

2023 Annual Report on Air Emissions from Facilities at Campbell Industrial Park

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Hawaii 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 Hawaii 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 the annual data collected in 2022.

For the sake of clarity, the report is divided into three sections. Section one addresses the activities of the major sources and is split into two distinct parts. The first part of section one 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 two 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, Hawaii's air quality is far better than the national, health-based standards. The graphs also help illustrate any trend over the last five years.

The final section 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 at 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."

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SECTION 1.

Summary of Air Pollutants Emitted by Major Source Facilities in Campbell Industrial Park & Kahe Valley in 2022 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. Both criteria and non-criteria pollutants are included: Please refer to **Section 2** for a description of these 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 Hawaii Cogeneration Plant

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 Hawaii, 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 was discontinued on August 31, 2022. On December 12, 2022, AES Hawaii, LLC notified DOH-CAB that the coal-fired cogeneration plant and associated structures were being decommissioned in preparation for demolition in the first quarter of 2023 and that the only remaining source, ash handling equipment, remains in periodic operation and a separate notification would be issued for this source once permanently discontinued.

AES Hawaii, LLC operated a coal-fired cogeneration plant in 2022 to generate electricity for operation and sale to Hawaiian Electric. For operating the plant, coal is imported, crushed, and fed into two (2) circulating fluidized bed (CFB) boilers. Tire derived fuel (TDF), specification used oil, wood, and spent activated carbon are permitted as secondary fuel. After combustion, the exhaust flows through a selective non-catalytic reduction system and baghouse before reaching the exhaust stack. There is also a cooling tower which extracts heat from the combustion gases and emits particulates which are dissolved solids in the evaporated water.

Total suspended particulates (TSP), particulate matter which are 10 and 2.5 microns or smaller (PM₁₀ and PM_{2.5}, respectively), sulfur dioxide (SO₂), nitrogen oxides (NO_x), carbon monoxide (CO), volatile organic compounds (VOC), and lead (Pb) are the primary air pollutants emitted from this facility while operating in

2022. The following briefly describes the air pollution control methods being employed. Fugitive TSP emissions are contained in enclosed structures during the transportation and processing of the coal. Baghouses also collect fugitive TSP emissions during the processing stage. During the combustion stage, a baghouse is also used to collect TSP and Pb. SO₂ is controlled by the use of limestone injection into the two (2) boilers and the use of coal fuel with a maximum sulfur content of 1.5% by weight. NO_x is controlled by the use of a selective non-catalytic reduction system for the boilers. The TSP, PM₁₀ and PM_{2.5} emissions from the cooling tower are controlled by limiting the water flow rate and amount of total dissolved solids within the water.

IES Downstream LLC – Kapolei Terminal

In December 2018, IES Downstream, LLC sold the non-gasoline petroleum products producing refinery portion of the former IES Downstream, LLC petroleum refinery to Par Hawaii Refinery, LLC, and that portion was renamed the Par West Refinery. IES Downstream currently operates a petroleum distribution terminal which stores and distributes various types of petroleum products. Crude oil is imported by ship and stored in above ground tanks prior to processing by the Par West Refinery. The crude oil is processed, or refined, to produce various petroleum products, except gasoline, and stored in the Kapolei Terminal's storage tanks. The Kapolei Terminal also imports, by ship, gasoline and other types of finished petroleum products for retail sale that is stored in the Kapolei Terminal's storage tanks. The main emission units are storage tanks and a petroleum load rack.

Due to that significant change in operations, VOC is the primary air pollutant being emitted from this facility. During the storage of the petroleum products, VOC is controlled with the use of various equipment for the petroleum storage tanks such as gaskets, seals, and floating roofs. Since calendar year 1998, secondary seals have been installed on all applicable hydrocarbon tanks to provide additional controls for VOC. The gasoline producing equipment on the permit for this equipment was closed as of November 1, 2022.

Hawaiian Electric - Campbell Industrial Park

Hawaiian Electric operates a biodiesel / fuel oil No. 2 fueled combustion turbine generating station in CIP. 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 is 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. Hawaiian Electric will permanently replace the temporary boiler with an electric boiler that was previously ordered. CIP Generating Station is the first biodiesel fueled combustion turbine plant in Hawaii. For operation in 2022, fuel oil No. 2 was the only fuel used for the combustion turbine generator.

Primary air pollutants emitted from this facility are SO₂, TSP, PM₁₀, 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 SO₂ emissions from the combustion turbine generator and the temporary boiler at the tank farm. 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.

Hawaiian Electric – Kahe Valley

Hawaiian Electric operates Kahe Generating Station in Kahe Valley. Fuel oil is received by pipeline from Hawaiian Electric's Barber's Point tank farm next to 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.

TSP, PM₁₀, PM_{2.5}, SO₂, NO_x, CO, and VOC are the primary air pollutants. TSP, PM₁₀, and PM_{2.5} are mainly controlled by the consumption of fuel oil with a low ash content. The SO₂ 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.

Honolulu Resource Recovery Venture (H-POWER)

H-POWER operates a municipal waste disposal facility to generate electricity for its operation and sale to Hawaiian Electric. The municipal solid waste (MSW) is received, sorted, shredded, then fed into two (2) 854 ton per day (TPY) refuse derived fuel (RDF) municipal waste combustor (MWC) boilers. MSW is also received, sorted, and fed to one (1) 900 TPY mass-burn MWC boiler. Post combustion air pollution controls are used for the boilers to control pollutant 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_{2.5}, PM₁₀, SO₂, NO₂, CO, MWC metals (cadmium, lead, and mercury), and acid gases are the primary air pollutants emitted from boilers at this facility. PM_{2.5}, PM₁₀, and MWC metals from boiler combustion are controlled with baghouses. Emissions of SO₂, H₂SO₄, HCl, and HF are controlled with spray dryer absorbers. The spray dryer absorbers inject a lime slurry which absorbs SO₂ and other acid gases. The baghouses then remove the lime slurry precipitate and other particulate

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 NO₂ 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 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., H₂S) 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

Kalaeloa Partners operates a cogeneration plant which generates electricity for its own use and for sale to Hawaiian Electric. This facility qualifies as a cogenerator since it also produces steam with the hot combustion gases. The steam is sold to Par Hawaii Refining. Fuel oil is piped in and consumed by two combustion turbines. There is also a cooling tower which extracts heat from the combustion gases and emits particulates which are dissolved solids in the evaporated water.

TSP, PM₁₀, PM_{2.5}, SO₂, and NO_x are the primary air pollutants being emitted from this facility. The following briefly describes the air pollution control methods being employed. SO₂ 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 TSP and particulate matter emissions are controlled by limiting the water flow rate and amount of total dissolved solids within the water.

Par Hawaii Refining, LLC – Par East Refinery

Par Hawaii Refining operates a petroleum refinery producing various types of 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.

TSP, PM₁₀, PM_{2.5}, SO₂, NO_x, CO, and VOC are the primary air pollutants emitted from this facility. The following briefly describes the air pollution control methods being employed. The TSP, PM₁₀ 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. SO₂ 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 SO₂, NO_x, and CO emissions during flaring events from shutdowns or upsets.

