2022 Annual Report on Air Emissions from Facilities at Campbell Industrial Park

Prepared by:
Clean Air Branch
Hawaii State Department of Health

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Introduction

This report has been prepared by the Clean Air Branch of the Department of Health 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 Department of Health to generate an annual report to the communities using specific information provided by the major sources located in Campbell Industrial Park and Kahe Valley. The information for this report is based on the annual data collected in 2021.

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 Campbell Industrial Park. The data are 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 Clean Air Branch of the Department of Health 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.”

The Department of Health provides access to its programs and activities without regard to race, color, national origin (including language), age, sex, religion, or disability. Write our Affirmative Action Officer at P.O. Box 3378, Honolulu, Hawaii 96801-3378, or call (808) 586-4616 (voice) within 180 days of a problem.

SECTION 1.
Summary of Air Pollutants Emitted by Major Source Facilities in Campbell Industrial Park & Kahe Valley in 2021 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; these air pollutants are described in **Section 2**. 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

AES Hawaii, Inc. operates a coal-fired cogeneration plant which generates electricity for operation and sale to Hawaiian Electric. Coal is imported, crushed, then 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 air emissions flow through a selective non-catalytic reduction system and baghouse before it reaches 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 (PM_{10} and $PM_{2.5}$, respectively), sulfur dioxide (SO_2), nitrogen oxides (NO_x), carbon monoxide (CO), volatile organic compounds (VOC), and lead (Pb) are the primary air pollutants being emitted from this facility. 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. SO_2 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, PM_{10} 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.

The permit for AES Hawaii, Inc. was amended on October 27, 2020 in accordance with Act 023 (September 15, 2020) (to be codified as HRS, Section 342B-) of the 30th Hawaii State Legislature, 2020 requiring all coal burning or consumption of coal for generating electricity to cease on December 31, 2022.

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 and stored in the Kapolei Terminal's storage tanks. The main emission units are storage tanks and a petroleum loadrack.

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.

Hawaiian Electric - Campbell Industrial Park

Hawaiian Electric operates a biodiesel/fuel oil no. 2 fueled combustion turbine generating station in Campbell Industrial Park (CIP). The CIP generating station operates one (1) simple cycle combustion turbine generator and two (2) black start diesel engine generators. Biodiesel for the combustion turbine generator is imported and stored inside above ground storage tanks. The generating station was the first biodiesel fueled combustion turbine plant in Hawaii.

Primary air pollutants emitted from this facility are SO_2, TSP, 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. 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, PM_{10}, $PM_{2.5}$, SO_2, NO_x, CO, and VOC are the primary air pollutants. TSP, 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 burners which precisely controls the mixing of fuel and air to minimize NO_X emissions. The CO and VOC emissions are controlled by combustion design and good combustion practices.

Honolulu Resource Recovery Venture (H-POWER)

H-POWER operates a municipal waste combustion 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 in a landfill or recycled, as appropriate. Cooling towers are also used to extract heat from boiler circulation water systems.

PM, SO_2, NO_2, CO, MWC metals (cadmium, lead, and mercury), and acid gases are the primary air pollutants emitted from boilers at this facility. PM and MWC metals from boiler combustion are controlled with baghouses. Emissions of SO_2, H_2SO_4, HCl, and HF 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 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 NO_2 emissions. An activated carbon injection system is also used for the mass-burn boiler to reduce mercury and MWC organics. 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 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

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, PM_{10}, $PM_{2.5}$, SO_2, and NO_x are the primary air pollutants being 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. Particulate emissions from the cooling tower 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, PM_{10}, $PM_{2.5}$, SO_2, NO_x, CO, and VOC are the primary air pollutants being emitted from this facility. The following briefly describes the air pollution control methods being employed. The TSP, 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.

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, PM_{10}, $PM_{2.5}$, SO_2, NO_x, CO, and VOC are the primary air pollutants being emitted from this facility. The following briefly describes the air pollution control methods being employed. The TSP, 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. The cooling tower also emits TSP, PM_{10} 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 SO_2, 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, except for the Effluent Treatment Plant, the Par West Refinery was shut down for the majority of 2020 and almost all of 2021.

TABLE A

2021 Campbell Industrial Park and Kahe Valley Major Source Air Emissions (tons/year)

Facility	TSP	PM_{10}	$PM_{2.5}$	SO_2	NO_x	CO	VOC	Pb
AES [1]	102.1	86.3	67.7	426.5	562.5	39.1	5.0	0.0
IES Downstream [2]	0.0	0.0	0.0	0.0	0.0	0.0	123.3	0.0
HECO CIP Plant	20.0	19.4	18.5	1.0	104.7	258.5	21.1	0.0
HECO Kahe Plant	352.6	283.5	238.2	5,487.8	5,339.4	196.2	34.0	0.0
HPOWER [3]	118.8	124.1	110.3	18.1	838.0	144.9	6.0	0.0
Kalaeloa Partners	343.8	519.2	497.7	2,754.0	2,221.1	17.7	8.2	0.1
Par Hawaii East[2]	76.5	60.0	46.3	388.8	739.7	233.9	394.3	0.0
Par Hawaii West[2]	0.2	0.2	0.2	0.0	3.5	1.9	13.7	0.0
TOTAL (tons/year)	1,012.6	988	887.2	9,059.1	9,075.1	1,006.1	620.7	0.1

Source: State Department of Health, Clean Air Branch. Based on Covered Source actual emissions for 2021, as submitted by the respective sources.

TSP - Total Suspended Particulates
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. The nitrogen and sulfur content in the coal supply will continue to vary year to year.
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: 2017 - 2021

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 limits emissions. The ambient air is monitored throughout the State by analyzers and meteorological equipment installed at strategic locations.

Air pollution is generated by many different sources. "Stationary sources" include those of 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. This last pollutant 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. Total Suspended Particulates (TSP) was replaced as a criteria pollutant by PM_{10}. 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 NO_2 are more stringent than the NAAQS). Hawaii air monitoring data shows that Hawaii's air quality meets all of the federal and state air quality standards.

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.

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. The air quality trends for SO_2, NO_2, CO, and PM_{10}/$PM_{2.5}$ in the CIP area have consistently been well below the national and state standards.

Summary of Air Quality Data
2017 - 2021

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 $PM_{2.5}$ 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 (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. 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 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 approximately 200 yards south of the Desalination facility and the Kapolei Fire Station. Both the Kapolei SLAMS station and the NCore station are located here.

The pollutants sampled at the Kapolei station are carbon monoxide (CO), NO_2, O_3, SO_2, Particulate Matter 10 microns or less (PM_{10}), and $PM_{2.5}$. Pb sampling was discontinued December 31, 2018 with EPA approval. Meteorological parameters measured are wind speed, wind direction and ambient temperature. To address resource challenges, CO and SO_2 sampling at Kapolei will be discontinued as of March 31, 2022 and February 28, 2022, respectively, as trace-level CO and trace-level SO_2 sampling are already being conducted at the NCore station.

