PROPOSED

COVERED SOURCE PERMIT REVIEW - NO. 0218-01-C

Significant Modification - Add oil burners and modify water tubes

Application No. 0218-04

Applicant: Gay & Robinson, Inc.
Facility: 347 MMBtu/hr Bagasse/Oil-Fired Boiler and 6.7 MMBtu/hr Seed Plant Boiler

Equipment Location: 1 Kaumakani Ave, Kaumakani, Kauai

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Background:

Gay and Robinson (G&R) operate a sugar cane processing facility located in Kaumakani, Kauai. The facility operates a 347 MMBtu/hr bagasse and oil-fired boiler and a 6.7 MMBtu/hr seed plant boiler. The 347 MMBtu/hr boiler was installed in 1965 and modified in 2001. In the previous and current permits, the boiler was incorrectly identified as a 182 MMBtu/hr boiler. The original documents and past firing practices confirm that the boiler is capable of a heat input of 347 MMBtu/hr.

The main boiler can be fired on bagasse and fuel oil no. 2. However, the fuel oil delivery system and the burners have degraded to a point of being non-functional. The main boiler is rated at 130,000 pounds per hour of steam. The steam is used for the processing of sugar and the generation of electricity. The seed plant boiler fires on fuel oil no. 2 and specification used oil. The emissions from the main boiler exceed 100 tons per year and as such, the facility is a major source.

The bagasse comes from the sugar cane fields near the processing facility. The cane is mechanically harvested in the fields and hauled by truck to the facility. The processing facility cleans, chops, shreds, and crushes the cane to extract the juices. The cane residue, or bagasse, is conveyed to a storage area and then used to fuel the boiler. The capacity of the cane crushing system is 120 tons per hour.

The cane juice extracted in the mill is sent to the boiling house where it is weighed, heated, clarified by settling, evaporated, and crystallized into sugar by boiling. The product is then centrifuged to separate the sugar crystal from molasses. The sugar and molasses are stored and eventually shipped to a sugar refinery in California.

Proposed Project:

G&R is proposing to modify the 347 MMBtu/hr boiler to increase the thermal efficiency and to refurbish the oil firing system. The existing oil firing system has deteriorated to almost nothing. After the modifications are complete, the fuel feed rate for bagasse will remain the same and the boiler will able fire on fuel oil no. 2 and specification used oil. The boiler will be limited to 190,000 tons per year of bagasse and combined total of 1,000,000 gallons per year of fuel oil no.2 and spec used oil. The proposed modifications to the main boiler are as follows:

1. Replacement of the existing Dietrick-Dennis fuel chambers with a traveling grate. The supply air ducting and ash disposal conveying system will be replaced to accommodate the traveling grate;
2. Install an over fire air fan and associated ductwork;
3. Remove three existing bagasse conveyors and modify the remaining conveyor to distribute the bagasse uniformly on the grate;
4. Increase the length and number of superheater tubes;
5. Install a new air heater; and
6. Install new oil guns to provide for firing on liquid fuel.

Once the modifications are complete, the thermal efficiency will increase from 52 percent to 68 percent. The steam temperature will also increase from 510° F to 750° F. These increases will be achieved without increasing the furnace volume or the fuel feed rate.

The proposed modifications will subject the boiler to 40 CFR Part 60, Subpart Db - Standards of Performance for Industrial-Commercial-Institutional Steam Generating Units. Pursuant to subpart Db, the facility is required to install a continuous opacity monitoring system (COMS) at the exhaust stack. Opacity readings are used as a segregate for particulate emission monitoring.

However, water vapor from the wet scrubber is entrained in the flue gas leaving the wet scrubber and will interfere with the opacity readings of the COMS. As such, in September 2007, G&R has proposed to the U.S. EPA an alternate method to continuously monitor the particulate emissions. In the alternate monitoring plan (AMP), G&R proposed to continuously monitor the pressure differential across the wet scrubber and the water flow rate to the wet scrubber. G&R declared that these parameters are significant in determining the efficiency of the wet scrubber.

In February 2008, the U.S. EPA concurred with G&R's AMP, and listed some conditions that G&R must follow. One of the conditions is that U.S. EPA will determine the allowable operating range of the pressure differential across the scrubber and the water flow rate to the scrubber. This determination will be made by reviewing the initial, and possibly subsequent, source performance test(s). Deviations from the allowable ranges will be considered excess emissions.

Equipment Description:

The following is a list of the equipment that will be covered under this covered source permit:

a. One 347 MMBtu/hr Bagasse and Oil Fired Boiler, Combustion Engineering Model VU-50X; bagasse and oil fired boiler with three (3) each 37.5 MMBtu/hr Coen DAZ oil burners;

b. One 6.7 MMBtu/hr Orr and Sembower Boiler, Model Powermester H-3;

c. Zurn Industries Model MTSA-224-9CYT-XD-NR-TA mechanical dust collector, servicing the bagasse and oil fired boiler;

d. Crews Evaporator & Drier Company Multi-Throated Jet Scrubber servicing the bagasse and oil fired boiler; and

e. One 10,500 gallon fuel oil No. 2 storage tank, 28 feet in length with 8 foot diameter.

