CRITERION 419

INSPECTIONS AND TESTING OF

PRESSURE VESSELS AND PRESSURE RELIEF VALVES

SIGNATURES

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CRITERION 419

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1.0 PURPOSE

The purpose of this Criterion is to establish the minimum requirements and best practices for operation, inspection, and testing of commercial pressure vessels and relief valves on systems supporting LANL facilities. Non-commercial pressure systems are addressed by LIR 402-1200-01.0 (pressure, vacuum, and cryogenic systems).

This document addresses the requirements of LIR 230-05-01(Ref 10.1), "Operations and Maintenance Manual."

Implementation of this Criterion satisfies DOE Order 430.1A (Ref 10.2) for the subject equipment / system. DOE Order 430.1A (Ref 10.2)"Life Cycle Asset Management," Attachment 2 "Contractor Requirements Document," Paragraph 2, Sections A through C, which in part requires 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 operation, inspection, testing, and preventive and predictive maintenance of facility-related pressure vessels and pressure relief valves at all nuclear and non-nuclear LANL facilities. Equipment addressed by this criterion includes air receivers, heat exchangers, expansion tanks, steam and hot water heating boilers, electric and gas water heaters.

Relief valves, safety valves and rupture discs associated with the above-mentioned equipment or other facility equipment (chillers, cryogenic tanks) are also included in this criterion. Department of Transportation (DOT) compressed gas cylinders and containers are not in the scope of this criterion.

Appendix A contains a specific list of exclusions from the inspection requirements of this criterion (419).

Pressurized systems, vacuum systems and cryogenic systems intended for research and development or programmatic purposes are addressed by LIR 402-1200-01-0 (Pressure, Vacuum and Cryogenic Systems).

3.0 ACRONYMS AND DEFINITIONS

3.1 Acronyms

AHJ	Authority Having Jurisdiction
API	American Petroleum Institute
ASME	American Society of Mechanical Engineers
API	American Petroleum Institute
CFR	Code of Federal Regulations
DOE	Department of Energy
DOT	Department of Transportation
FWO	Facility and Waste Operations
LIR	Laboratory Implementing Requirement
LPR	Laboratory Performance Requirement
MAWP	Maximum Allowable Working Pressure
MOP	Maximum Operating Pressure
MSE	Maintenance and Systems Engineering
NBIC	National Board Inspection Code
NDT	Nondestructive Testing
O&M	Operations and Maintenance
POC	Point of Contact
PPE	Personal Protective Equipment
PP&PE	Personal Property and Programmatic Equipment
RRES	Risk Reduction & Environmental Services
RP&IE	Real Property and Installed Equipment
SSC	Structures, Systems, and Components
UBC	Uniform Building Code
UC	University of California

UMC	Uniform Mechanical Code
WSS	Work Smart Standards adopted by LANL

3.2 Definitions

Administrative Authority. The Administrative Authority is the individual official, board, department, or agency established and authorized by a state, county, city, or other political subdivision created by law to administer and enforce the provisions of the mechanical code as adopted or amended. This definition shall include the Administrative Authority's duly authorized representative. For LANL, the Administrative Authority for the mechanical code is DOE. DOE has appointed (through LIR 220-03-01) the POC for the mechanical chapter of the engineering manual as the administrative authority or AHJ for the mechanical code. (Reference 10.10)

ASME Code. The American Society of Mechanical Engineers (ASME) Boiler and Pressure Vessel Code establishes Recommended Rules for the Care and Operation of Heating Boilers and also establishes the Rules of Safety governing the Design, Fabrication and Inspection during construction of Boilers and Pressure Vessels. (Reference 10.7)

Boiler. A closed vessel used for heating water or for generating steam by direct application of heat from combustible fuels or electricity. (Reference 10.8)

Corrosive Fluids. Substances that cause corrosion. (Reference 10.12)

Huddling Chamber. Part on a safety valve that increases the area of the safety valve disc, thus increasing the total upward force to pop open.

