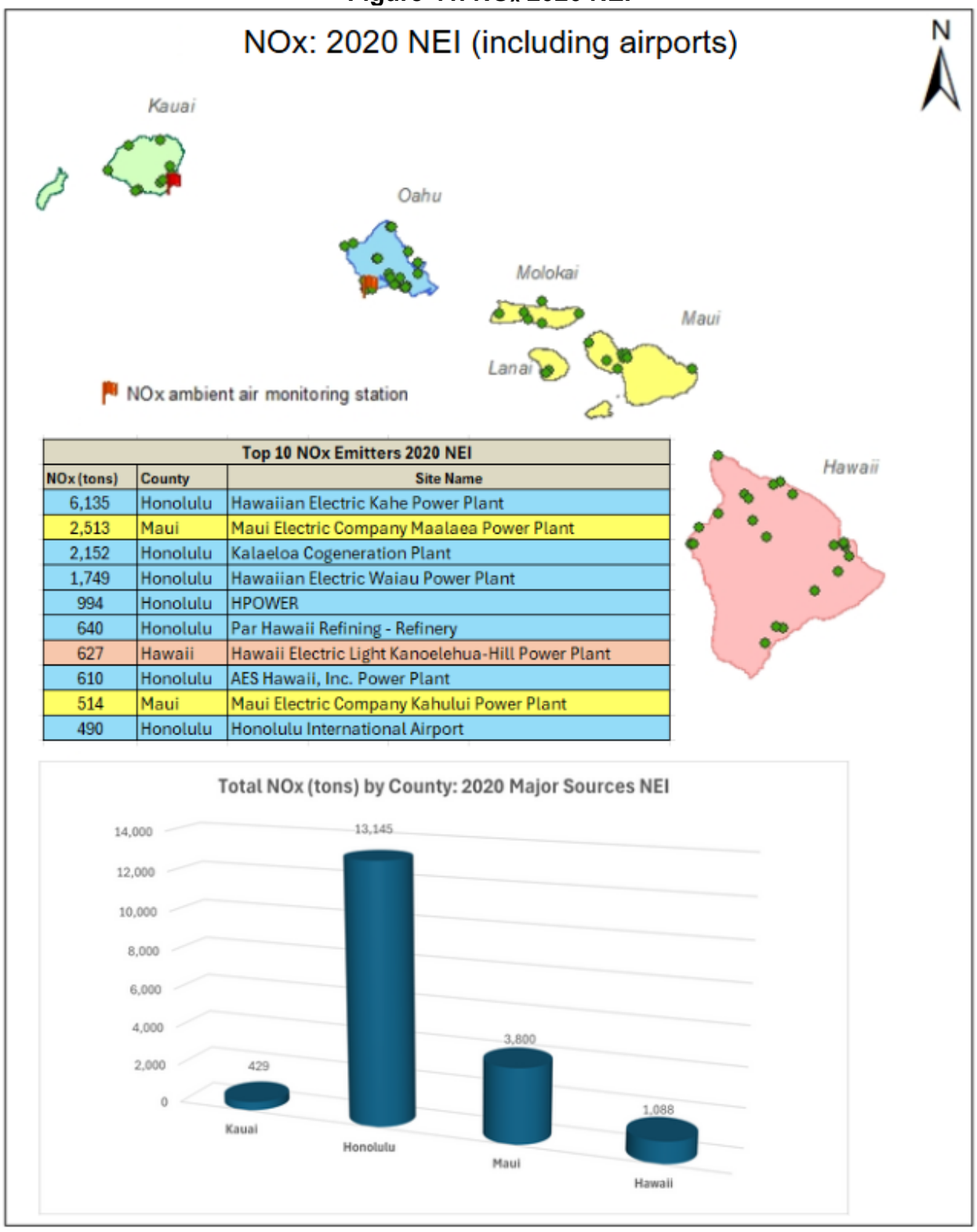
County	CO (tpy)[1]	NOx (tpy)	SO_2 (tpy)	PM_{10} (tpy)	$PM_{2.5}$ (tpy)
Major sources – Kauai	247	429	9	17	16
All sources – Kauai	12,740	1,385	19	1,614	410
Major sources – Oahu	2,739	13,145	11,318	1,218	1,072
All sources – Oahu	77,700	20,652	11,446	14,553	4,369
Major sources – Maui	691	3,800	2,227	215	186
All sources – Maui	30,518	5,642	2,353	4,226	1,816
Major sources – Hawaii	893	1,088	2,899	197	172
All sources - Hawaii	29,517	3,561	2,928	2,677	990
Major sources – State	4,578	18,464	16,453	1,647	1,446
All sources – State	150,658	31,249	16,747	23,070	7,585

Figure 40. CO 2020 NEI



Top 10 CO Emitters 2020 NEI		
CO (tons)	County	Site Name
1,103	Honolulu	Honolulu International Airport
564	Honolulu	Kalaeloa (John Rodgers) Airport
359	Hawaii	Kona Internatioal at Keahole Airport
329	Maui	Kahului Airport
245	Honolulu	Hawaiian Electric Campbell Industrial Park Power Plant
226	Honolulu	Hawaiian Electric Kahe Power Plant
220	Honolulu	Par Hawaii Refining - Refinery
211	Maui	Maui Electric Company Maalaea Power Plant
185	Hawaii	Hawaii Electric Light Kanoelehua-Hill Power Plant
141	Kauai	Lihue Airport

Figure 41. NO_x 2020 NEI



Top 10 NOx Emitters 2020 NEI		
NOx (tons)	County	Site Name
6,135	Honolulu	Hawaiian Electric Kahe Power Plant
2,513	Maui	Maui Electric Company Maalaea Power Plant
2,152	Honolulu	Kalaeloa Cogeneration Plant
1,749	Honolulu	Hawaiian Electric Waiau Power Plant
994	Honolulu	HPOWER
640	Honolulu	Par Hawaii Refining - Refinery
627	Hawaii	Hawaii Electric Light Kanoelehua-Hill Power Plant
610	Honolulu	AES Hawaii, Inc. Power Plant
514	Maui	Maui Electric Company Kahului Power Plant
490	Honolulu	Honolulu International Airport

