Ray Compressor Station
EUENGINE2-7
Preventative Maintenance Plan

PLANNED MAINTENANCE

Responsibility **ACTION**

Station Maintenance Personnel

1. Perform the planned maintenance activities for EUENGINE2-7 according to the following schedule.

Planned Maintenance Activities

Dresser-Rand 2-7
Change spark plugs and PCC when the individual power cylinder exhaust temperature exceeds the average power cell temperature by 300°F.
Clean air intercoolers once per 2 years
Inspect and change air filters, if necessary, every 700 hours
Balance the power cylinders monthly during the injection cycle or more frequently if operating parameters indicate, providing that the unit has operated at least 300 hours per month.

2. Compliance shall be documented in a SAP maintenance work order.

4. Maintain in inventory the **spare parts (AQYY018)** listed in the table below and the PM/MAP. Reorder parts when used. Review at least annually to assure parts are in stock.

Spare Parts
Maintain in Inventory Stock

Dresser-Rand 2-7
spark plugs
PCC valves
fuel valves
air filter set

5. Maintain all records for five (5) years.

ROUTINE TURBOCHARGER REPLACEMENT

Responsibility

Field Leader

1. Before returning an engine to normal operating service following routine turbocharger replacement, ensure that the turbochargers are generating adequate air flow by verifying that the air intake manifold pressure is no more than 5% below that called for by the set point controller at 100% speed and torque and that the waste gate controller is functioning properly. The set point controller has been calibrated by the most recent stack testing.

2. If the air intake manifold pressure is less than 5% below the set point controller and/or the waste gate controller does not function properly and corrective actions do not work, do not operate the engine until the turbochargers can be correctly repaired or until verifying that the engine can meet the applicable limits at required loads through stack testing or a portable analyzer.

3. Document verification of the air intake manifold pressure and waste gate controller at 100% speed and torque on a work order.

MALFUNCTION ABATEMENT

Responsibility	ACTION
Field Leader	1. If a malfunction causes the unit to operate outside of the normal operation range, and the unit cannot be brought back into the established operating range within 1 hour, the unit will be shutdown and not returned to service until the repairs have been made.

NOTE:
After the unit has been shutdown, an investigation to determine the reason for operating outside of the allowed ROP operating range will be conducted. The unit will not be returned to service until necessary repairs have been made.

2. Initiate corrective actions as soon as possible.

3. If the unit is operated outside of the established operating ranges, based on the daily average, prepare a deviation report**.**

PLAN CHANGES

Responsibility	ACTION
Field Leader	1. If plan changes are necessary, prepare the changes and send the revised document to ES for review and concurrence. Do not implement the proposed changes until ES-AQ has provided concurrence.
ES-AQ	2. Notify the Field Leader if any proposed changes are unacceptable and revise procedure(s) as necessary.
Field Leader	3. Maintain a current copy of the **Preventative Maintenance and Malfunction Abatement Plan** on file.

Preventative Maintenance/Malfunction Abatement Plan (PM/MAP)

Ray Compressor Station
Plant 3

For
Glycol Dehydration System

Prepared by:
Joe S. Taylor
December 2012

Table of Contents

1.0 PM/MAP Overview and Approval

Facility: RAY COMPRESSOR STATION PLANT 3
Physical Address: 69333 Omo Road
Armada, MI 48005
Plan Adoption Date: _____
Previous Revisions: None
_____
_____

Purpose of the PM/MAP:

The purpose of this PM/MAP is to describe the actions that will be taken at the Ray Compressor Station Plant 3 to prevent, detect, and correct malfunctions or equipment failures that could result in emissions exceeding any applicable limits. This Plan is for the glycol dehydration system in Plant 3.

This PM/MAP and any revisions of this Plan, will be maintained for a period of five (5) years, and will be on file at the Ray Compressor Station. This PM/MAP does not contain proprietary information.

At Ray Compressor Station, the Field Leader, Dominic Tomasino or his designee, is responsible for assuring that the most recent copy of this PM/MAP is made available to personnel involved with the affected operations. This individual is also responsible for ensuring that Station employees are aware of the procedures and requirements contained in this Plan.

All reports for the PM/MAP must be signed by a Responsible Official.

PM/MAP Approval: Initial PM/MAP – Yes [X] or Revision No. _____

Name: _____ Date: _____

Title: _____

Signature: _____

2.0 Equipment Covered by PM/MAP

This PM/MAP addresses the glycol dehydration system and associated control and monitoring equipment located in Plant 3, designated as Emission Unit EUDEHY3. The glycol dehydration system is designed to lower the water content of the natural gas being withdrawn from the storage field and meet pipeline gas specifications. The dehydration system normally operates during the winter withdrawal season on an as-needed basis. The system consists of two contact towers, equipped with a common flash tank, surge tank, a reboiler, and a thermal oxidizer.

A thermal oxidizer unit is the air emissions control device for the glycol dehydration system The thermal oxidizer has a PLC based local control panel that is monitored by the Plant 3 control system. Natural gas will not be processed in the glycol dehydration system unless the thermal oxidizer is operating in a satisfactory manner. The thermal oxidizer was designed and manufactured by GasTech Engineering LLC and is identified with serial 3019-01.

3.0 Operating Variables to be Monitored

The thermal oxidizer is designed for an inlet feed temperature of 212 degrees F, an oxidizing temperature of 1600 degrees F and a destruction efficiency of 99.5 %. It is fired to maintain a normal setpoint oxidizer temperature of 1600 degrees F. The acceptable oxidizer operating temperature range is 1400 to 1700 degrees F. The thermal oxidizer control system monitors the following operating variables to maintain required performance and safety:

- Combustion – Flame sensor at burner
- Combustion air pressure – Low pressure shutdown
- Fuel flow rate – Continuously recorded
- Fuel pressure - Low and high shutdowns
- Fuel supply valves – Position switches
- Burner control valve – Position switch
- Oxidizer operating temperature – Continuously recorded
- Oxidizer temperature – Low alarm
- Oxidizer temperature – High shutdown
- Inlet feed liquids - High level alarm
- Exhaust stack cover – Position switch

- Control panel – Low purge pressure alarm

The fuel flow rate for the thermal oxidizer burner is measured with an Emerson Micro Motion Coriolis Type flow meter. Fuel flow and oxidizer operating temperature will be continuously recorded by the Ray Station control system.

4.0 Malfunction Events & Procedures

The glycol dehydration system thermal oxidizer unit malfunction events and procedures are as follows:

- Combustion flame sensor – Shutdown on loss of flame

  Check fuel supply valves for correct operation and fuel pressure. Check flame sensor and related controls.

- Combustion flame sensor – Failure to ignite (fire)

  Check pilot fuel system for correct pressure and flow. Check electronic pilot ignition system for correct operation. Check spark electrodes for correct gap.

- Combustion air pressure – Low pressure shutdown

  Check pressure sensing tube for insect, ice or other plugging. Check blower for correct operation and performance. Check air inlet rain cap screen for ice or other obstruction.

- Fuel flow rate – Low or high flow rate or loss of signal

  Check meter for proper operation. Check flow signal for accuracy. Check thermo oxidizer for proper operating temperature. Check for upsets in reboiler and flash tank operations.

- Fuel pressure – Low shutdown

  Check setting and operation of fuel gas pressure regulator PCV-301. Check for any obstructions in the upstream fuel supply system. Check setting and operation of low pressure switch PSLL-301.

- Fuel pressure – High shutdown

  Check setting and operation of fuel gas regulator PCV-301. Check setting and operation of high pressure switch PSHH-302.

- Oxidizer temperature – Low alarm

  Check burner temperature controllers TIC-300A and TIC-300B for correct operation and calibration. Check IP-300 and burner control valve XV-305 for proper operation and calibration. Check fuel supply and air supply to main burner. Check manual setting of burner valve 30FGV-3322 (A7S). Check for high fluids in the inlet pre-heater. Check setting and calibration of temperature indicating

switch low TISL-301. Reduce contact tower natural gas processing rate, if necessary.

- Oxidizer temperature - High

  Check for possible upsets in flash tank or reboiler operations resulting in increased hydrocarbons being fed to thermo oxidizer. Check burner temperature controllers TIC-300A and TIC-300B for correct operation and calibration. Check IP-300 and burner control valve XV-305 for proper operation and calibration. Check manual setting of burner valve 30FGV-3322 (A7S).

- Oxidizer temperature fault – Shutdown

  Check for failure of thermocouples TE-300A, TE-300B and TE-301. If one has failed the unit will be shutdown.

- Inlet feed liquids – High level alarm

  Check to make sure main burner is firing to maintain at least 1600 degree F oxidizer temperature setting. Check to see if reboiler is operating properly with still column exit temperature of at least 212 degrees F and no liquid carryover to thermo oxidizer. Reduce contact tower natural gas processing rate, if necessary.

- Exhaust stack cover

  Cover is to be removed before operation. Check operation of proximity switch ZSH-300.

- Control panel purge pressure alarm

  Check panel air purge fan for proper operation. Check panel door and door seals for leaks. Check panel purge pressure switch for proper setting and operation.

*Malfunction events listed above will be further investigated and mitigated using the Thermal Oxidizer Control Panel PLC and the associated GasTech operating instructions and drawings, when necessary. Failed and defective components will be repaired or replaced as necessary.

5.0 Preventative Maintenance

Scheduled preventative maintenance will be done to maintain performance of the thermo oxidizer and to help prevent unscheduled outages. The following thermo oxidizer maintenance tasks will normally be performed on the frequency indicated when the dehydration system is in service:

- Check thermo oxidizer operating temperature – Daily
- Check for accumulated liquids in oxidizer inlet volume chamber – Daily
- Check for evidence of gas, air and other fluid leaks – Weekly
- Inspect combustion air control valves and actuators – Monthly
- Drain any accumulated moisture in instrument air supply regulators – Monthly
- Inspect filters and vents on instrument air supply regulators and clean if needed – Monthly
- Check fuel gas scrubber liquid level and drain when needed – Monthly
- Inspect the flexible sleeves on the combustion air discharge for weathering and cracking. Replace if needed. – Annually
- Inspect the internal surfaces of the ceramic fiber insulation installed in the shell and stack sections for damage or deterioration. Replace if needed. – Annually
- Shut-off fuel gas supply and heat trace during seasonal outages. –Annually
- Check fuel gas regulators for proper operation and settings – Annually
- Test fuel gas pressure relief valve for correct setting – Annually
- Inspect all 2” and larger gas valves – Annually
- Check operation of scrubber vessel and fuel piping electric heat trace system – Annually
- Check fuel gas strainer and clean if needed – Annually
- Inspect combustion air blower and lubricate bearings if needed – Annually
- Check calibration and function of all instruments, alarms and shutdowns – Annually
- Collect a sample of the wet gas during normal dehydration system operation and analyze. The analysis shall include nitrogen, carbon dioxide, hydrogen sulfide, C1 through C6 series hydrocarbons, benzene, toluene, xylene, ethyl benzene and heptanes plus. The sample analysis will be used for determining benezene emissions. - Annually

Maintenance logs will be kept in the work management system. A sample work order can be found on the following page.

Consumers Energy

Order No: 17262819
Order Type: FMPM

Due Date: 02/01/2012

PM Description: MONTHLY - RAY BOILER OPERATIO (SEASONAL)

Source Data
Requestor:
Phone: Room#
Notification No: 1014487450
Person Responsible:

Notification Text:
MONTHLY - RAY BOILER OPERATIO (SEASONAL)

Dates/Timing
Release Date: 01/27/2012
Start Date: 01/26/2012
End Date: 02/01/2012

Planned time: 0.5
Actual Time:_____

Object Data
Functional Location:
FA-RAY-CB01-BSYS-HVAC-BOIL
Room No: MECH RM

Order Data
PM Plan No: 10001383
Work Order Status: CLSD TECO SETC
Work Order Priority:

Equipment Description
RAY BOILER (HOT WATER)
Tech ID No: **841501-1**
Equipment No: **4000000723**

Manufacturer: BRYAN
Model No: AH-229305
Serial No: NA

Operation Data

Operation	Description	Dur	Control Key	Work Center
0010	MONTHLY - BOILERS AND RELATED EQUIPMENT	0.5	PM01	FA-MTOM

Material Data

Material#	Description Res#	Quantity Req#
Comments		

Operations Text

Operation	Description
0010	MONTHLY - BOILERS AND RELATED EQUIPMENT

Follow all safety procedures prior to commencing the following:

SAFETY PREPARATION

___1. Clean area around the boiler, removing any items that would cause a potential tripping hazard.

___2. Wear safety glasses, use appropriate hand tools, ladder, gloves, and footwear for maintenance. If necessary, prepare buckets, mops, rags and other equipment for cleanup.

___3. Use caution and correct bending technique to reach valves and equipment.

___4. If there is a safety issue of concern, please notify supervisor.

PROCEDURE

___1. Slow drain test low and high pressure boilers.

___2. By means provided by the manufacturer check the ability of the low water cut-off to operate on boilers without resorting to draining boiler system. Make working test of boiler, if drained. Record on operating log.

___3. Take samples of water for chemical analysis per water treatment vendor#s recommendation.

___4. Check the operation of temperature and/or pressure controls and reset.

___5. Record boiler temperature(F) on operating log.

___6. Record the condition of burner operation on operating log.

___8. Check boiler/system water level in boiler or expansion tank sight glass. Record on operating log.

___9. Grease valve stems as needed.

___10. Manually hand test boiler safety/relief valve for proper operation and record on operating log.

___11. Check coupler between seal and motor. Replace as needed.

___12. Record these steps on log in the boiler room.

___13. Perform final cleanup of area and restore equipment to normal operation when work is complete.

Object List

Equipment No	Description
4000000723	

6.0 Parts & Inventory

The following spare parts are recommended by the thermo oxidizer manufacturer and will normally be on hand for maintenance:

GasTech Spare Parts

Qty	Description	Material
1	GASKET 1/8" THK x 11 3/4" O.D. 8 3/4" I.D. W/(6) 9/16"DIA. HOLES ON A 10 1/4" B.C.	NON-ASB
1	GASKET 1/8" THK 1 1/2"-150# SPIRAL WOUND GRAFOIL FILLED 304SS WINDINGS AND INNER RING API STD 601	304SS/GRAFOIL
1	GASKET 1/8" THK 4"-150# SPIRAL WOUND GRAFOIL FILLED 304SS WINDINGS AND INNER RING API STD 601	304SS/GRAFOIL
1	GASKET 1/8" THK 19" O.D. x 13" I.D. w/(12) 1" DIA HOLES EQUALLY SPACED ON 17" B.C. (BLOWER DISCH.)	NON-ASB
1	GASKET 1/8" THK 18" O.D. x 13" I.D. W/(12) 11/16" DIA HOLES EQUALLY SPACED ON 15 3/4" B.C. (BLOWER DISCH.)	NON-ASB
1	GASKET 1/8" THK 2"-150# SPIRAL WOUND GRAFOIL FILLED 304SS WINDINGS AND INNER RING API STD 601	304SS/GRAFOIL
1	NEOPRENE 1/2" THK. x 1 7/8" x 1'-0" LG. (BLOWER ISOLATION)	NEOPRENE
1	GASKET 1/8" THK 54 1/2" O.D. x 35" I.D. w/(56) 11/16" DIA HOLES EQUALLY SPACED ON 50 1/2" DIA. B.C. (STACK FLANGE)	NON-ASB

The following spare parts are for the thermo oxidizer controls and accessories and will normally be on hand for maintenance in addition to the above parts recommended by the thermo oxidizer manufacturer:

Additional Spare Parts

- Diaphragm, spring, seat and positioner for Dezurik valve actuators
- Fisher Model 846 I/P transducer
- Fisher Model 67CFR instrument air regulator
- Repair kits and filter elements for Fisher Model 67CFR instrument air regulators
- Repair kit for Fisher Model 627 fuel gas regulator
- Soft goods replacement parts for Fisher Model 299 fuel gas regulator
- Soft goods repair kit for Anderson Greenwood Model 83 pressure relief valve
- Eclipse Model 11941 spark igniter
- Replacement screen and cover gasket for SSI fuel gas strainer
- Combustion air blower, 10 HP
- Honeywell flame detector element, UV scanner
- Honeywell flame relay/flame amplifier
- Honeywell ignition transformer
- Tate-Jones 2” Pyrex glass sight port
- Maxon burner oven pak
- SOR Model 12LC-KK614-M4-C2A-C6 pressure switch
- Dwyer Model 1950-02-2-F-AT pressure switch
- Rosemount Model 0183R25K2N00N130ES thermocouple assembly
- WKM/Bettis fuel isolation pneumatic actuated valve
- ASCO pilot and control solenoid valves
- Top Worx Model 73 proximity switch
- Ignition Wire
- Fuses – Control Transformer, Control Circuit & Blower Motor

7.0 Supervisory Personnel Responsible for Maintenance of Glycol Dehydration System

Name: Dominic J. Tomasino

Title: Field Leader

Location: Ray Compressor Station
69333 Omo Road
Armada, MI 48005

Phone: 586 784-2096 office
586 321-3038 cell

Email: dominic.tomasino@cmsenergy.com

8.0 Retention of Records

Records shall be maintained on file for a period of 5 years.

9.0 Updates/Revisions of PM/MAP

Periodically this PM/MAP may need to be revised. Copies of all PM/MAP revisions will be retained for a period of 5 years.

Revisions must be completed within 45 days if the PM/MAP does not address – or inadequately address – an event that occurs and meets the characteristics of a malfunction. The revisions must include procedures to operate and maintain the source during similar malfunction events and a program of corrective action for similar malfunctions of the thermo oxidizer or associated controls and monitoring equipment. The revised plan shall be submitted to the AQD District Supervisor. Should the AQD determine the PM/MAP to be inadequate, the AQD District Supervisor may request modification of the plan to address those inadequacies. MDNRE recommends the PM/MAP be reviewed annually.

Preventative Maintenance & Operation Plan

for

Ray Compressor Station
Plant 3
EUEMERGGEN3

Prepared by:
Kathryn R. Ross

April 2013
Rev. 2

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1.0 Plan Overview

The purpose of this Preventative Maintenance & Operation Plan ("Plan") for EUEMERGGEN3 is to describe the emissions control-related operational and preventative maintenance actions that will be taken to assure compliance with the federal National Emission Standards for Hazardous Air Pollutants (NESHAP) for Stationary RICE, 40 CFR Part 63 Subpart ZZZZ requirements and the New Source Performance Standards (NSPS) for Stationary RICE Subpart JJJJ (spark ignition).

This Plan may be superseded by implementing the requirements within the manufacturer's emission-related written instructions for any subject emission unit.

This Plan is not intended to address all preventative maintenance checks or actions that are recommended by a manufacturer, insurance carrier or otherwise required to be conducted by the Company for purposes of assuring startup and operation of an engine.

The current Plan, and prior versions, must be maintained for a period of five (5) years and made available upon request of an Agency.

The following personnel or positions (or their designees) are responsible for assuring that the most recent copy of this Plan is made available to personnel involved with the engine's operation, maintenance and readiness testing activities. This includes ensuring that the necessary employees are aware / trained in the procedures and requirements contained in this Plan and the AQ procedures.

- Ray Compressor Station – Gas Field Leader

2.0 Equipment Covered by Plan

The Plan covers EUEMERGGEN3, which is installed and operating at the Ray Compressor Station.

3.0 Engine Operation

All RICE must be installed, maintained and operated at all times in a manner consistent with safety and good air pollution control practices for minimizing emissions. The general duty to minimize emissions does not require reduction of emissions to levels beyond those required by the NESHAP regulation [63.6605(b)].

