PERMIT APPLICATION REVIEW
COVERED SOURCE PERMIT NO. 0031-04-C
Application for Renewal No. 0031-07

Company: Maui Electric Company, Ltd. (MECO)

Mailing Address: P.O. Box 398
Kahului, Hawaii 96733

Facility: Palaau Generating Station
Nine (9) Diesel Engine Generators and One (1) Combustion Turbine

Location: 32 Ulili Street, Kaunakakai, Molokai
UTM: Zone 4, 700,800 m E, 2,335,500 m N (Old Hawaiian)

SIC Code: 4911 (Electric Services)

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PROPOSED PROJECT

The Palaau Generating Station produces electricity for public use through the combustion of fossil fuels. The facility houses nine (9) diesel engine generators (DEGs), and one (1) Combustion Turbine (CT).

CUM3–CUM6 and CAT7–CAT9
Units CUM3–CUM6 and CAT7–CAT9 are 1 MW Cummins DEGs that were originally installed (circa 1990) and owned by Cummins Hawaii, Inc. On 3/17/92, Palaau Corporation became the new owner and replaced CUM6 with an identical unit on 11/4/92 because it was damaged beyond repair. MECO subsequently became the new owner circa 1993. These units became part of the PSD review with new units CAT7–CAT9 for Class II increment review. Units CUM3–CUM5 and CUM6 were permitted by ATC Nos. A-578-800 and A-998-886 respectively. The stack extensions of these units were authorized by PSD/CSP No. 0031-01-C dated 11/8/95.

Units CAT7–CAT9 are 2.2 MW Caterpillar DEGs that were installed in 1996 by MECO. PSD/CSP No. 0031-01-C dated 11/8/95 authorized the installation and current operation of these units. As mentioned above, the addition of units CUM3–CUM6 and CAT7–CAT9 triggered PSD review because of significant increase in emissions.

CAT1, CAT2, and CT1
CAT1 and CAT2 are 1.25 MW Caterpillar DEGs that were installed in 1990 by MECO.

CT1 is a 2.0 MW Solar International Combustion Turbine that was installed circa 1981 by Molokai Electric. MECO subsequently became the new owner in 1989.

Proposed Changes
MECO submitted an application to renew its covered source permit. MECO proposes the following changes in this permit renewal:

1. Incorporate the applicable RICE NESHAP (40 CFR Part 63, Subpart ZZZZ) operational and emission limitations, monitoring and recordkeeping, notification and reporting, and testing requirements into the permit. To comply with these applicable requirements, MECO proposes the following modifications for CAT1, CAT2, CUM3–CUM6, and CAT7–CAT9:

    a. Installation of the Miratech Optional Flow Design Diesel Oxidation Catalyst (DOC). The DOC will not affect stack parameters or increase emission rates. The DOC will reduce CO emissions by at least 70 percent.
    b. Use diesel fuel with a maximum sulfur content of 0.0015% by weight.
    c. Install an open crankcase filtration emission control system.
    d. Install a Continuous Parameter Monitoring System to monitor the catalyst inlet temperature.

2. Remove units CAT7–CAT9 minimum operating load requirement of 25% of rated load.
3. Add Method 19 and the supplier's fuel specification or fuel analysis as an additional test method to demonstrate compliance with the SO_2 emission limit for CAT7–CAT9.
4. Other miscellaneous changes such as updating permit conditions for consistency with current permit language and other MECO permits, and clarifying permit conditions.

None of the proposed changes should increase emissions.

EQUIPMENT DESCRIPTION

Unit Nos.	Description
CAT1, CAT2	1.25 MW Caterpillar diesel engine generators (model no. 3516, serial nos. 25Z00574, 25Z00575), 12.62 MMBtu/hr (90.14 gal/hr);
CUM3, CUM4, CUM6	1.0 MW Cummins diesel engine generators (model no. KTA50, serial nos. 33112906, 33108992, 33120964), 9.09 MMBtu/hr (max. 64.9 gal/hr);
CUM5	1.0 MW Cummins diesel engine generator (model no. KTTA50, serial no. 33110779), 9.52 MMBtu/hr (max. 68.0 gal/hr);
CAT7, CAT8, CAT9	2.2 MW Caterpillar diesel engine generators (model no. 3608, serial nos. 6MC00452, 6MC00453, 6MC00454), 23.38 MMBtu/hr (max. 167.0 gal/hr); and
CT1	2.0 MW Solar International combustion turbine (model no. Centaur T4001), 34 MMBtu/hr (243 gal/hr).