Figure 42. SO_2 2020 NEI

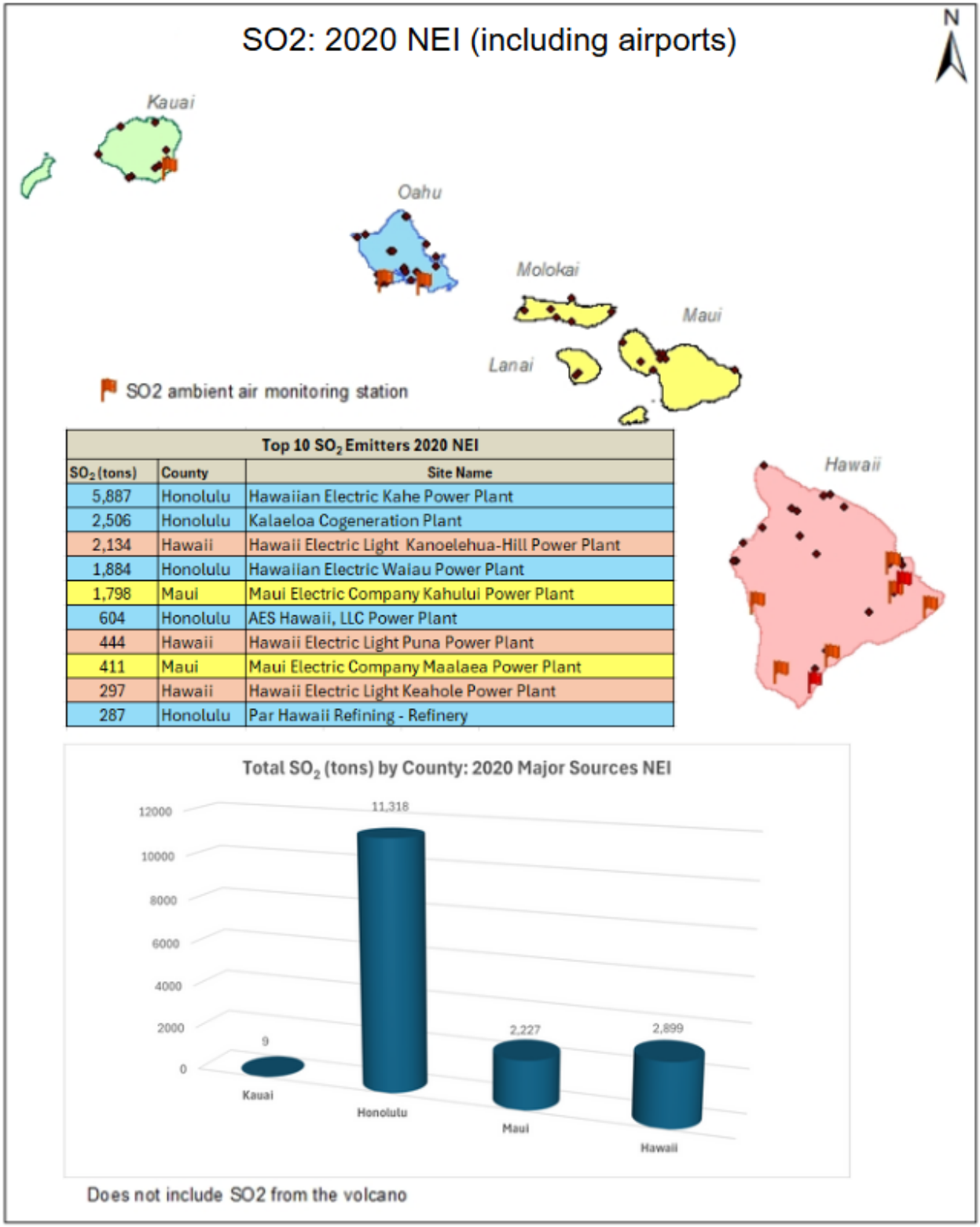
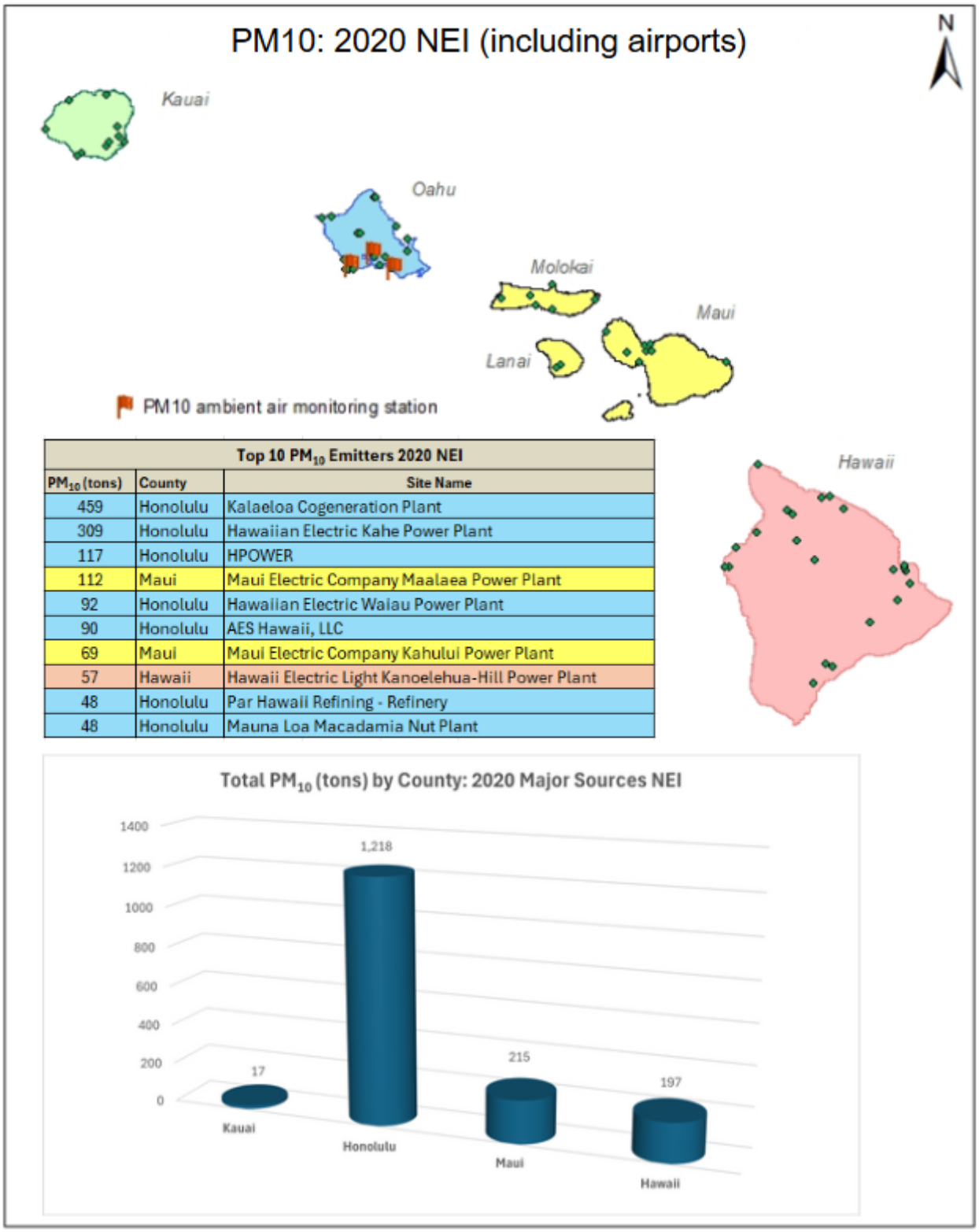
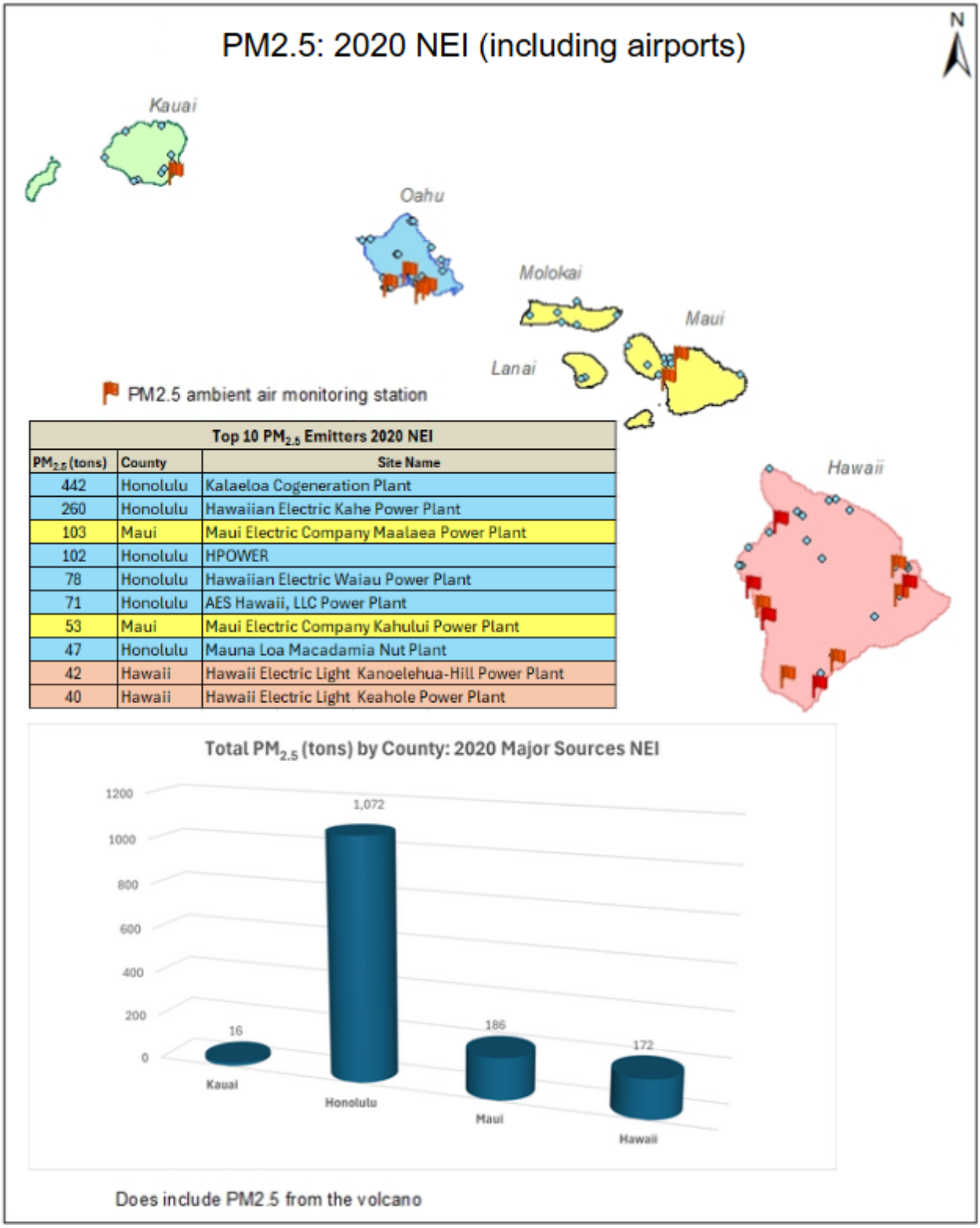


Figure 43. PM_{10} 2020 NEI



Top 10 PM_{10} Emitters 2020 NEI		
PM_{10} (tons)	County	Site Name
459	Honolulu	Kalaeloa Cogeneration Plant
309	Honolulu	Hawaiian Electric Kahe Power Plant
117	Honolulu	HPOWER
112	Maui	Maui Electric Company Maalaea Power Plant
92	Honolulu	Hawaiian Electric Waiau Power Plant
90	Honolulu	AES Hawaii, LLC
69	Maui	Maui Electric Company Kahului Power Plant
57	Hawaii	Hawaii Electric Light Kanoelehua-Hill Power Plant
48	Honolulu	Par Hawaii Refining - Refinery
48	Honolulu	Mauna Loa Macadamia Nut Plant

