

# Assisting the Cultural Shift to Streamline Operations & Maintenance Procedures



**Brian Wodka, PE, CEM, LEED AP**



# Project Requirements

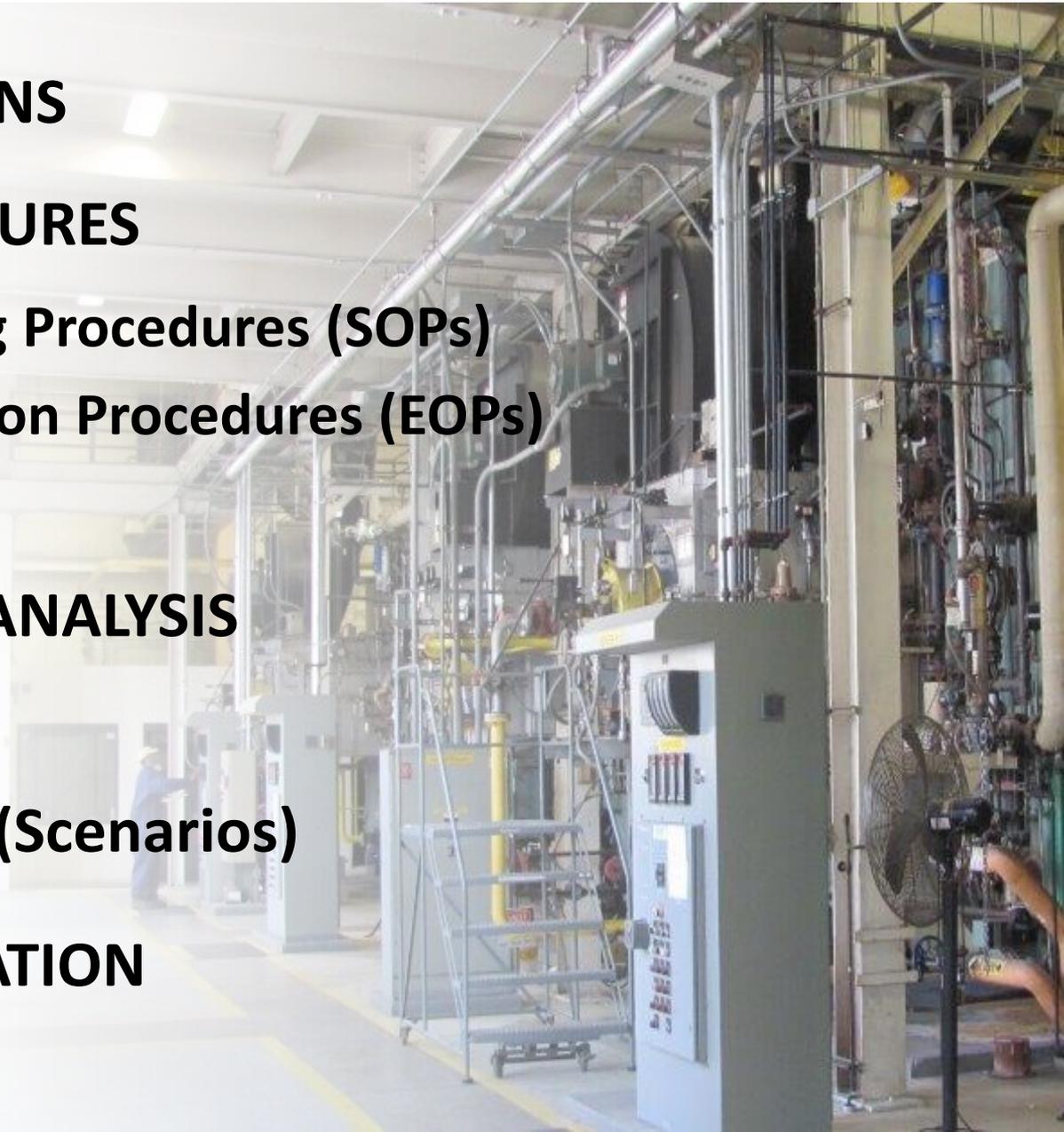
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- **TURNOVER**
  - Retirement
  - Attrition
- **TRAINING**
  - Simple
  - Practical
  - Safety
  - Optimization
- **CULTURE**
  - Heuristic





- **SYSTEM DESCRIPTIONS**
- **OPERATING PROCEDURES**
  - Standard Operating Procedures (SOPs)
  - Emergency Operation Procedures (EOPs)
  - Valve Line-Up Tables
- **ACTIVITY HAZARDS ANALYSIS**
  - EM-385-1 Compliant
- **SYSTEM DRAWINGS (Scenarios)**
- **PHOTO DOCUMENTATION**





# System Descriptions



- PROVIDE BASIC SYSTEM UN
- HIGH LEVEL
- JUST WHAT IS NEEDED TO O
  - Major Equipment
  - Normal Operating Ranges
  - Set Points

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B.

