

PERMIT SAMPLE EVALUATION
NATURAL GAS FIRED BOILER 5-20 MMBTU/HR
(Based on applicable Rules & Regulations as of September 2007)

ENGINEERING EVALUATION FOR PERMIT TO CONSTRUCT/OPERATE

APPLICANT ABC Company (Facility ID: 123456)

MAILINGS ADDRESS 123 ABC St.
Pasadena, CA 91103

EQUIPMENT LOCATION 123 ABC St.
Pasadena, CA 91103

EQUIPMENT DESCRIPTION

BOILER, CLEAVER BROOKS, WATER TUBE TYPE, MODEL NO. FLX700-250-160HW, SERIAL NO. BT009480, WITH A 20,000,000 BTU PER HOUR, INDUSTRIAL STEAM, MODEL NTH025NGX-12S-2P, LOW NOX BURNER, NATURAL GAS FIRED, WITH AN EXTERNAL FLUE GAS RECIRCULATION SYSTEM.

BACKGROUND/SUMMARY

This is an application for a new boiler from a new facility that was received by AQMD on 2/1/07 and accepted on 3/9/07 as Class I. There is no other permitted equipment at this facility.

Fees: Permit processing fee as per Rule 301 for boiler in the range of 5-20 MMBtu, natural gas fired is schedule C.

CEQA ANALYSIS

This equipment is not part of a project that is subject to CEQA. There is no significant impact.

EMISSION CONTROL DESCRIPTION

The burner achieves low NO_x levels through the introduction of gaseous fuel and air using three independent areas of supply. The first area is located within the inner core tube of the burner assuring positive flame stabilization independent of burner load. The second area is used to inject fuel and air into a swirling flow generated by the fixed angle blades within the outer swirler. The third area is through specially designed burner nozzles which deliver and connect the fuel stages to blend with the axial and swirl air supplies. The axial, radial and tangential turbulent air flow field generated at the burner outlet is combined with the high velocity fuel jets resulting in an optimized and well defined mixing pattern. The burner operates in conjunction with flue gas recirculation to achieve NO_x levels that comply with BACT standards.

PERMIT SAMPLE EVALUATION

NATURAL GAS FIRED BOILER 5-20 MMBTU/HR

(Based on applicable Rules & Regulations as of September 2007)

AQMD BACT limits for new boiler using natural gas with rating 5-20 MMBtu/hr are 12 ppmv NO_x @ 3% O₂ and 100 ppmv CO @ 3% O₂. This boiler is expected to meet current BACT limits. A source test would be required to verify the actual emission rate.

EMISSION CALCULATIONS

DATA

- Boiler Heat Input is 20 MMBtu/hr
- Natural gas F-factor is 8,710 dscf/MMBtu @ 68 °F (40 CFR 60, Appendix A-7, Table 19-2)
- Molar volume is 385.44 ft³/lb-mole @ 68 °F
- Natural gas hhv is 1,050 Btu/scf (Regulation XX, Rule 2012, Table 3-D)

CALCULATIONS

Emission Factors of Natural Gas Combustion Pollutants for Boiler

| Pollutant | Uncontrolled | | Controlled | | Source |
|------------------|--------------------------------------|-----------------------|--|-----------------------|--|
| | Emission Factor (default) [lb/mmscf] | Converted to lb/MMBtu | Emission Factor [ppmv] @ 3% dry O ₂ | Converted to lb/MMBtu | |
| VOC | 2.8 | 0.0027 | | | AQMD's Annual Emission Report (AER), 2007 |
| NO _x | 100 | 0.09524 | 12 | 0.015 | AQMD's BACT Limit for Controlled emissions |
| SO _x | 0.6 | 0.00057 | | | AQMD's Annual Emission Report (AER), 2007 |
| CO | 84 | 0.08000 | 100 | 0.074 | AQMD's BACT Limit for Controlled emissions |
| PM ₁₀ | 7.6 | 0.0072 | | | AQMD's Annual Emission Report (AER), 2007 |

High Heating Value for Natural Gas [Btu/scf]: 1050

Boiler Heat Input [MMBtu/hr]: 20

| | Max | Avg |
|-------------------------|------|-----|
| Equip. Operating Load : | 100% | 80% |
| hr/day = | 24 | 16 |
| day/week = | 7 | 5 |
| week/yr = | 52 | 50 |

