UNION CARBIDE INTERNAL CORRESPONDENCE

CHEMICALS AND PLASTICS

P. O. BOX 471, TEXAS CITY, TEXAS 77590

TO (NAME) Mr. V. F. Villani
COMPANY 2000-4319
LOCATION TECHNICAL CENTER

DATE March 31, 1978

COPY TO
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Mr. R. L. Bighouse, HEC
Mr. R. M. Caswell
Mr. D. J. Grammer
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SUBJECT - Stage II Fuel Oil Conversion Project CPS-1-120

From; C. W. Frankenfield, Production Representative

Mr. R. L. Bighouse has requested endorsement of the proposed basic process package, dated March 10, 1978, which has been reviewed by the Energy Systems production staff at Texas City. Formal endorsement of this package is contingent upon the incorporation of the following additional items as part of the rescoped Stage II project:

1.0 No. 1 Steam Plant - Upgrade

1.1 Addition of oxygen and combustibles analyzers as per Standard ES-101 and ES-102; Sections 3.1.2 and 3.1.3 (Attachments I and II, respectively).

1.2 Correction of deficiencies that are detailed in "Compliance with Boiler Safety Criteria - Energy Systems", dated 2/13/78 (Attachment III).

1.3 Installation of burner cleaning facility for oil burners as listed in Base Master Plan, "Deficiencies in Steam System", Item S-16.

1.4 The design basis are to be in compliance with Standard ES-101 and ES-102.

2.0 No. 2 Steam Plant

2.1 Installation of gas burner management systems on boilers No. 21, No. 22, and No. 23 in accordance with Standard ES-101 (Attachment I).

2.2 Correction of deficiencies that are detailed in "Compliance with Boiler Safety Criteria - Energy Systems", dated 2/13/78 (Attachment III).

2.3 Installation of structure with roof only at boiler fronts for personnel and equipment protection.

3.0 No. 3 Steam Plant

3.1 Installation of a gas burner management system for boiler No. 31 as per Standard ES-101 (Attachment I).

3.2 Correction of deficiencies that are detailed in "Compliance with Boiler Safety Criteria - Energy Systems" (Attachment III).

3.3 Installation of a sump and oil collection system for spills at the pumps and tank area.

3.4 Environmental Protection Permit compliance for fuel oil tankage and No. 36 superheater will require close coordination as there are presently two separate permits in the offering.

4.0 Marine Terminal

4.1 The sulphur analyzer system should include recorders and provisions for continuous on-line blending. Viscosity, as well as sulphur, must be controlled.

4.2 An operator shelter will be required for blending operations.

4.3 An oil collection system will be required for EP compliance.

4.4 A chemical additive system will be needed for blending No. 6 fuel oil.

It is desirable for the rescoped design package to include a detailed listing of the additions and deletions that were approved as changes to the original process package to expedite endorsement.

L. D. Pell
Group Leader

C. W. Frankenfield
Production Representative

/jf

Attachments I, II, III

DESIGN STANDARD FOR FLAME SAFETY SYSTEMS FOR GAS FIRED STEAM GENERATORS

1 INTRODUCTION

1.1 The purpose of this standard is to define the requirements of a flame safety system to be applied in Union Carbide Corporation Chemicals and Plastics locations to provide for safe operation of gas fired steam generators. It is mandatory that this standard be used for the design for new installations including the retrofitting of new fuel burning equipment on existing steam generators. The basis for this standard is the No. 85, and 858 pamphlets of the National Fire Protection Association (NFPA). This standard defines the conceptual system requirements for a safe system, but does not attempt to define details of hardware selection or construction which will vary between applications. It is intended to be used as a reference for the development of detailed design and purchase specifications. It does not apply to tangentially fired furnaces, although some of the requirements are applicable thereto.

Applications of this standard does not eliminate the requirement for obtaining insurance carriers review and approval of the specific installation.

2 SCOPE

2.1 This standard covers flame safety systems for gas fired steam generators which have continuous operator attention. This attention may be centered at the steam generator or in a remote control room with regular surveillance visits by the operator to the steam generator. It is not to be used for fully automatic unattended steam generators, which start-up, modulate the flame on-off without any operator action required.

3 SYSTEM REQUIREMENTS

3.1 COMBUSTION CONTROL

3.1.1 Air/Fuel Ratio - The boiler must be equipped with a combustion control system which maintains the fuel and air inputs in accordance with demand. It shall control these inputs to maintain the air/fuel mixture within safe limits to provide a stable flame. Positive means shall be provided for limiting the fuel valve and air dampers to the minimum and maximum settings as recommended by the burner manufacturer. These settings should be verified by operating tests.

During changes in firing rates the fuel and air flow must be changed together. This should be done such that the air flow leads the fuel flow on load increases and the air flow lags the fuel flow on load decreases.

3.1.2 Oxygen Monitoring - An oxygen analyzer must be provided to monitor each boiler stack. It is recommended that automatic closed loop oxygen control be considered.

3.1.3 Combustibles Monitoring - A combustibles analyzer must be provided to monitor each boiler stack.

3.2 FLAME MONITORING - The system shall have continuous flame monitoring using C&P approved flame detector systems. The flame detectors are to monitor the main flame and the pilot or ignitor flame. The burner shall remain in operation as long as the flame detector "sees" a flame. If two flame detectors are provided for each burner, the burner shall remain in operation as long as one of the two flame detectors "sees" a flame, i.e., both detectors have to lose their flame signal to trip a burner on loss of flame. Each flame detector shall have a meter located at the boiler control station to indicate the detector output signal.

3.3 C&P APPROVED GAS FLAME DETECTORS - The following are the types of detectors that are C&P approved by Energy Systems Applied Technology group, at the date of issue of this standard. A new type that has been more recently developed may be used if it has been reviewed and approved by the Energy System Applied Technology Group. The approved types of detectors for gas firing are:

3.3.1 Repetitive self-checking ultraviolet type detector.

3.3.2 Discriminating infra-red type that does not "see" refractory radiation.

Specific manufacturers and model numbers can be recommended by the Energy Systems Applied Technology Group by request.

3.4 DETECTOR LOCATION - The detectors are to be located such that they can monitor the flame only for their associated burner, not any adjacent burners. The system must include a rigid steady mount for the flame detector. Any adjustable type of mount must have provision for locking in a rigid position so that vibrations will not change the detector aim. Install the detector as closely coupled to the burner front as possible.

3.5 IGNITOR REQUIREMENTS - Each burner shall be equipped with a spark-ignited oil or gas ignited oil or gas ignitor which produces a flame that impinges on the main burner air/fuel mixture. A direct ignition carbon rod ignitor may be used as an alternate. The ignitor shall be capable of supplying sufficient ignition energy for proper lightoff (i.e., 4 to 10 percent of full load burner fuel input).

For burners that only burn gas, the pilot or ignitor may be left on if the ignitor's heat release is at least 10 percent of the full load main burner fuel input.

3.6 FUEL TRIP VALVES Each main burner fuel line shall have steel trip valves with positive closed indication to the safety interlock system to assure that all fuel flow is stopped during the purge and lightoff period. The closed indication devices can be provided as an integral part of the fuel trip valves. Each fuel gas line to the main burners and ignitors shall be equipped with automatic double trip valves with an automatic vent valve between them.

