CRITERION 404

GAS FURNACES/UNIT HEATERS

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RECORD OF REVISIONS

Revision No.	Date	Description
0	09/10/98	Initial Issue. Replaces 3.7-315, Rev. 0. Deleted Forward, Statement of Authority, Maintenance Standard Update, 1.0 General Requirements, and 2.0 LANL Maintenance Policy Documents.
1	09/06/01	This revision includes the addition of a Table of Contents, the use of Basis Statements in Sections 6, 7, and 9, further clarification based on the new Criterion Writer's Guide, and incorporates a review of ORPS & NRC Lessons Learned 1/1/95 to 6/2000.
	08/6/02	Editorial changes: Removal of "in development" in Section 8.2.1 and Ref. 10.12
2	03/07/06	This revision include: • Updated Facility Maintenance Division and FM-MSE Group information • Updated Air Quality Group information • Removed LIRs that have been rescinded or cancelled

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1.0 PURPOSE

The purpose of this criterion is to establish the minimum requirements and best practices for operation and maintenance of Gas Furnaces/Unit Heaters at LANL. This document addresses the requirements of LIR 230-05-01 (Ref. 10.1), "Operations and Maintenance Manual."

Implementation of these requirements and recommendations satisfies DOE Order 430.1A, "Life Cycle Asset Management," Attachment 2 "Contractor Requirements Document," Paragraph 2, Sections A through C, (Ref. 10.2) which in part require UC to "…maintain physical assets in a condition suitable for their intended purpose" and employ "preventive, predictive, and corrective maintenance to ensure physical asset availability for planned use and/or proper disposition." Compliance with DOE Order 430.1A is required by Appendix G of the UC Contract.

2.0 SCOPE

The scope of this criterion includes the routine inspection, testing and maintenance of gas furnaces/unit heaters at all nuclear and non-nuclear LANL facilities. This Criterion does not address corrective maintenance actions required to repair or replace equipment.

3.0 ACRONYMS AND DEFINITIONS

3.1 Acronyms

AR	Administrative Requirements
CFR	Code of Federal Regulations
CO	Carbon Monoxide
CPSC	Consumer Product Safety Commission
DX	Direct Expansion
FGF	Furnace, Gas Fired
HDG	Heater, Duct, Gas
HUG	Heater, Unit, Gas
HVA	Heating, Ventilating & Air Conditioning
LIR	Laboratory Implementing Requirement
LIG	Laboratory Implementing Guidance

LPR	Laboratory Performance Requirement
MEL	Master Equipment List
O&M	Operations and Maintenance
PPE	Personal Protection Equipment
PP&PE	Personal Property and Programmatic Equipment
RP&IE	Real Property and Installed Equipment
SSC	Structures, Systems, and Components
UC	University of California
UL	Underwriters Laboratories

3.2 Definitions

Blower Fan. A device which provides the primary means for circulation of air. (Ref. 10.3)

Burner. A device for the final conveyance of a mixture of gas, or a mixture of gas and air, to the combustion zone. (Ref. 10.3)

Carbon Monoxide. A colorless, odorless gas that is formed as a product of the incomplete combustion of carbon. (Ref. 10.5)

Combustion Chamber. The portion of an appliance within which combustion occurs. (Ref. 10.3)

Controls. Devices designed to regulate the gas and air to a gas appliance. (Ref. 10.3) These devices include a shut-off valve, gas regulator and control valve between the burner and the source of gas.

Draft Hood. A nonadjustable device built into an appliance, or made part of the vent connector from an appliance that is designed to (1) provide for the ready escape of the flue gases from the appliance in the event of no draft, a backdraft, or stoppage beyond the draft hood, (2) prevent a backdraft from entering the appliance, and (3) neutralize the effect of stack action of the chimney or gas vent during the operation of the appliance. (Ref. 10.3)

Duct Heater. A hanging, self-contained, automatically controlled, vented, fuel-gas burning appliance intended for installation on the space to be heated with the use of ducts, having integral means for circulation of air, normally by a propeller fan. (Ref. 10.3) The above mentioned units are designed as HDG's at LANL.