AIR POLLUTION CONTROLS

1. The diesel engine generators use fuel injection timing retard (FITR) for NO_X control.
2. CAT7–CAT9 use air intake cooling to further reduce NO_X.
3. The diesel engine generators are equipped with Miratech Optional Flow Design Diesel Oxidation Catalyst (DOC) for CO control to comply with 40 CFR Part 63, Subpart ZZZZ.

APPLICABLE REQUIREMENTS

Hawaii Administrative Rules (HAR)
Title 11 Chapter 59, Ambient Air Quality Standards
Title 11 Chapter 60.1, Air Pollution Control
- Subchapter 1, General Requirements
- Subchapter 2, General Prohibitions
  - 11-60.1-31, Applicability
  - 11-60.1-32, Visible Emissions
  - 11-60.1-38, Sulfur Oxides from Fuel Combustion
- Subchapter 5, Covered Sources
- Subchapter 6, Fees for Covered Sources, Noncovered Sources, and Agricultural Burning
  - 11-60.1-111, Definitions
  - 11-60.1-112, General Fee Provisions for Covered sources
  - 11-60.1-113, Application Fees for Covered sources
  - 11-60.1-114, Annual Fees for Covered sources
  - 11-60.1-115, Basis of Annual Fees for Covered Sources
- Subchapter 7, Prevention of Significant Deterioration Review
- Subchapter 8, Standards of Performance for Stationary Sources
  - 11-60.1-161, New Source Performance Standards
- Subchapter 9, Hazardous Air Pollutant Sources
- Subchapter 10, Field Citations

Standard of Performance for New Stationary Sources (NSPS), 40 Code of Federal Regulations (CFR) Part 60
Subpart GG – Standards of Performance for Stationary Gas Turbines is applicable to the combustion turbine because the capacity is greater than 10 MMBtu/hr and it was constructed after October 3, 1977. Pursuant to §60.332(e), standards for nitrogen dioxide do not apply since the heat input load is greater than 10 MMBtu/hr and less than 100 MMBtu/hr and commenced construction prior to October 3, 1982. Pursuant to §60.333(b) standards for sulfur dioxide can be met by burning fuel oil with a sulfur content not to exceed 0.8% by weight.

Subpart KKKK – Standards of Performance for Stationary Combustion Turbines is not applicable to the combustion turbine because it commenced construction, modification, or reconstruction before February 18, 2005.

Subpart IIII – Standards of Performance for Stationary Compression Ignition Internal Combustion Engines is not applicable to the diesel engine generators because the engines commenced construction before July 11, 2005.

National Emission Standards for Hazardous Air Pollutants (NESHAP), 40 CFR Part 61
This source is not subject to NESHAPs because there are no standards in 40 CFR Part 61 applicable to this facility.

NESHAPs for Source Categories (Maximum Achievable Control Technology (MACT)), 40 CFR Part 63
Subpart ZZZZ – National Emissions Standards for Hazardous Air Pollutants for Stationary Reciprocating Internal Combustion Engines (RICE) is applicable to the diesel engine generators. For stationary RICE located at an area source of HAP emissions, a stationary RICE is existing if you commenced construction or reconstruction of the stationary RICE before June 12, 2006. The permittee must comply with the applicable emission limitations and operating limitations no later than May 3, 2013.

Prevention of Significant Deterioration (PSD), 40 CFR Part 52, §52.21
This source is not subject to PSD review because there are no significant increases in emissions.

Compliance Assurance Monitoring (CAM), 40 CFR Part 64
The purpose of CAM is to provide a reasonable assurance that compliance is being achieved with large emissions units that rely on air pollution control device equipment to meet an emissions limit or standard. Pursuant to 40 CFR Part 64, for CAM to be applicable, the emissions unit must: (1) be located at a major source; (2) be subject to an emissions limit or standard; (3) use a control device to achieve compliance; (4) have potential pre-control emissions that are 100% of the major source level; and (5) not otherwise be exempt from CAM.