National Board Inspection Code (NBIC). It is the purpose of the National Board Inspection Code to maintain the integrity of pressure vessels and pressure retaining devices after they have been placed into service. The code does this by providing rules and guidelines for inspection after installation, repair, alteration and re-rating, thereby helping to ensure that these objects may continue to be safely used. (Reference 10.9)

Nondestructive Testing (NDT): Any testing method which does not involve damaging or destroying the test sample; including the use of x-rays, ultrasonics, radiography, magnetic flux, and so on. (Reference 10.12)

Owner-User (Inspection Organization). An owner or user of pressure retaining items that maintains an established inspection program, whose organization and inspection procedures meet the requirements of the National Board rules and are acceptable to the jurisdiction or jurisdictional authority wherein the owner is located. (Reference 10.9)

Pressure Vessel: A container designed and built to hold pressurized fluids. Pressure vessels not meeting national codes and standards are specialized pressure systems. (Reference 10.6)

Remaining Life. Period of service time based on corrosion rates and conditions of service. See NBIC RB-3236.

Safety and Relief Valves. In ordinary diction the term "safety valve" and "relief valve" are frequently used interchangeably. This is satisfactory to the extent that both safety valves and relief valves of the spring-loaded type are similar in external appearance and both serve the broad general purpose of limiting pressure (liquid or gaseous) by discharging some of the pressurized liquid or gas. Some authorities restrict "safety valves" to those installed in boilers, super heaters and fired vessels. All others are classified as relief valves. They are defined briefly as follows:

- Safety Valves - An automatic pressure-relieving device actuated by the static pressure upstream of the valve characterized by full opening pop action and are used with gases, which include steam, air and vapors. Their design always includes a huddling chamber, which utilizes the expansion forces of these gases to effect quick opening (popping) and closing actions. The difference between the opening and closing pressures is termed "blowdown" and for steam safety valves blowdown limitations are carefully stated in the ANSI/ASME boiler and pressure vessel codes.
- Relief Valves - An automatic pressure-relieving device actuated by the static pressure upstream of the valve, which opens further with the increase in pressure over the opening pressure. These valves are normally used for liquid service although safety valves may be used. Ordinarily relief valves do not have an accentuated huddling chamber or a regulator ring for varying or adjusting blowdown. They therefore operate with a relatively lazy action, slowly opening as pressure increases and slowly closing as pressure decreases. Such relieving action affords suitable protection for vessels or systems where there is no need for instantaneous release of large volumes, and where sufficient leeway is provided between the design pressure and the operating pressure in the system.
- Safety Relief Valves - An automatic pressure-relieving device suitable for use either as a safety valve or relief valve, depending on the application. This type of valve would be like the safety relief valve found on hot water heaters, it works on temperature as a safety valve and as a relief valve for pressure.

Rupture Disk. A non-reclosing relief device actuated by inlet static pressure and designed to function by the bursting of a pressure-containing disk. A rupture disk is the pressure containing and pressure sensitive element of a rupture disk. Rupture discs may be designed in several configurations, such as plain flat, prebulged, or reverse buckling. A rupture disk holder is the structure, which encloses and clamps the rupture disk in position.

4.0 RESPONSIBILITIES

4.1 FWO- Maintenance and Systems Engineering (MSE)

4.1.1 FWO-MSE is responsible for the technical content of this Criterion and monitoring the applicability and the implementation status of this Criteria and either assisting the organizations that are not applying or meeting the implementation expectations contained herein or elevating their concerns to the director(s).

Basis: LIR 301-00-01.11; Issuing and Managing Laboratory Operations Implementation Requirements and Guidance, Section 5.4, OIC Implementation Requirements.

4.1.2 FWO-MSE shall provide technical assistance to support implementation of this Criterion.

4.2 Facility Manager

4.2.1 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.