The Natural Gas Burner is designed for the combustion of Natural Gas with an approximate heat input of 71 MMBTU/HR.

C. No. 2 Fuel Oil Burner

1. Function

The burner mixes the combustion air and fuel supply and discharges the air/fuel mixture into the furnace to release heat in the form of combustion.

2. Design Specifications

NO. 2 FUEL OIL BURNER	
MANUFACTURER	JOHN ZINK/TODD
MODEL NUMBER	V54SIGOXXX
CAPACITY (MMBTUH)	69
TURNDOWN (RATIO)	WIP
DESIGN OIL FLOW (PPH)	3,594
DESIGN OIL PRESSURE (PSIG)	150
DESIGN ATOMIZING PRESSURE (PSIG)	80-100

3. Detailed Description

The burner is designed for the combustion of No. 2 Fuel Oil with an approximate heat input of 69 MMBTU/HR. Compressed air or steam can be used as the atomizing medium.

- a. Atomizing Media System

The atomizing media system includes an isolation valve, a pressure regulating valve, and a pressure gauge. It is used to atomize, shear liquid fuel droplets from the main fuel supply. The objective is to deliver the liquid fuel to the combustion zone in a state that closely approximates that of a gaseous fuel.

D. Pilot Gas System

1. Function

The Pilot Gas System supplies natural gas or propane to the burners for light off. Upon ignition of the burner, the pilot system shall be isolated.

2. Detailed Description

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# Operation Procedures



- STANDARD OPERATING PROCEDURES (SOPs)
- EMERGENCY OPERATING PROCEDURES (EOPs)

## DIVISION 2 - OPERATING PROCEDURES

The purpose of operating procedures is to provide safe guidelines for aligning, start up, and shutting down specific components within a system. The following prerequisites, precautions, and limitations apply to all procedural operations.

### 2.1 PREREQUISITES

- Personnel have all read and understand the applicable AHAs for the associated procedure.
- Obtain, read, and understand vendor material as published in the operation and maintenance manuals as it relates to the work to be performed.
- Check lockout/tagout log for tags on any component related the boiler.
- Verify valve lineup, refer to Figures 03-01 thru 05.
- Prior to starting any boiler, the operator shall walkdown the system to verify all components are ready for startup.
- Verify all auxiliary systems and boiler subsystems are ready for operation.
- Verify all material is removed from the boiler, manways are closed, and properly sealed.
- Verify controllers are in MANUAL and in minimum or appropriate startup position.

### 2.2 PRECAUTIONS AND LIMITATIONS

- The water level controller is the most important device in the boiler. The system is equipped with three low water devices. The first is an alarm contact which signals an alarm if the water level drops approximately 6 1/2" below normal water level. As a back-up control, there is another alarm which shuts the boiler down if the water level drops approximately 9 3/4" below the normal water level. At this level, the water would barely be visible in the site glass. IF THERE IS NO WATER IN THE SITE GLASS, DO NOT

### 2.3 ROUTINE SYSTEM OPERATION

- Check the local drum level gauge to assure it is reading in accordance with remote drum level indicators. Blowdown periodically if buildup is observed or discrepancy between level gauge and other indicators is present.
- Assure that the desired boiler water solids concentration and chemistry is continuously maintained.
- Control oxygen content and pH of feedwater strictly.
- Monitor steam temperature.

### 2.4 ROUTINE INSPECTIONS AND ADJUSTMENTS

- A general system walkdown should be done every four hours looking for system leaks, pluggage, unusual noises or any other abnormal condition.
- Any alarm regarding abnormalities such as low drum level, steam pressures, etc., requires CRD attention. Failure to investigate the cause of the alarm and take any necessary action may result in equipment damage or injury to personnel.