Emission limits or standards proposed after November 15, 1990 are exempt from the CAM requirements pursuant to 40 CFR §64.2(b). This source is not subject to CAM because 40 CFR Part 63, Subpart ZZZZ was promulgated after November 15, 1990.

Air Emissions Reporting Requirements (AERR), 40 CFR Part 51, Subpart A
AERR is applicable because potential emissions from the facility exceed AERR thresholds. The facility is subject to AERR as a Type B source.

DOH In-house Annual Emissions Reporting
The Clean Air Branch requests annual emissions reporting from those facilities that have facility wide emissions exceeding in-house reporting levels and for all covered sources. Annual emissions reporting will be required because this facility is a covered source.

Best Available Control Technology (BACT)
This source is not subject to BACT analysis because there is no net increase in potential emissions. BACT analysis is required for new sources or modifications to sources that have the potential to emit or increase emissions above significant levels considering any limitations as defined in HAR, §11-60.1-1.

Synthetic Minor Source
A synthetic minor source is a facility that is potentially major, as defined in HAR, §11-60.1-1, but is made non-major through federally enforceable permit conditions. This facility is not a synthetic minor source because it is a major source.

INSIGNIFICANT ACTIVITIES / EXEMPTIONS

Insignificant activities identified by the applicant that meet the exemption criteria specified in HAR §11-60.1-82(f) and (g) are listed as follows:

Basis for Exemption	Description
§11-60.1-82(f)(1)	The Palaau Generating Station contains fixed roof VOC storage tanks with capacities less than 40,000 gallons that are not subject to Section 111 or 112 of the CAA.
§11-60.1-82(f)(5)	Two (2) 15 kW Olympian-Caterpillar emergency diesel engine generators.
§11-60.1-82(f)(7)	Two (2) 126,904 gallon fixed roof storage tanks store fuel with low vapor pressure. Also, there may be fugitive equipment leaks from valves, flanges, pump seals and oil/water separators. Solvents are used for maintenance purposes.
§11-60.1-82(g)(6)	205 hp Detroit Diesel fire pump diesel engine manufactured in 1995.

ALTERNATIVE OPERATING SCENARIOS

1. The permittee may replace each diesel engine generator and combustion turbine with a temporary replacement unit of similar size with equal or lesser emissions if any repair reasonably warrants the removal of the diesel engine generator or combustion turbine from its site (i.e., equipment failure, engine overhaul, or any major equipment problems requiring maintenance for efficient operation).
2. The permittee may fire the diesel engine generators and combustion turbine on an alternate fuel.

PROJECT EMISSIONS

None of the proposed changes should increase air pollutant emissions from the previous permit review. Emissions for CO and SO_2 has decreased since the previous permit due to the installation of the oxidation catalyst and firing of ultra-low sulfur diesel. The AP-42 emission factors are shown for information only because some permit limits have lower emission rates.

Criteria Pollutants

Emission rates for NO_X, SO_2, CO, PM/PM-10/PM-2.5, VOC, and HAPs were based on an evaluation of AP-42 calculations, stack test data, and permit limits. Because of the uncertainties associated with AP-42 emission factors, compliance factors (based on stack test data) greater than the AP-42 emission factors were used by MECO to determine certain emission rates. NOx permit limits were required for all diesel engine generators to ensure continuing compliance using FITR. Permit limits were required for all criteria pollutants for CAT7–CAT9 to ensure continuing compliance using the diesel engine generators combustion technology.

To be conservative, the applicant assumed that PM-10 emissions were equal to all PM emissions.

The DOH adjusted the hourly PM-10 emissions to include the burning of spec used oil as permitted for CUM3–CUM6 (CAT7–CAT9 may also burn spec used oil, but they have PM/PM-10 emission limits). VOC emissions tend to increase while burning spec used oil also, but since VOC is not required to be modeled, the short term emissions were not adjusted.

The AP-42 emission factors for the DEGs are from Section 3.4 (10/96) and the AP-42 emission factors for CT1 are from Section 3.1 (4/00).

Annual emissions were based on fuel limits of 1,650,000 gal/yr combined for CUM3–CUM6 and 1,230,000 gal/yr for CT1

HAPs

Some of the HAPs emission rates were determined by using EPRI PISCES Air Toxic Database while others were calculated using AP-42 data. None of the HAPs emissions were at levels exceeding the HAP thresholds of ten (10) TPY for any single HAP and twenty-five (25) TPY for a combination of HAPs. To be conservative, all HAPs emissions were calculated assuming 8,760 hr/yr of operation.