Limit of monthly fuel usage to be imposed on permit condition (based on average operating schedule) [MMscf/mo]: 5.079365

Equipment Emission

| Pollutant | Average | | Maximum | | | | | Annual Average | 30-day avg ** |
|------------------|-----------------------------|---------------------------|-----------------------------|-----------------------------|-----------------------------|---------------------------|------------------------------|----------------|---------------|
| | Hourly Uncontrolled [lb/hr] | Hourly Controlled [lb/hr] | Hourly Uncontrolled [lb/hr] | Hourly Controlled * [lb/hr] | Daily Uncontrolled [lb/day] | Daily Controlled [lb/day] | Annual Controlled [ton/year] | [lb/year] | [lb/day] |
| VOC | 0.043 | 0.043 | 0.053 | 0.053 | 1.28 | 1.28 | 0.2 | 171 | 1.3 |
| NO _x | 1.52 | 0.233 | 1.90 | 0.29 | 45.7 | 7.0 | 1.27 | 932 | 7.1 |
| SO _x | 0.009 | 0.009 | 0.011 | 0.011 | 0.27 | 0.27 | 0.05 | 37 | 0.3 |
| CO | 1.28 | 1.18 | 1.60 | 1.48 | 38 | 35 | 6.45 | 4,729 | 35.8 |
| PM ₁₀ | 0.12 | 0.12 | 0.14 | 0.14 | 3 | 3 | 1 | 463 | 3.5 |

* Controlled hourly emissions of NO_x = 0.015 (lb-NO_x/MMBtu) x 20 (MMBtu/hr) = 0.29 (lb-NO_x/hr)

PERMIT SAMPLE EVALUATION
NATURAL GAS FIRED BOILER 5-20 MMBTU/HR
(Based on applicable Rules & Regulations as of September 2007)

** 30-day average = (max daily controlled emissions x max days/month) / (30 days/month)

$$\frac{EF_{parts}}{10^6 parts} \times \frac{20.9\%}{20.9\% - 3\%} \times 8,710 \frac{dscf}{MMBtu} \times MW \frac{lb}{lb - mole} \times \frac{1lb - mole}{385.44 ft^3} = EF \frac{lb}{MMBtu}$$
$$EF \frac{lb}{MMscf} \times \frac{1MMscf}{1,050MMBtu} = EF \frac{lb}{MMBtu}$$

RULES EVALUATION

RULE 212 – STANDARDS FOR APPROVING PERMITS

(c)(1) This section requires a public notice for all new or modified permit units located within 1,000 feet of the outer boundary of a school. An online search using MAPQUEST shows that the permit unit is not located within 1,000 feet from the outer boundary of a school (See Appendix A). Therefore, a public notice is not required for this section.

(c)(2) This section requires a public notice for all new or modified facilities that have on-site emission increases exceeding any of the daily maximums specified in subdivision (g) of this rule. The increase in emissions does not exceed the daily maximum limits. Therefore, a public notice is not required for this section.

(c)(3) This section requires a public notice for all new or modified permit units with increases in emissions of toxic air contaminants such that a person may be exposed to a Maximum Individual Cancer Risk (MICR) of greater than 1×10^{-6} for facilities with more than one permitted unit and greater than 10×10^{-6} for facilities with one permit unit. As shown in the Health Risk Assessment in Appendix B, a public notice is not required for this section.

RULE 401 – VISIBLE EMISSIONS

Compliance is expected with well maintained and properly operated equipment.

RULE 402 – NUISANCE

No nuisance is expected with well maintained and properly operated equipment.

RULE 404 – PARTICULATE MATTER

Compliance is expected.

RULE 407 – LIQUID AND GASEOUS CONTAMINANTS

PERMIT SAMPLE EVALUATION

NATURAL GAS FIRED BOILER 5-20 MMBTU/HR

(Based on applicable Rules & Regulations as of September 2007)

The CO emissions from these boilers are expected to be below 100 ppmv. This rule has a CO limit of 2,000 ppmv; therefore, compliance is expected.

RULE 409 – COMBUSTION CONTAMINANTS

Compliance is expected.

RULE 431.1 – SULFUR CONTENT OF GASEOUS FUELS

The facility will purchase and use PUC regulated natural gas that has a sulfur content less than 16 ppmv calculated as H₂S; therefore, compliance is expected.