Engine settings:

All stationary emergency RICE following their manufacturer's emissions related written instructions must be installed, configured, operated and maintained accordingly (if available). Do not change any emissions related control settings unless authorized by the manufacturer. This will likely void the engine's emissions certification and subsequently require emission testing to demonstrate continued regulatory compliance.

Engine Startup and Idle:

All stationary emergency RICE must adhere to the following operational restrictions:

- Minimize the engine's time spent at idle during startup
- Minimize the engine's startup time to a period needed for appropriate and safe loading of the engine
- Do not exceed 30 minutes of startup [63.6625(h)]

Emergency Operation:

An emergency engine may be operated for unlimited duration in the event of an emergency situation. Examples of an emergency include use of a stationary RICE to produce power for critical networks or equipment (including power supplied to portions of a facility) when electric power from the local utility (or the normal power source, if the facility runs on its own power production) is interrupted, or stationary RICE used to pump water in the case of fire or flood, etc..

Maintenance & Readiness Testing:

An emergency engine may be operated for the purpose of maintenance checks and readiness testing, provided that the tests are recommended by Federal, State or local government, the manufacturer, the vendor, or the insurance company associated with the engine. The engine may not be operated for these purposes in excess of 100 hours per calendar year.

Other Non-Emergency Operation:

Operation outside of emergency situations, maintenance and readiness testing is strictly constrained. Contact Environmental Services-Air Quality Section to discuss compliance requirements for other operating circumstances.

Operation Log:
A log of the hours of operation of each engine shall be maintained to document compliance. The log must include how many hours are spent for emergency operation, maintenance, readiness testing, and non-emergency operation (if applicable), as well as what constituted the emergency operation. Verify hourly limitations have not been exceeded on a calendar year basis. See the AQ-290 RICE procedure or your site-specific RICE procedure (if applicable) for details.

4.0 Engine Malfunction Events

A malfunction is defined (in part) as any sudden, infrequent, and not reasonably preventable failure of a process (e.g. engine) to operate in a normal or usual manner. Failures that are caused in part by poor maintenance or careless operation are not malfunctions.

Knowledgeable personnel who observe a malfunction or abnormal operating condition, including but not limited to abnormal or sustained visible emission observations, have an obligation to notify the appropriate responsible party to curtail engine operation as soon as safely possible. An investigation and corrective repairs should be undertaken and documented to return the malfunctioning equipment to its normal operation and/or before returning the unit to service.

If visible emissions from an engine were observed for two or more continuous hours, a notification of an Excess Emission Event may be required to be submitted to the Michigan Department of Environmental Quality-Air Quality Division within two business days of the event.

Consult with Environmental Services-Air Quality and/or Legal prior to making an Excess Emission Event Notification compliance determination. See AQ-023-3 Excess Emission Event Notification/Reporting procedure for details.

5.0 Scheduled Maintenance

The following preventative maintenance actions must be conducted and documented on the identified schedule:

- Change oil and filter every 500 hours of operation or annually, whichever comes first, or utilize the prescribed oil analysis program at the same frequency (details below) to extend the specified oil changing requirements.

- Inspect all hoses and belts every 500 hours of operation or annually, whichever comes first, and replace as necessary.

- Inspect spark plugs every 1,000 hours of operation or annually, whichever comes first, and replace as necessary.

Note: Annually is defined as once per calendar year.

Additionally, following completion of the required maintenance activities, it is recommended that a visual emission observation be conducted under routine testing/operating conditions to assure that the engine is operating properly.

Optional Prescribed Oil Analysis Program Requirements:

To extend the specified oil changing requirements, an analysis must be performed at the same frequency specified for changing the oil (i.e. every 500 hours of operation or annually, whichever comes first). If any of the limits are exceeded, the oil must be changed within 2 business days of receiving the results of the analysis or before commencing operation (if the engine is not in operation), whichever is later. Documentation of the analytical results must be maintained.

Analyze at a minimum the following three parameters: Total Acid Number (TAN), viscosity, and percent water content.

The oil must be changed if any of the following limits are exceeded:

- Total Acid Number (TAN) increases by more than 3.0 milligrams of potassium hydroxide (KOH) per gram from Total Acid Number of the oil when new;
- Viscosity of the oil has changed by more than 20 percent from the viscosity of the oil when new; and,
- Percent water content (by volume) is greater than 0.5. [63.625(j)]

NOTE: If an emergency engine is operating during an emergency and it is not possible to shut down the engine in order to perform the work practice requirements on the schedule specified, or if performing the work practice on the required schedule would otherwise pose an unacceptable risk under Federal, State, or local law, the work practice can be delayed until the emergency is over or the unacceptable risk under Federal, State, or local law has abated. The work practice should be performed as soon as practicable after the emergency has ended or the unacceptable risk under Federal, State, or local law has abated.

6.0 Retention of Records

All compliance records shall be maintained for a period of five (5) years and may be retained in hardcopy or electronic format. Records must be readily accessible and made available to an Agency upon request. At a minimum, the most recent two (2) years of hardcopy records shall be retained on-site, unless the location is unmanned in which case the records shall be maintained at the nearest headquarters with personnel responsible for the equipment.

Compliance records include:

- Documentation that the required maintenance activities were conducted
- Records of deviations for not conducting the required maintenance
- Corrective actions taken during periods of a malfunction to restore a malfunctioning equipment to its normal operation
- If the oil analysis program is utilized, records of the parameters that were analyzed, the results of the analysis, and whether the oil was changed.
- Record the operating hours and reason of use (i.e. emergency, maintenance, readiness testing) for each time an emergency RICE is run. Include a statement describing any emergency operations.

Preventative Maintenance/Malfunction Abatement Plan (PM/MAP)

Ray Compressor Station
Plant 3

For
Heating Boiler

Prepared by:
Joe S. Taylor
July 2012

Table of Contents

1.0 PM/MAP Overview and Approval

Facility: RAY COMPRESSOR STATION PLANT 3
Physical Address: 69333 Omo Road
Armada, MI 48005
Plan Adoption Date: _____
Previous Revisions: None
_____
_____

Purpose of the PM/MAP:

The purpose of this PM/MAP is to describe the actions that will be taken at the Ray Compressor Station Plant 3 to prevent, detect, and correct malfunctions or equipment failures that could result in emissions exceeding any applicable limits. This Plan is for the heating boiler in Plant 3.

This PM/MAP and any revisions of this Plan, will be maintained for a period of five (5) years, and will be on file at the Ray Compressor Station. This PM/MAP does not contain proprietary information.

At Ray Compressor Station, the Field Leader, Dominic Tomasino or his designee, is responsible for assuring that the most recent copy of this PM/MAP is made available to personnel involved with the affected operations. This individual is also responsible for ensuring that Station employees are aware of the procedures and requirements contained in this Plan.

All reports for the PM/MAP must be signed by a Responsible Official.

PM/MAP Approval: Initial PM/MAP – Yes [X] or Revision No. _____

Name: _____ Date: _____

Title: _____

Signature: _____

2.0 Equipment Covered by PM/MAP

This PM/MAP covers the heating boiler and associated boiler control and monitoring equipment located in Plant 3. The heating boiler is a Johnston Model PTFA300-AG60WG, Serial Number 10911-01, natural gas fired hot water packaged fire-tube boiler with forced air low NOx burner. The exhaust gases from the boiler are discharged unobstructed, first through breeching, then vertically upwards to the ambient air through the boiler flue stack (SVBOILER3). The boiler flue stack is a maximum of 20 inches in diameter and exits at a point least 42 feet above grade.

3.0 Boiler Operating Variables to be Monitored

A water bath temperature controller is the primary control for firing the boiler. The boiler control system monitors the following operating variables to maintain required performance and safety:

- Combustion – Flame sensor
- Combustion air pressure – Low pressure switch
- Fuel pressure - Low and high fuel pressure switches
- Water bath temperature - Low and high temperature switches
- Water bath low level - Low level shutdown

The boiler control system is monitored by the Ray Station control system.

The boiler fuel consumption is measured with a Micromotion Model CMF100 Meter and continuously recorded by the Ray Station control system. The fuel gas supply is preheated and filtered to maintain boiler operating performance.

Boiler Maintenance logs will be kept in the work management system. A sample work order can be found on the following page:

Consumers Energy

Order No: 17262819

Order Type: FMPM

Due Date: 02/01/2012

PM Description: MONTHLY - RAY BOILER OPERATIO (SEASONAL)

Source Data

Requestor:
Phone: Room#
Notification No: 1014487450
Person Responsible:

Notification Text:
MONTHLY - RAY BOILER OPERATIO (SEASONAL)

Dates/Timing

Release Date: 01/27/2012
Start Date: 01/26/2012
End Date: 02/01/2012

Planned time: 0.5
Actual Time:_____

Object Data

Functional Location:
FA-RAY-CB01-BSYS-HVAC-BOIL
Room No: MECH RM

Order Data

PM Plan No: 10001383
Work Order Status: CLSD TECO SETC
Work Order Priority:

Equipment Description

RAY BOILER (HOT WATER)
Tech ID No: **841501-1**
Equipment No: **4000000723**

Manufacturer: BRYAN
Model No: AH-229305
Serial No: NA

Operation Data

Operation	Description	Dur	Control Key	Work Center
0010	MONTHLY - BOILERS AND RELATED EQUIPMENT	0.5	PM01	FA-MTOM

Material Data

Material#	Description Res#	Quantity Req#
Comments		

Operations Text

Operation	Description
0010	MONTHLY - BOILERS AND RELATED EQUIPMENT

Follow all safety procedures prior to commencing the following:

SAFETY PREPARATION

___1. Clean area around the boiler, removing any items that would cause a potential tripping hazard.

___2. Wear safety glasses, use appropriate hand tools, ladder, gloves, and footwear for maintenance. If necessary, prepare buckets, mops, rags and other equipment for cleanup.

___3. Use caution and correct bending technique to reach valves and equipment.

___4. If there is a safety issue of concern, please notify supervisor.

PROCEDURE

___1. Slow drain test low and high pressure boilers.

___2. By means provided by the manufacturer check the ability of the low water cut-off to operate on boilers without resorting to draining boiler system. Make working test of boiler, if drained. Record on operating log.

___3. Take samples of water for chemical analysis per water treatment vendor#s recommendation.

___4. Check the operation of temperature and/or pressure controls and reset.

___5. Record boiler temperature(F) on operating log.

___6. Record the condition of burner operation on operating log.

___8. Check boiler/system water level in boiler or expansion tank sight glass. Record on operating log.

___9. Grease valve stems as needed.

___10. Manually hand test boiler safety/relief valve for proper operation and record on operating log.

___11. Check coupler between seal and motor. Replace as needed.

___12. Record these steps on log in the boiler room.

___13. Perform final cleanup of area and restore equipment to normal operation when work is complete.

Object List

Equipment No	**Description**
4000000723	

4.0 Boiler Malfunction Events & Procedures

The boiler malfunction events and procedures are as follows:

- Combustion flame sensor – Shutdown on loss of flame

  Check pilot fuel system for correct pressure and flow. Check electronic pilot ignition system for correct operation. Check spark electrode for correct gap. Repair/replace as necessary.

- Low combustion air pressure – Shutdown

  Check combustion air blower operation and associated dampers and repair if needed. Check for and remove any restrictions to combustion air flow to the boiler room and blower inlet.

- Fuel pressure low – Shutdown

  Check and adjust fuel gas supply regulator if needed. Check for fuel line restrictions. Repair/replace as necessary.

- Fuel pressure high – Shutdown

  Adjust fuel gas supply regulator. Repair/replace regulator if necessary.

- Low water bath temperature – Alarm

  Check for other alarms on control panel to help identify problem. Check temperature controller for correct setting and operation. Check boiler system including combustion air blower and fuel control for possible start-up and operating problems and correct if necessary.

- High water bath temperature – Shutdown

  Check temperature controller for correct setting and operation. Verify that high temperature switch is operating properly.

- Water bath low level – Shutdown

  Check for leaks in system. Repair as necessary.

*Malfunction events listed above will be further investigated and mitigated using the Johnston Boiler Company Parts and Operations Manual for Model PFTA300-4G125W/G Packaged Boiler, when necessary.

5.0 Boiler Preventative Maintenance

Scheduled preventative maintenance will be done to maintain boiler performance and help prevent unscheduled boiler outages. The following boiler maintenance tasks will normally be performed on a daily basis:

- Check boiler level
- Test water cut-off controls
- Check operation of feedwater pumps
- Check boiler bath and burner temperatures & pressures
- Check the start-up & operation of the burner pilot & main flames
- Check appearance of flames
- Check for adequate supply of combustion air to boiler room
- Check boiler air inlet screen for obstructions
- Check for system leaks
- Check condition of boiler water for proper chemical treatment
- Check indicating lights & assure all alarms are operational
- Maintain a clean, orderly & safe boiler room

The following boiler maintenance tasks will normally be performed on a weekly basis:

- Check burner linkage joints, arms & rods for tightness. Check the linkage firing rate motor, shafts, bearings & flow control fuel valves for proper & smooth operation.
- Grease the burner blower shaft bearings sparingly & only while in operation.
- Check the flame sight ports for cracks in the lens. Schedule replacement if damaged.

The following boiler maintenance tasks will normally be performed on a monthly basis:

- Check the burner pilot assembly for cleanliness & proper condition. Check the electrode for cracks in the porcelain & proper adjustment. Check the condition of the lead wire & connectors. Standard electrode setting is a 1/8” to 3/16” gap.
- Check the flame scanner for cleanliness. Check the condition of connecting cable.

- Check the blower assembly condition, cleanliness & proper operation, including the motor, blower wheel, air damper & linkages. Lubricate motor, damper shaft and linkage bearings.
- Check the main gas valves for proper & smooth operation.

The following boiler maintenance tasks will normally be performed on an annual basis:

- Check the condition of the burner internals, including swirlers, main gas ring & refractory.
- Check alarms, shutdowns, gauges & thermometers for proper calibration.
- Open, clean (flush) & inspect the boiler waterside, including all water level controls, piping & fittings.
- Open, clean & inspect the boiler fireside. Inspect condition of the boiler refractory, including refractory in burner, rear combustion chamber access door & flue box doors. Hairline cracking in refractory is normal. Loose or missing pieces in the refractory must be patched, repaired or replaced.
- Check condition of fireside gaskets. Check for hardness & cracking. Replace fireside gaskets as needed, but not less than every three years.
- Replace waterside gaskets. Handhole and manway gaskets may need to be replaced more frequently than annually.
- Lubricate studs, nuts & firebox door hinges.

6.0 Boiler Parts & Inventory

The following spare parts are recommended by the boiler manufacturer and will normally be on hand for maintenance:

- Belt, Blower Drive
- Connector, Ignition Wire
- Electrode, Ignition
- Wire, Ignition
- Linkage Joints & Arms
- Flame Scanner
- Bulb, Indicating Light
- Fuses – Control Transformer, Control Circuit & Blower Motor
- Brush, Flue (boiler tube)

- Gasket, Rear Sight Port
- Lens, Rear Sight Port
- Lug, Door
- Gasket, Water Level Control
- Nut, Washer & Threaded Stud, Door Lug
- Gasket, Handhole & Manhole
- Drop Wrap Gasketing (roll)
- Programmer
- Amplifier

7.0 Supervisory Personnel Responsible for Maintenance of Equipment

Name:	Dominic J. Tomasino
Title:	Field Leader
Location:	Ray Compressor Station
	69333 Omo Road
	Armada, MI 48005
Phone:	586 784-2096 office
	586 321-3038 cell
Email:	dominic.tomasino@cmsenergy.com

8.0 Retention of Records

Records shall be maintained on file for a period of 5 years.

9.0 Updates/Revisions of PM/MAP

Periodically this PM/MAP may need to be revised. Copies of all PM/MAP revisions will be retained for a period of 5 years.

Revisions must be completed within 45 days if the PM/MAP does not address – or inadequately address – an event that occurs and meets the characteristics of a malfunction. The revisions must include procedures to operate and maintain the source during similar malfunction events and a program of corrective action for similar malfunctions of the heating boiler or associated controls and monitoring equipment. The revised plan shall be submitted to the AQD District Supervisor. Should the AQD determine the PM/MAP to be inadequate, the AQD District Supervisor may request modification of the plan to address those inadequacies. MDNRE recommends the PM/MAP be reviewed annually.

Ray Compressor Station
FGTURBINES
Preventative Maintenance Plan

PLANNED MAINTENANCE

Responsibility **ACTION**

Station Maintenance

Personnel

1. Perform the following planned maintenance activities according to the following schedule. Use a work order to document maintenance.

Planned Maintenance Activity	Frequency
Change air filters	When no longer able to be activated
Water wash compressor blades on gas generator:	Annual* To be performed if unit has run 1,320 hours or more. If unit has under 1,320 runtime hours, defer maintenance activity to next year. Do not exceed two years or 4,000 hours since previous water wash

2. Compliance shall be documented in a SAP maintenance work order.

3. If the planned maintenance is not carried out in accordance with this schedule, perform the required maintenance and prepare a deviation report.

4. Maintain in inventory the spare parts listed in the table below. Reorder parts when used. Review at least annually to assure parts are in stock.

Spare Parts
Maintain in Inventory Stock

Solar 2-5 and 2-6
consumable spare parts, as determined by unit, are maintained

5. Maintain all records for five (5) years.

MALFUNCTION ABATEMENT

Responsibility ACTION

Field Leader

1. If a malfunction causes the unit to operate outside of the normal operation range, and the unit cannot be brought back into the established operating

range within 1 hour, the unit will be shutdown and not returned to service until the repairs have been made.

NOTE:
After the unit has been shutdown, an investigation to determine the reason for operating outside of the allowed ROP operating range will be conducted. The unit will not be returned to service until necessary repairs have been made.

2. Initiate corrective actions as soon as possible. Possible corrective actions may include:

    - reducing speed to bring within normal operating range,
    - adjusting pressure to bring within normal operating range, or
    - if normal operation cannot be obtained, the unit is to be shutdown.

3. If the unit is operated outside of the established operating ranges, based on the daily average, prepare a deviation report.

PLAN CHANGES

Responsibility	ACTION
Field Leader	1. If plan changes are necessary, prepare the changes and send the revised document to ES for review and concurrence. Do not implement the proposed changes until ES-AQ has provided concurrence.
ES-AQ	2. Notify the Field Leader if any proposed changes are unacceptable and revise procedure(s) as necessary.
Field Leader	3. Maintain a current copy of the Preventative Maintenance and Malfunction Abatement Plan on file.

Startup, Shutdown, Malfunction Plan

Ray Compressor Station
Plant 3

Maximum Achievable Control Technology (MACT) Standards for Stationary, Gas-Fired Reciprocating Internal Combustion Engines

Prepared by:
Ed Kelly
Reviewed By:
Matt Bye

May 2013
Updated December 2013, April 2014

Table of Contents

A. SSM Plan Purpose

The IC Engine MACT (40 CFR 63, Subpart ZZZZ) requires that affected engines have a plan in place to meet requirements of 40 CFR 63.6(e)(3). You must prepare and implement a written plan that describes how you will startup and shutdown your engines to minimize air pollution emissions, and what you will do to minimize emissions when malfunctions occur for the engine, emission controls (e.g., NSCR/oxidation catalyst), or monitoring equipment (pressure drop and inlet temperature CPMS). This is called the SSM Plan.