4.2.2 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.

4.3 Group Leader

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

4.3.2 Responsible for system performance analysis and subsequent replacement or refurbishment of assigned PP&PE.

4.4 Authority Having Jurisdiction (AHJ) – Mechanical POC for LANL Engineering Manual

4.4.1 The AHJ is responsible for providing a decision on a specific technical question regarding national, state and local codes and DOE orders.

4.5 Pressure Safety Committee

Responsible for approving all non-commercial or specialized pressure retaining systems, assuring the designs are sound and meet appropriate codes.

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/precautions that may not be immediately obvious.

5.1.1 Before installing a new relief valve it is recommended that a pipe tap be used to assure clean cut and uniform threads in the vessel opening and to allow for normal hand engagement followed by a half to one turn by wrench.

5.1.2 Avoid over tightening as this can distort the safety/relief valve seats.

5.1.3 Avoid excessive "popping" of the safety/relief valve as even one opening can provide a means for leakage. Safety/relief valves should be operated only often enough to assure that they are in good working order.

> **Note:** Safety valves should only be operated as specified in National Boiler Inspection Code. There is now approved equipment that can check that the valve will open at its set pressure without full exercising of the valve. This avoids premature cutting of the valve seat. This service is available from an ASME approved repair shop with stamp authority.

5.1.4 Avoid wire, cable, or chain pulls for attachment to levers that do not allow a vertical pull. The weight of these devices should not be directed to the safety/relief valve.

5.1.5 Avoid having the operating pressure too near the safety/relief valve set pressure. A very minimum differential of 5 psi. or 10% (whichever is greater) is recommended. An even greater differential is desirable, when possible, to assure better seat tightness and valve longevity.

5.1.6 Avoid discharge piping, where the safety/relief valve carries its weight, even though supported separately changes in temperature alone can cause piping strain. It is recommended that drip pan elbows or flexible connections be used wherever possible.

5.1.7 Apply only a moderate amount of pipe compound to male threads only, leaving the first thread clean. Compound applied to female threads or used to excess can find its way into the valve, causing leakage. Flanged connections should be clean and straight, with new gaskets. Draw the mounting bolts down evenly.

5.1.8 Do not hand operate a relief valve with less than 75% of the stamped set pressure exerted on the underside of the disc. When hand operating, be sure to hold the valve in an open position long enough to purge accumulated foreign material from the seat area and then allow the valve to snap shut.

5.1.9 Much of the inspection work is accomplished while the vessel is in operation and under pressure.

5.1.10 When preparing a pressure vessel for internal inspection that normally operates at high temperature or low temperature (below –20°F or 7°C) the vessel shall be allowed to cool or warm at a rate low enough to avoid damage to vessel.

5.1.11 Adhere to all lockout/tagout requirements to assure that connections to vessels including drain lines are isolated.

5.1.12 ESH/HSR professionals can provide assistance in confined space entry and to assure that vessel is purged of contaminants. Personal protective equipment and clothing shall be worn as appropriate.

5.1.13 Do not try to stop leakage on over pressure-relieving devices by tightening the spring or by blocking it in any manner whatsoever.

5.1.14 Never look into discharge of any type of safety device while the system has pressure in it.

5.1.15 Never use a hammer or tool of any kind to rap on a safety/relief valve. Always use the try lever or pull ring to open the valve and always let the valve snap shut.

5.1.16 Steam safety valves must always be piped to the outside (when possible relief valves should be piped outside). The discharge of all safe devices must be pointed in a safe direction.

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. Nuclear facilities shall implement the requirements of DOE Order 4330.4B (Ref. 10.3) (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. Requested variances to these requirements shall be prepared and submitted to FWO-MSE in accordance with LIR 301-00-02 (Ref. 10.4), "Variances and Exceptions to Laboratory Operations Requirements," for review and approval. The Criterion users are responsible for analysis of operational performance and SSC replacement or refurbishment based on this analysis. Laws, codes, contractual requirements, engineering judgment, safety matters, and operations and maintenance experience drive the requirements contained in this section.