### 2.5 EMERGENCY OPERATING PROCEDURES

#### A. Emergency Contact List

Refer the Emergency Contact List located on page 1 of this narrative.

#### B. Upset Operation

Whenever the water level disappears from sight in the water gages, either high or low, the following should be done.

- Secure the burner immediately.
- Close the feedwater valves.



# Activity Hazards Analysis



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## STANDARD OPERATING PROCEDURE

### Boiler Startup

SOP-BS-001

#### Training Requirements/Competent or Qualified Personnel name(s)

Competent/Qualified Personnel:

Mr. Clayton Barber  
Mr. Richard Pfau  
Operational Supervisor

Training Requirements:

Fall protection  
Lift operation  
Hot surface hazards

Seq. #	Job Steps/Hazards	Controls	RAC
<b>0. General Safety Requirements</b>			
0. 1	Falls on same level.	0. 1. 1 Walking areas to be cleared of tripping hazards.	L
0. 2	Falls from another level.	0. 2. 1 Verify that ladders and lifts are set up properly and are properly used per manufacturer's instructions.	L
		0. 2. 2 Have an associate support the base of the ladder.	L
0. 3	Hot equipment.	0. 3. 1 Wear proper clothing and gloves.	L
		0. 3. 2 Use caution around hot piping.	L
0. 4	Fire and explosions.	0. 4. 1 Do not smoke.	L
		0. 4. 2 Never use an open flame to detect gas leaks.	L
		0. 4. 3 Use a leak test solution or other approved methods for leak testing.	L
0. 5	Noise	0. 5. 1 Use hearing protection when inside the Power Plant	L
0. 6	Electric Shock	0. 6. 1 Only licensed electricians with proper OSHA lockout/tag out safety should perform all electrical system work and inspection.	M

EDURE  
Startup  
-BS-001

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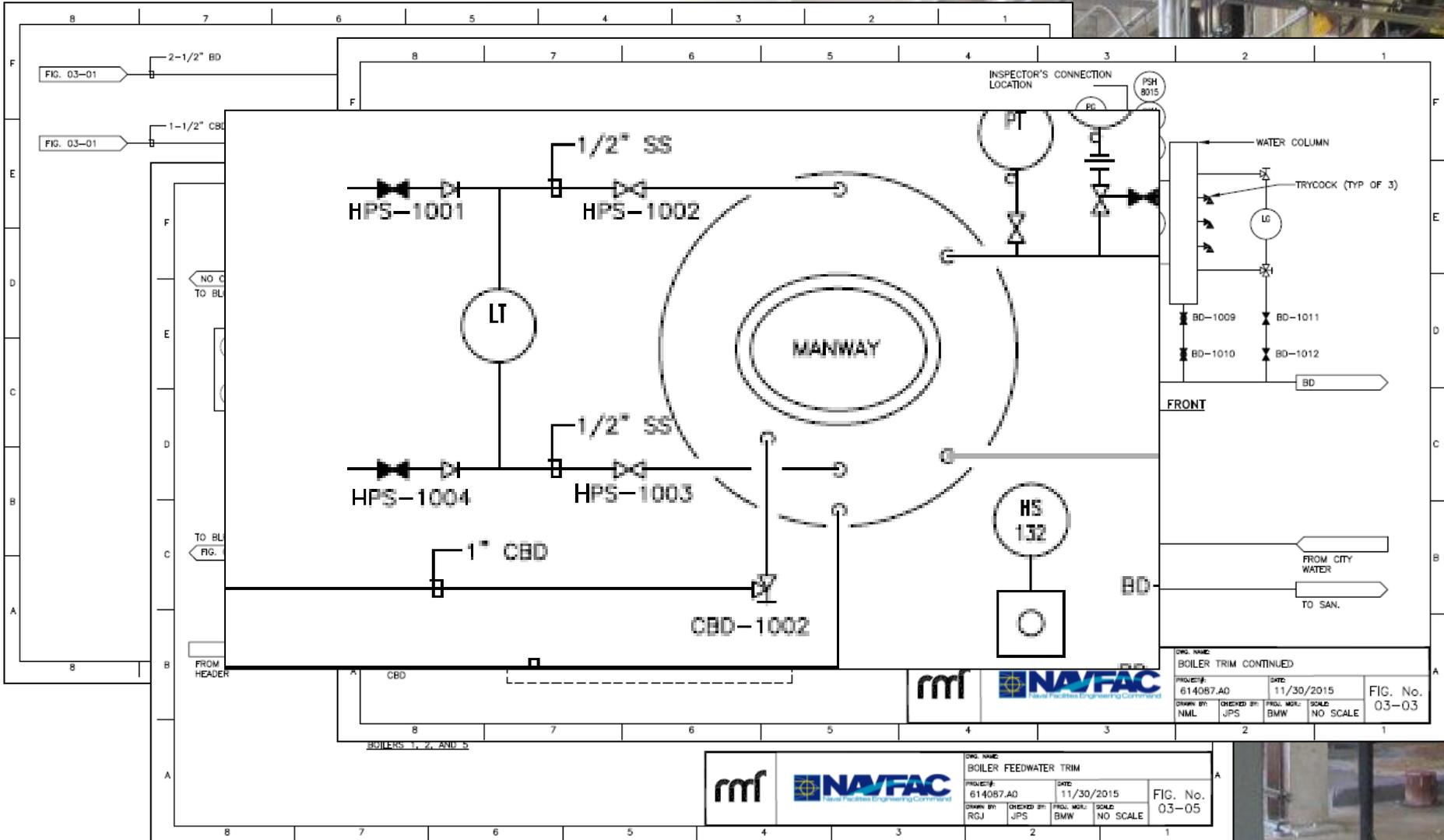
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# System Drawings