RULE 1146 – EMISSIONS OF OXIDES OF NITROGEN FROM INDUSTRIAL, INSTITUTIONAL, AND COMMERCIAL BOILERS, STEAM GENERATORS, AND PROCESS HEATERS

Emission limits are 30 ppm for NO_x and 400 ppm for CO, when fired using a gaseous fuel. The equipment is expected to meet BACT limits of 12 ppmv-NO_x and 100 ppm-CO through a source test; therefore, compliance is expected.

REGULATION XIII – NEW SOURCE REVIEW

RULE 1303(a) – BEST AVAILABLE CONTROL TECHNOLOGY (BACT)

This is a non-major source and BACT Part D applies. BACT limit for 5-20MMBtu/hr natural gas fired is 12 ppmv NO_x and 100 ppmv CO (water-tube), both at 3% O₂. [<http://www.aqmd.gov/bact/part-d-final-7-14-2006-update.pdf>]

Table 3. BACT Requirement

| Pollutant | Equipment Maximum Daily Controlled Emissions [lb/day] | BACT Triggered if Max Daily Emissions > 1 lb/day | BACT Requirement | BACT Achieved? |
|------------------|---|--|--|----------------|
| VOC | 1.28 | Yes | None | N/A |
| NO _x | 7.0 | Yes | 12 ppmv | Yes * |
| SO _x | 0.27 | No | Natural gas as fuel | Yes |
| CO | 35 | Yes | - 100 ppmv for water tube - 50ppm for fire-tube | Yes * |
| PM ₁₀ | 3 | Yes | Natural gas as fuel | Yes |

* As per the manufacturer, BACT limits would be met. An initial source testing will be required to show compliance with the BACT requirements.

RULE 1303(b)(1) – MODELING

PERMIT SAMPLE EVALUATION
NATURAL GAS FIRED BOILER 5-20 MMBTU/HR
 (Based on applicable Rules & Regulations as of September 2007)

Screening Analysis – Since the hourly controlled emissions are less the screening values listed in Table A-1 in Rule 1303 (b)(1), detailed modeling is not required and the boiler complies with the modeling requirements

From Table A –1: Screening Threshold for Boiler rated between 5 and 20 MMBtu/hr

| Boiler Heat Input Capacity [MMBtu/hr] | NOx [lbs/hr] | CO [lbs/hr] | PM10 [lbs/hr] |
|---------------------------------------|--------------|-------------|---------------|
| 5-10 | 0.47 | 25.9 | 2.8 |
| >10 – 20 | 0.86 | 47.3 | 5.2 |
| <u>Equipment Emission (lbs/hr)</u> | 0.29 | 1.48 | 0.14 |
| Complies ? | Yes | Yes | Yes |

RULE 1303(b)(2) – EMISSION OFFSETS

Emission offset are not required as the facility potential to emit is below 4 tons a year for VOC, NOx, SOx and PM and 29 tons for CO.

| Pollutant | Facility Potential to Emit [tons/ year] | | | Offset Threshold [tons/year] | Offset Required? Yes/No |
|------------------|---|----------------|----------------------------|------------------------------|-------------------------|
| | Before Construction | From Equipment | Total (After Construction) | | |
| VOC | 0 | 0.2 | 0.2 | 4 | No |
| NO _x | 0 | 1 | 1 | 4 | No |
| SO _x | 0 | 0.05 | 0.05 | 4 | No |
| CO | 0 | 6 | 6 | 29 | No |
| PM ₁₀ | 0 | 1 | 1 | 4 | No |

RULE 1401 – NEW SOURCE REVIEW OF TOXIC AIR CONTAMINANTS

Toxic air contaminants are emitted when natural gas is burned. The list of toxic air contaminants that are emitted and the emission rates are as listed below. A screening analysis (Tier II) using AQMD’s approved spreadsheet program (available on http://www.aqmd.gov/permit/r1401_risk_assessment.htm) shows that the MICR is less than 1 in a million and the Hazard Index for Hazard and Chronic Health Effect are less than 1. Therefore, the boiler will operate in compliance with this rule.

