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BOILER PLANT OPERATIONS

1. PURPOSE: This Veterans Health Administration (VHA) Directive revises VHA policy on the operation of boiler plants.

2. BACKGROUND

a. Without constant and vigilant care, equipment involving combustion and/or steam production under pressure, such as boilers and pressure vessels, can and occasionally do explode with significant property damage and sometimes fatalities.

b. The boiler plant is essential to the operation of the medical center providing steam and hot water required for sanitation, infection control and a healthful environment for the delivery of health care. Fuel costs for the boilers are a significant portion of a medical center's expenditures. A recent review of eleven VA boiler plants reported "every facility tested lacked proper safety devices, settings, and/or test procedures."

c. Boiler plant safety is dependent on well-trained operators, properly functioning safety equipment, proper operational procedures, well-maintained boilers and support equipment, and a commitment to continuous quality improvement.

3. POLICY: It is VHA policy that each boiler plant be operated in a safe and economical manner recognizing its importance and the potential for pressure vessel and/or furnace explosion.

4. ACTION: The Medical Center Director, or qualified designee, is responsible for the safe and efficient operation of the boiler plant, and for ensuring that:

a. **There are Written Policies and Procedures.** Written policies and procedures are established, which at a minimum, must include:

(1) A clear statement and definition of safety as the first priority for boiler plant operations. Boiler plant safety must not be compromised to maintain steam service.

(2) A requirement that all safety devices installed in the boiler plant, or installed as part of the fuel systems, steam distribution systems and condensate return systems, must be periodically tested to ensure their proper function.

(3) A system of notification so that no boiler safety device is recognized as non-functional without the Medical Center Director's knowledge.

(4) Testing procedures that are in accordance with the VHA Boiler Plant Safety Devices Testing Manual (available from vaww.ceosh.med.va.gov). Plant operators must be knowledgeable of the location, purpose, and proper function of all safety devices.

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(5) Assurance that there is continuous operator attendance within boiler plants generating high pressure steam (above 15 pounds per square inch gauge (psig)). Boiler plant operators must not leave any high pressure (above 15 psig) boiler plant unattended at any time, nor can they be relieved by unqualified persons.

(6) Ensurance that no boiler of any pressure can be restarted remotely.

(7) An ongoing training program to develop, maintain, and regularly refresh operator proficiency in safe boiler plant operations.

(8) Ensurance that operators that are well trained and proficient in properly performing the following:

- (a) Lighting off, warming up, placing in service, and shutting down the boilers.
- (b) Firing on each of the available fuels.
- (c) Operating all plant equipment and controls, including start-up and shutdown.
- (d) Gradual warm-up of hot piping systems and placing them into service.
- (e) Maintaining water quality to protect the equipment and piping from damage.
- (f) Handling malfunctions and emergency situations.
- (g) Collecting and organizing the plant performance records.
- (h) Routine equipment maintenance.
- (i) Preparation of equipment for inspections.
- (j) Facilitating and monitoring the receipt of fuels and supplies.

(9) Operation of all equipment at the highest cost effectiveness and efficiency. This means maintaining steam pressure at the minimum necessary for the proper operation of the plant and connected loads.

(10) A steam conservation program focused particularly on maintaining steam traps, condensate pumps, and the integrity of piping systems and pipe insulation. Steam and condensate leaks and other necessary repairs must be reported and given a high priority.

(11) A steam load-shedding plan for implementation during a boiler plant emergency that reduces steam-generating capability, and identifies the critical loads that must continue to be served, to the greatest extent possible, without compromising boiler plant safety.

(12) Provisions that the emergency electrical generator serving the boiler plant is included as part of the medical center's emergency power supply system testing and maintenance program.

(13) A water treatment program that includes daily tests, records of the tests, and the use of chemicals and includes a periodic review by a technical representative of the chemical supplier, by an independent water treatment consultant, or a properly trained operator.

(14) A utilities systems security program ensuring limited access to the boiler plant and on site fuel facilities, including fuel storage and piping systems.

(15) A system for regular checking on the boiler plant operator during each shift to ensure that the ability to perform assigned duties has not been impaired due to an accident or other event. **NOTE:** *One qualified boiler plant operator per shift is sufficient to attend gas-fired or oil-fired high-pressure boilers under normal circumstances.*

(16) A requirement that boiler operators have annual physical examinations to ensure physical fitness to perform assigned duties (see VA Handbook 5019, Pt. II).

