General Motors LLC
Orion Assembly
Electric Generation Facility

Malfunction Abatement &
Preventative Maintenance Plan

Issued: December 13, 2013
Revised: October 7, 2019

Background

This malfunction abatement and preventative maintenance plan was prepared in accordance with the FGENGINES Condition III.2.

Plan approval terms and conditions:

a) Identification of the equipment and, if applicable, air-cleaning device, and the supervisory personnel responsible for overseeing the inspection, maintenance, and repair.
b) Description of the items or conditions to be inspected and frequency of the inspections or repairs.
c) Identification of the equipment and, if applicable, air-cleaning device, operating parameters that shall be monitored to detect a malfunction or failure, the normal operating range of these parameters and a description of the method of monitoring or surveillance procedures.
d) Identification of the major replacement parts that shall be maintained in inventory for quick replacement.
e) A description of the corrective procedures or operational changes that shall be taken in the event of a malfunction or failure to achieve compliance with the applicable emission limits.

This plan has been developed to satisfy the above requirements. As such, it provides procedures and elements of inspection, inspection frequencies, back up equipment inventories and general information used to prevent, detect and correct malfunctions.

It is important to note that the regulations anticipated periodic shutdowns of control equipment at a landfill. Since periodic malfunctions, unforeseen circumstances or short duration maintenance activities are anticipated by the regulations, GM believes they have implemented a program consistent with these requirements.

GM understands that AQD expects GM to address any temporary break down of a control device or devices. While a plan has been written suggesting parts lists, inspections, inspection frequencies, etc. to comply with the above paragraph it is anticipated the short duration shutdown events will continue to occur which are beyond GM's control.

Affected Equipment

GM plans to operate five internal combustion engines that are covered by this plan. The engines are used for combusting treated landfill gas to produce electricity. These engines are identified as Emission Units EUENGINE1, EUENGINE2, EUENGINE3, EUENGINE4 and EUENGINE5.

Responsible Personnel

All supervisory personnel responsible for overseeing the inspection, maintenance and repair of the engine plant are listed below:

Responsible Personnel Titles*
Facility Engineer
Plant Operator
Environmental Engineer

*Responsible Personnel and/or Titles are subject to change without resubmittal of the plan

Malfunction Abatement and Preventative Maintenance Plan

The following section of this Plan contains prevention of malfunctions, detection of malfunctions and correction of malfunctions of each of the engines.

Description of the Equipment

GM plans to operate five internal combustion engines for combusting treated landfill gas to produce electricity. These engines are identified as Emission Units EUENGINE1, EUENGINE2, EUENGINE3, EUENGINE4 and EUENGINE5.

Equipment Inspection

Table 1 shows the Engine Plant items or conditions that are inspected, the frequency of the inspections, the procedures followed to aid in the prevention of a malfunction, monitoring parameters that are used to detect and aid in the prevention of a malfunction or equipment failure, the normal range of these parameters and recording / retaining of monitoring records.

Table 1
List of Engine Plant Prevention / Detection Items

Item or Conditions to Be Inspected	Frequency of Inspection / Monitoring	Procedures to be followed to Aid in the Prevention of Malfunctions	Monitoring Parameters Used to Detect and Help Prevent a Malfunction / Equipment Failure	*Normal Range of Parameters	Recording / Retaining of Monitoring Records***
Engine Air Cleaner Element	*Performance based assessment	Visual observation and monitoring engine intake air temperature	Engine intake air temperature	< 140 °F	Co-Gen Log Sheets
Engine Oil	*Performance based assessment (assess at approximately 1,100 hours of use)	Change oil approximately every 1,100 hours	Operating hours	~1,100 hours	Engine Oil Maintenance Document
Engine Oil Level	**Weekly	Check engine sight glass & secondary auto-fill	Oil level	≥50% for engine sight glass ≥75% for secondary auto-fill	Co-Gen Log Sheets
Engine Oil Temperature	**Weekly	Check temperature gauge	Oil temperature	199 – 203 °F	Co-Gen Log Sheets
Oil Filter Differential Pressure	**Weekly	Check Technician (ET) software	Pressure differential	3 – 10 psi	Co-Gen Log Sheets
Engine Oil Filter	*Performance based assessment; typically performed with Engine Oil change	Check pressure differential; Change engine oil filter as needed	Pressure differential	<12 psi	Co-Gen Log Sheets
Fuel Metering Valve	*Performance based assessment	Check engine fuel flow and engine inlet gas pressure	- Engine fuel flow - Engine inlet gas pressure	- 525 – 550 scfm - 2 – 3 psi	Co-Gen Log Sheets
Throttle Control Valve	*Performance based assessment	Check electronic valves Technician (ET) software	Throttle position	62 – 65.5%	Co-Gen Log Sheets