Figure 44. $PM_{2.5}$ 2020 NEI



Top 10 $PM_{2.5}$ Emitters 2020 NEI		
$PM_{2.5}$ (tons)	County	Site Name
442	Honolulu	Kalaeloa Cogeneration Plant
260	Honolulu	Hawaiian Electric Kahe Power Plant
103	Maui	Maui Electric Company Maalaea Power Plant
102	Honolulu	HPOWER
78	Honolulu	Hawaiian Electric Waiau Power Plant
71	Honolulu	AES Hawaii, LLC Power Plant
53	Maui	Maui Electric Company Kahului Power Plant
47	Honolulu	Mauna Loa Macadamia Nut Plant
42	Hawaii	Hawaii Electric Light Kanoelehua-Hill Power Plant
40	Hawaii	Hawaii Electric Light Keahole Power Plant

D. Monitoring Assessment Findings based on Emissions Sources

1. Continue monitoring for cruise ship emissions at the Niumalu, Kauai station. If resources allow, with community input, either close the station or move it to a population-based area within Lihue or Kapaa.
2. Continue to operate the two $PM_{2.5}$ monitoring stations in Kihei and Kahului. When resources allow, DOH may add continuous monitoring for CO, NO_2, and SO_2 on Maui.
3. Continue the nine SO_2 and $PM_{2.5}$ volcanic emissions monitoring stations on the island of Hawaii.
4. Continue monitoring for H_2S in Puna for emissions from geothermal energy production and exploration.
5. No other new or relocated stations or monitors are proposed.

VII. Data Assessment

A. Particulate Matter ≤2.5 µm ($PM_{2.5}$)

Introduction

There are currently 14 stations that monitor $PM_{2.5}$. The ambient air quality standards for $PM_{2.5}$ are listed below:

Table 5. $PM_{2.5}$ State and National Standards for the Year

Ambient Air Quality Standards				
Pollutant	Averaging Time	Hawaii Standards	National Standards	
		Concentration	Primary	Secondary
Particulate Matter 2.5 µm ($PM_{2.5}$)	24 hour block average	None	35 µg/m^3	Same as primary
	Annual average	None	None	9 µg/m^3

$PM_{2.5}$ Measurements

Table 6 lists the maximum 24-hour $PM_{2.5}$ measurements and annual average for each location.

Table 6. $PM_{2.5}$ Measurements by Site

Site (name)	Maximum 24-Hr (µg/m^3)					Annual Average (ppb)				
	2020	2021	2022	2023	2024	2020	2021	2022	2023	2024
Kinau Hale	7.8	8.2	23.3	22.0	27.4	3	3	3.3	4.1	4.1
Kapolei	15.4	8.5	10	15.8	11.5	3.4	2.9	3.8	4.5	4.6
Pearl City	10.7	8	8.7			3.2	3.2	3.4		
Sand Island	8.9	8.8	10	42	19.8	3.9	3.3	3.7	3.9	4.0
Kihei	14.4	15.4	8.2	6.1	8.8	2.9	2.5	2.3	2.3	2.8
Hilo	7.5	8.4	10.5	10.1	6.8	3.5	3.7	3.4	2.9	2.6
Kona	14.1	16.2	12.1	18.7	20.3	2.0	3.6	4.7	8.2	2.5
Mt. View	7.6	8.8	19.7	20.0	9.6	2.0	1.7	2.4	2.1	2.1
Pahala	13.4	11.7	10.1	10.2	8.9	2.2	2.5	3.6	3.6	3.1

Site (name)	Maximum 24-Hr (µg/m³)					Annual Average (ppb)				
	2020	2021	2022	2023	2024	2020	2021	2022	2023	2024
Ocean View	26.1	14.2	11.0	16.4	19.2	2.0	9.6	4.6	2.6	2.0
Kailua-Kona	6.7	15.9	12.3	17.6	20.5	2.4	4.7	5.3	3.4	2.9
Keaau	8.1	8.9	11	8.6	8.7	2.9	2.7	2.7	2.5	2.8
Naalehu	7.8	7.5	5.7	11.2	8.0	2.3	2.4	3.3	3.0	2.9
Waikaloa		8.5	9.0	13	22.2		1.8	2.3	2.8	2.4
Niumalu	9.9	8.4	6.8			3.0	3.2	2.3		
Kahului	9.2	9.1	13	57.2	35.7	3.9	3.9	4.0	4.0	3.9

$PM_{2.5}$ Design Value

Table 7 lists the design values from 2020 to 2024 for each monitoring location. The 24-hour design value is the 98th percentile averaged over 3 years and must be ≤35 µg/m³. The annual design value is the annual mean averaged over 3 years and must be ≤9 µg/m³.

Table 7. $PM_{2.5}$ Concentrations by Site for the Design Value

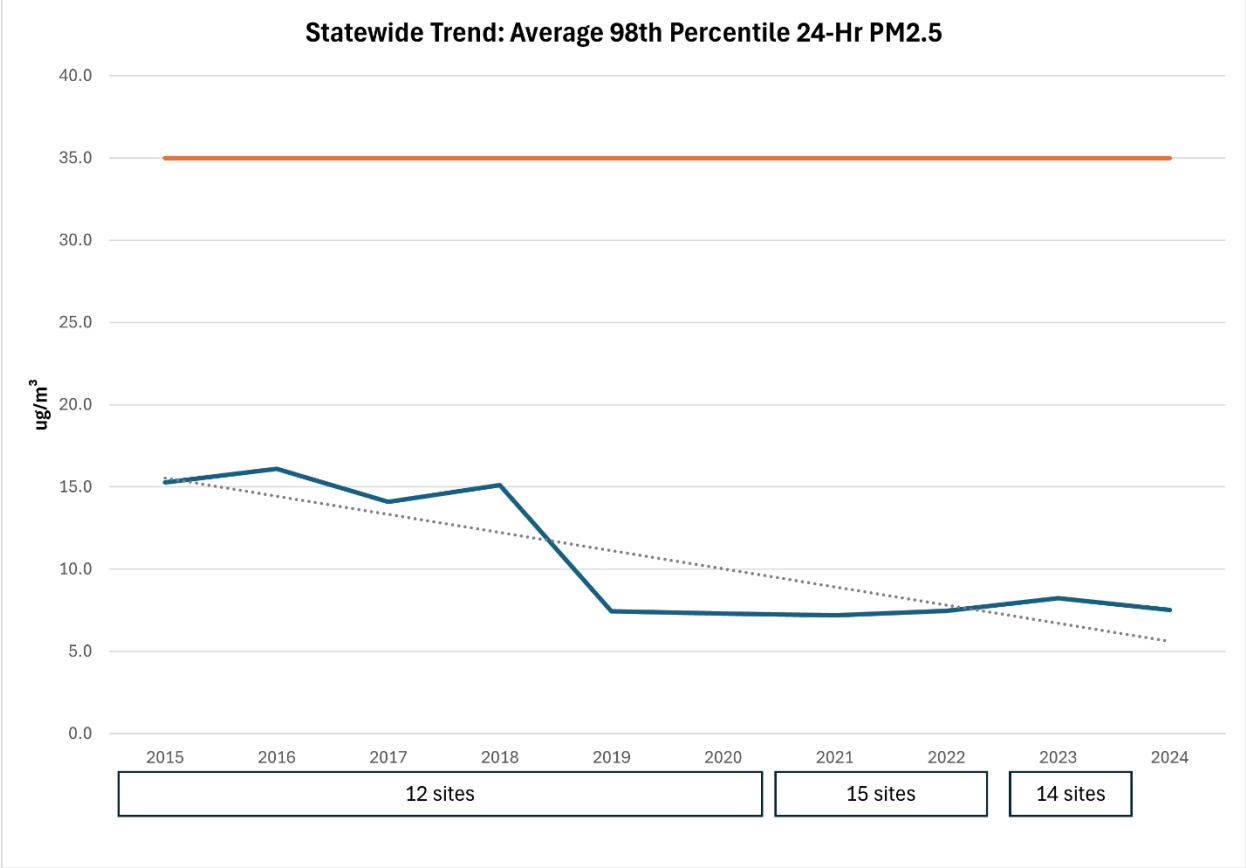
Site (name)	24-Hr Design Value (µg/m³)					Annual Design Value (µg/m³)				
	2018-2020	2019-2021	2020-2022	2021-2023	2022-2024	2018-2020	2019-2021	2020-2022	2021-2023	2022-2024
Kinau Hale	7	6	6	7	8	3.3	3.1	3.1	3.5	3.8
Kapolei	6.8	6	7	8	9	2.6	2.7	3.4	3.7	4.3
Pearl City	7	6	6			3.2	3.2	3.3		
Sand Island	7	7	7	8	9	3.8	3.7	3.6	3.6	3.9
Kihei	12	10	7	6	6*	3.8	3.2	2.6	2.4	2.6*
Hilo	7	6	6	7	6	3.5	3.5	3.5	3.3	3.0
Kona	17	8	10	10	10	4.9	2.6	3.4	3.8	3.5
Mt. View	10	5	5	6	6	3.0	1.8	2.1	2.1	2.2
Pahala	11	7	7	7	7	3.6	2.5	2.8	3.4	3.4
Ocean View	19	9	10	10	11	5.4	2.7	3.4	3.6	3.1
Kailua-Kona	4	8	9	11	10	2.4	3.6	4.1	4.5	3.9
Keaau	5	6	7	6	6	2.9	2.8	2.7	2.6	2.7
Naalehu	5	4	6	6	6	2.3	2.4	3.3	3.2	3.1
Waikaloa	5	9	7	8	8	2.3	1.8	2.1	2.3	2.5
Niumalu	8	8	7			2.9	3.1	2.9		
Kahului	8	7	7	8	8	3.4	3.7	3.9	4.0	4.0

* 2023 not reported.

