2025 Annual Report on Air Emissions from Facilities at Campbell Industrial Park

Prepared by:
Clean Air Branch
Hawai‘i State Department of Health

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Introduction

This report has been prepared by the Department of Health (DOH), Clean Air Branch (CAB) pursuant to the requirements set forth in Hawai‘i Revised Statutes (HRS) Section 342B-18. The purpose of the report is to provide members of the communities surrounding Campbell Industrial Park (CIP) and Kahe Valley with an understanding of the circumstances and activities related to ambient air quality in those areas.

HRS §342B-18 directs the DOH to generate an annual report to the communities using specific information provided by the major sources located in CIP and Kahe Valley. The information for this report is based on 2024 annual data collected in 2025.

For the sake of clarity, the report is divided into three sections. Section 1 addresses the activities of the major sources and is split into two distinct parts. The first part of Section 1 describes each major facility, the sources of emissions, and the air pollution controls that the facility employs to minimize its air emissions. The second part, Table A, identifies the type and quantity of criteria air pollutants, and other pollutants of interest, emitted by each major facility for the calendar year.

Section 2 provides the air quality monitoring data obtained from the monitoring stations located on the outskirts of CIP. The data is presented in tabular form as well as in graphs which compare the data to the federal and state ambient air quality standards. In every case, Hawai‘i’s air quality is far better than the national, health-based standards. The graphs also help illustrate any trend over the last five years.

Section 3 is a report on the measurements of the criteria and non-criteria air pollutants and the expected health effects at the measured levels. The purpose of this section is to provide the reader with an understanding of the potential impacts on human health at the existing levels of air quality.

The DOH-CAB administers the statewide air pollution control program. It consists of a permitting program which regulates the facilities, an air quality and source monitoring program, and an investigatory and enforcement program.

If you have questions about this report or about air quality, please contact the Clean Air Branch at the following:

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A copy of this report can be found on the Clean Air Branch website:
http://health.hawaii.gov/cab
Open the topic area for “Reports.”
Click on the link, “Annual Reports on Campbell Industrial Park.”

SECTION 1
Summary of Air Pollutants Emitted by Major Source Facilities in Campbell Industrial Park & Kahe Valley in 2024 and a Description of the Air Pollutant Controls

Air Pollutants Emitted by the Facilities

This initial section describes the controls, operating procedures, or other measures used to control air pollutant emissions at the major sources in Campbell Industrial Park (CIP) and Kahe Valley in accordance with each facility's covered source permit (CSP). Both criteria and non-criteria pollutants are included in the CSPs and in this report. Please refer to **Section 2** for a description of the included pollutants. A list of air emissions is presented in **Table A**. The emissions were derived using actual operating hours or fuel usage, stack test results, continuous emission monitoring data, and standard emission factors.

Descriptions of the Respective Air Pollutant Controls

AES Hawai'i Cogeneration Plant (CSP No.0087-01-C)

In September 2020, Act 23 was signed into law, prohibiting the future use of coal-generated electricity past December 31, 2022. On September 20, 2022, AES Hawai'i, LLC notified DOH-CAB that the cessation of coal burning at their facility occurred on August 31, 2022. Boiler A was taken offline on August 30, 2022, Boiler B was taken offline on August 31, 2022, and coal crushing and coal/oil burning were discontinued on August 31, 2022. On December 12, 2022, AES Hawai'i, LLC notified DOH-CAB that the coal-fired cogeneration plant and associated structures were being decommissioned in preparation for demolition. DOH-CAB was notified that the ash handling equipment permanently ceased operations on December 13, 2023 and the air permit for AES was subsequently closed on December 31, 2023. There were no reported emissions in 2023.

Hawaiian Electric – Kahe Valley (CSP No. 0240-01-C)

Hawaiian Electric operates the Kahe Generating Station located in Kahe Valley. Fuel oil is received by pipeline from Hawaiian Electric's Barber's Point tank farm next to the CIP Generating Station, then stored in above ground storage tanks at the Kahe facility. From the storage tanks, the fuel oil is fed into the six (6) boilers and two (2) black start diesel engine generators for combustion.

Particulate matter (PM), particulate matter 10 microns or smaller (PM_{10}), particulate matter 2.5 microns or smaller ($PM_{2.5}$), sulfur dioxide (SO_2), nitrogen oxides (NO_x), carbon monoxide (CO), and volatile organic compounds (VOC) are the primary air pollutants emitted from this facility. PM, PM_{10}, and $PM_{2.5}$ are mainly controlled by the consumption of fuel oil with a low ash content. The SO_2 emissions are controlled by the combustion of low sulfur fuel oil (< 0.5% sulfur by weight). Boiler K6 is equipped with a low NO_x burner which precisely controls the mixing of fuel and air to minimize NO_x emissions.

Hawaiian Electric - Campbell Industrial Park Generating Station (CSP No. 0548-01-C)

Hawaiian Electric operates a biodiesel / fuel oil No. 2 fueled combustion turbine generating station in CIP. CIP Generating Station is the first biodiesel fueled combustion turbine plant in Hawai'i. The facility operates one (1) simple cycle combustion turbine generator and two (2) black start diesel engine generators. Biodiesel and fuel oil No. 2 for the combustion units are stored inside above ground storage tanks at the tank farm next to the CIP Generating Station. A temporary boiler combusting fuel oil No. 2 was used at the tank farm to heat fuel to increase its fluidity for supplying the fuel to generating units at the Kahe and Waiau Generating Stations until 2023. Hawaiian Electric permanently replaced the temporary boiler with an electric boiler and removed the combustion boiler from the site in March 2023. For operation in 2024, fuel oil No. 2 was the only fuel used for the combustion turbine generator.

Primary air pollutants emitted from this facility are SO_2, PM_{10}, $PM_{2.5}$, NO_x, CO, and VOC. A water injection system is used to control NO_x from the combustion turbine generator. The system injects demineralized water into the turbine generator's combustion chamber to reduce peak flame combustion temperature. Lowering combustion temperature reduces the formation of thermal NO_x. Low sulfur fuel with not more than 0.05% by weight sulfur content is used to minimize SO_2 emissions from the combustion turbine generator. This low sulfur fuel had also been used for the temporary boiler at the tank farm prior to its replacement with an electric boiler. The black start diesel engine generators are fired on ultra-low sulfur fuel with maximum 0.0015% by weight sulfur content. Good combustion practices are used for the combustion turbine generator to minimize particulate, CO, and VOC emissions. Storage tanks servicing the combustion turbine generator are equipped with internal floating roofs with tank seal systems to control VOC emissions.

Reworld Honolulu (CSP Nos. 0255-01-C and 0255-02-C)

Reworld Honolulu, formerly the Covanta Honolulu Resource Recovery Venture (H-POWER) operates a municipal waste disposal facility to generate electricity for its operation and sale to Hawaiian Electric. Municipal solid waste (MSW) from the City and County of Honolulu is received, sorted, shredded, then fed into two (2) 854 ton per day (TPD) refuse derived fuel (RDF) municipal waste combustors (MWCs). MSW is also received, sorted, and fed to one (1) 900 TPD mass-burn MWC. Post combustion air pollution controls are used for the boilers to control emissions. Bottom ash and fly ash from the boilers are treated, collected, and blended together. The combined ash and recovered metal are disposed of in a landfill or recycled, as appropriate. Cooling towers are also used to extract heat from boiler circulation water systems.

PM, $PM_{2.5}$, PM_{10}, SO_2, NO_x, CO, MWC metals (cadmium, lead, and mercury), and MWC acid gases (SO_2, H_2SO_4, HCl, and HF) are the primary air pollutants emitted from boilers at this facility. PM, $PM_{2.5}$, PM_{10}, and MWC metals from boiler combustion are controlled with baghouses. MWC acid gases are controlled with spray dryer absorbers. The spray dryer absorbers inject a lime slurry which absorbs SO_2 and other acid gases. The baghouses then removes the lime slurry precipitate and other particulates from the boiler exhaust stream. Emissions control for the

mass-burn boiler includes selective non-catalytic reduction (SNCR) and very low-NO_x (VLN) systems to control NO_x emissions. An activated carbon injection system is also used for the mass-burn boiler to reduce mercury and dioxin furan emissions. Cooling towers are equipped with drift eliminators to remove droplets from the air stream before exiting the tower to reduce particulate and VOC emissions.

