PERMIT BOILERPLATE FOR SMALL GAS AND/OR DISTILLATE OIL-FIRED BOILERS

To specify requirements for permit approval for distillate (including diesel) oil-fired boilers having a heat input capacity from 10 through 100 x 10^6 Btu/hr and gas-fired boilers having a heat input capacity from 50 through 100 x 10^6 Btu/hr. This boilerplate may not apply to boilers subject to Prevention of Significant Deterioration or Nonattainment permit review. Additional details concerning applicability are given under Permit Applicability.

The boilerplate is meant to provide a guideline for the minimum requirements of the Department of Environmental Quality. More stringent requirements may be imposed if necessary to demonstrate compliance with NAAQS or other special requirements.

REFERENCE NOTES

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BOILERPLATE DEVIATIONS {B1}

This NGDO boilerplate deals with specific issues that occur in the permitting of small boilers in accordance with Article 6 of the Regulations. This boilerplate was not designed to cover all situations that may arise in the drafting of NSR permits for boilers. When deviations from the wording in this document are indicated by varying conditions at the facility, such deviations should be explained in the supporting documentation that accompanies the permit package.

DEFINITIONS {B2}

The following definitions are for use in this guideline and do not necessarily have the same meaning in other portions of the regulations.

boiler - a steam generating unit that combusts fuel by external combustion to produce steam or to heat any medium.
distillate oil - fuel oil (including diesel oil) that complies with the specifications for fuel numbers 1 or 2 as defined by the American Society for Testing and Materials in ASTM D396.

This definition does not include number 4 oil nor does it include used or waste oil. Although diesel oil has its own ASTM specification, numbers 1 and 2 diesel oil should be considered distillate oil for the purpose of this boilerplate.

installation - connecting and making an emissions unit that has previously been assembled at another location ready for use at the location of its intended use.

liquefied petroleum gas - petroleum gas, including butane and propane, as defined by the American Society for Testing and Materials in ASTM D1835.

CEMS - continuous emissions monitoring system

COMS - continuous opacity monitoring system

natural gas - (1) a naturally occurring mixture of hydrocarbon and non-hydrocarbon gases found in geologic formations beneath the earth's surface, of which the principal constituent is methane, or (2) liquefied petroleum (LP) gas, as defined by the American Society for Testing and Materials in ASTM D1835-86, "Standard Specification for Liquefied Petroleum Gases". This definition does not include synthetic gases.

process heater - a device that is primarily used to heat a material to initiate or promote a chemical reaction in which the material participates as a reactant or catalyst.

steam generating unit - a device that combusts any fuel and produces steam or heats water or any other heat transfer medium. This term includes any duct burner that combusts fuel and is part of a combined cycle system. This term does not include process heaters.

APPLICABILITY{B3}

Permitting Applicability

This boilerplate applies to construction, reconstruction, installation, modification, or relocation of boilers fired by distillate oil having a heat input capability from 10 x 10^6 Btu/hr through 100 x 10^6 Btu/hr and boilers fired by natural gas and liquid petroleum gas having a heat input capacity from 50 x 10^6 Btu/hr through 100 x 10^6 Btu/hr. This procedure may be used as a guideline for other fuels, however, caution should be exercised in reviewing applicability and calculation of emissions.

Please note that units firing gaseous fuels only (including back-up fuel) and having a heat input capability of less than 50 x 10^6 Btu/hr are exempt from permit requirements by 9 VAC 5-80-1320 B of State Regulations. However, these units may be subject to NSPS Subpart Dc requirements, registration (9 VAC 5-20-160), and other state requirements (i.e., malfunction reporting, visible emission standard).
Although boilers fired by gaseous fuels only and having a heat input capability of less than 50 x 10^6 Btu/hr are exempted by 9 VAC 5-80-1320 B, PSD permitting requirements may apply. For PSD major sources, the reviewer should verify that any emission increases are less than

significance levels and review impacts on Class I areas if within 10 km. In the event that PSD permitting is triggered, the reviewer is reminded that this boilerplate procedure is not intended to address PSD modifications. If PSD applies, the boilerplate would not be directly applicable but may be used as a guideline for the PSD permit. Likewise, the reviewer should consider the effect of PTE from unpermitted units in cases where Title V applicability could be triggered.