2017	
Pollutant	**Kapolei**
1-hour Carbon Monoxide (ppm)	
Maximum Concentration	1.7
Average of Daily Max. Conc.	0.3
Valid Periods / Possible Periods	8207 / 8760
State / Federal Standard	9 / 35
8-hour Carbon Monoxide (ppm)	
Maximum Concentration	1.1
Average of Daily Max. Conc.	0.2
Valid Periods / Possible Periods	7968 / 8755
State / Federal Standard	4.4 / 9
1-hour Sulfur Dioxide (ppb)	
Maximum Concentration	12.4
99^{th} Percentile Value	8.3
Valid Periods / Possible Periods	8234 / 8760
Federal Standard	75
3-hour Sulfur Dioxide (ppm)	
Maximum Concentration	0.006
Average of Daily Max. Conc.	0.001
Valid Periods / Possible Periods	2667 / 2920
State and Federal Standard	0.500
24-hour Sulfur Dioxide (ppm)	
Maximum Concentration	0.003
Valid Periods / Possible Periods	353 / 365
State Standard	0.140
Ann. Ave. Sulfur Dioxide (ppm)	
Annual Average	0.001
Valid Periods / Possible Periods	8234 / 8760
State Standard	0.030
1-hour Nitrogen Dioxide (ppb)	
Maximum Concentration	41
98^{th} Percentile Value	33
Valid Periods / Possible Periods	8250 / 8760
Federal Standard	100
Ann. Ave. Nitrogen Dioxide (ppm)	
Annual Average	0.004
Valid Periods / Possible Periods	8250 / 8760
State / Federal Standard	0.040 / 0.053
8-hour O_3 (ppm)	
Maximum Concentration	0.052
4^{th} Highest Daily Value	0.049
Valid Periods / Possible Periods	7435 / 8755
Federal Standard	0.070
24-hour PM_{10} (µg/m^3)	
Maximum Concentration	39
Valid Periods / Possible Periods	352 / 365
State and Federal Standard	150
Ann. Ave. PM_{10} (µg/m^3)	
Annual Average	13
Valid periods / Possible Periods	352 / 365
State Standard	50
24-hour $PM_{2.5}$ (µg/m^3)	
Maximum Concentration	15.5
98^{th} Percentile Value	9.6
Valid Periods / Possible Periods	312 / 365
Federal Standard	35
Ann. Ave. $PM_{2.5}$ (µg/m^3)	
Annual Average	4.3
Valid Periods / Possible Periods	312 / 365
Federal Standard	12
3-month Pb (µg/m^3)	
Maximum 3-month average	0.003
Valid Periods / Possible Periods	12 / 12
Federal Standard	0.15

Preliminary data only – subject to change

2018	
Pollutant	**Kapolei**
1-hour Carbon Monoxide (ppm)	
Maximum Concentration	3.2
Average of Daily Max. Conc.	0.6
Valid Periods / Possible Periods	8058 / 8760
State / Federal Standard	9 / 35
8-hour Carbon Monoxide (ppm)	
Maximum Concentration	2.5
Average of Daily Max. Conc.	0.5
Valid Periods / Possible Periods	8031 / 8755
State / Federal Standard	4.4 / 9
1-hour Sulfur Dioxide (ppb)	
Maximum Concentration	21.5
99^{th} Percentile Value	9.6
Valid Periods / Possible Periods	8157 / 8760
Federal Standard	75
3-hour Sulfur Dioxide (ppm)	
Maximum Concentration	0.017
Average of Daily Max. Conc.	0.001
Valid Periods / Possible Periods	2672 / 2920
State and Federal Standard	0.500
24-hour Sulfur Dioxide (ppm)	
Maximum Concentration	0.004
Valid Periods / Possible Periods	339 / 365
State Standard	0.140
Ann. Ave. Sulfur Dioxide (ppm)	
Annual Average	0.001
Valid Periods / Possible Periods	8157 / 8760
State Standard	0.030
1-hour Nitrogen Dioxide (ppb)	
Maximum Concentration	31
98^{th} Percentile Value	27
Valid Periods / Possible Periods	8185 / 8760
Federal Standard	100
Ann. Ave. Nitrogen Dioxide (ppm)	
Annual Average	0.004
Valid Periods / Possible Periods	8185 / 8760
State / Federal Standard	0.040 / 0.053
8-hour O_3 (ppm)	
Maximum Concentration	0.055
4^{th} Highest Daily Value	0.049
Valid Periods / Possible Periods	7579 / 8755
Federal Standard	0.070
24-hour PM_{10} (µg/m^3)	
Maximum Concentration	29
Valid Periods / Possible Periods	347 / 365
State and Federal Standard	150
Ann. Ave. PM_{10} (µg/m^3)	
Annual Average	10
Valid periods / Possible Periods	347 / 365
State Standard	50
24-hour $PM_{2.5}$ (µg/m^3)	
Maximum Concentration	11.2
98^{th} Percentile Value	8.7
Valid Periods / Possible Periods	346 / 365
Federal Standard	35
Ann. Ave. $PM_{2.5}$ (µg/m^3)	
Annual Average	2.5
Valid Periods / Possible Periods	346 / 365
Federal Standard	12
3-month Pb (µg/m^3)	
Maximum 3-month average	0.001
Valid Periods/Possible Periods	12 / 12
Federal Standard	0.15

Preliminary data only – subject to change.

2019	
Pollutant	**Kapolei**
1-hour Carbon Monoxide (ppm)	
Maximum Concentration	0.9
Average of Daily Max. Conc.	0.2
Valid Periods / Possible Periods	8470 / 8760
State / Federal Standard	9 / 35
8-hour Carbon Monoxide (ppm)	
Maximum Concentration	0.3
Average of Daily Max. Conc.	0.1
Valid Periods / Possible Periods	8327 / 8755
State / Federal Standard	4.4 / 9
1-hour Sulfur Dioxide (ppb) *	
Maximum Concentration	15.8
99^{th} Percentile Value	10.9
Valid Periods / Possible Periods	8085 / 8760
Federal Standard	75
3-hour Sulfur Dioxide (ppm) *	
Maximum Concentration	0.012
Average of Daily Max. Conc.	0.001
Valid Periods / Possible Periods	2673 / 2920
State and Federal Standard	0.500
24-hour Sulfur Dioxide (ppm) *	
Maximum Concentration	0.004
Valid Periods / Possible Periods	332 / 365
State Standard	0.140
Ann. Ave. Sulfur Dioxide (ppm) *	
Annual Average	0.001
Valid Periods / Possible Periods	8085 / 8760
State Standard	0.030
1-hour Nitrogen Dioxide (ppb)	
Maximum Concentration	34
98^{th} Percentile Value	28
Valid Periods / Possible Periods	8371 / 8760
Federal Standard	100
Ann. Ave. Nitrogen Dioxide (ppm)	
Annual Average	0.004
Valid Periods / Possible Periods	8371 / 8760
State / Federal Standard	0.040 / 0.053
8-hour O_3 (ppm)	
Maximum Concentration	0.056
4^{th} Highest Daily Value	0.052
Valid Periods / Possible Periods	8126 / 8755
Federal Standard	0.070
24-hour PM_{10} (µg/m^3)	
Maximum Concentration	42
Valid Periods / Possible Periods	352 / 365
State and Federal Standard	150
Ann. Ave. PM_{10} (µg/m^3)	
Annual Average	12
Valid periods / Possible Periods	352 / 365
State Standard	50
24-hour $PM_{2.5}$ (µg/m^3)	
Maximum Concentration	10.8
98^{th} Percentile Value	5.2
Valid Periods / Possible Periods	349 / 365
Federal Standard	35
Ann. Ave. $PM_{2.5}$ (µg/m^3)	
Annual Average	1.8
Valid Periods / Possible Periods	349 / 365
Federal Standard	12