Controls are also used for other sources that generate emissions at this facility. Baghouses are used to control particulate matter emissions that are generated by shredders operating inside the waste processing building before the air is vented to the outside. Fugitive dust is controlled with enclosures and/or paved areas for waste processing, ash handling systems, and transportation. The mass-burn boiler is allowed to burn mechanically dewatered sewage sludge and dried sewage sludge pellets when combusting MSW. Odors (e.g., H_2S) in the air from sludge unloading and storage at the sludge receiving station are vented through a bio-tower odor abatement system and/or vented over the mass-burn boiler's refuse pit to be drawn into the boiler combustion air.

Kalaeloa Partners Cogeneration Plant (CSP No. 0214-01-C)

Kalaeloa Partners operates a cogeneration facility which generates electricity for sale to Hawaiian Electric and steam for sale to Par Hawai'i Refining. The facility operates as a combined-cycle plant, using exhaust heat from its combustion turbines to increase efficiency and produce steam for steam turbine electricity production and steam to the neighboring refinery for its processes. Fuel delivered by pipeline is consumed by two combustion turbines to power their respective generators as the primary cycle. The exhaust gas of the turbines passes through heat recovery steam generators to produce steam which is sent to a steam turbine connected to a generator completing the combined cycle. A cooling tower removes heat from the steam turbine outlet and other plant processes.

PM, PM_{10}, $PM_{2.5}$, SO_2, and NO_x are the primary air pollutants emitted from this facility. The following briefly describes the air pollution control methods being employed. SO_2 is controlled by the use of low sulfur fuel oil (< 0.5% sulfur by weight). NO_x is controlled by the use of steam injection which lowers the combustion temperature. The cooling tower emits particulates which are dissolved solids in the evaporated water. Particulate matter emissions from the cooling tower are controlled by limiting the water flow rate and amount of total dissolved solids within the water.

Par Hawai'i Refining, LLC – Par East Refinery (CSP No. 0212-01-C)

Par Hawai'i Refining operates a petroleum refinery producing petroleum products. Crude oil is imported by ship and stored in above ground tanks prior to processing. The crude oil is processed or refined to produce various petroleum products. The main emission units are storage tanks, furnaces, boilers, a combustion turbine, and a flare.

PM, PM_{10}, $PM_{2.5}$, SO_2, NO_x, CO, and VOC are the primary air pollutants emitted from this facility. The following briefly describes the air pollution control methods employed. The PM, PM_{10} and $PM_{2.5}$ emissions are mainly controlled by the consumption of fuel oil with a low ash content and the use of refinery fuel gas. SO_2 is

controlled by the use of low sulfur fuel oil (< 0.5% sulfur by weight) and process controls such as a sulfur recovery unit. The sulfur recovery unit removes the sulfur from the gas streams which is condensed and sold as a solid. NO_x is controlled by the use of low NO_x burners in the heaters and water injection in the combustion turbine. VOC is controlled by the use of a flare, a thermal oxidizer for wastewater treatment, and the employment of proper leak detection and maintenance procedures. During the storage of the petroleum products, VOC is controlled with the use of various equipment for petroleum storage tanks such as gaskets, seals, and floating roofs. Slotted guide poles with sleeves were installed in 28 storage tanks to reduce fugitive VOC emissions. A flare gas vapor recovery system reduces SO_2, NO_x, and CO emissions during flaring events from shutdowns or upsets.

On December 8, 2023 a permit application for a significant modification (No. 0212-60) was submitted for constructing a renewable fuel production facility at the Par East Refinery. The construction involved the conversion of the existing diesel hydroeater to a renewable hydroeater and added a renewable feedstock pretreatment unit and high-pressure steam generating boiler to the refinery. This change in equipment helps to further Par Pacific's renewable fuel strategy by commissioning the state's largest renewable fuel production facility to supplement existing conventional fuel production. The permit modification to construct the renewable fuel production facility was issued by CAB on September 4, 2024.

<u>Par Hawai'i Refining, LLC – Par West Refinery (CSP No. 0088-01-C)</u>

In December 2018, Par Hawai'i Refining, LLC purchased the refinery portion of the former IES Downstream, LLC petroleum refinery and renamed it the Par West Refinery. This petroleum refinery produced various types of petroleum products excluding gasoline. Crude oil imported by ship and stored in above ground tanks at the IES Downstream Kapolei Terminal was processed, or refined, to produce various petroleum products. The main emission units of Par's refinery operations were furnaces, boilers, combustion turbines, cooling towers, and flares.

PM, PM_{10}, $PM_{2.5}$, SO_2, NO_x, CO, and VOC were the primary air pollutants emitted during refinery operations. The PM, PM_{10}, and $PM_{2.5}$ emissions were mainly controlled by the consumption of fuel oil with a low ash content and the use of refinery fuel gas. The cooling tower PM, PM_{10}, and $PM_{2.5}$ emissions were controlled by limiting the water flow rate and amount of total dissolved solids within the water. A flare gas vapor recovery system reduced SO_2, NO_x, and CO emissions during flaring events from shutdowns or upsets. Furnaces used low NO_x burners and combustion turbines used water injection/low NO_x burners for NOx control. CO and VOCs were controlled by the use of steam atomizers and excess oxygen which completes the combustion process before the exhaust is emitted through the exhaust stack. VOC was also controlled by the use of a flare, a Benzene Recovery Unit, and the use of proper leak detection and maintenance procedures.

Par West Refinery was shut down for the majority of 2020 and 2021 and completely shut down in 2022. Par West removed their crude unit, hydrogenation unit, acid plant, cooling tower, and flare from service, and the facility no longer

functions as a refinery. The effluent treatment plant, emitting primarily VOCs, is the only source of emissions since 2023.

IES Downstream Kapolei Terminal (CSP No. 0863-01-C)

IES previously operated a petroleum refinery facility under CSP Nos. 0863-01-C and 0863-02-C covering their bulk storage facility and their refinery respectively. IES sold their refinery equipment covered under CSP No. 0863-02-C to PAR Hawai‘i in 2018. The refinery equipment that IES retained (e.g., fluid catalytic cracking unit, dimersol plant, and alkylation plant) did not operate, were fully retired in 2022, and the air permit was closed for these units. IES retained the operation of their facility covered under CSP No. 0863-01-C as a petroleum bulk terminal only.

VOCs are the primary pollutants emitted from equipment handling products at this facility. The current Kapolei Terminal contains eighteen gasoline intermediates and finished product storage tanks with external floating roofs, five crude oil external floating roof storage tanks, three vertical fixed roof jet fuel storage tanks, one external floating roof crude water draw storage tank, a petroleum truck loading rack, and various equipment for handling petroleum products.

External floating roofs with sealing devices between the roof edge and the tank wall are used to control VOCs. The floating roofs are required to float on the liquid at all times except when allowed by permit conditions for certain activities (e.g., when tank is emptied and subsequently refilled). There are also volatility constraints for each of the storage tanks according to their designations, as specified in the permit. All tank gauging and sampling devices for each of the storage tanks are required to be maintained as gas-tight when not sampling.

The facility uses a petroleum truck loading rack to load product from the storage tanks into tank trucks. Any equipment used for the transfer of gasoline or gasoline vapors requires routine leak inspections and leak repairs as soon as reasonable to minimize VOC emissions. Submerged filling is used from the bottom of cargo tanks to minimize VOC emissions from loading tank trucks with product.