Nitrogen Oxides (NO_X) Emissions					
Unit No.	Heat Input (MMBtu/hr)	AP-42 EF (lb/MMBtu)	Assumed EF (lb/MMBtu)[1]	Emission Rate (lb/hr)[2]	Annual Emissions (ton/yr)
CAT1	12.62	3.2	2.147	27.10	118.7
CAT2	12.62	3.2	2.147	27.10	118.7
CUM3	9.09	3.2	2.146	19.51	248.0
CUM4	9.09	3.2	2.146	19.51	
CUM5	9.52	3.2	2.037	19.39	
CUM6	9.09	3.2	2.146	19.51	
CAT7	23.38	3.2	2.205	51.56	225.8
CAT8	23.38	3.2	2.205	51.56	225.8
CAT9	23.38	3.2	2.205	51.56	225.8
CT1	34.00	0.88	1.396	47.46	120.1
				Total:	1283.0

1. Assumed EFs for the DEGs were back calculated from permit limits. Assumed EF for CT1 was proposed by the applicant.
2. Emission rates for the DEGs were based on permit limits.

Sulfur Dioxide (SO_2) Emissions					
Unit No.	Heat Input (MMBtu/hr)	AP-42 EF (lb/MMBtu)	Assumed EF (lb/MMBtu)[1]	Emission Rate (lb/hr)	Annual Emissions (ton/yr)
CAT1	12.62	0.002	0.002	0.02	0.1
CAT2	12.62	0.002	0.002	0.02	0.1
CUM3	9.09	0.002	0.002	0.01	0.2
CUM4	9.09	0.002	0.002	0.01	
CUM5	9.52	0.002	0.002	0.01	
CUM6	9.09	0.002	0.002	0.01	
CAT7	23.38	0.002	0.002	0.04	0.2
CAT8	23.38	0.002	0.002	0.04	0.2
CAT9	23.38	0.002	0.002	0.04	0.2
CT1	34.00	0.404	0.516	17.54	44.4
				Total:	45.2

1. Assumed EFs for the DEGs were based on AP-42 EFs (mass balance). Assumed EF for CT1 was proposed by the applicant.

Carbon Monoxide (CO) Emissions					
Unit No.	Heat Input (MMBtu/hr)	AP-42 EF (lb/MMBtu)[1]	Assumed EF (lb/MMBtu)[2]	Emission Rate (lb/hr)[3]	Annual Emissions (ton/yr)
CAT1	12.62	0.255	0.535	6.75	29.6
CAT2	12.62	0.255	0.535	6.75	29.6
CUM3	9.09	0.255	0.295	2.68	34.0
CUM4	9.09	0.255	0.295	2.68	
CUM5	9.52	0.255	0.281	2.68	
CUM6	9.09	0.255	0.295	2.68	
CAT7	23.38	0.255	0.131	3.06	13.4
CAT8	23.38	0.255	0.131	3.06	13.4
CAT9	23.38	0.255	0.131	3.06	13.4
CT1	34.00	0.0033	0.144	4.90	12.4
				Total:	456.8

1. A 70% reduction was applied to the DEG AP-42 EF to account for the emission reduction requirement of 40 CFR Part 63, Subpart ZZZZ.
2. Assumed EFs for CAT1, CAT2, CUM3–CUM6, and CT1 were proposed by the applicant. Assumed EFs for CAT7–CAT9 were back calculated from permit limits. . A 70% reduction was applied to the DEG EFs to account for the emission reduction requirement of 40 CFR Part 63, Subpart ZZZZ.
3. Emission rates for CAT7–CAT9 were based on permit limits. A 70% reduction was applied to account for the emission reduction requirement of 40 CFR Part 63, Subpart ZZZZ.