PERMIT SAMPLE EVALUATION
NATURAL GAS FIRED BOILER 5-20 MMBTU/HR
 (Based on applicable Rules & Regulations as of September 2007)

Rule 1401 natural gas emissions factors (Source: Ventura County APCD AB-2588, 8/95)

| Pollutant | Engine Rating | Emission Factor [lb/MMscf] | | |
|---|---------------|----------------------------|-----------------|---------------|
| | | <10 MMBtu/hr | 10-100 MMBtu/hr | >100 MMBtu/hr |
| Acetaldehyde | | 4.30E-03 | 3.10E-03 | 4.30E-02 |
| Acrolein | | 2.70E-03 | 2.70E-03 | 1.00E-02 |
| Benzene (including benzene from gasoline) | | 8.00E-03 | 5.80E-03 | 1.90E-01 |
| Ethyl benzene | | 9.50E-03 | 6.90E-03 | 1.44E+00 |
| Formaldehyde | | 1.70E-02 | 1.23E-02 | 1.17E+00 |
| Hexane (n-) | | 6.30E-03 | 4.60E-03 | 2.90E-02 |
| Naphthalene | | 3.00E-04 | 3.00E-04 | 1.10E-02 |
| Polycyclic Aromatic Hydrocarbon (PAHs) | | 1.00E-04 | 1.00E-04 | 3.00E-03 |
| Propylene | | 7.31E-01 | 5.30E-01 | 2.44E+00 |
| Toluene (methyl benzene) | | 3.66E-02 | 2.65E-02 | 5.80E-02 |
| Xylenes (isomers and mixtures) | | 2.72E-02 | 1.97E-02 | 2.90E-02 |

RULE 1401.1 – REQUIREMENTS FOR NEW AND RELOCATED FACILITIES NEAR SCHOOLS

This is a new facility that does not located within 500 ft of a school. Rule 1401.1 is not applicable.

RECOMMENDATION

All applicable Rules and Regulations have been met. A permit to construct/operate is recommended with the conditions shown.

PERMIT SAMPLE EVALUATION
NATURAL GAS FIRED BOILER 5-20 MMBTU/HR

(Based on applicable Rules & Regulations as of September 2007)

PERMIT CONDITIONS

1. OPERATION OF THIS EQUIPMENT SHALL BE CONDUCTED IN ACCORDANCE WITH ALL DATA AND SPECIFICATIONS SUBMITTED WITH THE APPLICATION UNDER WHICH THIS PERMIT IS ISSUED UNLESS OTHERWISE NOTED BELOW.
2. THIS EQUIPMENT SHALL BE PROPERLY MAINTAINED AND KEPT IN GOOD OPERATING CONDITION AT ALL TIMES.
3. THIS EQUIPMENT SHALL BE FIRED ON NATURAL GAS ONLY.
4. THIS BOILER SHALL EMIT NO MORE THAN 12 PPM OF OXIDES OF NITROGEN (NOX), CALCULATED AS NO₂, AND 100 PPM OF CARBON MONOXIDE (CO), ALL MEASURED BY VOLUME ON A DRY BASIS AT 3% O₂ AND AVERAGED OVER A PERIOD OF 15 CONSECUTIVE MINUTES.
5. AN OPERATIONAL NON-RESETABLE TOTALIZING GAS FLOW METER SHALL BE INSTALLED AND MAINTAINED IN THE FUEL SUPPLY LINE TO THIS BOILER.
6. THE TOTAL AMOUNT OF NATURAL GAS CONSUMED BY THIS BOILER SHALL NOT EXCEED 5,079,365 STANDARD CUBIC FEET IN ANY ONE CALENDAR MONTH.
7. THE COMBUSTION BURNER SHALL BE INSPECTED AND MAINTAINED PER MANUFACTURER'S SPECIFICATIONS. RECORDS OF THE INSPECTIONS AND MAINTENANCE OF THE BURNER SHALL BE KEPT FOR AT LEAST TWO YEARS AND BE MADE AVAILABLE TO DISTRICT PERSONNEL UPON REQUEST.
8. THE FLUE GAS RECIRCULATION SYSTEM SHALL BE IN FULL USE WHENEVER THE BOILER IS IN OPERATION.
9. THE BURNER SHALL BE EQUIPPED WITH A CONTROL SYSTEM TO REGULATE COMBUSTION AIR, FUEL AND RECIRCULATED FLUE GAS AS THE BOILER LOAD VARIES. THE CONTROL SYSTEM SHALL BE ADJUSTED AND TUNED AT LEAST TWICE A YEAR ACCORDING TO THE MANUFACTURER'S SPECIFICATIONS TO ASSURE ITS ABILITY TO REPEAT THE SAME PERFORMANCE AT THE SAME FIRING RATE.
10. RECORDS OF ADJUSTMENTS AND TUNE-UPS AS STATED IN CONDITION NO. 7 SHALL BE KEPT FOR AT LEAST TWO YEARS AND BE MADE AVAILABLE TO DISTRICT PERSONNEL UPON REQUEST.
11. ALL RECORDS AS REQUIRED BY THIS PERMIT SHALL BE MAINTAINED AND KEPT ON FILE FOR TWO YEARS AND MADE AVAILABLE TO DISTRICT PERSONNEL UPON REQUEST.
12. THIS EQUIPMENT SHALL COMPLY WITH RULE 1146.
13. THE OWNER OR OPERATOR OF THIS EQUIPMENT SHALL CONDUCT A SOURCE TEST UNDER THE FOLLOWING CONDITIONS:

PERMIT SAMPLE EVALUATION
NATURAL GAS FIRED BOILER 5-20 MMBTU/HR

(Based on applicable Rules & Regulations as of September 2007)

- A. SOURCE TESTING SHALL BE CONDUCTED WITHIN 60 DAYS AFTER RECEIPT OF THIS PERMIT UNLESS OTHERWISE APPROVED IN WRITING BY THE EXECUTIVE OFFICER.
 - B. THE SOURCE TEST SHALL BE PERFORMED TO VERIFY COMPLIANCE WITH THE NOX AND CO EMISSION LIMITS SPECIFIED BY THIS PERMIT.
 - C. THE SOURCE TEST SHALL BE CONDUCTED IN ACCORDANCE WITH SCAQMD METHOD 100.1.
 - D. THE TESTS SHALL BE PERFORMED WHEN THE BOILER IS OPERATING AT MAXIMUM, AVERAGE, AND MINIMUM FIRING RATES AND ALSO WHILE OPERATING UNDER NORMAL CONDITIONS. THE SAMPLING DURATIONS SHALL BE AT LEAST 15 CONSECUTIVE MINUTES FOR EACH MAXIMUM, AVERAGE, MINIMUM, AND NORMAL LOADS.
 - E. WRITTEN NOTICE OF THE SOURCE TESTS SHALL BE SUBMITTED TO THE DISTRICT (ADDRESSED TO SOUTH COAST AIR QUALITY MANAGEMENT DISTRICT, P.O. BOX 4941, DIAMOND BAR, CA 91765) AT LEAST 14 DAYS PRIOR TO TESTING SO THAT AN OBSERVER MAY BE PRESENT.
 - F. TWO COMPLETE COPIES OF SOURCE TEST REPORTS SHALL BE SUBMITTED TO THE DISTRICT (ADDRESSED TO SOUTH COAST AIR QUALITY MANAGEMENT DISTRICT, P.O. BOX 4941, DIAMOND BAR, CA 91765) REFERENCING APPLICATION NO. xxxxxx, WITHIN 45 DAYS AFTER THE TEST. THE REPORT SHALL INCLUDE, BUT NOT LIMITED TO EMISSION RATES IN POUNDS PER HOUR AND CONCENTRATIONS IN PPMV AT THE OUTLET OF THE BOILER, MEASURED ON A DRY BASIS AT 3% OXYGEN. THE FOLLOWING OPERATING DATA SHALL ALSO BE INCLUDED FOR EACH FIRING RATE:
 - I. THE EXHAUST FLOW RATES, IN ACTUAL CUBIC FEET PER MINUTE (ACFM).
 - II. THE FIRING RATES IN BTU PER HOUR.
 - III. THE EXHAUST TEMPERATURE, IN DEGREES F.
 - IV. THE OXYGEN CONTENT OF THE EXHAUST GASES, IN PERCENT.
 - V. THE FUEL FLOW RATE.
14. A TESTING LABORATORY CERTIFIED BY THE CALIFORNIA AIR RESOURCES BOARD IN THE REQUIRED TEST METHODS FOR CRITERIA POLLUTANT TO BE MEASURED, AND IN COMPLIANCE WITH DISTRICT RULE 304 (NO CONFLICT OF INTEREST) SHALL CONDUCT THE TEST.