6.1 Operations Requirements

6.1.1 Pressure Vessels

Pressure Vessels must operate at or below the Maximum Operating Pressure (MOP) and within its design temperature limits. The MOP is generally 10-20% below the Maximum Allowable Working Pressure (MAWP), which is the pressure at which pressure relief devices are set to open. Operating above the design temperature can lower the strength of the pressure system material, thereby actually lowering the MAWP and MOP. Operating below the design temperature can, in some materials, decrease ductility of the pressure system material, which increases the chance of failure due to local stress concentrations.

Basis: IAPMO UMC, Section 1026.0. (Reference 10.10) The UMC is specified by the WSS UBC Code, and by the LANL Engineering Manual, LIR 220-03-01.

6.1.2 Pressure Relief Devices

The following table contains the operating requirements for relief devices based on ASME Code:

PRESSURE RELIEF DEVICE OPERATING REQUIREMENTS				
APPLICATION	**ALLOWABLE VESSEL OVERPRESSURE (ABOVE MAWP OR VESSEL DESIGN PRESSURE)**	**SPECIFIED PRESSURE SETTINGS**	**SET PRESSURE TOLERANCE WITH RESPECT TO SET PRESSURE**	**REQUIRED BLOWDOWN**
SECTION I				
Boilers	6% *	One valve ≤ MAWP Others up to 3% above MAWP	± 2 psi up to and including 70 psi ± 3% for pressures above 70 psi up to and including 300 psi ± 10 psi for pressures over 300 psi up to and including 1000 psi ± 1 % for pressures above 1000 psi	Minimum: 2% of set pressure or 2 psi whichever is greater Maximum: 4% of set pressure or 4 psi whichever is greater, with some exceptions
Forced-Flow steam Generators	20%	May be set above MAWP, Valves must meet overpressure requirements	Same as above	Maximum: 10% of set pressure
SECTION IV				
Steam Boilers	5 psi	≤ 15 psi	± 2 psi (HG-401.1k)	2 – 4 psi
Hot Water Boilers	10% for a single valve 10% above highest set valve for multiple valve	One valve at or below MAWP Additional valves up to 6 psi above MAWP for pressures to and including 60 psi and up to 5% for pressures exceeding 60 psi	± 3 psi up to and including 60 psi ± 5% for pressure above 60 psi	None Specified

PRESSURE RELIEF DEVICE OPERATING REQUIREMENTS				
APPLICATION	**ALLOWABLE VESSEL OVERPRESSURE (ABOVE MAWP OR VESSEL DESIGN PRESSURE)**	**SPECIFIED PRESSURE SETTINGS**	**SET PRESSURE TOLERANCE WITH RESPECT TO SET PRESSURE**	**REQUIRED BLOWDOWN**
SECTION VIII DIVISION 1 & 2				
All vessels unless an exception specified	10% or 3 psi – whichever is greater	≤ MAWP of vessel	± 2 psi up to and including 70 psi	None Specified
Exceptions: When multiple devices are used	16% or 4 psi – whichever is greater	One valve ≤ MAWP, additional valves up to 105% of MAWP	± 3% over 70 psi	
Supplemental device to protect against hazard due to fire	21%	Up to 100% MAWP		**Note:** Pressure relief valves for compressible fluids having an adjustable blowdown construction must be adjusted prior to initial capacity certification testing so that blowdown does not exceed 5% of set pressure or 3 psi, whichever is greater
Device to protect liquefied compressed gas storage vessel in fire (Div. 1 only)	20%	≤ MAWP	-0% + 10%	Same as above
Bursting disk	Same as above	Stamped burst pressure to meet requirements noted above	± 2 psi up to and including 40 psi ± 5% of stamped burst pressure at specified coincident disk	Same as above

* Note: References in parentheses are to Code paragraphs

1 psi = 6.89 kPa

6.2 Maintenance Requirements

6.2.1 Pressure Vessel Inspections: Type and Frequency

Type of service	Type of inspection	Frequency of inspection
Steam	External	Annually*
Air and clean dry gases	External	Biannually*
Propane, refrigerant and others	External	Biannually*
Corrosive fluids	External & Internal	Biannually

*External inspection may lead to an internal inspection or shut down if deficiencies are found. Internal inspection is also required following modification of pressure retaining components.