$PM/PM_{10}/ PM_{2.5}$ Emissions					
Unit No.	Heat Input (MMBtu/hr)	AP-42 EF (lb/MMBtu)	Assumed EF (lb/MMBtu)[1]	Emission Rate (lb/hr)[2]	Annual Emissions (ton/yr)[3]
CAT1	12.62	0.1	0.270	3.41	14.9
CAT2	12.62	0.1	0.270	3.41	14.9
CUM3	9.09	0.1	0.358	3.25	41.4
CUM4	9.09	0.1	0.358	3.25	
CUM5	9.52	0.1	0.357	3.40	
CUM6	9.09	0.1	0.358	3.25	
CAT7	23.38	0.1	0.115	2.69	11.8
CAT8	23.38	0.1	0.115	2.69	11.8
CAT9	23.38	0.1	0.115	2.69	11.8
CT1	34.00	0.012	0.122	4.15	10.5
				Total:	117.1

1. Assumed EFs for CAT1, CAT2, CUM3–CUM6, and CT1 were proposed by the applicant. Assumed EFs for CAT7–CAT9 were back calculated from permit limits.
2. Emission rates for CAT7–CAT9 were based on permit limits.
3. The total annual increase in PM-10 emissions using the permit limit of 10,000 gal of spec used oil is 0.035 ton/yr (insignificant).

Volatile Organic Compounds (VOC) Emissions					
Unit No.	Heat Input (MMBtu/hr)	AP-42 EF (lb/MMBtu)	Assumed EF (lb/MMBtu)[1]	Emission Rate (lb/hr)[2]	Annual Emissions (ton/yr)
CAT1	12.62	0.0819	0.500	6.31	27.6
CAT2	12.62	0.0819	0.500	6.31	27.6
CUM3	9.09	0.0819	0.095	0.86	11.0
CUM4	9.09	0.0819	0.095	0.86	
CUM5	9.52	0.0819	0.090	0.86	
CUM6	9.09	0.0819	0.095	0.86	
CAT7	23.38	0.0819	0.095	2.23	9.8
CAT8	23.38	0.0819	0.095	2.23	9.8
CAT9	23.38	0.0819	0.095	2.23	9.8
CT1	34.00	0.00041	0.102	3.47	8.8
				Total:	104.3

1. Assumed EFs for CAT1, CAT2, CUM3–CUM6, and CT1 were proposed by the applicant. Assumed EFs for CAT7–CAT9 were back calculated from permit limits.
2. Emission rates for CAT7–CAT9 were based on permit limits.

Hazardous Air Pollutant (HAP) Emissions (ton/yr)					
HAP	CAT1, CAT2	CUM3–CUM6	CAT7–CAT9	CT1	Annual Emissions (ton/yr)[1]
Acetaldehyde	0.00139	0.00116	0.00255	0.00375	0.0188
Acrolein	0.000436	0.000362	0.000797	0.00117	0.0059
Benzene	0.0429	0.0357	0.0785	0.116	0.5801
Formaldehyde	0.026	0.0217	0.0477	0.0701	0.3520
Naphthalene	0.00719	0.00598	0.0132	0.0194	0.0973
Toluene	0.0155	0.0129	0.0284	0.0418	0.2096
Xylene	0.0107	0.00888	0.0195	0.0287	0.1441
Arsenic Compounds	0.00061	0.00051	0.0011	0.0016	0.0082
Beryllium Compounds	0.000017	0.000014	0.000031	0.000046	0.0002
Cadmium Compounds	0.00027	0.00022	0.00049	0.00071	0.0036
Chromium Compounds	0.00061	0.00051	0.0011	0.0016	0.0082
Lead Compounds	0.00077	0.00064	0.0014	0.0021	0.0104
Manganese Compounds	0.044	0.036	0.08	0.12	0.5920
Mercury Compounds	0.000066	0.000055	0.00012	0.00018	0.0009
Nickel Compounds	0.00025	0.00021	0.00047	0.00069	0.0034
Polycyclic Organic Matter (POM)	0.0117	0.00975	0.0215	0.0316	0.1585
Selenium Compounds	0.0014	0.0011	0.0025	0.0037	0.0184
				Total:	2.21

1. Annual HAP emissions assumed no annual limits (8,760 hr/yr of operation).

Greenhouse Gas (GHG) Emissions
Total GHG emissions are summarized in the table below:

GHG	GWP	GHG Mass-Based Emissions (TPY)[1]	CO_2e Based Emissions (TPY)
Carbon Dioxide (CO_2)	1	100988.1	100988.1
Methane (CH_4)	25	4.1	102.4
Nitrous Oxide (N_2O)	298	0.8	244.1
Total Emissions:			101334

