3.4 Boilers and Heaters

3.4.1 General Description of Source Category

LANL maintains and operates many small natural gas-fired boilers, personal comfort heaters and furnaces, personal use water heaters, and combined comfort heating, ventilation, and air conditioning (HVAC) units with small gas heaters. There are approximately 200 small boilers that range in size from 0.075 MMBtu/hr to 14.6 MMBtu/hr for the maximum nameplate heat input capacity. There are approximately 1100 small furnaces, heaters, and HVAC units in addition to the boilers with an average size range of 0.05 MMBtu/hr to 0.2 MMBtu/hr. The majority of boilers, furnaces, and heaters are used solely to provide comfort heating and hot water for personal use. Larger boilers that are not included here, are discussed in Section 3.10 (Power Plant), and in Section 3.13 (Steam Plant).

Because LANL is located at a high elevation, the boilers do not operate at nameplate capacity. The maximum heat input capacity, derated for altitude, is referred to as the design rate. For atmospheric boilers, the design rate reflects a 30% decrease in input rating consistent with the LANL Facility Engineering Manual (Chapter 6) specification for this altitude. For forced draft boilers, the design rate reflects a 15% decrease in input rating.

More than 80% of the LANL boilers operate on a seasonal basis. The boilers that operate seasonally are mainly those used to provide comfort space heat and to keep water tanks and cooling towers from freezing. An additional 10% of boilers provide heat and steam for both comfort and process needs. The remaining boilers provide process steam and heat.

A summary description of boiler size ranges and functions are provided in Table 3.4-1. As shown in Table 3.4-1, most of the boilers qualify as insignificant emissions units under NMED Title V operating permit requirements.

Table 3.4-1. Miscellaneous Boiler Summary Description

Percentage of Boilers Within Category	Approximate Sum of Design Ratings for Category (MMBtu/hr)	Functional Category	Design Rate Range (MMBtu/hr)	Status
74%	220.4	Comfort Heat	≤ 5	NMED Insignificant Activity #3
12%	20.2	Comfort and Process Heat	<2.3	NMED Insignificant Activity #1
6%	71.1	Comfort and Process Heat	>5 and <10	Do not qualify as NMED Insignificant Activity.
6%	42.5	Comfort and Process Heat, Low NO_x	>2.3 and <6.3	NMED Insignificant Activity #1
1%	24.9	Comfort Heat	≥ 10	Subject to 40 CFR 60 Subpart Dc.
1%	10.7	Process Heat	≥ 10	Installed before June 9, 1989; therefore, not subject to 40 CFR 60 Subpart Dc.

There are fourteen gas-fired boilers that do not meet the insignificant emission unit criteria established by NMED. These boilers are listed in Table 3.4-2.

Table 3.4-2. List of Non-Exempt Boilers

Location (Technical Area-Building)	Equipment ID (Manufacturer/ Serial No.)	Design Input Rating (MMBtu/hr)	Air Pollution Control System
TA-16-1484	Sellers/10291	6.35	Low-NO_x
TA-16-1484	Sellers/10290	6.35	Low-NO_x
TA-16-1485	Sellers/10288	7.84	Low-NO_x
TA-16-1485	Sellers/10289	7.84	Low-NO_x
TA-48-1	Sellers/99017	5.34	None
TA-48-1	Cleaver Brooks/L-62569	5.34	None
TA-48-1	Cleaver Brooks/L-093412	7.14	None
TA-53-365	Sellers/99031-1	7.11	None
TA-53-365	Sellers/99031-2	7.11	None
TA-55-6	Sellers/101319-B	12.4	None
TA-55-6	Sellers/101319-A	12.4	None
TA-59-1	Cleaver Brooks/L-64591	5.34	None
TA-59-1	Cleaver Brooks/L-92957	5.34	None
TA-50-2	Superior-9661	10.7	None

Heaters and furnaces are used solely to provide either hot water for personal use or building heat for personal comfort. All heaters and furnaces have a design rate less than or equal to 5 MMBtu/hr and qualify for insignificant activity #3 in the NMED insignificant activity list. Table 3.4-3 provides a summary description of this equipment.