Pilot gas solenoid valves are not required to have "positive closed" indication, since pilot gas fuels are clean, and the solenoid valves have a history of proper closing. If the quality of the pilot gas is questionable, then special provisions should be made to assure proper closing of the valves. Liquid fuel lines may have a single fuel trip valve for each burner. The trip valves should be located as close to the burner as practical while leaving access for operation and maintenance.

3.7 RESIDUE FUEL REQUIREMENTS - As used in this standard, a residue fuel is one that is difficult to burn and is "incinerated" or has its flame stablized by being burned in close proximity to the main burner flame. Each residue burner shall have trip valve(s) that closes when its associated main burner trip valve(s) closes. Residue fuel heat input should not be a significant amount of the total boiler heat input. When residual liquid fuels are burned that may clog up to the safety trip valves, a double valve and vent arrangement should be used. No fuel or process off-gas is to be introduced into a boiler other than through one of its burners.

3.8 PRE-LIGHTOFF REQUIREMENT - The system shall have a purge timer to assure that all steam generator passages are purged properly, with the full trip valves proved closed. The requirements are:

3.8.1 For Single Burner Boilers - The purge must be for eight furnace volume changes at an air flow rate of at least 70 percent of maximum continuous rating (MCR) air flow.

3.8.2 For Multi-Burner Boilers - The purge must last for at least for 5 minutes, at a measured air flow rate of 25 percent of maximum continuous rating (MCR). The purge must provide at least 5 air changes of the furnace volume.

3.9 LIGHTOFF REQUIREMENTS - The pilot or ignitor must be ignited first. The time trial for ignition shall be 10 seconds or less. The main burner shall be permitted to be lighted only after the ignitor flame is proven. The main gas burner shall have a maximum time trial for ignition of 10 seconds.

3.10 TOTAL SHUTDOWN INTERLOCKS - It is mandatory that the following interlocks be provided. These interlocks shall cause a "complete safety shutdown" of the steam generator. A "complete safety shutdown" is defined as a total stoppage of fuel and residue flow to the boiler, requiring an air purge before restarting. Also each of the interlocks should be preceded by an alarm to warn the operator that the parameter in question is approaching a shutdown condition, to the extent that this is practicable.

3.10.1 Low Combustion Air Flow - Actuated when the combustion air flow goes low. For multi-burner boiler trip at 25 percent of full load air flow. For single burner boilers set at manufacturers recommendations depending on design of burner.

3.10.2 Low Fuel Pressure - Actuated when the gas burner pressure falls below the minimum recommended by the burner manufacturer.

3.10.3 High Fuel Pressure - Actuated when the gas supply pressure exceeds the normal supply pressure by 20 percent. This interlock may be omitted if a full capacity safety valve is installed to prevent the gas pressure from exceeding the maximum allowable pressure.

3.10.4 Loss of Fans - For pressurized furnace units, to be actuated upon loss of the forced draft (combustion air) fans; or, for balanced draft units, to be actuated upon loss of the ID fan. Loss of the respective fan may be determined directly, such as by auxiliary contacts on the motor starter, or indirectly by pressure switch on the air flow meter. (see 3.10.1 above). For fired boilers supplied by gas turbine exhaust, the boiler must be tripped on a gas turbine shutdown.

3.10.5 Loss of Control Power - (Including loss of power to the flame safety system).

3.10.6 High Furnace Pressure - Actuated when the furnace pressure goes above normal.

3.10.7 Low Drum Water Level - Actuated when the water level in the steam drum goes below the lowest level gage indication. This trip is to have a time-delay to minimize trips caused by level transients. The length of time-delay is to be calculated to actuate the trip when the water level reaches the bottom of the drum, based on a complete loss of feedwater flow at full load steam flow.

3.11 INDIVIDUAL BURNER SHUTDOWN INTERLOCK - It is mandatory that the following interlock be provided to trip all fuel to the associated burner.

3.11.1 Loss Flame - Actuated to shutdown each individual burner when all of its flame detectors lose their flame proving signal.

3.12 SPECIAL REQUIREMENTS FOR REMOTE BURNER LIGHTOFF - If the burner management system is designed to provide the capability to lightoff the burners from a remote location then the ignitor gas trip valves must be closed when the ignitor gas pressure goes too high or low.

3.13 BYPASSING OF SHUTDOWN INTERLOCKS - Bypasses may be provided on interlocks when it is required to perform maintenance or calibration on the sensing instrumentation. When the interlocks are being bypassed, an alarm shall be actuated to inform the operator of the condition. No interlocks are to be bypasses for lightoff of the burners.

3.14 SPECIAL REQUIREMENTS FOR TWO BURNER BOILERS - Special features are required for two burner units to prevent the air flow from going through both burners where the fuel is going to only one burner and causing a hazardous fuel rich mixture.

3.14.1 Trip of Fuel to One Burner - When the fuel trip valves go closed on one burner then the burner registers just automatically closed to simultaneously shut off the air supply to the burner. An alternate to closing the registers is to close all fuel trip valves on the boiler.

3.14.2 Burner Lightoff Procedures - Special consideration must be given in plant operating procedures requiring operator attention to flame stability during lightoff. Excess air should be maintained at a high value when lighting off an idle burner. The operator should check both burners for proper flame stability before releasing control to the combustion control system.

3.15 TEST CONNECTIONS - Each fuel gas trip valve arrangement (ignitor or main burner) shall have a test connection between the double trip valves. This connection is to be used to check the first fuel gas trip valve for leakage.

4 SYSTEM RELIABILITY

4.1 OPERATION DURING ELECTRICAL POWER LOSS - If the steam generator is designed to operate during an electrical power loss additional equipment must be installed to maintain the flame safety system in operation during the power failure. This shall be provided by a battery system through a dc-ac inverter. For systems that require ac power only for the flame detectors, two inverters must be supplied for each steam generator, with one detector for each burner being on one inverter and the other detector on the second inverter.

Also, all of the critical "startup" and "run" electrical controls shall be either dc type and connected to a dc battery supply, or supplied from the inverters. In cases where it is not necessary to lightoff burners during a power failure, the ignitor transformers purge relays, purge timers, and other lightoff relays may be supplied from the normal ac power supply.

4.2 OPERATION DURING ELECTRICAL VOLTAGE DIPS - The steam generator must operate during electrical voltage dips, and additional equipment must be installed to maintain the flame safety system in operation. This is to be done by using the inverter system described in paragraph 4.1 or using a system with time delay relays to hold the system in operation during the dips.

4.3 TRIP ANNUNCIATORS - Each boiler shall be equipped with an alarm annunciator with an individual alarm point for each boiler trip function. These trip inputs shall have a "first out" capability to positively identify the cause of any boiler trip.

4.4 REQUIRED SYSTEM ALARMS - The following alarms shall be provided.

4.4.1 Fuel Gas Burner Header Pressure - Alarmed for a high or low fuel gas pressure outside of the normal operating range.

