

ENGINEERING DIVISION

APPL. NOS.

DATE

APPLICATION PROCESSING AND CALCULATIONS

522846 & 522847

8/8/13

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ABDI MAJIDIFAR

CMT

PERMIT TO CONSTRUCT AND OPERATEAPPLICANT'S NAME: LA City, Hyperion Treatment PlantMAILING ADDRESS: 12000 Vista Del Mar
Playa Del Rey, CA 90293EQUIPMENT LOCATION 12000 Vista Del Mar
Playa Del Rey, CAEQUIPMENT DESCRIPTIONAPPLICATION NO. 522846

BOILER, BABCOCK AND WILCOX, MODEL NO. FM-10-57, WATER-TUBE TYPE, RATED AT 62 MMB.T.U. PER HOUR MAXIMUM, WITH A LOW NOX BURNER, ALZETA OR EQUIVALENT, MODEL CSB30-3SO-30/30/EC, OR EQUIVALENT, DIGESTER GAS AND NATURAL GAS FIRED.

APPLICATION NO. 522847

BOILER, STANDBY, HURST, MODEL NO. DS1750-250-XID-2, FIRE-TUBE TYPE, RATED AT 28,800,000 B.T.U. PER HOUR, DIGESTER GAS AND NATURAL GAS FIRED, WITH AN ALZETA LOW NOX BURNER, MODEL CSB288R.

HISTORY

Application 522846 was filed on 5/2/11 as Class I for new construction of a boiler to replace boiler # 2 under Permit to Construct # 388675 (inactive). It should be noted that the boiler # 2 has been removed.

Application 522847 was filed on 5/2/11 for the above boiler rated as 28,800,000 btu/hr. Presently, this boiler operates under Various Locations Permit to Operate # G6300 issued to Nationwide Boiler Inc. LA City intends to purchase this boiler from Nationwide Boiler Inc. and use it as standby for the new boiler under A/N 522846.

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PROCESS DESCRIPTION

The above boilers will be used for steam generation at this facility. The steam generated is supplied to the digesters. The boiler under A/N 522847 rated at 28,800,000 btu/hr will be used as standby for the boiler under A/N 522846 (primary source of steam). The primary fuel for the boilers will be digester gas with a higher heating value of 640 btu/scf. Natural gas will be used in both boilers as standby fuel. Both boilers are equipped with low NOX burners. The primary boiler will operate at a stack temperature of 550⁰F (approx.).

The maximum operating schedule is 24 hrs/day, 7 days/wk, and 52 wks/yr.

EMISSIONS

Digester gas and natural gas emissions will be calculated for each boiler. However, the digester gas emissions will be reported in the NSR for each boiler as the worst case.

Note:

The facility is a major polluting facility and is subject to LAER. However, there is no LAER emission data found for boilers operating on digester gas as primary fuel. Therefore, the BACT requirements for both boilers operating on digester gas will be used for emissions calculations. Also, based on the available data (see attached), LAER emission data for natural gas is considered the same as the BACT requirements for the above boilers.

Application No. 522846:

Given:

Boiler rating: 59,500,000 btu/hr
Operating schedule: 24 hrs/day
7 days/wk
52 wks/yr

Emissions due to combustion of digester gas with HHV of 640 btu/ft³ (based on the boiler specification data):

Emiss. Factors (based on the Boiler # 2 evaluation under A/N 388675):

CO: 100 ppmv @ 3% O₂ dry (based on the BACT requirements)

NOX: 30 ppmv @ 3% O₂ dry (based on the BACT requirements)

PM = PM10: 4.47 lbs/mm cf of digester gas (AP-42)

ROG: 3.24 lbs/mm cf of digester gas (AP-42)

SOX: 40 ppmv (Rule 431.1)

$$\begin{aligned} \text{Fuel Rate (max.)} &= 59.5 \text{ mm btu/hr} \times \text{ft}^3/640 \text{ btu} \\ &= 92,967 \text{ ft}^3/\text{hr} \end{aligned}$$

Exhaust flow rate:

Natural gas EPA F-factor: 8,740 dscf/mm btu at 68^oF & 0% O₂

$$\begin{aligned} \text{F-factor at 3\% O}_2 &= 8,740 \text{ dscf/mm btu} \times (20.9 - 0)/(20.9 - 3) \\ &= 10,204 \text{ dscf/mm btu (based on boiler \# 2 evaluation under A/N 388675)} \\ \text{Exhaust flow rate} &= 10,204 \text{ dscf/mm btu} \times 59.5 \text{ mm btu/hr} \\ &= 607,138 \text{ dscf/hr (10,119 scfm)} \end{aligned}$$