Par Hawaii Refining, LLC – Par West Refinery

In December 2018, Par Hawaii Refinery, LLC purchased the refinery portion of the former IES Downstream, LLC petroleum refinery and renamed it the Par West Refinery. This petroleum refinery produces various types of petroleum products except gasoline. Crude oil is imported by ship and stored in above ground tanks at the IES Downstream Kapolei Terminal prior to processing. The crude oil is processed, or refined, to produce the various petroleum products. The main emission units are furnaces, boilers, combustion turbines, cooling tower, and flares.

TSP, PM₁₀, PM_{2.5}, SO₂, 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 TSP, PM₁₀ 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. The cooling tower also emits TSP, PM₁₀, and PM_{2.5} emissions which are controlled by limiting the water flow rate and amount of total dissolved solids within the water. A flare gas vapor recovery system reduces SO₂, NO_x, and CO emissions during flaring events from shutdowns or upsets. NO_x is controlled by the use of low NO_x burners in the furnaces and water injection/low NO_x burners in the combustion turbines. CO and VOCs are 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 is also controlled by the use of a flare, a Benzene Recovery Unit, and the use of proper leak detection and maintenance procedures.

Please note that the Par West Refinery was shut down for the majority of 2020 and 2021, and completely shut down in 2022. The effluent treatment plant, emitting VOCs, was the only source of emissions in 2022.

TABLE A
2022 Campbell Industrial Park and Kahe Valley Major Source Air Emissions (tons/year)

Facility	TSP	PM₁₀	PM_{2.5}	SO₂	NO_x	CO	VOC	Pb
AES ¹	70.3	60.4	48.5	245.0	342.4	23.9	3.1	0.0
IES Downstream ²	0.0	0.0	0.0	0.0	0.0	0.0	112.2	0.0
HECO CIP Plant	40.9	39.7	37.9	1.6	126.9	191.4	16.7	0.0
HECO Kahe Plant	405.8	326.7	275.1	6,469.7	4,724.1	206.8	36.2	0.1
HPOWER ³	93.5	90.7	79.0	14.2	872.0	153.6	2.6	0.0
Kalaeloa Partners	345.6	531.3	509.8	2,787.4	2,285.2	35.2	8.1	0.1
Par Hawaii East ²	65.0	52.2	41.7	348.1	707.9	231.6	401.5	0.0
Par Hawaii West ²	0.0	0.0	0.0	0.0	0.0	0.0	12.7	0.0
TOTAL (tons/year)	1,021.1	1,101.0	992.0	9,866.0	9,058.5	842.5	593.1	0.1

Source: State Department of Health, Clean Air Branch. Based on Covered Source actual emissions for 2022, as submitted by the respective sources.

TSP - Total Suspended Particulates

NO_x - Nitrogen Oxides

VOC - Volatile Organic Compounds

SO₂ - Sulfur Dioxide

CO - Carbon Monoxide

Pb - Lead

PM₁₀ - 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

Note:

1. The nitrogen and sulfur content in the coal supply varies year to year. Coal crushing and coal/oil burning was discontinued on August 31, 2022.
2. The emissions will vary year to year depending on the demand for fuel.
3. 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

2018 - 2022

The State of Hawaii 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 (SO₂), nitrogen dioxide (NO₂), carbon monoxide (CO), ozone (O₃), lead (Pb), and particulate matter, which includes both particulate matter with an aerodynamic diameter less than or equal to ten microns (PM₁₀) 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 O₃, and, consequently, of smog. Total Suspended Particulates (TSP) was replaced as a criteria pollutant by PM₁₀. Performance standards exist for VOCs and TSP within the Hawaii Administrative Rules and both pollutants are controlled by permit.

Hawaii has also established state ambient air quality standards (SAAQS) which may be more stringent than the NAAQS (e.g., SAAQS for CO and NO₂ are more stringent than the NAAQS). Hawaii air monitoring data shows that Hawaii is in attainment, meeting both federal and state air quality standards criteria. .

The Department of Health currently operates and maintains a network of four State and Local Air Monitoring Stations (SLAMS) on the island of Oahu. The Kapolei station is the only station operating near the CIP area.

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. 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. Hawaii 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 SO₂ 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 PM₁₀, the air quality trends for SO₂, NO₂, and CO in the CIP area have been relatively level and consistently well below the national and state standards. The PM₁₀ values show comparatively greater variability but are still consistently below the NAAQS.

Summary of Air Quality Data 2018 – 2022

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 (NO₂) 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. Similarly, the “99th percentile” for Sulfur Dioxide (SO₂) 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 (O₃), the value that determines compliance with the 8-hour standard is the 4th highest daily 8-hour value in the year. For Lead (Pb), compliance is the maximum rolling 3-month average of 24-hour values. Pb was sampled once every 6 days with a manual filter-based sampler until December 31, 2018, when sampling was discontinued with EPA approval.
4. “Possible Periods” is the total number of possible sampling periods in the year.
5. “Valid Periods” is the total number of valid sampling periods after data audits.
6. “Annual Average” is the arithmetic mean of all hours recorded in the year.
7. “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 SO₂, 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 approximately 200 yards south of the Desalination facility and the Kapolei Fire Station. Both the Kapolei SLAMS station and the National Ambient Air Monitoring Strategy – National Core Monitoring (NCore) station are located here.

The pollutants sampled at the Kapolei station are CO, NO₂, O₃, SO₂, PM₁₀, and PM_{2.5}. Sampling for Pb was discontinued on December 31, 2018, with EPA approval. Meteorological parameters measured are wind speed, wind direction and ambient temperature. To address resource challenges, CO and SO₂ sampling at Kapolei were discontinued as of March 31, 2022, and February 28, 2022, respectively, as trace-level CO and trace-level SO₂ sampling were already being conducted at the NCore station. The values from the trace-level CO and trace-level SO₂ analyzers will be used going forward.

2018	
Pollutant	Kapolei
1-hour Carbon Monoxide (ppm) Maximum Concentration Average of Daily Max. Conc. Valid Periods / Possible Periods State / Federal Standard	3.2 0.6 8058 / 8760 9 / 35
8-hour Carbon Monoxide (ppm) Maximum Concentration Average of Daily Max. Conc. Valid Periods / Possible Periods State / Federal Standard	2.5 0.5 8031 / 8755 4.4 / 9
1-hour Sulfur Dioxide (ppb) Maximum Concentration 99 th Percentile Value Valid Periods / Possible Periods Federal Standard	21.5 9.6 8157 / 8760 75
3-hour Sulfur Dioxide (ppm) Maximum Concentration Average of Daily Max. Conc. Valid Periods / Possible Periods State and Federal Standard	0.017 0.001 2672 / 2920 0.500
24-hour Sulfur Dioxide (ppm) Maximum Concentration Valid Periods / Possible Periods State Standard	0.004 339 / 365 0.140
Ann. Ave. Sulfur Dioxide (ppm) Annual Average Valid Periods / Possible Periods State Standard	0.001 8157 / 8760 0.030
1-hour Nitrogen Dioxide (ppb) Maximum Concentration 98 th Percentile Value Valid Periods / Possible Periods Federal Standard	31 27 8185 / 8760 100
Ann. Ave. Nitrogen Dioxide (ppm) Annual Average Valid Periods / Possible Periods State / Federal Standard	0.004 8185 / 8760 0.040 / 0.053
8-hour O ₃ (ppm) Maximum Concentration 4 th Highest Daily Value Valid Periods / Possible Periods Federal Standard	0.055 0.049 7579 / 8755 0.070
24-hour PM ₁₀ (µg/m ³) Maximum Concentration Valid Periods / Possible Periods State and Federal Standard	29 347 / 365 150
Ann. Ave. PM ₁₀ (µg/m ³) Annual Average Valid periods / Possible Periods State Standard	10 347 / 365 50
24-hour PM _{2.5} (µg/m ³) Maximum Concentration 98 th Percentile Value Valid Periods / Possible Periods Federal Standard	11.2 8.7 346 / 365 35
Ann. Ave. PM _{2.5} (µg/m ³) Annual Average Valid Periods / Possible Periods Federal Standard	2.5 346 / 365 12
3-month Pb (µg/m ³) Maximum 3-month average Valid Periods/Possible Periods Federal Standard	0.001 12 / 12 0.15

Preliminary data only – subject to change.