1. Emissions were based on EFs from 40 CFR Part 98, Subpart C, Table C-2.

AIR QUALITY ASSESSMENT

The applicant conducted an ambient air quality impact analysis to address the plant's compliance with the National Ambient Air Quality Standards (NAAQS) and State Ambient Air Quality Standards (SAAQS). The applicant proposes to remove the twenty-five percent (25%) minimum load requirement for units CAT7–CAT9. The modeling contained in the May 1993 (revised in October 1993 and May 1994) PSD permit application for the construction of units CAT7–CAT9 did not address loads below twenty-five percent (25%) of rated load. Source testing conducted in September 2012 of MECO's Mike Basin units LL7 and LL8 with the oxidation catalyst installed as required by 40 CFR Part 63 Subpart ZZZZ confirms that NO_X, CO, PM, and VOC emissions at low loads (i.e., loads less than twenty-five percent (25%) of rated load) are lower than those at twenty-five percent (25%) of rated load.

This analysis addresses the operation of units CAT7–CAT9 at loads ranging from 100% of rated load to 8% of rated load (low load) to support MECO's request to remove units CAT7–CAT9 minimum operating load requirement.

Model Selection and Options
AERMOD (version 12345) was used for the modeling analysis. The SO_2, CO, PM-10, and PM-2.5 modeling is performed using the regulatory default modeling options. The 1-hour and annual NO_2 impacts are modeled using the regulatory default settings and the non-default Plume Volume Molar Ratio Method (PVMRM) modeling option. The PVMRM calculates the conversion of NO_X to NO_2. DOH's Sand Island Air Quality Monitoring (AQM) station is the only source of concurrent O_3 data. Hourly O_3 data are obtained from EPA's AQS Data Mart for the 5-year period (January 1, 2005 through December 31, 2009) of the meteorological data.

Meteorological data
Five years (January 1, 2005 through December 31, 2009) of National Weather Service surface data from Molokai Airport and upper air meteorological data form Lihue Airport was used for the modeling.

Receptor Grid
Receptor grid spacing consisted of:
1. 10 m property line receptors;
2. 30 m spaced receptors from the sources to 1 km;
3. 100 m spaced receptors from 1 km to 1.5 km; and
4. 250 m spaced receptors from 1.5 km to 2.75 km.

Dispersion Coefficient
Rural dispersion coefficient was selected.

Building Downwash

EPA's Building Profile Input Program (BPIP-PRIME) was used to evaluate downwash effects of nearby structures.

Emission Rates and Stack Parameters

The tables below lists the stack parameters and emission rates. The 100%, 75%, 50%, and 25% loads stack parameters and emission rates for CAT7–CAT9 are based on information contained in the initial PSD/CSP application. PM-2.5 emission rates are based on filterable plus condensable PM-2.5 emission rates from AP-42, Table 3.4-2 (10/96). The modeled low load (8%) stack parameters are derived from stack testing conducted on units LL7 and LL8 (2.2 MW Caterpillar DEGs, model no. 3608) at MECO's Miki Basin Generating Station on September 1, 2012. The low load stack testing confirms that actual emission are expected to be well below the 25% load levels. Thus, the modeled low load emission rates, except for SO_2, are set to the 25% load emission rates.

The CT1, CAT1, CAT2, and CUM3–CUM6 modeled emission rates for NO_X, SO_2, PM-10, and CO are based on CSP application emission rates. DEG PM-2.5 emissions are based on filterable plus condensable PM-2.5 emissions from AP-42, Table 3.4-2 (10/96). CT1's PM-2.5 emission rate is based on total PM emissions from AP-42, Table 3.1-2a (4/00).

The PVMRM option requires defining the fraction of NO_X emissions that are directly emitted as NO_2. In lieu of source specific data, EPA's March 1, 2011 memorandum established a "default" NO_2/NO_X in-stack ratio of 50% for the PVMRM option. MECO conducted source specific testing to determine the NO_2/NO_X in-stack ratio from each DEG model. The modeled source specific NO_2/NO_X in-stack ratios are conservatively set to 20% (approximately 1.35X the measured values) for CAT1 and CAT2, and 15% (approximately 1.25X to 1.65X the measured values) for the remaining DEGs to account for potential variability in the NO_2/NO_X in-stack ratio. The CT1 in-stack ratio of 20% appears to be conservative based on a review of available data on NO_2/NO_X in-stack ratios for CTs.