$PM_{2.5}$ Statewide Trend

Figure 45 shows the average 98th percentile 24-hour $PM_{2.5}$ of all of CAB's monitoring stations from 2015 to 2024.

Figure 45. Statewide Trend: Average 98th Percentile 24-Hr $PM_{2.5}$



B. Sulfur Dioxide (SO_2)

Introduction

There are currently 12 stations that monitor SO_2. The ambient air quality standards for SO_2 are listed below:

Table 8. SO_2 State and National Standards for the Year

Ambient Air Quality Standards				
Pollutant	Averaging Time	Hawaii Standards	National Standards	
		Concentration	Primary	Secondary
Sulfur Dioxide (SO_2)	1 hour	None	75 ppb	None
	3 hour	0.5 ppm	None	None
	24 hour	0.14 ppm	None	None
	Annual average	0.03 ppm	None	<10 ppb (3-yr average)

SO_2 Measurements

Table 9 lists the maximum 1-hour and 24-hour SO_2 measurements and annual average for each location. Note that Kapolei has both a SLAMS and NCore site.

Table 9. SO_2 Measurements by Site

Site (name)	Maximum 1-Hr (ppb)					Maximum 24-Hr (ppb)					Annual Average (ppb)				
	2020	2021	2022	2023	2024	2020	2021	2022	2023	2024	2020	2021	2022	2023	2024
Kinau Hale	6.1	2.2	2.5	4.8	3.7	1.1	0.9	1.2	2.0	2.0	0.3	0.2	0.3	1.2	1.6
Kapolei	15.3	4.0	1.1			4.2	2.0	0.7			0.6	0.7	0.4		
Kapolei (TRACE)	15.8	10.9	2.7	23.8	13.4	5.6	1.5	0.9	2.3	1.2	0.7	0.4	0.1	0.3	0.04
Hilo	12.6	216.3	41.8	144.3	7.8	4.1	23.7	5.3	32.9	2.3	2.3	2.1	0.3	1.3	1.6
Kona	3.6	13.5	43.1	69.0	48.6	3.2	5.2	6.2	12.0	23.7	1.1	1.8	1.6	1.7	1.6
Mt. View	12.8	103.4	93.9	132.0	14.5	5.1	21.6	17.8	13.8	2.9	1.9	2.1	0.7	1.0	0.9
Pahala	16.5	591.6	366.8	293.0	174.8	4.7	130.2	53.4	74.2	32.7	2.5	8.9	7.8	3.4	2.4
Leilani	1.6	9.6	2.4	4.2	2.6	0.3	3.6	1.6	2.4	1.4	0	0.3	0.8	1.1	0.7
Ocean View	3.1	303.5	168.2	1083.4	173.1	1.2	64.6	32.0	87.6	37.7	0.5	3.8	4.3	2.6	1.9
Keaau	17.1	44.9	92.8	84.7	5.9	2.4	8.0	15.9	9.5	1.7	1.2	0	0	0	0.2
Naalehu	9.4	85.5	89.1	337.5	272.8	1.4	15.5	11.0	33.7	50.3	-0.3	3.8	2.2	2.3	1.2
Waikoloa				11.5	37.5				3.5	16.4				0.3	0.8
Niumalu	52.3	2.8	1.9	3.0	2.1	2.6	2.6	1.4	1.6	1.0	0.4	0.6	0.8	0.5	0.7

SO_2 Design Value

Table 10 lists the design values from 2020-2024 for each monitoring location. The design value is based on the three-year average of the annual 99th percentile values and is met when it is ≤75 ppb.

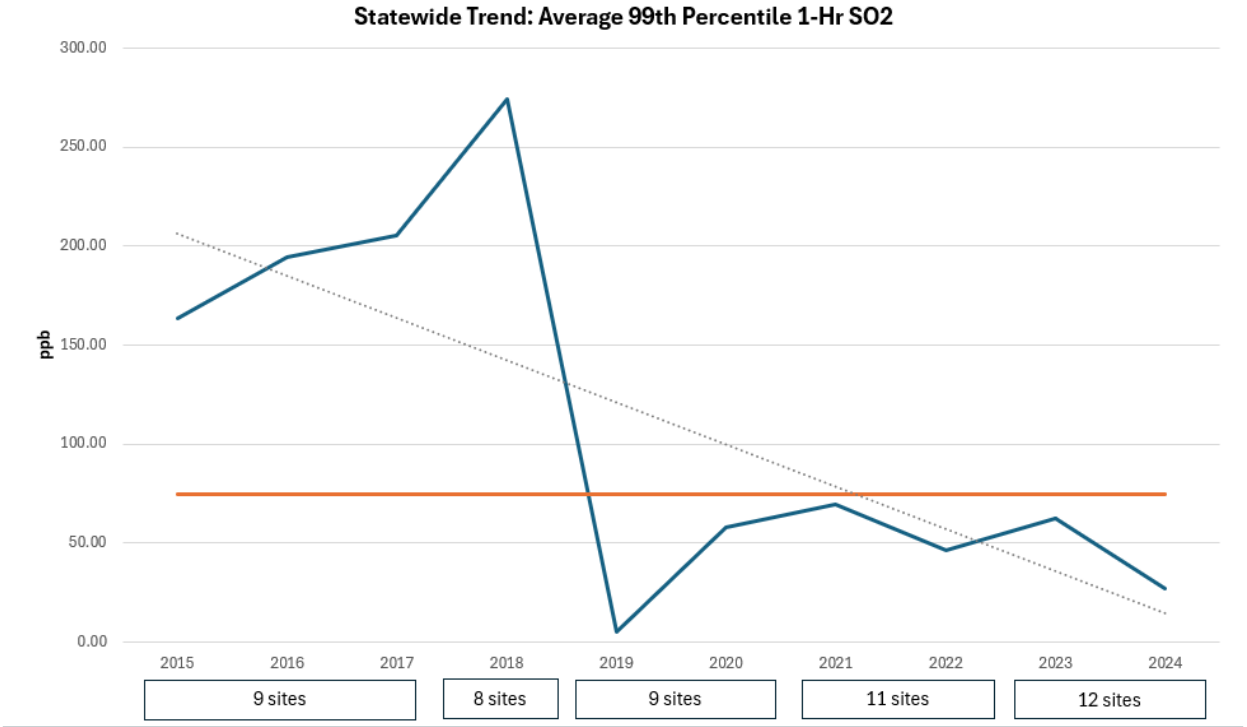
Table 10. SO_2 Concentrations by Site for the Design Value

Site (name)	Design Value (ppb)				
	2018-2020	2019-2021	2020-2022	2021-2023	2022-2024
Kinau Hale	3	3	1	2	2
Kapolei	5.1	4.0	3.2		
Kapolei (TRACE)	9	8.0	5.0	6	7
Hilo	71	17	21	48	41
Kona	36	8	10	12	18
Mt. View	113	25	41	53	35
Pahala	323	234	308	295	186
Leilani	2	3	3	3	2
Ocean View	365	125	160	162	138
Keaau	2	14	21	36	23
Naalehu	3	35	32	67	69
Waikoloa				4	5
Niumalu	3	3	3	2	2

SO_2 Statewide Trend

Figure 46 shows the average 99th percentile 1-hour SO_2 of all of CAB's monitoring stations from 2015 to 2024.

Figure 46. Statewide Trend: Average 99th Percentile 1-Hr SO_2 (ppb)



Volcanic emissions steady from 2010-2017, increased significantly during 2018 LERZ eruption, which ended in August 2018. Summit eruption occurred throughout 2020-2023. Southwest Rift Zone and East Rift Zone eruptions occurred in 2024. In December 2024, summit eruptions resumed and are currently ongoing.

C. Nitrogen Dioxide (NO_2)

Introduction

There is currently 1 station that monitor NO_2. The ambient air quality standards for NO_2 are listed below:

Table 11. NO_2 State and National Standards for the Year

Ambient Air Quality Standards				
Pollutant	Averaging Time	Hawaii Standards	National Standards	
		Concentration	Primary	Secondary
Nitrogen Dioxide (NO_2)	1 hour	None	100 ppb	None
	Annual average	0.04 ppm	53 ppb	Same as primary

NO_2 Measurements

Table 12 lists the maximum NO_2 measurements and annual average for each location.