4.4.2 Loss of Fan(s) - Alarmed when fan is supposed to be running and is not.

4.4.3 Low Air Flow - Alarmed when total air flow falls below 30 percent of full load air flow.

4.4.4 Loss of Flame - Alarmed for partial or total loss of flame. Where dual detectors are used, it shall alarm for the loss of any one detector. A separate alarm is to be provided for each burner. Also a means must be provided to clear the detector trip alarm for a detector that is out of service.

4.4.5 High or Low Oxygen - Alarmed from a stack O_2 analyzer.

4.4.6 Combustibles - Alarmed for high combustibles in the stack.

4.4.7 High Furnace Pressure - Alarmed to warn the operator of an impending trip because of high furnace pressure.

4.5 RECOMMENDED ALARMS - The following alarms are highly recommended.

4.5.1 Air/Fuel Ratio - Alarmed for an approach to a hazardous fuel rich condition.

4.6 FUEL FLOW CONTROL - A means of limiting the fuel flow during burner light must be provided. This can be provided by an interlock limit switch on the fuel flow control valve requiring it to be in "lightoff position" or providing a small self-contained pressure reducing valve bypassing the main valve. This shall allow only sufficient flow to lightoff the burner(s) at a low firing rate.

This is to minimize the possibility of lighting off burners with too great a flow which could cause a puff or explosion.

5 REVIEW BY INSURANCE CARRIERS

5.1 The actual flame safety system design must go through a design review by the insurance carriers. This review is handled by the Process Safety and Fire Protection Group in CEC. The review procedure will differ depending on the insurance carrier. As examples, for the Industrial Risk Insurers only deviations from this criteria need to be submitted. For Factory Mutual 3 copies of the entire design, including schematic wiring diagrams, list of equipment and system descriptions, must be submitted for review.

DESIGN STANDARD FOR FLAME SAFETY SYSTEMS FOR OIL FIRED STEAM GENERATORS

1 INTRODUCTION

1.1 The purpose of this standard is to define the requirements of a flame safety system to be applied in Union Carbide Corporation Chemicals and Plastics locations to provide for safe operation of oil fired steam generators. It is mandatory that this standard be used for the design for new installations including the retrofitting of new fuel burning equipment on existing steam generators. The basis for this standard is the No. 85, and 85D pamphlets of the National Fire Protection Association (NFPA). This standard defines the conceptual system requirements for a safe system, but does not attempt to define details of hardware selection or construction which will vary between applications. It is intended to be used as a reference for the development of detailed design and purchase specifications. It does not apply to tangentially fired furnaces, although some of the requirements are applicable thereto.

Applications of this standard does not eliminate the requirement for obtaining insurance carriers review and approval of the specific installation.

2 SCOPE

2.1 This standard covers flame safety systems for oil fired steam generators which have continuous operator attention. This attention may be centered at the steam generator or in a remote control room with regular surveillance visits by the operator to the steam generator. It is not to be used for fully automatic unattended steam generators, which start up, modulate the flame on-off without any operator action required.

3 SYSTEM REQUIREMENTS

3.1 COMBUSTION CONTROL

3.1.1 Air/Fuel Ratio - The boiler must be equipped with a combustion control system which maintains the fuel and air inputs in accordance with demand. It shall control these inputs to maintain the air/fuel mixture within safe limits to provide a stable, flame. Positive means shall be provided for limiting the fuel valve and air dampers to the minimum and maximum settings as recommended by the burner manufacturer. These settings should be verified by operating tests.

During changes in firing rates the fuel and air flow must be changed together. This should be done such that the air flow leads the fuel flow on load increases and the air flow lags the fuel flow on load decreases.

3.1.2 Oxygen Monitoring - An oxygen analyzer must be provided to monitor each boiler stack. It is recommended that automatic closed loop oxygen control be considered.

3.1.3 Combustibles Monitoring - A combustibles analyzer must be provided to monitor each boiler stack

3.2 FLAME MONITORING - The system shall have continuous flame monitoring using two C&P approved flame detector systems for each burner.

Both detectors shall monitor the main flame and at least one of the two shall monitor the pilot or ignitor flame. The burner shall remain in operation as long as one of the two flame detectors "sees" a flame, i.e., both detectors have to lose their flame signal to trip a burner on loss of flame. Each flame detector shall have a meter located at the boiler control station to indicate the detector output signal.

3.3 C&P APPROVED OIL FLAME DETECTORS - The following are the types of detectors that are C&P approved by Energy Systems Applied Technology Group at the date of issue of this standard. A new type that has been more recently developed may be used if it has been reviewed and approved by the Energy System Technology Group. The approved types of detectors for oil firing are:

3.3.1 Repetitive self-checking ultraviolet type detector.

3.3.2 Discriminating infra-red type that does not "see" refractory radiation.

3.3.3 Discriminating visible light type that does not "see" refractory radiation. If this type of detector is used on an oil burner with a gas pilot, it must be supplemented by an ultraviolet or infra-red type, since a gas flame does not emit sufficient visible light to actuate a visible light type detector. Specific manufacturers and model numbers can be recommended by the Energy Systems Applied Technology Group by request.

3.4 DETECTOR LOCATION - The detectors are to be located such that they can monitor the flame only for their associated burner, not any adjacent burners. The system must include a rigid steady mount for the flame detector. Any adjustable type of mount must have provision for locking in a rigid position so that vibrations will not change the detector aim. Install the detector as closely coupled to the burner front as possible.

3.5 IGNITOR REQUIREMENTS - Each burner shall be equipped with a spark-ignited oil or gas ignitor which produces a flame that impinges on the main burner air/fuel mixture. A direct ignition carbon rod ignitor may be used as an alternate. The ignitor shall be capable of supplying sufficient ignition energy for proper light off (i.e., 4 to 10 percent of full load burner fuel input). The ignitor must be turned off after the main burner is ignited.

3.6 FUEL TRIP VALVES - Each main burner fuel line shall have a steel trip valve with positive closed indication to the safety interlock system to assure that all fuel flow is stopped during the purge and lightoff period. The closed indication devices can be provided as an integral part of the fuel trip valves. If gas pilots are used, they shall have automatic double trip valves with an automatic vent valve between them. Pilot gas solenoid valves are not required to have "positive closed" indication, since pilot gas fuels are clean, and the solenoid valves have a history of proper closing. If the quality of the pilot gas is questionable, then special provisions should be made to assure proper closing of the valves. Liquid fuel lines may have a single fuel trip valve for each burner. The trip valves should be located as close to the burner as practical while leaving access for operation and maintenance.

3.7 RESIDUE FUEL REQUIREMENTS - As used in this standard, a residue fuel is one that is difficult to burn and is "incinerated" or has its flame stablized by being burned in close proximity to the main burner flame. Each residue burner shall have trip valve(s) that closes when its associated main burner trip valve(s) closes. Residue fuel heat input should not be a significant amount of the total boiler heat input. When residual liquid fuels are burned that may clog up to the safety trip valves, a double valve and vent arrangement should be used. No fuel or process off-gas is to be introduced into a boiler other than through one of its burners.

3.8 PRE-LIGHTOFF REQUIREMENT - The system shall have a purge timer to assure that all steam generator passages are purged properly with the full trip valves proved closed. The requirements are:

3.8.1 For Single Burner Boilers - The purge must be for eight furnace volume changes at an air flow rate of at least 70 percent of maximum continuous rating (MCR) air flow.