The purpose of the SSM Plan is to:

- Ensure you operate and maintain your engine and controls to minimize emissions during all startups, shutdowns, and malfunctions (SSM) consistent with safety and good air pollution control practices. [63.6(e)(3)(i)(A)]
- Ensure you are prepared to correct malfunctions as soon as practicable, to minimize emissions. [63.6(e)(3)(i)(B)]
- Reduce the reporting burden associated with SSM periods, since procedures you followed during SSM periods will be covered in your SSM Plan. [63.6(e)(3)(i)(C)]

B. Summary of SSM Plan Requirements

The SSM Plan must provide detailed operation and maintenance procedures that you will follow during startup, shutdown, or malfunction (SSM) events. You must define the SSM events in your Plan.

Development of the SSM Plan may be accomplished by completing the following steps:

1. Identification of equipment to address in SSM Plan.
2. Definition of SSM events.
3. Development of procedures to operate & maintain equipment during SSM events.
4. Development of logs to record SSM events and checklists or other records of actions taken during SSM events, including records of whether actions are consistent with the SSM Plan or not.

Key items to note for each step are discussed below, along with provisions to revise the SSM Plan.

Step 1. Identification of Equipment to Address in SSM Plan

For 4-stroke rich burn engines (4SRB) subject to MACT, include:

- 4SRB engine
- Non-selective catalytic reduction (NSCR) catalyst, including air/fuel ratio controller (AFRC)
- Pressure drop measurement equipment
- Continuous parameter monitoring system (CPMS) for inlet temperature to NSCR, including thermocouple and data acquisition system (CPMS-T)

For 4-stroke lean burn engines (4SLB) or 2-stroke lean burn engines (2SLB) subject to MACT, include:

- 4SLB or 2SLB engine
- Oxidation catalyst (Oxy-Cat)
- Pressure drop measurement equipment
- Continuous parameter monitoring system (CPMS) for inlet temperature to Oxy-Cat, including thermocouple and data acquisition system (CPMS-T)

Step 2. Definition of SSM Events

You must define SSM events for the equipment covered by the SSM Plan. You must define the SSM events consistent with the regulatory definitions for startup, shutdown and malfunction included in 40 CFR 63.2 – see inset below.

For the engine (4SRB, 4SLB, or 2SLB), you must include all three events:

- Startup
- Shutdown
- Malfunction

For catalysts (NSCR/AFRC or Oxy-Cat), you must include:

- Malfunction events

NOTE: In this Plan we have also included "startup" and "shutdown" events to capture catalyst installation and removal. You must track catalyst changes after an engine's compliance date for MACT – and conduct an emissions test (called a performance test) to demonstrate compliance with the newly installed catalyst. You may do this outside the SSM Plan if you wish, however, altering the Plan will require filing the revised Plan and reporting the revision in the semiannual compliance report.

For the pressure drop equipment and CPMS-T, you must include:

- Malfunction events

NOTE: In this Plan we have also included "periods CPMS is inoperable" – which includes QA/QC events (such as calibration checks). You must track downtime for CPMS-T after an engine's compliance date for MACT – and report the downtime in a Semi-Annual Compliance Report. You may do this outside the SSM Plan if you wish, however, altering this Plan will require filing the revised Plan and reporting the revision in the semiannual compliance report.

Regulatory Definitions of Startup, Shutdown, and Malfunction [63.2]

Startup means the setting in operation of an affected source or portion of an affected source for any purpose.

Shutdown means the cessation of operation of an affected source or portion of an affected source for any purpose.

Malfunction means any sudden, infrequent, and not reasonably preventable failure of air pollution control and monitoring equipment, process equipment, or a process to operate in a normal or usual manner which causes or has the potential to cause, the emission limitations in an applicable standard to be exceeded. Failures that are caused in part by poor maintenance or careless operation are not malfunctions.

Step 3. Development of Procedures to Operate & Maintain Equipment During SSM Events

You must develop procedures to operate and maintain equipment addressed by the SSM Plan. You may refer to Standard Operating Procedures (SOP) or other manuals if these procedures are already in place. You must define SSM events and detailed procedures to meet the requirements per 63.6(e)(3).

Step 4. Development of Logs to Record SSM Events and Checklists or Other Records of Actions During SSM Events

You must conduct the following recordkeeping and reporting for SSM events:

- Occurrence and duration of SSM events for engine (4SRB, 4SLB or 2SLB)
- Occurrence and duration of malfunction events for catalysts (NSCR/AFRC or Oxy-Cat)
- Occurrence and duration of malfunction events for CPMS-T (also record periods CPMS-T is inoperable – include in Plan or elsewhere)
- Occurrence and duration of malfunction events for the pressure drop measurement equipment
- Actions taken during each SSM event and whether those actions were consistent with the SSM Plan.
  - You may use a checklist if actions are consistent with the SSM Plan
  - If actions are not consistent with the SSM Plan, you must record actions actually taken, circumstances of event, and reasons for not following the SSM Plan. You must submit an Immediate SSM Report within 2 days of event by phone or fax – and by letter within 7 days of event.
  - If a malfunction occurs that is not covered by the plan, you must record actions actually taken and nature of malfunction or circumstances of event. You must submit an Immediate SSM Report within 2 days of the event by phone or fax – and by letter within 7 days of event. You must also revise your SSM Plan within 45 days of such malfunction event.

It may be useful to develop logs, checklists or forms to facilitate the SSM recordkeeping and reporting requirements. In this template, a number of examples are provided for your consideration, including the following:

- SSM Log – to record occurrence & duration of SSM events & periods CPMS-T is inoperable.
- Catalyst Event Checklist – to record actions taken during malfunction event for catalyst (NSCR or Oxy-Cat). This checklist also includes a

place to record catalyst installation or removal to assist you in tracking catalyst changes.

- CPMS-T Event Checklist – to record actions taken during malfunction for CPMS-T.
- Immediate SSM Report Form – to facilitate fax/phone report of SSM events, when actions are not consistent with SSM Plan or malfunction events occur that are not covered by the Plan.

You are not required to use any of these materials – but they may serve as a starting point to develop your SSM recordkeeping and reporting procedures. You may also wish to develop other logs, checklists or forms.

SSM Plan Revisions

Periodically you may need to revise your SSM Plan. You must retain copies of all SSM Plan revisions for a period of 5 years. Revisions to the SSM Plan are not considered revisions to the Title V permit. [63.6(e)(3)(ix)]

You must revise your SSM Plan if:

- You changed your operations or SSM procedures since you prepared the last SSM Plan. [63.6(e)(viii)]
- Your SSM Plan does not address a SSM event that has occurred. [63.6(e)(3)(vii)(A)]
- Your SSM Plan includes inadequate procedures inconsistent with your general duty to minimize emissions during SSM events. [63.6(e)(3)(vii)(B)]
- Your SSM Plan includes inadequate procedures to correct malfunctions as quickly as practical. [63.6(e)(3)(vii)(C)]
- Your SSM Plan includes an event that does not meet the regulatory definition of *startup, shutdown,* or *malfunction* per 63.2. [63.6(e)(3)(vii)(D)]

Revisions must be completed within 45 days if the SSM Plan does not address – or inadequately addresses – an event that occurs and meets the characteristics of a malfunction, but was not included in the SSM Plan. The revisions must include procedures to operate and maintain the source during similar malfunction events and a program of corrective action for similar malfunctions of the engine, controls, or monitoring equipment. [63.6(e)(3)(viii)]

If the SSM Plan revisions alter the scope of activities that are considered startup, shutdown, or malfunction, the revised plan will not take effect until after you provide a written notice describing the revision to the permitting authority. [63.6(e)(3)(viii)]

You must report revisions of the SSM Plan in the next SSM Report, which is submitted with the Semi-Annual Compliance Report. [63.6(e)(3)(viii)]

You must maintain revisions of the SSM Plan for 5 years after revision date.

1.0 SSM Plan Overview and Approval

Facility: RAY COMPRESSOR STATION
Physical Address: 69333 OMO ROAD
ARMADA, MI 48005
Plan Adoption Date: December 2013
Previous Revisions: April 2013

Purpose of SSM Plan:
The purpose of this SSM Plan is to describe the actions that will be taken at the Ray Compressor Station Plant 3 during SSM events for engines included in **Table 1** of this Plan. These engines are subject to emission limitations and operating limitations under the IC Engine MACT, 40 CFR 63, Subpart ZZZZ.

Copies of the current SSM Plan are on file at the Ray Compressor Station Plant 3. The SSM Plan, and prior versions must be maintained for a period of five (5) years. This SSM Plan does not contain proprietary information.

At the Ray Compressor Station Plant 3, the station manager, Dominic J Tomasino or his designee is responsible for assuring that the most recent copy of this SSM Plan is made available to personnel involved with the affected engine operations. This individual is also responsible for ensuring that Station employees are aware of the procedures and requirements contained in this Plan.

All reports for the SSM Plan must be signed by a Responsible Official.

SSM Plan Approval: Initial SSM Plan – Yes [] or Revision No. 1

Name: Dominic J Tomasino Date

Title: Ray Station Gas Field Leader

Signature:

Table 1. IC Engines Subject to IC Engine MACT & Covered by SSM Plan

Facility: RAY PLANT 3 COMPRESSOR STATION

Engine ID	Engine Description		Site-Rated HP	Emission Controls (NSCR/AFRC or Oxy-Cat)	Pressure Drop & CPMS-T	Subcategory & Compliance Date for MACT Requirements (check one & enter compliance date)
	Manufacturer	Model				
BLB 00568	Caterpillar	G3616TALE	4,735	Oxidation catalyst	Initial ΔP 2.2" water – alarm @ 4.5" and automatic shutdown @ 5" of water column. Initial catalyst inlet temperature at 869° F, alarm at 1100° F	☐ 4SRB ☑ 4SLB ☐ 2SLB compliance date: April 22, 2013
BLB 00591	Caterpillar	G3616TALE	4,735	Oxidation catalyst	Initial ΔP 2.3" water – alarm @ 4.5" and automatic shutdown @ 5" of water column. Initial catalyst inlet temperature at 880° F, alarm at 1100° F	☐ 4SRB ☑ 4SLB ☐ 2SLB compliance date: April 23, 2013
BLB 00599	Caterpillar	G3616TALE	4,735	Oxidation catalyst	Initial ΔP 2.0" water – alarm @ 4.5" and automatic shutdown @ 5" of water column. Initial catalyst inlet temperature at 801° F, alarm at 1100° F	☐ 4SRB ☑ 4SLB ☐ 2SLB compliance date: April 23, 2013
BLB 00602	Caterpillar	G3616TALE	4,735	Oxidation catalyst	Initial ΔP 2.7" water – alarm @ 4.5" and automatic shutdown @ 5" of water column. Initial catalyst inlet temperature at 870° F, alarm at 1100° F	☐ 4SRB ☑ 4SLB ☐ 2SLB compliance date: April 26, 2013
BLB 00604	Caterpillar	G3616TALE	4,735	Oxidation catalyst	Initial ΔP 2.11" water – alarm @ 4.5" and automatic shutdown @ 5" of water column. Initial catalyst inlet temperature at 842° F, alarm at 1100° F	☐ 4SRB ☑ 4SLB ☐ 2SLB compliance date: April 26, 2013

a Only engines subject to full MACT requirements must be covered by the SSM Plan. New or reconstructed emergency or limited use engines do not have to be addressed in the SSM Plan

2.0 Equipment Covered by SSM Plan

This SSM Plan covers the engines, emission controls, and monitoring equipment that are included in **Table 1** of this SSM Plan.

3.0 Engine SSM Events & Procedures

This section addresses the engines included in **Table 1** of this SSM Plan. SSM events are defined to identify events that meet regulatory definitions of startup, shutdown, and malfunction.

NOTE: All startups and shutdowns of the engines in **Table 1** must be addressed by the Plan. Regulatory definitions for startup and shutdown are:

> *Startup* means the setting in operation of an affected source or portion of an affected source for any purpose.
>
> *Shutdown* means the cessation of operation of an affected source or portion of an affected source for any purpose.

ALSO NOTE: Not all "upsets" for the engines in **Table 1** qualify as malfunctions under MACT. Malfunctions for MACT must meet the following regulatory definition for malfunction [40 CFR 63.2]:

> *Malfunction* means any sudden, infrequent, and not reasonably preventable failure of air pollution control and monitoring equipment, process equipment, or a process to operate in a normal or usual manner which causes or has the potential to cause, the emission limitations in an applicable standard to be exceeded. Failures that are caused in part by poor maintenance or careless operation are not malfunctions.

3.1 Engine Startup Events & Procedures

Definition of Startup Event for Engines in Table 1

Startup means the initiation and completion of a series of steps, the final goal of which is to utilize an internal combustion natural gas fired reciprocating engine to supply power to drive a natural gas compressor. The startup is completed once the engine and catalyst have attained full operating temperatures and, based on manufacturer's recommendations, would then be available for maximum speed and load operation. This also includes short duration periods of engine operation for purposes of troubleshooting, if required. Each fully successful start will appear on the SSM log.
NOTE: You must log the occurrence and duration of each startup event for the engines included in Table 1 on the SSM Log.

ALSO NOTE: Ensure times for SSM Logs are synchronized with time for CPMS-T data acquisition system – you will need to compare SSM Logs and the CPMS-T data to identify when data is reported for SSM events.

Startup Procedures for Engines in Table 1

For Startup procedures, please refer to CATERPILLAR OPERATION AND MAINTENANCE MANUAL, G3600 SERIES ENGINES, OPERATION SECTION and ENGINE STARTING.
NOTE: You may also refer to Ray 3 Operating and Maintenance Procedures or other plans (ex. PM/MAP) that already address these procedures.

ALSO NOTE: You must operate the Continuous Parameter Monitoring System-Temperature and Delta-P at all times the engines in Table 1 are operating, except during CPMS-T or Delta-P malfunctions, repairs, or QA/QC activities (such as calibration checks).

3.2 Engine Shutdown Events & Procedures

Definition of Shutdown Event for Engines in Table 1

Shutdown means 1) UNSCHEDULED SHUTDOWN, or 2) SCHEDULED SHUTDOWN, a series of events, including gradual unloading and cool down of the engine, the ultimate intent of which is to cease operation of the engine. *NOTE: You must log the occurrence and duration of each shutdown event for the engines included in Table 1 on the SSM Log.*

ALSO NOTE: Ensure times for SSM Logs are synchronized with time for CPMS-T data acquisition system – you will need to compare SSM Logs and the CPMS-T data to identify when data is reported for SSM events.

Shutdown Procedures for Engines in Table 1

For both UNSCHEDULED and ROUTINE SHUTDOWN PROCEDUES, refer to CATERPILLAR OPERATION AND MAINTENANCE MANUAL, G3600 SERIES ENGINES, OPERATION SECTION and ENGINE STOPPING.

NOTE: You may also refer to Ray 3 Operating and Maintenance Procedures or other plans (ex. PM/MAP) that already address these procedures

ALSO NOTE: You must operate the CPMS-T and Delta-P at all times the engines in Table 1 are operating, except during CPMS-T and Delta-P malfunctions, repairs, or QA/QC activities (such as calibration checks).

3.3 Engine Malfunction Events & Procedures

Malfunction Events Included in SSM Plan for Engines in Table 1

[Include list of malfunction events – it may be useful to "name" each type of event – include detailed definitions for events and procedures below for each malfunction event listed]

The following malfunction events are covered by the SSM Plan for the engines in **Table 1**:

- High Engine Coolant Temperature
  - Automatic Shutdown @ 208°F (CATERPILLAR)
- Engine Overspeed
  - Automatic Shutdown @ 1130 rpm (CATERPILLAR)
- High Engine Oil Temperature
  - Automatic Shutdown @ 194°F (CATERPILLAR)
- Low Engine Oil Pressure
  - Automatic Shutdown @ 14.5 PSIG @ < 600 rpm (CATERPILLAR)
  - Automatic Shutdown @ 50.7 PSIG @ > 600 rpm (CATERPILLAR)
- High Inlet Air temperature at Low Engine Load
  - Automatic Shutdown @ 185°F (CATERPILLAR)
- High Inlet Air Temperature at High Engine Load
  - Automatic Shutdown @ 167°F (CATERPILLAR)
- High Exhaust Temperature (pre catalyst)
  - Alarm @ 1100°F (ENERFLEX)
  - Automatic Shutdown @ 1202°F (CATERPILLAR)
- High Crankcase Pressure
  - Automatic Shutdown @ 4" H_2O (CATERPILLAR)
- Low Coolant Level
  - Automatic Shutdown @ < 35% of expansion tank volume (CATERPILLAR)
- High Catalyst Pressure
  - Alarm @ 4.5" H_2O (ENERFLEX)
  - Automatic Shutdown @ 5" H_2O (ENERFLEX)

NOTE: You must log the occurrence and duration of each malfunction event for the engines included in Table 1 on the SSM Log.

ALSO NOTE: Ensure times for SSM Logs are synchronized with time for CPMS-T data acquisition system – you will need to compare SSM Logs and the CPMS-T data to identify when data is reported for SSM events.

4.0 Oxidation Catalyst Events & Procedures

This section addresses the catalysts installed on the engines included in **Table 1** of this SSM Plan. The catalysts are installed to reduce emissions as necessary to comply with emission limitations that apply to the engines according to 40 CFR 63, Subpart ZZZZ. Under Subpart ZZZZ, operating limitations are established to ensure the catalysts are performing the required emission reductions.

This SSM Plan addresses the following events for the oxidation catalyst devices listed in **Table 1** of this SSM Plan:

oxidation catalyst element installation

oxidation catalyst element removal

oxidation catalyst malfunctions

NOTE: You must track catalyst changes on or after the engine's compliance date. You may include the procedures here – or include those procedures in a separate document.

The malfunction events are defined to identify events that meet the regulatory definition of malfunction. NOTE: Not all "upsets" for the oxidation catalyst devices in **Table 1** qualify as malfunctions under MACT. Malfunctions for MACT must meet the following regulatory definition for malfunction [40 CFR 63.2]:

Malfunction means any **sudden, infrequent, and not reasonably preventable failure** of air pollution control and monitoring equipment, process equipment, or a process to operate in a normal or usual manner which causes or has the potential to cause, the emission limitations in an applicable standard to be exceeded. Failures that are caused in part by poor maintenance or careless operation are not malfunctions.

4.1 Oxidation Catalyst Malfunction Events & Procedures

Malfunction Events Included in SSM Plan for Oxidation Catalyst Included in **Table 1:**

[Include list of malfunction events – it may be useful to "name" each type of event – include detailed definitions for events and procedures below for each malfunction event listed]

The following malfunction events are covered by the SSM Plan for the engines in **Table 1**:

- Oxidation **Catalyst High Backpressure** @ Full speed & loaded. Alarm @ 4.50" H_2O and automatic shutdown @ 5.00" H_2O. Permit value @ initial test backpressure plus 2" H_2O column.
- Oxidation **Catalyst Low Backpressure** @ Full speed & loaded. Alarm @ 4.50" H_2O and automatic shutdown @ 5.00" H_2O. Permit value @ initial test backpressure minus 2" H_2O column.

- Oxidation **Catalyst High Temperature**
  - Alarm @ 1100° F (ENERFLEX) and automatic shutdown @1202°F (CATERPILLAR). Permit value @ 1350°F
- Oxidation **Catalyst Low Temperature**
  - After engine 'cold start' & warm-up. Permit value @ 450° F. Units are not operated with an exhaust temperature of 450°F or less.

NOTE: Each event noted above will appear in the SSM log. Forms will be completed to indicate the action taken in regard to the catalyst.
ALSO NOTE: Ensure times for SSM Logs are synchronized with time for CPMS-T data acquisition system – you will need to compare SSM Logs and the CPMS-T data to identify when data is reported for SSM events.

High Catalyst Back Pressure

Event Definition:
High backpressure is the original backpressure at full speed and load conditions, plus 2 additional inches of water column.

