



**Preventative Maintenance/Malfunction  
Abatement Plan (PM/MAP)  
St. Clair Compressor Station  
Standby Emergency Generator  
(EUEMERGEN3-1)**

Prepared by:

Jahirul Chowdhury

January 2017

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## 1.0 PM/MAP Overview and Approval

Facility: Saint Clair Compressor Station

Physical Address: 10021 Marine City Hwy  
Ira, MI 48023

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 Saint Clair Compressor Station Facility to prevent, detect, and correct malfunctions or equipment failures that could result in emissions exceeding any applicable limits. This plan is for the standby emergency generator associated with the St. Clair Compressor Station.

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 St. Clair Compressor station. This PM/MAP does not contain proprietary information.

At St. Clair Compressor Station, the field leader, or 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 preventative maintenance and malfunction abatement plan addresses the standby emergency generator at the St. Clair Plant 3 Compressor Station. The standby emergency generator is identified as ENGN-3-00-01 or emissions unit EUEMERGEN3-1.

Table 1: Engine Description

Engine Description					
Engine ID	Manufacturer	Model	S/N	Site Rated [HP]	Emissions Controls (NSCR / AFRC or Oxy-Cat)
ENGN-3-00-01	Caterpillar	3516B	L6J00161	1818	AFRC

Table 2: Internal Combustion Engine Covered by PM/MAP

Emissions Data - Engine Out				
	LOAD	100%	75%	50%
NOx (NO2)	g/bhp-hr	0.5	0.5	0.5
CO	g/bhp-hr	2.49	2.58	2.82
THC	g/bhp-hr	5.45	5.82	6.78
NMHC	g/bhp-hr	0.82	0.87	1.02
NMNEHC (VOCs)	g/bhp-hr	0.54	0.58	0.68
HCHO (FORMALDEHYDE)	g/bhp-hr	0.34	0.37	0.42
CO2	g/bhp-hr	504	527	559
EXHAUST OXYGEN	% DRY	9.3	9.1	9.0
LAMBDA		1.73	1.7	1.66

Table 3: Emissions Limits

Pollutant	Limit	Time Period/Operating Scenario	Equipment	Testing/Monitoring Method	Underlying Applicable Requirements
1. NOx	2.0 g/hp-hr	Test Protocol*	EUEMERGEN3-1	SC V.1	R 336.1205(1)(a), 40 CFR Part 52.21 (c) & (d) 40 CFR Part 60 Subpart JJJJ
2. CO	4.0 g/hp-hr	Test Protocol*	EUEMERGEN3-1	SC V.1	40 CFR Part 52.21 (d) 40 CFR Part 60 Subpart JJJJ
3. VOC	1.0 g/hp-hr	Test Protocol*	EUEMERGEN3-1	SC V.1	R 336.1205(1)(a), R336.1702, 40 CFR Part 60 Subpart JJJJ
*Test Protocol shall determine the averaging time					

### **3.0 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 parameter exceeds the acceptable range.

#### **Engine ECM Monitoring – Shutdown Events**

- High Inlet Air Temperature at Low Engine Load
- High Inlet Air Temperature at Low Engine Load
- High Engine Coolant Temperature
- Low System Voltage
- Engine Overspeed
- Low Oil Filter Differential Pressure
- High Oil Filter Differential Pressure
- High Engine Oil to Engine Coolant Differential Pressure
- High Engine Oil Temp

#### **Integrated Temperature Sensing Module (ITSM)**

The ITSM monitor the temperatures of the cylinder exhaust ports, the inlets of the turbocharger turbine, and the outlets of the turbocharger turbines. If a temperature exceeds an acceptable range, the ITSM can initiate a “WARNING” or “SHUTDOWN”.

#### **Integrated Temperature Sensing Module – Shutdown Events**

- High Exhaust Temperature
- Exhaust Port Temperature High Deviation
- Exhaust Port Temperature Low Deviation
- High Turbo Turbine Inlet Temperature
- High Turbo Turbine Outlet Temperature

## 4.0 Malfunction Events & Procedures

Listed below are malfunction events for the Standby Generator which will cause the equipment to shut down. These are the default parameters for the programmable monitoring systems and these values will reflect the system set points upon start up.