Table 3.4-3. Small Heater and Furnace Summary Description

Type of Unit	Identifier	Average Size (Btu/hr)	Approximate Number of Units
Hot Water Heaters	HWG and BWS	75,000 and 200,000	153 and 47
Comfort Heat Furnaces	FGF	125,000	240
Unit Wall Heaters	HUG	100,000	353
Unit Wall Heaters (infrared)	HUI	50,000	174
Combined HVAC Systems	HVA	125,000	142

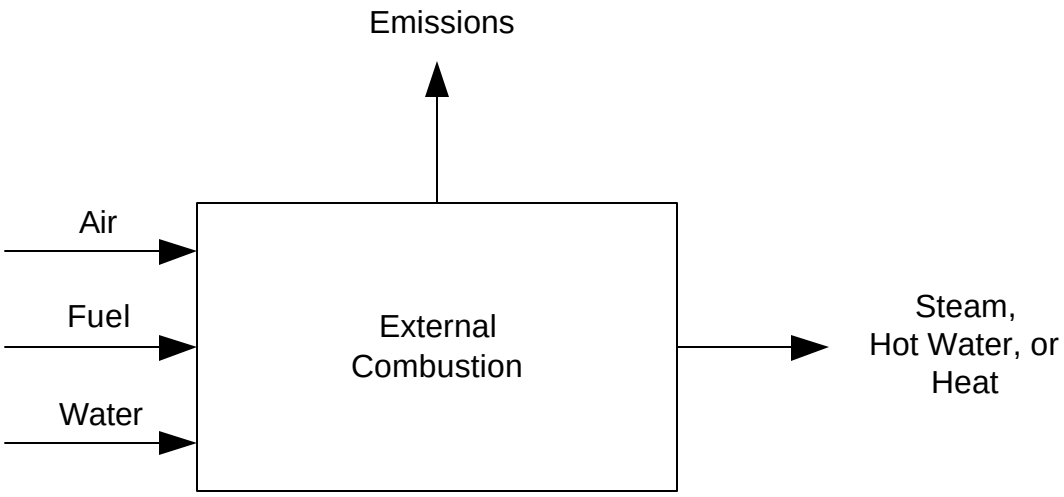
3.4.2 Operating Schedule

The majority of the boilers, furnaces, and heaters at LANL operate seasonally. The typical heating season starts at the beginning of October and ends mid-May. During the heating season, the units can operate continuously. The process boilers operate as needed.

3.4.3 Process Flow Diagram

A general process flow diagram for an external combustion unit is provided in Figure 3.4-1.

Figure 3.4-1. Process Flow Diagram for Boilers and Heaters



3.4.4 Emissions

Combustion of natural gas in boilers and heaters generates emissions of criteria pollutants (NO_x, CO, SO_2, PM, VOCs) and small quantities of HAPs. Emission factors used to estimate emissions are shown in Table 3.4-4. Natural gas emission factors were taken from AP-42, 7/98, Section 1.4, Natural Gas Combustion, Tables 1.4-1 and 1.4-2 for criteria pollutants and Tables 1.4-3 and 1.4-4 for HAPs. Emission factors for NO_x and CO from low NO_x boilers were supplied by Sellers Engineering, the boiler vendor.

Table 3.4-4. Emission Factors for Miscellaneous Boilers and Heaters

Criteria Pollutant	Emission Factors [(a)] for Natural Gas Uncontrolled Boilers ($lb/10^6 ft^3$)	Emission Factors [(a)] for Natural Gas Low NO_x Boilers ($lb/10^6 ft^3$)
NO_x	100	37.1 [(b)]
CO	84	37.1 [(b)]
SO_x	0.6	0.6
PM	7.6	7.6
VOC	5.5	5.5
HAP	1.89	1.89

(a) Emission factors, unless otherwise indicated, AP-42, 7/98, Section 1.4, Natural Gas Combustion, Tables 1.4-1, 1.4-2, 1.4-3 and 1.4-4.
(b) Emission factors from Sellers Engineering (vendor).