TABLE A
2024 Campbell Industrial Park and Kahe Valley Major Source Air Emissions (tons/year)

Facility [1]	**PM**	**PM_{10}**	**$PM_{2.5}$**	**SO_2**	**NO_x**	**CO**	**VOC**	**Pb**
IES Downstream [2]	0.0	0.0	0.0	0.0	0.0	0.0	94.9	0.0
HE[3] CIP Plant	35.5	34.5	32.9	0.8	103.3	182.0	19.6	0.0
HE[3] Kahe Plant	426.9	346.0	293.0	6,426.2	5,355.1	261.9	45.4	0.2
Reworld Honolulu[4]	99.2	84.9	74.6	8.2	830.5	117.0	2.9	0.0
Kalaeloa Partners	522.3	504.7	482.1	2,643.2	2,618.2	28.6	6.3	0.1
Par Hawai‘i East [2]	55.1	44.7	37.4	198.7	694.5	256.0	399.4	0.0
Par Hawai‘i West [2]	0.0	0.0	0.0	0.0	0.0	0.0	10.6	0.0
TOTAL (tons/year)	1,139.0	1,014.8	920.0	9,277.1	9,601.6	845.5	579.1	0.3

Source: State Department of Health, Clean Air Branch. Based on Covered Source actual emissions for 2024, as submitted by the respective sources.

PM - Particulate Matter
SO_2 - Sulfur Dioxide
PM_{10} - Particulate Matter with aerodynamic diameter less than or equal to 10 microns
$PM_{2.5}$ - Particulate Matter with aerodynamic diameter less than or equal to 2.5 microns
NO_x - Nitrogen Oxides
CO - Carbon Monoxide
VOC - Volatile Organic Compounds
Pb - Lead

Note:

1. Particulate matter emissions include both filterable and condensable portions.
2. The emissions will vary year to year depending on the demand for fuel.
3. Hawaiian Electric (HE)
4. The emissions may differ year to year due to the inconsistency of fuel (municipal waste).

SECTION 2
Ambient Air Quality at Campbell Industrial Park: 2

2020 - 2024

The State of Hawai‘i enjoys some of the best air quality in the nation. However, as in any metropolitan area, we still experience our share of air pollution. In order to maintain Hawaii’s air quality, pollution sources are regulated through the promulgation of rules, and the issuance of air permits which limit emissions. The ambient air is monitored throughout the State by air sensors and air quality monitoring stations installed at strategic locations with measurement systems for pollutants and meteorology.

Air pollution is generated by many different sources. “Stationary sources” include factories, power plants, and refineries. “Area sources” are smaller stationary sources from which emissions are not easily associated with a single piece of equipment or activity. “Mobile sources” include cars, buses, planes, trucks, and trains. “Natural sources” are events such as wildfires, windblown dust, and volcanic eruptions. To protect the air quality, the Clean Air Act was enacted to provide the principal framework for National and State efforts against air pollution.

The Clean Air Act established the National Ambient Air Quality Standards (NAAQS). The NAAQS is a set of health-based limits below which no adverse impacts to humans or the environment are anticipated. Two levels of standards are set in the NAAQS. “Primary” standards are designed to establish limits to protect public health, including the health of “sensitive” populations such as asthmatics, children, and the elderly. “Secondary” air quality standards set limits to protect public welfare, including protection against decreased visibility and damage to animals, crops, vegetation, and buildings.

The U.S. Environmental Protection Agency (EPA) has set NAAQS levels for six principal pollutants referred to as “criteria” pollutants. These are sulfur dioxide (SO_2), nitrogen dioxide (NO_2), carbon monoxide (CO), ozone (O_3), lead (Pb), and particulate matter, which includes both particulate matter with an aerodynamic diameter less than or equal to ten microns (PM_{10}) and two and a-half microns ($PM_{2.5}$).

Two other air pollutants, not covered by the NAAQS, are mentioned in this report. Volatile Organic Compounds (VOC) are a precursor of O_3, and, consequently, of smog. In 1987, EPA established a new NAAQS for PM_{10} which replaced the NAAQS for PM. New Source Performance Standards exist for VOCs and PM and both pollutants are controlled by permit conditions.

Hawai‘i has also established state ambient air quality standards (SAAQS) which may be more stringent than the NAAQS (e.g., SAAQS for CO and NO_2 are more stringent than the NAAQS). Hawai‘i air monitoring data shows that Hawai‘i is in attainment, meeting both federal and state air quality standards.

The Department of Health currently operates and maintains a network of three State and Local Air Monitoring Stations (SLAMS) on the island of Oahu. The Kapolei station, operating near the CIP area, also contains an NCore monitor.

The ambient air quality trends are based on actual measurements of pollutant concentrations in the air. Air pollutant trends for the Kapolei station during the most recent five years are graphically displayed while the tables summarize the highest concentrations and annual average concentrations.

None of the air pollutants measured exceeded the national or state ambient air quality standards except for a single 1-hour CO concentration during abnormal brush fire activities in 2022. The 1-hour CO concentration exceeded the SAAQS of 9 ppm but did not exceed the NAAQS of 35 ppm. For compliance with the NAAQS and SAAQS, both the 1-hour and 8-hour CO limits shall not be exceeded more than once in a calendar year. Hawai‘i is in attainment of the SAAQS, as there was not more than one exceedance of the standard in a calendar year. Please see HAR §11-59-4.

The 1-hour and 8-hour CO, and 3-hour SO_2 trends are based on the annual average of the daily maximum concentrations in each calendar year. Annual trends are based on the average of all valid hourly measurements recorded in the year. Except for PM_{10}, the air quality trends for SO_2, NO_2, and CO in the CIP area have been relatively level and consistently well below the national and state standards. The PM_{10} values show comparatively greater variability but are still consistently below the NAAQS.

Summary of Air Quality Data
2020 - 2024

DEFINITIONS

1. The "Maximum Concentration" is the highest value recorded in the year for the averaging period.

2. The "Average of the Daily Max. Conc." is the annual arithmetic mean of all the daily maximum values recorded for the averaging period.

3. "98th percentile" for Nitrogen Dioxide (NO_2) and Particulate Matter 2.5 microns or less ($PM_{2.5}$) is the 1-hour or 24-hour average, respectively, that is higher than 98 percent of all valid values recorded in the year.

4. "99th percentile" for Sulfur Dioxide (SO_2) is the 1-hour average that is higher than 99 percent of all valid values recorded in the year. The percentile values are used to determine compliance with these standards. For Ozone (O_3), the value that determines compliance with the 8-hour standard is the 4th highest daily 8-hour value in the year.

5. "Possible Periods" is the total number of possible sampling periods in the year.

6. "Valid Periods" is the total number of valid sampling periods after data audits.

7. "Annual Average" is the arithmetic mean of all hours recorded in the year.

8. "Design Value" is a statistic that describes the air quality status of a given location relative to the level of the National Ambient Air Quality Standards (NAAQS). These values are typically used in the determination of attainment with NAAQS for criteria pollutants. For SO_2, the design value for the primary 1-hour NAAQS is the 3-year average of annual 99th percentile daily maximum 1-hour values for a monitoring site.

STATION

Kapolei/NCore

This station is located at 2052 Lauwiliwili Street in the Kapolei Business Park, southeast of the Kapolei Fire Station, next to a drainage canal that separates the park from Barber's Point, approximately 1.5 miles from Malakole Street in Campbell Industrial Park. Both the Kapolei SLAMS station and the National Ambient Air Monitoring Strategy – National Core Monitoring (NCore) station are located here.

The pollutants sampled at this station are carbon monoxide (CO), nitrogen dioxide (NO_2), ozone (O_3), sulfur dioxide (SO_2), particulate matter PM_{10}, and $PM_{2.5}$. Meteorological parameters measured are wind speed, wind direction and ambient temperature. Trace-level CO and trace-level SO_2 are sampled at the NCore station and the values from the trace-level analyzers are now used.

