PREVENTIVE MAINTENANCE & MALFUNCTION ABATEMENT PLAN
Start-Up & Shut-Down Plan

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Submitted to:

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Preventative Maintenance Program

1.0 General

Viking Energy of Lincoln's (VEL) goal in establishing this plan is to: 1) ensure that during normal operation and during start-ups and shutdowns, process or process equipment shall be maintained and operated in a manner consistent with good air pollution control practices, and 2) to ensure all practicable measures are taken to minimize the emissions of air contaminants.

2.0 Operating Theory

The operating theory at VEL is to operate the plant within the emission levels required by its Air Use Permit. To achieve this goal, the boiler will be operated in the most efficient manner possible, which will conserve fuel and provide for complete combustion. VEL recognizes that unavoidable exceedance of limits may occur during certain malfunction situations, as well as startup and shutdown of the boiler and emission control equipment. The staff will use their best effort to operate and maintain the equipment in a manner that will minimize the duration and magnitude of these incidents. During the shutdowns and startups, personnel shall follow procedures to insure that all equipment is operated within guidelines to insure minimal emissions.

3.0 Equipment

3.1 Boiler

Supervisor Responsible: *Production Support Supervisor*

Item to be inspected	***Frequency of inspection***	***Recordkeeping***
Stoker grate	***Annually***	***Maximo***
Deflection plates	***Annually***	***Maximo***
Over-fire air ports	***Annually***	***Maximo***
Boiler water wall tubes & ductwork	***Annually***	***Maximo***
Clean boiler and super heater tubes	***Annually***	***Maximo***
O2 monitor	***Annually***	***Maximo***

Maintenance Inspection: *Consist of inspecting boiler combustion area: the stoker grate, deflection plates and Over-fire air ports.*

Frequency of Inspection: *The only time one can do an internal inspect is during a plant shutdown. Plant is shut down once a year at a minimum.*

Replacement Parts: *Grate parts (tile, t-rails, slide plates), deflection plates and ports are stored on site.*

3.2 Mechanical Dust Collectors & Opacity

Supervisor Responsible: *Production Support Supervisor*

Item to be inspected	***Frequency of inspection***	***Recordkeeping***
Cones	***Annually***	***Maximo***
Vanes	***Annually***	***Maximo***

Maintenance Inspection: *Cones and vanes of collectors are checked over for wear. If any holes are detected the cones are replaced.*

Frequency of Inspection: *Since the collectors are in the flue gas path, the only time one can inspect them is during a plant shutdown. Plant is shut down once a year at a minimum.*

Replacement Parts*: Five sets of cones and vanes are kept on site.*

Operating variable to be monitored	***Normal range of operating Variable***	***Frequency and recordkeeping***
Differential pressure across collector	***3 to 7 inches of differential pressure***	***Monitored 24 hours a day in control room***
Opacity	***Less than 15% on a six minute average***	***Monitored 24 hours a day in control room (COMS)***

Supervisor Responsible: *Unit Supervisor*

Operating Variables to be Monitored: *Differential pressure is monitored across collectors while the boiler is operational in the control room. Also since this is a control device for the Opacity, the Opacity is monitored 24 hours a day from the control room.*

Normal Operating Range: *The range of operation is from 3 to 7 inches of differential. Normal Opacity is less than 15% on a 6 minute average.*

Method of Monitoring: *Pressure transmitters before and after the collectors monitor the pressures. The readings are sent to the control room which is manned 24 hours a day. An Opacity meter monitors the Opacity and is displayed in the control room 24 hours a day.*

Corrective Procedures*: The collectors have no moving parts therefore they are unlikely to fail. Cones and vanes are replaced with new cones depending on wear.*

Start up/Shutdown: *The mechanical collectors are part of the flue gas stream and are always in service when the boiler is on.*

3.3 Precipitator (ESP) & Opacity

Supervisor Responsible: *Production Support Supervisor*

Item to be inspected	***Frequency of inspection***	***Recordkeeping***
Collection plates	***Annually***	***Maximo***
Electrodes	***Annually***	***Maximo***
Rapping plates	***Annually***	***Maximo***
Rappers	***Daily***	***Log sheet***

Maintenance Inspection*: External inspection consist of checking over the rappers to insure all are rapping. Internal inspection of Precipitator is done during the*

annual outage. The plates and electrodes are checked over for damage. The rapping plates are checked for cracking.