### Engine Electronic Control Module (ECM) Monitoring

High Inlet Air Temperature at Low Engine Load

- 73 °C

High Inlet Air Temperature at High Engine Load

- 57 °C

High Engine Coolant Temperature

- 113 °C

Low System Voltage

- 18 V

Engine Overspeed

- 1770 RPM

Low Oil Filter Differential Pressure

- 5 kPa

High Oil Filter Differential Pressure

- 138 kPa

High Engine Oil to Engine Coolant Differential Pressure

- 20 °C

High Engine Oil Temperature

- 104 °C

### Integrated Temperature Sensing Module (ITSM)

High Exhaust Temperature

- 665 °C

Exhaust Port Temperature High Deviation

- 200 °C

Exhaust Port Temperature Low Deviation

- 200 °C

High Turbo Turbine Inlet Temperature

- 730 °C

High Turbo Turbine Outlet Temperature

- 625 °C

## **5.0 Preventative Maintenance**

Scheduled preventative maintenance will be performed to maintain the performance of the Standby Generator and to help prevent unscheduled outages. The preventative maintenance tasks that will normally be performed will be determined after the equipment is in operation and the equipment life cycle duration can be determined.

SAP work orders will be issued in accordance with the Standby Generator preventative maintenance plan. Maintenance logs will be kept in the SAP system.

## **6.0 Spare Parts and Inventory**

Spare parts that will be maintained in inventory for quick replacement will be determined after the equipment has been operated and life cycle duration can be determined.

## **7.0 Supervisory Personal Responsible for Maintenance of Control Equipment**

Name: Brian Mauzy  
Title: Field Leader  
Location: St. Clair Compressor Station  
10021 Marine City Hwy  
Ira, MI 48023  
Phone: (586)-716-3331 (Office)  
Email: BRIAN.MAUZY@cmsenergy.com

## **8.0 Retention of Records**

Records shall be maintained on file for a period of five 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 five 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 Generator or associated controls and monitoring equipment. The revised plan shall be submitted to the AQD District Supervisor may request modification of the plan to address those inadequacies. MDEQ recommends the PM/MAP be reviewed annually.





**Preventative Maintenance/Malfunction  
Abatement Plan (PM/MAP)  
St. Clair Compressor Station  
Auxiliary Boiler  
(EUBOILER3-1)**

Prepared by:

Paul Lenihan

September 2016

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- 8.0 Retention of Records
- 9.0 Updates/Revisions of PM/MAP

## 1.0 PM/MAP Overview and Approval

Facility: Saint Clair Compressor Station

Physical Address: 10021 Marine City Hwy  
Ira, MI 48023

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 Saint Clair Compressor Station Facility to prevent, detect, and correct malfunctions or equipment failures that could result in emissions exceeding any applicable limits. This plan is for the natural gas-fired heating boiler associated with the St. Clair Compressor Station.

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 St. Clair Compressor Station. This PM/MAP does not contain proprietary information.

At St. Clair Compressor Station, the field leader, or 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: Brian Mauzy

Date: 10/12/2016

Title: Gas Field Leader III – St. Clair Compressor Station

Signature: \_\_\_\_\_

## **2.0 Equipment Covered by PM/MAP**

This preventative maintenance and malfunction event plan addresses the natural gas fired 12.3 MMBtu/hr boiler for building heat at the St. Clair Plant 3 Compressor Station. The hot water boiler is identified as BOIL-3-09-01 or as emissions unit EUBoiler3-1.

## **3.0 Operating Variables to be monitored**

The hot water boiler is a Cleaver-Brooks 4WG, equipped with a CB780E/CB784E microprocessor-based integrated burner control for automatically fired gas, burner applications. The automatic burner control provides the following functions: automatic sequencing, flame supervision, system status indication, system or self-diagnostics, and troubleshooting.

**4.0 Malfunction Events & Procedures** In the event of a malfunction the PLC will shut down the boiler and the plant will be alerted to the equipment's status. Upon completion of appropriate diagnosis and maintenance, the equipment will undergo the proper start up procedures in accordance with the manufacturer specifications to bring the equipment back online.

## **5.0 Preventative Maintenance**

Scheduled preventative maintenance will be performed to maintain the performance of the auxiliary boiler and to help prevent unscheduled outages. The preventative maintenance tasks that will normally be performed will be determined after the equipment is in operation and the equipment life cycle duration can be determined.

SAP work orders will be issued in accordance with the heating boiler preventative maintenance plan. Maintenance logs will be kept in the SAP system.

## **6.0 Spare Parts and Inventory**

Spare parts that will be maintained in inventory for quick replacement will be determined after the equipment has been operated and life cycle duration can be determined.