* SO_2 values taken from Kapolei N-Core Trace SO_2 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	1.2
Average of Daily Max. Conc.	0.2
Valid Periods / Possible Periods	8515 / 8784
State / Federal Standard	9 / 35
8-hour Carbon Monoxide (ppm)	
Maximum Concentration	0.4
Average of Daily Max. Conc.	0.2
Valid Periods / Possible Periods	8376 / 8779
State / Federal Standard	4.4 / 9
1-hour Sulfur Dioxide (ppb)	
Maximum Concentration	8.5
99^{th} Percentile Value	5.8
Valid Periods / Possible Periods	8262 / 8784
Federal Standard	75
3-hour Sulfur Dioxide (ppm)	
Maximum Concentration	0.005
Average of Daily Max. Conc.	0.001
Valid Periods / Possible Periods	2716 / 2928
State and Federal Standard	0.500
24-hour Sulfur Dioxide (ppm)	
Maximum Concentration	0.003
Valid Periods / Possible Periods	345 / 366
State Standard	0.140
Ann. Ave. Sulfur Dioxide (ppm)	
Annual Average	0.001
Valid Periods / Possible Periods	8262 / 8784
State Standard	0.030
1-hour Nitrogen Dioxide (ppb)	
Maximum Concentration	32
98^{th} Percentile Value	26
Valid Periods / Possible Periods	8507 / 8784
Federal Standard	100
Ann. Ave. Nitrogen Dioxide (ppm)	
Annual Average	0.003
Valid Periods / Possible Periods	8507 / 8784
State / Federal Standard	0.040 / 0.053
8-hour O_3 (ppm)	
Maximum Concentration	0.047
4^{th} Highest Daily Value	0.045
Valid Periods / Possible Periods	8387 / 8779
Federal Standard	0.070
24-hour PM_{10} (µg/m^3)	
Maximum Concentration	43
Valid Periods / Possible Periods	343 / 366
State and Federal Standard	150
Ann. Ave. PM_{10} (µg/m^3)	
Annual Average	12
Valid periods / Possible Periods	343 / 366
State Standard	50
24-hour $PM_{2.5}$ (µg/m^3)	
Maximum Concentration	15.4
98^{th} Percentile Value	6.9
Valid Periods / Possible Periods	335 / 366
Federal Standard	35
Ann. Ave. $PM_{2.5}$ (µg/m^3)	
Annual Average	3.4
Valid Periods / Possible Periods	335 / 366
Federal Standard	12

Preliminary data only – subject to change.

2021	
Pollutant	**Kapolei**
1-hour Carbon Monoxide (ppm)	
Maximum Concentration	0.8
Average of Daily Max. Conc.	0.2
Valid Periods / Possible Periods	8453 / 8760
State / Federal Standard	9 / 35
8-hour Carbon Monoxide (ppm)	
Maximum Concentration	0.4
Average of Daily Max. Conc.	0.2
Valid Periods / Possible Periods	8298 / 8755
State / Federal Standard	4.4 / 9
1-hour Sulfur Dioxide (ppb) *	
Maximum Concentration	10.9
99^{th} Percentile Value	5.8
Valid Periods / Possible Periods	8354 / 8760
Federal Standard	75
3-hour Sulfur Dioxide (ppm) *	
Maximum Concentration	0.007
Average of Daily Max. Conc.	0.001
Valid Periods / Possible Periods	2754 / 2920
State and Federal Standard	0.500
24-hour Sulfur Dioxide (ppm) *	
Maximum Concentration	0.002
Valid Periods / Possible Periods	344 / 365
State Standard	0.140
Ann. Ave. Sulfur Dioxide (ppm) *	
Annual Average	0.001
Valid Periods / Possible Periods	8354 / 8760
State Standard	0.030
1-hour Nitrogen Dioxide (ppb)	
Maximum Concentration	30
98^{th} Percentile Value	22
Valid Periods / Possible Periods	8451 / 8760
Federal Standard	100
Ann. Ave. Nitrogen Dioxide (ppm)	
Annual Average	0.003
Valid Periods / Possible Periods	8451 / 8760
State / Federal Standard	0.040 / 0.053
8-hour O_3 (ppm)	
Maximum Concentration	0.050
4^{th} Highest Daily Value	0.047
Valid Periods / Possible Periods	8212 / 8755
Federal Standard	0.070
24-hour PM_{10} (µg/m^3)	
Maximum Concentration	46
Valid Periods / Possible Periods	273 / 365
State and Federal Standard	150
Ann. Ave. PM_{10} (µg/m^3)	
Annual Average	9
Valid periods / Possible Periods	273 / 365
State Standard	50
24-hour $PM_{2.5}$ (µg/m^3)	
Maximum Concentration	8.5
98^{th} Percentile Value	6.7
Valid Periods / Possible Periods	336 / 365
Federal Standard	35
Ann. Ave. $PM_{2.5}$ (µg/m^3)	
Annual Average	2.9
Valid Periods / Possible Periods	336 / 365
Federal Standard	12

* SO_2 values taken from Kapolei N-Core Trace SO_2 analyzer as it was used to calculate the 2021 design value.