Frequency of Inspection: *External inspection done daily. Since the precipitators are in the flue gas path, the only time one can do an internal inspect is during a plant shutdown. Plant is shut down once a year at a minimum.*

Replacement Parts: *Spare rapper, and rapper plate kept on site.*

Operating variable to be monitored	***Normal range of operating Variable***	***Frequency and recordkeeping***
Opacity	***Less than 15% on a six minute average***	***Monitored 24 hours a day in control room***
Precipitator voltage and current	***Primary 75 - 225 Volts 5 – 35 Amps Secondary 20 – 45 KVolts 45 – 150 MilliAmps***	***Monitored 24 hours a day in control room***

Responsible Supervisor: *Unit Supervisor*

Operator Variables to be Monitored: *Since this is a control device for the Opacity, the Opacity is monitored 24 hours a day from the control room. Also the voltage and current on the Precipitator controller is monitor. These readings are in the control room.*

Normal Operating Range: *Normal Opacity is less than 15% on a six minute average. Primary Voltage range is 75 – 225 volts and Primary Current range is 5 – 35 amps Secondary Voltage is 20 – 45 KVolts and Secondary Current is 45 – 150 Milliamps.*

Method of Monitoring: *An Opacity meter monitors the Opacity and is displayed in the control room 24 hours a day. The voltage and current for the Precipitator is displayed on the controller in the control room.*

Corrective Procedures: *If the voltage or current on the Precipitator is out of range and there is an Opacity problem, it is generally from overloading in the*

Precipitator. To correct this, the operator with reduce load on the boiler and decrease the amount of particulates going to the Precipitator.

If the problem is related to a failure on a rapper, the operator with need the maintenance staff to fix or replace the rapper.

Start up/Shutdown: *The Precipitator is part of the flue gas flow and is always on when the boiler is on.*

4.0 Emissions

4.1 CO Control

Supervisor Responsible (Maintenance): *Production Support Supervisor*

Maintenance Inspection: *Consist of inspecting boiler combustion area: the stoker grate, deflection plates and Over-fire air ports.*

Frequency of Inspection: *The only time one can do an internal inspect is during a plant shutdown. Plant is shut down once a year at a minimum.*

Replacement Parts: *Grate parts (tile, t-rails, slide plates), deflection plates and ports are stored on site.*

Operating variable to be monitored	***Normal range of operating Variable***	***Frequency and recordkeeping***
CO	***.09 to .25 lbs/mmbtu***	***Monitored 24 hours a day in control room***

Supervisor Responsible (Operations): *Unit Supervisor*

Operator Variables to be Monitored: *The CO is monitored by the CEM and displayed in the control room 24 hours a day.*

Normal Operating Range: *CO emissions will vary drastically depending on fuel types, moisture and blends. On average the CO range is .09 to .25lb/mmbtu.*

During startup and shutdown the unit will experience abnormally high CO as a result of the O2 levels being high and not being steady state.

Method of Monitoring: *CO is monitored by the CEM, which displays in the control room.*

Corrective Procedures: *To reduce CO emissions the operators will take the following actions: reduce load, change fuel blend and change fuel to air ratio. To minimize CO during startup and shutdown the operator will follow the procedures, use gas burner and quickly go through startup or shutdown.*

4.2 NOX Control

Supervisor Responsible (Maintenance): *Production Support Supervisor*

Maintenance Inspection: *Consist of inspecting boiler combustion area: the stoker grate, deflection plates and Over-fire air ports.*

Frequency of Inspection: *The only time one can do an internal inspect is during a plant shutdown. Plant is shut down once a year at a minimum.*

Replacement Parts: *Grate parts, deflection plates and ports are stored on site.*

Operating variable to be monitored	***Normal range of operating Variable***	***Frequency and recordkeeping***
NOX	***.17-.25 lbs/mmbtu***	***Monitored 24 hours a day in control room***

Responsible Supervisor (Operations): *Unit Supervisor*

Operator Variables to be Monitored: *The NOX is monitored by the CEM and displayed in the control room 24 hours a day.*

Normal Operating Range: *NOX emissions are greatly influenced by fuel born nitrogen and furnace temperature. Normal range is .17 - .25lb/mmbtu.*