NOTE: Malfunction events may not include events caused in part by poor maintenance or careless operation. Malfunction events must be due to infrequent event not reasonably preventable – not the result of poor maintenance or careless operation.

Event Procedures:
NOTE: You may refer to Ray 3 Operating & Maintenance Procedures or other plans (such as catalyst manuals) that already address these procedures.

Excess fouling of the catalyst may significantly impact the performance of the NSCR/AFRC or Oxidation Catalyst. At the earliest opportunity, conduct the following to evaluate and restore catalyst function:

- Record date & time of event beginning for SSM log.
- Remove Oxidation catalyst element to confirm excess fouling – complete log for catalyst removal

  ⇒ Determine cause of excess fouling (catalyst manual troubleshooting or other), if possible and correct the cause
- Conduct washing of catalyst & re-install or replace - complete log.
- Complete SSM log and prepare Catalyst Event Checklist to document actions taken to respond to this malfunction.
- Retest efficiency to ensure system meets minimum 93% CO reduction requirement

Catalyst Failure

Event Definition:
Catalyst failure is the inability of the catalyst system to reduce carbon monoxide levels by the requisite 93% from the CO concentrations at the inlet to the catalyst.
*NOTE: Malfunction events may not include events caused in part by poor maintenance or careless operation. Malfunction event must be due to infrequent event not reasonably preventable – not the result of poor maintenance or careless operation. The catalyst **will** undergo a normal aging process over time, and will lose efficiency gradually, eventually falling below the 93% minimum level. This normal aging process, and the relative predictability of catalyst failure, is an O&M function. If catalyst failure is the result of the normal aging process, there will be no 'root cause' to neither investigate nor remediate.*

Catalyst Failure Event may be caused by the following conditions:

- Catalyst poisoning
- Catalyst physical damage
  (as a result of excess vibration, engine backfire or other cause)

Event Procedures:
NOTE: You may refer to Ray 3 Operating & Maintenance Procedures or other plans (such as catalyst manuals) that already address these procedures.

Confirmed catalyst failure will require replacement of the catalyst element. At the earliest opportunity:

- Record date & time of event beginning for SSM log.
- Remove failed catalyst element for oxidation catalyst – complete log for catalyst removal.
- Determine cause of catalyst failure (catalyst manual troubleshooting or other), **if possible** and address underlying cause of catalyst failure, as applicable:
- Install replacement catalyst element(s) - complete log.
- Complete SSM log and prepare Catalyst Event Checklist to document actions taken to respond to this malfunction.

Catalyst Gasket Failure

Event Definition:

A gasket failure will allow exhaust gasses to bypass the catalyst elements, resulting in both a decline in destruction efficiency of CO, as well as a reduction in backpressure upstream of the catalyst. The backpressure measurement should be observed and recorded by the sensing device in the port upstream of the catalyst, and the engine is programmed to shut down if the backpressure is reduced by 2 inches of water column from the initial backpressure measurement taken during the first port engine break-in efficiency test.

NOTE: Malfunction events may not include events caused in part by poor maintenance or careless operation. Malfunction events must be due to infrequent event not reasonably preventable – not the result of poor maintenance or careless operation.

Event Procedures:

NOTE: You may refer to Ray 3 Operating & Maintenance Procedures or other plans (such as catalyst manuals) that already address these procedures.

Confirmed catalyst gasket failure will require replacement of the catalyst gasket. At the earliest opportunity:

- Record date & time of event beginning for SSM log.
- Inspect all catalysts and gasket assemblies
- Remove failed catalyst gasket(s) for oxidation catalyst.
- Install replacement catalyst gasket.
- Check for exhaust leaks – correct if present.
- Complete SSM log and prepare Catalyst Event Checklist to document actions taken to respond to this malfunction.

Catalyst Event Checklist

Completed by:_____ **Date:**_____

Type of Event:

- ☐ Catalyst Removal
- ☐ Catalyst Installation
- ☐ Malfunction
- ☐ Other*_____

Catalyst Removal

- Date & Time Catalyst Removed:_____
- Reason for Catalyst Removal: ☐ Catalyst Failure ☐ Excess Catalyst Fouling ☐ Catalyst Seal/Seat Failure Other*:_____ ☐ Routine Maintenance
- Did you follow manufacturer's procedures for catalyst removal? ☐ YES ☐ NO*
- Was the same catalyst element re-installed? ☐ YES ☐ NO*
- Did you record this change in the catalyst log? ☐ YES ☐ NO

Catalyst Installation

- Date & Time Catalyst Installed:_____
- Reason for Catalyst Installation: ☐ Catalyst Failure ☐ Excess Catalyst Fouling ☐ Catalyst Seal/Seat Failure Other*:_____ ☐ Routine Maintenance
- Did you follow manufacturer's procedures for installation? ☐ YES ☐ NO*
- Was the same catalyst element re-installed? ☐ YES ☐ NO*
- Did you record this change in the catalyst log? ☐ YES ☐ NO

Malfunctions

- Date & Time Malfunction Identified:_____
  Duration of Malfunction:_____
- Type of Malfunction: ☐ Catalyst Failure ☐ Excess Catalyst Fouling ☐ Catalyst Gasket Failure ☐ Oxygen Sensor Failure ☐ Alarm for Oxygen Sensor ☐ Air/Fuel Ratio Controller Failure ☐ Other*:_____

Catalyst Failure:

- Reason for catalyst failure, if known:_____
- Did you remove failed catalyst, install a new catalyst, & complete the catalyst log? ☐ YES ☐ NO*

Excess Catalyst Fouling:

- Reason for excess catalyst fouling, if known:_____
- Did you remove fouled catalyst? ☐ YES ☐ NO*
- Did you remove the fouling & reinstall the same catalyst element or install a new catalyst? ☐ NEW CATALYST ☐ SAME CATALYST RE-INSTALLED
- Did you record this change in the catalyst log? ☐ YES ☐ NO

Catalyst Gasket Failure:

- Reason for excess seal/seat failure, if known:_____
- Did you remove the catalyst to repair/replace the seal/seat? ☐ YES ☐ NO
- Did you repair or replace the seal/seat? or install a new catalyst? ☐ REPAIRED ☐ REPLACED
- Did you record this change in the catalyst log? ☐ YES ☐ NO

*** If "other" or "NO" there may be immediate reporting requirements.**
Contact _____ immediately at _____ (tel)
and fax this form to: _____ (fax) _____

5.0 CPMS-T Malfunction Events & Procedures

This section addresses the continuous parameter monitoring systems (CPMS) for inlet temperature installed on the engines included in **Table 1** of this SSM Plan. The CPMS-T is required to measure inlet temperature into the oxidation catalysts. Inlet temperature must be monitored continuously at all times the engines included in **Table 1** are operating, except during CPMS malfunctions, repairs, and QA/QC activities (such as calibration checks).

This SSM Plan addresses the following events for the CPMS-T devices listed in **Table 1** of this SSM Plan:

- CPMS-T malfunctions
- Periods CPMS-T inoperable

NOTE: You must record periods when the CPMS-T is inoperative. This SSM template includes this recordkeeping requirement in the SSM Plan. You may address this activity in a separate document.

The malfunction events are defined to identify events that meet the regulatory definition of malfunction. NOTE: Not all "upsets" for the CPMS-T systems will qualify as malfunctions under MACT. Malfunctions for MACT must meet the following regulatory definition for malfunction [40 CFR 63.2]:

> *Malfunction* means any sudden, infrequent, and not reasonably preventable failure of air pollution control and monitoring equipment, process equipment, or a process to operate in a normal or usual manner which causes or has the potential to cause, the emission limitations in an applicable standard to be exceeded. Failures that are caused in part by poor maintenance or careless operation are not malfunctions.

5.1 CPMS-T Malfunction Events & Procedures

Malfunction Events Included in SSM Plan for CPMS-T**:**

The following malfunction events are covered by the SSM Plan for the CPMS-T devices included in **Table 1**:

- Data Acquisition CPMS-T Not Working
- Thermocouple Not Working

NOTE: You must log the occurrence and duration of each malfunction event for the CPMS-T included in Table 1 on the SSM Log. You may choose to use the Inlet Temperature Event Checklist included with this Template or other record.

ALSO NOTE: Ensure times for SSM Logs are synchronized with time for CPMS-T data acquisition system – you will need to compare SSM Logs and the CPMS-T data to identify when data is reported for SSM events.

Data Acquisition CPMS-T Not Continuously Working

Event Definition: Engine parameters are monitored by the CAT ADEM III system and the unit control programmable logic controller (PLC) system. A failure of either of these systems shuts the engine down immediately, eliminating emissions.

The data acquisition system is composed of an Ethernet network that logs catalyst differential pressures and inlet and outlet temperatures. This information is logged at six separate locations. In the event of a failure of the entire network, the PLC will continue to log 24 hours worth of data.

NOTE: Malfunction events may not include events caused in part by poor maintenance or careless operation.

Data Acquisition System Not Working Event may be caused by the following conditions:

- Software failure, glitch
- Loss of power or communications
- Improper or failed wiring

Event Procedures:

NOTE: You may also refer to Ray 3 Operating and Maintenance Procedures or other plans (ex. PM/MAP or CPMS) that already address these procedures

If the Data Acquisition System is not working, restore system operation as soon as practical. Procedures for this event may include:

- Record date & time of event beginning for the SSM log.
- Troubleshoot per manufacturer's recommendations, including reinstallation of software, inspection/repair of power or communications connections and wiring, if required.
- Confirm restoration of data acquisition system operation. Record date & time of event ending
- Complete SSM log and prepare Inlet Temperature Event Checklist to document actions taken to respond to this malfunction.

Thermocouple Not Working or Working Improperly

Event Definition:

NOTE: Malfunction events may not include events caused in part by poor maintenance or careless operation.

Thermocouple Not Working or Working Improperly Event may be caused by the following conditions:
Thermocouple input failure can indicate a failure of the thermocouple itself, or failed wiring.

Event Procedures:

NOTE: You may also refer to Ray 3 Operating and Maintenance Procedures or other plans (ex. PM/MAP or CPMS) that already address these procedures

If the thermocouple is not working or working improperly, restore system operation as soon as practical. In the event of temperature readings below or in excess of MACT limits, the controls are already programmed to shut the engine down. In the event of a loss of signal, the controller is, again, programmed to shut the engine down. Procedures for this event may include:

- Record date & time of event beginning for the SSM log.
- TC input failure will be logged in the SSM
- Conduct troubleshooting per manufacturer's instructions.
- Identify required adjustment, repair, or replacement, per manufacturer instructions. Complete required actions.
- Thermocouples cannot be calibrated. Once replaced, check the temperature readout on the monitor screen for atmospheric temperature as an indication the thermocouple is giving accurate readings.
- Repair information will be on the inlet temperature event checklist

Inlet Temperature Event Checklist

Completed by:_____ Date:_____

Type of Event:

☐ **Thermocouple Not Working** ☐

Other*_____

Thermocouple Not Working

- **Date & Time Noted TC Not Working:_____**
- **Data & Time Last Data Recorded:_____**
- **Date & Time Recorder Operation Restored:_____**
- **Reason for Recorder Failure, if known:_____**

_____

_____

- **Did you follow manufacturer's procedures for troubleshooting?** ☐ **YES** ☐ **NO***
- **Did you repair or replace the data recorder?** ☐ **REPAIR** ☐ **REPLACE**
- **Did you re-calibrate per manufacturer procedures?** ☐ **YES** ☐ **NO***

Other*:

Describe what happened:

_____

_____

_____

When did this event begin:_____

When did this event end: _____

Describe the actions you took to respond:

_____

_____

_____

_____

*** If "other" or "NO" there may be immediate reporting requirements.**
Contact _____ immediately at _____ (tel)
and fax this form to: _____ (fax) _____

6.0 Pressure Drop Malfunction Events & Procedures

This section addresses the measurement equipment for pressure drop for the engines included in **Table 1** of this SSM Plan. The pressure drop equipment measures pressure drop across the oxidation catalysts. Pressure drop **is measured continuously** while the engine is operating.

This SSM Plan addresses the following events for the devices listed in **Table 1** of this SSM Plan to conduct pressure drop measurements. The pressure drop measurement will be accomplished utilizing an electronic pressure sensitive device.

- Malfunctions:
- Failure of a signal from the device
- Abnormal readings

The malfunction events are defined to identify events that meet the regulatory definition of malfunction. NOTE: Not all "upsets" for the pressure drop equipment will qualify as malfunctions under MACT. Malfunctions for MACT must meet the following regulatory definition for malfunction [40 CFR 63.2]:

> *Malfunction* means any sudden, infrequent, and not reasonably preventable failure of air pollution control and monitoring equipment, process equipment, or a process to operate in a normal or usual manner which causes or has the potential to cause, the emission limitations in an applicable standard to be exceeded. Failures that are caused in part by poor maintenance or careless operation are not malfunctions.

Signal Failure: in the event of a signal loss, the controller is programmed to shut the engine down.

Record date and time of beginning of event on SSM log

Trouble shoot per manufacturer's recommendation

Adjust, repair, or replace as required, including system check to ensure correct output reads

Abnormal readings – 'out of limit' based on backpressure data acquired during the initial CO efficiency test – engine is programmed to shut down in the event the backpressure exceeds these limits by 1.5 inches of water or more.

Record date and time of beginning of event on SSM log

Trouble shoot per manufacturer's recommendations

Adjust, repair, or replace as required, including subsequent system checks to ensure system is operating correctly

Record date and time of event end on SSM log

7.0 Catastrophic Events

This section addresses events and procedures for catastrophic events. Such events may be considered malfunctions and include:

- Fire
- Lightening
- Weather
- Other 'Acts of God'

Event Definition: Fire, lightening, hazardous weather conditions, or other 'Acts of God' that either occur or have the potential to occur may pose a serious enough threat to the safety of personnel and equipment to warrant emergency shutdown of operating equipment at the facility.

Event Procedures: In the event any of the above described events cause an emergency shut down, after the event has ended and the facility has been deemed safe, conduct the following:

Log in the date and time of the beginning of the event on the SSM log sheet. The beginning time of the event will be logged by the computer system.

Record the end of the event on the SSM log when it is safe for personnel to return and return the equipment (engines) to operation.

NOTE: You may refer to Standard Operating Procedures (SOP) or other plans that already address these procedures.

Malfunction events are defined to identify events that meet the regulatory definition of malfunction. NOTE: Not all "upsets" will qualify as malfunctions under MACT. Malfunctions for MACT must meet the following regulatory definition for malfunction [40 CFR 63.2]:

Malfunction means any sudden, infrequent, and not reasonably preventable failure of air pollution control and monitoring equipment, process equipment, or a process to operate in a normal or usual manner which causes or has the potential to cause, the emission limitations in an applicable standard to be exceeded. Failures that are caused in part by poor maintenance or careless operation are not malfunctions.

8.0 What to Do if Actions are Consistent with SSM Plan

If actions taken during SSM events covered by this Plan are consistent with the Plan, you must:

1. Log occurrence & duration of SSM event for SSM Log.
   ⇒ Beginning time & ending time –synchronize with times for CPMS-T, since you will need to compare data from these two systems to identify CPMS-T data recorded during SSM events.
2. Record actions taken during event – checklist.
3. Keep copies of checklists & SSM logs.

9.0 What to Do if Actions are Inconsistent with SSM Plan

If actions taken during SSM events covered by this Plan are inconsistent with the Plan, you must:

1. Log occurrence & duration of SSM event for SSM Log
   ⇒ Beginning time & ending time –synchronize with times for CPMS-T, since you will need to compare data from these two systems to identify CPMS-T data recorded during SSM events.
2. Record actions taken during event, circumstances of event, & why plan was not followed.
3. Assess whether emissions or operating limits have been exceeded.
4. Prepare & submit Immediate SSM Report to [EPA or delegated authority] – see form.
   ⇒ Submit phone or fax report within 2 days
   ⇒ Submit letter report within 7 days – Letter report must include:
   -Actions taken during SSM event.
   –Explanation of circumstances of the event.
   –Description of all excess emissions and/or parameter monitoring exceedances that are believed to have occurred.
   –Name, Title, Signature of owner/operator or other responsible official who is certifying accuracy of the Immediate SSM Reports
5. Keep copies of checklists & SSM logs.
6. Review SSM procedures to determine if SSM Plan should be revised.

Immediate Startup, Shutdown, Malfunction Report

For reporting procedures inconsistent with SSM Plan or Malfunctions not covered by Plan

Facility: _____

Address: _____

Engine: _____

Malfunctioning Device: NSCR: _____

Temperature CPMS: _____

Date of Malfunction: _____

Covered by Plan? Yes [ ] No [ ]

If yes, were actions inconsistent with Plan? Yes [ ] No [ ]

Time Malfunction Began: _____ Time Malfunction Ended: _____

Suspected cause of malfunction: _____

Corrective actions taken _____

If actions inconsistent with plan, why did you take other actions: _____

Do you believe any excess emissions and/or parameter monitoring exceedances occurred during the malfunction? Yes [ ] No [ ]

Were any units shut down due to event? Yes [ ] No [ ]

Your name: _____ Title: _____

Signature of Responsible Official: _____

Fax or call this information into local air permitting agency within 2 working days of the event & send letter within 7 working days

10.0 What to Do if Malfunction Occurs Not Covered by SSM Plan

If malfunction occurs not covered by this SSM Plan, you must:

1. Log occurrence & duration of SSM event for SSM Log
   ⇒ Beginning time & ending time –synchronize with times for CPMS-T, since you will need to compare data from these two systems to identify CPMS-T data recorded during SSM events.
2. Record actions taken during event and circumstances of event.
3. Assess whether emissions or operating limits have been exceeded.
4. Prepare & submit Immediate SSM Report to [EPA or delegated authority] – see form.

   ⇒ Submit phone or fax report within 2 days

   ⇒ Submit letter report within 7 days – Letter report must include:
   -Actions taken during SSM event.
   –Explanation of circumstances of the event.
   –Description of all excess emissions and/or parameter monitoring exceedances that are believed to have occurred.
   –Name, Title, Signature of owner/operator or other responsible official who is certifying accuracy of the Immediate SSM Reports
5. Keep copies of checklists & SSM logs.
6. Revise SSM Plan within 45 days after malfunction event. NOTE: If revision changes the scope of SSM activities, the plan revision does not take effect until written notification of the change is submitted to [EPA or the delegated authority].

Appendix:

Preventative Maintenance/Malfunction Abatement Plan (PM/MAP)

Ray Compressor Station
Plant 3

For
Compressor Engines

Prepared by:
Joe S. Taylor
July 2012

Table of Contents

1.0 PM/MAP Overview and Approval

Facility: RAY COMPRESSOR STATION PLANT 3
Physical Address: 69333 Omo Road
Armada, MI 48005
Plan Adoption Date: _____
Previous Revisions: None
_____
_____

Purpose of the PM/MAP:

The purpose of this PM/MAP is to describe the actions that will be taken at the Ray Compressor Station Plant 3 to prevent, detect, and correct malfunctions or equipment failures that could result in emissions exceeding any applicable limits. The equipment included in this Plan are the compressor engines listed in **Table 1.**

This PM/MAP and any revisions of this Plan, will be maintained for a period of five (5) years, and will be on file at the Ray Compressor Station. This PM/MAP does not contain proprietary information.

At Ray Compressor Station, the Field Leader, Dominic Tomasino or his designee, is responsible for assuring that the most recent copy of this PM/MAP is made available to personnel involved with the affected operations. This individual is also responsible for ensuring that Station employees are aware of the procedures and requirements contained in this Plan.

All reports for the PM/MAP must be signed by a Responsible Official.