3.8.2 For Multi-Burner Boilers - The purge must last for at least 5 minutes, at a measured air flow rate of 25 percent of maximum continuous rating (MCR). The purge must provide at least 5 air changes of the furnace volume.

3.9 LIGHTOFF REQUIREMENTS - The pilot or ignitor must be ignited first. The time trial for ignition shall be 10 seconds or less. The main burner shall be permitted to be lighted only after the ignitor flame is proven. The main burner shall have a maximum time trial for ignition of 15 seconds.

3.10 STARTUP INTERLOCK - For firing fuel oils that required heating to obtain proper viscosity for burning, a low fuel oil temperature interlock must be provided to prevent main burner lightoff until the fuel oil viscosity is within the range specified by the burner manufacturer. After the first main oil burner is in operation, this interlock will be used only for alarm purposes.

3.11 TOTAL SHUTDOWN INTERLOCKS - It is mandatory that the following interlocks be provided. These interlocks shall cause a "complete safety shutdown" of the steam generator. A "complete safety shutdown" is defined as a total stoppage of fuel and residue flow to the boiler, requiring an air purge before restarting. Also each of the interlocks should be preceded by an alarm to warn the operator that the parameter in question is approaching a shutdown condition, to the extent that this is practicable.

3.11.1 Low Combustion Air Flow - Actuated when the combustion air flow goes low. For multi-burner boilers trip at 25 percent of full load air flow. For single burner boilers set at manufacturers recommendations depending on design of burner.

3.11.2 Low Fuel Pressure - Actuated when the oil burner pressure falls below the minimum recommended by the burner manufacturer.

3.11.3 Loss of Atomizing Medium - When there is one controller for all the burners on a boiler, the total shutdown must be actuated by sensors when proper atomization is not being accomplished. The type of sensor depends on the burner design. Some methods to be considered are:

A flow switch or a differential pressure switch across an orifice.

For a dp controlled burner a differential pressure switch to assure that the atomizing pressure is kept the proper amount above the fuel oil pressure can be used. On some burners the proper atomizing pressure will be lower than the oil pressure at high loads, then the dp switch cannot be used. A pressure switch should be used in this case.

3.11.4 Loss of Fans - For pressurized furnace units, to be actuated upon loss of the forced draft (combustion air) fans; or, for balanced draft units, to be actuated upon loss of the ID fan. Loss of the respective fan may be determined directly, such as by auxiliary contacts on the motor starter, or indirectly by pressure switch on the air flow meter. (See 3.11.1 above). For fired boilers supplied by gas turbine exhaust, the boiler must be tripped on a gas turbine shutdown.

3.11.5 Loss of Control Power - (Including loss of power to the flame safety system).

3.11.6 High Furnace Pressure - Actuated when the furnace pressure goes above normal.

3.11.7 Low Drum Water Level - Actuated when the water level in the steam drum goes below the lowest level gage indication. This trip is to have a time delay to minimize trips caused by level transients. The length of time delay is to be calculated to actuate the trip when the water level reaches the bottom of the drum, based on a complete loss of feedwater flow at full load steam flow.

3.12 INDIVIDUAL BURNER SHUTDOWN INTERLOCKS - It is mandatory that the following interlocks be provided to trip all fuel to the associated burner.

3.12.1 Loss of Flame - Actuated to shut down each individual burner when both of its flame detectors lose their flame proving signal.

3.12.2 Loss of Atomizing Medium - When there is an individual atomizing control for each burner, the burner shutdown is to be actuated by sensors when proper atomization is not being accomplished. See 3.11.3 for suggested methods of monitoring the atomizing medium.

3.13 SPECIAL REQUIREMENTS FOR REMOTE BURNER LIGHTOFF - If the burner management system is designed to provide the capability to lightoff the burners from a remote location, the following trip devices must be provided.

3.13.1 Ignitor Pressure - The ignitor gas trip valves must be closed when the ignitor pressure goes high or low.

3.13.2 Oil Ignitor Atomization - If an oil ignitor which requires atomizing fluid is used, then the ignitor trip valves must be closed for a loss of ignitor atomization.

3.14 BYPASSING OF SHUTDOWN INTERLOCKS - Bypasses may be provided on interlocks when it is required to perform maintenance or calibration on the sensing instrumentation. When the interlocks are being bypassed, an alarm shall be actuated to inform the operator of the condition.

No interlocks are to be bypassed for lightoff of the burners.

3.15 SPECIAL REQUIREMENTS FOR TWO BURNER BOILERS - Special features are required for two burner units to prevent the air flow from going through both burners where the fuel is going to only one burner and causing a hazardous fuel rich mixture.

3.15.1 Trip of Fuel to One Burner - When the fuel trip valves go closed on one burner then the burner registers must automatically close to simultaneously shut off the air supply to the burner. An alternate to closing the registers is to close all fuel trip valves on the boiler.

3.15.2 Burner Lightoff Procedures - Specfal consideration must be given in plant operating procedures requiring operator attention to flame stability during lightoff. Excess air should be maintained at a high value when lighting off an idle burner. The operator should check both burners for proper flame stability before releasing control to the combustion control system.

3.16 TEST CONNECTIONS - Each pilot fuel gas trip valve arrangement shall have a test connection between the double trip valves. This connection is to be used to check the first fuel gas trip valve for leakage.

4 SYSTEM RELIABILITY

4.1 OPERATION DURING ELECTRICAL POWER LOSS - If the steam generator is designed to operate during an electrical power loss additional equipment must be installed to maintain the flame safety system in operation during the power failure. This shall be provided by a battery system through a dc-ac inverter. For systems that require ac power only for the flame detectors, two inverters must be supplied for each steam generator, with one detector for each burner being on one inverter and the other detector on the second inverter.

Also, all of the critical "startup" and "run" electrical controls shall be either the dc type and connected to a dc battery supply, or supplied from the inverters. In cases where it is not necessary to light off burners during a power failure, the ignitor transformers purge relays, purge timers, and other lightoff relays may be supplied from the normal ac power supply.

4.2 OPERATION DURING ELECTRICAL VOLTAGE DIPS - The steam generator must operate during electrical voltage dips, and additional equipment must be installed to maintain the flame safety system in operation. This is to be done by using the inverter system described in paragraph 4.1 or using a system with time delay relays to hold the system in operation during the dips.

4.3 ATOMIZING MEDIUM LOSS - One of the areas with a great potential of causing trips is that associated with the differential pressure between the atomizing medium and the fuel oil. When operating changes are made to shut down or lightoff burners, the operator must be careful not to cause a swing of the atomizing medium pressure causing a shutdown.

To minimize the possibility of these pressure swings it is recommended that each burner be furnished with its own self-contained pressure control valve to regulate atomizing medium pressure. This can be done as inexpensively as furnishing a pneumatic motor valve and control loop for the entire unit. With this type of system, variation in the atomizing medium pressure only affects one burner. Then the loss of atomizing medium trip device can then be installed on each burner, so that only the affected burner will trip on upsets.

Consideration should also be given to installing a gas bag accumulator or surge tank with an inert gas supply to maintain the fuel oil header pressure at a constant pressure when individual burners are lit or shut off.