2019	
Pollutant	Kapolei
1-hour Carbon Monoxide (ppm) Maximum Concentration Average of Daily Max. Conc. Valid Periods / Possible Periods State / Federal Standard	0.9 0.2 8470 / 8760 9 / 35
8-hour Carbon Monoxide (ppm) Maximum Concentration Average of Daily Max. Conc. Valid Periods / Possible Periods State / Federal Standard	0.3 0.1 8327 / 8755 4.4 / 9
1-hour Sulfur Dioxide (ppb) * Maximum Concentration 99 th Percentile Value Valid Periods / Possible Periods Federal Standard	15.8 10.9 8085 / 8760 75
3-hour Sulfur Dioxide (ppm) * Maximum Concentration Average of Daily Max. Conc. Valid Periods / Possible Periods State and Federal Standard	0.012 0.001 2673 / 2920 0.500
24-hour Sulfur Dioxide (ppm) * Maximum Concentration Valid Periods / Possible Periods State Standard	0.004 332 / 365 0.140
Ann. Ave. Sulfur Dioxide (ppm) * Annual Average Valid Periods / Possible Periods State Standard	0.001 8085 / 8760 0.030
1-hour Nitrogen Dioxide (ppb) Maximum Concentration 98 th Percentile Value Valid Periods / Possible Periods Federal Standard	34 28 8371 / 8760 100
Ann. Ave. Nitrogen Dioxide (ppm) Annual Average Valid Periods / Possible Periods State / Federal Standard	0.004 8371 / 8760 0.040 / 0.053
8-hour O ₃ (ppm) Maximum Concentration 4 th Highest Daily Value Valid Periods / Possible Periods Federal Standard	0.056 0.052 8126 / 8755 0.070
24-hour PM ₁₀ (µg/m ³) Maximum Concentration Valid Periods / Possible Periods State and Federal Standard	42 352 / 365 150
Ann. Ave. PM ₁₀ (µg/m ³) Annual Average Valid periods / Possible Periods State Standard	12 352 / 365 50
24-hour PM _{2.5} (µg/m ³) Maximum Concentration 98 th Percentile Value Valid Periods / Possible Periods Federal Standard	10.8 5.2 349 / 365 35
Ann. Ave. PM _{2.5} (µg/m ³) Annual Average Valid Periods / Possible Periods Federal Standard	1.8 349 / 365 12

* SO₂ values taken from Kapolei N-Core Trace SO₂ analyzer as it was used to calculate the 2019 design value.

Preliminary data only – subject to change.

2020	
Pollutant	Kapolei
1-hour Carbon Monoxide (ppm) Maximum Concentration Average of Daily Max. Conc. Valid Periods / Possible Periods State / Federal Standard	1.2 0.2 8515 / 8784 9 / 35
8-hour Carbon Monoxide (ppm) Maximum Concentration Average of Daily Max. Conc. Valid Periods / Possible Periods State / Federal Standard	0.4 0.2 8376 / 8779 4.4 / 9
1-hour Sulfur Dioxide (ppb) Maximum Concentration 99 th Percentile Value Valid Periods / Possible Periods Federal Standard	8.5 5.8 8262 / 8784 75
3-hour Sulfur Dioxide (ppm) Maximum Concentration Average of Daily Max. Conc. Valid Periods / Possible Periods State and Federal Standard	0.005 0.001 2716 / 2928 0.500
24-hour Sulfur Dioxide (ppm) Maximum Concentration Valid Periods / Possible Periods State Standard	0.003 345 / 366 0.140
Ann. Ave. Sulfur Dioxide (ppm) Annual Average Valid Periods / Possible Periods State Standard	0.001 8262 / 8784 0.030
1-hour Nitrogen Dioxide (ppb) Maximum Concentration 98 th Percentile Value Valid Periods / Possible Periods Federal Standard	32 26 8507 / 8784 100
Ann. Ave. Nitrogen Dioxide (ppm) Annual Average Valid Periods / Possible Periods State / Federal Standard	0.003 8507 / 8784 0.040 / 0.053
8-hour O ₃ (ppm) Maximum Concentration 4 th Highest Daily Value Valid Periods / Possible Periods Federal Standard	0.047 0.045 8387 / 8779 0.070
24-hour PM ₁₀ (µg/m ³) Maximum Concentration Valid Periods / Possible Periods State and Federal Standard	43 343 / 366 150
Ann. Ave. PM ₁₀ (µg/m ³) Annual Average Valid periods / Possible Periods State Standard	12 343 / 366 50
24-hour PM _{2.5} (µg/m ³) Maximum Concentration 98 th Percentile Value Valid Periods / Possible Periods Federal Standard	15.4 6.9 335 / 366 35
Ann. Ave. PM _{2.5} (µg/m ³) Annual Average Valid Periods / Possible Periods Federal Standard	3.4 335 / 366 12

Preliminary data only – subject to change.

2021	
Pollutant	Kapolei
1-hour Carbon Monoxide (ppm) Maximum Concentration Average of Daily Max. Conc. Valid Periods / Possible Periods State / Federal Standard	0.8 0.2 8453 / 8760 9 / 35
8-hour Carbon Monoxide (ppm) Maximum Concentration Average of Daily Max. Conc. Valid Periods / Possible Periods State / Federal Standard	0.4 0.2 8298 / 8755 4.4 / 9
1-hour Sulfur Dioxide (ppb) * Maximum Concentration 99 th Percentile Value Valid Periods / Possible Periods Federal Standard	10.9 5.8 8354 / 8760 75
3-hour Sulfur Dioxide (ppm) * Maximum Concentration Average of Daily Max. Conc. Valid Periods / Possible Periods State and Federal Standard	0.007 0.001 2754 / 2920 0.500
24-hour Sulfur Dioxide (ppm) * Maximum Concentration Valid Periods / Possible Periods State Standard	0.002 344 / 365 0.140
Ann. Ave. Sulfur Dioxide (ppm) * Annual Average Valid Periods / Possible Periods State Standard	0.001 8354 / 8760 0.030
1-hour Nitrogen Dioxide (ppb) Maximum Concentration 98 th Percentile Value Valid Periods / Possible Periods Federal Standard	30 22 8451 / 8760 100
Ann. Ave. Nitrogen Dioxide (ppm) Annual Average Valid Periods / Possible Periods State / Federal Standard	0.003 8451 / 8760 0.040 / 0.053
8-hour O ₃ (ppm) Maximum Concentration 4 th Highest Daily Value Valid Periods / Possible Periods Federal Standard	0.050 0.047 8212 / 8755 0.070
24-hour PM ₁₀ (µg/m ³) Maximum Concentration Valid Periods / Possible Periods State and Federal Standard	46 273 / 365 150
Ann. Ave. PM ₁₀ (µg/m ³) Annual Average Valid periods / Possible Periods State Standard	9 273 / 365 50
24-hour PM _{2.5} (µg/m ³) Maximum Concentration 98 th Percentile Value Valid Periods / Possible Periods Federal Standard	8.5 6.7 336 / 365 35
Ann. Ave. PM _{2.5} (µg/m ³) Annual Average Valid Periods / Possible Periods Federal Standard	2.9 336 / 365 12

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

Preliminary data only – subject to change.