NSPS Subpart Dc Applicability

This NSPS applicability discussion is based upon Subpart Dc as amended on June 13, 2007. It is the individual permit writer's responsibility to determine if changes to Subpart Dc after this date affect applicability or implementation. (See http://ecfr.gpoaccess.gov)

NSPS Subpart Dc applies to boilers for which construction, reconstruction, or modification, commenced after June 9, 1989 and that have a heat input capacity from 10 x 10^6 Btu/hr to 100 x 10^6 Btu/hr. Note that Subpart Dc applicability is not triggered by simple relocation (see EPA ADI Control No. 9800056). The applicability of relocated units to the NSPS is therefore based on the date of construction (fabrication for mass-produced units provided to customers in completed form (see EPA ADI Control No. 0300006)), modification or reconstruction of the relocated unit.

Gas-fired units that have a heat input capacity from 10 x 10^6 Btu/hr through 50 x 10^6 Btu/hr are subject to NSPS Subpart Dc notification and record keeping requirements even though these units are exempt from state permitting. An exemption letter which informs the facility of these requirements should be sent to the source. Boilers greater than 30 x 10^6 Btu/hr may have additional requirements than those less than 30 x 10^6 Btu/hr. Use the latest boilerplate exemption letter as filed on DEQNET.

Boilers of 30 x 10^6 Btu/hr or greater constructed, reconstructed or modified after February 28, 2005, have a PM standard of 0.030 lb/MMBtu. However, the PM standard is waived for boilers combusting oil with less than or equal to 0.5% sulfur which have no post-combustion technology (except a wet scrubber) to reduce PM or SO_2. See paragraph 60.43c (e)1-4 of the updated NSPS.

Emissions requirements in this boilerplate are at least as stringent as NSPS Subpart Dc. See the latest version of Subpart Dc to determine the specific requirements for the unit being permitted.

Industrial, Commercial, Institutional Boilers and Process Heaters MACT (40 CFR 63 Subpart DDDDD) Applicability

On June 8, 2007, the U.S. Court of Appeals for the District of Columbia Circuit vacated and remanded the Boiler MACT, which was subsequently mandated on July 30, 2007. Therefore, the EPA will be developing a new regulation. Also, the EPA is in the process of developing area source standards for this source group.

At the time of application review, the permit writer must determine if the proposed installation will be a major source of HAPs. Until the EPA has promulgated a new Boiler MACT regulation, if the proposed installation is a major HAP source, the owner will need to apply for a case-by-case MACT determination under 9 VAC 5-60 Article 3. Contact the Central Office Air Toxics Coordinator for guidance.

When the Boiler MACT has been revised and promulgated for the second time, these procedures will be updated.

Area Source Standards for Industrial Boilers and Institutional/Commercial Boilers

The USEPA has established Clean Air Act §112(c)(3) area source categories for Industrial Boilers and for Institutional/Commercial Boilers and is scheduled to promulgate final regulations for these categories by June 15, 2009. At the time of application review, the permit writer is to review the status of these standards, as well as the delegation or adoption by DEQ, to ensure that any resulting requirements are appropriately considered. See the link below http://www.epa.gov/ttn/atw/area/arearules.html for the current status of these rules. Contact the Central Office Air Toxics Coordinator if additional guidance is needed.

EQUIPMENT LIST {B4}

The equipment list should contain all emission units that are subject to permitting; whether the units are being constructed, modified, were previously permitted, or are existing units. Exempt units may or may not appear in this list depending on the situation at the time the permit is drafted.

Equipment Capacity {B4A}

As stated in Rule 4-8, "Rated Capacity" means the capacity as stipulated in the purchase contract for the condition of 100% load, or such other capacities as mutually agreed to by the board or owner using good engineering judgment. "Heat input" means the total gross calorific value of all fuels burned in the emissions unit. Emission factors for fuel-burning equipment are calculated starting with the total heat input rating of the emissions unit. A typical rating is in terms of **millions of Btus per hour** of heat input. When boiler ratings are given in terms of **boiler horsepower** or **pounds of steam produced**, it is understood that these ratings are for output energy only and depend on the heat transfer efficiency of the fuel-burning unit.

Equipment Federal Requirements {B4B}

"Federal Requirements" refers to EPA Rules, such as NSPS, NESHAP, or MACT. List the CFR Part and Subpart for the applicable Rule; i.e., 40 CFR 60 (NSPS), Subpart Dc, etc, or 40 CFR 63 (MACT), Subpart DDDDD.