ROG:

$$\begin{aligned} \text{R1} = \text{R2} &= 3.24 \text{ lbs/mm ft}^3 \times 92,967 \text{ ft}^3/\text{hr} \\ &= 0.3 \text{ lb/hr} \\ &= 7.2 \text{ lbs/day} \end{aligned}$$

NOX:

$$\begin{aligned} \text{R1} = \text{R2} &= 30 \text{ ppm} \times 607,138 \text{ dscf/hr} \times 46 \text{ lbs/lb-mole} \times 1 \text{ lb-mole}/379 \text{ cf} \\ &= 2.2 \text{ lbs/hr} \\ &= 52.8 \text{ lbs/day} \end{aligned}$$

SOX:

$$\begin{aligned} \text{R1} = \text{R2} &= 40 \text{ ppm} \times 92,967 \text{ ft}^3/\text{hr} \times 64 \text{ lbs/lb-mole} \times 1 \text{ lb-mole}/379 \text{ cf} \\ &= 0.63 \text{ lb/hr} \\ &= 15.12 \text{ lbs/day} \end{aligned}$$

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CO:

$$\begin{aligned}
 R1 = R2 &= 100 \text{ ppm} \times 607,138 \text{ dscf/hr} \times 28 \text{ lbs/lb-mole} \times 1 \text{ lb-mole}/379 \text{ cf} \\
 &= 4.51 \text{ lbs/hr} \\
 &= 108.24 \text{ lbs/day}
 \end{aligned}$$

PM = PM10 (assume):

$$\begin{aligned}
 R1 = R2 &= 4.47 \text{ lbs/mm ft}^3 \times 92,967 \text{ ft}^3/\text{hr} \\
 &= 0.41 \text{ lb/hr} \\
 &= 9.84 \text{ lbs/day}
 \end{aligned}$$

Emissions due to combustion of natural gas (1,050 btu/ft³):

Emiss. Factors:

CO: 100 ppmv @ 3% O2 dry (based on the BACT requirements)
 NOX: 9 ppmv @ 3% O2 dry (based on the BACT requirements)
 PM: 7.5 lbs/mmcf *
 ROG: 5.5 lbs/mmcf *
 SOX: 0.6 lb/mmcf *

*Based on the Dist. AER

Note: LAER emission data for natural gas is considered the same as the BACT requirements.

$$\begin{aligned}
 \text{Exhaust flow rate} &= 607,138 \text{ dscf/hr (see above)} \\
 \text{Fuel Rate (max.)} &= 59.5 \text{ mm btu/hr} \times \text{ft}^3/1050 \text{ btu} \\
 &= 56,667 \text{ ft}^3/\text{hr}
 \end{aligned}$$

ROG:

$$\begin{aligned}
 R1 = R2 &= 5.5 \text{ lbs/mmcf} \times 56,667 \text{ ft}^3/\text{hr} \\
 &= 0.31 \text{ lb/hr} \\
 &= 7.44 \text{ lbs/day}
 \end{aligned}$$

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NOX:

$$\begin{aligned} R1 = R2 &= 9 \text{ ppm} \times 607,138 \text{ dscf/hr} \times 46 \text{ lbs/lb-mole} \times 1 \text{ lb-mole/379 cf} \\ &= 0.66 \text{ lb/hr} \\ &= 15.84 \text{ lbs/day} \end{aligned}$$

SOX:

$$\begin{aligned} R1 = R2 &= 0.6 \text{ lbs/mmcf} \times 56,667 \text{ ft}^3/\text{hr} \\ &= 0.034 \text{ lb/hr} \\ &= 0.82 \text{ lb/day} \end{aligned}$$

CO:

$$\begin{aligned} R1 = R2 &= 100 \text{ ppm} \times 607,138 \text{ dscf/hr} \times 28 \text{ lbs/lb-mole} \times 1 \text{ lb-mole/379 cf} \\ &= 4.51 \text{ lbs/hr} \\ &= 108.2 \text{ lbs/day} \end{aligned}$$

PM = PM10 (assume):

$$\begin{aligned} R1 = R2 &= 7.5 \text{ lbs/mm ft}^3 \times 56,667 \text{ ft}^3/\text{hr} \\ &= 0.42 \text{ lb/hr} \\ &= 10.08 \text{ lbs/day} \end{aligned}$$

Emissions Summary (A/N 522846):

Compound:	Digester Gas Combustion		Natural Gas Combustion	
	R1 = R2		R1 = R2	
	lb/hr	lb/day	lb/hr	lb/day
CO	4.51	108.24	4.51	108.2
NOX	2.2	52.8	0.66	15.84
PM10	0.41	9.84	0.42	10.08
ROG	0.3	7.2	0.31	7.44
SOX	0.63	15.12	0.034	0.82

Note:

Digester gas emissions will be reported in NSR for the primary boiler.