Pollutant	2020	2021	2022	2023	2024
1-hour **Carbon Monoxide** (ppm)					
Maximum Concentration	1.2	0.8	9.5 [2] (brush fire)	0.6	0.5
Average of Daily Max. Conc.	0.2	0.2	0.2 [2]	0.1	0.1
Valid Periods / Possible Periods	8515 / 8784	8453 / 8760	8265 / 8760	7129 / 8760	6696 / 8784
State / Federal Standard	9 / 35	9 / 35	9 / 35	9 / 35	9 / 35
8-hour **Carbon Monoxide** (ppm)					
Maximum Concentration	0.4	0.3	1.3 [2] (brush fire)	0.3	0.2
Average of Daily Max. Conc.	0.2	0.1	0.1 [2]	0.1	0.1
Valid Periods / Possible Periods	8376 / 8779	8298 / 8755	8249 / 8755	7130 / 8755	6721 / 8779
State / Federal Standard	4.4 / 9	4.4 / 9	4.4 / 9	4.4 / 9	4.4 / 9
1-hour **Sulfur Dioxide** (ppb)					
Maximum Concentration	8.5	10.9 [1]	2.7 [3]	23.8	13.4
99th Percentile Value	5.8	5.8 [1]	1.9 [3]	11.4	6.3
Valid Periods / Possible Periods	8262 / 8784	8354 / 8760	8605 / 8760	8377 / 8760	8660 / 8784
Federal Standard	75	75	75	75	75
3-hour **Sulfur Dioxide** (ppm)					
Maximum Concentration	0.005	0.007 [1]	0.002 [3]	0.015	0.005
Average of Daily Max. Conc.	0.001	0.001 [1]	0.000 [3]	0.001	0.000
Valid Periods / Possible Periods	2716 / 2928	2754 / 2920	2833 / 2920	2733 / 2920	2819 / 2928
State and Federal Standard [4]	0.500	0.500	0.500	0.500	0.500
24-hour **Sulfur Dioxide** (ppm)					
Maximum Concentration	0.003	0.002 [1]	0.001 [3]	0.002	0.001
Valid Periods / Possible Periods	345 / 366	344 / 365	363 / 365	354 / 365	364 / 366
State Standard	0.140	0.140	0.140	0.140	0.140
Annual Average **Sulfur Dioxide** (ppm)					
Annual Average	0.001	0.001 [1]	0.000 [3]	0.000	0.000
Valid Periods / Possible Periods	8262 / 8784	8354 / 8760	8605 / 8760	8377 / 8760	8660 / 8784
State / Federal Standard [4]	0.030	0.030	0.030	0.030	0.030 / 0.010 [4]
1-hour **Nitrogen Dioxide** (ppb)					
Maximum Concentration	32	30	31	34	31
98th Percentile Value	26	22	23	23	20
Valid Periods / Possible Periods	8507 / 8784	8451 / 8760	5711 / 8760	8366 / 8760	8518 / 8784
Federal Standard	100	100	100	100	100
Annual Average **Nitrogen Dioxide** (ppm)					
Annual Average	0.003	0.003	0.006	0.003	0.003
Valid Periods / Possible Periods	8507 / 8784	8451 / 8760	5925 / 8760	8366 / 8760	8518 / 8784
State / Federal Standard	0.040 / 0.053	0.040 / 0.053	0.040 / 0.053	0.040 / 0.053	0.040 / 0.053
8-hour **Ozone** (ppm)					
Maximum Concentration	0.047	0.050	0.044	0.045	0.045
4th Highest Daily Value	0.045	0.047	0.041	0.043	0.045
Valid Periods / Possible Periods	348 / 366	332 / 365	330 / 365	344 / 365	362 / 366
Federal Standard	0.070	0.070	0.070	0.070	0.070
24-hour **PM_{10}** ($\mu g/m^3$)					
Maximum Concentration	43	46	48	76	36
Valid Periods / Possible Periods	343 / 366	273 / 365	351 / 365	328 / 365	360 / 366
State and Federal Standard	150	150	150	150	150
Annual Average **PM_{10}** ($\mu g/m^3$)					
Annual Average	12	12	17	17	15
Valid periods / Possible Periods	343 / 366	273 / 365	351 / 365	328 / 365	360 / 366
State Standard	50	50	50	50	50
24-hour **$PM_{2.5}$** ($\mu g/m^3$)					
Maximum Concentration	15.4	8.5	9.9	15.8	11.5
98th Percentile Value	6.9	6.7	8.1	10.0	8.9
Valid Periods / Possible Periods	335 / 366	323 / 365	334 / 365	328 / 365	360 / 366
Federal Standard	35	35	35	35	35
Annual Average **$PM_{2.5}$** ($\mu g/m^3$)					
Annual Average	3.4	2.9	3.8	4.5	4.6
Valid Periods / Possible Periods	335 / 366	323 / 365	334 / 365	328 / 365	360 / 366
Federal Standard [5]	12	12	12	12	9 [5]

[1] SO2 values taken from Kapolei N-Core Trace SO2 analyzer as it was used to calculate the 2021 design value.

[2] CO values taken from Kapolei N-Core trace CO analyzer as the CO analyzer at Kapolei was discontinued on March 31, 2022.

[3] SO_2 values taken from Kapolei N-Core trace SO_2 analyzer as the SO_2 analyzer at Kapolei was discontinued on February 28, 2022.

[4] On December 10, 2024, EPA revised the previous SO_2 3-hour Federal secondary standard of 0.5 ppm and replaced it with an annual standard of ≤10 ppb, averaged over a 3-year period, The State SO_2 3-hour and annual standards remain unchanged.

[5] On February 7, 2024, EPA revised the $PM_{2.5}$ annual Federal primary standard from 12 $\mu g/m^3$ to 9 $\mu g/m^3$.

Preliminary data only – subject to change.

Figure 1. Carbon Monoxide Annual Average of Maximum 1-hour: 2020 - 2024

(Annual average of the daily maximum 1-hour values)

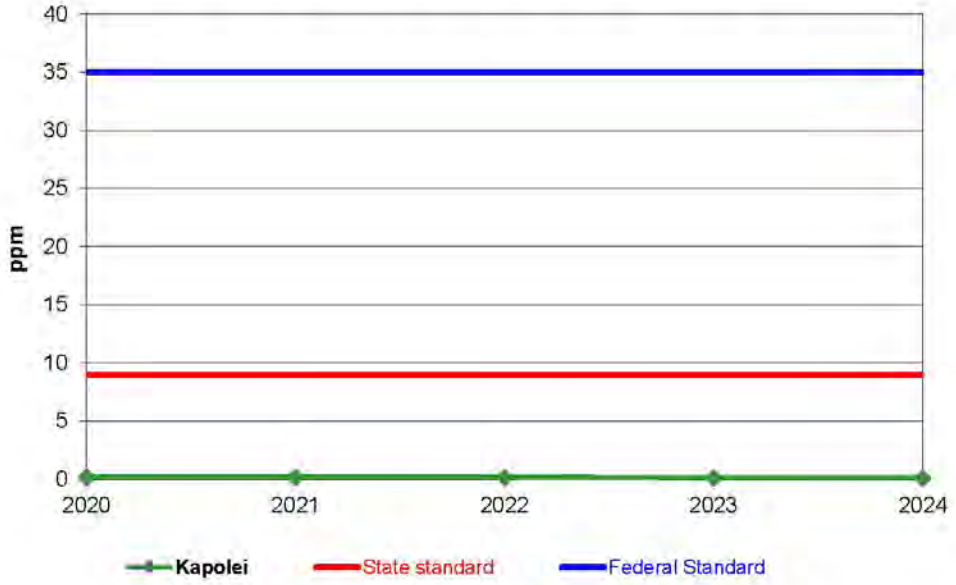


Figure 2. Carbon Monoxide Annual Average of Maximum 8-hour: 2020 - 2024

(Annual average of the daily maximum 8-hour values)