Method of Monitoring*: NOX is monitored by the CEM, which is displayed in the control room.*

Corrective Procedures: *Fuel born nitrogen is fairly consistent, so operating the boiler in a steady efficient manner achieves the best NOX control. If there is a need to minimize the NOX emissions the operator will make boiler air adjustments to lower the furnace temperature.*

4.3 SO2 Control

Supervisor Responsible (Maintenance): *Production Support Supervisor*

Maintenance Inspection: *Consist of inspecting boiler combustion area: the stoker grate, deflection plates and Over-fire air ports.*

Frequency of Inspection*: The only time one can do an internal inspect is during a plant shutdown. Plant is shut down once a year at a minimum.*

Replacement Parts: *Grate parts, deflection plates and ports are stored on site.*

Operating variable to be monitored	***Normal range of operating Variable***	***Frequency and recordkeeping***
SOX	***0-.25 lbs/mmbtu***	***Monitored 24 hours a day in control room***

Supervisor Responsible: *Unit Supervisor*

Operator Variables to be Monitored: *The SO2 is monitored by the CEM and displayed in the control room 24 hours a day.*

Normal Operating Range: *SO2 emissions is an easily controlled emission, since fuel sulfur content is the only source of SO2, and these values remain very constant in fuels burned at VEL. Range of emission is 0 - .25lb/mmbtu, depending on the amount of TDF being burned.*

Method of Monitoring*: SO2 is monitored by the CEM.*

Corrective Procedures: *To reduce SO2 emissions the operator will reduce the amount of TDF being consumed.*

5.0 CEM and COM Equipment

Supervisor Responsible: *Production Support Supervisor*

5.1 Maintenance Inspection and Frequency:

EQUIPMENT	*Frequency*
CLEAN OPACITY LENS AND REFLECTOR	*6 MONTHS*
OPACITY BLOWER FILTERS	*6MONTHS*
CLEAN OUT OPACITY PORTS	*6 MONTHS*
SWAP OUT MOTT FILTER	*ANNUALLY*
GREASE AOVS/CHECK O-RINGS	*ANNUALLY*
4 AOVS IN STACK HOUSE	*ANNUALLY*
1 AOV UP ON STACK PLATFORM	*ANNUALLY*
REPLACE AIR POLISHER	*ANNUALLY*
SAMPLE CHILLER REPLACE TEFLON FILTER	*ANNUALLY*
SWAP OUT OPACITY DESSICANT	*WHEN SATURATED*
INSPECT SAMPLE PUMP DIAPHRAM	*6 MONTHS*
CONDENSATE PUMP CLEAN/GREASE BEARINGS	*ANNUALLY*
CONDENSATE PUMP REPLACE TUBING	*ANNUALLY*
INSTRUMENT AIR FILTERS INSPECT	*QUARTERLY*
OIL SEPERATOR FILTER	*QUARTERLY*
PARTICULTE FILTER	*QUARTERLY*
PURGE AIR FILTER	*QUARTERLY*
REPLACE SAMPLE PUMP DIAPHRAM	*ANNUALLY*
REPLACE SAMPLE PUMP CHECK VALVES & GASKET	*ANNUALLY*
PERFORM CAL GAS AUDIT	*QUARTERLY*
PERFORM RELATIVE ACCUACY TEST AUDIT	*ANNUALLY*

FLUSH OUT SAMPLE LINE CONTAMINANTS	*6 MONTHS*
CLEAN SAMPLE CELL LENS(CO,NOX, & SOX)	*ANNUALLY*
REPLACE NOX CATALYST	*3 YEAR*
REPLACE O2 INLINE FILTER	*MONTHLY*
CHECK FOR ANY TUBING LEAKS IN STACKHOUSE	*QUARTERLY*
CHECK PURGE AIR HEATER FOR PROPER OPERATION	*DAILY*
CHECK FOR PROPER FLOW RATES TO EACH ANALYZER	*DAILY*
EMPTY SAMPLE CONDENSATE	*WEEKLY*
CHECK O2 MAIN HEATER TEMPERATURE	*DAILY*
CHECK SAMPLE LINE HEAT TRACE TEMPERATURE	*DAILY*
CHECK PURGE AIR TEMPERATURE	*DAILY*

Records of maintenance kept on Maximo.