## **7.0 Supervisory Personal Responsible for Maintenance of Control Equipment**

Name: Brian Mauzy  
Title: Field Leader  
Location: St. Clair Compressor Station  
10021 Marine City Hwy  
Ira, MI 48023  
Phone: (586)-716-3331 (Office)  
Email: BRIAN.MAUZY@cmsenergy.com

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**Preventative Maintenance/Malfunction  
Abatement Plan (PM/MAP)  
St. Clair Compressor Station  
Fuel Gas Heater  
(EUGASHEATER3-1)**

Prepared by:

Olaniyi Dawodu

September 2016

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- 8.0 Retention of Records
- 9.0 Updates/Revisions of PM/MAP

## 1.0 PM/MAP Overview and Approval

Facility: Saint Clair Compressor Station

Physical Address: 10021 Marine City Hwy  
Ira, MI 48023

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 Saint Clair Compressor Station Facility to prevent, detect, and correct malfunctions or equipment failures that could result in emissions exceeding any applicable limits. This plan is for the natural gas fired fuel gas heater associated with the St. Clair Compressor Station.

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 St. Clair Compressor Station. This PM/MAP does not contain proprietary information.

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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: Brian Mauzy

Date: 10/12/2016

Title: Gas Field Leader III – St. Clair Compressor Station

Signature: \_\_\_\_\_



## **2.0 Equipment Covered by PM/MAP**

This preventative maintenance and malfunction abatement plan addresses the 0.75 MMBtu/hr natural gas fired gas heater for superheating the natural gas prior to combusting in natural gas fired equipment associated the St Clair Compressor Station

This unit is identified as FGHT-3-04-01 (emission unit EUGASHEATER3-1).

FGHT-3-04-01 is a process gas single burner natural draft (0.75 MMBtu/hr) indirect water bath heater. Site piping provides a manual bypass around the heater for maintenance or during periods when the gas does not require heating.

The fuel gas heater control panel is an Allen-Bradley MicroLogix based programmable logic controller (PLC) for control, alarm/shutdown annunciation and communication with the plant control system. One Honeywell RM7898 series flame relay is provided for the fuel gas burner pilot monitoring. The PLC in conjunction with the flame relay provides automatic burner management of the fuel gas heater.

## **3.0 Operating Variables to be monitored**

Low Heater Bath Level Switch

- Shut down if heater bath level falls below switch

High Bath Temperature

- Alarm and shutdown

High Bath Pressure

- Shutdown

High Heater Stack Temperature

- Shutdown

## **4.0 Malfunction Events & Procedures**

Diagnosis and troubleshooting will be performed in accordance to the manufacturer specifications to ensure that the fuel gas heater is restored. Once the system has received the proper attention and is again operating per the manufacturer's specifications, the proper manufacturer specified procedures will be followed to bring the system back online.

## **5.0 Preventative Maintenance**

Scheduled preventative maintenance will be performed to maintain the performance of the fuel gas heaters and to help prevent unscheduled outages. The preventative maintenance tasks that will

normally be performed will be determined after the equipment is in operation and the equipment life cycle duration can be determined.

SAP work orders will be issued in accordance with the fuel gas heater preventative maintenance plan. Maintenance logs will be kept in the SAP system.

## **6.0 Spare Parts and Inventory**

Spare parts that will be maintained in inventory for quick replacement will be determined after the equipment has been operated and life cycle duration can be determined.

## **7.0 Supervisory Personal Responsible for Maintenance of Control Equipment**

Name: Brian Mauzy  
Title: Field Leader  
Location: St. Clair Compressor Station  
10021 Marine City Hwy  
Ira, MI 48023  
Phone: (586)-716-3331 (Office)  
Email: BRIAN.MAUZY@cmsenergy.com

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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 may request modification of the plan to address those inadequacies. MDEQ recommends the PM/MAP be reviewed annually.



**Preventative Maintenance/Malfunction  
Abatement Plan (PM/MAP)  
St. Clair Compressor Station  
Glycol Dehydration System  
(FGDEHY)**

Prepared by:

Paul Lenihan

September 2016

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- 5.0 Preventative Maintenance
- 6.0 Parts and Inventory
- 7.0 Supervisory Personal Responsible for Maintenance of Control Equipment
- 8.0 Retention of Records
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## 1.0 PM/MAP Overview and Approval

Facility: Saint Clair Compressor Station

Physical Address: 10021 Marine City Hwy  
Ira, MI 48023

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 Saint Clair Compressor Station Facility to prevent, detect, and correct malfunctions or equipment failures that could result in emissions exceeding any applicable limits. This plan is for the dehydration equipment associated with the St. Clair Compressor Station.