Item or Conditions to Be Inspected	Frequency of Inspection / Monitoring	Procedures to be followed to Aid in the Prevention of Malfunctions	Monitoring Parameters Used to Detect and Help Prevent a Malfunction / Equipment Failure	*Normal Range of Parameters	Recording / Retaining of Monitoring Records***
Cooling System Coolant Level	**Weekly	Check sight glass for level	Coolant level	Sight glass on engine = 100%; Sight glass on make-up tanks ≥50%	Co-Gen Log Sheets
Cooling System Coolant Temperature	**Weekly	Check Technician (ET) software	Engine coolant temperature	224 – 236 °F	Co-Gen Log Sheets
Cooling System Coolant Pressure	**Weekly	Check Technician (ET) software	Engine coolant pressure absolute	30 – 40 psi	Co-Gen Log Sheets
Differential Pressure Crankcase Vent	**Weekly	Check pressure, control vacuum (walk around)	Crankcase vent filter differential pressure	Max 50 inches of H_2O	Co-Gen Log Sheets
Generator Load	**Weekly	Check load conditions (kilowatts)	Generator total real power	1,585 –1,615 kW	Co-Gen Log Sheets
Generator	*Performance based assessment (assess at approximately 8,000 hours of use)	Visually inspect system for loose wires/fittings, vibration damage, etc.	Not applicable, visual inspection	Not applicable	Caterpillar Preventative Maintenance Report
Walk-Around Inspection	**Weekly	Check for any unusual conditions, leaks, broken gauges, pinched wires/tubing, etc.	Not applicable, visual inspection	Not applicable	Co-Gen Log Sheets
Belts (Radiator)	*Every 12 months	Inspect, Adjust, and/or Replace, as necessary	Not applicable, visual inspection	Not applicable	Co-Gen Log Sheets

Item or Conditions to Be Inspected	Frequency of Inspection / Monitoring	Procedures to be followed to Aid in the Prevention of Malfunctions	Monitoring Parameters Used to Detect and Help Prevent a Malfunction / Equipment Failure	*Normal Range of Parameters	Recording / Retaining of Monitoring Records***
Radiator	*Performance based assessment or yearly minimum review	Check inlet & outlet temperatures, clean/wash exterior surfaces as needed	- Aftercooler supply temp - Aftercooler return temp - Jacket water supply temp - Jacket water return temp	- 80 – 90 °F - 123 – 130 °F - 150 – 160 °F - 223 – 236 °F	Co-Gen Log Sheets
Water Pump	*Performance based assessment	Inspect/Replace as necessary	- Water weep visual inspection and - Jacket water return temp	- No oil present - 223-236 °F	Co-Gen Log Sheets
Turbocharger	*Performance based assessment (assess at approximately 8,000 hours of use)	Inspect/Replace as necessary	Operating hours	~8,000 hours	Caterpillar Preventative Maintenance Report
Overhaul – Top End	*Performance based assessment (assess at approximately 8,000 hours of use)	Overhaul	Operating hours	~8,000 hours	Caterpillar Preventative Maintenance Report
Overhaul In-Frame	*Performance based assessment (assess at approximately 24,000 hours of use)	Overhaul	Operating hours	~24,000 hours	Caterpillar Preventative Maintenance Report
Overhaul – Major	*Performance based assessment (assess at approximately 80,000 hours of use)	Overhaul	Operating hours	~80,000 hours	Caterpillar Preventative Maintenance Report

Engine performance supersedes frequency of maintenance activities. Approximate values used in this table **should only be used as a guideline in your evaluation of each parameter to be inspected, maintained and replaced.*
***Weekly, when in operation.*
****Records are to be retained for a minimum of 5 years.*

Replacement Parts

To facilitate quick replacement, the spare or replacement parts necessary for proper engine operation and routine maintenance will be provided as needed by the local factory authorized service center.

Corrective Procedures

Corrective procedures or operational changes shall be undertaken in the event of a malfunction or failure of the generation facility. GM will expeditiously implement the appropriate procedures to correct the event. Repair records will be maintained.

Implementation of and Updates to Plan

Implementation of the Plan

If the plan fails to address or inadequately addresses an event that meets the characteristics of a malfunction at the time the plan is initially developed, the owner or operator shall revise the plan within 45 days after such an event occurs and submit the revised plan for approval to the AQD District Supervisor. Should the AQD determine the malfunction abatement/preventative maintenance plan to be inadequate, the AQD District Supervisor may request modification of the plan to address those inadequacies. If the AQD does not notify GM Orion Assembly within 60 days of submittal, the revised plan shall be considered approved.

Updates to the Plan

This plan will be updated within 60 days of modifying the components of the Engine Plant with components not described herein. If no components of the Engine Plant are replaced or expanded, the Plan will be reviewed and updated, if required at least once every 5 years.