Basis: The above inspection frequency is required per the UMC, Section 1025.0/1025.4. (Reference 10.10) The UMC is specified by the WSS UBC Code, and by the LANL Engineering Manual, LIR 220-03-01.

Note: NBIC-23 states in Section RB-3237 that the maximum period between internal inspections or a complete on-stream evaluation of pressure vessels shall not exceed ½ of the estimated remaining life of the vessel or 10 years, whichever is less. When the remaining operating life is less than 4 years, the inspection interval may be the full remaining safe operating life up to a maximum of 2 years

6.2.2 Pressure Vessel External Inspection

Note: The following inspection shall be performed by a National Board Commissioned Inspector or by an inspector holding a valid Owner-User Inspection Commission issued by the National Board of Boiler and Pressure Vessel Inspectors or American Petroleum Institute (API) certified inspector. Perform an external inspection per NBIC-23 Section RB-3231. (Reference 10.9)

6.2.2.1 Pre-Inspection Activities

- Review safety valve test certificates and test dates on all safety valves if certificate is not available, call stamp holding company and request a certificate copy for all safety valves to be kept on file with boiler inspection certificates.
- Review operating conditions against vessel rating.
- Review normal contents of the vessel
- Review date of last inspection

- Review current inspection permit
- Review ASME Code Symbol Stamping or mark of code construction
- Review National Board registration number
- Review records of wall thickness checks, especially on vessels where corrosion is a consideration.

Basis: The above pre-inspection requirements are based NBIC-23 Section RB-3220, National Board Inspection Code. (Reference 10.9) The NBIC-23 National Board Inspection Code is the nationally recognized code containing inspection criteria for ASME pressure vessels. API 579, 580, 581, 510, 572, 573, 574 and 576 are also referenced in LIR 402-1200-01.0 as a requirements basis. (Reference 10.14)

6.2.2.2 Pressure Vessel External Inspection Steps

- Review name plate data from pressure vessel
- Review the working pressure of the vessel
- Review nameplate marking or stamping of the vessel pressure relief valve(s). It should be compared to stamping on the pressure vessel. The set pressure shall be no higher than the MAWP marked on the pressure vessel
- Verify nameplate capacity and if possible, compare to system capacity requirements
- Visually inspect the vessel for damage, modifications, weldments, etc. to validate vessel integrity
- Fill out inspection report form
- Out-brief owner of vessel
- Issue certificate of code inspection compliance

Basis: Steps followed by National Board Commissioned Inspectors of past external inspections performed on LANL pressure vessels.

Note: The vessel external inspection may occur while the vessel is on stream, but may lead to internal inspection or shutdown if deficiencies are found. The inspector may use a variety of non-destructive testing methods including visual examination, ultrasonic thickness test, liquid penetrant

testing, magnetic particle testing, or radiography depending upon field conditions.

6.2.2.3 Inspection of Gages

During pressure vessel external inspection, the pressure indicated by the required gauge should be compared with other gauges (gauges within calibration date) on the same system. When required (apparent damage to gauge – indicator hunting, vibrating, damping fluid drained and contaminated) compare the pressure indicated by the pressure gage that indicates operating pressure with a calibrated standard test gage.