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 St. Clair Compressor station. This PM/MAP does not contain proprietary information.

At St. Clair Compressor Station, the field leader, or 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 contains 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: Brian Mauzy

Date: 10/12/16

Title: Gas Field Leader III – St. Clair Compressor Station

Signature: \_\_\_\_\_

## **2.0 Equipment Covered by PM/MAP**

This PM/MAP addresses the triethylene glycol (TEG) dehydration systems and associated control and monitoring equipment located in the St. Clair Compressor Station, designated as emissions units EUDEHY1 and EUDEHY2. Each system consists of an absorber, flash tank, glycol regenerator and natural gas-fired regenerator boiler. The (2) two systems share a common thermal oxidizer. The dehydration systems are designated to lower the water content of natural gas being withdrawn from the storage field. The dehydration systems are normally operational during the winter withdrawal season on an as-needed basis.

A thermal oxidizer unit is the air emissions control device for the glycol dehydration system. The thermal oxidizer has a process logic control based local control panel. Natural gas will not be processed in the glycol dehydration system unless the thermal oxidizer is operating in a satisfactory manner.

## **3.0 Operating Variables to be Monitored for the Thermal Oxidizer**

Temperatures will be maintained at 1400 °F or above on a daily average

Automated controls shall prevent the contactors and regenerator from operating without the thermal oxidizer in operation. There is also a combustion chamber temperature monitoring device with a continuous recorder that has an accuracy of  $\pm 1$  percent of the temperature being monitored.

Operating variables for the thermal oxidizer which will be monitored automatically are listed below.

High Temperature Shutdown:

- Shutdown

High Stack Temperature Shutdown

- Shutdown

High Chamber Temperature

- Shutdown

Low Burner Blower Pressure

- Shutdown

Flame Failure

- Shutdown

High Fuel Gas Pressure

- Shutdown

Low Fuel Train Pressure

- Shutdown

## **4.0 Malfunction Events & Procedures**

In the event of a malfunction, the regenerator unit is programmed to automatically shut down. The unit can be manually stopped from the Touch Screen or with either emergency shut down. If this occurs, both the regenerator burner assembly and the glycol charge pump are shut down.

Diagnosis and troubleshooting will be performed in accordance to the manufacturer specifications to ensure that the dehydration system is within limits. Once the system is again operating per the manufacturer's specifications, the proper manufacturer specified procedures will be followed to bring the system back online.

## **5.0 Preventative Maintenance**

Thermal oxidizer preventative maintenance will be performed to maintain the performance of the thermal oxidizer and to help prevent unscheduled outages. Maintenance that will be performed on the equipment will be executed per manufacturer recommendation. Any necessary maintenance that may arise during the operation of this equipment will be approached utilizing the manufacturer recommended steps for troubleshooting and maintaining the equipment.

SAP work orders will be issued in accordance with the glycol dehydration system preventative maintenance plan. Maintenance logs will be kept in the SAP system.

## **6.0 Parts and Inventory**

The replacement parts that will be maintained in inventory for quick replacement will be determined after the equipment has been operated and life cycle duration can be determined.

## **7.0 Supervisory Personal Responsible for Maintenance of Control Equipment**

*Name:* Brian Mauzy  
*Title:* Field Leader  
*Location:* St. Clair Compressor Station  
10021 Marine City Hwy  
Ira, MI 48023  
*Phone:* (586)-716-3331 (Office)  
*Email:* BRIAN.MAUZY@cmsenergy.com

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**Preventative Maintenance/Malfunction  
Abatement Plan (PM/MAP)  
St. Clair Compressor Station  
Compressor Engines  
(FGENGINES-P3)**

Prepared by:

Paul Lenihan

September 2016

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- 2.0 Equipment Covered by PM/MAP
- 3.0 Engine Operating Variables to be Monitored and Scheduled Maintenance
- 4.0 Engine Malfunction Events & Procedures
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- 8.0 Emissions Checks
- 9.0 Scheduled Oxidation Catalyst Maintenance
- 10.0 Major Oxidation Catalyst Replacement Parts Inventory
- 11.0 Supervisory Personal Responsible for Maintenance of Control Equipment
- 12.0 Retention of Records
- 13.0 Updates/Revisions of PM/MAP

## 1.0 PM/MAP Overview and Approval

Facility: Saint Clair Compressor Station

Physical Address: 10021 Marine City Hwy  
Ira, MI 48023

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 Saint Clair Compressor Station Facility to prevent, detect, and correct malfunctions or equipment failures that could result in emissions exceeding any applicable limits. This plan is for the compressor engines associated with the St. Clair Compressor Station.