4.4 TRIP ANNUNCIATORS - Each boiler shall be equipped with an alarm annunciator with an individual alarm point for each boiler trip function. These trip inputs shall have a "first out" capability to positively identify the cause of any boiler trip.

4.5 REQUIRED SYSTEM ALARMS - The following alarms shall be provided.

4.5.1 Low Fuel Oil Burner Header Pressure - Alarmed to warn the operator of an impending trip.

4.5.2 Loss of Atomizing Medium - One alarm to warn the operator on an impending trip for loss of atomization.

4.5.3 Loss of Fan(s) - Alarmed when fan is supposed to be running and is not.

4.5.4 Low Air Flow - Alarmed when total air flow falls below 30 percent of full load air flow.

4.5.5 Loss of Flame - Alarmed for partial or total loss of flame, and it shall alarm for the loss of any one detector. A separate alarm is to be provided for each burner. Also a means must be provided to clear the detector trip alarm when the detector is out of service.

4.5.6 High Furnace Pressure - Alarmed to warn the operator of an impending trip because of high furnace pressure.

4.5.7 High or Low Oxygen - Alarmed from stack O_2 analyzer.

4.5.8 Combustibles - Alarmed for high combustibles in the stack.

4.6 RECOMMENDED ALARMS - The following alarms are highly recommended.

4.6.1 High Fuel Oil Viscosity - For fuel oils which must be heated or have a varying viscosity an alarm should be provided. This can be alarmed for low fuel oil temperature for fuel oils with constant viscosity. A viscosity meter should be used for fuel oils with varying viscosity.

4.6.2 Air/Fuel Ratio - Alarmed for an approach to a hazardous fuel rich condition.

4.7 FUEL FLOW CONTROL - A means of limiting the fuel flow during burner light must be provided. This can be provided by an interlock limit switch on the fuel flow control valve requiring it to be in the "lightoff position" or providing a small self-contained pressure reducing valve bypassing the main valve. This shall allow only sufficient flow to lightoff the burner(s) at a low firing rate.

This is to minimize the possibilibty of lighting off burners with too great a flow which could cause a puff or explosion.

5 REVIEW BY INSURANCE CARRIERS

5.1 The actual flame safety system design must go through a design review by the insurance carriers. This review is handlec by the Process Safety and Fire Protection Group in CEC. The review procedure will differ depending on the insurance carrier. As examples, for the Industrial Risk Insurers only deviations from this criteria need to be submitted. For Factory Mutual 3 copies of the entire design, including schematic wiring diagrams, list of equipment and system descriptions, must be sumitted for review.

ATTACHMENT III UC 149-2

UNION CARBIDE INTERNAL CORRESPONDENCE

CHEMICALS AND PLASTICS

P. O. BOX 471, TEXAS CITY, TEXAS 77590

TO (NAME) Mr. L. D. Pell
COMPANY Mr. G. F. Painter
LOCATION TEXAS CITY PLANT

DATE February 13, 1978

COPY TO

SUBJECT Compliance with Boiler Safety Criteria - Energy Systems

Attached please find a document presenting the Energy Systems Operation Team's "Fixed Boiler Mandatory Safety Criteria," and the status of compliance of the sixteen boilers and one superheater in Energy Systems at Texas City.

C. W. Frankenfield

C. W. Frankenfield

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SUMMARY MATRIX

COMPLIANCE WITH BOILER SAFETY CRITERIA

TEXAS CITY ENERGY SYSTEMS - FEBRUARY 13, 1978

Criteria Number	BOILER COMPLIANCE STATUS							
	1-8	21-22	23	31	32	33-34	35	41
A-1	4Q78	CPS1-210	CPS1-210	CPS1-210		COMP	COMP	
A-2	CPS1-210	CPS1-210	CPS1-210	CPS1-210		CPS-210	CPS-210	
A-3	WBP	WBP	WBP	WBP		WBP		
A-4	WBP		WBP					
A-5	COMP	COMP	COMP	COMP	COMP	COMP		COMP
A-6	COMP	4Q78	4Q78	4Q78		COMP		
A-7	COMP							
A-8	COMP							
A-9	COMP	COMP	COMP	COMP		COMP		COMP
A-10	COMP			COMP				
A-11	COMP	COMP	COMP	COMP	COMP	COMP	COMP	COMP
A-12	COMP	COMP	COMP	COMP	COMP	COMP	COMP	COMP
A-13	COMP	COMP	COMP	WBP	WBP	WBP	WBP	WBP
A-14	4Q78	CPS1-210	CPS1-210	CPS1-210			CPS1-045	
A-15						COMP		
B-1	COMP	COMP	COMP	COMP	COMP	COMP	COMP	COMP
B-2	COMP	COMP	COMP	COMP	COMP	COMP	COMP	COMP
B-3	COMP	COMP	COMP	COMP	COMP	COMP	COMP	COMP
B-4	CPS1-210	CPS1-210	CPS1-210	CPS1-210		CPS1-210	CPS1-210	
B-5	COMP	COMP	COMP	COMP		COMP		
B-6	COMP	CPS1-210	CPS1-210	CPS1-210		COMP		
B-7	COMP	COMP	COMP	COMP	COMP	COMP	COMP	COMP
B-8	COMP	CPS1-210	CPS1-210	CPS1-210				
B-9	COMP	COMP	COMP	COMP	COMP	COMP	COMP	COMP
B-10	COMP	CPS1-210	CPS1-210	CPS1-210		CPS1-210	CPS1-045	
B-11	COMP	CPS1-210	COMP	COMP		COMP	COMP	
B-12	COMP	CPS1-210	COMP	COMP		COMP	COMP	
B-13	4Q78	COMP	COMP	CPS1-210	COMP	COMP	COMP	COMP
B-14	COMP	COMP	COMP	COMP	COMP	COMP	COMP	COMP
C-1	4Q78		NAP	4Q78				
C-2	4Q78							
C-3								
C-4	COMP	COMP	COMP	COMP	COMP	COMP	COMP	COMP
C-5	2Q78							
C-6	COMP	COMP	COMP	COMP	COMP	COMP	COMP	COMP
C-7	COMP	COMP	COMP	COMP	COMP	COMP	COMP	COMP
C-8	COMP	COMP	COMP	COMP	COMP	COMP	COMP	COMP
E-1	COMP	COMP	COMP	COMP	COMP	COMP	COMP	COMP
E-2	COMP	COMP	COMP	COMP	COMP	COMP	COMP	COMP
E-3	COMP	COMP	COMP	COMP	COMP	COMP	COMP	COMP

COMPLIANCE WITH BOILER SAFETY CRITERIA

TEXAS CITY ENERGY SYSTEMS - FEBRUARY 13, 1978

LEGEND FOR COMPLIANCE STATUS	BLANK - Criteria Not Applicable COMP - Boiler(s) in compliance DATE - Compliance date to be obtained through completion of a project WBP - Working budget project needed to obtain compliance CPS1-210 - Will attempt to include in Stage II Fuel Conversion rescope to obtain compliance with criteria CPS1-045 - Item should be included in a scope change of this project, to obtain compliance with the criteria NAP - No action planned

ENERGY SYSTEMS OPERATIONS DEPARTMENT

TEXAS CITY PLANT

FIXED BOILER MANDATORY SAFETY CRITERIA

A. Equipment

1. Each Boiler will be equipped with a burner management system. The system will be of such quality as to permit operation in the trip mode and will be operated in that mode.