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Equipment Permit Date {B4C}

Determine from the facility's history, when each unit was previously permitted, or if not, that the particular unit is an existing one. Units being constructed by the current permit should reflect the date that this current permit is issued.

Equipment Regulatory Reference {B4D}

Rated Capacities and other specifications for equipment listed are not intended to establish throughput limits, etc. for the equipment to be permitted or which has been permitted. These specifications are important when they are used to determine subjectivity in the case of a Federal Rule with a threshold, or State Regulation for certain size equipment. Applicable requirements for emission units should be clearly stated in a 'limitation' condition, with the applicable regulation cited.

EMISSION CONTROLS AND BACT UNDER ARTICLE 6 {B5}{B6}

See the discussion for BACT in the Generic Permit Boilerplate section. **LINK G4**

Nitrogen Oxide (NO_X)

The primary techniques for control of **NO_X** for boilers of this size can be classified into one of two fundamentally different methods — combustion controls and postcombustion controls. Combustion controls reduce **NO_X** by suppressing **NO_X** formation during the combustion process while postcombustion controls reduce **NO_X** emissions after their formation. Combustion controls are the most widely used method of controlling **NO_X** formation in all types of boilers and include low excess air, burners out of service, biased-burner firing, flue gas recirculation, overfire air, and low- **NO_X** burners. Postcombustion control methods include selective noncatalytic reduction (SNCR) and selective catalytic reduction (SCR). These controls can be used separately, or combined to achieve greater **NO_X** reduction.[1]

For oil fired boilers, low- **NO_X** burners and/or low- **NO_X** burners with flue gas recirculation are typically considered to be presumptive BACT for smaller boilers (less than 30 MMBtu/hr capacity) covered by this boilerplate. For the purposes of this procedure, distillate oil firing low- **NO_X** burners are units achieving 50 ppm **NO_X** or less, unless otherwise demonstrated in a case by case BACT. For larger boilers with increased potential for **NO_X** emissions other types of controls should be considered on a case-by-case basis taking into account energy, environmental and economic impacts and other costs.

For natural gas fired boilers the two most prevalent combustion control techniques used to reduce **NO_X** emissions are flue gas recirculation (FGR) and low **NO_X** burners.[2] These control techniques are typically considered to be presumptive BACT for smaller boilers covered by this boilerplate. For the purposes of this procedure, natural gas firing low- **NO_X** burners are units achieving 30 ppm **NO_X** or less, unless otherwise demonstrated in a case by case BACT. For larger boilers (30 MMBtu/hr and greater capacity) with increased potential for **NO_X** emissions other types of add-on controls may be considered on a case-by-case basis taking into account emissions, energy, environmental and economic impacts.

Sulfur Dioxide (SO_2)

Control of sulfur dioxide, for oil fired boilers of the size covered by this boilerplate, is typically accomplished by controlling the percentage of sulfur in the fuel. In the past the EPA, for NSPS Dc, and DEQ relied on the ASTM International, originally known as the American Society for Testing and Materials (ASTM), specification in ASTM D396 for fuel oil of a maximum sulfur content of 0.5% to restrict the sulfur content of the fuel used in boilers. For purposes of this boilerplate procedure, the presumptive BACT standard for fuel sulfur content shall be 0.2%. It is recognized that there may be circumstances where a lower sulfur content may be considered to address air quality impacts or other factors.

Particulate Matter, Carbon Monoxide and Volatile Organic Compounds

Emissions controls for natural gas and/or distillate oil-fired boilers are typically not required for Particulate Matter [PM] (including PM-10), Carbon Monoxide [CO], or Volatile Organic Compounds [VOC].

State Air Toxics

In addition, boilers firing natural gas or propane are not subject to the state toxic pollutant standards as provided in 9 VAC 5-60-300 C 7.

FUEL SPECIFICATIONS {B7}

Fuel specifications are included in the permit as necessary to make the permit enforceable as a practical matter, as a component of BACT, or to establish a NSPS requirement as a permit condition. In any of these cases, use only the specifications that are relevant to the purpose. Once the appropriate specifications have been selected, the engineering analysis should explain why the specification was included in the permit. When the permitted unit is subject to NSPS Subpart Dc, the citation of 9 VAC 5-50-410 should be included.
NSPS Dc lists the appropriate ASTM fuel specifications for natural gas and distillate oil in the definitions in §60.41c.