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Application No. 522847 (Standby boiler):

Given:

Boiler rating: 28,800,000 btu/hr
 Operating schedule: 24 hrs/day
 7 days/wk
 52 wks/yr

Emissions due to combustion of digester gas with HHV of 640 btu/ft³:

Emiss. Factors:

CO: 100 ppmv @ 3% O₂ dry (based on the BACT requirements)
 NOX: 30 ppmv @ 3% O₂ dry (based on the BACT requirements)
 PM = PM10: 4.47 lbs/mm cf of digester gas (AP-42)
 ROG: 3.24 lbs/mm cf of digester gas (AP-42)
 SOX: 40 ppmv (Rule 431.1)

Natural gas EPA F-factor (used for the rental standby boiler evaluation A/N 471635): 8,740 dscf/mm btu
 at 68^oF & 0% O₂

F-factor at 3% O₂ = 8,740 dscf/mm btu x (20.9 - 0)/(20.9 - 3)
 = 10,204 dscf/mm btu
 Exhaust flow rate = 10,204 dscf/mm btu x 28.8 mm btu/hr
 = 293,875 dscf/hr (4,898 scfm)

Fuel Rate (max.) = 28.8 mm btu/hr x ft³/640 btu
 = 45,000 ft³/hr

ROG:

R1 = R2 = 3.24 lbs/mm ft³ x 45,000 ft³/hr
 = 0.146 lb/hr
 = 3.5 lbs/day

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NOX:

$$\begin{aligned}
 R1 = R2 &= 30 \text{ ppm} \times 293,875 \text{ scf/hr} \times 46 \text{ lbs/lb-mole} \times 1 \text{ lb-mole}/379 \text{ cf} \\
 &= 1.07 \text{ lbs/hr} \\
 &= 25.68 \text{ lbs/day}
 \end{aligned}$$

SOX:

$$\begin{aligned}
 R1 = R2 &= 40 \text{ ppm} \times 45,000 \text{ ft}^3/\text{hr} \times 64 \text{ lbs/lb-mole} \times 1 \text{ lb-mole}/379 \text{ cf} \\
 &= 0.3 \text{ lb/hr} \\
 &= 7.2 \text{ lbs/day}
 \end{aligned}$$

CO:

$$\begin{aligned}
 R1 = R2 &= 100 \text{ ppm} \times 293,875 \text{ scf/hr} \times 28 \text{ lbs/lb-mole} \times 1 \text{ lb-mole}/379 \text{ cf} \\
 &= 2.17 \text{ lbs/hr} \\
 &= 52.08 \text{ lbs/day}
 \end{aligned}$$

PM = PM10 (assume):

$$\begin{aligned}
 R1 = R2 &= 4.47 \text{ lbs/mm ft}^3 \times 45,000 \text{ ft}^3/\text{hr} \\
 &= 0.2 \text{ lb/hr} \\
 &= 4.8 \text{ lbs/day}
 \end{aligned}$$

Emissions due to combustion of natural gas (1,050 btu/ft³):

Emiss. Factors:

CO: 50 ppmv @ 3% O2 dry (based on the BACT requirements)
 NOX: 9 ppmv @ 3% O2 dry (based on the BACT requirements)
 PM: 7.5 lbs/mmcf *
 ROG: 5.5 lbs/mmcf *
 SOX: 0.6 lb/mmcf *

*Based on the Dist. AER

Note: LAER emission data for natural gas is considered the same as the BACT requirements.