Compliance Status

Boilers #1 - #8: These boilers are generally in compliance with this criteria. The present burner management system allows the boilers to operate in the trip mode most of the time. Operator initiated bypassing of the system does occur because of equipment problems. A project, CPS 1-210, will correct the problem by the fourth quarter of 1978.

Boilers #21, #22, & #23: These boilers are not in compliance with the criteria. They have no burner management system. Project CPS 1-210 will address this problem.

Boiler #31: This boiler has a flame management system, but is not considered reliable. The stage II fuel conversion (CPS 1-210) project will address itself to this problem. Completion of boilers #21, #22, #23, and #31 is scheduled for the second quarter of 1979.

Boilers #33 & #34: These boilers have flame detectors monitoring their duct burners. These boilers are in compliance with the intent of this criteria.

No. 35 Superheater: This device is equipped with a burner management system which does operate in the trip mode.

Boilers #32 & #41: These boilers are unfired and therefore not covered by this criteria.

2. Each boiler will have a reliable combustibles analyzer on its flue gas outlet.

Compliance Status

None of the boilers at Texas City are equipped with combustibles analyzers in their stacks with the exception of #31. The combustibles analyzer in #31 is not considered reliable.

2. Compliance Status (Cont'd)

Presently there are no plans to install combustibles analyzers in any of the boiler flue gas outlets.

To bring Texas City Energy Systems' boilers into compliance with this criteria, combustibles analyzers will need to be installed in all boilers. This project will be requested as part of the Stage II Fuel Conversion (CPS 1-210) rescope, along with stack oxygen analyzers (See B.4).

3. Each fuel gas line supplying a boiler or set of boilers shall have a liquid knock-out pot in the line. The pot shall be equipped with a high-level alarm and a high-high level fuel gas trip to prevent liquid carryover to the boiler burners. The only exception to this will be where fuel gas is purchased from a public utility distribution system and can be certified as being dry.

No toxic or dangerous vapor residue will be added to the principal fuel gas system which could prevent proper removal of liquid from knock-out pots.

Compliance Status

Boilers #1 - #8: These boilers are not in compliance with the criteria.

The fuel lines supplying this set of boilers have entrainment separators. Further, the individual fuel line to each boiler has a knock-out pot in it. Each vertical row of burners has a liquid drain leg in the fuel line. All liquid draining operations are done manually. There are no level indications, alarms, or trips. Draining is not done routinely as there is vinyl chloride in the fuel and pot draining would create a safety hazard.

In order to be in full compliance with this criteria, the vinyl chloride stream would need to be removed from the fuel header and piped to a boiler to be burned as a residue. This would allow draining of the main fuel gas system knock-out pots. Each of the knock-out pots would then need to be equipped with high-level alarms and shutdowns.

Further thought needs to be given to putting knock-out pot liquid level in as a trip function. A false (or real) trip of all eight boilers may create a far greater safety hazard.

A practical approach to bringing boilers #1 - #8 into compliance with the intent of this criteria would be to install a level indicating controller, high-level alarm, and drain system on the main fuel header pots. Also remove the vinyl chloride from the fuel gas and incinerate it at the unit. This system would allow manual draining of the knock-out pots at the boilers when high levels were encountered in the main fuel header pots and would not cause untimely boiler trips.

3. Compliance Status (Cont'd)

Boilers #21 - #23, #31 - #35, & #41: Boilers #32 and #41 are unfired and therefore unaffected by this criteria.

The remaining boilers' fuel systems are equipped with knock-out pots. The pots are drained manually on a routine basis. They are not equipped with high-level alarms or trips.

All comments made on boilers #1 - #8, concerning compliance and obtaining it, apply here also, excepting those dealing with vinyl chloride.

4. Waste gaseous fuels (not hydrogen-methane, which is considered a "principal" fuel) received from chemical production units to be disposed of by burning or incinerating in a boiler, must be handled through a proper system which includes:

a. A pipeline dedicated to transporting the waste stream

b. Flame arresting equipment in the pipeline

c. Liquid knock-out pot with high-level alarm and high-high level shutdown (see A.3 above).

d. A burner system designed to properly dispose of the waste gases (not an open ended pipe inserted into the boiler).

e. All necessary equipment in accord with safety design criteria for fuels and boiler fuel control

Compliance Status

Boilers #1 - #8: The only waste gaseous fuel handled by these boilers is vinyl chloride (as discussed in Item 3). This stream is totally out of compliance with the criteria. To bring boilers #1 - #8 into compliance a system as described above should be installed and the vinyl chloride removed from the fuel header.

Boiler #23: This boiler handles a waste organic acid and nitrogen stream, which is not in compliance with the criteria. A request has been submitted to Engineering to develop a safer system for disposal of this stream.

None of the remaining boilers handle waste gas streams.

5. Each boiler will have two independent level indicating gauges or glasses on its steam drum. One of the level gauges may be a remote level indication at the control panel.

5. Compliance Status

All Texas City Energy Systems boilers are in compliance with this criteria.

6. Each boiler will have alarms for high drum water level and low drum water level, and a trip on low-low drum water level. A time delay trip on the low level alarm may take the place of the low-low level trip.

Compliance Status

Boilers #1 - #8: All of these boilers are equipped with high and low drum level alarms and low-low drum level trips. No further action is needed to bring these boilers into compliance.

Boilers #21 - #23: All of these boilers are equipped with high and low level alarms, but no trips. A low-low level drum trip is needed to come into compliance, and is included in project 930-1928.

Boilers #31 - #34: All of these boilers are equipped with high and low drum level alarms. Boilers #31 and #32 do not have low-low drum level trips. Boilers #33 and #34 have controls which trip the auxiliary burners in the turbine exhaust duct on low-low drum level.

To come into compliance with the criteria, boiler #31 will have to be equipped with a low-low drum level trip as part of 930-1928. Boiler #32 need not be equipped with a low drum level trip as it is a waste heat boiler and would sustain no damage should it lose its water or circulation. The same is true of #33 and #34 once the duct burners are tripped.

Boiler #41: This boiler is equipped with high and low drum level alarms. Since it is an unfired waste heat boiler, it does not need a trip.

7. Provisions shall be made to ensure a dry steam supply to all automized oil/liquid residue burners.

Compliance Status

Texas City Energy Systems is in compliance with this criteria.

Steam automization is presently used only on the oil burners in boilers #1 - #8. The steam used is supplied by the 200 lb. steam system which handles only 200 lb. superheated steam.

8. Means shall be provided to safely relieve or prevent excessive hydrostatic pressure buildup in heated liquid fuel lines caused by entrapment during periods of no flow.

Compliance Status

The Texas City Energy Systems is in compliance with this criteria.

Boilers #1 - #8 are the only Texas City boilers which use oil. The oil heaters supplying these boilers are provided with relief valves to prevent overpressuring. The fuel line itself is not heated.