Table 12. NO_2 Measurements by Site

Site (name)	Maximum (ppb)					Annual Average (ppb)				
	2020	2021	2022	2023	2024	2020	2021	2022	2023	2024
Kapolei	32.1	29.5	31.4	34.3	30.8	3.4	3.0	6.0	3.3	2.6
Niumalu	41.1	18.9	36.2			3.1	2.0	2.0		

NO_2 Design Value

Table 13 lists the design value for each monitoring location. The design value is based on the three-year average of the annual 98th percentile values and is met when it is ≤100 ppb.

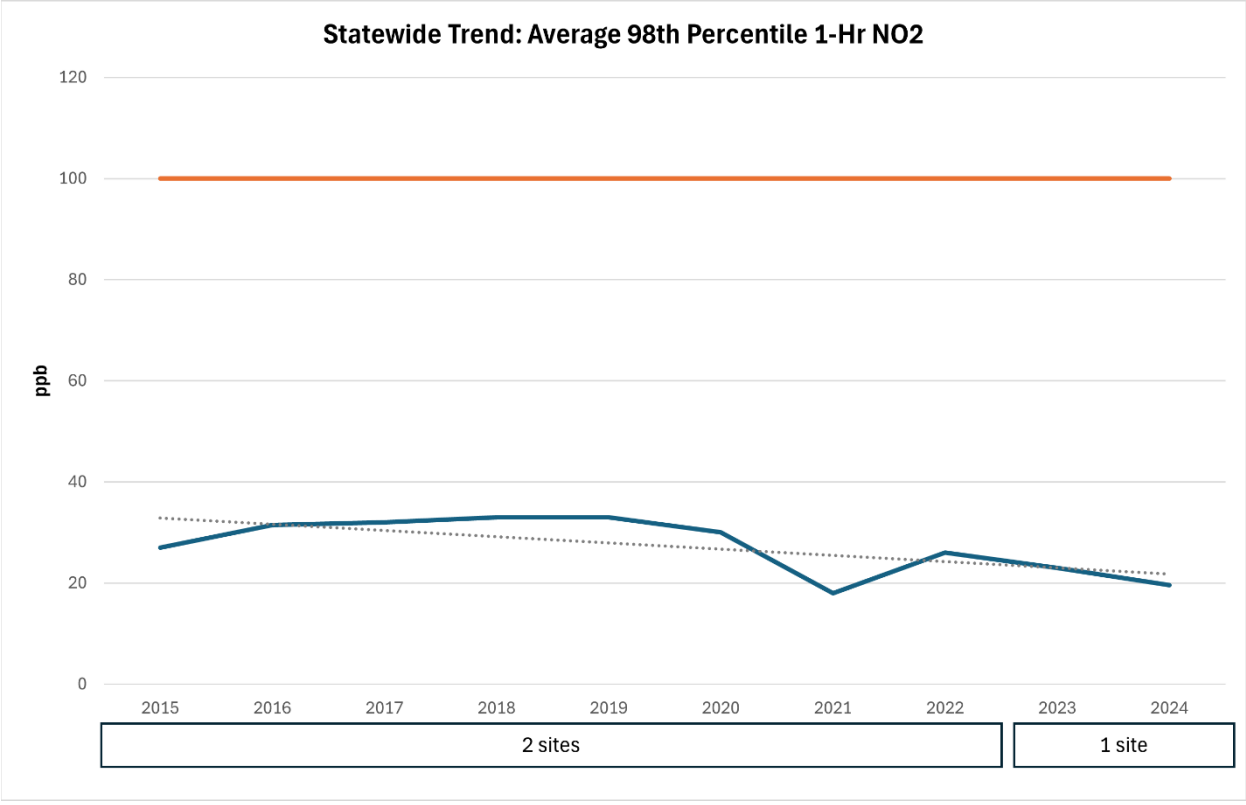
Table 13. NO_2 Concentrations by Site for the Design Value

Site (name)	Design Value (ppb)				
	2018-2020	2019-2021	2020-2022	2021-2023	2022-2024
Kapolei	27	25	23	23	22
Niumalu	37	29	26		

NO_2 Statewide Trend

Figure 47 shows the average 98th percentile 1-hr NO_2 of all of CAB's monitoring stations from 2015 to 2024.

Figure 47. Statewide Trend: Average 98th Percentile 1-Hr NO_2



D. Ozone (O_3)

Introduction

There are currently 2 stations that monitor O_3. The ambient air quality standards for O_3 are listed below:

Table 14. O_3 State and National Standards for the Year

Ambient Air Quality Standards				
Pollutant	Averaging Time	Hawaii Standards	National Standards	
		Concentration	Primary	Secondary
Ozone (O_3)	8-hour rolling average	0.08 ppm	0.070 ppm	Same as primary

O_3 Measurements

Table 15 lists the maximum 8-hour rolling O_3 measurements for each location.

Table 15. O_3 Measurements by Site

Site (name)	Maximum 8-hr Rolling (ppm)				
	2020	2021	2022	2023	2024
Kapolei	0.047	0.050	0.044	0.045	0.045
Sand Island	0.046	0.046	0.048	0.048	0.046

O_3 Design Value

Table 16 lists the design values from 2020-2024 for each monitoring location. The design value is based on the three-year average of the annual 4th highest daily maximum 8-hour average and is met when it is ≤ 0.075 ppm.

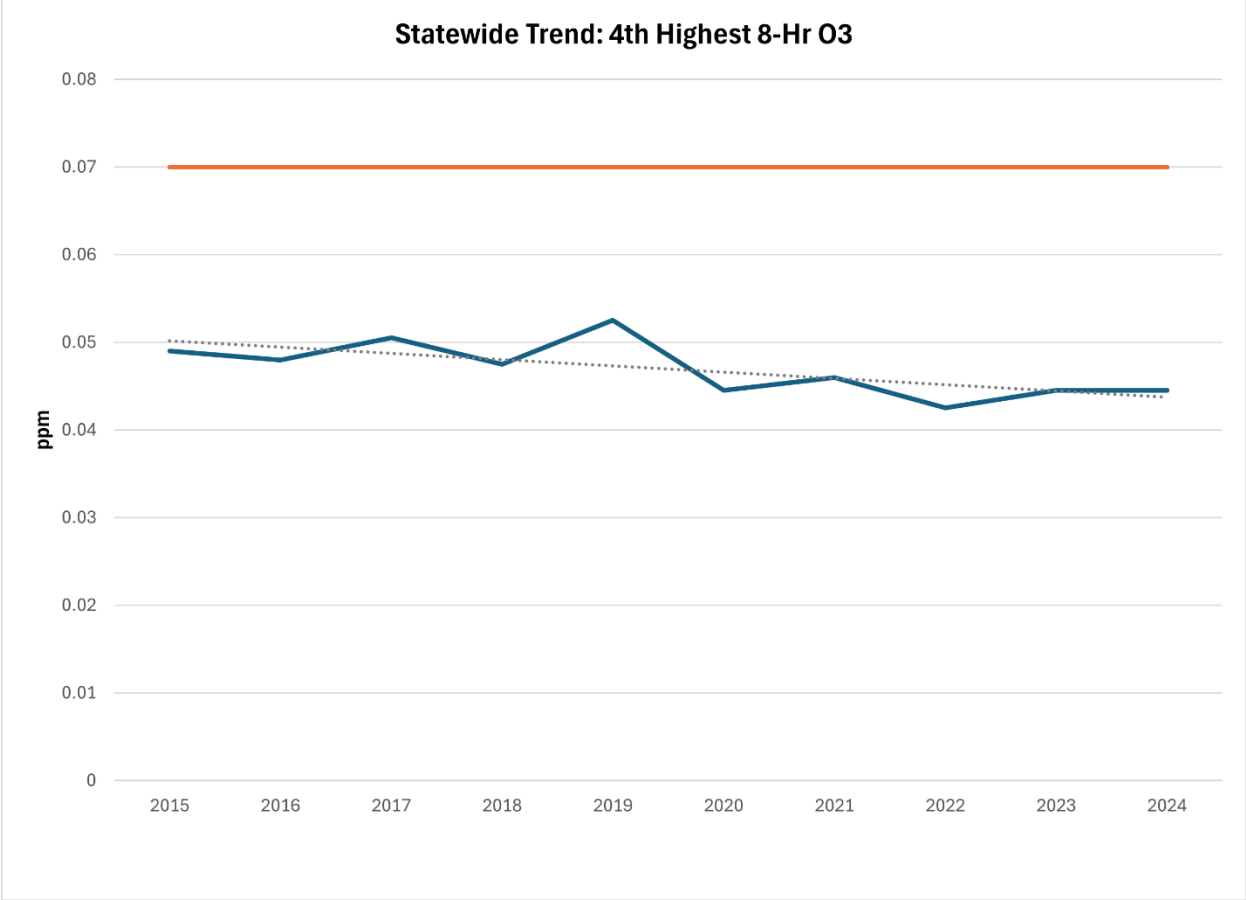
Table 16. O_3 Concentrations by Site for the Design Value

Site (name)	Design Value (ppm)				
	2018-2020	2019-2021	2020-2022	2021-2023	2022-2024
Kapolei	0.048	0.048	0.044	0.043	0.043
Sand Island	0.047	0.047	0.044	0.045	0.044

O_3 Statewide Trend

Figure 48 shows the average 4th highest rolling 8-hour O_3 concentration of all of CAB's monitoring stations from 2015 to 2024.