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Exhaust flow rate = 293,875 dscf/hr (see above)
 Fuel Rate (max.) = 28.8 mm btu/hr x ft³/1050 btu
 = 27,429 ft³/hr

ROG:

R1 = R2 = 5.5 lbs/mmcf x 27,429 ft³/hr
 = 0.15 lb/hr
 = 3.6 lbs/day

NOX:

R1 = R2 = 9 ppm x 293,875 dscf/hr x 46 lbs/lb-mole x 1 lb-mole/379 cf
 = 0.32 lb/hr
 = 7.68 lbs/day

SOX:

R1 = R2 = 0.6 lbs/mmcf x 27,429 ft³/hr
 = 0.016 lb/hr
 = 0.38 lb/day

CO:

R1 = R2 = 50 ppm x 293,875 dscf/hr x 28 lbs/lb-mole x 1 lb-mole/379 cf
 = 1.09 lb/hr
 = 26.16 lbs/day

PM = PM10 (assume):

R1 = R2 = 7.5 lbs/mm ft³ x 27,429 ft³/hr
 = 0.2 lb/hr
 = 4.8 lbs/day

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Emissions Summary (A/N 522847):

Compound:	Digester Gas Combustion		Natural Gas Combustion	
	R1 = R2		R1 = R2	
	lb/hr	lb/day	lb/hr	lb/day
CO	2.17	52.08	1.09	26.16
NOX	1.07	25.68	0.32	7.68
PM10	0.2	4.8	0.2	4.8
ROG	0.15	3.6	0.15	3.6
SOX	0.3	7.2	0.02	0.48

Emissions to be reported in NSR for A/N 522847 (standby boiler burning digester gas):

Compound:	Primary Boiler (A/N 522846)	Standby Boiler (A/N 522847)	Emiss. Differences (emiss. to be reported for A/N 522847)
	lb/hr	lb/hr	lb/hr
CO	4.51	2.17	-2.34 (0)
NOX	2.2	1.07	-1.13 (0)
PM10	0.41	0.2	-0.21 (0)
ROG	0.3	0.15	-0.15 (0)
SOX	0.63	0.3	-0.33 (0)

Screening Risk Analysis for the above boilers using digester gas (worst case):

Given:

Nearest Commercial Receptor Distance: 3000 ft. (914 m)
 Nearest Residential Receptor Distance: 1000 ft. (305 m)
 Stack height (primary boiler): 125 ft. (38 m)
 Stack dia. (primary boiler): 86 in. (2.18 m)
 Stack height (standby boiler): 15 ft. (4.6 m)
 Stack dia. (standby boiler): 20 in. (0.51 m)
 Building (Energy Recovery Bldg.) height: 77 ft. (23 m)
 Min. horizontal bldg. dimension: 170 ft. (52 m)
 Max. horizontal bldg. dimension: 460 ft. (140 m)
 Exhaust flow rate (primary boiler): 10,544 scfm (max.)

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Exhaust flow rate (standby boiler): 4,898 scfm (max.)
 Exhaust temperature (primary boiler): 550 °F (Form 400-PS)
 Exhaust temperature (standby boiler): 320 °F (Form 400-PS)

Toxic compounds maximum concentrations resulting from digester gas combustion (based on the s/t results for boiler # 2) are as follows:

COMPOUND	Concentrations (max.) used in the risk analysis*
	ppmv
Formaldehyde	0.219
Acetaldehyde	0.149
Acrolein	0.117
1,2-Dichloroethane	0.001
1,1,1-Trichloroethane	0.0005
Benzene	0.0035
Carbon Tetrachloride	0.0005
Trichloroethene	0.001
Toluene	0.003
Tetrachloroethene	0.0005
Chlorobenzene	0.0005
Xylenes	0.0005
Styrene	0.0005
1,4-Dichlorobenzene	0.0005
Vinyl Chloride	0.0005
Methylene Chloride	0.042
Chloroform	0.0005

*Based on the source tests results for boiler # 2.

The MICR for the commercial & residential for each boiler is less than 1×10^{-6} . Also, the HIA & HIC in the risk analysis for each boiler are less than 1.

Note:

- 1) Tier 2 (worst case) risk analysis used for the main boiler (using digester gas). The MICR values based on Tier 2 (using the maximum exhaust flow rate of 10,119 scfm) are determined to be 2.83×10^{-7} & 1.04×10^{-8} for residential & commercial, respectively.
- 2) Tier 2 risk analysis used for the standby boiler (using digester gas). The MICR values for residential & commercial (based on the maximum exhaust flow rate of 4,898 scfm) are determined as 1.93×10^{-7} & 0.621×10^{-8} , respectively.

RULES COMPLIANCE**RULE 212**

Public Notice not required (no schools within 1,000 ft. of the property). Criteria pollutants emissions are below R212 (g) limits. The MICR determined for each boiler is less than 1×10^{-6} .

