

Malfunction Abatement and Preventative Maintenance Plan

Energy Developments

Grand Blanc

October 2018

Prepared for:



2361 West Grand Blanc Road
Grand Blanc, Michigan 48439



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1 BACKGROUND

This Malfunction Abatement and Preventative Maintenance Plan (Plan) was prepared in accordance with Conditions III.2/III.4 of three flexible groups listed within Renewable Operating Permit (ROP) No. MI-ROP-N5991-2016 for Energy Developments Lansing in Grand Blanc (EDGB), LLC. The ROP conditions associated with the permit read as follows:

FG3516ENGINES, comprised of four (4) Caterpillar 3516 engines (EUENGINE1, EUENGINE2, EUENGINE3, and EUENGINE4)

The permittee shall submit to the AQD District Supervisor, for review and approval, a malfunction abatement/preventative maintenance plan (PM/MAP) for FG3516ENGINES. After approval of the PM/MAP by the AQD District Supervisor, the permittee shall not operate FG3516ENGINES unless the PM/MAP, or an alternate plan approved by the AQD District Supervisor, is implemented and maintained. The plan shall incorporate procedures recommended by the equipment manufacturer as well as incorporating standard industry practices. At a minimum the plan shall include:

- 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.*

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 PM/MAP to be inadequate, the AQD District Supervisor may request modification of the plan to address those inadequacies. (R 336.1213(2), R 336.1911)

FGENGINES, comprised of two (2) Caterpillar G3520 engines (EUENGINE6 and EUENGINE7)

The permittee shall not operate FGENGINES unless the malfunction abatement/preventative maintenance plan (PM/MAP), or an alternate plan approved by the AQD District Supervisor, is

implemented and maintained. The plan shall incorporate procedures recommended by the equipment manufacturer as well as incorporating standard industry practices. At a minimum the plan shall include:

- 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.

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 PM/MAP to be inadequate, the AQD District Supervisor may request modification of the plan to address those inadequacies. (R 336.1702(a), R 336.1910, R 336.1911, R 336.1912, R 336.2803, R 336.2804, 40 CFR 60 Subpart JJJJ, 40 CFR 52.21(c) and (d))

FGICEMACT, comprised of all new and reconstructed non-emergency engines greater than 500 hp fueled with landfill gas, located at a major source of HAPs (EUENGINECITB(16), EUENGINE6 and EUENGINE7)

The permittee shall submit to the AQD District Supervisor, for review and approval, a malfunction abatement/preventative maintenance plan (PM/MAP) for FGRICEMACT. After approval of the PM/MAP by the AQD District Supervisor, the permittee shall not operate FGRICEMACT unless the PM/MAP, or an alternate plan approved by the AQD District Supervisor, is implemented and maintained. The plan shall incorporate procedures recommended by the equipment manufacturer as well as incorporating standard industry practices. At a minimum the plan shall include:

- 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.

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 PM/MAP to be inadequate, the AQD District Supervisor may request modification of the plan to address those inadequacies. (R 336.1213(2), R 336.1911)

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.

EDGB understands that AQD expects EDGB 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 EDGB's control.

3 RESPONSIBLE PERSONNEL

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

| Name and Title | Phone Number |
|--|---------------------|
| Jim Grant, Director, Electric Operations | 517-648-2894 |
| Doug Hine, Plant Operator | 989-666-1528 |
| Mike Schaper, Maintenance Manager | 989-313-1450 |
| Dan Zimmerman, Dir of NA, H&S & Compliance | 517-896-4417 |

4 MALFUNCTION ABATEMENT AND PREVENTATIVE MAINTENANCE PLAN

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

4.1 Description of Equipment

EDGB owns and operates five Caterpillar 3516 units (EUENGINECITB(16), EUENGINE1, EUENGINE1, EUENGINE1, and EUENGINE1) and two Caterpillar 3520 units (EUICEENGINE6 and EUICEENGINE7). These units are defined as such in ROP No. MI-ROP-N5991-2016 issued by Michigan Department of Environmental Quality.

4.2 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 the 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 |
|------------------------------------|---|--|
| Engine Air Cleaner Element | *Performance based assessment | Check Sensor (difference in pressure) Replace when necessary |
| Engine Oil | *Performance based assessment | Establish baseline, use oil chemistry and performance as a guide (Change when necessary) |
| Engine Oil Sample | Establish Baseline for each engine (Performance/oil sample) | Once baseline is established verify frequency with oil chemistry sampling results |
| Engine Oil Level | Weekly | Check float & secondary auto-fill |
| Engine Oil Temperature | Weekly | Check temperature gauge |
| Oil Filter Differential Pressure | Weekly | Check Electronic Technician (ET) software |