2022	
Pollutant	Kapolei
1-hour Carbon Monoxide (ppm) * Maximum Concentration Average of Daily Max. Conc. Valid Periods / Possible Periods State / Federal Standard	9.5 (brush fire) 0.2 8265 / 8760 9 / 35
8-hour Carbon Monoxide (ppm) * Maximum Concentration Average of Daily Max. Conc. Valid Periods / Possible Periods State / Federal Standard	1.3 (brush fire) 0.1 8249 / 8755 4.4 / 9
1-hour Sulfur Dioxide (ppb) ** Maximum Concentration 99 th Percentile Value Valid Periods / Possible Periods Federal Standard	2.7 1.9 8605 / 8760 75
3-hour Sulfur Dioxide (ppm) ** Maximum Concentration Average of Daily Max. Conc. Valid Periods / Possible Periods State and Federal Standard	0.002 0.000 2833 / 2920 0.500
24-hour Sulfur Dioxide (ppm) ** Maximum Concentration Valid Periods / Possible Periods State Standard	0.001 363 / 365 0.140
Ann. Ave. Sulfur Dioxide (ppm) ** Annual Average Valid Periods / Possible Periods State Standard	0.000 8605 / 8760 0.030
1-hour Nitrogen Dioxide (ppb) Maximum Concentration 98 th Percentile Value Valid Periods / Possible Periods Federal Standard	31 23 5711 / 8760 100
Ann. Ave. Nitrogen Dioxide (ppm) Annual Average Valid Periods / Possible Periods State / Federal Standard	0.003 5711 / 8760 0.040 / 0.053
8-hour O ₃ (ppm) Maximum Concentration 4 th Highest Daily Value Valid Periods / Possible Periods Federal Standard	0.044 0.041 8004 / 8755 0.070
24-hour PM ₁₀ (µg/m ³) Maximum Concentration Valid Periods / Possible Periods State and Federal Standard	48 351 / 365 150
Ann. Ave. PM ₁₀ (µg/m ³) Annual Average Valid periods / Possible Periods State Standard	17 351 / 365 50
24-hour PM _{2.5} (µg/m ³) Maximum Concentration 98 th Percentile Value Valid Periods / Possible Periods Federal Standard	25.9 9.3 319 / 365 35
Ann. Ave. PM _{2.5} (µg/m ³) Annual Average Valid Periods / Possible Periods Federal Standard	4.7 319 / 365 12

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

** SO₂ values taken from Kapolei N-Core trace SO₂ analyzer as the SO₂ analyzer at Kapolei was discontinued on February 28, 2022.

Preliminary data only – subject to change.