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PM/MAP APPROVAL: Initial PM/MAP – Yes [ X ] or Revision No. \_\_\_\_\_

Name: Brian Mauzy \_\_\_\_\_

Date: 10/12/2016 \_\_\_\_\_

Title: Gas Field Leader III – St. Clair Compressor Station

Signature: \_\_\_\_\_

## 2.0 Equipment Covered by PM/MAP

This PM/MAP covers four new natural gas fired compressor engines. Each engine is a four stroke, lean burn, 4835 HP, natural gas fired internal combustion (IC) engine with oxidation catalyst for control. The gas compressor engines and related emission controls and monitoring equipment are included in Table 1.

**Table 1**  
**IC Engines Covered by PM/MAP**

Emission Unit ID	Engine ID	Engine Description		Site-Rated HP	Emission Controls (NSCR/AFRC or Oxy-Cat)	Initial Pressure Drop (in)	Subcategory & Compliance Date for MACT
		Manufacturer	Model				
EUENGINE3-1	ENGN-3-01-01	GE Waukesha	16V275GL+	4,835	Oxidation Catalyst	TBD	<input type="checkbox"/> 4SRB <input type="checkbox"/> 4SLB <input type="checkbox"/> 2SLB Compliance Date:
EUENGINE3-2	ENGN-3-01-02	GE Waukesha	16V275GL+	4,835	Oxidation Catalyst	TBD	<input type="checkbox"/> 4SRB <input type="checkbox"/> 4SLB <input type="checkbox"/> 2SLB Compliance Date:
EUENGINE3-3	ENGN-3-01-03	GE Waukesha	16V275GL+	4,835	Oxidation Catalyst	TBD	<input type="checkbox"/> 4SRB <input type="checkbox"/> 4SLB <input type="checkbox"/> 2SLB Compliance Date:
EUENGINE3-4	ENGN-3-01-04	GE Waukesha	16V275GL+	4,835	Oxidation Catalyst	TBD	<input type="checkbox"/> 4SRB <input type="checkbox"/> 4SLB <input type="checkbox"/> 2SLB Compliance Date:

## 3.0 Engine Operating Variables to be monitored

The natural gas fired IC engines will be constantly monitored by the onboard Engine Control Unit (ECU). The Engine System Manager (ESM) and the NOx Control Module (NCM) will control the engine such that the engine is performing per manufacturer specification. These controllers utilize various sensors to provide critical operating information to the ECU. If a sensor provides a signal outside of the normal range the ECU will flag either an alarm or a shutdown, depending on how great the value deviates from normal.

Engine maintenance will be performed in accordance with the manufacturers recommended schedule. At a minimum, the preventative maintenance schedule for the engines will be as follows:

- Change oil and filter every 500 hours of operation or annually, whichever comes first
  - Or utilize an oil analysis program at the same frequency to extend the specified oil/filter changing frequency
- 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.

SAP work orders will be issued in accordance with the engine maintenance plan. Engine maintenance logs will be kept in the SAP system.

## **4.0 Engine Malfunction Events & Procedures**

### **Malfunction Events for Engines in Table 1**

#### **Engine System Manager (ESM)**

- High Exhaust Temperature
  - Alarm and Shutdown
- High Engine Exhaust Post-Turbo Temperature
  - Alarm and Shutdown
- High Intake Manifold Temperature
  - Alarm and Shutdown

## **5.0 Major Engine Parts Replacement Inventory**

Spare parts that will be maintained in inventory for quick replacement will be determined after the equipment has been operated and life cycle duration can be determined.

## **6.0 Oxidation Catalyst Operating Parameters**

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

### **Pressure Drop Across Catalyst**

Maintain the catalyst such that the pressure drop across the catalyst does not change by more than 2 inches, at full load. A base reading will be done after cleaning each time to mark the new baseline pressure drop across the catalyst. The pressure drop across the catalyst is monitored by an electronic pressure transmitter.

### **Catalyst Temperature**

Maintain the engine exhaust temperature such 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.

## 7.0 Oxidation Catalyst Malfunction Events & Procedures

Malfunction Events for oxidation Catalyst Included in Table 1:

- High/Low Catalyst Backpressure
  - Alarm control room @ Initial test backpressure plus or minus 2 in H<sub>2</sub>O
- High Catalyst Inlet Temperature
  - Alarm control room
- Low Catalyst Inlet Temperature
  - After engine cold start & warm-up: Alarm control room @ 450°F

### Malfunction Procedures

In the event of a malfunction of the catalyst, signified by monitoring equipment alarms, the catalyst and/or monitoring equipment will be inspected to determine the cause. The engine will shut down automatically or manually, as necessary, to maintain prescribed emission quality.