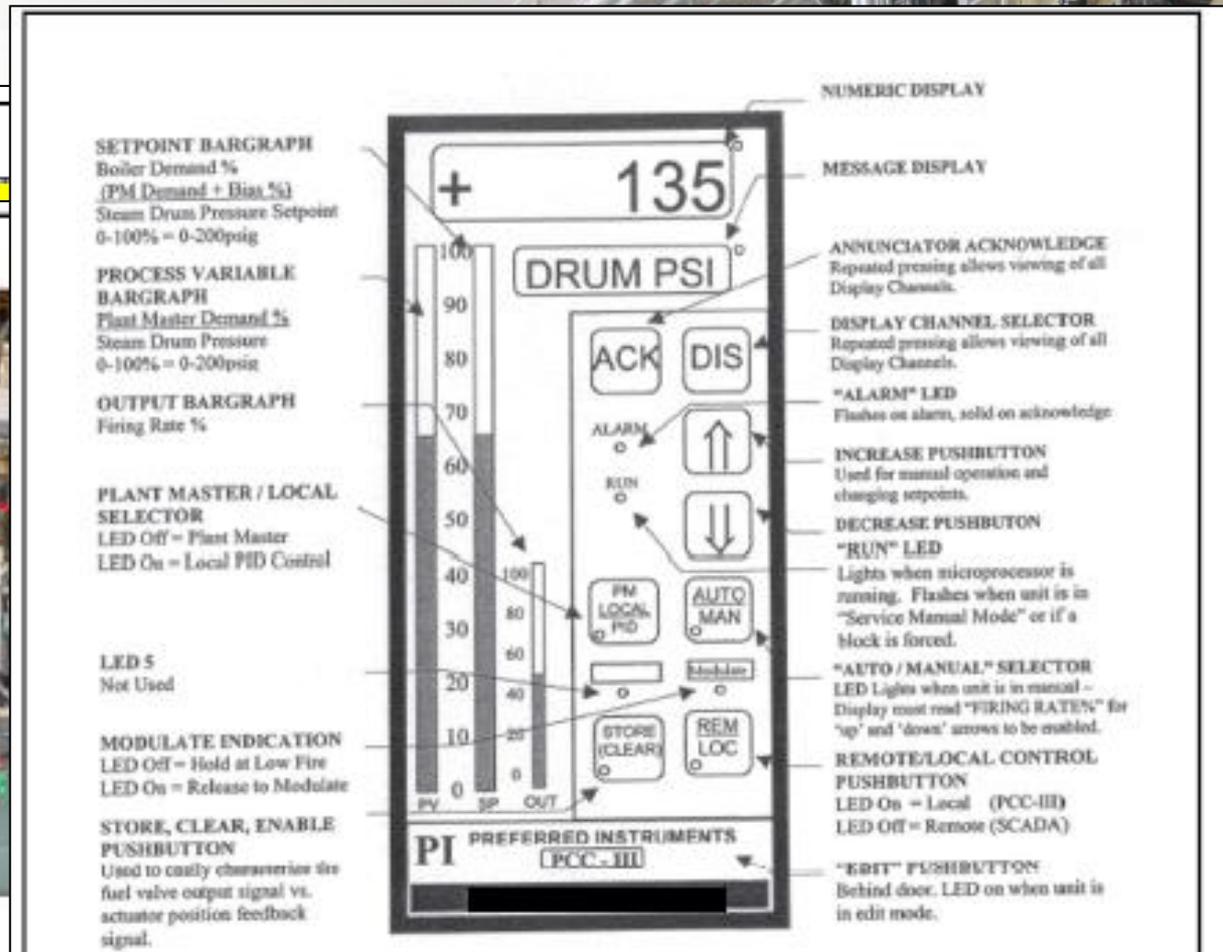
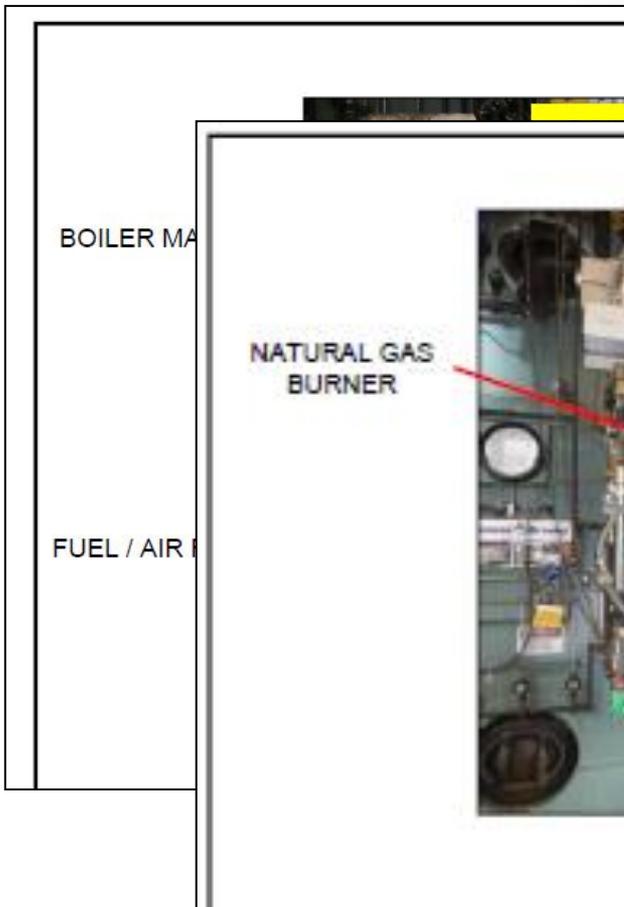