Filter. A device that filters the re-circulated return air before it enters the blower compartment. (Ref. 10.4)

Furnace. Is a central unit equipped with a fan or blower which provides the primary means for circulation of air through the use of ducts. (Ref. 10.4)

NOTE: The above mentioned units are designated as FGF's at LANL. A gas heating unit with ventilating and cooling capabilities, by the use of DX coils, is considered a heating, ventilating and air conditioning unit. Some of these units are roof mounted. These units are designated as HVA's at LANL. These units are also subject to the requirements of this document.

Pilot. A pilot is utilized to ignite the gas at the main burner or burners. (Ref. 10.3)

Unit Heater. A hanging, self-contained, automatically controlled, vented, fuel-gas burning appliance intended for installation in the space to be heated without the use of ducts, having integral means for circulation of air, normally by a propeller fan, and may be equipped with louvers or face extensions made in accordance with the manufacturer's specifications. (Ref. 10.3) The above mentioned units are designated as HUG's at LANL.

Vent. A passageway used to convey flue gases from gas utilization equipment or their vent connectors to the outside atmosphere. (Ref. 10.3)

4.0 RESPONSIBILITIES

4.1 ENV-MAQ Air Quality

4.1.1 Responsible for air quality compliance and ambient air monitoring. For gas furnaces/unit heater replacements or upgrades the State of New Mexico stipulates air quality requirements for activities that increase air emissions. As a result, it is necessary to contact ENV-MAQ to ensure compliance with state regulations and LANL's Air Quality, LIR 404-01-01, if a gas furnace/unit heater(s) upgrade or replacement is planned.

4.2 FM-MSE Maintenance Support and Engineering

4.2.1 FM-MSE is responsible for the technical content of this Criterion and assessing the proper implementation across the Laboratory.

4.2.2 FM-MSE shall provide technical assistance to support implementation of this Criterion.

4.3 Maintenance Manager

4.3.1 Responsible for operations and maintenance of institutional, or Real Property and Installed Equipment (RP&IE) under their jurisdiction, in accordance with the requirements of this document.

4.3.2 Responsible for operations and maintenance of those Personal Property and Programmatic Equipment (PP&PE) systems and equipment addressed by this document that may be assigned to the FM in accordance with the FMU-specific Facility/Tenant Agreement.

4.4 Group Leader

4.4.1 Responsible for operations and maintenance of those Personal Property and Programmatic Equipment (PP&PE) systems and equipment addressed by this document that are under their jurisdiction

4.4.2 Responsible for system performance analysis and subsequent replacement or refurbishment of RP&IE and assigned PP&PE based on sound Life Cycle Analysis techniques and system-specific performance requirements.

5.0 PRECAUTIONS AND LIMITATIONS

5.1 Precautions

This section is not intended to identify all applicable precautions necessary for implementation of this Criterion. A compilation of all applicable precautions shall be contained in the implementing procedure(s) or work control authorization documents. The following precautions are intended only to assist the author of a procedure or work control document in the identification of hazards and precautions that may not be immediately obvious.

5.1.1 Take care to ensure that the area around gas-fired heating units are free of all combustible materials.

5.1.2 Do not use furnace closets as storage areas.

5.1.3 Do not block the combustion air inlet (s).

5.2 Limitations

The intent of this Criterion is to identify the minimum generic requirements and recommendations for SSC operation and maintenance across the Laboratory. Each user is responsible for the identification and implementation of additional facility-specific requirements and recommendations based on their authorization basis and unique equipment and conditions, (e.g., equipment history, manufacturer warranties, operating environment, vendor O&M requirements and guidance, etc.). Nuclear facilities and moderate to high-hazard non-nuclear facilities will typically have additional facility-specific requirements beyond those presented in this Criterion which are contained in their Authorization Basis (e.g., Safety Analysis Report, Technical Safety Requirements, or Facility Safety Plans), as applicable. Nuclear facilities must implement the requirements of DOE Order 433.1 (Ref. 10.7) (or 10 CFR 830.340, Maintenance Management, when issued) as the minimum programmatic requirements for a maintenance program. Additional requirements and recommendations for SSC operation and maintenance may be necessary to fully comply with the current DOE Order or CFR identified above.