Diagnosis, troubleshooting, cleaning, or replacement will be performed in accordance with the manufacturer's specifications. The engine will be returned to normal service once the catalyst and/or monitoring equipment are repaired and functioning per the manufacturer's specifications.

## 8.0 Emissions Checks

Following major maintenance of the engine or control device, exhaust emissions may be checked following the procedure below:

The CO and O<sub>2</sub> 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<sub>2</sub> at the same time as the measurement for CO concentration. The CO concentration will be corrected to 15% O<sub>2</sub>, dry basis.

## 9.0 Scheduled Oxidation Catalyst Maintenance

Oxidation catalyst maintenance will be performed in accordance with the manufacturer suggested maintenance. Given that the oxidation catalyst may require maintenance for a variety of reasons, any malfunction that may arise during the operation of this equipment will be approached utilizing the manufacturer recommended steps for troubleshooting and maintaining the equipment.

At a minimum the Preventative Maintenance schedule for the catalyst will be as follows:

### **Preventative Maintenance – Oxidation Catalyst**

1. Physical inspection per manufacturer's specification.
2. Vacuuming as needed to reduce ash build up and associated increased backpressure.
3. Approved washing procedure (Low pH) will be used to improve performance as required.

SAP work orders will be issued in accordance with the glycol dehydration system preventative maintenance plan. Maintenance logs will be kept in the SAP system.

## 10.0 Major Oxidation Catalyst Replacement Parts Inventory

The replacement parts that will be maintained in inventory for quick replacement will be determined after the equipment has been operated and life cycle duration can be determined.

## 11.0 Supervisory Personal Responsible for Maintenance of Control Equipment

*Name:* Brian Mauzy  
*Title:* Field Leader  
*Location:* St. Clair Compressor Station  
10021 Marine City Hwy  
Ira, MI 48023  
*Phone:* (586)-716-3331 (Office)  
*Email:* [BRIAN.MAUZY@cmsenergy.com](mailto:BRIAN.MAUZY@cmsenergy.com)

## 12.0 Retention of Records

Records shall be maintained on file for a period of five 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 five 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 may request modification of the plan to address those inadequacies. MDEQ recommends the PM/MAP be reviewed annually.





# Environmental Manual

Status: Final

Subject # : **AQ-137**  
 Subject Topic: **Combustion Turbines - Preventative Maintenance and Malfunction Abatement Plan**  
 Procedure # : **AQ-100**  
 Procedure Title: **Air Quality Requirements**  
 Issue Date: **10/8/2019**

## Location(s): St Clair Gas Compressor Station

**SUMMARY** Described is the equipment protection, preventative maintenance and malfunction abatement plan for the combustion turbines to minimize emissions of air pollutants.

**BASIS** In addition to the turbine parameter monitoring required by the ROP to ensure compliance with the emission limits, equipment protection measures, preventative maintenance, and malfunction abatement actions will assure that the turbines are operated as designed to minimize emissions.

## EQUIPMENT PROTECTION MEASURES

### Responsibility

### ACTION

**St Clair  
Field Leader**

1. Assure equipment is protected by the Emergency Shutdown System. Perform the Emergency Shutdown System Inspection Test annually to verify system performance.
2. Maintain the Annual Emergency Shutdown System Test records for 5 years.

## PLANNED MAINTENANCE

### Responsibility

### ACTION

**Field Leader**

1. Ensure that the activities defined in the Maintenance Plan are carried out and documented on the schedule identified, or more frequently, as needed.

The Maintenance Plan will include, at a minimum, the following scheduled inspections/activities.

Semi-annual:

- a. Check proper operation of SoLoNO<sub>x</sub> system
- b. Check proper operation of fuel gas system, include pilot valves
- c. Emission verification check, if necessary

Annual:

- a. Power-wash the turbine compressor section blades if efficiency losses are observed.

- i. Vendor Recommendation: To be performed if unit has run 1,320 hours or more. If unit has under 1,320 runtime hours, defer water wash to following year. Do not exceed two (2) years or 4,000 hours since previous water wash.
- b. Clean and/or replace the air filters as required.
- c. Sample and analyze the turbine oil.

The inspection results and maintenance activities/corrective actions will be documented appropriately.