Fuel Certification {B7A}

For distillate oil-fired boilers, the permittee must obtain a "fuel supplier certification" for each shipment that includes: the sulfur content of the oil, the name of the oil supplier, and a statement that the oil complies with the specifications for fuel oil Grades 1 or 2, as defined by ASTM D396. For NSPS boilers, fuel specifications contained in the fuel certification must meet one of the following: ASTM D396–78, 89, 90, 92, 96, 98, or any version of D396 subsequently incorporated into 40 CFR 60.17 or any alternate monitoring plan approved pursuant to 40 CFR 60.13(i).

In addition to ASTM D396 for distillate oils, ASTM D975 specification covers Grades 1-D and 2-D of diesel fuel with designations of S5000, S500, or S15 that include sulfur contents of 5000 ppm (0.5%), 500 ppm (.05%), and 15 ppm (0.0015%) respectively. USEPA has previously accepted supplier certification under D975 specifications in lieu of D396 certification for the purpose of meeting NSPS Subpart Dc certification for distillate oil. If the permit is specifying use of diesel fuel to limit SO_2 emissions at a NSPS Dc unit, certification with D975 can be used on a case-by-case basis. When this approach is used the engineering analysis for the permit action must describe this approval and reference the previous approval.

EMISSION LIMITS {B8}

Unless specified and well documented by the applicant, the most recent AP-42 emission factors shall be used to calculate uncontrolled emissions. The 1998 AP-42 emission factors for industrial boilers are the ones used in the NGDO spreadsheet on DEQNET.

Unless otherwise documented by the applicant, the following values for fuels may be used to calculate conservative estimates of emissions:

<table>
<tr><th>Fuel</th><th>Average Heat Content</th><th>Fuel Densities</th><th>Sulfur Content</th></tr>
<tr><td>natural gas</td><td>1,000 Btu/ft^3</td><td>0.042 lb/ft^3</td><td>N/A**</td></tr>
<tr><td>liquid petroleum gas (butane)</td><td>97,000 Btu/gal</td><td>4.84 lb/gal</td><td>0.014%*</td></tr>
<tr><td>liquid petroleum gas (propane)</td><td>90,000 Btu/gal</td><td>4.24 lb/gal</td><td>0.0185%*</td></tr>
<tr><td>#1 distillate oil (including: #1-D diesel oil)</td><td>134,000 Btu/gal
(126,000 Btu/gal)</td><td>6.79 lb/gal</td><td rowspan="2">0.5%* [5000 ppm] [ASTM D396 S5000 (or ASTM D975 S5000)]
0.2% presumptive BACT for this procedure
0.05% [500 ppm] [ASTM D396 S500 (or ASTM D975 S500)]
0.0015%* [15 ppm]) [ASTM D975 S15]</td></tr>
<tr><td>#2 distillate oil (including: #2-D diesel oil)</td><td>138,000 Btu/gal
(131,000 Btu/gal)</td><td>7.05 lb/gal</td></tr>
<tr><td colspan="4">* Maximum based on ASTM standards</td></tr>
<tr><td colspan="4">**The natural gas SO2 emission factor used in the NG-DO calculation spreadsheet is based on a sulfur content of 1.0 grains/100 cf. DEQ considers this sulfur content specification to be sufficiently conservative such that compliance with any minor NSR emission limit derived from this value is reasonably assured without the need for sulfur content limits or monitoring.</td></tr>
</table>

Permit limits are not necessary for each criteria pollutant when emission estimates are less than 0.5 tons per year. However, permit limits are necessary for each criteria pollutant when:

- The limit is part of a BACT determination. For example, if low **NO_X** burners are required as part of a BACT determination then a permit limit for **NO_X** may be required.

- There is an air quality issue. For example, if modeling has indicated a limit is needed to meet a NAAQS then a permit limit may be necessary for that pollutant.

For units capable of burning both gas and distillate oil, lbs/hr limits are based on the higher emission rate of the fuels combusted.
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PM, PM-10, SO_2, and **NO_X** emission rates are generally higher when burning distillate oil**.** VOC and CO emissions are generally higher for gaseous fuels. However, it is recommended that the Environmental Engineer perform emissions calculations to confirm this assumption.