9. Boilers must be equipped with fuel valves which will provide positive shutoff to all liquid and gaseous fuels in the event of a boiler trip.

Compliance Status

All Energy Systems boilers are equipped with interceptor valves which shut off the fuel in the event of a boiler trip.

10. Whenever any trip control function is bypassed, a positive indicator will be provided to define the fact that the function is bypassed.

Compliance Status

Boilers #1 - #8: These boilers have trip bypasses and when a trip is bypassed a light comes on to indicate that a function is in the bypass mode. These boilers are in compliance.

Boiler #31: The fire eyes on boiler #31 can be bypassed, and a local indication comes on to indicate the function is bypassed.

Boilers #21 - #23, #32 - #34, & #41: The trip functions on these boilers cannot be bypassed; therefore, there is no indication.

Generally, Texas City Energy Systems boilers are in compliance with the criteria.

11. No boiler control rooms shall contain direct connected process leads which could fail and cause injury to personnel in that control room or result in need to evacuate the control room.

Compliance Status

All Texas City Energy Systems boiler control rooms are in compliance.

There is a possible exception to this criteria. It is when there is a loss of all instrument air and nitrogen is supplied as instrument air. When this occurs, it is necessary to provide sufficient ventilation to prevent an oxygen shortage in the control room. Since this only occurs in rare emergency situations, no further corrective action is needed over existing procedures.

12. An independent and reliable source of emergency illumination shall be provided at the boiler control boards.

Compliance Status

All Texas City Energy Systems powerhouses are in compliance with this criteria.

13. A first-out alarm system will be provided that monitors all shutdown devices on a boiler, to aid in troubleshooting.

Compliance Status:

Boilers #1 - #8 & #21 - #23: These boilers are equipped with a first-out alarm system for each boiler.

Boilers #31 - #35 & #41: None of these boilers are equipped with first-out alarm systems. The Stage II Fuel Conversion Project (CPS 1-210) presently underway may bring some of these boilers into compliance, and as plant load continues to shrink, some of these boilers may be taken out of service. Thus, no specific plans for compliance should be made now, but as boilers are renovated or fuels converted, their control revisions should be scoped to bring them into compliance with this criteria.

14. Each boiler will be instrumented with a lead-lag/fuel-air control system, in which air leads fuel for an increase in load and air lags fuel for a decrease in load. This system will include all fuels being fired on each boiler. Small package boilers may be satisfactorily equipped with a standard mechanical parallel-positioning control system.

Compliance Status

Boilers #1 - #8: These boilers do not presently have lead-lag fuel system but are being equipped with such a system as part of CPS 1-210. This will bring the No. 1 Powerhouse into compliance with the criteria by the end of 1978.

Boilers #21 - #23, #31 - & #41: The criteria does not apply to boilers #32 and #41 as they are unfired. It also does not apply to #33 and #34 as their air supply is a fixed volume, produced by their gas turbines. The same is true of #23 and #31 when they are using turbine exhaust.

The criteria does apply to the following boilers: #21 and #22, #23, #31 and #35 when using fan or natural draft. None of these boilers have lead-lag control systems. To comply with the criteria such a system is recommended for installation on each of the above-mentioned boilers.

15. Any boiler that is equipped with a forced circulation pump as the means of internal circulation shall have control systems which trip the boiler on low flow or on low differential pressure across the pump.

Compliance Status

Boilers #32 - #34 and #41: These boilers have forced circulation pumps. #33 and #34 will trip the auxiliary duct burners upon loss of a circulating pump. Boilers #32 and #41 will not trip, as a trip is not needed to protect the boiler since it is constructed to withstand the turbine exhaust temperature without water in it. The same is true at #33 and #34 when the duct burners are tripped.

Texas City Energy Systems is in compliance with this criteria.

B. Procedures - Start-Up

1. Each plant will have detailed procedures for boiler start-up and shutdown, dated and maintained current, in accordance with C&P policy.

Compliance Status

Texas City Energy Systems' boilers are in compliance with this criteria.

2. Each plant will have a start-up checklist, to be followed during each cold start-up and initialed stepwise by operating personnel. An abbreviated checklist will be utilized for hot restarts following a trip.

Compliance Status

Texas City Energy Systems is in compliance with this criteria.

3. A positive check is required to assure that gags and blanks are removed from all safety valves prior to light-off.

Compliance Status

Texas City Energy Systems is in compliance with this criteria.

4. A positive check is required to assure that the oxygen and combustible analyzers are in service and functioning properly prior to light-off.

4. Compliance Status

Boilers #1 - #8: The oxygen analyzers on these boilers are checked for proper operation prior to light-off, but a malfunctioning analyzer will not prevent light-off. The reason for this philosophy is that the analyzers are considered unreliable and do not provide an additional safety margin when in service.

There are no combustibles analyzers to be checked on these boilers.

Boilers #21 - #23: The oxygen analyzers on these boilers are checked and repaired as necessary prior to light-off. Checking is done by an instrument mechanic.

There are no combustibles analyzers to check on these boilers.

Boiler #31: The oxygen analyzer on this boiler is checked and repaired as necessary prior to light-off. The combustibles analyzer is also checked, but a serious malfunction will not prevent light-off as the analyzer is not considered reliable. (See A.2 for compliance plans for above boilers.)

Boilers #32 - #34 and #41: These are all waste heat boilers and are not equipped with oxygen analyzers as they would be useless since the air volume is fixed and it is not mechanically possible to over fire the auxiliary duct burners. Also, there are no combustibles analyzers.

5. All drum water level gauge glasses and alarms as well as the low-level trips will be in service and functioning properly prior to light-off.

Compliance Status

Texas City Energy Systems complies with this criteria. There are limitations where such equipment does not exist. (See A.6.)

6. A boiler that is designed to operate with fan created draft and/or gas turbine exhaust-created draft, will not be started or operated by attempting a natural draft.

For a boiler with only one ID or one FD fan, the boiler must be tripped upon loss of that fan. Where multiple fans exist, the loss of one fan or other large loss of air flow shall immediately result in a cutback of fuel to maintain safe operation.

Compliance Status

Boilers #1 - #8: The control systems of these boilers will trip the boiler upon loss of the ID fan and cause a fuel reduction upon loss of the FD fan.

6. Compliance Status (Cont'd)

Boilers #21 - #23: On boilers #21 and #22, the loss of the FD fan causes the operator to initiate a boiler trip. There are no automatic shutdowns. Boiler #23 causes the same course of events as #21 and #22 when it is running on the FD fan and it is lost. When the boiler is drafting from the gas turbine and the turbine trips, the FD fan is started manually and the duct louvers positioned manually to keep the boiler running.

To attain the safety margin this criteria is trying to set the tripping of these boilers on loss of a force draft fan should be performed automatically. Also, the switching of #23 boiler drafts should be controlled automatically. This would be a more positive method of preventing explosive gas buildup in the fire boxes of these boilers.

Boiler No. 31: What was listed previously about #23 applies to #31 also.

Boiler #32 and #41 are not covered by this criteria since they are unfired.

Boilers #33 and #34 trip their duct burners when their gas turbines trip.