Figure 1. Annual Average of Maximum 1-hour Carbon Monoxide: 2018 - 2022

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

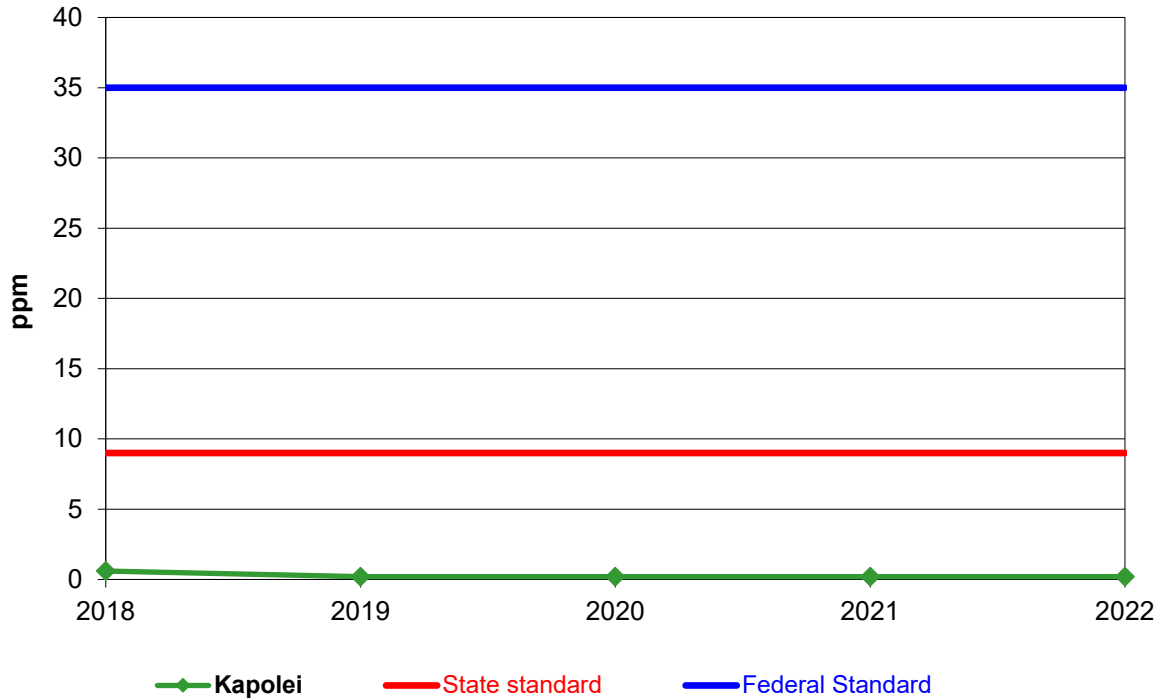


Figure 2. Annual Average of Maximum 8-hour Carbon Monoxide: 2018 - 2022

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

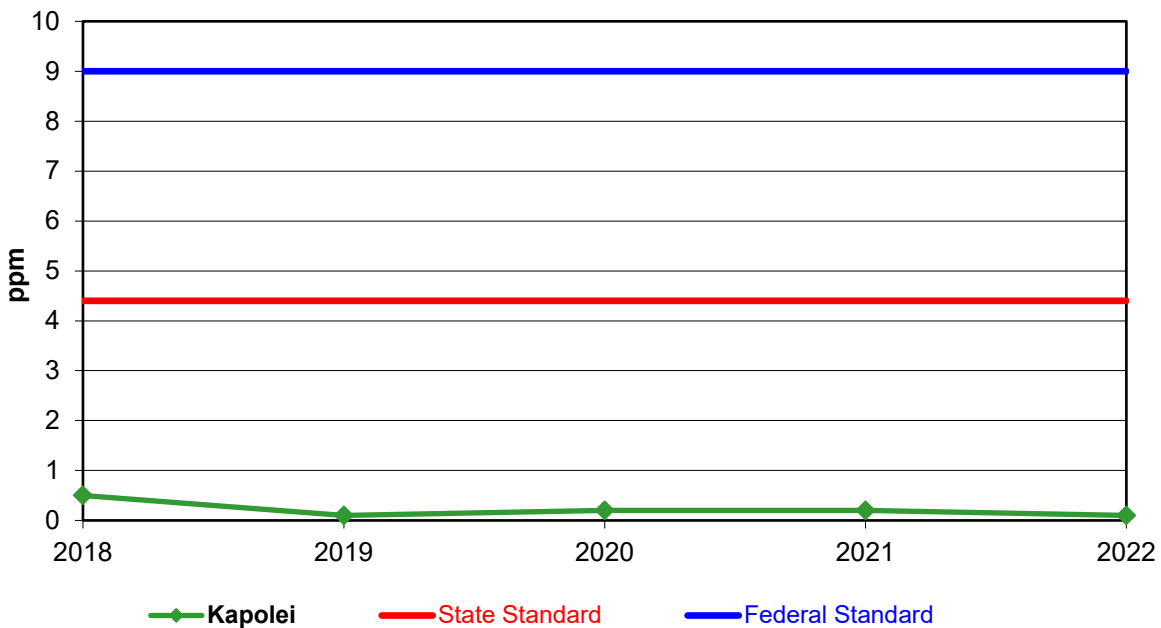


Figure 3. Annual Average of Maximum 3-hour Sulfur Dioxide: 2018 - 2022

(Annual average of the maximum 3-hour values)

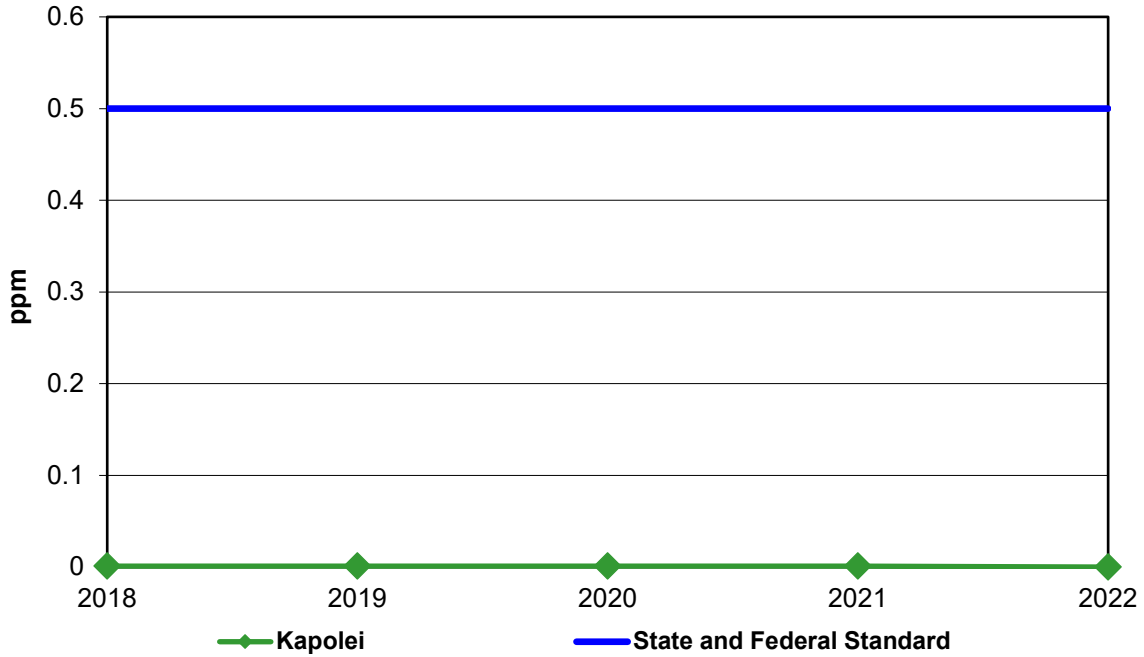
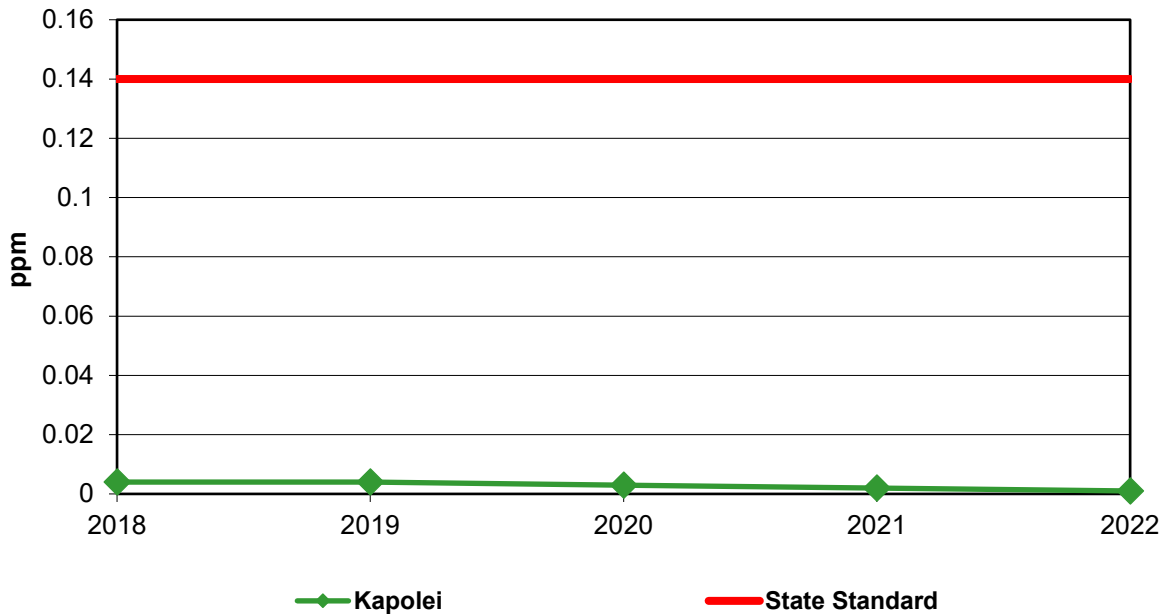


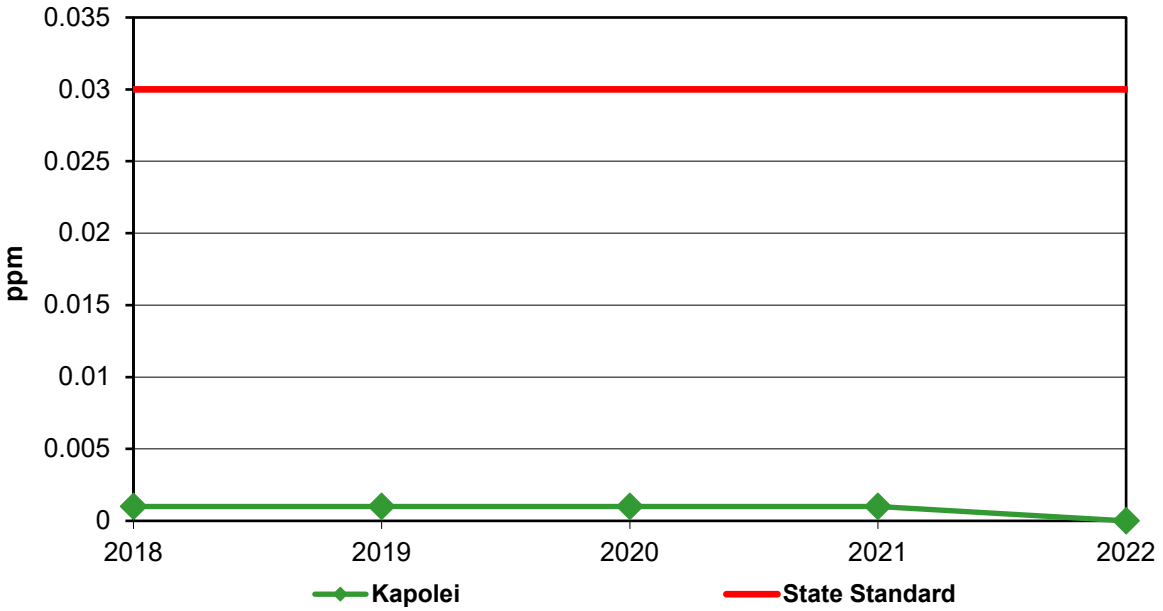
Figure 4. Maximum 24-hour Sulfur Dioxide: 2018 - 2022