Annual emissions limits in tons/yr are based on the permitted combination of fuel that produces the highest emission rate. An example is given in Attachment A.

For emission limits that are in units of measure of concentration, the concentration must be stated at a reference amount of diluting gas. In practice, common diluent gases are CO2 and O2, and common reference concentrations are 12% CO2 and 7% O2. When a reference diluent gas concentration is applicable, a single reference gas should be specified (i.e., NOT both CO2 and O2).

Particulate Matter {B8A}

Under NSPS Dc, a boiler rated at 30 million Btu/hr or greater particulate matter emissions shall not exceed 0.030 pounds per million Btus of heat input. However, the PM standard is waived for these boilers combusting distillate oil with less than or equal to 0.5% sulfur and that have no post-combustion technology (except a wet scrubber) to reduce PM or SO_2. Using the AP-42 emission factors in the NG_DO_RO.xls spreadsheet will yield a value less than this for natural gas and distillate oil fueled boilers. A discussion of inclusion of condensable PM in the permit limit is given under the Generic Permit Boilerplate section at **G9A.**

For natural gas boiler all PM (total, condensable, and filterable) in AP-42 is assumed to be less than 1.0 micrometer in diameter. For distillate oil boilers all condensable PM in AP-42 is assumed to be less than 1.0 micron in diameter and needs to be added to the various PM categories (PM, PM10) to obtain total PM emissions for each category.

Sulfur Dioxide {B8B}

Distillate oil-fired units must burn oil with a sulfur content not to exceed 0.2 percent by weight.

Other Criteria Pollutants {B8C}

Emission limits for other criteria pollutants are calculated based on the emission factors used in the spreadsheet. Credit for Low-NO_X burners can be given if documented by the permittee. The use of a Low- NO_X burner can also effect the value of other emission factors for a particular burner. A condition can be added to the permit which requires the use of Low-NO_X burners, if applicable.

Toxic Pollutants {B8D}

The NG_DO_RO.xls spreadsheet includes calculations for toxic pollutants for natural gas, distillate oil, and residual oil-fired units using the emission factors from AP-42 (1998). For natural gas units up to 100 x 10^6 Btu/hr, all toxic pollutants are exempt. For distillate oil units up to 100 x 10^6 Btu/hr, all toxic pollutants are exempt except for beryllium and formaldehyde. For beryllium, distillate oil units smaller than 22.07 million Btu per hour are exempt. For formaldehyde, distillate oil units smaller than 89.87 million Btu per hour are exempt. Toxic pollutant evaluation and permit requirements should follow current toxics procedure.

Modeling

Modeling is to be done by approved agency guidelines.

VISIBLE EMISSIONS {B9}

Visible emissions shall not exceed 10 percent opacity except during one six-minute period in any one hour in which visible emissions shall not exceed 20 percent opacity. This condition applies at all times except during start-up, shutdown, or malfunction. This is more stringent than NSPS Subpart Dc. These types of boilers when operated and maintained properly should emit visible emissions less than the requirement in NSPS Dc.

Revisions to NSPS Dc on February 27, 2006 indicate that emissions and VEE testing are not required for natural gas and distillate fueled boiler, so long as the sulfur content does not exceed 0.5 weight percent and the source maintains fuel supplier certifications of the sulfur content of the fuels burned.

REQUIREMENTS BY REFERENCE {B10}

NSPS Subpart Dc

The reference condition is used to emphasize that the unit being permitted is subject to all of the applicable NSPS requirements regardless of whether the requirements are specifically listed in the permit.

Notification of the following dates as required by §60.7 shall be submitted to the Regional Office, with copies mailed to the NSPS Coordinator, EPA Region III. The Skeleton Permit Boilerplate contains condition language for these requirements.

- the date of commencement of construction or reconstruction, (In §60.7(a)(1) the commence construction date is not required for mass-produced facilities which are purchased in completed form, therefore this requirement can be optional especially if the unit has already been installed.)

- the anticipated date of start-up

- the actual date of start-up

MACT Subpart DDDDD

(Conditions for the MACT will be inserted at the proper time.)

RECORDS AND REPORTING {B11}

On Site Records {B11A}

All facilities operating distillate oil or gas-fired units must maintain the following records on site:

- Records of fuel consumption specifying each fuel consumed.
- Records of fuel supplier certifications for distillate oil-fired units.
- Maintenance and training records as required by the General Conditions.
- Copies of all visible emission evaluations and stack tests.