(17) An organizational structure that promotes continuous quality improvement in safe boiler operations.

(18) A procedure for steam system shut down to allow maintenance to be performed.

(19) Requirements that repairs to boilers and pressure vessels comply with the American Society of Mechanical Engineers (ASME) Boiler and Pressure Vessel Code. No welded repairs are permitted except by certified welders using Code-approved procedures.

(20) An equipment replacement program based on the following useful life expectancies. Retention of equipment beyond the useful life expectancy must be based on an engineering evaluation of the reliability, efficiency, and cost effectiveness of continued operation.

<u>Equipment</u>	<u>Useful Life Expectancy (in years)</u>
(a) Fire tube boilers and burners	30
(b) Water tube boilers and burners	40
(c) Feedwater deaerator	30
(d) Economizers	15
(e) Burner management controls	20
(f) Combustion controls	20
(g) Instrumentation	20

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<u>Equipment</u>	<u>Useful Life Expectancy (in years)</u>
(h) Boiler feed and condensate pumps	20
(i) Condensate and blow-off tanks and heat recovery	40
(j) Fuel oil pumps	40
(k) Fuel oil tanks	40
(l) Valves; shut off and control	20
(m) Water treatment equipment	20

(21) Required documentation that must be available to all operators in the boiler plant. This is to include:

(a) References. These references must include the:

1. One-line diagrams of boiler plant systems.
2. Manufacturers literature of installed equipment.
3. Boiler Efficiency Improvement Operator Manual.
4. VHA Boiler Plant Safety Devices Testing Manual.
5. Current VHA Boiler Plant Operations Directive.
6. Current Medical Center Boiler Operations Policy.
7. Current normal and emergency operations procedures including start-up, operating, and shut down including all boiler plant equipment, fuel systems, and steam distribution systems.
8. Current list of connected equipment and their pressure and quantity requirements.
9. Lock-out tag-out procedures for all equipment in the boiler plant.
10. Confined space entry procedures, as applicable.

(b) Maintenance and Testing Records. Maintenance and testing records must be retained for at least 3 years.

1. All components of the utility system associated with the production and use of steam at the medical center, including fuel, must be individually reviewed for inclusion in the preventive

maintenance program. All safety devices must be considered critical utility system components. Inspection, testing, and maintenance records are required for all critical components of the utility system.

2. Records must include the:

- a. Date of test, inspection, and/or maintenance;
- b. Results of the test, inspection, and maintenance procedures accomplished;
- c. Parts installed;
- d. Names of individuals performing testing, inspection, and/or maintenance;
- e. Subsequent required notification of the Medical Center Director is made regarding any device failures; and
- f. Repairs and/or adjustments made to safety devices and the date of their return to service.

(c) Performance Data. Performance data must be retained for at least 3 years and must include:

1. Total steam production and fuel consumed (daily, monthly, yearly).
2. Daily outside temperature range.
3. Make-up water quantity, and percent of make-up in relation to amount of steam generated.
4. Minimum and maximum steam demand per shift.
5. Boiler efficiency based on steam output and/or fuel input (daily).
6. Water treatment data including all test reports and chemicals utilized.
7. Boiler flue gas oxygen and stack temperature in relation to burner firing rate.

b. VA Central Office is Notified, as Required

(1) VHA Office of Facilities Management (18) notification is required prior to installation or replacement of high-pressure steam boilers (above 15 psig or greater); installation of new fuel burning equipment on existing boilers; and retubing 30 percent or more of a high-pressure steam boiler.

(2) Unusual occurrences, such as a rupture or explosion of a boiler or pressure vessel, a furnace explosion, extensive damage from overheating, or any other unusual condition must be reported immediately to the Deputy Under Secretary for Health for Operations and Management

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(10N). **NOTE:** *Following the notification of the Deputy Under Secretary for Health for Operations and Management, a thorough origin and cause analysis must be performed by the facility and a written report submitted as soon as possible.*

c. **On-Site Reserve Fuel Requirements are Maintained.** **NOTE:** *Where unusual conditions exist, the Medical Center Director, or qualified designee, may authorize deviations from the storage quantity requirements. There must be a program of fuel testing and maintenance, or replacement, to ensure that stored fuel remains suitable for burning.*

(1) Facilities firing coal as the main fuel normally store a sufficient supply of fuel to meet the normal demands of continuous operation for a period of 15 January days.