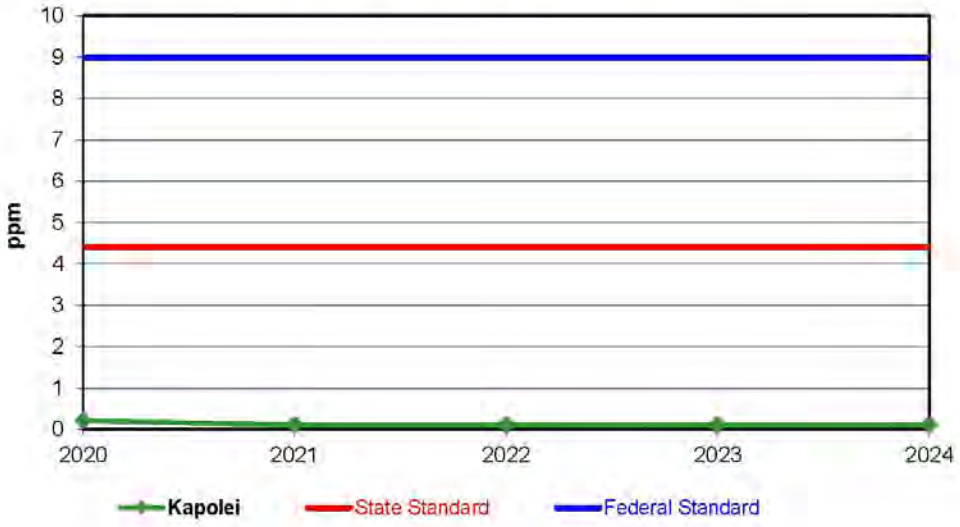


Figure 3. Sulfur Dioxide 99th Percentile 1-hour: 2020 - 2024

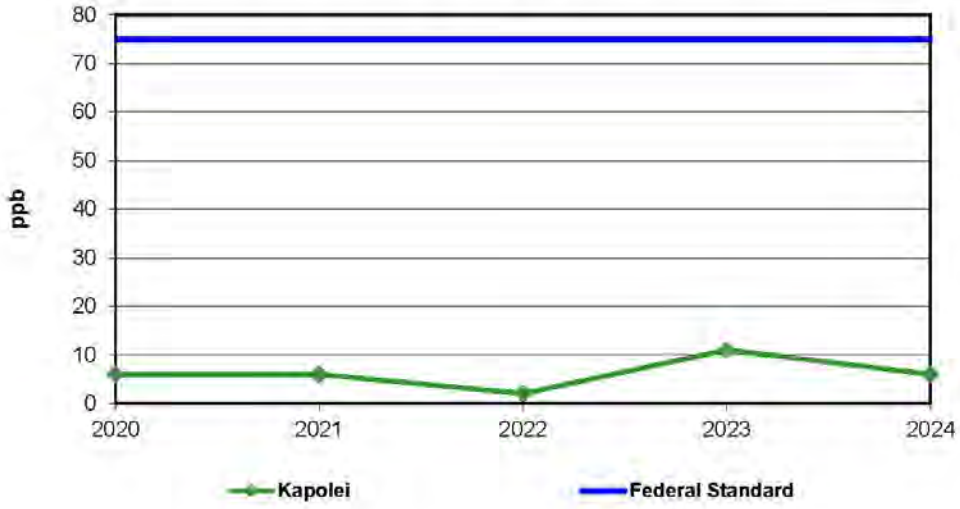


Figure 4. Sulfur Dioxide Annual Average of Maximum 3-hour: 2020 - 2024

(Annual average of the maximum 3-hour values)

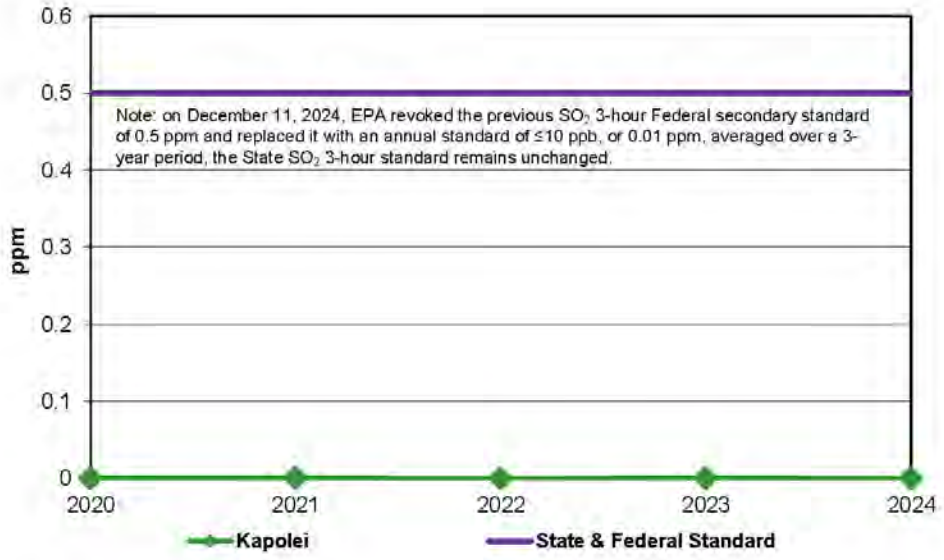


Figure 5. Sulfur Dioxide Maximum 24-hour: 2020 - 2024

(The highest 24-hour value in the year)

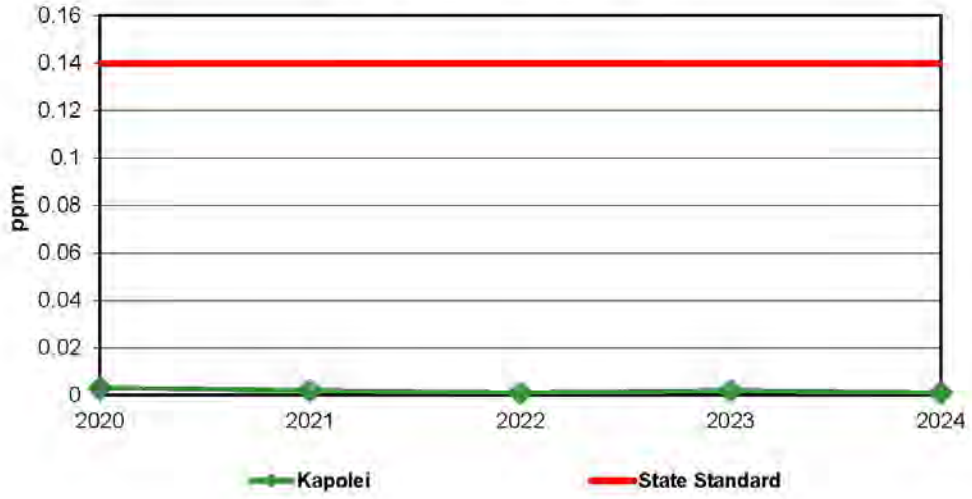
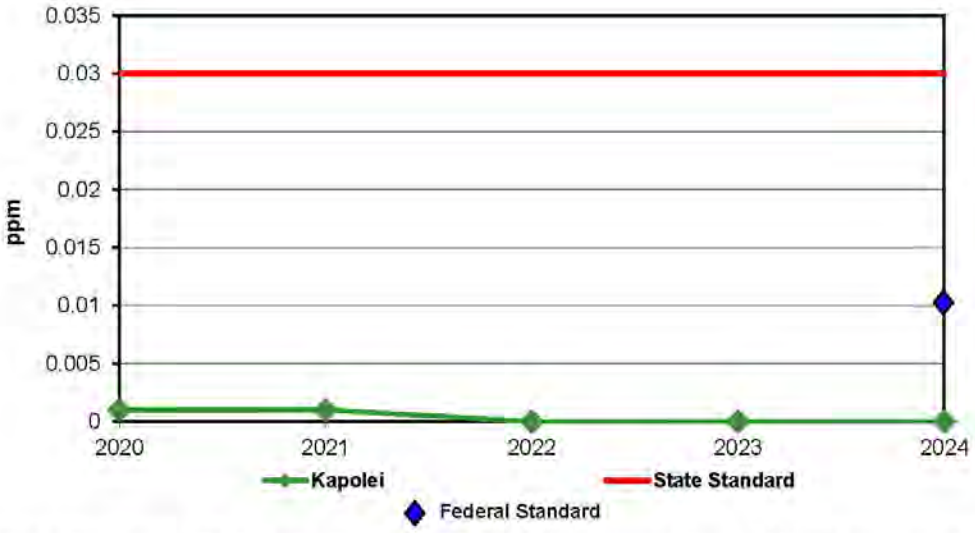


Figure 6. Sulfur Dioxide Annual Average: 2020 - 2024

(Average of all valid hours in the year)



Note: on December 11, 2024, EPA revoked the previous SO_2 3-hour Federal secondary standard of 0.5 ppm and replaced it with an annual standard of ≤10 ppb, or 0.01 ppm, averaged over a 3-year period. The State SO_2 3-hour and annual standards remain unchanged.