6.0 REQUIREMENTS

Minimum requirements that Criterion users shall follow are specified in this section. The Criterion users are responsible for analysis of operational performance and SSC replacement or refurbishment based on this analysis. Laws, codes, contractual requirements, engineering judgement, safety matters, and operations and maintenance experience drive the requirements contained in this section.

6.1 Operations Requirements

No requirements beyond those stated in Section 5.2 Limitations.

6.2 Maintenance Requirements

6.2.1 The following preventative maintenance activities shall be performed once a year on all gas furnaces/unit heaters.

- Visually inspect the combustion chamber for cracks using an inspection mirror and a strong light.

  Note: A unit with a cracked heat exchanger should immediately be secured, “red-tagged” and replaced.

- When unit is fired for operational checks, check for the presence of CO at the point(s) of discharge of the heated air.

Basis: The above maintenance requirements are based on a personnel safety issue, LANL maintenance experience, the CPSC, and recommendations from various manufacturer’s operations and maintenance manuals. (Ref.

10.9) Per the CPSC, "CO poisoning associated with the use of fuel burning appliances kills more than 200 people each year and sends more than 10,000 to hospital emergency rooms for treatment." (Ref. 10.10) Yearly attention to gas furnaces/unit heaters help ensure safe operation.

6.2.2 See 7.2.1

7.0 RECOMMENDATIONS AND GOOD PRACTICES

The information provided in this section is recommended based on acceptable industry practices and should be implemented by each user based on his/her unique application and operating history of the subject systems/equipment.

7.1 Operations Recommendations

7.1.1 Equipment start-up and maintenance should be completed by October 10th of each year.

Basis: Engineering Judgement: Experience at LANL has shown that hard freeze conditions can occur by this date.

7.1.2 An adequate supply of repair parts should be maintained.

Basis: NFPA 54 (National Fuel Gas Code, Appendix B 3.9)

7.1.3 Operating instructions should be furnished and left in a prominent position near the equipment for the use of the consumer.

Basis: NFPA 54 (National Fuel Gas Code, Chapter 8.7)

7.1.4 Furnaces designated as FGF's at LANL, that share the same supply ducting with evaporative swamp coolers, should have the manual dampers in the supply ducts above them closed off during the cooling season and the units secured electrically. Reverse this process during the start of the heating season when these swamp coolers are secured and drained. It is advisable to keep the pilot lights on, during the cooling season, to help keep the combustion chambers dry in the event that the manual dampers do not seal properly.

Basis: This prevents the combustion chambers from rusting when the evaporative swamp coolers are in operation. Securing these particular furnaces electrically during the cooling season prevents the possibility of both units (heating & cooling) from operating at the same time.

NOTE: The above does not apply to gas furnaces designated as HVA's at LANL that incorporate DX coils for cooling. (Refrigeration)

7.1.5 Maintain positive air pressure, if feasible, in buildings where gas furnaces/unit heaters are in operation.

Basis: This will help prevent the possibility of "spillage" of flue gases in the building, through the draft hood, causing an unsafe condition.

7.1.6 Maintenance of this equipment should only be performed by personnel having a New Mexico gas license.

Basis: Personnel safety due to risk of explosion and fire.

7.2 Maintenance Recommendations

7.2.1 In conjunction with the maintenance requirements specified the following operations should also be performed once a year.

- Observe the general condition of unit. Inspect main burner and pilot assembly. Clean if necessary.
- Inspect the blower fan motor(s). Lubricate the blower fan motor(s) if they are of the type that require lubricating. (Ref. 10.11)
- Inspect fan blade surfaces and clean if necessary. Where applicable inspect condition of fan belt. Replace if necessary. Also inspect fan belt for proper alignment and tightness.
- Where applicable, inspect and clean or replace air filters.
- Inspect the venting system. Look for any obstructions or deterioration.
- Where applicable, inspect combustion air supply openings to ensure that they are not closed or stopped up.
- Inspect the fuel supply system and gas control equipment. Leak check the gas controls and associated piping with a leak detector or bubble test.
- Inspect all electrical wiring and controls.
- Operationally check the unit to determine suitability for return to service. Observe firing sequence and visually determine that the main flame is burning properly. Adjust the primary air as required.
- Where applicable, test for spillage at the draft hood relief opening after 5 minutes of main burner operation. Use the flame of a match or candle.