Figure 48. Statewide Trend: 4th Highest 8-Hr O_3



E. Particulate Matter ≤10 µm (PM_{10})

Introduction

There are currently 2 stations that monitor PM_{10}. The ambient air quality standards for PM_{10} are listed below:

Table 17. PM_{10} State and National Standards for the Year

Ambient Air Quality Standards				
Pollutant	Averaging Time	Hawaii Standards	National Standards	
		Concentration	Primary	Secondary
Particulate Matter 10 µm (PM_{10})	24 hour block average	150 µg/m^3	150 µg/m^3	Same as primary
	Annual average	50 µg/m^3	None	None

PM_{10} Measurements

Table 18 lists the maximum 24-hour PM_{10} measurements and annual average for each location.

Table 18. PM_{10} Measurements by Site

Site (name)	Maximum 24-Hr (µg/m³)					Annual Average (ppb)				
	2020	2021	2022	2023	2024	2020	2021	2022	2023	2024
Kinau Hale	22	26	25	33	41	10.7	9.8	10.7	12.4	11.9
Kapolei	43	46	48	76	36	11.6	11.9	16.5	16.7	15.1
Pearl City	26	25	24			14.4	11.4	13.9		

PM_{10} Design Value

There is no PM_{10} design value. However, its 24-hour concentration is not to be exceeded more than once per year on average over 3 years. Table 19 shows the number exceedances for each site from 2020-2024.

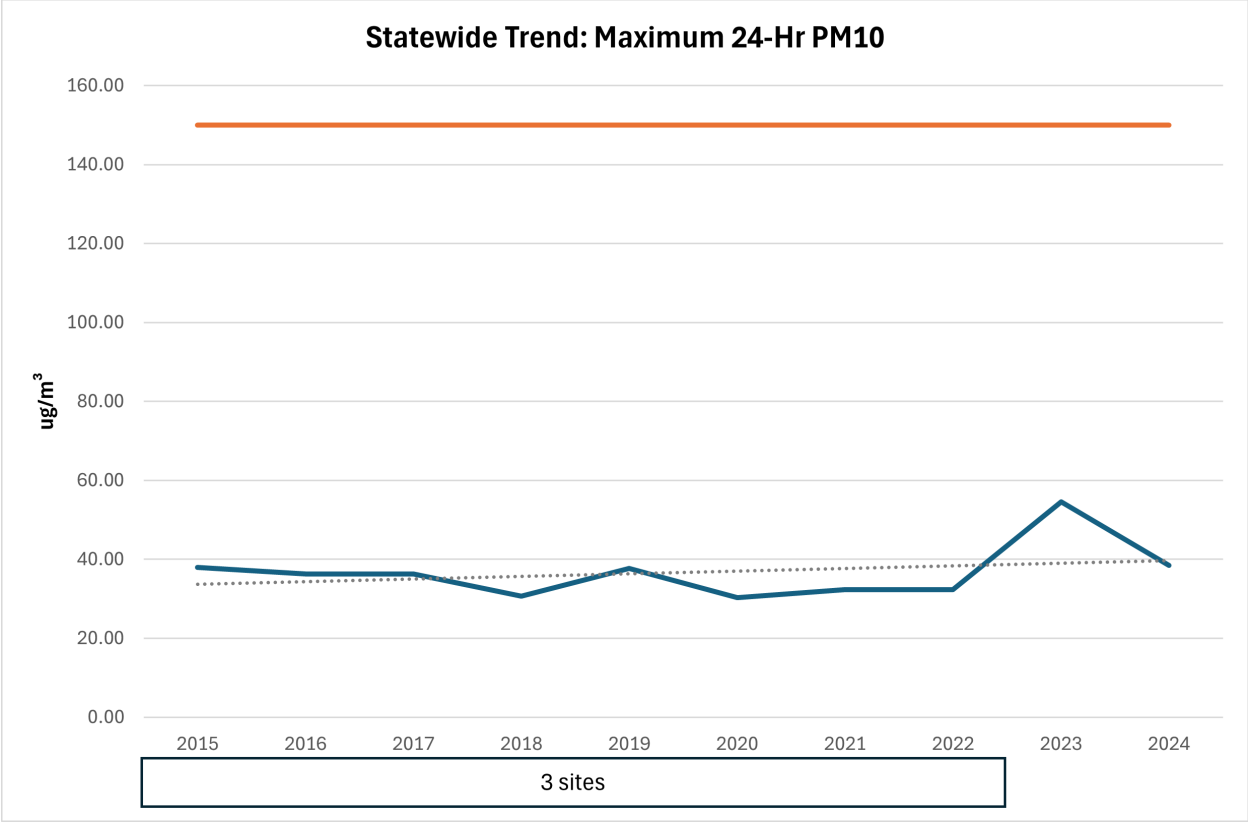
Table 19. PM_{10} Exceedances by Site

Site (name)	Number exceedances				
	2020	2021	2022	2023	2024
Kinau Hale	0	0	0	0	0
Kapolei	0	0	0	0	0
Pearl City	0	0	0		

PM_{10} Statewide Trend

Figure 49 shows the average maximum 24-hr PM_{10} concentrations of all of CAB's monitoring stations from 2015 to 2024.

Figure 49. Statewide Trend: Maximum 24-Hr PM_{10}



F. Carbon Monoxide (CO)

Introduction

There are currently 2 stations that monitor CO. The ambient air quality standards for CO are listed below:

Table 20. CO State and National Standards for the Year

Ambient Air Quality Standards				
Pollutant	Averaging Time	Hawaii Standards	National Standards	
		Concentration	Primary	Secondary
Carbon Monoxide (CO)	1-hour average	9 ppm	35 ppm	None
	8-hour average	4.4 ppm	9 ppm	None

CO Measurements

Table 21 lists the maximum 1-hour and 8-hour rolling CO measurements and annual average for each location.

Table 21. CO Measurements by Site

Site (name)	Maximum 1-Hr (ppm)					Maximum 8-Hr (ppm)					Annual Average (ppm)				
	2020	2021	2022	2023	2024	2020	2021	2022	2023	2024	2020	2021	2022	2023	2024
Kinau Hale	1.4	0.9	1.1	0.7	6.8	0.8	0.7	0.7	0.4	1	0.4	0.5	0.1	0.1	0.1
Kapolei	0.9	0.7	0.6	0.6	0.5	0.3	0.3	0.3	0.3	0.2	0.1	0.1	0.2	0.07	0.1

CO Design Value

There is no design value for CO. However, its concentration is not to be exceeded more than once per year for the 8-hour rolling value, and not to be exceeded for the 1-hour value. Table 22 shows the number of exceedances for each site from 2020-2024.