(The highest 24-hour value in the year)

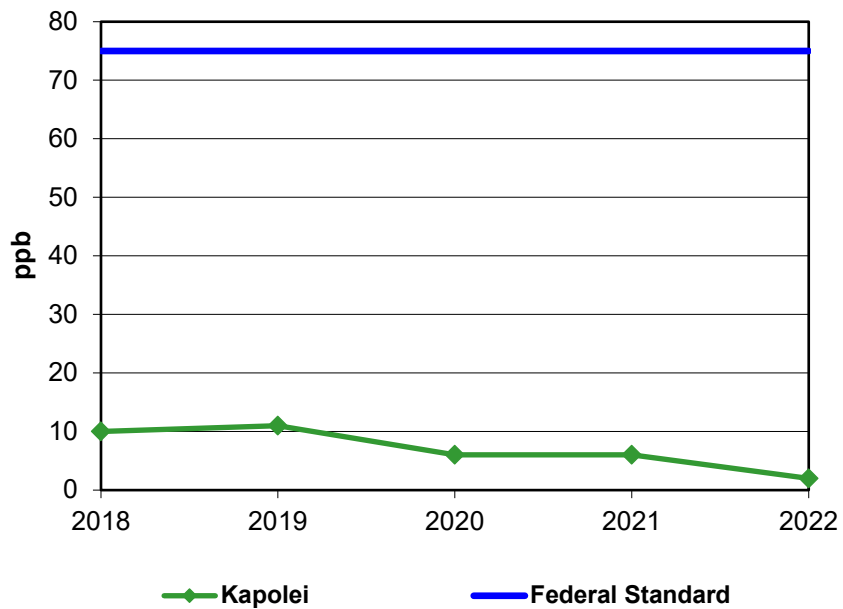


**Figure 5. Annual Average of Sulfur Dioxide:
2018 - 2022**

(Average of all valid hours in the year)

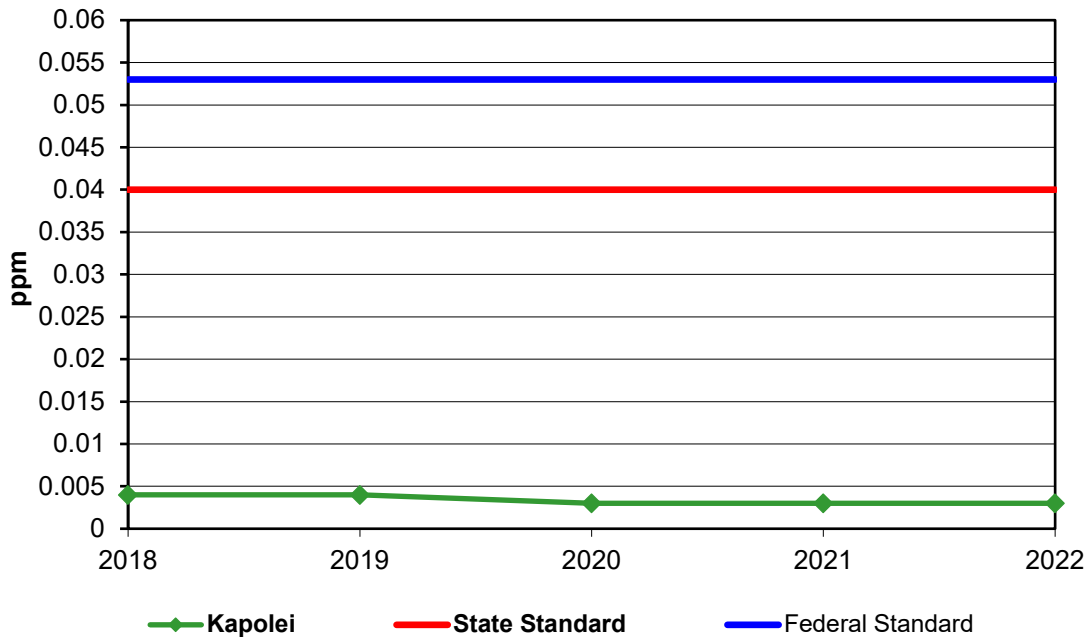


**Figure 6. 99th Percentile 1-hour Sulfur
Dioxide:
2018 - 2022**



**Figure 7. Annual Average of Nitrogen Dioxide:
2018 - 2022**

(Average of all valid hours in the year)