Reporting {B11B}

All NSPS affected facilities operating distillate oil-fired units shall submit SO_2 emissions reports (typically fuel certification reports) to the Department for each six-month period [§60.48c (j)]. DEQ has chosen to make the periods end on June 30th and December 31st of each year. For affected units using fuel certification to demonstrate compliance with SO_2, when no shipments of distillate oil were received during the calendar report period, the report shall include item the dates of the period and a statement that no oil was received during the period.

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ATTACHMENT A
CALCULATION OF PERMIT LIMITS FOR MULTIPLE FUELS

Example:

An applicant proposes to install a 13.8 x 10^6 Btu/hr boiler and requests the following.

Maximum #2 oil consumption:	100 gallons/hr	500,000 gallons/yr
Equivalent operation on oil:	5000 hours/yr	
Maximum gas consumption:	13,800 ft^3/hr	69 x 10^6 ft^3/yr
Equivalent operation on gas:	5000 hours/yr	

<u>Toxic Pollutants</u>

Because the unit has a heat input capacity of less than 22 x 10^6 Btu/hr, emissions of all toxic pollutants are exempt and toxic emissions limits are not necessary.

<u>Criteria Pollutants</u>

Based on the assumed emission factors and fuel characteristics in the <u>Definitions</u> and <u>Fuel Quality Specifications</u> and the NSPS standard for SO_2, short term emissions are calculated as follows.

Hourly emissions are calculated as follows:

PM

distillate oil:	0.1 x 10^3 gal/hr x 2.0 lbs/10^3 gals = 0.20 lbs/hr
natural gas:	0.0138 x 10^6 ft^3/hr x 7.6 lbs/10^6 ft^3 x = 0.10 lbs/hr
worse case fuel:	distillate oil

PM-10

distillate oil:	0.1 x 10^3 gal/hr x 1.0 lbs/10^3 gals = 0.10 lbs/hr
natural gas:	0.0138 x 10^6 ft^3/hr x 7.6 lbs/10^6 ft^3 = 0.10 lbs/hr
worse case fuel:	distillate oil/natural gas

SO_2

distillate oil:	0.1 x 10^3 gal/hr x 142 x (0.5%S) lbs/10^3 gals = 7.1 lbs/hr
natural gas:	0.0138 x 10^6 ft^3/hr x 3.0 lbs/10^6 ft^3 = 0.04 lbs/hr
worse case fuel:	distillate oil

NO_X

distillate oil:	0.1 x 10^3 gal/hr x 20.0 lbs/10^3 gals = 2.00 lbs/hr
natural gas:	0.0138 x 10^6 ft^3/hr x 100.0 lbs/10^6 ft^3 = 1.38 lbs/hr
worse case fuel:	distillate oil

CO

distillate oil: 0.1×10^3 gal/hr x 5.0 lbs/10^3 gals = 0.50 lbs/hr
natural gas: 0.0138×10^6 ft^3/hr x 84.0 lbs/10^6 ft^3 = 01.16 lbs/hr
worse case fuel: natural gas

VOC

distillate oil: 0.1×10^3 gal/hr x 0.20 lbs/10^3 gals = 0.02 lbs/hr
natural gas: 0.0138×10^6 ft^3/hr x 5.5 lbs/10^6 ft^3 = 0.08 lbs/hr
worse case fuel: natural gas

Lead

natural gas: assumed negligible
distillate oil: assumed negligible
worse case fuel: not applicable

Calculation of annual emissions may be a bit more difficult. Obviously, the applicant cannot burn distillate oil for 5000 hours and natural gas for 5000 hours in the same year. He can, however, burn 5000 hours of gas or 5000 hours of distillate oil in any one year. Therefore it is feasible to write a permit limit that allows the consumption of both 500,000 gallons of oil (5000 hours) and 69×10^6 ft^3 of gas (5000 hours) per year. By limiting the hourly rated capacity of the boiler, the Department has a means of ensuring that both 500,000 gallons oil and 69×10^6 ft^3 of gas are not burned in the same year.

Under these conditions, the annual emissions limit must be based on the worse case annual emissions. In this example, the worse-case PM, PM-10, SO_2, and **NO_X** emissions occur while the boiler operating at full load for 5000 hours (500,000 gals/yr) on distillate oil and the remainder of the year, 3760 hours (51.9×10^6 ft^3/yr), on natural gas. Worse case CO and VOC emissions occur when the boiler is operating at full load for 5000 hours (69×10^6 ft^3/yr) on natural gas and for 3760 hours (376,000 gals/yr) on distillate oil.