Air Pollution Controls:

Particulate matter from the main boiler is initially controlled by a multi-clone mechanical dust collector. The dust collector use centrifugal force to separate the particulate from the exhaust gases. Additional particulate control is provided by a wet scrubbing system that uses water sprays in the exhaust gas stream.

No other air pollution controls are used on the main boiler and no controls are used on the seed boiler.

Applicable Requirements:

Hawaii Administrative Rules (HAR):

Chapter 11-59, Ambient Air Quality Standards
Chapter 11-60.1 Air Pollution Control
Subchapter 1, General Requirements
Subchapter 2, General Prohibitions
11-60.1-31 Applicability

11-60.1-32 Visible Emissions
11-60.1-33 Fugitive Dust
11-60.1-36 Biomass Fuel Burning Boilers
11-60.1-38 Sulfur Oxides from Fuel Combustion
11-60.1-39 Storage of Volatile Organic Compounds
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 8, Standards of Performance for Stationary Sources
11-60.1-161 New Source Performance Standards
Subchapter 10, Field Citations

CERR (Consolidated Emission Reporting Rule):

40 CFR part 51, Subpart A – Emission Inventory Reporting Requirements, determines the annual emissions reporting frequency based on the actual emissions of each pollutant from any individual emission point within the facility that emits at or above the triggering levels. As shown in the table below, the facility exceeds the trigger level for NO_X and thus is subject to CERR.

Table 1
Comparison of Emissions to CERR Trigger Levels

Pollutant	Potential Emissions (TPY)	CERR trigger (TPY)
PM_{10}	60	100
SO_x	36	100
NO_x	124	100
VOC[1]	<1	100
CO	3	1,000

1 - total organic compounds (TOC) as volatile organic compounds (VOC)

NSPS:

40 CFR, Part 60, Subpart A - General Provisions

40 CFR, Part 60, Subpart Db - Standards of Performance for Industrial-Commercial-Institutional Steam Generating Units

40 CFR, Part 60, Subpart Kb - Standards of Performance for Volatile Organic Liquid Storage Vessels (Including Petroleum Liquid Storage Vessels) for Which Construction, Reconstruction, or Modification Commenced After July 23, 1984. The storage tank is only subject to recordkeeping requirements of §60.116b(b).

Non-Applicable Requirements:

BACT:

A Best Available Control Technology (BACT) analysis is required for each new or modified emissions unit located within a stationary source that has a net emissions increase equal to or greater than the significant levels defined in HAR §11-60.1-1. As shown in Table 2 below, the net increase in emissions are below the significant levels and as such, a BACT analysis is not required for the proposed modification.

Table 2
Comparison of Net Emissions to Significant Levels for BACT

Pollutant	Past 2-year Average (TPY)	Potential Emissions (TPY)	Net Increase (TPY)	BACT Trigger (TPY)
SO_2[1]	0.0	35.6	35.6	40
NO_x	84.9	124.0	39.1	40
CO	0.0	2.5	2.5	100
VOC[2]	0.0	0.3	0.3	40
PM_{10}	41.2	55.9	14.7	15
PM	42.4	58.0	15.6	25

1 - SO_2 from firing the annual limit of spec used oil (26,000 gal.) and fuel oil (974,000 gal.)
2 - total organic compounds (TOC) as volatile organic compounds (VOC)

CAM:

The purpose of Compliance Assurance Monitoring (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 Code of Federal Regulations, 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. The facility will be subject to CAM because: 1) the facility will be a major source for NO_X; 2) the boiler has an emission limit of 0.4 pounds of PM per hundred pounds of bagasse burned; 3) the boiler uses a dust collection system to control PM emissions; 4) without the dust collection system, the potential emissions from the boiler would exceed the major source level for PM/PM_{10}; and 5) the boiler is not otherwise exempt from CAM.

Large pollutant-specific emissions units, whose potential to emit with controls, is equal to or greater than the major source threshold are subject to CAM during the initial application, a significant modification, or permit renewal. Per 40 CFR §64.5, CAM is not immediately applicable to the other sources whose potential to emit with controls is less than the major source threshold. For these sources, CAM becomes applicable upon renewal of the permit. Since the emissions from the boiler are less than 100 tons per year of PM/PM_{10}, the facility is not subject to CAM until the renewal of the permit.

NESHAP/MACT:

40 CFR 63, Subpart DDDDD National Emission Standards for Hazardous Air Pollutants for Industrial, Commercial, and Institutional Boilers and Process Heaters is not applicable because the facility is not a major source of HAPs.

PSD:

PSD does not apply since this facility is not a major source.

Synthetic minor:

A synthetic minor is a facility that without limiting conditions, physical or operational, emits above the major triggering levels as defined by HAR 11-60.1-1 for either criteria pollutant(s) or hazardous air pollutant(s). The facility is a major source, thus, G&R is not a synthetic minor.