Figure 7. Nitrogen Dioxide 98th Percentile 1-hour: 2020 - 2024

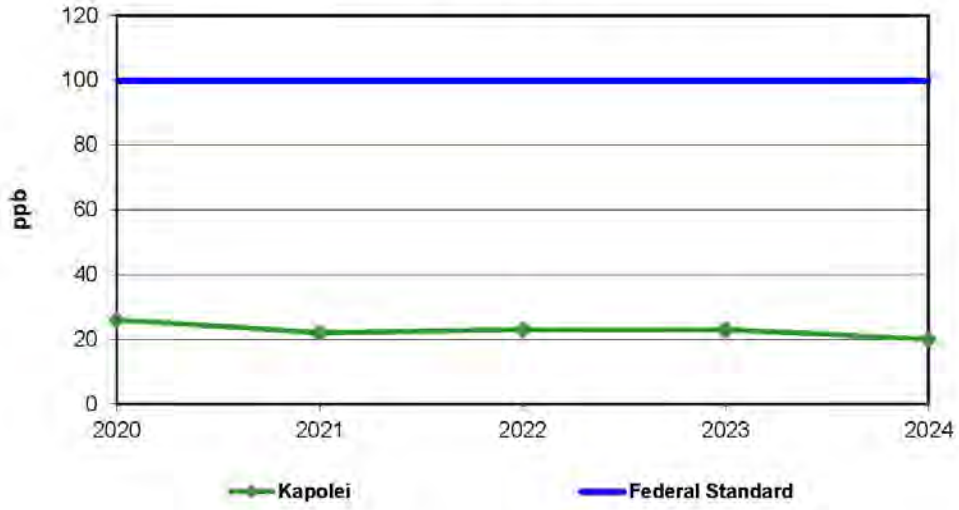


Figure 8. Nitrogen Dioxide Annual Average: 2020 - 2024

(Average of all valid hours in the year)

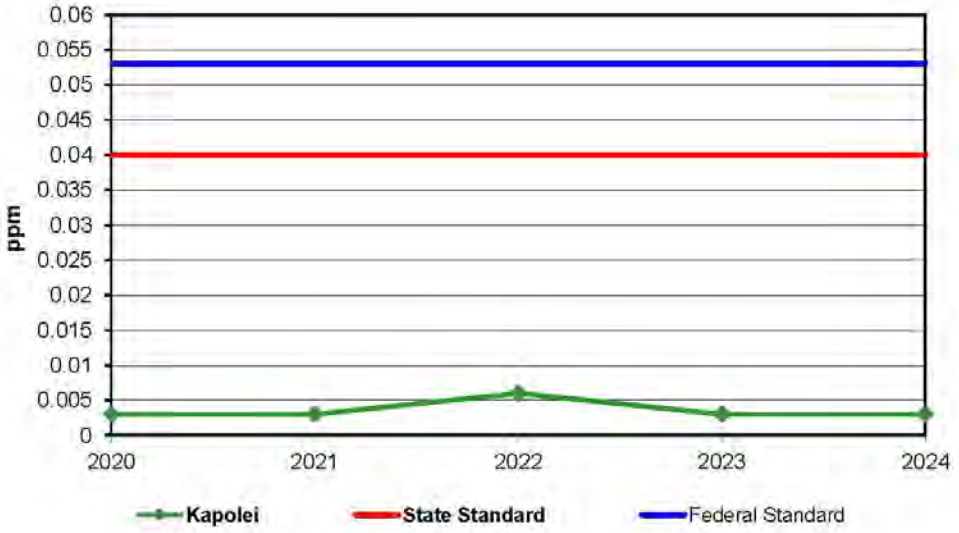


Figure 9. Ozone 4th Highest Daily Maximum: 2020 - 2024

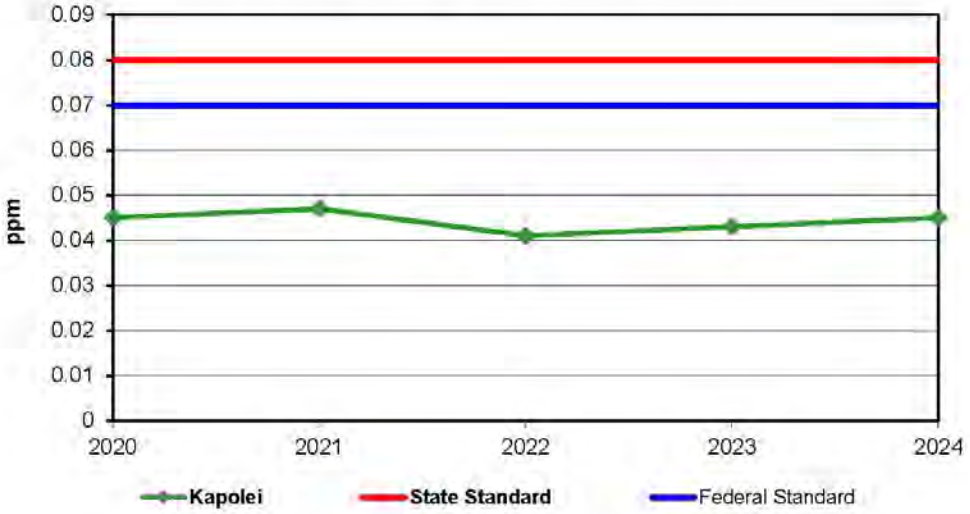


Figure 10. PM_{10} Maximum 24-hour: 2020 - 2024

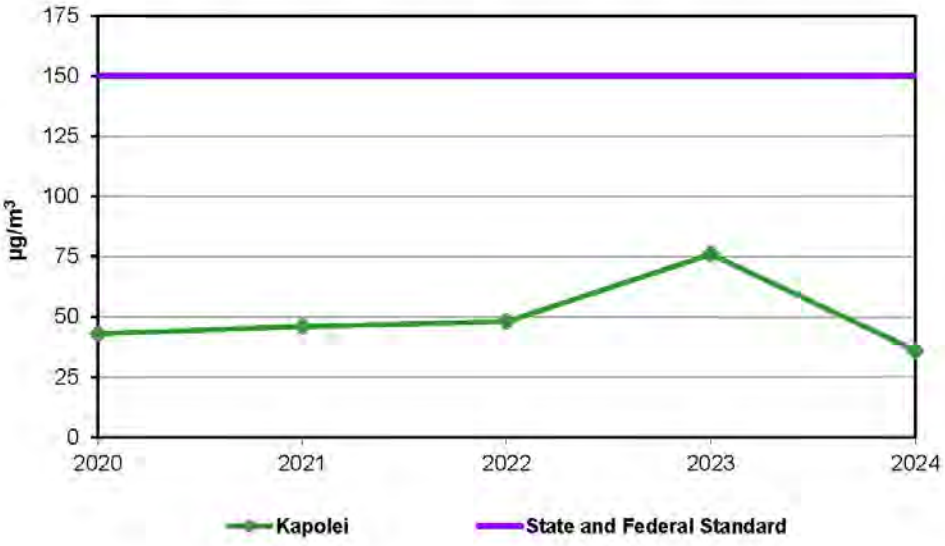


Figure 11. PM_{10} Annual Average: 2020 - 2024

(Average of all valid 24-hour values in the year)