Preliminary data only – subject to change

Figure 1. Annual Average of Maximum 1-hour Carbon Monoxide: 2017 - 2021

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

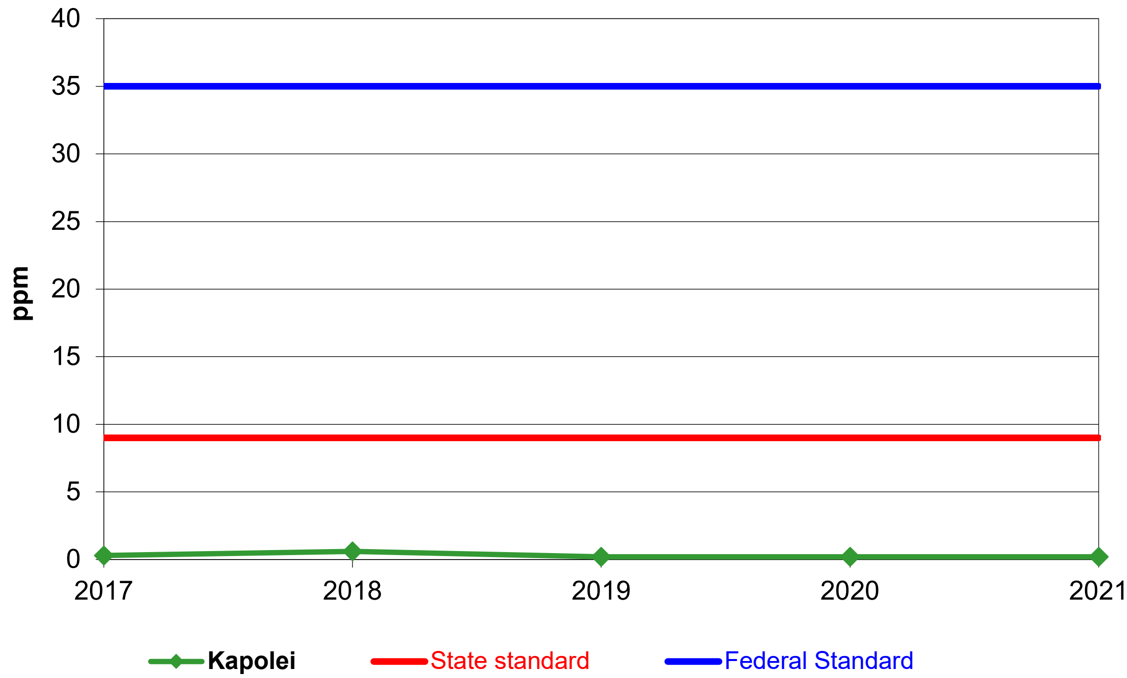


Figure 2. Annual Average of Maximum 8-hour Carbon Monoxide: 2017 - 2021

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

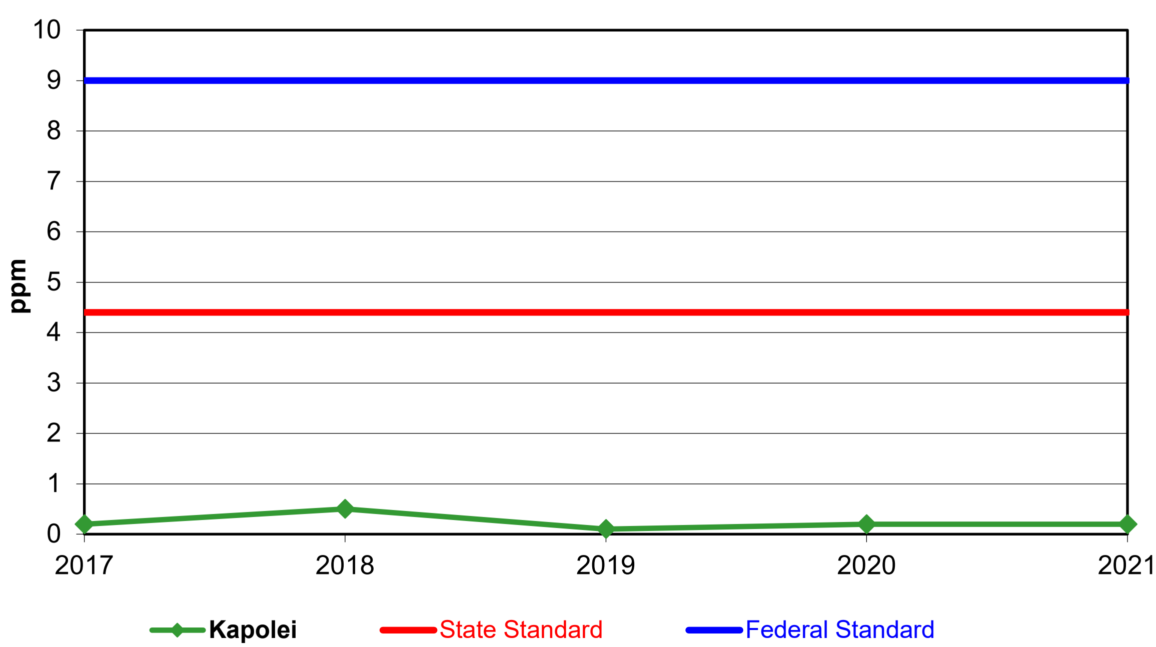


Figure 3. Annual Average of Maximum 3-hour Sulfur Dioxide: 2017 - 2021

(Annual average of the maximum 3-hour values)

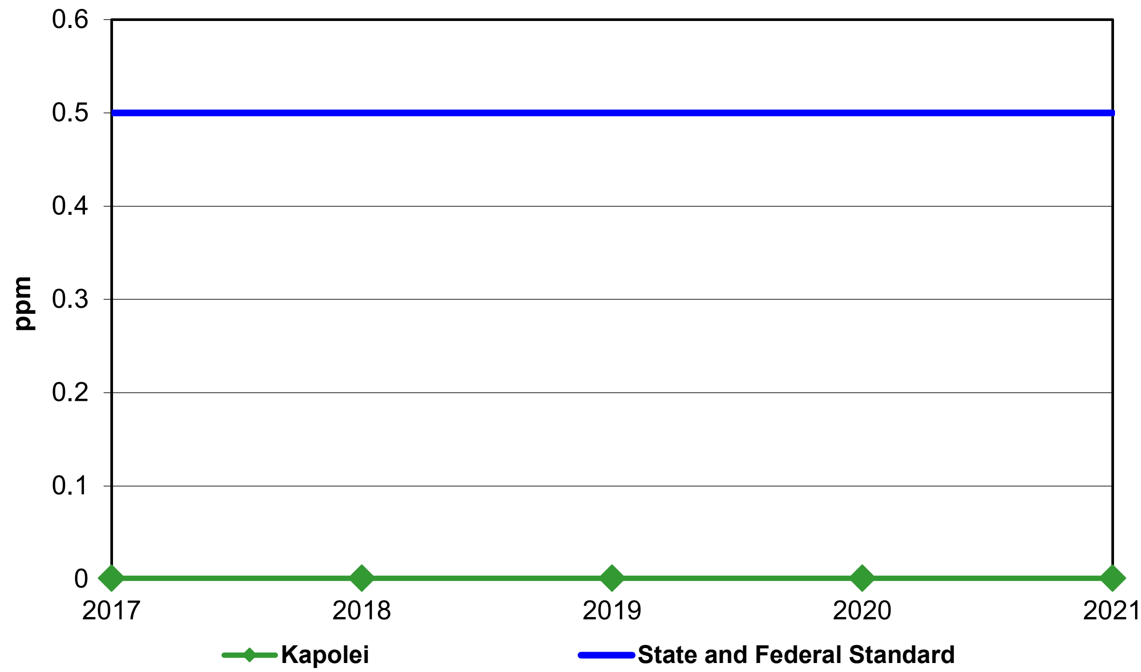


Figure 4. Maximum 24-hour Sulfur Dioxide: 2017 - 2021

(The highest 24-hour value in the year)