Stack Parameters							
Unit	Load	Fuel Flow (gal/hr)	Heat Input (MMBtu/hr)	Height (m)	Temperature (°K)	Velocity (m/s)	Diameter (m)
CAT7, CAT8, CAT 9	100%	167	23.1	30.5	686.32	30.30	0.591
	75%	110	15.2	30.5	685.59	21.03	0.591
	50%	77	10.7	30.5	664.76	13.99	0.591
	25%	45	6.2	30.5	587.65	8.14	0.591
	8%	33	4.6	30.5	510.87	7.33	0.591

Emission Rates (g/s)						
Unit	Load	NO_X	SO_2	PM-10	PM-2.5	CO
CAT7, CAT8, CAT 9	100%	6.50	0.00445	0.34	0.162	0.385
	75%	5.00	0.00294	0.20	0.106	0.267
	50%	3.47	0.00205	0.13	0.075	0.114
	25%	1.93	0.00120	0.12	0.043	0.090
	8%	1.93	0.00088	0.12	0.043	0.090

Unit	Stack Parameters				Emission Rates (g/s)				
	Height (m)	Temp. (°K)	Velocity (m/s)	Diameter (m)	NO_X	SO_2	PM-10	PM-2.5	CO
CT1	7.32	655.4	40.70	1.01	5.98	0.00664	0.523	0.049	0.617
CAT1	9.85	793.1	36.30	0.36	3.41	0.00246	0.429	0.088	0.851
CAT2	9.85	793.1	36.30	0.36	3.41	0.00246	0.429	0.088	0.851
CUM3	30.48	651.7	11.10	0.61	2.46	0.00173	0.410	0.064	0.338
CUM4	30.48	651.7	11.10	0.61	2.46	0.00173	0.410	0.064	0.338
CUM5	30.48	651.7	11.10	0.61	2.44	0.00181	0.428	0.067	0.337
CUM6	30.48	651.7	11.10	0.61	2.46	0.00173	0.410	0.064	0.338

Measured and Modeled NO_2/NO_X In-Stack Ratios				
Unit	Make	Model	NO_2/NO_X In-Stack Ratio Test Results	Modeled NO_2/NO_X In-Stack Ratio
CT1	Solar	Centaur T4001	-	20%
CAT1	Caterpillar	3516	-	20%
CAT2	Caterpillar	3516	15.04%	20%
CUM3	Cummins	KTA50	12.07%	15%
CUM4	Cummins	KTA50	-	15%
CUM5	Cummins	KTTA50	9.04%	15%
CUM6	Cummins	KTA50	-	15%
CAT7	Caterpillar	3608	-	15%
CAT8	Caterpillar	3608	-	15%
CAT9	Caterpillar	3608	11.17%	15%

Results

The modeling shows that the worst-case load scenario for CAT7-CAT9 is at 100% load. The modeling includes the CAT7-CAT9 at their worst-case load (at 100%) combined with CT1, CAT1, CAT2, and CUM3–CUM6. The table below shows the predicted ambient air quality impacts from the diesel engines should comply with State and National ambient air quality standards.

Predicted Ambient Air Quality Impacts							
Air Pollutant	Averaging Period	Modeled Impact ($\mu g/m^3$)	Background[1] ($\mu g/m^3$)	Total Impact ($\mu g/m^3$)	SAAQS ($\mu g/m^3$)	NAAQS ($\mu g/m^3$)	Compared to SAAQS / NAAQS
CO	1-hr [2]	261.0	4233 (Kapolei)	4494	10000	40000	44.9%
	8-hr [2]	99.0	1373 (Kapolei)	1472	5000	10000	29.4%
NO_2	1-hr [3]	120.0	14.2 (Maalea 235)	134.2	-	188	71.4%
	Annual [4]	44.5	7.5 (Kapolei)	52.0	70	100	74.3%
PM-10	24-hr [2]	40.8	59.0 (Kapolei)	99.8	150	150	66.5%
	Annual [5]	21.7	20.0 (Pearl City)	41.7	50	-	83.4%
PM-2.5	24-hr [6]	8.04	14.3 (Kihei)	22.3	-	35	63.8%
	Annual [7]	4.05	4.8 (Kihei)	8.85	-	12	73.8%
SO_2	1-hr [8]	0.426	15.7 (Waena 265)	16.1	-	196	8.2%
	3-hr [2]	0.489	60.3 (Honolulu)	60.8	1300	1300	4.7%
	24-hr [2]	0.245	13.1 (Honolulu)	13.3	365	365	3.7%
	Annual [5]	0.128	5.2 (Kapolei)	5.33	80	80	6.7%