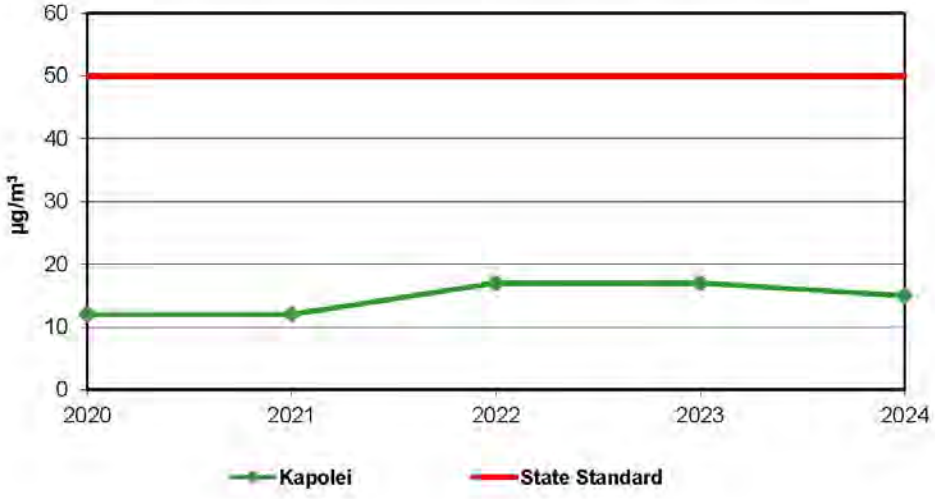


Figure 12. $PM_{2.5}$ 98th Percentile 24-hour: 2020 - 2024

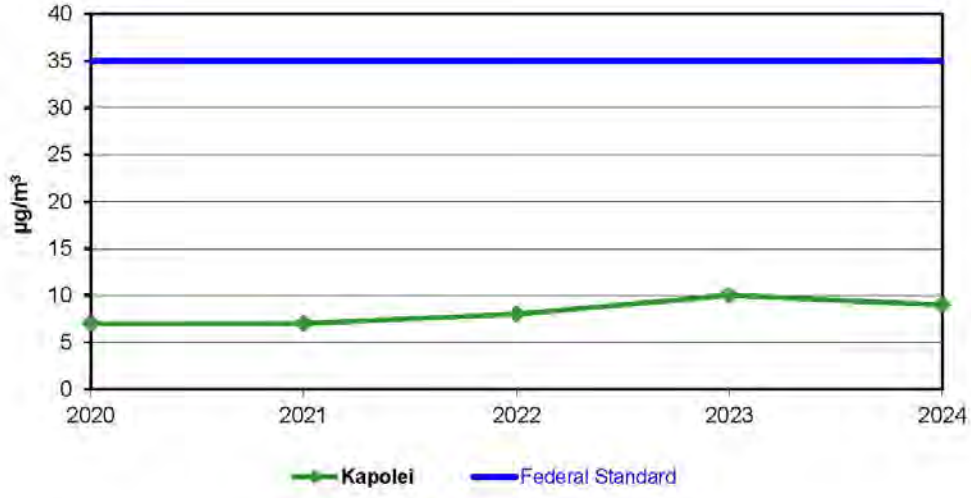
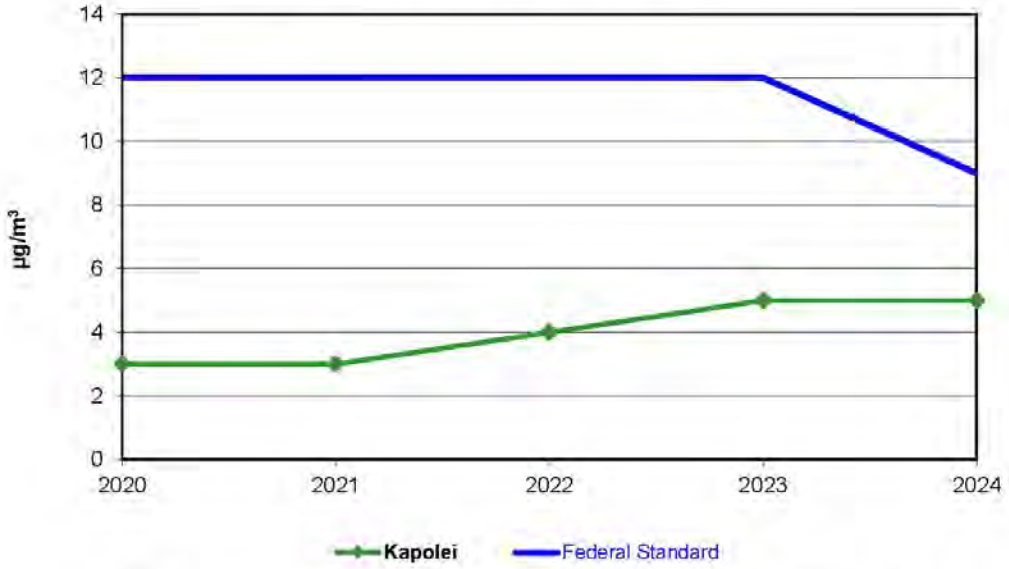


Figure 13. $PM_{2.5}$ Annual Average: 2020 - 2024

(Average of all valid 24-hour values in the year)



Note: on February 7, 2024, EPA revised the PM2.5 annual Federal primary standard from 12 µg/m³ to 9 µg/m³.

SECTION 3
Measurements of Selected Criteria Pollutants in the Campbell Industrial Park Area and the Health Effects Expected at These Levels of Exposure

HEER Office, April 2026

Criteria Pollutants

The EPA Office of Air Quality Planning and Standards has established NAAQS for six "criteria air pollutants" considered harmful to public health and the environment. These standards are based on epidemiological studies and laboratory experiments. The six criteria air pollutants include:

- ozone (O_3);
- airborne lead (Pb);
- particulate matter, including both PM_{10} and $PM_{2.5}$;
- carbon monoxide (CO);
- nitrogen dioxide (NO_2); and
- sulfur dioxide (SO_2).

These pollutants were selected based on multiple criteria including their toxicity, their abundance, and distribution in industrialized society.

The DOH-CAB has collected data for CO, NO_2, SO_2, PM_{10}, $PM_{2.5}$, and O_3 at the Kapolei Station in CIP. Data for Pb was recorded until December 31, 2018, when sampling was discontinued with EPA's approval. Data for the years 2020 – 2024 are summarized in Section 2 of this report.

The levels of these criteria air pollutants measured in the CIP area are consistently below the NAAQS and Hawai'i SAAQS. These standards were not exceeded during normal operation within CIP. A single exceedance of the 1-hour SAAQS for CO was recorded during temporary and irregular brush fire activity in late 2022. However, Hawai'i is still in attainment of the SAAQS, since there was not more than one exceedance of the standard in a calendar year. Please see HAR §11-59-4.

Possible Health Effects of Criteria Air Pollutants at CIP

The following is an overview of some of the possible health effects associated with the criteria air pollutants measured at CIP. This is not intended to be a complete or a thorough description of the toxicology of these pollutants. Rather, this note aims to give some idea of the effects these pollutants can have at high concentrations. First, it is important to understand the primary rule of toxicology: taking a large amount of any material into the body can produce toxic effects. The rate of intake can also influence toxic effects. Children and adults, on average, typically breathe about 10 to 20 cubic meters of air per day. Considering this and along with the available scientific data, there is a fairly clear understanding of what concentrations of air pollutants are required to develop adverse health effects. Even so, due to the variabilities between individuals, there are no clear-cut numbers indicating below which there is no risk and above which

we are all at risk. Therefore, safety factors are used to help compensate uncertainties and to provide added protection for the more sensitive population.

In the following paragraphs, the levels of pollutants measured in the CIP area in 2024 are compared to the state and federal air quality standards and the expected health effects for those levels of exposure are discussed. Additional information is provided describing the effects that could occur at much higher levels of exposure.

Sulfur Dioxide (SO_2):

SO_2 is a colorless gas with an odor often described as similar to fireworks. Man-made emissions of SO_2 are largely from sources that burn fossil fuels, coal, and oil. Stationary sources such as oil-fired power plants and refineries are the largest anthropogenic sources of emissions in Hawai‘i.