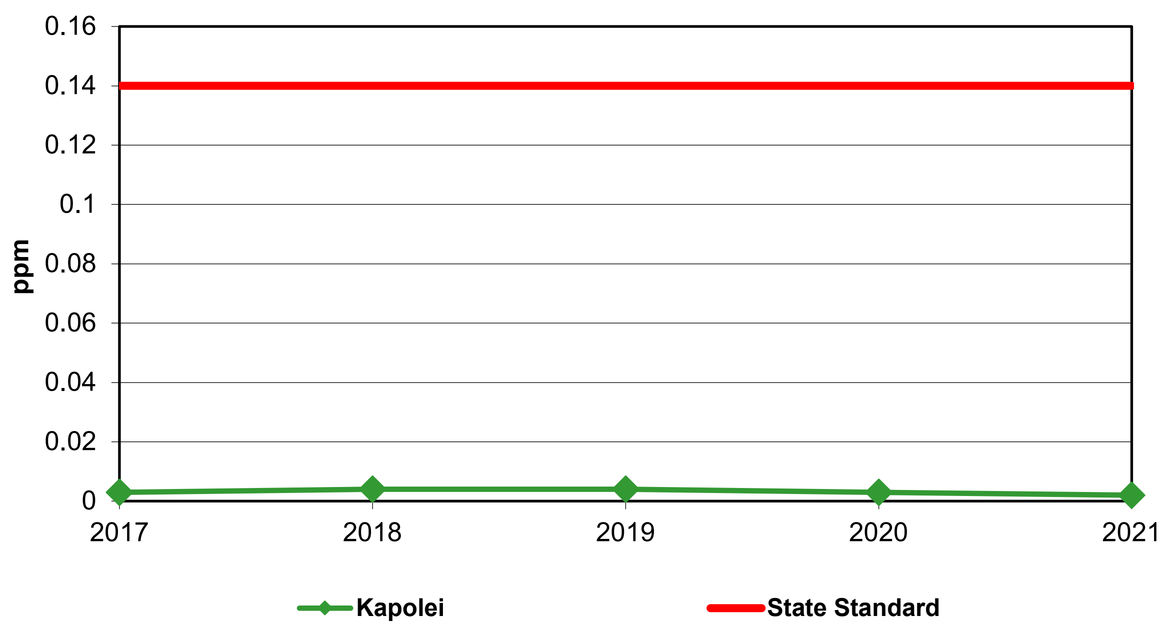


Figure 5. Annual Average of Sulfur Dioxide: 2017 - 2021

(Average of all valid hours in the year)