5.2 Replacement Parts: CEM/COMS

EQUIPMENT	*QUANTITY*
OPACITY INTERNAL CHOPPER MOTOR	*1*
INTERNAL CHOPPER BEARINGS	*2*
OPACITY EXTERNAL CHOPPER MOTOR	*1*
OPACITY BLOWER FILTERS	*2*
OPACITY PHOTO PICKUPS	*3*
OPACITY LIGHT SOURCE	*1*
OPACITY CHOPPER WHEEL	*1*
OPACITY CALIBRATION JIG AND LENS	*1*

CONDENSATE PUMP MOTOR	*1*
CONDENSATE PUMP TUBING	*1 BOX*
CONDENSATE PUMP ROTOR	*1*
CONDENSATE PUMP HOUSINGS	*2*
CONDENSATE PUMP BEARINGS	*2*
SAMPLE PUMP DIAPHRAM	*1*
SAMPLE PUMP CHECK VALVES	*2*
SAMPLE PUMP HEAD GASKET	*1*
SAMPLE PUMP CONNECTING ROD	*1*
SAMPLE PUMP COMPLETE	*1*
O2 PLATNIUM SAMPLE PROBE	*1*
NOX CATALYST RESIN	*1*
NOX CHOPPER MOTOR	*1*
SOX CHOPPER MOTOR	*1*
NOX INFRARED LIGHT SOURCE	*1*
INSTRUMENT AIR FILTERS	
PLEATED AIR FILTER	*1*
BRONZE POUROUS FILTER	*1*
MEMBRANE AIR POLISHER	*1*
SAMPLE CHILLER TEFLON FILTER	*1*
MOTT FILTER	*1*
SPARE CERTIFIED GAS BOTTLES	
10.0% OXYGEN	*1*
2.0% OXYGEN	*1*
450 ppm CO, 300 ppm NOX, & 150 ppm SOX MIXTURE	*1*

5.3 Corrective Procedures:

Corrective Action for Malfunctioning CEMS

I*f the CEMS system isn't working properly due to operational issues (calibration failures, reporting problems, etc.), software problems, or hardware problems, follow these steps to correct the situation:*

1. *If operational problems occur, operators should verify equipment is working properly in stack house and that computer is running and logging data like it should. Check cal gas bottles for charge and change out if necessary. Then rerun calibration and generate a report. Operators can open up reports and print them manually if they don't print automatically.*
2. *If there is a software problem with the plc or the control room computer, operators can attempt a reboot to correct the problem.*
3. *If there is a hardware problem with any of the equipment and can't be fixed by the operator, then proceed to contact support.*

If problems cannot be corrected using these methods, contact Maintenance Supervisor or the I&C Technician.

6.0 Boiler Start-Up and Shut-Down Procedures:

6.1 Boiler Start-Up

Prior to the introduction of fuel into the boiler, the following checks will be made by the Unit Supervisor.

1. *All tag/lock have been cleared.*
2. *Boiler doors secured.*
3. *Proper water level in boiler drum.*
4. *All boiler vents and superheater vents are open.*
5. *Precipitator (ESP) is on.*
6. *Confirm that CEM and COM is operational in the control room once fuel is being feed to the boiler.*

1. *Start ID fan.*

2. *Start FD fan.*
3. *Start Gas Burner. Gas burner is used only to initially start-up boiler to heat up fire box and start boiling process.*
4. *Once boiler is heated-up a wood fire is started. OFA fan is started and wood is slowly introduced to boiler. Increase wood feed and air flows gradually to match load on boiler.*
5. *During start-up and shut down the unit will experience abnormal high CO in the lbs/mmBTU as a result of the high excess O2 level. The operators will minimize the time the boiler is in this high O2 state to help control CO.*

6.2 Shut-Down Procedures:

1. *While reducing load on boiler, decrease wood feed and combustion air flows. TDF feed is shut down four hours prior to reducing load.*
2. *Once load on boiler gets low (30,000 to 40,000 lbs/hr) shut off the wood feed and continue to reduce the air flows.*
3. *Note: Precipitator and Mechanical Collectors are in-service while shutting down.*
4. *As boiler cools, shutdown combustion air fans.*
5. *During start-up and shut down the unit will experience abnormal high CO in the lbs/mmBTU as a result of the high excess O2 level. The operators will minimize the time the boiler is in this high O2 state to help control CO.*