Volcanoes can be a significant natural source of SO_2. SO_2 is of major concern on the Island of Hawai‘i because when erupting, the Kīlauea and Mauna Loa volcanoes release large quantities of SO_2 into the atmosphere that can directly impact people living nearby and downwind. In 2008, an increase in emissions from Halema‘uma‘u crater at the Kīlauea summit created potential health hazards for people with respiratory conditions living near the volcano as far away as Hilo and Kailua-Kona. In response to the increased emissions, DOH’s CAB and DOH’s Hazard Evaluation and Emergency Response (HEER) Branch, along with an EPA contractor, developed a color-coded short term SO_2 advisory for the Island of Hawai‘i (http://www.hiso2index.info/). This advisory was used extensively during the 2018 Lower East Rift Zone (LERZ) eruption that produced high levels of SO_2 emissions. During periods of active emissions, SO_2 concentrations in communities downwind of Kīlauea routinely exceed the SO_2 NAAQS. Reductions in air quality from increased SO_2, PM and the resulting vog affected many areas across Hawai‘i Island and the entire state during the 2018 LERZ eruption. From August 2018 until November 2022, SO_2 emissions from Kīlauea were very low. Intermittent eruptive activity from Mauna Loa in December of 2021 and in November and December of 2022 has led to sporadic impacts to air quality in the surrounding region. Air quality was also impacted during the intermittent eruptions from Kīlauea in June 2023, September 2023, and December 2024.

The EPA acknowledges that certain people may be more vulnerable to the health effects from air pollutants. There is substantial evidence from clinical and epidemiological studies indicating that people with asthma are more susceptible to the respiratory health effects of SO_2 compared to the general population. A large body of evidence suggests that brief exposures of 5 to 10 minutes to SO_2 can negatively affect the respiratory health of those affected by asthma. Because of these findings, the EPA established a 1-hour NAAQS for SO_2 of 75 ppb. The 1-hour standard is designed to protect people with asthma from short-term exposures or otherwise alert such individuals regarding the potential hazardous ambient air conditions in the area. The EPA considers this 1-hour standard to be appropriately protective of public health with an adequate margin of safety.

In 2024, the maximum measured 1-hour concentration of SO_2 at CIP was 13.4 ppb, well below the NAAQS of 75 ppb. The maximum 3-hour concentration of 0.005 ppm was well below the Federal and State secondary standard of 0.50 ppm. Secondary standards provide public welfare protection, including protection against decreased visibility and damage to animals, crops, vegetation, and buildings. No adverse effects were expected from these recorded levels of SO_2. The maximum 24-hour SO_2 concentration of 0.001 ppm was also below the Hawai‘i state standard of 0.140 ppm. On December 10, 2024, EPA revised the previous SO_2 3-hour Federal secondary standard of 0.5 ppm and replaced it with an annual standard of ≤10 ppb, averaged over a 3-year period. The State SO_2 3-hour and annual standards remain unchanged.

Ozone (O_3):

Ozone exists both in the Earth's upper atmosphere and at ground level. Ozone can be beneficial or cause adverse health effects, depending on where it is found. Ground level ozone is created by chemical reactions between NO_x and VOC. These pollutants emitted by cars, power plants, industrial boilers, refineries, chemical plants, and other sources, react in the presence of sunlight. Ozone is the main ingredient in “smog”. Breathing ozone can be harmful to health especially on hot sunny days when ozone can reach unhealthy levels. In 2024, the maximum 8-hour ozone concentration was 0.045 ppm, below the NAAQS of 0.070 ppm.

Nitrogen Dioxide (NO_2):

NO_2 is a gas that may appear red to brown and produces a pungent, acrid odor. Man-made emissions of NO_2, similar to SO_2, are mostly from sources that burn fossil fuels. Stationary sources such as oil-fired power plants and refineries are the largest sources in Hawai‘i. Short-term exposure to NO_2 can aggravate respiratory diseases while long-term exposure can contribute to asthma development and potentially increase susceptibility to respiratory infections.

In January 2010, EPA released a new NAAQS for NO_2. The new one-hour standard of 0.100 ppm was established to protect public health from peak short-term exposures. The annual average Federal NAAQS level for NO_2 is set to 0.053 ppm for a one-year averaging period. Hawai‘i has set an annual exceedance level of 0.040 ppm for added safety. The annual average concentration measured in 2024 was 0.003 ppm, well below both the Federal and State standard. The maximum 1-hour nitrogen dioxide concentration measured was 0.031 ppm, below the Federal standard of 0.100 ppm.

NO_2 and SO_2 are gases that can react with moisture on the wet surfaces of the body to produce acids. At high levels, these acids can irritate the lungs, eyes, nose and throat, resulting in shortness of breath. The levels measured in the CIP area are below State and Federal standards and are not expected to produce adverse health effects. Sensitive individuals may have short-lived responses to brief peaks in concentration which would not appear in these averaged data. Such short-term peaks are more apparent in the maximum readings found in shorter term (1-3 hour) averaging times.

Carbon Monoxide (CO):

The NAAQS levels for CO have been set at 35 ppm for a 1-hour averaging period, and 9 ppm for an 8-hour averaging period. Hawai‘i has set those levels lower at 9 ppm and 4.4 ppm respectively for added safety. For compliance with the NAAQS and SAAQS, both the 1-hour and 8-hour CO limits shall not be exceeded more than once in a calendar year. Hawai‘i met these criteria in 2024 and was in attainment with both the 1-hour and 8-hour state and federal standards for CO. In 2024, the 1-hour reported maximum CO concentration for the CIP area was 0.5 ppm and the 8-hour maximum CO concentration was 0.2 ppm, both below the state and federal standards.

CO is an odorless and colorless gas that interferes with the ability of blood to carry oxygen. Symptoms of overexposure include headache, shortness of breath, and dizziness which occur at about 50-100+ ppm. Severe headache, weakness, dizziness, nausea, vomiting, fainting, and rapid breathing can happen at 400-500+ ppm. At higher levels such as 1000-4000 ppm, people can experience fainting, seizure, coma, respiratory failure, and death.

Lead (Pb):

Lead is a heavy metal which in high doses can cause a myriad of health effects. Children exposed to lead over an extended period of time can have neurodevelopmental issues including problems with learning, attention, school performance and IQ. Most childhood exposures to lead occur at home as the result of deteriorated lead-based paint or lead contaminated soil from exterior lead-based paint or historical contamination from leaded-gasoline auto exhaust. The concentrations of airborne lead historically measured at CIP have been well below the Federal standard of 0.15 ug/m^3 and are not high enough to be a significant contribution of lead exposure nor expected to cause health effects. Lead sampling in the CIP area was discontinued on December 31, 2018, with EPA’s approval.

Particulate Matter (PM_{10} and $PM_{2.5}$):

The NAAQS level for PM_{10} has been set at 150 µg/m^3 averaged over 24 hours. Hawai‘i also has an additional standard of 50 µg/m^3 averaged over one (1) year. In response to new scientific data, EPA revised the particulate matter standard in July 1997 to include a standard for “fine particles” equal to or less than 2.5 micrometers in size ($PM_{2.5}$). These $PM_{2.5}$ standards were set at 65 µg/m^3 averaged over 24 hours and 15 µg/m^3 averaged over one (1) year. On December 17, 2006, the 24-hour standard for $PM_{2.5}$ was lowered to 35 µg/m^3 to better protect the public from short-term fine particle exposure. On December 14, 2012, the EPA strengthened the nation’s air quality standard for fine particle pollution by revising the annual $PM_{2.5}$ standard to 12 µg/m^3. On February 7, 2024, EPA revised the $PM_{2.5}$ annual Federal primary standard from 12 µg/m^3 to 9 µg/m^3.

Adverse health effects of particulate matter exposure can include impaired lung function, a reduction in capacity for physical activity, complications of heart disease, reproductive problems, and increased population death rates. The levels of exposure required to produce adverse effects are even less clear cut than they are for the gases discussed above. Based on laboratory results and extensive epidemiology studies, the EPA has set the fine particulate standards to provide an increased measure of protection from adverse health effects due to particulate matter.

The 2024 annual average for PM_{10} in the CIP area was 15 µg/m^3. The maximum 24-hour concentration reported was 36 µg/m^3. Although the adverse health effects from these levels of exposure are currently controversial, the average measured PM_{10} concentration in the CIP area is similar to that for Honolulu which has one (1) of the lowest urban particulate levels in the United States according to the American Lung Association (https://www.lung.org/research/sota/city-rankings/cleanest-cities). For $PM_{2.5,}$ the maximum 24-hour concentration was 11.5 µg/m^3 and the annual average was 4.6 µg/m^3, both below current Federal standards.