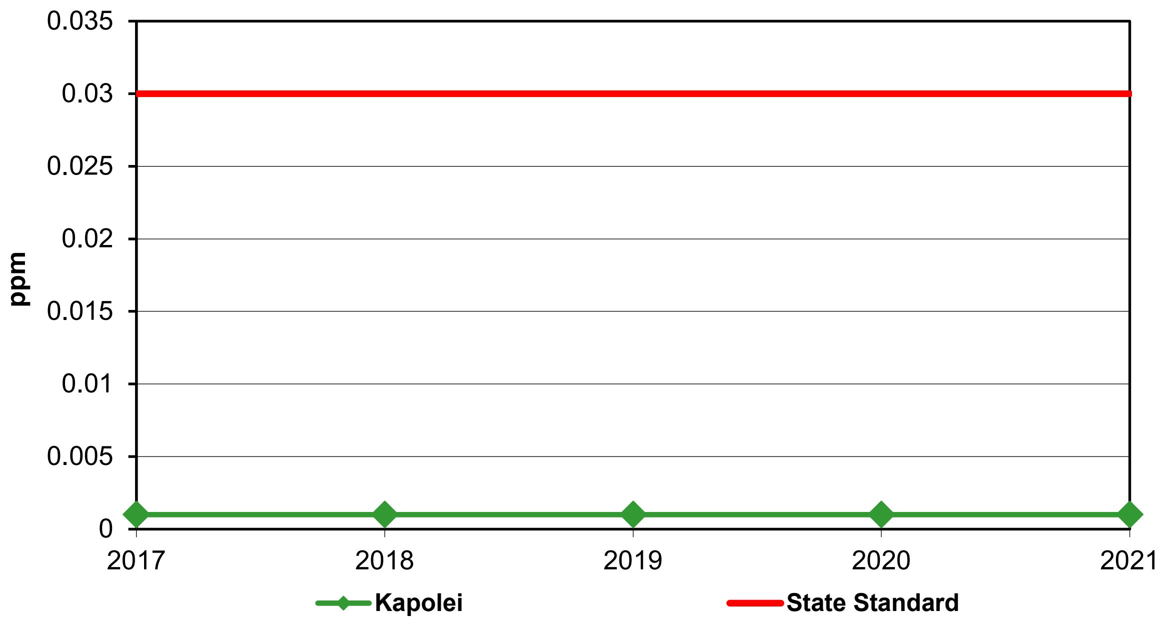


Figure 6. 99th Percentile 1-hour Sulfur Dioxide: 2017 - 2021

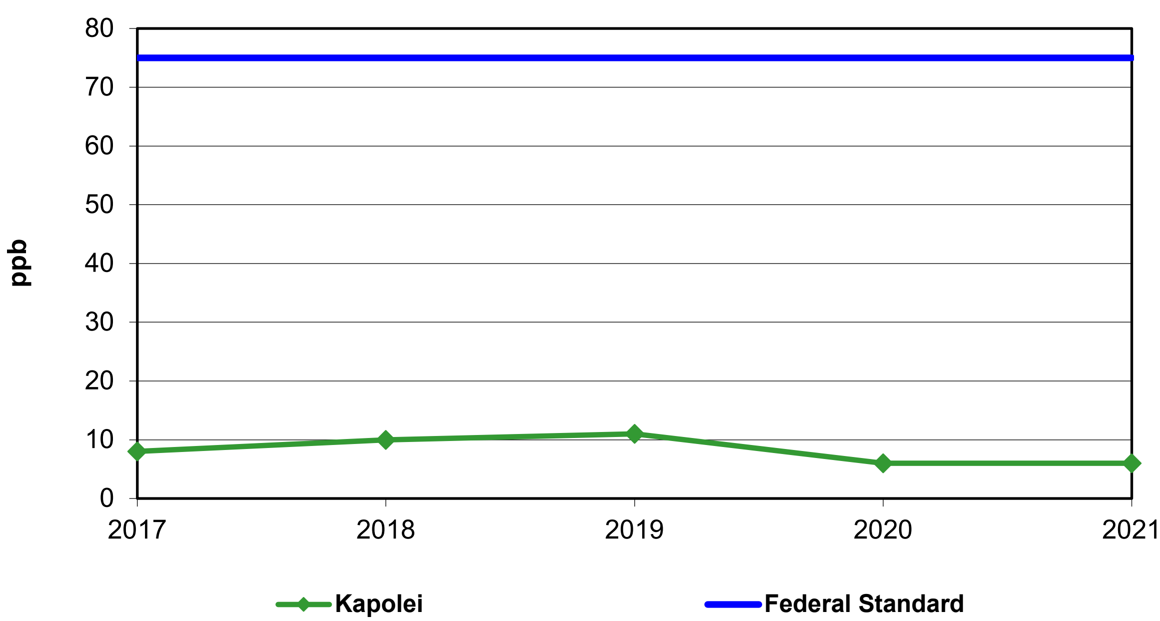


Figure 7. Annual Average of Nitrogen Dioxide: 2017 - 2021

(Average of all valid hours in the year)