PM/MAP Approval: Initial PM/MAP – Yes [X] or Revision No. _____

Name: _____ Date: _____

Title: _____

Signature: _____

2.0 Equipment Covered by PM/MAP

This PM/MAP covers the gas compressor engines and related emission controls and monitoring equipment that are included in **Table 1**.

Table 1. IC Engines Covered by PM/MAP

Facility: RAY COMPRESSOR STATION PLANT 3

Engine ID	Engine Description		Site-Rated HP	Emission Controls (NSCR/AFRC or Oxy-Cat)	Pressure Drop & CPMS-T	Subcategory & Compliance Date for MACT Requirements (check one & enter compliance date)
	Manufacturer	Model				
BLB 00568	Caterpillar	G3616TALE	4,735	Oxidation catalyst	TBD during initial compliance demonstration shutdown at 1350 and 450° F.	☐ 4SRB x 4SLB ☐ 2SLB compliance date: (TBD upon startup)
BLB 00591	Caterpillar	G3616TALE	4,735	Oxidation catalyst	TBD during initial compliance demonstration shutdown at 1350 and 450° F.	☐ 4SRB x 4SLB ☐ 2SLB compliance date: (TBD upon startup)
BLB 00599	Caterpillar	G3616TALE	4,735	Oxidation catalyst	TBD during initial compliance demonstration shutdown at 1350 and 450° F.	☐ 4SRB x 4SLB ☐ 2SLB compliance date: (TBD upon startup)
BLB 00602	Caterpillar	G3616TALE	4,735	Oxidation catalyst	TBD during initial compliance demonstration shutdown at 1350 and 450° F.	☐ 4SRB x 4SLB ☐ 2SLB compliance date: (TBD upon startup)
BLB 00604	Caterpillar	G3616TALE	4,735	Oxidation catalyst	TBD during initial compliance demonstration shutdown at 1350 and 450° F.	☐ 4SRB x 4SLB ☐ 2SLB compliance date: (TBD upon startup)

3.0 Engine Operating Variables to be Monitored

The Electronic Control Module (ECM) monitors the operating parameters of the engine. The ECM can initiate a warning or a shutdown if a specific engine parameter exceeds an acceptable range.

Engine ECM Monitoring

Low System Voltage

High Engine Coolant Temperature (88° C Jacket Water Rating)

Low Engine Coolant Temperature

High Pump Outlet Pressure

Low Jacket Water Outlet Pressure

Engine Overspeed

Engine Overload

High Engine Oil Temperature

Low Engine Oil Pressure (Under 600 RPM)

Low Engine Oil Pressure (Over 600 RPM)

High Engine Oil Pressure

High Oil Filter Differential Pressure

Low Oil Filter Differential Pressure

High Fuel Temperature

Low Fuel Differential Pressure

High Fuel Differential Pressure

High System Voltage

High Inlet Air Temperature at Low Engine Load 54° C SCAC

High Inlet Air Temperature at High Engine Load 54° C SCAC

High Engine Load

High Engine Oil to Engine Coolant Differential Temperature

High Inlet Air Restriction (Right)

High Inlet Air Restriction (Left)

The Integrated Combustion Sensing Module (ICSM) monitors the temperature of the cylinder exhaust ports, the inlets of the turbocharger turbine, and the outlets of the turbocharger turbines. The ICSM also monitors the combustion sensors.

Integrated Combustion Sensing Module (ICSM)

High Exhaust Temperature (Each Cylinder Exhaust Port)

Exhaust Port Temperature High Deviation

Exhaust Port Temperature Low Deviation

High Turbo Turbine Inlet Temperature

High Turbo Turbine Outlet Temperature

Engine Maintenance logs will be kept in the SAP system. A sample work order can be found on the next page:

ENG 3-01-02 CATALYST/SILENCER INSP - 1Y

GE08

Notification No: 1012922705
Order No: 16528556
Priority: Code - DEQ
Short Description: ENG 3-01-02 CATALYST/SILENCER INSP - 1Y

Printed By: DJTOMASI
Printed On: 07/02/12

Plant: White Pigeon T&S
Work Type: GPRM
Work Order Title: Gas Preventative Maintenance

Field Complete: Y / N

Functional Location

Functional Loc: CC-WP-PLT31111 Main Engines/Compressors
Township: TRS: WHITE PIGEON COMPRESSOR STA County: Billable: N
Customer: Account Type:
Address:
Addl Prem Info: Bldg: Floor: Room: Apt/Suite:
City: State: Zip:
Lat/Long:
Caller's Name: Primary Phone: Call Back Phone:

Time Frame For Completing The Work

Priority: Code - DEQ

Operation No	Work Ctr	Start No Earlier	Finish No Later
0010	GTCMPMCH	11/18/11	11/18/11

Component List

Operation No.	Description	Stock Nbr	Quantity	Storage Loc	Matl Used

Operation Step

Operation No/ Comments	Description (Short Text)	Measurement Point	Record Meas Document (Act Reading)	Initials/Date	Create New Notification? (Follow-up Work)
0010	EXHAUST CATALYST/SILENCER INSP - 1Y				

Object List

Equipment No/ Equip Desc	Measurement Point/ Comments	Record Meas Document (Act Reading)	Initials/Date	Create New Notification? (Follow-up Work)
3000082003	ENGINEHRCOUNTER		_____	
ENGINE 3-01-02		_____	_____	_____

Crew Instructions

Operation

0010 EXHAUST CATALYST/SILENCER INSP - 1Y

REFER TO LOCAL PROCEDURE 3-30

DONE IN CONJUNCTION WITH ROP EMISSIONS TESTING

4.0 Engine Malfunction Events & Procedures

Malfunction Events for Engines in Table 1

Engine Electronic Control Module (ECM) Monitoring

- Low System Voltage
  - Shutdown @ 18 Volts
- High Engine Coolant Temperature (88° C Jacket Water Rating)
  - Shutdown @ 208 °F
- High Pump Outlet Pressure
  - Shutdown @ 93 psi
- Low Jacket Water Outlet Pressure
  - Shutdown @ 14.9 psi
- Engine Overspeed
  - Shutdown @ 1017 rpm
- High Engine Oil Temperature
  - Shutdown @ 194 °F
- Low Engine Oil Pressure (Under 600 RPM)
  - Shutdown @ 14.5 psi
- Low Engine Oil Pressure (Over 600 RPM)
  - Shutdown @ 50.8 psi
- High Engine Oil Pressure
  - Shutdown @ 145 psi
- High Oil Filter Differential Pressure
  - Shutdown @ 43.5 psi
- Low Oil Filter Differential Pressure
  - Shutdown @ 0.44 psi
- High Inlet Air Temperature at Low Engine Load 54° C SCAC
  - Shutdown @ 185 °F
- High Inlet Air Temperature at High Engine Load 54° C SCAC
  - Shutdown @ 167 °F
- High Engine Oil to Engine Coolant Differential Temperature
  - Shutdown @ 59 °F
- High Inlet Air Restriction (Right)
  - Shutdown @ 0.76 psi
- High Inlet Air Restriction (Left)
  - Shutdown @ 0.76 psi

Integrated Combustion Sensing Module (ICSM)

- High Exhaust Temperature (Each Cylinder Exhaust Port)
  - Shutdown @ 1202 °F
- Exhaust Port Temperature High Deviation
  - Shutdown @ 212 °F
- Exhaust Port Temperature Low Deviation
  - Shutdown @ 752 °F
- High Turbo Turbine Inlet Temperature
  - Shutdown @ 1202 °F
- High Turbo Turbine Outlet Temperature
  - Shutdown @ 1112 °F

*Malfunction events listed above will be investigated and mitigated using the CATERPILLAR G3600 Engines Troubleshooting Guide.

5.0 Major Engine Parts Replacement Inventory

Part Number	Part Description
CATE-1948518	Plug, Spark
CATE-2835269	Transformer
CATE-9Y6792	Gasket
CATE-1791502	Element, Filter
CATE-6V3349	Seal
CATE-1G8878	Element, Filter
CATE-1059741	Element, Filter
CATE-6V3602	Seal, O-ring
CATE-8T8883	Seal, O-ring
TES-JFG-312R	Filter, Fuel Gas
CATE-1101168	Switch Assembly, Jacket Water
CATE-1162649	Thermocouple
CATE-1308299	Sensor Group, Fuel, Air Manifold/Oil Temperature
CATE-1495150	Regulator
CATE-1520807	Sensor Group, TE, Thermocouple
CATE-1593219	Sensor, Combustion
CATE-1638523	Sensor Group, PR, Filtered Oil Pressure
CATE-1945338	Sensor, Speed
CATE-1952431	Sensor Group, KN, Knock Detection
CATE-2076859	Sensor Group, PR, Crankcase Pressure
CATE-4W7103	Element, Filter

Remaining items will be ordered from CAT on an as-needed basis.

6.0 Oxidation Catalyst Operating Variables

The following variables will be constantly monitored using pressure and temperature transmitters feeding data into a digital control system (DCS) with a data historian. Operating ranges will be established during the initial performance test:

Pressure Drop across Catalyst

Maintain the catalyst so that the pressure drop across the catalyst does not change by more than two inches of water, at 100 percent load (+/- 10 percent load), from the pressure drop measured during the initial performance test (initial performance test will be conducted at 100 percent load +/- 10 percent load). Pressure drop across the catalyst will be monitored by an electronic pressure sensitive device.

Catalyst Inlet Temperature

Maintain the engine exhaust temperature so that the catalyst inlet temperature is greater than or equal to 450°F and less than or equal to 1350°F. The catalyst inlet temperature will be continuously monitored by a Continuous Parameter Monitoring System (thermocouple).

7.0 Oxidation Catalyst Malfunction Events & Procedures

Malfunction Events for Oxidation Catalyst Included in **Table 1:**

- High Catalyst Backpressure
  - @ Full speed & load (+,- 10%), shutdown @ (initial test backpressure + 2" water column)
- Low Catalyst Backpressure (after unit is online)
  - @ Full speed & load (+,- 10%), shutdown @ (initial test backpressure minus 2" water column)
- High Catalyst Temperature
  - Shutdown @ 950 degrees F
- Low Catalyst Temperature
  - After engine cold start & warm-up, shutdown @ 650 degrees F
- Catalyst deteriorates to 94% reduction efficiency, shutdown engine and inspect catalyst system

High Catalyst Back Pressure

Event Definition:

High backpressure is the original backpressure at full speed and load conditions, plus 2 additional inches of water column. The engine is programmed to shut down at this condition.

Event Procedures:

Excess fouling of the catalyst may significantly impact the performance. At the earliest opportunity, conduct the following to evaluate and restore catalyst function:

- Record date & time of event beginning in startups, shutdowns & malfunctions (SSM) log.
- Remove catalyst elements to confirm excess fouling – complete log for catalyst removal.

  $\Rightarrow$ Determine cause of excess fouling (catalyst troubleshooting manual or other), if possible and correct the cause.
- Conduct washing of catalyst & re-install or replace - complete log.
- Complete SSM log and prepare Catalyst Event Checklist to document actions taken to respond to this malfunction.
- Retest efficiency to ensure system meets minimum 93% CO reduction requirement.

Catalyst Failure

Event Definition:

Catalyst failure is the inability of the catalyst system to reduce carbon monoxide levels by the requisite 93% from the CO concentrations at the inlet to the catalyst.

*NOTE: The catalyst **will** undergo a normal aging process over time, and will lose efficiency gradually, eventually falling below the 93% minimum level. This normal aging process, and the relative predictability of catalyst failure, is an O&M function. If catalyst failure is the result of the normal aging process, there will be no 'root cause' to investigate nor remediate.*

Catalyst Failure Event may be caused by the following conditions:

- Catalyst poisoning
- Catalyst physical damage
  (as a result of excess vibration, engine backfire or other cause)

Event Procedure:
Confirmed catalyst failure will require replacement of the catalyst element. At the earliest opportunity:

- Record date & time of event beginning in startups, shutdowns & malfunctions (SSM) log.
- Remove failed catalyst elements and complete log for catalyst removal.
- Determine cause of catalyst failure (catalyst troubleshooting manual or other), if possible and address underlying cause of catalyst failure, as applicable.
- Install replacement catalyst element(s) - complete log.
- Complete SSM log and prepare Catalyst Event Checklist to document actions taken to respond to this malfunction.

Catalyst Gasket Failure

Event Definition:
A gasket failure will allow exhaust gasses to bypass the catalyst elements, resulting in both a decline in destruction efficiency of CO, as well as a reduction in backpressure upstream of the catalyst. The backpressure measurement should be observed and recorded by the sensing device in the port upstream of the catalyst, and the engine is programmed to shut down if the backpressure is reduced by 2 inches of water column from the initial backpressure measurement taken during the engine break-in efficiency test.

Event Procedure:
Confirmed catalyst gasket failure will require replacement of the catalyst element gasket. At the earliest opportunity:

- Record date & time of event beginning in startups, shutdowns & malfunctions (SSM) log.
- Inspect all catalyst elements and gasket assemblies.
- Remove failed catalyst element gasket(s).
- Install replacement catalyst element gasket (s).
- Check for exhaust leaks – correct if present.
- Complete SSM log and prepare Catalyst Event Checklist to document actions taken to respond to this malfunction.

8.0 Emissions Checks

Exhaust emissions will be checked following the procedure below:

The CO and O_2 will be measured at the inlet and outlet of the oxidation catalyst with an exhaust gas analyzer using ASTM D6522-00 (incorporated by reference, according to §63.14). Measurements will be made to determine O_2 at the same time as the measurements for CO concentration. The CO concentration will be corrected to 15% O_2, dry basis.

9.0 Scheduled Oxidation Catalyst Maintenance

The oxidation catalyst manufacturer, Pollution Control Associates (PCA), recommended cleaning and/or replacement schedule is listed below:

OPERATION WARNING SIGNS AND GUIDELINES

The major indications of change in catalyst operation that may signal the need for maintenance are:

1. Change in temperature rise across the catalyst. Normal rise may range from a few degrees to 100+ degrees, depending on the application and design. It is affected by the amount of destruction, gas flow rates, the amount of catalyst used and other factors. Consult your initial readings taken when the engine was first commissioned. *A practical guideline* is to remove and inspect the catalyst when the temperature rise drops to one-half the initial value. The change in temperature rise is the useful indicator.

2. Change in pressure drop across the catalyst. If soot or ash is clogging the honeycomb, the pressure difference will rise. *A practical guideline* is to remove and inspect the catalysts when the pressure drop is double the initial value or when engine backpressure becomes too high. Some regulations say that a 2" w.c. increase warrants catalyst inspection. This is about double the initial value, based on PCA sizing practices.

3. Upward trend in emission testing data. The emissions of the system will rise over time due to normal operation. Some exhaust compounds will slowly mask or cover the catalytic material. Most masking can be reversed by regenerating the catalyst periodically. Any sudden change in readings often indicates an unusual circumstance that needs to be investigated and identified:

   a. Are the engine operating parameters still the same or similar to the initial baseline readings?

   b. Has the fuel changed? Engine specifications state the fuel requirements.

c. Is the AFRC controller in adjustment? Engine temperatures can change drastically when operated out of mixture range.

d. Are all engine cylinders firing? Mis-fires add fuel to the exhaust and other cylinders may run hotter to produce rated output.

e. Has the engine been modified or the engine controller setting changed?

f. Was there a catastrophic event such as a turbo failure?

g. Has the catalyst been poisoned by exposure to antifreeze or other destructive compounds?

h. Has the catalyst been in operation for an extended period without being inspected?

Note: the length of time between inspections will vary based on operating conditions, manufacturers' requirements and duty cycle.

4. Failure of a regular emissions test or pretest.

REMOVAL, PHYSICAL INSPECTION AND TROUBLESHOOTING

When you remove the catalyst look for:

1. Sooty 'tracks' in the housing and gaskets that indicate some exhaust is bypassing the catalyst.

2. Large deposits of SOOT or ASH, especially on the face of the element.

3. Burned areas in the face of the element, evidence of fuel/oil fires or high temperature.

4. Telescoped catalyst bed, evidence of backfiring.

5. Gaps or sags in the catalyst creating a direct path through the bed. This is very rare in PCA catalysts due to active tension control during winding and over-packing and compressing the bed in rectangular units. When a catalyst is not functioning or if monitoring data indicates a decline in performance, the catalyst should be removed and examined.

INSURE ENGINE IS RUNNING WITHIN SPECIFICATIONS

1. Most PCA catalysts are built with integral bracing that helps them withstand engine backfire pressure pulses or other forces that can cause the catalyst to deform, making removal difficult. If the catalyst has been deformed, try to determine and fix the condition that caused the deformation.

2. If gaps or sags or bulges are evident, try to determine the cause such as excessive backfiring due to malfunctions or poor engine starting procedures.

3. If deep burns in the face of the elements are evident, the engine may be blowing excessive amounts of oil into the exhaust. These may build up in small areas and ignite. Check and service the engine to eliminate the source of excess oil. Other sources of "fire" are raw fuel in the exhaust and "hot" fuel.

4. Chemical Regeneration will be required if mechanical cleaning does not remove the debris and if the catalyst is not too old for regeneration.

5. Caterpillar maintenance procedures should be followed to keep the ignition and fuel systems operating within the specified ranges.

CATALYST REGENERATION (Washing)

Catalysts, in good condition, can be regenerated 2-3 times before they have to be replaced. Regeneration can often restore much of the effectiveness of the catalyst. However, if the performance of the unit was operating near EPA limits when new, a regenerated or new element will likely be needed. The regeneration process consists of immersing the catalyst into baths using weak non-phosphate alkaline cleaners and acetic acid solutions with de-ionized water rinses and careful drying to remove organic and inorganic compounds that have been deposited onto the catalyst beds. This work can be done by the original manufacturer or its designated contractor and should be done in accordance with manufactures maintenance procedures. The use of other chemicals or incorrect concentrations can permanently damage the element.

PCA does not recommend that chemical processing be done in the field unless full laboratory practices are available. Chemicals must be mixed carefully and used properly to avoid damage. After processing, solutions must be neutralized and properly disposed of. Solids removed from catalysts may contain heavy metals and other hazardous compounds.

When you install a regenerated element you should begin new data logging as though the element were new. You will notice the initial performance of the regenerated element to be less than when it was new. After the second or third

reprocessing, the performance difference between the before and after stages will be very close, indicating the need to purchase a new element.

A properly sized and maintained system should last several years. If short catalyst life is experienced, try to obtain actual engine output data, compare it to the original information used to size the catalyst. PCA can assist in resizing the catalyst for longer life.

Use only deionized water known to be free of calcium, zinc and other metallic ions for washing. Hard tap water, containing metallic ions will poison a catalyst over time.

Ultrasonic cleaning, which is really a way of agitating the cleaning solutions to shorten the process time, should be applied with care to prevent damage to the catalytic coatings on the steel substrates.

The use of high pressure washing equipment or high pressure air is not recommended. The platinum or other coatings are not plated on, and can be washed off with high pressure fluids.

CATALYST RE-INSTALLATION

1. Clean all mating surfaces of the catalyst and vessel to allow gaskets to seal properly.

2. Reinstall the existing gasket if it is in good condition or install a new gasket of the proper size, material and temperature rating.

3. Reinstall any mounting hardware

4. Seal the vessel cover(s).

5. Perform a final inspection and restart the unit in accordance with proper operating instructions.

6. Make entries in the data sheets and note readings, logging them as though the unit were new.

DANGER: Exhaust gases are poisonous and must be properly vented to the atmosphere. Do not operate the system unless all covers are sealed and in place.