| Item or Conditions to Be Inspected | Frequency of Inspection /Monitoring | Procedures to be Followed to Aid in the Prevention of Malfunctions |
|--|--|---|
| Engine Oil Filter | Establish Baseline for each engine (Performance/oil sample) | Check pressure differential, change engine oil filter as needed |
| Fuel Metering Valve | Performance based assessment | Check codes, clean sensor |
| Throttle Control Valve (Check electronic valves) | Performance based assessment | Check ET software |
| Cooling System Coolant Level | Weekly | Check sight glass for level and color |
| Cooling System Coolant Temperature | Weekly | Check ET software |
| Cooling System Coolant Pressure | Weekly | Check ET software |
| Differential Pressure Crankcase Vent | Weekly | Check pressure, control vacuum (walk around) |
| Generator Load | Weekly | Check load conditions (Kilowatts) |
| Walk-Around Inspection | Weekly | Check for any unusual conditions, leaks, broken gauges, pinched wires/tubing etc. |
| Battery Electrolyte Level | *Every 6 months of service | Check battery electrolyte level |
| Belts (Radiator) | *Every 12 months | Inspect/ Adjust/Replace |
| Engine Valve | Performance based assessment | Adjust as needed |
| Radiator | Performance based assessment | Check inlet & outlet temperatures, clean/wash exterior surfaces as needed |
| Water Pump | Performance based assessment | Inspect for leaks during walk-around inspection |
| Generator | *Performance based assessment (assess at approximately 8,000 hours of use) | Visually inspect system for loose wires/ fittings, vibration damage etc. |
| Ignition System Spark Plugs | Performance based assessment | Inspect/Replace |
| Turbocharger | *Performance based assessment (assess at approximately 8,000 hours of use) | Establish baseline to use as a guide (Change when necessary) |

| Item or Conditions to Be Inspected | Frequency of Inspection /Monitoring | Procedures to be Followed to Aid in the Prevention of Malfunctions |
|------------------------------------|--|--|
| Overhaul - Top End | *Performance based assessment (assess at approximately 50,000 hours of use) | Overhaul |
| Overhaul - In-Frame | Performance based assessment | Overhaul |
| Overhaul - Major | *Performance based assessment (assess at approximately 100,000 hours of use) | Overhaul |

Engine performance supersedes frequency of maintenance activities. Approximate values used in this table **should only be used as a guideline in evaluation of each parameter to be inspected, maintained and replaced.*

Based on facility records and EDGB personnel, a preventative maintenance program is conducted. Routine maintenance is conducted on the engines in accordance with manufacturer and company specifications which include replacing engine spark plugs, oil, and lubrication. Maintenance is also conducted on an as needed basis. In addition, a "top-end" overhaul, which includes replacing/cleaning cylinder heads, turbochargers and valves, is conducted on each engine. This is typically completed on site.

A "Major" overhaul includes all the work of a top end overhaul plus disassembling all bearings, seals, gaskets, and components that wear and may even include replacing the crankshaft. When an engine is due for a major overhaul, it is swapped out with another engine. When the engine is swapped, it is removed from the facility and either replaced with an engine with a different serial number and manufacture date or the same unit is brought back after being rebuilt and will have the same serial number and manufacture date. Swapping engines in this manner is an industry standard for maintaining the engines.

4.3 Replacement Parts

To facilitate quick replacement, the spare or replacement parts necessary for proper engine operation and routine maintenance will be located on site at each generation facility or at EDGB's central maintenance facility (major components or specialty parts will be ordered as needed). Inventory may vary from time to time.

Each engine is made up of hundreds of parts. Having each parts in the inventory is practically not feasible nor necessary. Below is the list of frequently used parts that may be available at Wood Street Generating Station, EDGB's central maintenance facility or other generating facilities owned by EDGB for quick replacement.

| | |
|-----------------------------------|-----------------------------------|
| <i>Actuators</i> | <i>Filter – various types</i> |
| <i>Adapters</i> | <i>FAN – various types</i> |
| <i>Temperature Regulators</i> | <i>Fuse – various types</i> |
| <i>Battery</i> | <i>Gasket – various types</i> |
| <i>Bearings</i> | <i>Hose – various types</i> |
| <i>Bell – various types</i> | <i>Regulators – various types</i> |
| <i>Bolt- various types</i> | <i>Motor – Various types</i> |
| <i>Brackets</i> | <i>Nut – various types</i> |
| <i>Cap screw</i> | <i>O-ring – various types</i> |
| <i>Oil filter</i> | <i>Pump – various types</i> |
| <i>Spark Plug – various types</i> | <i>Sensors – various types</i> |
| <i>Clamp</i> | <i>Switch – various types</i> |
| <i>Coolant</i> | <i>Valve – various type</i> |

4.4 Corrective Procedures

The corrective procedures or operational changes shall be undertaken in the event of a malfunction or failure of the generation facility. EDGB will expeditiously implement the appropriate procedures to correct the event. Repair records will be maintained in an operations log.

5 IMPLEMENTATION OF AND UPDATES TO PLAN

5.1 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.

5.2 Updates to the Plan

This Plan will be updated within 60 days of replacing or expanding the components of the Engine Plant with components not described herein. If no components of the Engine Plant are replaced or expanded with components described herein, the Plan will be updated at least once every 5 years or as needed.

LIMITATIONS

The work product included in the attached was undertaken in full conformity with generally accepted professional consulting principles and practices and to the fullest extent as allowed by law we expressly disclaim all warranties, express or implied, including warranties of merchantability or fitness for a particular purpose. The work product was completed in full conformity with the contract with our client and this document is solely for the use and reliance of our client (unless previously agreed upon that a third party could rely on the work product) and any reliance on this work product by an unapproved outside party is at such party's risk.

The work product herein (including opinions, conclusions, suggestions, etc.) was prepared based on the situations and circumstances as found at the time, location, scope and goal of our performance and thus should be relied upon and used by our client recognizing these considerations and limitations. Cornerstone shall not be liable for the consequences of any change in environmental standards, practices, or regulations following the completion of our work and there is no warrant to the veracity of information provided by third parties, or the partial utilization of this work product.

APPENDIX E

STARTUP, SHUTDOWN, AND MALFUNCTION PLAN