(2) Facilities firing oil as the main fuel must maintain a supply of fuel sufficient to meet the normal demands of continuous operation for a period of 15 January days. Plants that generate less than 50 percent of their annual steam demand by natural gas for 2 consecutive years are to be considered as burning oil only.

(3) Facilities firing natural gas as the main fuel with oil or propane back-up normally maintain a sufficient supply of back-up fuel to meet the normal demands of continuous operations for a period of 10 January days.

NOTE: *Fuel storage must be re-evaluated annually against actual fuel used in January.*

d. **Inspection and Testing are Effected Appropriately**

(1) **Qualified Testing Staff.** A Qualified Inspector is an individual who is determined by the medical center's management to be qualified to inspect equipment by reason of training and experience. This is a very important determination. The required services must be procured from qualified individuals, if no VA staff is qualified.

(a) Hydrostatic testing of boilers and pressure vessels must be conducted after a repair or a tube replacement, or when the integrity of the boiler or pressure vessel integrity is in doubt. Hydrostatic pressure must be limited to 150 percent of normal operating pressure of the boiler or pressure vessel.

(b) Selections of contractors for plant services including boiler inspections, burner adjustments, testing of safety devices, calibration of instruments, and monitoring of water treatment must be based on quality as the first priority. The contracting method chosen must allow contractors to be selected on the basis of qualifications as a first priority.

(c) A Qualified Professional Inspector (QPI) is any one or combination of:

1. A boiler inspector who has a valid commission from the National Board of Boiler and Pressure Vessel Inspectors.

2. A boiler inspector who has qualified by passing a written examination under the laws, rules and regulations of a jurisdiction of the state.

3. A boiler inspector who is regularly employed as a boiler inspector by a jurisdiction that has adopted and administers one or more sections of the American Society of Mechanical Engineers (ASME) Boiler and Pressure Vessel Code as a legal requirement, and has a representative serving as a member of the ASME Conference Committee.

4. A boiler inspector who is regularly employed by an insurance company that has been licensed or registered by the appropriate authority of a state of the United States to write boiler and pressure vessel insurance.

(2) Required Inspections and Operational Tests

(a) Key to Frequency Abbreviations

1. H = Hourly.
2. D = Daily.
3. M = Once per month.
4. 6M = Once every 6 months.
5. Y = Once per year.
6. 6Y = Once every 6 years.

(b) Frequency Chart

<u>ITEM</u>	<u>FREQUENCY</u>
1. High pressure boilers (above 15 psig): inspect furnace and other internal surfaces, closures and accessories.	Y
2. High pressure boilers (above 15 psig): inspect exterior of unit, casing, supports, closures, accessories, valves, controls.	Y
3. Deaerator: inspection and wet magnetic particle testing of welds of pressure vessel interior.	6Y
4. Boiler fouling and combustion gas flow check.	Y
5. Tube leak check.	Y

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NOTE: The items preceding (1. through 5.) must be accomplished by a Qualified Professional Inspector. The following items (6. through oo.) must be accomplished by a qualified individual as determined by the medical center's management. Such a determination must be carefully made for each item and each individual.

<u>ITEM</u>	<u>FREQUENCY</u>
6. Low pressure boilers (15 psig and below): inspect interior and exterior, supports, closures, accessories, valves, and controls.	Y
7. Deaerator: interior cleaning and visual inspection.	Y
8. Adjust burner combustion settings and calibrate oxygen trim.	6M
9. Check vibration of burner fans.	6M
10. Calibrate instrumentation, monitoring, and control systems.	6M
11. Calibrate pressure gages and thermometers.	Y
12. Operational Testing of Boiler Safety Devices:	
a. Low-water cutoff (slow drain)	M
b. Low-water cutoff shunt switch	M
c. Auxiliary low-water cutoff (slow drain)	M
d. Auxiliary low-water cutoff shunt switch	M
e. High-water alarm	M
f. Low-water alarm	M
g. High-steam pressure cutout (recycle)	6M
h. High-steam pressure cutout (non-recycle)	6M
i. Steam safety valves (raise boiler pressure until valve pops)	6M
j. Steam safety valves (accumulation test at high fire)	Y
k. Flame scanner	M
l. Check gas vent for leaks	6M