<b>Note</b>
Document all actions on a work order or in the Work Management System.

**MALFUNCTION ABATEMENT**

**Responsibility**

**ACTION**

**St Clair  
Field Leader**

1. If a malfunction causes the unit to operate outside of the established operating range and it cannot be brought back into its allowed operating range, such that the daily average gas producer speed is outside the range established through compliance testing, terminate unit operation within 1 hour and do not return the unit to service until repairs have been made. Document occurrence/corrective actions in the Control Room Logbook.

<b>Note</b>
The established gas producer operating range for turbines C1-1 and C1-2 is 93.0% - 98.8%.

2. Initiate corrective actions as soon as possible, and document all corrective actions and the results.



# Environmental Manual

Status: Final

Subject # : **AQ-151**

Subject Topic: **EUAUXGEN1 - Operational, Maintenance and Recordkeeping Requirements**

Procedure # : **AQ-100**

Procedure Title: **Air Quality Requirements**

Issue Date: **10/8/2019**

## Location(s): St Clair Gas Compressor Station

### SUMMARY

Described are the requirements for EUAUXGEN1 located at St. Clair Compressor Station.

- Natural gas-fired existing emergency generators <500 hp (EUAUXGEN1) which supply all essential safe standby loads of the facility when all other normal power sources fail

**Note:**

EUAUXGEN1 was exempt from Permit to Install requirements pursuant to Rule 285(g).

### REFERENCES

40 CFR Part 63 Subpart ZZZZ, National Emission Standards for Stationary Reciprocating Internal Combustion Engines

Rule 285(g) Permit to Install Exemption for internal combustion engines that have less than 10,000,000 Btu/hour maximum heat input.

### REQUIREMENTS

Existing emergency spark ignition (SI) RICE  $\leq$  500 hp, located at area sources of hazardous air pollutants (HAPs), must comply with the operating requirements **by October 19, 2013**

**Note:**

Installing new or reconstructing any existing emergency generator will require EGLE-AQD notification and compliance with RICE requirements. Contact ES-AQ prior to the construction/installation of new equipment to assure compliance.

Maintain on file (for the life of the facility) the RICE MACT applicability determination, with type and size of equipment and installation date. Refer to the Reference section of **AQ-290** for most current Applicability Determination table.

## Responsibility

## Actions

### Field Leader

#### Operating Limitations & Work Practices

1. Install a non-resettable hour meter on the emergency generator (if one is not already installed).
2. Operate and maintain the stationary RICE according to the manufacturer's emission-related written instructions or develop site-specific maintenance plan which must provide for the maintenance and operation of the engine in a manner consistent with good air pollution control practice for minimizing emissions. Conduct all maintenance activities in accordance with the manufacturer's / Company instructions.
3. Minimize engine time spent at idle during startup, do not exceed 30 minutes.

#### Monitoring, Installation, Collection, Operation, and Maintenance Requirements

4. Change oil **and** filter every 500 hours of operation or annually (or utilize an oil analysis program), whichever comes first.

#### Note:

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).

**For Spark Ignition RICE**, analyze at a minimum the following three parameters: Total Acid Number, viscosity, and percent water content.

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

- Total Acid Number is less 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.

**NOTE:** 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.

5. Inspect spark plugs every 1,000 hours of operation or annually, whichever comes first, and replace as necessary.
6. Inspect all hoses and belts every 500 hours of operation or annually, whichever comes first, and replace as necessary.

**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, or if performing the work practice 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. Sources **must report** any failure to perform the work practice on the schedule required and the Federal, State or local law under which the risk was deemed unacceptable.

7. Operate and maintain the stationary RICE according to the manufacturer's emission-related written instructions or develop site-specific maintenance plan which must provide for the maintenance and operation of the engine in a manner consistent with good air pollution control practice for minimizing emissions. Conduct all maintenance activities in accordance with the manufacturer's / Company instructions.
8. Minimize engine time spent at idle during startup, do not exceed 30 minutes.

**Recordkeeping Requirements**

11. Record corrective actions taken during periods of a malfunction or to restore a malfunctioning process to its normal operation.
12. Maintain records of all required maintenance performed, including records required by maintenance plans.
13. Record and maintain a log of the time period / hours of operation. For each start-up, document reason of use (ie: emergency, maintenance, readiness testing), on the Auxiliary (Emergency) Generator Log, or similar document. Document what caused/classified the operation as an emergency.
14. Assure maintenance checks and readiness testing is limited to 100 hours per calendar year.