Basis: NBIC-23 Section RB-3261. (Reference 10.9)

6.2.3 Pressure Vessel Internal Inspection

Perform an internal inspection in accordance with NBIC-23 Section RB-3232 if deficiencies identified during external inspections (cracks, evidence of corrosion, etc.) need additional evaluation. Internal inspections are also performed when corrosion rates control the life of the pressure vessel.

Basis: UMC Section 1025.0/1025.4, and LIR 402-1200-01 Pressure, Vacuum and Cryogenic Systems. (Reference 10.10 & 10.6)

6.2.4 Inspection/Testing of Pressure Relieving Devices

Inspect/test devices providing overpressure protection in accordance with NBIC-23 Section RB-3500 and in accordance with the following schedule found in Section RB-3560. Testing may be accomplished by the owner on the unit where the valve is installed or at a qualified test facility.

Service	Inspection Frequency
Steam	Annual
Air and clean, dry gasses	Every three years
Propane, Refrigerant	Every five years
All others	Per inspection history

Basis: NBIC 23, API 576 is also referenced in LIR402-1200-01.0 as requirements basis.

Note: For inspection of rupture discs, or other nonreclosing devices refer to NBIC-23, Section RB-3570d. Testing of other types of pressure relieving devices may be performed in place if the service fluid is non-hazardous. Two methods of testing accepted as good engineering practice are:

1. Lifting the test or try lever when the pressure vessel is in service.

Note: Only boilers low enough in pressure should be considered safe to lever lift.

2. Increasing steam boiler pressure to the popping point of the valve. (Pop Test) A pop test of a safety valve is conducted to determine that the valve will open under boiler pressure within the allowable tolerances. This rest requires the bypassing of operating controls and the use of calibrated test gauges. It should only be preformed by qualified individuals under carefully controlled conditions. It is recommended that a written procedure, approved by the Mechanical POC, be available to conduct this testing. Repairs & Recalibration of Pressure Relieving Devices shall be preformed by a test facility that meets the requirements of NBIC-23 Section RA-2200 including holding of a "VR" stamp authorization from the National Board of Boiler and Pressure Vessel Inspectors.

Note: "Certificate of Competence" issued by the state of New Mexico Construction Industries Division, Regulation and Licensing Department can indicate a "qualified inspector".

6.2.5 Rupture Discs

The inspector checks the markings on rupture discs to ensure that the stamped burst pressure and temperature are correct for the intended service conditions.

Where a rupture disc is installed between the vessel and a spring loaded safety or safety relief valve, the space between the rupture disc and the valve must be provided with a pressure gage, try cock, free vent, or suitable telltale indicator in order that leakage or rupture may be detected.

When a rupture disc is installed on the outlet side of a spring-loaded safety or safety relief valve, the valve is to be of such a design that it will not fail to open at its set pressure regardless of any backpressure that can accumulate between the valve and rupture disk. Assembly must be vented or drained to prevent accumulations of pressure due to a small amount of leakage from the valve.

Rupture discs have to be at a set pressure above a safety valve. These are "one time" devices. Also, they might fail before the safety valve causing shutdown or damage to pressure vessel.

In all cases, where rupture discs are installed in combination with safety or safety valves, the Inspector refers to the requirements of Section VIII, Division 1, of the ASME Code for the proper discharge capacity rating of such combinations.

Rupture discs can only be tested to failure. A spare disc needs to be installed after a test.

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

Operation of air receivers includes the accumulation of condensation in the vessel. A weekly program that includes slowly opening manual drain valves to assure that the automatic drains are functioning properly is recommended. Inspection of the "torpedo" oil/water separators for saturation is also recommended.

Basis: Engineering Judgement: Experience at LANL has shown that automatic traps occasionally plug-up, and a weekly inspection will prevent saturation of the air system with water.

7.1.1 If need be, obtain the services of an outside ASME certified service company for major emergency repairs, such as pressure vessel repairs, modification of supports, etc. There are several of these companies in Albuquerque, New Mexico and are licensed by the State of New Mexico, Construction Industries Division. (Reference 10.11) Most of these companies provide 24-hour emergency service.