Basis: The above maintenance recommendations are based on LANL maintenance experience, Work Smart Standard NFPA 54 (National Fuel Gas Code Appendix B.3 & H) (Ref. 10.3), and recommendations from various manufacturer's operations and maintenance manuals. (Ref. 10.9) Yearly attention to gas furnaces/unit heaters helps ensure efficient and reliable operation.

8.0 GUIDANCE

8.1 Operations Guidance

8.1.1 No implementing guidance available.

8.2 Maintenance Guidance

8.2.1 Provided it has been reviewed and approved by FM-MSE, an acceptable program for gas furnace/unit heater inspections may be found in the KSL preventative maintenance instruction (PMI) 40-40-014, Inspection of Gas Furnaces/Unit Heaters. (Ref. 10.12)

9.0 DOCUMENTATION

Maintenance history shall be maintained for Gas Furnaces/Unit Heaters to include, as a minimum, the parameters listed in the following table.

Table 9-1 Documentation Parameters

MAINTENANCE HISTORY DOCUMENTATION PARAMETERS				
PARAMETER	**ML 1**	**ML 2**	**ML 3**	**ML 4**
Maintenance Activities				
Repair / Adjustments	**X**	**X**	**X**	**X**
PM Activities (Section 7.2.1)	**X**	**X**	**X**	**X**
Replacement	**X**	**X**	**X**	**X**
Replacement Dates	**X**	**X**	**X**	**X**
Equipment Problems				
Failure Dates	**X**	**X**	**X**	
Failure Root Cause	**X**	**X**	**X**	
Inspection Results				
Inspection Date(s)	**X**	**X**	**X**	**X**
Visually inspect combustion chamber for cracks (6.2.1)	**X**	**X**	**X**	
Test Results				
CO test results (6.2.1)	**X**	**X**	**X**	

Basis: LPR 230-07-00, Performance Criteria 2. (Ref. 10.13) The above maintenance requirements are also based on a personnel safety issue, LANL maintenance experience, NFPA 54 (National Fuel Gas Code, Appendix B.3 & H), a Work Smart Standard, the CPSC, and

recommendations from various manufacturer's operations and maintenance manuals. (Ref. 10.9) Per the CPSC, "CO poisoning associated with the use of fuel burning appliances kills more than 200 people each year and sends more than 10,000 to hospital emergency rooms for treatment." Yearly attention to gas furnaces/unit heaters help ensure safe operation. (Ref. 10.10)

10.0 REFERENCES

10.1 LIR 230-05-01 Rev. 0, "Operations and Maintenance Manual."

10.2 DOE O 430.1A, "Life Cycle Asset Management, Attachment 2, "Contractor Requirements Document," Paragraph. 2, Sections A through C.

10.3 NFPA 54, National Fuel Gas Code, 1999 (A Work Smart Standard.)

10.4 Uniform Mechanical Code, 1997.

10.5 Dictionary of Scientific and Engineering Terms, McGraw-Hill, 5th Edition.

10.6 LIR 404-10-01.2, "Air Quality Reviews."

10.7 DOE Order 433.1, Maintenance Management Program for DOE Nuclear Facilities, Section 4.e and 5.b.

10.8 LIR 301-00-02 Rev. 3, "Variances and Exceptions to Laboratory Operations Requirements."

10.9 Various Manufacturer's Operation and Maintenance Manuals. Example: "Bryant, Day & Night and Payne Induced-Combustion Gas Furnaces," OMBPH-BDP-3338-310, August 15, 1992; "Installation and Service Manual for Gas Fired Unit Heaters," OMJG5-86, 1986, and others.

10.10 U.S. Consumer Product Safety Commission, Air Conditioning, Heating, & Refrigeration News, October 4, 1999.

10.11 O&M Criterion 510 Rev. 0, "Electric Motor Maintenance."

10.12 PMI 40-40-014, "Inspection of Gas Furnaces/Unit Heaters.

10.13 LPR 230-07-00 Rev. 0, "Performance Criteria #2."

11.0 APPENDICES

None.