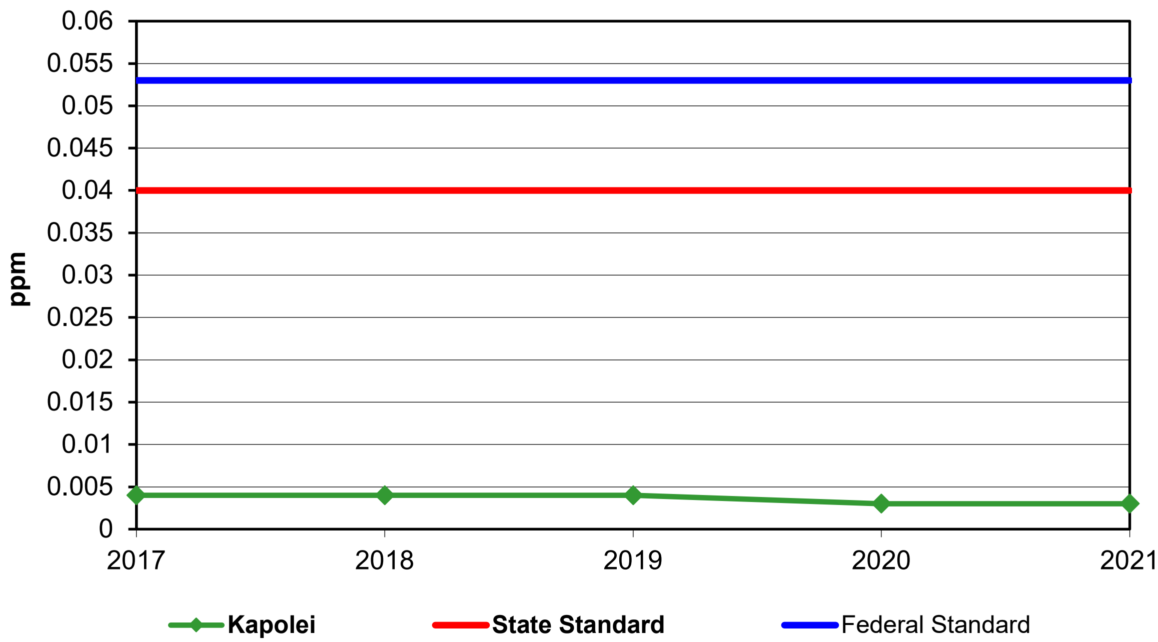


Figure 8. 98th Percentile 1-hour Nitrogen Dioxide: 2017 - 2021

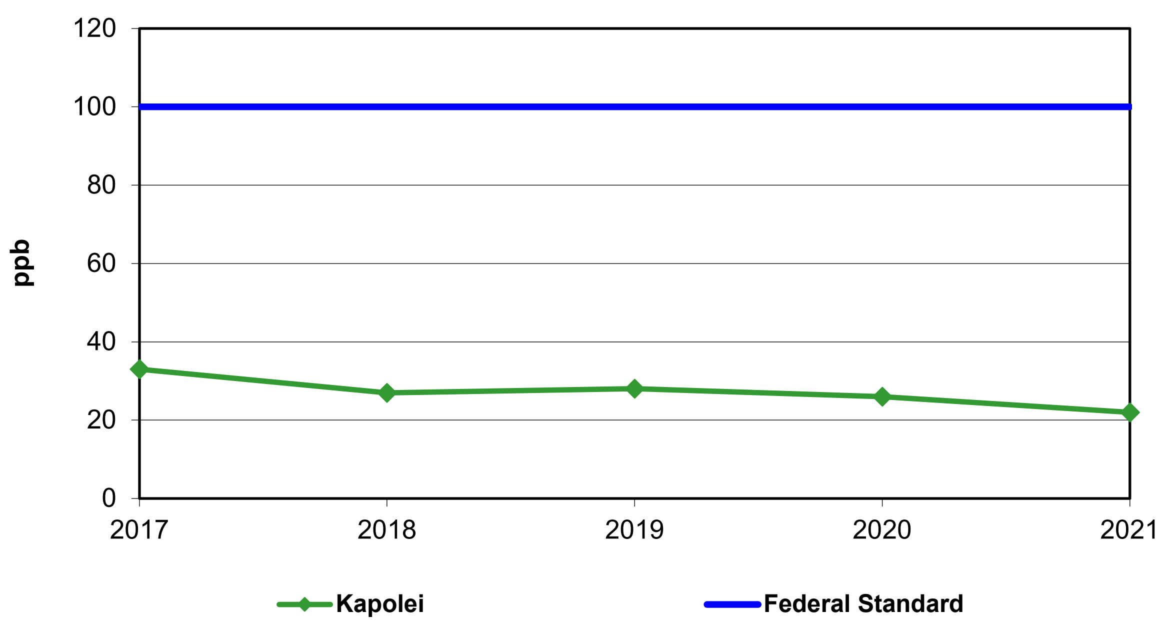


Figure 9. Maximum 24-hour PM_{10}: 2017 - 2021

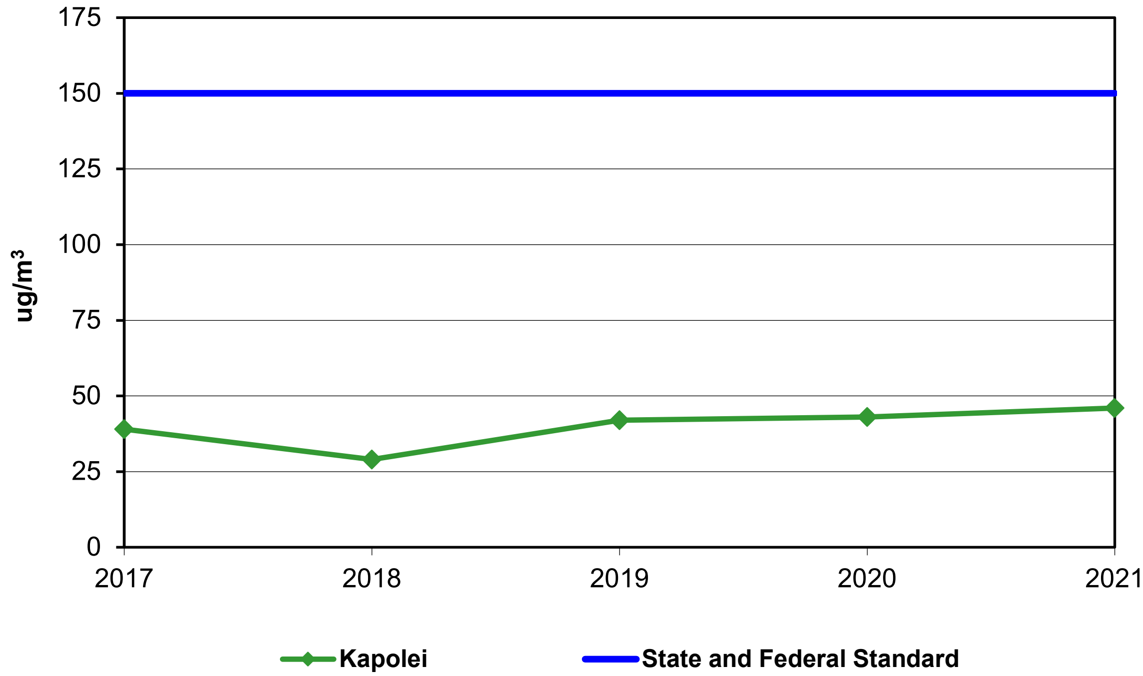


Figure 10. Annual Average of PM_{10}: 2017 - 2021

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

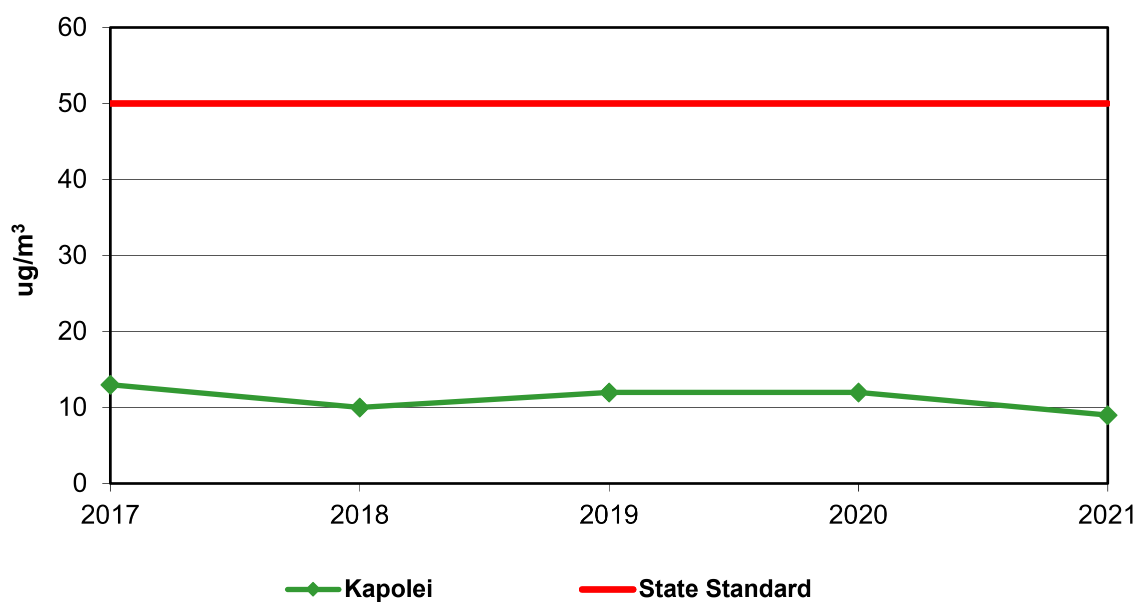


Figure 11. 98th Percentile 24-hour $PM_{2.5}$: 2017 - 2021

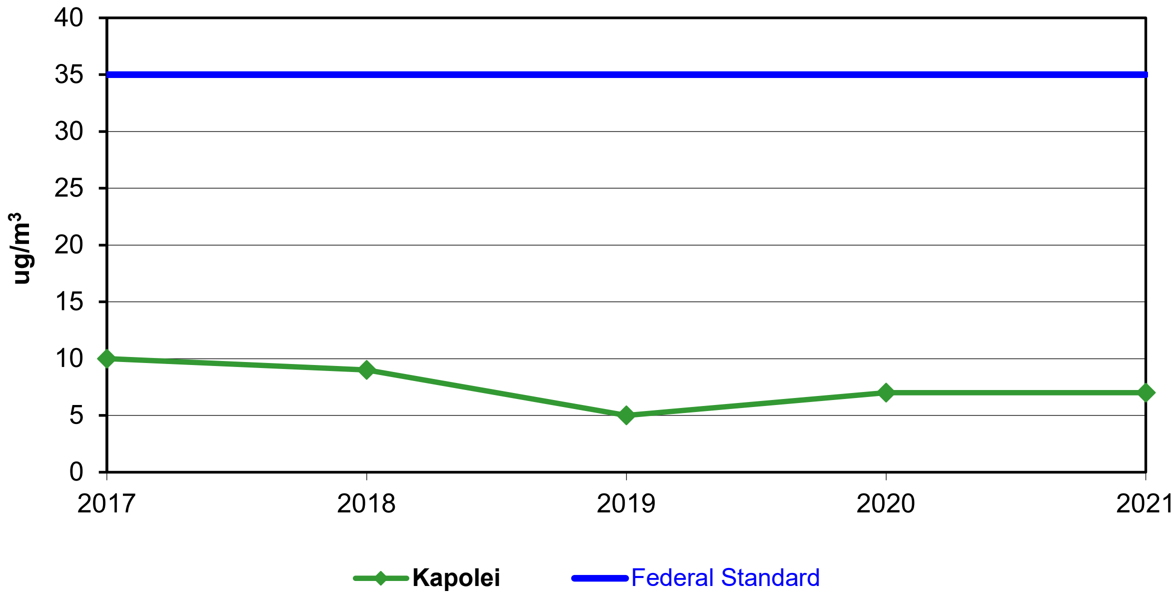
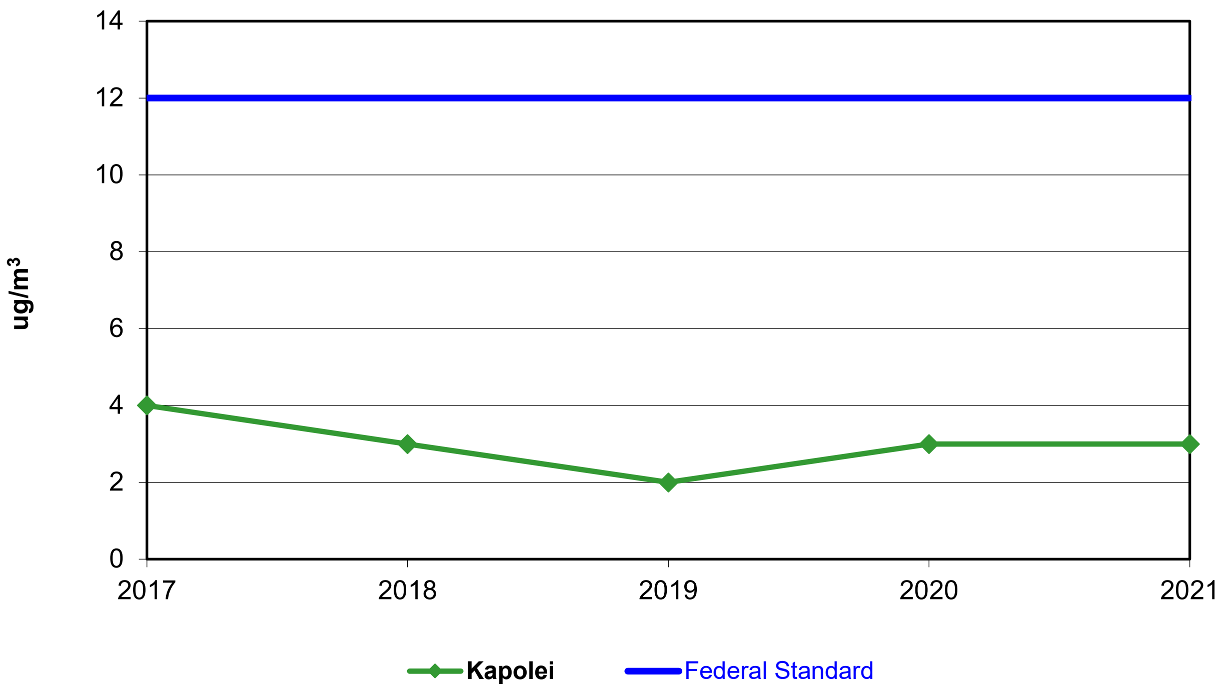


Figure 12. Annual Average of $PM_{2.5}$: 2017 - 2021

(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, November 2023

Criteria Pollutants

The United States Environmental Protection Agency (EPA) Office of Air Quality Planning and Standards has established National Ambient Air Quality Standards (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 and their abundance and distribution in industrialized society.

The Clean Air Branch in the Department of Health has collected data for CO, NO_2, SO_2, PM_{10}, $PM_{2.5,}$ and O_3 at the Kapolei Station in Campbell Industrial Park (CIP). Data for Pb was recorded until December 31, 2018 when sampling was discontinued with EPA approval. Data for the years 2017 – 2021 are summarized in Section 2 of this report.

The levels of these criteria air pollutants measured in the CIP area are consistently below the National Ambient Air Quality Standards and Hawaii State Ambient Air Quality Standards.

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 breath 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 2021 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 sources of emissions in Hawaii.

Volcanoes can be a significant natural source of sulfur dioxide. Sulfur dioxide is of major concern on the Island of Hawaii because when erupting, Kilauea and Mauna Loa volcanoes release large quantities of sulfur dioxide into the atmosphere that can directly impact people living nearby and downwind. In 2008, an increase in emissions from Halemaumau 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 SO_2 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 SO_2 emissions. During periods of active emissions, SO_2 concentrations in communities downwind of Kilauea routinely exceed the SO_2 NAAQS. Reductions in air quality from increased SO_2 and particulate matter and the resulting vog affected many areas across Hawaii Island and the entire state during the 2018 LERZ eruption. From August 2018 until December 2021, SO_2 emissions from Kilauea were very low. Intermittent eruptive activity beginning on December 20, 2021 has led to sporadic impacts to air quality in this 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 that people with asthma are more susceptible to the respiratory health effects of SO_2 in comparison to the general population. Based upon a large body of evidence that brief exposures (5-10 minutes) to SO_2 can negatively affect the respiratory health of asthmatics, in June 2010 the EPA established a new 1-hour NAAQS for SO_2 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 that the 1-hour standard to be appropriately protective of public health with an adequate margin of safety.