Basis: LANL pressure vessel maintenance experience.

7.2 Maintenance Recommendations

Proper installation of safety and relief valves will prevent many problems.

7.2.1 Mount the valve in a vertical position so that discharge piping and Code required drains can be properly piped to prevent build-up of backpressure and accumulation of foreign material around the valve seat area.

7.2.2 When installing flange-connected valves use new gaskets and draw the mounting bolts down evenly.

7.2.3 Do not use the valve outlet or cap as a lever for installation. Use only flat-jawed wrenches on the flats provided.

7.2.4 Arrange discharge piping (if used) so that it cannot bear on the valve when either hot or cold, by using a drip pan elbow or flexible connection between the valve and the escape pipe. The safety valve vent pipe must be two pipe sizes bigger than the valve outlet elbow reducing valve output capability.

7.2.5 Obtain the services of an outside ASME certified service company for pressure vessel repairs, modification of supports, etc. There are several of these companies in Albuquerque, N.M. and are licensed by the State of New Mexico, Construction Industries Division. (Reference 10.11) Most of these companies provide 24-hour emergency service.

Basis: LANL pressure vessel maintenance experience.

7.3 Safety Valve Repair

7.3.1 Develop a regular program of visual inspection, looking for steam and condensate leaks, clogged drains and discharge pipe, dirt build-up in and around the valve seat and broken or missing parts.

7.3.2 Do not paint, oil or otherwise cover any interior or working parts of any safety valve – safety valves do not require any lubrication or protective coating to work properly.

8.0 GUIDANCE

8.1 Operations Guidance

None

8.2 Maintenance Guidance

8.2.1 JCNNM PMI 40-40-18 (Water Heater Inspection and Maintenance) and PMI 40-40-40-003 (Boiler Inspection Testing and Maintenance) can provide guidance on Inspections and testing of pressure vessels and pressure vessel relief valves.

9.0 REQUIRED DOCUMENTATION

Maintenance history shall be maintained by FMs for pressure vessels and pressure relieving devices to include, as a minimum, the parameters listed in the Table 9-1 below:

Table 9-1 Documentation Parameters

MAINTENANCE HISTORY DOCUMENTATION PARAMETERS				
PARAMETER	**ML 1**	**ML 2**	**ML 3**	**ML 4**
Manufacturer's Name Plate Data	**X**	**X**	**X**	**X**
Maintenance Activities				
Repair / Adjustments including qualifications of repair organization	**X**	**X**	**X**	**X**
PM Activities	**X**	**X**	**X**	**X**
Replacement (includes dates)	**X**	**X**	**X**	**X**
Equipment Problems				
Failure Dates	**X**	**X**	**X**	**X**
Failure Root Cause	**X**	**X**		
Inspection Results				
Inspection Date(s)	**X**	**X**	**X**	**X**
SSC Condition	**X**	**X**	**X**	**X**
Vessel Pressure rating and temperature	**X**	**X**	**X**	**X**
ASME Code Stamp, National Board Number	**X**	**X**	**X**	**X**
Inspection permit provided and conditions noted	**X**	**X**	**X**	**X**
Date of Last Inspection	**X**	**X**	**X**	**X**
Wall Thickness Measurements (if performed)	**X**	**X**	**X**	**X**
Normal Contents of Vessel	**X**	**X**	**X**	**X**
Normal Operating conditions (temperature and Pressure)	**X**	**X**	**X**	**X**

Basis: Documentation of the parameters listed in Table 9-1 above satisfies the requirements of LPR 230-07-00, Criteria 2, (Ref. 10.5) which states; "Maintenance activities, equipment problems, and inspection and test results are documented." The documentation also meets the requirements of NBIC-23

10.0 REFERENCES

10.1 LIR 230-05-01.0, Operation and Maintenance Manual.

10.2 DOE O 430.1A, Attachment 2 "Contractor Requirements Document" (Paragraph 2, Sections A through C), a requirement of Appendix G of the UC Contract.