In general, a boiler emits more PM, PM-10, and SO_2 while burning oil and more VOC while burning gas. CO and NO_X may be higher for either fuel. In any case, calculations should be done to determine the worse-case fuel.

Annual emissions are calculated as follows:

PM

distillate oil: 500×10^3 gal/yr x 2.0 lbs/10^3 gals / 2000 lbs/ton = 0.50 tons/yr
natural gas: 51.9×10^6 ft^3/yr x 7.6 lbs/10^6 ft^3 / 2000 lbs/ton = 0.20 tons/yr
total: 0.50 + 0.20 = 0.70 tons/yr

PM-10

distillate oil: 500×10^3 gal/yr x 1.0 lbs/10^3 gals / 2000 lbs/ton = 0.25 tons/yr
natural gas: 51.9×10^6 ft^3/yr x 7.6 lbs/10^6 ft^3 / 2000 lbs/ton = 0.20 tons/yr
total: 0.25 + 0.20 = 0.45 tons/yr

SO_2

distillate oil: 500×10^3 gal/yr x 142 (0.5% S) lbs/10^3 gal/2000 lbs/ton = 17.75 tons/yr
natural gas: 51.9×10^6 ft^3/yr x 3.0 lbs/10^6 ft^3 / 2000 lbs/ton = 0.08 tons/yr
total: 17.75 + 0.08 = 17.83 tons/yr

NO_X

distillate oil: 500×10^3 gal/yr x 20.0 lbs/10^3 gals / 2000 lbs/ton = 5.00 tons/yr
natural gas: 51.9×10^6 ft^3/yr x 100.0 lbs/10^6 ft^3 / 2000 lbs/ton = 2.60 tons/yr
total: 5.00 + 2.60 = 7.60 tons/yr

CO

natural gas: 69×10^6 ft^3/yr x 84 lbs/10^6 ft^3 / 2000 lbs/ton = 3.00 tons/yr
distillate oil: 376×10^3 gal/yr x 5.0 lbs/10^3 gals / 2000 lbs/ton = 1.25 tons/yr
total: 3.00 + 1.25 = 4.25 tons/yr

VOC

natural gas: 69×10^6 ft^3/yr x 5.5 lbs/10^6 ft^3 / 2000 lbs/ton = 0.19 tons/yr
distillate oil: 376×10^3 gal/hr x 0.20 lbs/10^3 gals / 2000 lbs/ton= 0.04 lbs/hr
total: 0.19 + 0.04 = 0.23 tons/yr

Lead

natural gas: assumed negligible
distillate oil: assumed negligible
total: negligible

Considering the Department's procedure of not writing permit limits for calculated criteria pollutant emissions of less than 0.5 tons/yr, the suggested permit limits are as follows.

Fuel Consumption Limits:

distillate oil: 500,000 gallons/yr
natural gas: 69×10^6 ft/year

Short term limits:

Pollutant	Limit	Comment
PM	0.2 lbs/hr	based on distillate oil
PM-10	None	emissions < 0.5 tons/yr
SO_2	7.1 lbs/hr	based on distillate oil, 0.5% sulfur
NO_X	2.0 lbs/hr	based on distillate oil
CO	1.2 lbs/hr	based on natural gas
VOC	None	emissions < 0.5 tons/yr
Lead	None	emissions < 0.5 tons/yr

Annual limits:

Pollutant	Limit	Comment
PM	0.7 tons/yr	5000 hours oil, 3760 hours gas
PM-10	None	emissions < 0.5 tons/yr
SO_2	17.8 tons/yr	5000 hours oil, 3760 hours gas
NO_X	7.6 tons/yr	5000 hours oil, 3760 hours gas
CO	4.3 tons/yr	5000 hours gas, 3760 hours oil
VOC	None	emissions < 0.5 tons/yr
Lead	None	emissions < 0.5 tons/yr

[1] from AP-42 1.3 Fuel Oil Combustion - Section 1.3.4.3 NO_X Controls (9/98)

[2] from AP-42 1.4 Natural Gas Combustion - Section 1.4.4 Controls (7/98)

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