10.0 Major Oxidation Catalyst Replacement Parts Inventory

- PCA Oxidation Catalyst Elements
- PCA Catalyst Element Gaskets

11.0 Supervisory Personnel Responsible for Maintenance of Control Equipment

Name:	Dominic J. Tomasino
Title:	Field Leader
Location:	Ray Compressor Station
	69333 Omo Road
	Armada, MI 48005
Phone:	586 784-2096 office
	586 321-3038 cell
Email:	dominic.tomasino@cmsenergy.com

12.0 Retention of Records

Records shall be maintained on file for a period of 5 years.

13.0 Updates/Revisions of PM/MAP

Periodically this PM/MAP may need to be revised. Copies of all PM/MAP revisions will be retained for a period of 5 years.

Revisions must be completed within 45 days if the PM/MAP does not address – or inadequately addresses – an event that occurs and meets the characteristics of a malfunction. The revisions must include procedures to operate and maintain the source during similar malfunction events and a program of corrective action for similar malfunctions of the compressor engines or associated controls and monitoring equipment. The revised plan shall be submitted to the AQD District Supervisor. Should the AQD determine the PM/MAP to be inadequate, the AQD District Supervisor may request modification of the plan to address those inadequacies. MDNRE recommends the PM/MAP be reviewed annually.

A CMS Energy Company

Consumers Energy Company

Ray Compressor Station

Armada, Michigan

Units 3-1, 3-2, 3-3, 3-4 & 3-5

Continuous Parameter Monitoring System (CPMS)

Monitoring Plan

April 17, 2013

[1]Revisions must be retained for 5 years from the date of the revision.

1945 W. Parnall Road • Jackson, MI 49201 • Fax: 517 788 2329 • www.consumersenergy.com

Monitoring Plan Revision History[1]			
Revision No.	**Revised By**	**Revision Date**	**Comments (e.g. Description of Revisions)**
0	AD Kapuga	April 17, 2013	Draft for Review

[1]Revisions must be retained for 5 years from the date of the revision.

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1.0 CPMS Monitoring Plan Overview

Facility: Ray Compressor Station

Physical Address: 69333 Omo Road, Armada, MI

1.1 Regulatory Requirement

Subpart ZZZZ of 40 CFR 63 [National Emission Standard for Hazardous Air Pollutants (NESHAP) for Reciprocating Internal Combustion Engine (RICE)] requires continuous monitoring of the exhaust catalyst inlet temperature for affected units at the Ray Compressor Station. The primary monitoring requirement are defined in §63.6625(b) and §63.6635 of Subpart ZZZZ. Additional requirements are defined in the General Provisions (part 63, Subpart A). §63.6625(b) requires a Monitoring Plan for the continuous parameter monitoring system (CPMS) that monitors the catalyst inlet temperature to ensure compliance with a specified temperature operating limit. Common criteria associated with CPMS instrumentation and its operation can be used at multiple sites, but Subpart ZZZZ requires a site-specific Monitoring Plan that must be available for review if requested by EPA or delegated state or local air quality agencies.

1.2 Definitions

The following definitions apply:

Unit Startup: Unit startup is initiated in all cases when fuel and ignition are turned on and is considered complete when the unit bypass valve is fully closed.

Unit Shutdown: Unit shutdown is initiated when the issuance of a shutdown command, pushing the shutdown button, or reducing the unit load with intent to shut down if shutting down manually. The shutdown is complete when fuel and ignition have been turned off.

Malfunction: A malfunction means any sudden, infrequent, and not reasonably preventable failure of air pollution control and monitoring equipment, process equipment, or a process to operate in a normal or usual manner which causes or has the potential to cause, the emission limitations in an applicable standard to be exceeded. Failures that are caused in part by poor maintenance or careless operation are not malfunctions. This definition is provided for information only. Operations should consult

with the Station Supervisor to determine whether or not a malfunction has occurred due to any unit alarm or shutdown for purposes related to the MACT rules.

A CPMS is out-of-control if:

The zero (low-level), mid-level (if applicable), or high-level calibration drift (CD) exceeds two times the applicable CD specification in the applicable performance specification or in the relevant standard; or

The CPMS fails a performance test audit, relative accuracy audit, relative accuracy test audit, or linearity test audit.

2.0 Affected Sources and Associated CPMS Equipment

This section provides information on the affected RICE and the CPMS instrumentation and equipment. Per §63.6625(b)(1)(i), the CPMS Monitoring Plan must include monitoring system design specification and equipment performance criteria for the sample interface, detector signal analyzer, and data acquisition and calculations.

2.1 Affected Sources Description

Consumers Energy's Ray Compressor Station (B6636) is a natural gas compressor station used to maintain pressure of the natural gas in order to move it in and out of storage reservoirs and along the pipeline system. In 2013, five (5) natural gas fired, lean burn, reciprocating engines with a two-way catalyst for control (Caterpillar Model G3616, 4735 hp each) were installed. All engines are of a four stroke design and are spark-ignited (4 stroke lean burn - 4SLB).

Engines Subject to RICE MACT & Provisions of this Plan				
Engine ID	Engine Description		Site-Rated HP	Emission Controls
	Manufacturer	Model		
EUENGINE3-1	Caterpillar	G3616	4,735	OxyCat
EUENGINE3-2	Caterpillar	G3616	4,735	OxyCat
EUENGINE3-3	Caterpillar	G3616	4,735	OxyCat
EUENGINE3-4	Caterpillar	G3616	4,735	OxyCat

2.2 System Design Considerations

The purpose of the CPMS is to:

- Monitor the catalyst inlet temperature every 15 minutes, not including periods of startup, shutdown, or malfunction.
- Average the data on a 4-hour rolling basis.
- Ensure the catalyst inlet temperature is maintained between the established temperature range of 450°F – 1350°F.

2.2.1 Temperature Measurement Device Specifications

The following specifications apply to the temperature measurement devices:

Parameter	Specification
Location	Immediately upstream of the catalyst face, with an insertion depth of at least 1/3 pipe diameter and no more than ½ pipe diameter into the flow stream. Based on exhaust piping layout and the inclusion of mixing baffles in the catalyst housing, turbulent flow is assured so relatively uniform temperatures are anticipated along an axis across the exhaust duct.
Device Type	A NIST traceable RTD
Range	450°F - 1350°F
Tolerance	±1.0 percent of the temperature range, or 2.8°C (5°F), whichever is larger [§63.6625(b)(4)]

2.2.2 Wiring

Conduit cable is installed per the latest edition of the National Electric Code.

2.2.3 Data Acquisition System

The data acquisition system (DAS) is composed of an Ethernet network that logs catalyst inlet and outlet temperatures. This information is logged at six separate locations. In the event of a failure of the entire network, the PLC will continue to log 24 hours of data. The DAS will provide the following readouts: [§63.8(c)(2)(ii)]

- Instantaneous catalyst inlet temperature
- 15-minute snapshot temperature readings
- 1-hour average temperatures
- 4-hour rolling average temperatures
- Readout or other indication of operation must be readily accessible on-site.

Data will be retained for at least 6 days in the DAS for retrieval in the event of a failure of the reporting system. Additionally, the operator will have the capability of generating a screen print from the DAS in the event of a failure of the reporting system.

2.2.4 Reporting System

A PC with reporting software installed is connected to the DAS for data retention and report generation. The software is used to collect the data from the DAS, collate into a report formatted for printing, and for long-term retention of the data.

3.0 Temperature Monitoring System Performance Evaluation and Periodic QA/QC Procedures

3.1 Periodicity

The requirements for periodic audits consist of equipment requirements and procedural requirements. All equipment has to be calibrated and meet general requirements for accuracy: (1) An accuracy hierarchy of at least three, and (2) an accuracy that is NIST-traceable. An exception to the accuracy requirements for instruments that are used to audit the accuracy of the CPMS is when performing an accuracy audit using a redundant sensor, the redundant sensor would have to have an accuracy equal to or better than the accuracy of the primary sensor.

A factory calibrated unit was installed on each of the units. The calibration certification sheets, or other appropriate documentation, shall be retained demonstrating factory calibration. Annual QA/QC evaluations of the CPMS shall be conducted as described below.

3.2 Methodology

The performance of the temperature CPMS will be validated by comparing measured values to a calibrated measurement device, based on ASTM E220-07e1 (Standard Test Methods for Calibration of Thermocouples by Comparison Techniques). The sensor of the calibrated device will be located adjacent to the CPMS sensor. The measurements made using the CPMS and calibrated temperature measurement device will be concurrent.

3.2.1 Calibration

The calibration of the RTD shall be checked in place in accordance with manufacturer's recommendations and company policies and procedures. The methods used shall address both the RTD and the DAS. A written work order documenting steps to be followed shall be used.

3.2.2 Accuracy

The accuracy criteria for the validation check is ±1.0 percent of the temperature, or 2.8°C (5°F), whichever is greater. The catalyst inlet temperature is required to be maintained at 450°F to 1350°F. Therefore, the system accuracy criterion for the CPMS is ±1 percent of temperature.

3.3 Notification

Notification to MDEQ prior to conducting the performance evaluation or with results after testing is not required.

3.4 Documentation

Closeout of the work order shall be considered sufficient documentation provided factory calibration sheets, field readings, and/or other results, as appropriate, are included in the closeout comments or attached to the work order.

3.5 Malfunctioning CPMS

In the event of a malfunction of the CPMS, the engine shall be shut down until such time as troubleshooting can occur. Operation of the engine while troubleshooting a malfunction of the CPMS is acceptable. Possible indications of a malfunction include, but are not limited to:

- Temperatures out of range (high or low)
- Failure to generate daily printouts of the logs
- Erroneous or nonsensical data on the printed logs
- Failure of the visual display of temperatures from the DAS

3.5.1 Recordkeeping and Reporting

Logs documenting the malfunction of the CPMS, immediate actions and corrective actions shall be taken in accordance with Section 5.3 of this plan. Additionally, the Environmental Department shall be notified immediately of the malfunction.

3.5.2 Troubleshooting a Malfunctioning CPMS

Ray shall troubleshoot the CPMS according with the manufacturer's recommendations, company policy and procedures and good operating practices.

4.0 CPMS Operation and Maintenance

4.1 CPMS Operation

The CPMS will be in operation whenever the monitored engine operates, with the exception of monitoring malfunctions, associated repairs, and required quality assurance or control activities. Data will be collected as follows:

- Sample the catalyst inlet temperature at least once every 15 minutes including startup, shutdown and malfunction periods
- Average the 15-minute samples on an hourly basis. Average the hourly average on a 4-hour rolling average basis. Averaging should start from "end of startup event" (i.e., when the bypass valve is fully closed) and should stop at the "beginning of shutdown (i.e., issuance of the stop command) or malfunction event.
- An hour is defined as a 60-minute period beginning at the o-clock (i.e., 1:00, 2:00, etc.)
- If a unit starts midway through an hour, record 15-minute data points but begin averaging only if there are at least two data points for the first-based 60 minute period. Each of the two data points should represent a 15-minute period.
- If a unit stops midway through an hour, the 15-minute data points will be monitored and recorded; however, the average for that last clock-based 60 minute period should only be computed if at least two data points are available.
- Each 4-hour average calculation will include the most current hourly average and the 3 previous hourly average values collected during normal sequential engine operation.
- A 4-hour average will not be calculated until four 1-hour average values have been tabulated in sequence
- Each engine shutdown will reset the averaging process

Alarms and shutdowns shall be provided as follows:

- The CPMS shall alarm when the oxidation catalyst inlet temperature reaches 550°F decreasing or 1250°F increasing
- The CPMS shall shut down the unit when the oxidation catalyst inlet temperature is below 400°F for 20 minutes, or exceeds 1200°F.
- Alarms and shutdowns shall be disabled as follows:
    - High temperature: never
    - Low temperature: during unit startup

4.2 CPMS Maintenance

4.2.1 Preventative Maintenance

CPMS maintenance will be conducted in according with company policy and procedures. Additionally, daily station walkdowns take place to check on obvious signs of physical failure of the equipment.

4.2.2 Corrective Maintenance

Corrective maintenance will be conducted according to manufacturer's recommendations, company policy and procedures, and good operating practices, in a manner consistent with safety and good air pollution control practices for minimizing emissions in the event of a CPMS malfunction, impending malfunction, or out-of-control CPMS. In lieu of conducting immediate corrective maintenance, operations may shutdown the associated engine until such time as corrective maintenance can be performed.

4.3 Spare Parts

A set list of spare parts of the CPMS will not be maintained in inventory. If a spare part for the system is not available when needed, the affected engine will be shut down until such time as the necessary spare part can be procured and installed.

5.0 Data Management

5.1 Valid Data

Valid data is defined as data not "recorded during monitoring malfunctions, associated repairs, and required quality assurance or control activities". Specifically, valid data is comprised of:

- 15-minute readings not recorded during monitoring malfunctions, associated repairs, and required quality assurance or control activities
- Hourly averages consisting of at least two (2) valid 15-minute readings
- 4-hour rolling averages consisting of four (4) valid hourly averages

5.2 Data Review

Operations shall review the CPMS daily reports to:

- Confirm all required data was collected
- Identify any data collected that was not valid data, as defined above
- Confirm that no exceedances of temperature limits occurred

Missing data may be recovered by:

- Forcing a new printout
- Recover data from DAS/PLC
- Generating screen print

If missing data is unrecoverable (e.g., due to power failure), exceedances are identified, or non-valid data is identified, the Environmental Department shall be notified immediately. Additionally, in the event of repeated instances of missing data, whether recoverable or unrecoverable, over a short duration of time, an investigation as to the causes is to be conducted.

5.3 Recordkeeping

The following records collected by the CPMS are required to be retained for a period of five years. At a minimum, the most recent two-year data shall be available on site. The other three years data may be stored off site, but should be accessible within a reasonable time. These records can be retained either electronically, via hard copy, or both, and shall be easily accessible.

- Each 4-hour average
- Each hourly average used to calculate the 4-hour average values

- Each 15-minute data point used to calculate hourly averages, as well as 15-minute data points during startup and shutdowns.
- The algorithm/calculation procedure used to reduce data
- All readings taken during periods of CPMS breakdowns and out-of-control periods

Additionally, the following records shall be created and retained regarding the CPMS:

- The date and time identifying each period during which the CPMS was inoperative, except for zero (low-level) and high-level checks
- The date and time identifying each period during which the CPMS was out-of-control
- The date and time of commencement and completion of each time period where the CMPS 4-hour rolling temperature was out of the specified limits in this plan, other than during periods other than startups, shutdowns and malfunctions of the affected source.
- The nature and cause of any malfunction (if known)
- The corrective action taken or preventative measures adopted
- The nature of the repairs or adjustments to the CPMS that was inoperative or out of control
- The total process operating time during the reporting period
- Documentation of any QA/QC procedures performed for CPMS

5.4 Reports

5.4.1 Daily Data Reports

A daily report for each unit shall be generated and printed after midnight for the previous calendar day. The report shall include, at a minimum, the following:

- Each 15-minute data sample of the catalyst inlet temperature
- Each hourly average of the catalyst inlet temperature
- Each 4-hour rolling average of the catalyst inlet temperature
- Each malfunction event and the occurrence and duration of that event (begin time and end time)
- Every unit alarm and shutdown

5.4.2 Compliance Reports

- Immediate notifications of non-compliance
- Semiannual reports and annual compliance reports
- Notification of malfunctioning and out-of-control CPMS events
- Notification of intent to conduct performance test
- Notification of compliance status at the completion of performance tests

6.0 PROGRAM OF CORRECTIVE ACTION FOR A MALFUNCTIONING CPMS

The CPMS-T is required to measure inlet temperature into the oxidation catalysts. Inlet temperature must be monitored continuously at all times the engines are operating, except during CPMS malfunctions, repairs, and QA/QC activities (such as calibration checks).

Malfunction Events Included in SSM Plan for CPMS-T**:**

The following malfunction events are covered by the SSM Plan for the CPMS-T devices:

- Data Acquisition CPMS-T Not Working
- Thermocouple Not Working

Data Acquisition CPMS-T Not Continuously Working

Event Definition: Engine parameters are monitored by the CAT ADEM III system and the unit control programmable logic controller (PLC) system. A failure of either of these systems shuts the engine down immediately, eliminating emissions. The data acquisition system is composed of an Ethernet network that logs catalyst differential pressures and inlet and outlet temperatures. This information is logged at six separate locations. In the event of a failure of the entire network, the PLC will continue to log 24 hours worth of data.

NOTE: Malfunction events may not include events caused in part by poor maintenance or careless operation.

Data Acquisition System Not Working Event may be caused by the following conditions:

- Software failure, glitch
- Loss of power or communications
- Improper or failed wiring

Event Procedures:

If the Data Acquisition System is not working, restore system operation as soon as practical.

Procedures for this event may include:

- Record date & time of event beginning for the SSM log.
- Troubleshoot per manufacturer's recommendations, including reinstallation of software, inspection/repair of power or communications connections and wiring, if required.

- Confirm restoration of data acquisition system operation. Record date & time of event ending
- Complete SSM log and prepare Inlet Temperature Event Checklist to document actions taken to respond to this malfunction.

Thermocouple Not Working or Working Improperly

Event Definition: Thermocouple Not Working or Working Improperly Event may be caused by the following conditions: Thermocouple input failure can indicate a failure of the thermocouple itself, or failed wiring.