**Figure 8. 98th Percentile 1-hour Nitrogen
Dioxide:
2018 - 2022**

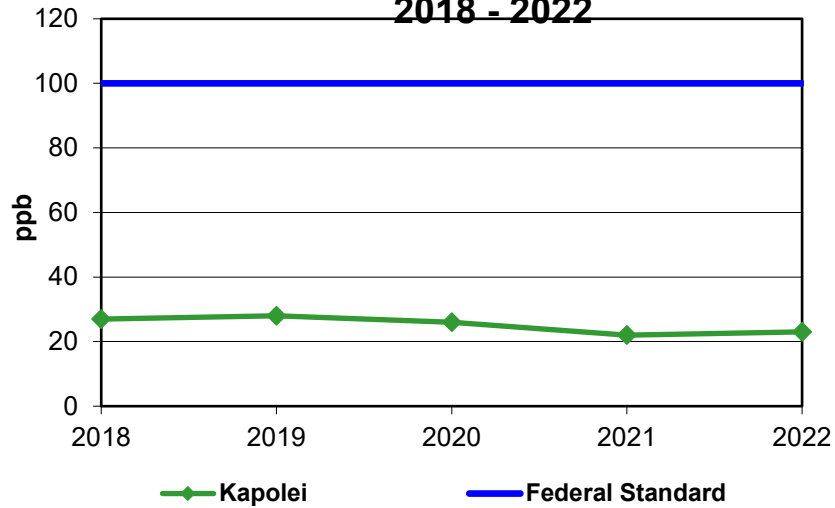


Figure 9. Maximum 24-hour PM₁₀: 2018 - 2022

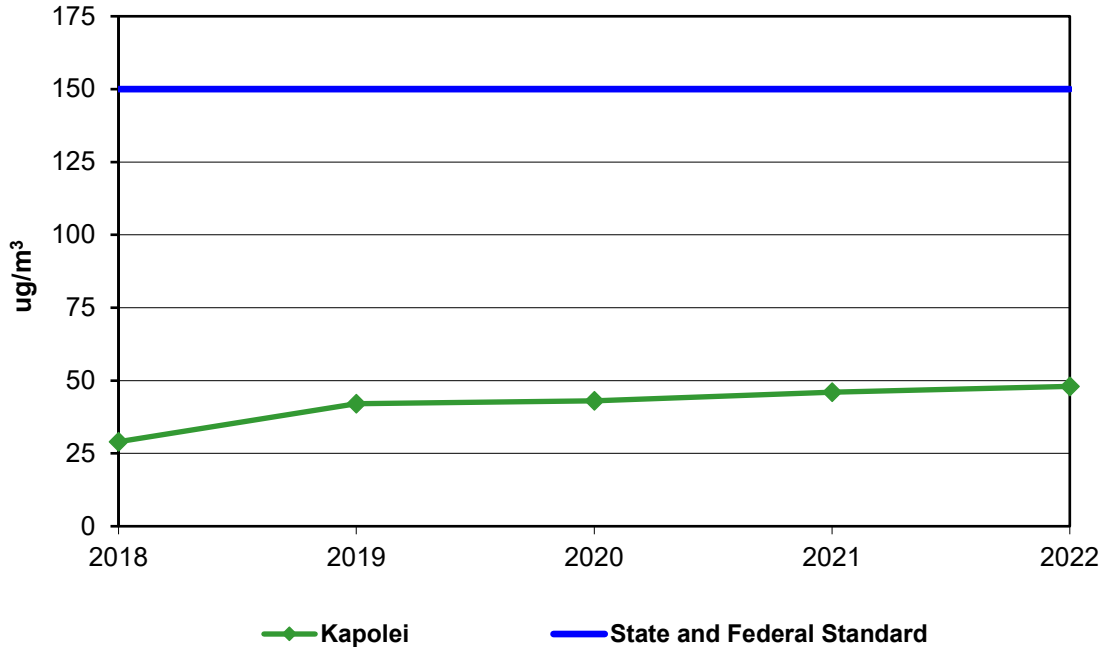
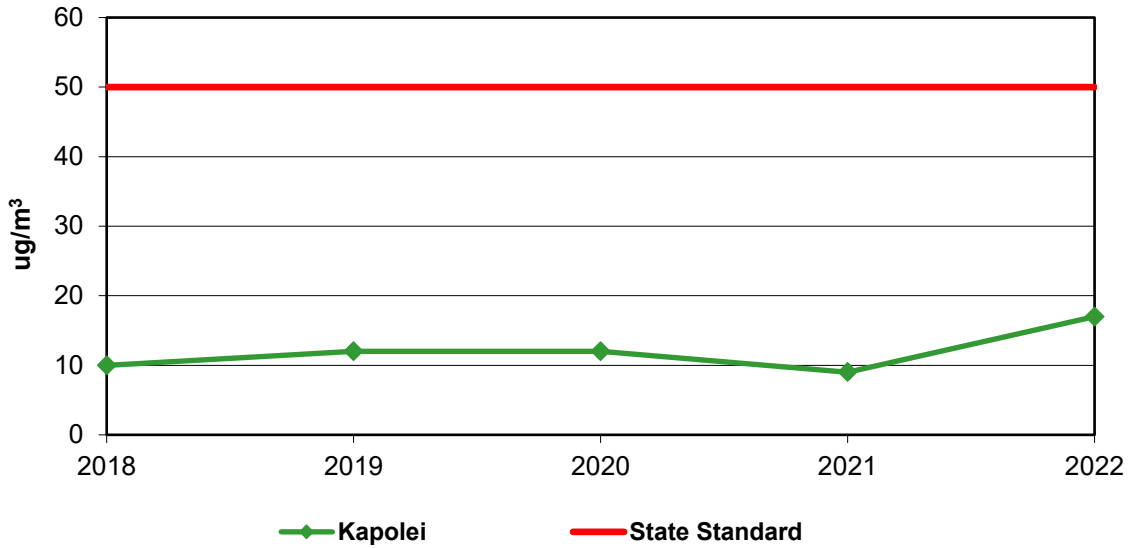


Figure 10. Annual Average of PM₁₀: 2018 - 2022
(Average of all valid 24-hour values in the year)



**Figure 11. 98th Percentile 24-hour PM_{2.5}:
2018 - 2022**

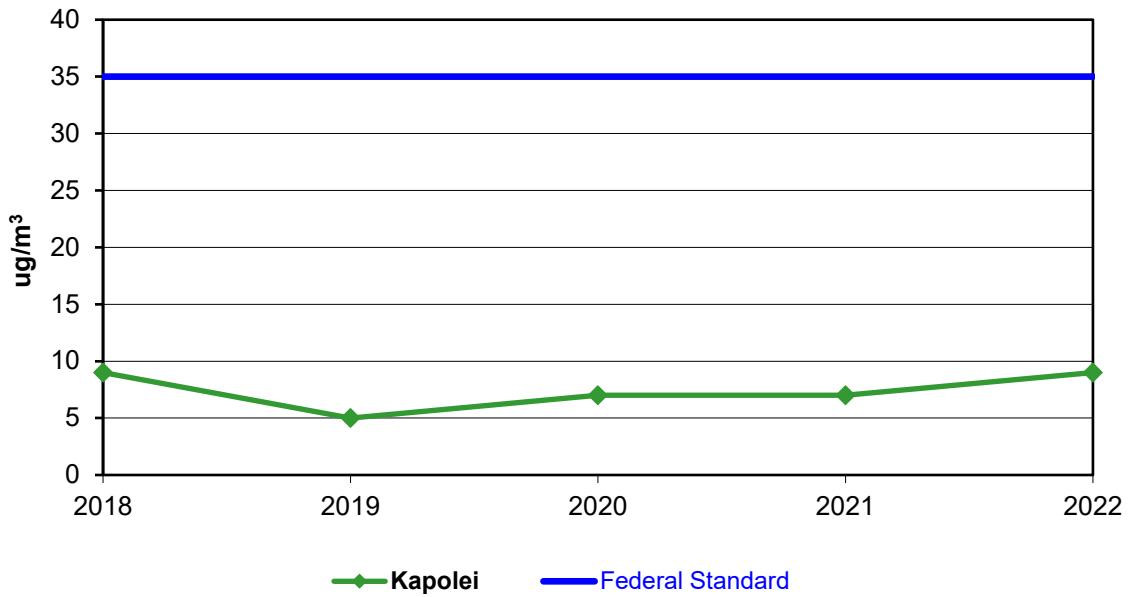
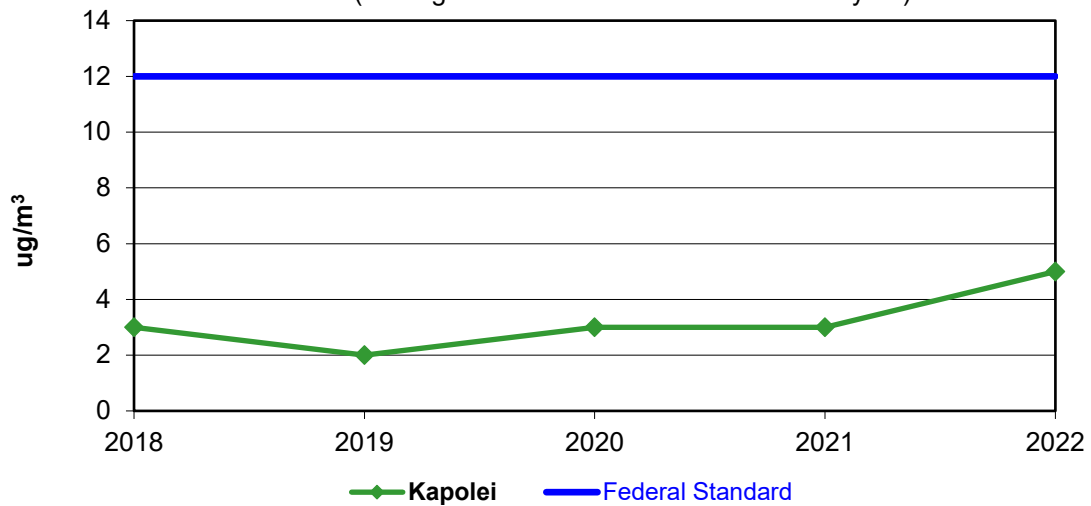