- BASIC DRAWINGS FOR OPERATIONS**





- Pictures of Equipment & Valves
  - Assists in Comprehension
  - Risk of Obsolescence





# Training / Testing



- Hands-On Training
- Test Questions
- Job Performance Measures

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**DIVISION 5 - TRAINING GUIDE**

**5.1 BOILER SYSTEMS**

**A. Control Room Operator**

1. Read entire module.
2. Walkdown system with schematics. Identify locations of valves and equipment in the plant.

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**DIVISION 6 - JOB PERFORMANCE MEASURE**

**6.1 BOILER SYSTEM**

**A.** The operator shall be able to successfully start the boiler.

**B.** The operator shall be able to successfully shutdown the boiler.

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**DIVISION 7 - TEST QUESTIONS**

**7.1 OPERATOR**

**A.** What is the purpose of the Safety Relief Valves?

1. Protect the boiler from over pressurization.
2. Provide the operator with fresh air.
3. Provide a cool looking device.
4. Produce a loud noise.

**B.** What is the name of the system that monitors the safe operation of the boiler?

1. Combustion Controls System (CCS)
2. National Fire Protection Association (NFPA)
3. International Brotherhood of Boilermakers
4. Burner Management System (BMS)

**C.** Can the boilers fire No. 2 fuel oil and natural gas at the same time (co-fire)?

1. True
2. False

**D.** An operator must always make sure the water level is at the NOL before starting the boiler?

1. True
2. False

**E.** What atomizing media should be used during a routine fuel oil startup?

1. Compressed Air
2. Hot Water
3. Mechanical Atomization
4. Steam

**F.** If natural gas is not available, what can be used to ignite the pilot flame?

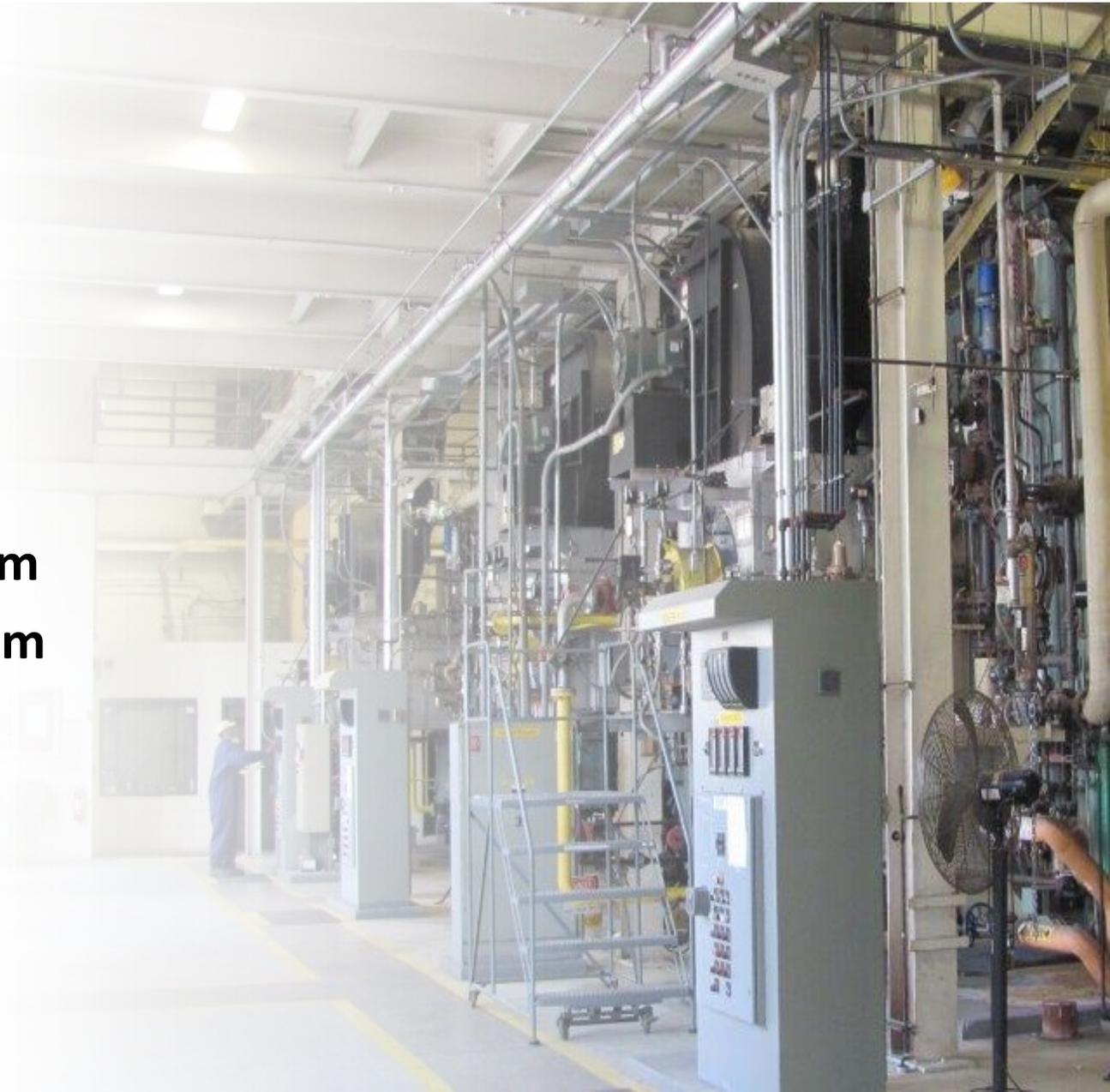
1. Natural Gas
2. O<sub>2</sub>
3. Propane
4. H<sub>2</sub>S

**G.** A boiler firing rate, in automatic, can be controlled by what?

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- **Boiler Systems**
- **Chiller Systems**
- **Fuel Systems**
- **Feedwater System**
- **Condensate System**
- **Breeching System**
- **Chemical Feed System**
- **Fire Protection System**
- **Softwater System**



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