RULE 401

Visible emissions from this equipment are expected to be minimal.

RULE 402

No nuisance complaints are expected from the operation of the above equipment.

RULE 404

Based on experience with similar equipment, compliance with this rule is expected.

RULE 407

This equipment is expected to meet the CO limit for this rule (this unit complies with Rule 1146 limit which is more stringent).

RULE 409

Based on experience with similar equipment, compliance with this rule is expected.

RULE 431.1

Digester gas is expected to have less than 40 ppmv total sulfur as H₂S. Compliance with this rule is expected.

RULE 1146

Compliance is expected. Permit conditions will ensure continuous compliance with this rule (source tests for both boilers will be required to verify NOX & CO concentrations). As stated in Table 1146-1, (c)(1)(D) for digester gas firing units, compliance with 15 ppm NOX limit by January 1, 2015 is required.

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Reg. XIII

BACT:

As per BACT guidelines for Water-Tube Type Boilers, the new boiler equipped with low NOX burner is required not to emit more than 30 ppm of NOX & 100 ppm of CO @ 3% O2 dry when using digester gas, and 9 ppm of NOX & 100 ppm of CO @ 3% O2 dry when using natural gas. Based on the manufacturer's data, compliance with the above concentrations is expected. These concentrations will be demonstrated by a source test.

As per BACT guidelines for Fire-Tube Type Boilers, the standby boiler equipped with a low NOX burner is required not to emit more than 30 ppm of NOX & 100 ppm of CO @ 3% O2 dry when using digester gas, and 9 ppm of NOX & 50 ppm of CO @ 3% O2 dry when using natural gas. These concentrations will be demonstrated by a source test.

Modeling:

Since operation of the 59.5 mmbtu/hr boiler replacing boiler # 2 and the continuous operation of the rental boiler will not result in facility emissions increase, modeling is not required.

Offsets:

This facility is a POTW and therefore qualifies for the Priority Reserve for offsetting purposes.

NESHAP

Based on the District Annual Emissions Inventory for the years 2011 & 2012 (see attached), each toxic pollutant emission is less than 10 tons/yr and the total toxic pollutants emission is less than 25 tons/yr as defined in subpart 63.2 (see attached). Therefore, the operation of the above boilers is not subject to NESHAP requirements for boilers for the major sources.

RULE 1401

Please see Screening Risk Analysis. Compliance with this rule is expected.

REG XXX

Compliance with Reg. XXX, Title V permit is expected. Addition of the above boilers is considered a de minimis significant revision and, upon the EPA 45-day review period, approved boilers permits will be included under Title V revision.

40CFR Part 60 (Regulation IX of SCAQMD Rules)

- **Subpart D** of 40 CFR Part 60 - New Source Performance Standards for Fossil Fuel Fired Steam Generators constructed after August 17, 1971
- **Subpart Da** of 40 CFR Part 60 - New Source Performance Standards for Electric Utility Steam Generating Units constructed after September 18, 1978
- **Subpart Db** of 40 CFR Part 60 - New Source Performance Standards for Industrial-Commercial-Institutional Steam Generating Units constructed after June 19, 1984
- **Subpart Dc** of 40 CFR Part 60 - New Source Performance Standards for Small Industrial-Commercial-Institutional Steam Generating Units constructed after June 9, 1989

These boilers were constructed after June 9, 1989 (actually in XXXX), and therefore subject to Subpart Dc - Standards of Performance for Small Industrial-Commercial-Institutional Steam Generating Units

§ 60.40c - Applicable for this boiler (heat input >10 mmbtu/hr and <= 100 mmbtuh).

§ 60.42c - 60.47c - Emission limits, testing, monitoring for Sox and PM are not applicable to this equipment which only burn digester gas and natural gas.

§ 60.48c - Initial notification only.

- Since the initial notification requirement is a prior requirement, no specific Dc permit conditions will be imposed.

National Emission Standards for Hazardous Air Pollutants (NESHAP) - 40 CFR part 63 subpart DDDDD for Industrial, Commercial, and Institutional and Process Heaters

The facility is a not a Major Source for hazardous air pollutants (HAPs). Therefore the boiler is not subject to subpart DDDDD compliance requirements.

RECOMMENDATION

Issuance of Permits to Construct for the above boilers subject to the permit conditions stated in the Sample Permits is recommended.