Event Procedures:

If the thermocouple is not working or working improperly, restore system operation as soon as practical. In the event of temperature readings below or in excess of MACT limits, the controls are already programmed to shut the engine down. In the event of a loss of signal, the controller is, again, programmed to shut the engine down. Procedures for this event may include:

- Record date & time of event beginning for the SSM log.
- TC input failure will be logged in the SSM
- Conduct troubleshooting per manufacturer's instructions.
- Identify required adjustment, repair, or replacement, per manufacturer instructions. Complete required actions.
- Thermocouples cannot be calibrated. Once replaced, check the temperature readout on the monitor screen for atmospheric temperature as an indication the thermocouple is giving accurate readings.
- Repair information will be on the inlet temperature event checklist

Inlet Temperature Event Checklist

Completed by:_____ Date:_____

Type of Event:

☐ **Thermocouple Not Working**

☐ **Other*_____**

Thermocouple Not Working

- **Date & Time Noted TC Not Working:_____**
- **Data & Time Last Data Recorded:_____**
- **Date & Time Recorder Operation Restored:_____**
- **Reason for Recorder Failure, if known:_____**

_____

_____

- **Did you follow manufacturer's procedures for troubleshooting? ☐ YES ☐ NO***
- **Did you repair or replace the data recorder? ☐ REPAIR ☐ REPLACE**
- **Did you re-calibrate per manufacturer procedures? ☐ YES ☐ NO***

Other*:

Describe what happened:

_____

_____

_____

When did this event begin:_____

When did this event end: _____

Describe the actions you took to respond:

_____

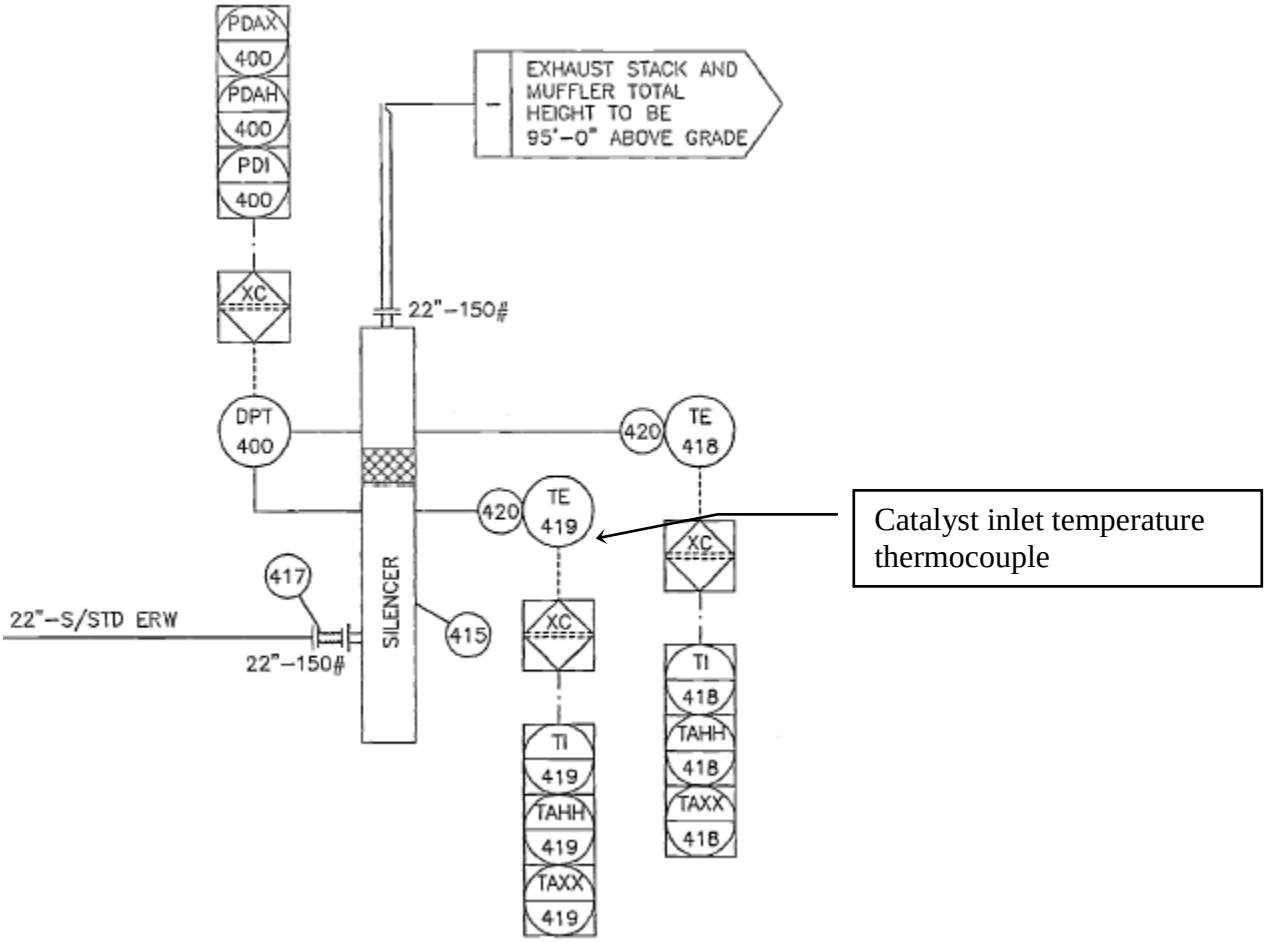
_____

_____

_____

*** If "other" or "NO" there may be immediate reporting requirements.**
Contact _____ immediately at _____ (tel)
and fax this form to: _____ (fax) _____

FIGURES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Catalyst inlet temperature thermocouple

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40 CFR 63 Subpart HHH

Site-Specific Monitoring Plan for

Glycol Dehydration System

Continuous Parametric Monitoring System (CPMS)

Consumers Energy Company

Ray Compressor Station (B6636)

Armada, Michigan

April 24, 2013

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1945 W. Parnall Road • Jackson, MI 49201 • Fax: 517 788 2329 • www.consumersenergy.com

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Revision No.	**Revised By**	**Revision Date**	**Comments (e.g. Description of Revisions)**
0	AD Kapuga	April 24, 2013	Draft
1	AD Kapuga	April 13, 2015	Draft
2	AD Kapuga	June 10, 2015	Incorporated comments from Dominic Tomasino
3	AD Kapuga	October 14, 2015	Incorporated comments from Dominic Tomasino

[1]Revisions must be retained for 5 years from the date of the revision.

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1.0 Glycol Dehydration Unit Inspection & Monitoring Plan Overview

Facility: Ray Compressor Station

Physical Address: 69333 Omo Road, Armada, MI

1.1 Regulatory Requirement

The facility is subject to Subpart HHH of 40 CFR 63 [National Emission Standard for Hazardous Air Pollutants (NESHAP) from Natural Gas Transmission and Storage Facilities], which establishes control, monitoring, recordkeeping and reporting requirements for glycol dehydration units. For each small glycol dehydration unit process vent, the owner or operator shall limit benzene, toluene, ethylbenzene and xylene (BTEX) emissions to the limit determined using the following equation:

$$EL_{BTEX} = 3.10\text{x}10^{-4} \times \text{Throughput} \times C_{i,BTEX} \times \frac{365 \text{ days}}{\text{yr}} \times \frac{1 \text{ Mg}}{1\text{x}10^{6} \text{ grams}}$$

Where:

EL_{BTEX} = Unit-specific BTEX emission limit, megagrams per year
$3.10\text{x}10^{-4}$ = BTEX emission limit, grams BTEX/standard cubic meter-ppmv
Throughput = Annual average daily natural gas throughput, standard cubic meters per day
$C_{i,BTEX}$ = Annual average BTEX concentration of the natural gas at the inlet to the glycol dehydration unit, ppmv

$EUGLYCDEHYD01 = 3.10\text{x}10^{-4} \times 830{,}322 \times 34 \times 365 \times 0.000001 = 3.2$ Mg/yr
$EUGLYCDEHYD02 = 3.10\text{x}10^{-4} \times 762{,}402 \times 34 \times 365 \times 0.000001 = 2.9$ Mg/yr
$EUDEHY3 = 3.10\text{x}10^{-4} \times 1{,}480{,}373 \times 34 \times 365 \times 0.000001 = 5.7$ Mg/yr

This calculated limit must be met in accordance with one of the following:

- Connect the process vent to a control device, or combination of control devices, through a closed-vent system
- Meet the emissions limit through process modifications
- Meet the emissions limit using a combination of process modifications and one or more control devices
- Demonstrate that the emissions limit is met through actual uncontrolled operation

The glycol dehydration process vents at Ray Compressor Station are connected to a control device (thermal oxidizer) through a closed-vent system. For each control device, a continuous parameter monitoring system (CPMS) must be installed and operating.

The primary monitoring requirements are defined in §63.1283(d) of Subpart HHH. Additional requirements are defined in the General Provisions (part 63, Subpart A). §63.1283(d)(1)(ii) requires a site-specific monitoring plan for the CPMS that monitors the thermal oxidizer combustion chamber temperature to ensure compliance with a specified temperature operating limit. The monitoring plan must address the monitoring system design, data collection, and the quality assurance and quality control elements.

1.2 Definitions

The following definitions apply:

Closed-Vent System: A system that is not open to the atmosphere and is composed of piping, ductwork, connections, and if necessary, flow inducing devices that transport gas or vapor from an emission point to one or more control devices. If gas or vapor from regulated equipment is routed to a process (e.g., to a fuel gas system), the conveyance system shall not be considered a closed-vent system and is not subject to closed-vent system standards.

Continuous Recorder: A data recording device that either records an instantaneous data value at least once every hour or records hourly or more frequent block average values.

Malfunction: A malfunction means any sudden, infrequent, and not reasonably preventable failure of air pollution control and monitoring equipment, process equipment, or a process to operate in a normal or usual manner which causes or has the potential to cause, the emission limitations in an applicable standard to be exceeded. Failures that are caused in part by poor maintenance or careless operation are not malfunctions. This definition is provided for information only. Operations should consult with the Field Leader to determine whether or not a malfunction has occurred due to any unit alarm or shutdown for purposes related to the Maximum Achievable Control Technology (MACT) rules.

Safety Device: A device that meets both of the following conditions: the device is not used for planned or routine venting of liquids, gases, or fumes from the unit or equipment on which the device is installed; and the device remains in a closed, sealed

position at all times except when an unplanned event requires that the device open for purpose of preventing physical damage or permanent deformation of the unit or equipment on which the device is installed in accordance with good engineering and safety practices for handling flammable, combustible, explosive, or other hazardous materials. Examples of unplanned events which may require a safety device to open include failure of an essential equipment component or a sudden power outage.

Shutdown: The cessation of operation of a glycol dehydration unit for purposes including, but not limited to: periodic maintenance, replacement of equipment, or repair.

Small glycol dehydration unit: A glycol dehydration unit, located at a major source, with an actual average natural gas flowrate less than 283.0 thousand standard cubic meters per day or actual annual average benzene emissions less than 0.90 Mg/yr.

Startup: Setting into operation of a glycol dehydration unit. Startup includes initial startup and operation solely for the purpose of testing equipment.

Temperature Monitoring Device: An instrument used to monitor temperature and having a minimum accuracy of ±2 percent of the temperature being monitored expressed in °C, or ±2.5 °C, whichever is greater. The temperature monitoring device may measure temperature in degrees Fahrenheit or degrees Celsius, or both.

A CPMS is out-of-control if:

The CPMS fails a performance test audit, relative accuracy audit, relative accuracy test audit, or linearity test audit.

2.0 Affected Sources and Associated CPMS Equipment

This section provides information on the affected emission units and the associated CPMS instrumentation and equipment. The CPMS Monitoring Plan must include monitoring system design specification and equipment performance criteria for the sample interface, detector signal analyzer, and data acquisition and calculations.

2.1 Affected Sources Description

Consumers Energy's Ray Compressor Station (B6636) is a natural gas compression station. The purpose of the facility is to maintain pressure of natural gas in order to move it in and out of storage reservoirs and along the pipeline system. There are three (3) affected sources (glycol dehydration units) installed at the station that are used to remove moisture from natural gas withdrawn from the storage fields, as follows:

Emission Unit ID	Emission Controls
EUGLYCDEHYD01	Thermal Oxidizer
EUGLYCDEHYD02	Thermal Oxidizer
EUDEHY3	Thermal Oxidizer

2.2 Control Equipment Requirements

The closed-vent system shall route all gases, vapors, and fumes to a control device that meets all of the following criteria:

- Designed and operated with no detectable emissions
- If the closed-vent system contains one or more bypass devices that could be used to divert all or a portion of the gases, vapors or fumes from entering the control device, you must meet the following:
  - At the inlet to the bypass device, properly install, calibrate, maintain and operate a flow indicator that is capable of taking periodic readings and sounding an alarm when the bypass device is open; **or**
  - Secure the bypass device valve in the non-diverting position using a car-seal or a lock-and-key type configuration
  - Low leg drains, high point bleeds, analyzer vents, open-ended valves or lines and safety devices are not subject to this requirement

2.3 Inspection & Monitoring

Each closed-vent system shall be inspected as follows:

- For joints, seams, or other connections that are permanently or semi-permanently sealed:

  - Conduct an initial inspection to demonstrate that the closed-vent system operates with no detectable emissions

  - Report inspection results with the Notification of Compliance Status Report

  - Conduct annual visual inspections for defects that could result in air emissions (ie: visible cracks, holes or gaps in piping; loose connections; broken or missing caps or other closure devices)

  - In addition, for components other than those listed above, conduct annual inspections to demonstrate that the components or connections operate with "no detectable emissions".

  - Report inspection results in the Periodic Report

Install, calibrate, operate & maintain a temperature monitoring device equipped with a continuous recorder to measure the combustion chamber temperature for each thermal oxidizer.

- Establish a minimum operating parameter value to define the conditions at which the control device must be operated to continuously achieve the applicable performance requirements.

Emission Unit ID	Minimum Thermal Oxidizer Operating Temperature °F
EUGLYCDEHYD01	1496
EUGLYCDEHYD02	1445
EUDEHY3	1488

- Using data recorded by the monitoring system, calculate the daily average for each monitored operating parameter for each operating day

2.4 System Design Considerations

The purpose of the CPMS is to:

- Continuously monitor the combustion chamber temperature of the thermal oxidizer.
- Record the temperature at least once every 15 minutes, not including periods of startup, shutdown, or malfunction.
- Average the data on a block-hour.
- Calculate a daily average based on the block-hour data.
- Ensure the daily average thermal oxidizer combustion chamber temperature is maintained above the minimum operating temperature.

2.4.1 Temperature Measurement Device Specifications

The following specifications apply to the temperature measurement devices:

Parameter	Specification
Location	The temperature sensor shall be installed at a location representative of the combustion zone temperature.
Device Type	A National Institute of Standards and Technology (NIST)-traceable resistance temperature detector (RTD)
Tolerance	±2 percent of the temperature being monitored in °C, or ±2.5 °C, whichever value is greater [63.1283(d)(3)(i)(A)]

2.4.2 Wiring

Conduit cable is installed per the latest edition of the National Electric Code.

2.4.3 Data Acquisition System

The data acquisition system (DAS) is composed of an Ethernet network that logs the thermal oxidizer combustion chamber temperature. In the event of a failure of the entire network, the PLC will continue to log 24 hours of data.

The DAS will provide the following readouts:

- Instantaneous thermal oxidizer combustion chamber temperature
- 15-minute snapshot temperature readings
- 1-hour average temperatures
- Daily average temperatures
- Readout or other indication of operation must be readily accessible on-site.

Data will be retained for at least 6 days in the DAS for retrieval in the event of a failure of the reporting system. Additionally, the operator will have the capability of generating a screen print from the DAS in the event of a failure of the reporting system.

2.4.4 Reporting System

A PC with reporting software installed is connected to the DAS for data retention and report generation. The software is used to collect the data from the DAS, collate into a report formatted for printing, and for long-term retention of the data.

3.0 Temperature Monitoring System Performance Evaluation and Periodic QA/QC Procedures

3.1 Periodicity

The requirements for periodic audits consist of equipment requirements and procedural requirements. All equipment has to be calibrated and meet general requirements for accuracy: (1) An accuracy hierarchy of at least three, and (2) an accuracy that is NIST-traceable. An exception to the accuracy requirements for instruments that are used to audit the accuracy of the CPMS is when performing an accuracy audit using a redundant sensor, the redundant sensor would have to have an accuracy equal to or better than the accuracy of the primary sensor.

A factory calibrated unit was installed on each of the units. The calibration certification sheets, or other appropriate documentation, shall be retained demonstrating factory calibration. Annual QA/QC evaluations of the CPMS shall be conducted as described below.

3.2 Methodology

The performance of the temperature CPMS will be validated by comparing measured values to a calibrated measurement device, based on ASTM E220-07e1 (Standard Test Methods for Calibration of Thermocouples by Comparison Techniques). The sensor of the calibrated device will be located adjacent to the CPMS sensor. The measurements made using the CPMS and calibrated temperature measurement device will be concurrent.

3.2.1 Calibration

The calibration of the RTD shall be checked in place in accordance with manufacturer's recommendations and company policies and procedures. The methods used shall address both the RTD and the DAS. A written work order documenting steps to be followed shall be used.

3.2.2 Accuracy

The accuracy criteria for the validation check is ±2 percent of the temperature being monitored in °C, or ±2.5 °C (36.5°F), whichever value is greater [63.1283(d)(3)(i)(A)]. The thermal oxidizer combustion chamber temperature is required to be maintained above the established operating condition. Therefore, the system accuracy criterion for the CPMS is ±2 percent of the temperature being monitored.

3.3 Notification

Notification to MDEQ prior to conducting the performance evaluation or with results after testing is not required.

3.4 Documentation

Closeout of the work order shall be considered sufficient documentation provided factory calibration sheets, field readings, and/or other results, as appropriate, are included in the closeout comments or attached to the work order.

3.5 Malfunctioning CPMS

Operation of the unit while troubleshooting a malfunction of the CPMS is acceptable. Possible indications of a malfunction include, but are not limited to:

- Temperatures out of range (high or low)
- Failure to generate daily printouts of the logs
- Erroneous or nonsensical data on the printed logs
- Failure of the visual display of temperatures from the DAS

3.5.1 Recordkeeping and Reporting

Logs documenting the malfunction of the CPMS, immediate actions and corrective actions shall be taken in accordance with Section 5.3 of this plan. Additionally, the Environmental Department shall be notified immediately of the malfunction.

3.5.2 Troubleshooting a Malfunctioning CPMS

Ray shall troubleshoot the CPMS according with the manufacturer's recommendations, company policy and procedures and good operating practices.

4.0 CPMS Operation and Maintenance

4.1 CPMS Operation

The CPMS will be in continuous operation whenever the monitored glycol dehydrator operates. Data will be collected as follows:

- Record the thermal oxidizer combustion chamber temperature at least once every 15 minutes including startup, shutdown and malfunction periods
- Average the 15-minute data on an hourly basis.
    - An hour is defined as a 60-minute period beginning at the o-clock (i.e., 1:00, 2:00, etc.)
    - If a unit starts midway through an hour, record 15-minute data points but begin averaging only if there are at least two data points for the first-based 60 minute period. Each of the two data points should represent a 15-minute period.
    - If a unit stops midway through an hour, the 15-minute data points will be monitored and recorded; however, the average for that last clock-based 60 minute period should only be computed if at least two data points are available.
- Calculate the daily average for each operating day.
    - If the glycol dehydrator operation is continuous, the operating day is a 24-hour period.
    - If the glycol dehydrator operation is not continuous, the operating day is the total number of hours of control device operation per 24-hour period.
    - Valid data points must be available for 75% of the operating hours in an operating day to compute the daily average.
- Compare the daily average to the minimum operating parameter value.

Alarms and shutdowns shall be provided as follows:

- The CPMS shall alarm when the thermal oxidizer combustion chamber temperature reaches 1450°F decreasing or 1650°F increasing.
- The CPMS shall shut down the unit when the thermal oxidizer combustion chamber temperature is below 1300°F for 20 minutes, or exceeds 1700°F.
- Alarms and shutdowns shall be disabled as follows:
    - High temperature: never
    - Low temperature: during unit startup

4.2 CPMS Maintenance

4.2.1 Preventative Maintenance

CPMS maintenance will be conducted in according with company policy and procedures. Additionally, daily station walkdowns take place to check on obvious signs of physical failure of the equipment.

4.2.2 Corrective Maintenance

Corrective maintenance will be conducted according to manufacturer's recommendations, company policy and procedures, and good operating practices, in a manner consistent with safety and good air pollution control practices for minimizing emissions in the event of a CPMS malfunction, impending malfunction, or out-of-control CPMS. In lieu of conducting immediate corrective maintenance, operations may shutdown the associated engine until such time as corrective maintenance can be performed.

4.3 Spare Parts

A set list of spare parts of the CPMS will not be maintained in inventory. If a spare part for the system is not available when needed, the affected equipment will be shut down until such time as the necessary spare part can be procured and installed.

5.0 Data Management

5.1 Valid Data

Valid data is defined as data not "recorded during monitoring malfunctions, associated repairs, and required quality assurance or control activities". Specifically, valid data is comprised of:

- 15-minute readings not recorded during monitoring malfunctions, associated repairs, and required quality assurance or control activities
- Hourly averages consisting of valid 15-minute readings
- Daily averages consisting of valid hourly averages

5.2 Data Review

Operations shall review the CPMS daily reports to:

- Confirm all required data was collected
- Identify any data collected that was not valid data, as defined above
- Confirm that no exceedances of the average daily temperature limits occurred

Missing data may be recovered by:

- Forcing a new printout
- Recover data from DAS/PLC
- Generating screen print

If missing data is unrecoverable (e.g., due to power failure), exceedances are identified, or non-valid data is identified, the Environmental Services Department shall be notified immediately. Additionally, in the event of repeated instances of missing data, whether recoverable or unrecoverable, over a short duration of time, an investigation as to the causes is to be conducted.