Insignificant Activities/Exemptions:

No insignificant activities were identified in the application, however, the facility has one 10,500 gallon fuel oil no. 2 storage tank. The tank is subject to the recordkeeping requirements of NSPS Subpart Kb.

Alternate Operating Scenarios:

The boiler may be fired on bagasse, fuel oil no. 2 or a blend of fuel oil no. 2 and specification used oil.

Project Emissions:

Emissions from the boiler while firing on fuel oil no. 2 and/or specification used oil were estimated using the AP-42 section 1.3, revised 9/98. Emissions from the boiler while firing on bagasse were estimated by using source test data for PM and the AP-42 section 1.8 for NO_X and PM_{10}. SO_2 emission estimate is for the worst case scenario which is firing the annual consumption limit of spec used oil (26,000 gallons) and fuel oil (974,000 gallons). Detailed emission calculations can be found in the appendix.

Table 3
Facility-wide Emissions

Pollutant	Firing Bagasse (TPY)	Firing Fuel Oil (TPY)	Facility-wide (TPY)
NO_x	114.0	10.0	124.0
CO		2.5	2.5
SO_2		35.6	35.6
VOC[1]		0.3	0.3
PM	57.0	1.0	58.0
PM_{10}	55.4	0.5	55.9
$PM_{2.5}$		0.1	0.1

1 - total organic compounds (TOC) as volatile organic compounds (VOC)

Air Quality Assessment:

The applicant performed an Ambient Air Quality Impact Analysis (AAQIA) using the U.S. USEPA recommended air quality model ISC3 with one year of meteorological data from Burns Field. Receptor arrays with 50 meter spacing were generated from USGS DEM data. The Department reviewed the input and output files for the model runs but had difficulty confirming the results because the applicant did not provide an adequate description of the inputs used in the model and the model results. As such, the Department ran a model to verify that the ambient air quality standards were not exceeded. The following assumptions were used in the Department's analysis:

1. Simple and complex terrain;
2. Rural dispersion;
3. Building downwash effects;

4. SCREEN3 default meteorological data;
5. 1,200 by 1,200 meter receptor grid with 50 meter spacing between receptors;
6. U.S. EPA Scaling factors of 0.9, 0.7, and 0.4 for the 3-hour, 8-hour, and 24-hour concentrations respectively; and
7. The Department's scaling factor of 0.2 for the annual concentrations.

Table 4 below lists the emission rates and stack parameters used in the analysis. Stack parameters while firing on oil were interpolated from the boiler design calculations.

Table 4
Emission Rates and Stack Parameters

	Emission Rates (g/s)				Stack Parameters			
Fuel	NOx	SO_2	PM_{10}	CO	Height (m)	Diameter (m)	Velocity (m/s)	Temperature (°K)
Bagasse	6.45	n/a	3.13	n/a	22.0	2.44	17.2	450
Fuel Oil	2.03	7.45	0.10	0.51	22.0	2.44	7.8	498

Table 5 below shows the results of the modeling run. The facility can operate 4,450 hours per year on bagasse and 1,244 hours per year on oil, or 5,694 hours per year in total. As such, the annual concentrations for NO_2, SO_2, and PM_{10}, assumed that the points of maximum impact for bagasse and oil were located at the same point. The total concentration is the sum of the bagasse, oil, and background concentrations. The analysis of the 24-hr concentration for PM_{10} used the higher concentration of bagasse in the total.

Table 5
Predicted Ambient Air Quality Impacts

	Averaging	Concentration ($\mu g/m^3$)					% of
Pollutant	Period	Bagasse	Oil	Background	Total	SAAQS	SAAQS
NO_2	annual	38.6	17.8	9	65	70	93
SO_2	3-hr		294.3	70	364	1,300	28
	24-hr		130.8	19	150	365	41
	annual		65.4	4	69	80	87
PM_{10}	24-hr	37.4	4.6	30	67	150	45
	annual	18.7	2.3	14	35	50	70
CO	1-hr		22.4	1,710	1,732	10,000	17
	8-hr		15.7	1,055	1,071	5,000	21

Background concentrations for NO_2 and CO were from the Kapolei monitoring station. Data

collected from the Makaiwa monitoring station was used for the SO_2 background concentrations and the background PM_{10} data is from the Lihue monitoring station.

Conclusion and Recommendation:

Gay & Robinson is proposing to increase the efficiency of their main boiler. The boiler will undergo major renovation work to increase the thermal efficiency and replace the components necessary to fire liquid fuels. The predicted emissions increase resulting from the modifications to the boiler were not significant and did not trigger a BACT review. The predicted ambient air quality impacts were below the federal and state standards.

The permittee is in compliance with their current permit and there is no reason to believe that they will not continue to do so after the modification to the boiler is complete. Issuance of an amendment to their Covered Source Permit No. 0218-01-C is recommended based on the review of the information provided by the applicant and the conservative nature of the calculations.

Appendix

Emissions Calculations