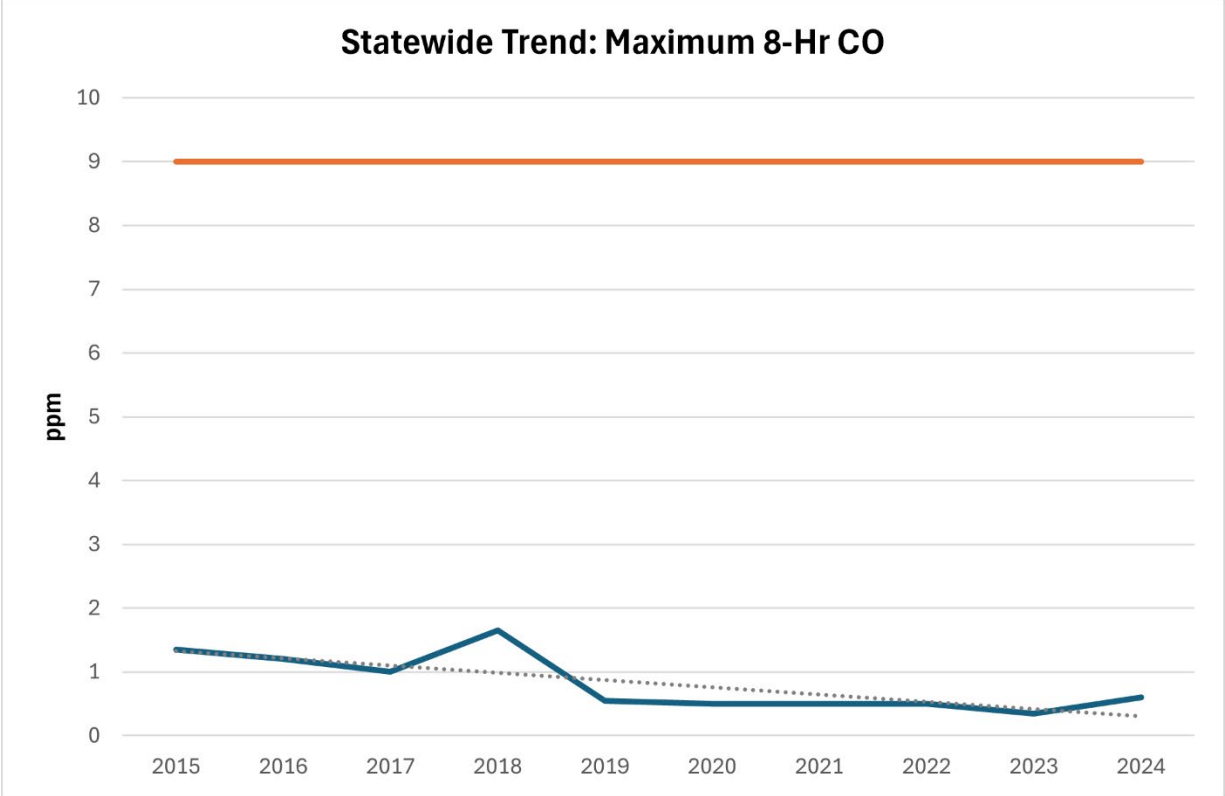
Table 22. CO Exceedances by Site

Site (name)	Number exceedances (1-Hr)					Number exceedances (8-Hr)				
	2020	2021	2022	2023	2024	2020	2021	2022	2023	2024
Kinau Hale	0	0	0	0	0	0	0	0	0	0
Kapolei	0	0	0	0	0	0	0	0	0	0

CO Statewide Trend

Figure 50 shows the average maximum 8-hour CO concentrations of all of CAB's monitoring stations from 2015 to 2024.

Figure 50. Statewide Trend: Maximum 8-Hr CO



G. Other Pollutants

Hydrogen Sulfide (H_2S)

H_2S is a non-criteria pollutant and there is no federal standard. Due to geothermal activities, Hawaii has a state standard for H_2S and monitors its concentrations at one SPMS.

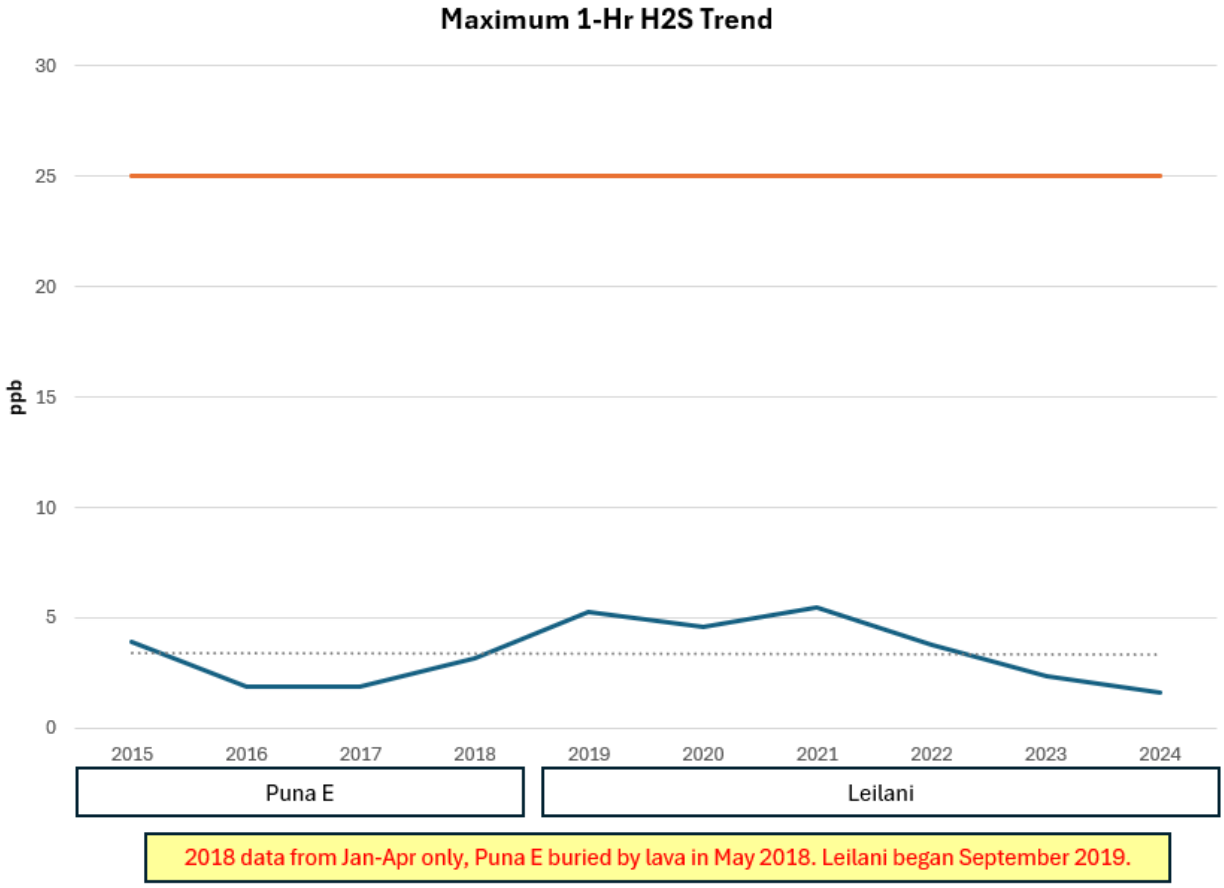
Table 23. H_2S State and National Standards for the Year

Ambient Air Quality Standards				
Pollutant	Averaging Time	Hawaii Standards	National Standards	
		Concentration	Primary	Secondary
Hydrogen Sulfide (H_2S)	1-hour average	25 ppb	None	None

Table 24. H_2S Measurements by Site

Site (name)	Maximum 1-Hr (ppb)					Annual Average				
	2020	2021	2022	2023	2024	2020	2021	2022	2023	2024
Leilani	4.6	5.5	3.8	2.4	1.6	1.9	1.9	0.7	1.2	0.5

Figure 51. Statewide Trend: Maximum 1-Hr H_2S



Non-Regulatory Pollutants

Non-regulatory pollutants include NO, NO_y, and $PM_{10-2.5}$. These are all measured at Kapolei NCore.

Table 25. Non-Regulatory Pollutants Measurements

Pollutant	Maximum					Annual Average				
	2020	2021	2022	2023	2024	2020	2021	2022	2023	2024
NO (ppb)	41.8	N/A*	N/A†	59.1‡	28.3	0.6	N/A*	N/A†	0.8‡	0.5
NO_y (ppb)	63.8	N/A*	N/A†	78.2‡	51.4	3.2	N/A*	N/A†	4.0‡	2.5
$PM_{10-2.5}$ ($\mu g/m^3$)	39.7	44.1	39.1	60.8	11.5	9.5	9.5	12.3	11.7	4.6

* No valid 1-hr periods for the year.
† Did not run – no data for the entire year.
‡ 4th quarter only.

H. Monitoring Assessment Findings Based on Data and Trends

1. Criteria pollutant prioritization: SO_2, $PM_{2.5}$, NO_2, O_3, PM_{10}, CO
    a. The primary pollutants of concern for the state remain $PM_{2.5}$ and SO_2, mainly due to possible future volcanic events.
        i. No new SO_2 monitors are required.
        ii. Since 14 of the state's 16 stations monitor for $PM_{2.5}$, no new or relocated $PM_{2.5}$ monitors are needed.

b. Other than monitoring the population of the Honolulu MSA as it hovers below the one million mark (with a slight estimated downward trend), to meet the near-road NO_2 requirement - data trends do not indicate a need for any new monitoring.
c. Towards the end of 2015, EPA lowered the 8-hour O_3 NAAQS to the current 70 ppb standard. The data collected at the two O_3 sites will be closely monitored for any significant increase. To better characterize the formation of O_3 at the Sand Island station, a 10 meter meteorological tower for WS and WD should be installed.
d. PM_{10} values have remained steady on Oahu since the City & County began regulating the use of fireworks for the New Year's celebrations. The state currently meets the minimum PM_{10} monitoring requirements in 40 CFR 58, no new or relocated monitors are needed.
e. CO values have been consistently low at all monitors with no indication of an increase in CO emission sources. Discontinued the redundant CO monitor at the Kapolei SLAMS station since CO is being monitored at Kapolei NCore.

VIII. Monitoring Assessment Findings Based on New NAAQS Requirements

On February 7, 2024, the U.S. Environmental Protection Agency (EPA) promulgated a revised annual primary National Ambient Air Quality Standard (NAAQS) for $PM_{2.5}$, strengthening the standard from 12 µg/m³ to 9 µg/m³. The Hawaii Department of Health (DOH) remains in attainment of the revised standard.