7. A complete air purge of the boiler must be made before initiating light-off. Particular efforts must be made to assure that stagnant zones are purged. Firm assurance must be provided that no combustibles exist in the boiler prior to light-off; either spot tests will be made or the certain absence of the need for such tests will be determined.

Compliance Status

Texas City Energy Systems' procedures are in compliance with this criteria.

8. Boiler start-up is to employ the open-register method. This means that:

a. Air registers on all burners are essentially wide open during the pre-light-off purge.

b. During light-off, the air flow through the boiler will be maintained above the low air flow trip point (specified by the NFPA as 25% of full rate air flow). The low air flow trip will be in operation prior to light-off.

c. When lighting off a burner that burners air register will only be closed as much as is necessary to prevent flame-out. The register will never be completely closed during light-off.

8. (Cont'd)
An air rich atmosphere must be assured to reduce the possibility of an explosion and to establish a minimum velocity through the furnace that will tend to prevent hazardous accumulations of unburned fuel.

Compliance Status

The fired boilers at Texas City employ the "open register method" on start-up. However, boilers #21 - #23, and #31 do not have minimum air flow trips, therefore, these cannot be in service. To be in full compliance with this criteria, minimum air flow trips would need to be installed in the above boilers.

9. During light-off, personnel at the boiler front will use the proper prescribed safety equipment.

Compliance Status

Texas City Energy Systems operating procedures specify the proper safety equipment. Texas City is in compliance with this criteria.

10. If a burner igniter fails to light within the prescribed time interval (normally 10 seconds), repeated retrials must be prevented in order to reduce the hazard of a large accumulation of combustibles in the area near the burner. (NFPA specifies a one-minute interval between retrials, with air flow maintained at light-off rate.)

Compliance Status

Boilers #1 - #8: These boilers are equipped with controls which prevent retrials until the boiler has repurged. These boilers are in compliance with the criteria.

Boilers #21 - #23, #31, #33, #34 & #35: These boilers have no controls which prevent retrials of burner igniter light-offs. The S.O.P.'s covering the operation of these boilers do prevent retrials without an adequate purge period. This does comply with the criteria, but better safety assurance would be attained by installing hardware functionally similar to that used on boilers #1 - #8.

11. Where automatic pilots (igniters) exist, the following policy will be adhered to: The main burner will be lit off from that burner's pilot light. If the pilot system will not operate, the main burner light-off will not be carried out manually.

Boiler light-off has been done manually for many years. The automatic ignition systems; however, are installed for improved light-off safety, and the igniters are usually an integral part of the burner management sequencing.

11. Compliance Status

All Texas City Energy Systems boiler burners are lit from pilot lights only with the following exceptions: #21 and #22 boilers. Because the operation of these boilers' pilots are so unreliable, it is sometimes necessary to manually light the main burners in order to get the boilers on line. These igniters need to be made reliable for these boilers to be in compliance with the criteria.

12. Never light one burner from another, or from the hot setting; always use the igniter for the burner to be lit.

Compliance Status

Texas City Energy Systems S.O.P.'s do not allow the lighting of a burner from a hot setting nor do they allow the jumping of burners, with the exception of boilers #21 and #22. Here the burners are jumped since the pilot system is inadequate.

To come into full compliance with the criteria, the pilot systems of boilers #21 and #22 need to be redesigned.

13. No bypassing of safety devices is permitted:

Compliance Status

Presently, Texas City Energy Systems S.O.P.'s allow bypassing of the flame safety systems. On boilers #1 - #8 this problem will be eliminated with installation of a revised flame safety project (CPS-210).

On boiler #31 the problem will continue until a workable flame safety system is installed. The remaining boilers operate with what few safety devices they have in the trip mode.

14. A positive check is required to insure that the section of outlet steam line between the boiler non-return valve and the line stop valve is drained of water and properly heated prior to placing the boiler on line.

Compliance Status

This is part of the Texas City Energy Systems boiler S.O.P.'s at all the powerhouses.

C. Procedures - Operating

1. The fuel supply pressures and flows will be under control of the boiler operating personnel at all times. This includes all liquid and vapor residue fuels.

1. Compliance Status

   Presently the boiler operating personnel have no control over the residue streams they are burning, other than a trip. They do have control over the fuels they burn.

   There is a project in progress to give the operating personnel control of the liquid residue fuels as demanded by the criteria. The vapor residue streams are not under control of the operator. Section A.4 discusses these.

2. When switching fuels on a main burner, the flame scanners for that burner must be in service and operating properly.

   Compliance Status

   Presently boilers #1 - #8 are the only boilers with dual fuel capabilities. A project, CPS 1-210, will allow the burners to be switched with the scanners in service. Scheduled completion is fourth quarter 1978.

3. Item No. 3 deals with the hand slagging and is not applicable to the Texas City Plant, therefore, it will not be discussed.

4. Whenever observing the furnace fire side through an open port or door, a face shield must be worn. For pressurized boilers, the port or door to be opened must have aspirating air to prevent fire from blowing out on the observer.

   Compliance Status

   Texas City Energy Systems S.O.P.'s comply with this criteria.

5. Soot-blowing on a hot furnace with fires out is not permitted because of explosion hazard.

   Compliance Status

   Boilers #1 - #8 are the only boilers presently equipped with soot blowers. The S.O.P.'s concerning these will be modified to comply with this criteria.

6. A complete test of each safety interlock/alarm system must be made and documented as a minimum during each insurance inspection. It is recommended that these tests be done at least annually.

   Compliance Status

   The Texas City Energy Systems complies with this criteria. Instrument/ interlock systems are checked during the two-year insurance inspection.

7. Boiler safety valves will be tested during the period of state insurance inspection of the boiler. Annual testing is recommended.

   Compliance Status

   Texas City Energy Systems complies with this criteria. The safety valves are tested during the two-year insurance inspection.

8. Testing of boiler steam safety valves may be done on the boiler by steam lifting the valves, or may be done on a hot-test stand at an approved shop. If any valve fails to lift or reseat properly, it will be repaired as soon as the boiler it is to protect can be shut down.

   Compliance Status

   Texas City Energy Systems is in compliance with this criteria.

D. Special: Coal-Firing Procedures

These procedures do not apply to Texas City therefore will not be discussed.

E. Boiler Entry

1. No one is permitted to enter the fire side of a boiler until:

   a. All fuel and residue lines have been slipblinded or disconnected and offset.

   b. Power to spark igniters has been locked out.

   c. All coal feeding equipment has been locked out.

   d. Proper pre-entry safety precautions have been taken.

   If steam to soot blowers is not supplied by the boiler itself, that steam must be locked out.

   Compliance Status

   Texas City Energy Systems complies with this criteria.

2. No one is permitted to enter the water-side of a boiler until the following lines have been either slipblinded, disconnected, or double valved and vented.

2. a. Feed water

   b. Produced steam

   c. Continuous blowdown

   d. Intermittent blowdown (if it is connected to a common system used by other boilers)

   e. Chemical feeds

   Compliance Status

   Texas City Energy Systems complies with this criteria.

3. For entry to the water side of a forced-circulation boiler, the pump must be drained, the pump driver locked-out, and the seal flush line valved and locked shut.

   Compliance Status

   Texas City Energy Systems complies with this criteria.

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