Figure 12. Annual Average of PM_{2.5}: 2018 - 2022
(Average of all valid 24-hour values in the year)



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, June 2024

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 (O₃);
- airborne lead (Pb);
- particulate matter, including both PM₁₀ and PM_{2.5};
- carbon monoxide (CO);
- nitrogen dioxide (NO₂); and
- sulfur dioxide (SO₂).

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, NO₂, SO₂, PM₁₀, PM_{2.5}, and O₃ at the Kapolei Station in CIP. Data for Pb was recorded until December 31, 2018, when sampling was discontinued with EPA approval. Data for the years 2018 – 2022 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 Hawaii 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, Hawaii 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 of the criteria air pollutants measured at CIP. This is not intended to be a complete or 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 enough concentrations. First, it is important to understand the primary rule of toxicology: taking a sufficient 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. Because of this and available scientific data, there is a fairly clear understanding of what concentrations of air pollutants are needed before adverse health effects develop. Even so, because of human variability, there are no clear-cut numbers below which there is no risk and above which we are all at risk. Safety factors are

therefore used to help compensate for uncertainties and to provide added protection for the more sensitive people in the population.

In the following paragraphs, the levels of pollutants measured in the CIP area in 2022 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 (SO₂):

SO₂ is a colorless gas with an odor often described as similar to fireworks. Man-made emissions of SO₂ are largely from sources that burn fossil fuels, coal, and oil. Stationary sources such as oil-fired power plants and refineries are the largest sources of emissions in Hawaii.

Volcanoes can be a significant natural source of SO₂. SO₂ is of major concern on the Island of Hawaii because when erupting, the Kilauea and Mauna Loa volcanoes release large quantities of SO₂ 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 Kilauea 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, along with other State and Federal agencies, developed a color coded short term SO₂ advisory for the Island of Hawaii (<http://www.hiso2index.info/>). This advisory was used extensively during the 2018 Lower East Rift Zone (LERZ) eruption that produced high levels of SO₂ emissions. During periods of active emissions, SO₂ concentrations in communities downwind of Kilauea routinely exceed the SO₂ NAAQS. Reductions in air quality from increased SO₂ and PM and the resulting vog affected many areas across Hawaii Island and the entire state during the 2018 LERZ eruption. From August 2018 until November 2022, SO₂ emissions from Kilauea 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.

The EPA acknowledges that certain people may be more vulnerable to the health effects from air pollutants. There is substantial evidence from human clinical and epidemiological studies indicating that people with asthma are more susceptible to the respiratory health effects of SO₂ compared to the general population. Based upon a large body of evidence that brief exposures (5-10 minutes) to SO₂ can negatively affect the respiratory health of asthmatics, in June 2010, the EPA established a new 1-hour NAAQS for SO₂ of 0.075 ppm. The new standard is designed to protect against short-term exposures that result in adverse respiratory effects in people with asthma or otherwise alert such individuals to potential hazardous ambient air conditions in the area. The EPA considers the 1-hour standard to be appropriately protective of public health with an adequate margin of safety.

In 2022, the maximum measured 1-hour concentration of SO₂ at CIP was 0.0027 ppm, well below the NAAQS of 0.075 ppm. The maximum 3-hour concentration of 0.002 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 the recorded levels of SO₂. The maximum 24-hour SO₂ concentration of 0.001 ppm was below the Hawaii state standard of 0.140 ppm.

Ozone (O₃):

Ozone occurs 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 2022, the maximum 8-hour ozone concentration was 0.044 ppm, below the NAAQS of 0.070 ppm.

Nitrogen Dioxide (NO₂):

NO₂ is a gas that may appear red to brown and produces a pungent, acrid odor. Man-made emissions of NO₂, similar to SO₂, are mostly from sources that burn fossil fuels, coal, and oil. Stationary sources such as oil-fired power plants and refineries are the largest sources in Hawaii. Short-term exposure to NO₂ 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 NO₂. 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 NO₂ is set to 0.053 ppm for a one-year averaging period. Hawaii has set an annual exceedance level of 0.040 ppm for added safety. The annual average concentration measured in 2022 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.

NO₂ as well as SO₂ are gases that, combined with water on the wet surfaces of the body, produce acids. At high enough levels, these acid gases are irritating to the lungs, eyes, nose and throat, and can cause 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. For irritants such as the acid gases of SO₂ and NO₂, 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. Hawaii 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. Hawaii met these criteria in 2022 and was in attainment with both the 1-hour and 8-hour state and federal standards for CO. In 2022, the 1-hour reported

average for the CIP area was 0.20 ppm and the 8-hour average was 0.10 ppm. While the maximum measured 1-hour concentration (1st high) for CO in 2022 of 9.50 ppm, was greater than the state standard of 9 ppm over a 1-hour averaging period, the 2nd highest measured concentration was below the state standard at 6 ppm, and therefore, the standard was not exceeded more than once in a calendar year. These concentrations were measured during temporary and irregular brush fire activity in November and December 2022. The maximum 8-hour concentration for CO measured at 1.3 ppm was below the state standard of 4.4 ppm. Maximum CO concentrations for both the 1-hour and 8-hour averaging periods were higher than normal due to unusual brush fire activities in 2022.

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 that in high enough doses can cause a myriad of health effects. Children exposed to lead over an extended period of time can have neurodevelopmental problems 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/m³ 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 approval.

Particulate Matter (PM₁₀ and PM_{2.5}):

The NAAQS level for PM₁₀ has been set at 150 µg/m³ averaged over 24 hours. Hawaii also has an additional standard of 50 ug/m³ averaged over one 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/m³ averaged over 24 hours and 15 µg/m³ averaged over one year. On December 17, 2006, the 24-hour standard for PM_{2.5} was lowered to 35 µg/m³ to better protect the public from short-term fine particle exposure. On Dec. 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/m³. In December 2021, the EPA announced it will retain, without revision, the existing NAAQS for particulate matter.

Adverse health effects of particulate matter 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 2022 annual average for PM₁₀ in the CIP area was 17 µg/m³. The maximum 24-hour concentration reported was 48 µg/m³. Although the adverse health effects from these levels of exposure are currently controversial, these averages are similar to Honolulu which has one of the lowest urban PM₁₀ levels in the United States. For PM_{2.5}, the maximum 24-hour concentration was 25.9 µg/m³ and the annual average was 4.7 µg/m³, both below current Federal standards.