As part of its monitoring assessment, DOH partnered to establish two sulfur dioxide (SO_2) monitoring stations near the Hawaiian Electric Company (HECO) Kahe and Waiau generating stations:

- **Kahe Station**: The Kahe SO_2 monitor demonstrated attainment of the 2010 1-hour SO_2 NAAQS, based on the five most recent EPA-designated design values (2019–2023). Accordingly, EPA approved DOH's request to shut down the Kahe SO_2 SLAMS monitor pursuant to 40 CFR §58.14(c)(1).
- **Waiau Station**: The Waiau SO_2 monitor recorded a three-year design value of 16 ppb (2017–2019), which is less than 50% of the 1-hour SO_2 NAAQS. EPA approved DOH's request to shut down the Waiau SO_2 SLAMS monitor pursuant to 40 CFR §58.14(c)(3).

IX. Technology Updates

DOH has upgraded its monitoring technology by replacing all original Met One BAM 1020 continuous $PM_{2.5}$ monitors with newer BAM 1022 models, which also hold Federal Equivalent Method (FEM) designations. Currently, the network operates thirteen (13) BAM 1022 units, including two (2) collocated monitors as required by 40 CFR Part 58.

In 2022, DOH installed two T640X instruments to provide continuous measurement of both $PM_{2.5}$ and PM_{10} at the Honolulu and Kapolei/NCore monitoring stations.

X. 2025 Assessment Findings

Implementation of the 2020 Assessment Findings

Hawaii's ambient air monitoring network continues to operate efficiently and effectively, achieving its objectives and delivering reliable, high-quality air quality data to the public, researchers, regulatory agencies, and other stakeholders. Most recommendations from the 2020 network assessment have been successfully implemented over the past five years.

One key lesson from the last three assessments is the need for flexibility. Changing conditions—including evolving federal regulations, economic fluctuations, revised NAAQS, limited resources, and the impacts of the COVID-19 pandemic—require adaptive planning and execution.

Despite persistent challenges such as limited funding and staffing, DOH has managed to maintain and expand its network. The introduction of unfunded federal mandates—such as NCore and near-road NO_2 monitoring—continues to place strain on resources. Nevertheless, DOH successfully established four new monitoring stations as proposed in the 2015 assessment.

Table 26. 2020 Assessment Implementation

2020 Assessment Recommendation	Implementation
Relocate the Kapolei SLAMS and Kapolei NCore stations; EPA approval will be needed. The current site, which belongs to the Board of Water Supply, is undergoing site renovations and construction to be transformed into a baseyard: • The SLAMS station began operating at the current location in 2002 monitoring for CO, SO_2, NO_2, PM_{10} and $PM_{2.5}$; • In 2011, the state's required NCore station began operating at this site monitoring for the NCore parameters CO (trace), SO_2 (trace), NO/NOy, O_3, $PM_{2.5}$, PM_{10}, $PM_{10-2.5}$, WS/WD, ambient temperature, relative humidity and Pb (beginning in 2012);	Relocating the Kapolei SLAMS and NCORE station is no longer necessary as the Board or Water Supply has decided not to pursue their plans to transform the site into a base yard.

2020 Assessment Recommendation	Implementation
Be prepared to establish the near-road NO_2 station if the urban Honolulu MSA reaches one million in population: • The site has already been selected near the roadway on Oahu with the highest Annual Average Daily Traffic (AADT); • Include details of the station in the appropriate Annual Network Plan; • CO and $PM_{2.5}$ monitoring will be needed in addition to NO_2.	Near-road NO_2 monitoring requirement for CBSAs with a population of greater than 500,000 but less than one million, which includes the Honolulu MSA, has been removed by EPA as of December 22, 2016. The population and Annual Average Daily Traffic (AADT) for the Honolulu CBSA will be monitored, and in the event they hit the minimum threshold in the future, the near-road monitoring will be implemented.
Install a 10 meter meteorological tower at the Sand Island station to better characterize the formation of O3 from sources originating in downtown Honolulu.	The 10-meter meteorological tower has yet to be installed.
Continue cruise ship monitoring on Kauai for at least one year.	The Niumalu station continues to monitor for SO_2.
Continue to operate the Kahe station to monitor for SO_2 to satisfy the requirements of the Data Requirement Rule: • The state has completed a minimum of three years of data collection at each of the two DRR stations , Kahe and Waiau, that have been in operation since December 2016. The state will request that the Waiau station be allowed to close, as the 3-year design value of 16 ppb is less than 50% of the 1-hour SO_2 NAAQS of 75 ppb. The Kahe station had a 3-year design value of 52 ppb, greater than 50% of the 1-hour SO_2 NAAQS. • The affected facilities being monitored by the Kahe station are the HECO Kahe electrical generating facility, Kalaeloa Power Partners and AES Hawaii all located in West Oahu; • Continue utilizing the private/public partnership with HECO in operating, and maintaining this station.	The state has completed a minimum of three years of data collection at each of the two stations that have been in operation since the beginning of 2017 as required by the DRR, On July 24, 2024, the state received approval from EPA to discontinue the Kahe site which was shut down on September 30, 2024. On October 8, 2021, the state received approval from EPA to discontinue the Waiau site which was shut down December 31, 2021.
The FRM co-located sampler at Hilo was relocated to the Pearl City station to meet department budgetary needs and to improve program efficiency.	The FRM co-located sampler at Hilo was relocated to Sand Island on April 6, 2023.
Finalize site improvements at Leilani Community Association Center per the association's requirements and relocate the monitor to its long-term location from its current temporary location at the center.	The monitor was relocated to its permanent location on June 1, 2021.
Finalize site improvements at Kailua-Kona. This long-term site selections was finalized in 2018 and AQMS had been directed to complete set up of this SPMS stations in accordance with DWS direction and using DWS power until DOH could set up its own poles. However, continuous site improvement delays have kept the sampler from being moved to its intended long-term location on the property.	The monitor was relocated to its permanent location on the property.

2020 Assessment Recommendation	Implementation
Finalize site improvements at Waikoloa DWS long-term site and relocate the $PM_{2.5}$ sampler from the temporary site at Waikoloa Elementary School. This station on the northwest side of Hawaii island was selected to be sited within a fenced area that contains a water tank and pump house; this is the same exact site that DOH had operated a station (15012021) from 2012-14. AQMS had set up a non-regulatory temporary station at the Waikoloa Elementary School during the 2018 LERZ eruption; it has been monitoring for $PM_{2.5}$ at the school since June 29, 2018 as a non-regulatory temporary station as the sampler was neither sited properly nor installed for long-term use. The long-term site was selected by CAB in August 2018 and a final request was made to AQMS in October 2018 to relocate the sampler as the new site was already prepped and secured for a $PM_{2.5}$ sampler to be immediately deployed. However, AQMS has yet to relocate the sampler to the DWS site as an electric power meter has yet to be installed there.	The monitoring station was moved to a permanent location on December 7, 2022.
Finalize site improvements at the Naalehu Elementary School long-term site and relocate the $PM_{2.5}$ sampler from the temporary site at the Naalehu Volunteer Fire Station to the long-term site next to the USGS Seismograph Building at Naalehu Elementary School, where the SO_2 monitor is located. This long-term site selection was also finalized in 2018 and AQMS had been directed to move the $PM_{2.5}$ sampler next to the SO_2 monitor, as the sampler was placed there at the beginning of the emergency and was neither properly sited nor installed for long-term use. AQMS has yet to relocate the sampler.	Site improvements were finalized, and the monitor was moved to its permanent location on December 5, 2022.
Finalize site improvements at the Kamehameha Schools Hawaii campus in Keeau. The long-term site was selected to be at the Switch Gear Building on campus. The monitors for this station are currently located at the Keeau – Temporary station, approximately 827 meters to the NNW and will need to relocate.	The monitoring station was moved to the permanent location June 30, 2022.
Site improvements at Honaunau and Pahoa are on hold due to funding and resource issues.	The Honaunau and Pahoa sites are not needed and will not be established

Summary of 2025 Assessment Findings

1. Combine and upgrade the Kapolei NCORE and SLAMS monitoring station efficiency and data quality.
2. Prepare for future requirements by planning for the establishment of a near road NO_2 monitoring station if the urban Honolulu MSA reaches a population of one million.
3. Install a 10-meter meteorological tower at the Sand Island station to better characterize the formation of ozone (O_3) from emission sources in downtown Honolulu.
4. Continue cruise ship related monitoring on Kauai. Data from the Niumalu station indicate a significant reduction in SO_2 levels. If resources permit, consult with

the community to explore relocating the station to a more populated area such as Lihua or Kapaa which is designated as micropolitan statistical area.

5. Maintain operation of the two $PM_{2.5}$ monitoring stations in Kihei and Kahului. As resources allow, consider expanding to include CO, NO_2, and SO_2 on Maui.
6. Continue operation of nine SO_2 and $PM_{2.5}$ volcanic emissions monitoring stations on the Hawaii Island.
7. Sustain H_2S monitoring in the Puna region to track emissions from geothermal energy production and exploration activities.
8. Supplement the regulatory network with temporary monitors such as low-cost air quality sensors to enhance spatial coverage and public awareness.
9. Change the designation of Hilo $PM_{2.5}$, Kona $PM_{2.5,}$ and Pahala SO_2 monitoring stations from SPMS to SLAMS on January 1, 2026.