<u>ITEM</u>	<u>FREQUENCY</u>
<u>m.</u> High-gas fuel pressure cutoff	6M
<u>n.</u> Low-gas fuel pressure cutoff	6M
<u>o.</u> Gas fuel safety shut off valves proof of closure	6M
<u>p.</u> Leak test gas fuel safety shut off valves	6M
<u>q.</u> High-fuel oil temperature cutoff (heated fuel)	6M
<u>r.</u> Low-fuel oil temperature cutoff (heated fuel)	6M
<u>s.</u> Low-atomizing pressure for fuel oil	6M
<u>t.</u> High-fuel oil pressure cutoff	6M
<u>u.</u> Low-fuel oil pressure cutoff	6M
<u>v.</u> Fuel oil safety shut off valves proof of closure	6M
<u>w.</u> Leak test fuel oil safety shut off valves	6M
<u>x.</u> Check operation of Liquid Petroleum Gas pilot	6M
<u>y.</u> Low-pilot gas pressure cutout	6M
<u>z.</u> Forced draft fan motor interlock	6M
<u>aa.</u> Forced draft fan damper wide open for purge	6M
<u>bb.</u> Boiler outlet damper wide open for purge	6M
<u>cc.</u> Purge air flow interlock	6M
<u>dd.</u> Timing for prepurge	6M
<u>ee.</u> Timing for post purge	6M
<u>ff.</u> Igniter timing	6M
<u>gg.</u> Low fire position interlock	6M
<u>hh.</u> Combustion air interlock	6M

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<u>ITEM</u>	<u>FREQUENCY</u>
ii. Main flame out; i.e., time to close valves	6M
jj. Ignition flame out; i.e., it is time to close valves	6M
kk. Minimum igniter flame test	6M
ll. Scanner not sensing ignition spark	6M
mm. Low-oxygen alarm and/or cutout	6M
nn. Prepurge setting of flue gas recirculation damper	6M
oo. Interlock of building outside air damper with burner control	6M

***NOTE:** The preceding safety devices are essential for ensuring the safest possible operation. Any boilers not so equipped must be immediately programmed for retrofit, with priority given to providing two low water cutoffs per boiler and two fuel safety shut off valves per fuel per boiler.*

13. Boiler Plant Safety and Operational Duties

<u>ITEM</u>	<u>FREQUENCY</u>
a. Overall plant operation	H
b. Blowdown water columns	D
c. Testing and adjusting water treatment	D
d. Check furnace pressure	6M
e. Check combustion gas leaks into boiler room	6M
f. Clean waterside of boilers	Y
g. Clean fireside and repair refractory	Y
h. Operation of deaerator high and low water alarms	M
i. Operation of deaerator steam pressure/temperature control	M
j. Operation of condensate storage tank high and low water alarms	M
k. Operation of all other alarm devices	M

<u>ITEM</u>	<u>FREQUENCY</u>
l. Operation of boiler economizers; temperatures in or out	D
m. Review written procedures	6M

***NOTE:** The inspection and testing schedule is required for boilers in service during the period. Boilers not in service must be inspected and tested prior to placing in service. For boilers in service less than 3 months during the period, the schedule of inspections and tests performed by qualified technicians for burner-related functions may be extended to not exceed 1 year.*

5. REFERENCES:

- a. National Fire Protection Association 85, Boiler and Combustion Systems Hazard Code;
- b. Joint Commission for Accreditation of Healthcare Organizations, Management of the Environment of Care (EC) Standard 1.7;
- c. Boiler Efficiency Improvement Operator Manual;
- d. VHA Boiler Plant Safety Devices Testing Manual;
- e. VHA Directive 7701 and,
- f. VHA Handbook 7701.

6. FOLLOW-UP RESPONSIBILITIES: The Director, Network Support (10NB), is responsible for the contents of this Directive. Questions may be addressed to 202-273-5880.

7. RESCISSION: VHA Directive 2000-011 is rescinded. This VHA Directive expires on September 30, 2008.

S/ by Louise Van Diepen for
Robert H. Roswell, M.D.
Under Secretary for Health

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