10.3 DOE Order 4330.4B, Maintenance Management Program, Section 3.4.9.

10.4 LIR 301-00-02.0, Variances and Exceptions to Laboratory Operation Requirements.

10.5 LPR 230-07-00, Maintenance History, Performance Criteria [2].

10.6 LIR 402-1200-01-0, Pressure, Vacuum, and Cryogenic Systems.

10.7 ASME Section VI. (Recommended Rules for the Care and Operations of Heating Boilers), 1998.

10.8 ASME CSD-1-1998. (Controls and Safety Devices for Automatically Fired Boilers).

10.9 National Board Inspection Code, 2001.

10.10 Uniform Mechanical Code, 1997.

10.11 Chardan's Boiler Service, Welch's Boiler Service, A-1 Boiler Service, etc.

10.12 McGraw-Hill Dictionary of Scientific and Technical Terms, Third Edition, 1984.

10.13 ASME Section VIII, Pressure Vessels, 1986

10.14 American Petroleum Institute (API) Standards

510, 572, 573 – Pressure Vessel Inspection

520, 521, 576 – Pressure Relief Devices

570, 574 – Piping

579 – Fitness for Service

580, 581 – Risk –Based Inspection

10.15 LIR 402-1200-01.0, "Pressure, Vacuum, Cryogenic", Appendix 1, Section 4

11.0 APPENDICES

Appendix A – Criterion 419 Exclusions

APPENDIX A

CRITERION 419 EXCLUSIONS

The following are excluded from the inspection requirements of Criterion 419.

1. Domestic water systems including sanitary waste water systems.
2. Fire protection water systems.
3. Natural gas distribution systems (inside and outside).
4. Vehicle systems (engine, hydraulic, and pressurized gas).
5. Construction equipment with hydraulic systems, air power hoists, etc.
6. DOT shipping containers for HE detonator material.
7. DOT Compressed Gas Cylinders and Containers except those that are designated for nuclear materials.
8. Commercial containers which contain materials such as spray paint, keyboard cleaners, bug spray, WD-40, molycoat, etc.
9. Systems attached to stationary or mobile equipment that are required for operation and are, in fact, part of the equipment (e.g. diesel generator fuel and cooling systems, automobile fuel), portable or MSEi-portable cooling and refrigeration systems (However, pressure vessels in central refrigeration systems are not excluded).
10. ASME Section VIII Exempted Vessels:

    - Fire process tubular heaters.
    - Pressure containers which are integral parts or components of rotating or reciprocating mechanical devices, such as pumps, compressors, turbines, generators, engines, and hydraulic or pneumatic cylinders where the primary design considerations and/or stresses are derived from the functional requirements of the device.
    - Structures whose primary function is the transport of fluids from one location to another within a system of which it is an integral part, that is, piping systems.
    - Piping components, such as pipe, flanges, bolting, gaskets, valves, expansion joints, fittings, and the pressure-containing parts of other components, such as strainers and devices which serve such purposes as mixing, separating, snubbing, distributing, and metering or controlling flow, provided that pressure-containing parts of such components are generally recognized as piping components or accessories.
    - Vessels with a nominal water-containing capacity of 120 gallon or less for containing water under pressure, including those containing air, the compression of which serves only as a cushion.

- A hot water supply storage tank heated by steam or any other indirect means when none of the following limitations is exceeded:

  (a) a heat input of 200,000Btu/hr
  (a) a water temperature of 210° F
  (b) a nominal water-containing capacity of 120 gallon

- Vessels having an internal or external operating pressure not exceeding 15 psi or less than 1 kJ of stored energy.

Basis: LIR 402-1200-01.0, "Pressure, Vacuum, Cryogenic", Appendix 1, Section 4. (Ref 10.15)