5.3 Recordkeeping

The following records collected by the CPMS are required to be retained for a period of five years. At a minimum, the most recent two-year data shall be available on site. The other three years data may be stored off site, but should be accessible within a reasonable time. These records can be retained either electronically, via hard copy, or both, and shall be easily accessible.

- Each daily average
- Each hourly average used to calculate the daily average values
- Each 15-minute data point used to calculate hourly averages, as well as 15-minute data points during startup and shutdowns.
- The algorithm/calculation procedure used to reduce data
- All readings taken during periods of CPMS breakdowns and out-of-control periods

Additionally, the following records shall be created and retained regarding the CPMS:

- The date and time identifying each period during which the CPMS was inoperative, except for zero (low-level) and high-level checks
- The date and time identifying each period during which the CPMS was out-of-control
- The date and time of commencement and completion of each time period where the CMPS daily average temperature was out of the specified limits in this plan, other than during periods other than startups, shutdowns and malfunctions of the affected source.
- The nature and cause of any malfunction (if known)
- The corrective action taken or preventative measures adopted
- The nature of the repairs or adjustments to the CPMS that was inoperative or out of control
- The total process operating time during the reporting period
- Documentation of any QA/QC procedures performed for CPMS

5.4 Reports

5.4.1 Daily Data Reports

A daily report for each unit shall be generated and printed after midnight for the previous calendar day. The report shall include, at a minimum, the following:

- Each 15-minute data sample of the thermal oxidizer combustion chamber temperature
- Hourly averages of the thermal oxidizer combustion chamber temperature
- Daily averages of the thermal oxidizer combustion chamber temperature
- Each malfunction event and the occurrence and duration of that event (begin time and end time)
- Every unit alarm and shutdown

5.4.2 Compliance Reports

The following compliance reports are required:

- Immediate notifications of non-compliance
- Semiannual reports and annual compliance reports
- Notification of malfunctioning and out-of-control CPMS events
- Notification of intent to conduct performance test
- Notification of compliance status at the completion of performance tests

6.0 PROGRAM OF CORRECTIVE ACTION FOR A MALFUNCTIONING CPMS

The CPMS is required to measure thermal oxidizer combustion chamber temperature. This temperature must be monitored continuously at all times the glycol dehydration units are operating, except during CPMS malfunctions, repairs, and QA/QC activities (such as calibration checks).

Malfunction Events Included in SSM Plan for CPMS:

The following malfunction events are covered by the SSM Plan for the CPMS-T devices:

- Data Acquisition CPMS-T Not Working
- Thermocouple Not Working

NOTE: Malfunction events may not include events caused in part by poor maintenance or careless operation.

Data Acquisition CPMS Not Continuously Working

Event Definition: The data acquisition system is composed of an Ethernet network that logs thermal oxidizer combustion chamber temperatures. In the event of a failure of the entire network, the PLC will continue to log 24 hours worth of data.

Data Acquisition System Not Working Event may be caused by the following conditions:

- Software failure, glitch
- Loss of power or communications
- Improper or failed wiring

Event Procedures:

If the Data Acquisition System is not working, restore system operation as soon as practical.

Procedures for this event may include:

- Record date & time of event beginning for the SSM log.
- Troubleshoot per manufacturer's recommendations, including reinstallation of software, inspection/repair of power or communications connections and wiring, if required.
- Confirm restoration of data acquisition system operation. Record date & time of event ending
- Complete SSM log and prepare Inlet Temperature Event Checklist to document actions taken to respond to this malfunction.

Thermocouple Not Working or Working Improperly

Event Definition: Thermocouple Not Working or Working Improperly Event may be caused by the following conditions: Thermocouple input failure can indicate a failure of the thermocouple itself, or failed wiring.

Event Procedures:

If the thermocouple is not working or working improperly, restore system operation as soon as practical. Procedures for this event may include:

- Record date & time of event beginning for the SSM log.
- TC input failure will be logged in the SSM
- Conduct troubleshooting per manufacturer's instructions.
- Identify required adjustment, repair, or replacement, per manufacturer instructions. Complete required actions.
- Thermocouples cannot be calibrated. Once replaced, check the temperature readout on the monitor screen for atmospheric temperature as an indication the thermocouple is giving accurate readings.
- Repair information will be on the inlet temperature event checklist

Combustion Chamber Temperature Event Checklist

Completed by:_____ Date:_____

Type of Event:

☐ **Thermocouple Not Working**

☐ **Other*_____**

Thermocouple Not Working

- **Date & Time Noted TC Not Working:_____**
- **Data & Time Last Data Recorded:_____**
- **Date & Time Recorder Operation Restored:_____**
- **Reason for Recorder Failure, if known:_____**

_____

_____

- **Did you follow manufacturer's procedures for troubleshooting? ☐ YES ☐ NO***
- **Did you repair or replace the data recorder? ☐ REPAIR ☐ REPLACE**
- **Did you re-calibrate per manufacturer procedures? ☐ YES ☐ NO***

Other*:

Describe what happened:

_____

_____

_____

When did this event begin:_____

When did this event end: _____

Describe the actions you took to respond:

_____

_____

_____

_____

*** If "other" or "NO" there may be immediate reporting requirements.**
Contact _____ immediately at _____ (tel)
and fax this form to: _____ (fax) _____

Preventative Maintenance/Malfunction Abatement Plan (PM/MAP)

Ray Compressor Station
Plant 3

For
Line Heaters

Prepared by:
Joe S. Taylor
December 2012

Table of Contents

1.0 PM/MAP Overview and Approval

Facility: RAY COMPRESSOR STATION PLANT 3
Physical Address: 69333 Omo Road
Armada, MI 48005
Plan Adoption Date: _____
Previous Revisions: None
_____
_____

Purpose of the PM/MAP:

The purpose of this PM/MAP is to describe the actions that will be taken at the Ray Compressor Station Plant 3 to prevent, detect, and correct malfunctions or equipment failures that could result in emissions exceeding any applicable limits. This Plan is for the two gas line heaters in Plant 3.

This PM/MAP and any revisions of this Plan, will be maintained for a period of five (5) years, and will be on file at the Ray Compressor Station. This PM/MAP does not contain proprietary information.

At Ray Compressor Station, the Field Leader, Dominic Tomasino or his designee, is responsible for assuring that the most recent copy of this PM/MAP is made available to personnel involved with the affected operations. This individual is also responsible for ensuring that Station employees are aware of the procedures and requirements contained in this Plan.

All reports for the PM/MAP must be signed by a Responsible Official.

PM/MAP Approval: Initial PM/MAP – Yes [X] or Revision No. _____

Name: _____ Date: _____

Title: _____

Signature: _____

2.0 Equipment Covered by PM/MAP

This PM/MAP addresses the two gas line heaters and associated control and monitoring equipment located in Plant 3, designated as Emission Units EUPIPEHEATER31 and EUPIPEHEATER32. Each line heater is rated at 10.27 MMBtu/hr, forced draft, natural gas fired, indirect glycol/water bath type and has three low NOx burners. Each heater has a single exhaust stack. Exhaust gases from the burners is discharged unobstructed vertically upwards to the ambient air. The stacks are 16 inch diameter, exit 25 feet above the ground level and have covers that close when the heater is shutdown. The two line heaters were designed and manufactured by Gas Tech Engineering LLC and are identified with serial numbers 2251-01 and 2251-02.

3.0 Operating Variables to be Monitored

Each heater is fired to maintain the glycol/water bath temperature at a normal set point between 155 and 175 degrees F. Each heater control system monitors the following operating variables to maintain required performance and safety:

- Combustion – Flame sensor at each burner
- Combustion air pressure – Low pressure switch
- Fuel flow rate
- Fuel pressure - Low and high fuel limits
- Fuel temperature – After preheat
- Fuel scrubber condensate level – Low and high alarms
- Water bath temperature – Low and high alarms
- Water bath temperature – High shutdown
- Water bath level - Low level shutdown
- Exhaust gas temperature – Low and high alarms
- Exhaust stack cover – Proof of closure
- Process gas temperature – Heater inlet
- Process gas temperature – Heater outlet

Each heater control system is monitored by the Ray Station control system.

The fuel flow rate for each heater is measured with an Emerson Micro Motion Coriolis Type flow meter. Fuel flow for each heater is continuously recorded by the Ray Station control system. The fuel gas supply is preheated and passes through a scrubber to maintain a quality fuel supply.

4.0 Malfunction Events & Procedures

Line heater malfunction events and procedures are as follows:

- Combustion flame sensor – Shutdown on loss of flame

  Check fuel supply valves for correct operation and fuel pressure. Check flame sensor and related controls.

- Combustion flame sensor – Failure to ignite (fire)

  Check pilot fuel system for correct pressure and flow. Check electronic pilot ignition system for correct operation. Check spark electrodes for correct gap.

- Combustion air pressure – Low pressure switch

  Check blower for correct operation and performance. Check 6" burner air flow trim valves for proper setting. Check air inlet rain cap screen for ice or other obstruction.

- Fuel flow rate - High flow rate or loss of signal

  Check meter for proper operation. Check flow signal for accuracy.

- Fuel pressure – Low

  Check setting and operation of main fuel supply control valve (PCV-28-46 for Heater #1 and PCV-28-20 for Heater #2). Check for any obstructions in the upstream fuel supply system. Check operation and calibration of low pressure switch (PSLL-28-46 for Heater #1 and PSLL-28-16 for Heater #2).

- Fuel pressure – High

  Check setting and operation of main fuel supply control valve (PCV-28-46 for Heater #1 and PCV-28-20 for Heater #2). Check operation and calibration of high pressure switch (PSHH-28-45 for Heater #1 and PSHH-28-17 for Heater #2).

- Fuel temperature – Below 50 degrees F at fuel meter

  Verify that fuel preheat coil is being used rather than the cold start supply. Verify the heater water/bath is up to normal temperature (155 to 175 degrees F). Check temperature transmitter portion of fuel flow meter and signal to station control system.

- Fuel scrubber condensate level – Low

  Check for leaks in scrubber drain valve and piping. Check operation of low level alarm switch.

- Fuel scrubber condensate level – High

  Check for proper operation of the scrubber dump system. Check operation of high level alarm switch.

- Water bath temperature – Low

  Check water bath temperature controller for correct operation. Check heater ignition and firing system. Check pilot and main fuel supply systems. Check process gas flow rate – May be too high. Check low temperature alarm for correct setting and operation.

- Water bath temperature - High

  Check water bath temperature controller for correct operation. Check high alarm for correct setting and operation.

- Water bath temperature – High shutdown

  Check water bath temperature controller for correct operation. Check high temperature shutdown for correct setting and operation.

- Water bath level - Low level shutdown

  Verify that there is an actual low level by reading sight gauge. Check for any leaks of glycol/water from the heater. Add glycol/water to the heater bath to the normal operating level

- Exhaust gas temperature – Low and high alarms

  Check blower operation and associated flow control and trim valves. Check fuel supply and burner management system.

- Exhaust stack cover – Proof of closure

  Visually check cover position. Repair cover and/or cover switch as needed.

- Process gas temperature – Heater inlet

  Should normally be between 50 and 70 degrees F. Check for throttled valve(s) in inlet gas piping if temperature is low. Also low temperature may be experienced during startup due to ambient temperature.

- Process gas temperature – Heater outlet

  Should normally be between 80 and 140 degrees F. Adjust process gas flow rate if temperature is higher or lower than necessary downstream of pressure regulation, prior to dehydration. Verify that heater is maintaining desired bath temperature. Adjust bath control set-point as needed.

*Malfunction events listed above will be further investigated and mitigated using the Heater Control Panel PLC and the associated GasTech operating instructions and drawings, when necessary. Failed and defective components will be repaired or replaced as necessary.

5.0 Preventative Maintenance

Scheduled preventative maintenance will be done to maintain performance of the line heaters and to help prevent unscheduled outages. The following line heater maintenance tasks will normally be performed on the frequency indicated when the heaters are in service:

- Check for evidence of gas, glycol/water or air leaks – Weekly
- Check glycol/water bath level in sight glass and add glycol/water if needed - Monthly
- Inspect combustion air control valves and actuator – Monthly
- Drain any accumulated moisture in instrument air supply regulators – Monthly
- Inspect filters and vents on instrument air supply regulators and clean if needed – Monthly
- Check fuel gas regulators for proper operation and settings – Annually
- Test fuel gas pressure relief valves for correct setting – Annually
- Inspect all 2" and larger gas valves – Annually
- Check operation of fuel gas scrubber drain system – Annually
- Check operation of scrubber vessel and drain piping electric heat trace system – Annually
- Check fuel gas strainers and clean if needed – Annually
- Inspect blower and lubricate bearings if needed – Annually
- Check calibration and function of all instruments, alarms and shutdowns – Annually
- Take a glycol/water sample from bath and check for degradation and impurities. Treat or replace glycol/water as needed - Annually

Maintenance logs will be kept in the work management system. A sample work order can be found on the following page:

Consumers Energy

Order No: 17262819

Order Type: FMPM

Due Date: 02/01/2012

PM Description: MONTHLY - RAY BOILER OPERATIO (SEASONAL)

Source Data

Requestor:
Phone: Room#
Notification No: 1014487450
Person Responsible:

Notification Text:
MONTHLY - RAY BOILER OPERATIO (SEASONAL)

Dates/Timing

Release Date: 01/27/2012
Start Date: 01/26/2012
End Date: 02/01/2012

Planned time: 0.5
Actual Time:_____

Object Data

Functional Location:
FA-RAY-CB01-BSYS-HVAC-BOIL
Room No: MECH RM

Order Data

PM Plan No: 10001383
Work Order Status: CLSD TECO SETC
Work Order Priority:

Equipment Description

RAY BOILER (HOT WATER)
Tech ID No: **841501-1**
Equipment No: **4000000723**

Manufacturer: BRYAN
Model No: AH-229305
Serial No: NA

Operation Data

Operation	Description	Dur	Control Key	Work Center
0010	MONTHLY - BOILERS AND RELATED EQUIPMENT	0.5	PM01	FA-MTOM

Material Data

Material#	Description Res#	Quantity Req#
Comments		

Operations Text

Operation	Description
0010	MONTHLY - BOILERS AND RELATED EQUIPMENT

Follow all safety procedures prior to commencing the following:

SAFETY PREPARATION

___1. Clean area around the boiler, removing any items that would cause a potential tripping hazard.

___2. Wear safety glasses, use appropriate hand tools, ladder, gloves, and footwear for maintenance. If necessary, prepare buckets, mops, rags and other equipment for cleanup.

___3. Use caution and correct bending technique to reach valves and equipment.

___4. If there is a safety issue of concern, please notify supervisor.

PROCEDURE

___1. Slow drain test low and high pressure boilers.

___2. By means provided by the manufacturer check the ability of the low water cut-off to operate on boilers without resorting to draining boiler system. Make working test of boiler, if drained. Record on operating log.

___3. Take samples of water for chemical analysis per water treatment vendor#s recommendation.

___4. Check the operation of temperature and/or pressure controls and reset.

___5. Record boiler temperature(F) on operating log.

___6. Record the condition of burner operation on operating log.

___8. Check boiler/system water level in boiler or expansion tank sight glass. Record on operating log.

___9. Grease valve stems as needed.

___10. Manually hand test boiler safety/relief valve for proper operation and record on operating log.

___11. Check coupler between seal and motor. Replace as needed.

___12. Record these steps on log in the boiler room.

___13. Perform final cleanup of area and restore equipment to normal operation when work is complete.

Object List

Equipment No	Description
4000000723	

6.0 Parts & Inventory

The following spare parts are recommended by the heater manufacturer and will normally be on hand for maintenance:

GasTech Spare Parts

Qty	Description	Material
1	GASKET 1/8" THK x 16" O.D. x 12 5/16" I.D. w/(12) 9/16" DIA. HOLES EQ SP. ON 14 1/4" DIA. B.C. (MATCH DETAIL ITEM #64 & SILENCER INLET)	NON-ASB
1	GASKET 12"-150# RF 1/8" THK SPIRAL WOUND TYPE "CGI" w/304 SS WINDINGS	NON-ASB
1	GASKET 6"-150# RF 1/8" THK. SPIRAL WOUND TYPE "CGI" w/304 SS WINDINGS	NON-ASB
1	GASKET 1/8" THK x 15 1/2" O.D. x 8 7/8" I.D. w/(8) 7/16" DIA. HOLES EQ SP. ON 11 3/4" DIA. B.C. (MATCH DETAIL ITEM #62)	NON ASB
1	GASKET 1 1/2"-150# RF 1/8" THK. SPIRAL WOUND TYPE "CGI" w/304 SS WINDINGS	NON-ASB
1	GASKET 2"-900# RF 1/8" THK. SPIRAL WOUND TYPE "CGI w/304 SS WINDINGS	NON-ASB
1	GASKET 2"-150# RF 1/8" THK. SPIRAL WOUND TYPE "CGI" w/304 SS WINDINGS	NON-ASB
1	GASKET 1/8" THK. X 11" O.D. X 9 1/2" I.D. w/(8) 7/8" DIA. HOLES EQ. SP. ON 9 1/2" DIA. B.C. (MATCH DETAIL ITEM #61)	NON-ASB
1	GASKET 1/8" THK x 16" O.D. x 10 5/16" I.D. w/(12) 9/16" DIA. HOLES EQ SP. ON 14 1/4" DIA. B.C. (MATCH BLOWER INLET FLANGE & SILENCER OUTLET FLANGE)	NON ASB

The following spare parts are for the heater controls and accessories and will normally be on hand for maintenance in addition to the above parts recommended by the heater manufacturer:

Additional Spare Parts

- Diaphragm, spring, seat and positioner for Maxon air valve actuators
- Fisher Model 67CFR instrument air regulator
- Repair kits and filter elements for Fisher Model 67CFR instrument air regulators
- Repair kit for Fisher Model 627 fuel gas regulators
- Soft goods replacement parts for Fisher Model 299H fuel gas regulator
- Repair kit for Fisher Model 64 fuel gas regulators
- Repair kit for Fisher Model L2 level controllers
- Repair kit for Fisher Model D2 control valves
- Soft goods repair kit for Anderson Greenwood Model 83 pressure relief valves
- Eclipse Model ES 368 fuel gas regulator
- Eclipse Immersojet burner pilot assembly
- Eclipse spark igniter
- Replacement screen and cover gasket for Mueller fuel gas strainers
- Combustion air blower, 60 HP
- Honeywell flame detector element, UV scanner
- Honeywell flame relay/flame amplifier
- Honeywell ignition transformer
- Ignition Wire
- Fuses – Control Transformer, Control Circuit & Blower Motor

7.0 Supervisory Personnel Responsible for Maintenance of Line Heaters

Name: Dominic J. Tomasino

Title: Field Leader

Location: Ray Compressor Station
69333 Omo Road
Armada, MI 48005

Phone: 586 784-2096 office
586 321-3038 cell

Email: dominic.tomasino@cmsenergy.com

8.0 Retention of Records

Records shall be maintained on file for a period of 5 years.

9.0 Updates/Revisions of PM/MAP

Periodically this PM/MAP may need to be revised. Copies of all PM/MAP revisions will be retained for a period of 5 years.

Revisions must be completed within 45 days if the PM/MAP does not address – or inadequately address – an event that occurs and meets the characteristics of a malfunction. The revisions must include procedures to operate and maintain the source during similar malfunction events and a program of corrective action for similar malfunctions of the gas line heaters or associated controls and monitoring equipment. The revised plan shall be submitted to the AQD District Supervisor. Should the AQD determine the PM/MAP to be inadequate, the AQD District Supervisor may request modification of the plan to address those inadequacies. MDNRE recommends the PM/MAP be reviewed annually.