**NOTE:**

Each RICE may operate for up to 50 hours/year of non-emergency use; however, these hours are counted towards the 100 hour maintenance and testing limit.

If a generator is operated when electric power is available, except for maintenance checks or readiness testing (i.e. if it's operated for non-emergency reasons), contact the ES-AQ to determine compliance and/or deviation reporting requirements.

See **AQ-290**  or contact ES-AQ for further details.

15. Document fuel usage on a monthly basis.

**Figure 1 (example)  
Auxiliary (Emergency) Generator Log**

Month Start-up Date	Hours of Operation**		Total Hours of Operation	Annual Hours of Operation*	Reason for Operation /Comments
	Emergency Use	Maintenance Checks/ Readiness Testing			

**Notes:**

\*Maintenance checks/readiness testing is limited to 100 hours per calendar year

\*\*Contact ES-AQ if the engine is operated for other purposes

Emergency operation is due to power loss; provide explanation in comments section if reason is different

During Maintenance Checks / Readiness Testing verify startup time does not exceed 30 minutes and idling is minimized; note if different



**Preventative Maintenance/Malfunction  
Abatement Plan (PM/MAP)  
St. Clair Compressor Station  
Pipeline Heaters  
(FGPIPEHEATERS-P3)**

Prepared by:

Olaniyi Dawodu

September 2016

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- 8.0 Retention of Records
- 9.0 Updates/Revisions of PM/MAP



## 1.0 PM/MAP Overview and Approval

Facility: Saint Clair Compressor Station

Physical Address: 10021 Marine City Hwy  
Ira, MI 48023

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 Saint Clair Compressor Station Facility to prevent, detect, and correct malfunctions or equipment failures that could result in emissions exceeding any applicable limits. This plan is for the natural gas fired pipeline heaters associated with the St. Clair Compressor Station.

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 St. Clair Compressor Station. This PM/MAP does not contain proprietary information.

At St. Clair Compressor Station, the field leader, or 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 contains 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: Brian Mauzy

Date: 10/12/16

Title: Gas Field Leader III – St. Clair Compressor Station

Signature: \_\_\_\_\_

## **2.0 Equipment Covered by PM/MAP**

This preventative maintenance and malfunction event plan addresses the natural gas fired pipeline heaters associated with Dehy preheaters). The units are identified as LHTR-4-01-01 (emission unit EUPIPEHEATER3-1) and LHTR-4-01-02 (emission unit EUPIPEHEATER3-2).

The two line gas heaters are indirect water bath heaters rated at 15 MMBtu/hr each. Each heater is equipped with an Allen-Bradley Micro Logix programmable logic controller (PLC) for controlling process condition, alarm/shutdown annunciation status and process status.

## **3.0 Operating Variables to be monitored**

Heater Bath low level switch

- Shut down heater if bath level falls below indicated level

High Bath Temperature

- Alarm and Shutdown

High Heater Bath Pressure

- Shutdown

Heater stack temperature

- Shutdown

Low Pilot/Burner Gas Pressure

- Shutdown

High Pilot/Burner Gas Pressure

- Shutdown

## **4.0 Malfunction Events & Procedures**

In the event of a malfunction the PLC will shut down the pipeline heaters and the plant will be alerted to about the equipment's status. Upon completion of appropriate diagnosis and maintenance the equipment will undergo the proper start up procedures in accordance with the manufacturer specifications to bring the equipment back online.

## **5.0 Preventative Maintenance**

Scheduled preventative maintenance will be performed to maintain the performance of the pipeline heaters and to help prevent unscheduled outages. The preventative maintenance tasks that will normally be performed will be determined after the equipment is in operation and the equipment life cycle duration can be determined.

SAP work orders will be issued in accordance with the pipeline heaters' preventative maintenance plan. Maintenance logs will be kept in the SAP system.

## **6.0 Spare Parts and Inventory**

Spare parts that will be maintained in inventory for quick replacement will be determined after the equipment has been operated and life cycle duration can be determined.

## **7.0 Supervisory Personal Responsible for Maintenance of Control Equipment**

Name: Brian Mauzy  
Title: Field Leader  
Location: St. Clair Compressor Station  
10021 Marine City Hwy  
Ira, MI 48023  
Phone: (586)-716-3331 (Office)  
Email: BRIAN.MAUZY@cmsenergy.com

## **8.0 Retention of Records**

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## **9.0 Updates/Revisions of PM/MAP**

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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 may request modification of the plan to address those inadequacies. MDEQ recommends the PM/MAP be reviewed annually.