In 2021, the maximum measured, 1-hour concentration of SO_2 at CIP was 0.0109 ppm, well below the NAAQS of 0.075 ppm. The maximum 3-hour concentration of 0.007 ppm was well below the Federal and State secondary standard of 0.500 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 SO_2. The maximum 24-hour SO_2 concentration was 0.002 ppm, below the Hawaii state standard of 0.140 ppm.

Ozone (O_3):

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 oxides of nitrogen (NO_x) and volatile organic compounds (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 2021, the maximum 8-hour ozone concentration was 0.050 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 are similar to SO_2 and 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 NO_2 can aggravate respiratory diseases while long-term exposure contributes 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 nitrogen dioxide is set to 0.053 ppm. Hawaii has set a level of 0.040 ppm for added safety. The annual average concentration measured in 2021 was 0.003 ppm, well below both the Federal and State standard. The maximum 1-hour nitrogen dioxide concentration measured was 0.030 ppm, below the Federal standard of 0.100 ppm.

NO_2 as well as SO_2 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 SO_2 and NO_2, 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 carbon monoxide 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 at 9 and 4.4 ppm respectively for added safety. In 2021, the 1-hour reported average for the CIP area was 0.20 ppm and the 8-hour average was 0.20 ppm. The maximum 1-hour concentration for carbon monoxide was 0.80 ppm. The maximum 8-hour concentration for carbon monoxide was 0.4 ppm. These levels of exposure are not expected to produce adverse health effects.

CO is an odorless 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. The highest one-hour average level measured in the CIP area in 2021 of 0.8 ppm was far below these levels and not expected to cause health effects.

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, lead in household objects such as jewelry and dishes 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 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. Hawaii also has an additional standard of 50 ug/m^3 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/m^3 averaged over 24 hours and 15 µg/m^3 averaged over one 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 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 $\mu g/m^3$. 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 2021 annual average for PM_{10} in the CIP area was 9 $\mu g/m^3$. The maximum 24-hour concentration reported was 46 $\mu g/m^3$. 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 PM_{10} levels in the United States. For $PM_{2.5}$, the maximum 24-hour concentration was 8.5 $\mu g/m^3$ and the annual average was 2.9 $\mu g/m^3$, both well below current Federal standards. These levels are similar to measurements from prior years at CIP.