1. Background concentrations were taken from DOH's AQM stations on Maui and Oahu (2009 - 2011), and MECO's AQM stations no. 235 near MECO's Maalaea Generating Station (Nov. 1, 2006 – Oct. 31, 2007) and No. 265 located in central Maui (Sept. 15, 2000 – Sept. 14, 2001).
2. Maximum concentrations, across 5 years.
3. 98th percentile (8th highest rank) of the 1-hr daily maximum concentrations, averaged over 5 years.
4. Maximum concentration based on PVMRM, across 5 years. The annual modeling does not take credit for the CUM3–CUM6 and CT1 annual limits.
5. Maximum concentrations, across 5 years. The annual modeling does not take credit for the CUM3–CUM6 and CT1 annual limits.
6. Maximum concentration, averaged over 5 years.
7. Maximum concentration, averaged over 5 years. The annual modeling does not take credit for the CUM3–CUM6 and CT1 annual limits.
8. 99th percentile (4th highest rank) of the 1-hr daily maximum concentrations, averaged over 5 years.

SIGNIFICANT PERMIT CONDITIONS

Existing Permit Conditions

DEGs

1. Total combined fuel consumption limit of 1,650,000 gallons in any rolling 12-month period for CUM3–CUM6.
2. Total combined specification used oil consumption of 10,000 gallons in any rolling 12-month period for CUM3–CUM6 and CAT7–CAT9.
3. Operate and maintain a fuel injection timing retard (FITR) for each DEG.
4. NO_x emission limits for CAT1, CAT2 and CUM3–CUM6.
5. SO_2, NO_x, CO, VOC, and PM-10 emission limits for CAT7–CAT9.
6. Source performance testing for each DEG.
7. Operate and maintain a CEMS for CAT7–CAT9.
8. Alternate operating scenarios for temporary replacement units and firing alternate fuels.
9. Fuel oil no. 2 with a maximum sulfur content not to exceed 0.4% by weight (revised to sulfur content not to exceed 0.0015% by weight).
10. CAT7–CAT9 minimum operating load requirement of 25% of rated load (removed).

CT1

1. 40 CFR Part 60, Subpart GG requirements.
2. CT1 shall not operate below 25% load except during start-up, shut-down, maintenance, and/or testing.
3. Diesel with a maximum sulfur content not to exceed 0.4%by weight.
4. Fuel consumption limit of 1,230,000 gallons in any rolling 12-month period.
5. Alternate operating scenarios for temporary replacement units and firing alternate fuels.

Most of these permit conditions are existing requirements to comply with SAAQS and emissions thresholds. The alternate operating scenarios and spec used oil conditions were provided to allow operational flexibility.

New Significant Permit Conditions

1. Incorporate provisions of 40 CFR Part 63, Subpart ZZZZ for the DEGs, including the following:

    a. Use diesel fuel with the following specifications:

i. Maximum sulfur content not to exceed 0.0015% by weight; and
ii. Minimum cetane index of 40 or maximum aromatic content of 35 volume percent.

b. Limit concentration of CO in the engine exhaust to 23 ppmvd at 15 percent O_2 or reduce CO emissions by 70% percent or more.
c. Install, operate, and maintain an oxidation catalyst.
d. Install a crankcase system to reduce emissions.
e. Install a Continuous Parameter Monitoring System to monitor the catalyst inlet temperature.
f. Perform source performance tests.

2. Add Method 19 and the supplier's fuel specification or fuel analysis as an additional test method to demonstrate compliance with the SO_2 emission limit for CAT7–CAT9.

CONCLUSION

There are no increase in emissions from the proposed changes in this permit renewal. The ambient air quality impact analysis demonstrates compliance with State and National Ambient Air Quality Standards. Recommend issuance of the covered source permit subject to the incorporation of the significant permit conditions, 30-day public comment period, and 45-day Environmental Protection Agency review period.

Mark Saewong
May 14, 2015