Maximum annual criteria pollutant and HAP emission rates were calculated using the following general formula:

$$Emission\ Rate\left(\frac{lb}{yr}\right) = [Emission\ Factor\ (\frac{lb}{MMCF\ gas})]\ [Gas\ Input\ Rate\ (\frac{MMCF\ gas}{yr})]$$

Annual emissions for each pollutant were calculated by multiplying the annual natural gas input by the appropriate emission factors for each pollutant. All boilers and heaters in this source category were placed in one of two groups to estimate emissions. One group is referenced as the TA-16 boilers. The 28 boilers in this group are all controlled with low NO_x burners and are also metered. These boilers are all located at TA-16 with the exception of two, which are located at TA-9. Fuel usage for these boilers is tracked separately from other boilers at LANL. The second group consists of all remaining miscellaneous boilers and heaters other than those in the TA-16 group. Fuel usage for this group is tracked by removing from the total gas usage at LANL the gas used at metered sources. The proposed fuel limit proposed and used in calculating annual emissions is 870 MMscf per year for all units combined. 200 MMscf was apportioned to the TA-16 boilers and 670 MMscf per year for all other units combined to estimate emissions. The low NO_x emission factors from Table 3.4-4 were used in calculating

emissions for the TA-16 boilers. The uncontrolled boiler emission factors were used to calculate emissions from the second group. Emission estimates are shown in Table 3.4-5.

Table 3.4-5. Emissions Estimates for Miscellaneous Boilers and Heaters

Criteria Pollutant	TA-16 Boilers (ton/year)	All other boilers/heaters (ton/year)	Total (ton/year)
NO_x	3.7	33.5	37.2
CO	3.7	28.1	31.9
SO_x	0.06	0.2	0.3
PM	0.8	2.5	3.3
VOC	0.6	1.8	2.4
HAP	0.2	0.6	0.8

3.4.5 Emissions Control Equipment

More than 15% of the boilers at LANL are equipped with low-NO_x burners. Low NOx burners reduce NOx emissions by staging the combustion process, which partially delays combustion. This results in reduced flame temperatures and suppressed NOx formation.

3.4.6 Applicable Requirements

Unit-specific applicable requirements, which apply to the miscellaneous boilers and heaters, are listed below in Table 3.4-6 followed by a citation of the basis for the requirement.

Table 3.4-6. Applicable Requirements for Miscellaneous Boilers and Heaters

Source Category	Applicable Requirement
All miscellaneous boilers and heaters	***Operating Requirements:*** • Limit natural gas to 870 MMscf/yr, 12-month rolling average. (LANL proposed condition)

3.4.7 Proposed Monitoring, Recordkeeping, and Reporting

Proposed monitoring, recordkeeping, and reporting for this source category are shown in Table 3.4-7.

Table 3.4-7. Proposed Monitoring, Recordkeeping, and Reporting for Miscellaneous Boilers and Heaters

Source Category	Monitoring, Recordkeeping, and Reporting
TA-16 boilers	***Monitoring:*** • A volumetric flow meter shall be utilized to measure the total combined amount of natural gas being used on a semiannual basis. (LANL proposed condition)
TA-55 12.4 MMBtu/hr boilers	***Monitoring:*** • A volumetric flow meter shall be utilized to measure the total amount of natural gas being used on a monthly basis. (40 CFR Part 60.48c(g) and NMED alternate monitoring plan approval dated August 26, 2002)
All Misc. Boilers and Heaters Including TA-16 and TA-55 Boilers	***Monitoring/Recordkeeping:*** • Records of total natural gas usage shall be kept on a semiannual basis, except a record shall be kept monthly for the two 12.4 MMBtu/hr boilers at TA-55. (LANL proposed condition, except 40 CFR Part 60.48c(g) and NMED alternate monitoring plan approval dated August 26, 2002 for the two 12.4 MMBtu/hr boilers at TA-55) ***Reporting:*** • Report criteria pollutant and HAP emissions on a semiannual basis for those sources that do not qualify as an insignificant emission unit. (20.2.73.300 NMAC for criteria pollutants and LANL proposed condition for HAPs and semiannual basis) • Submit semiannual report of any required monitoring within 45 days from the end of each reporting period. The reporting periods are January to June and July to December. (20.2.70.302.E.(1) NMAC)