



# **Eagle Valley Recycle and Disposal Facility Landfill**

## **Landfill Gas-to-Energy Facility**

### **Updated Malfunction Abatement / Preventative Maintenance Plan**

**Prepared for:**

**Waste Management of Michigan, Inc.**

**Reference:**

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**February 28, 2018**

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## **1. INTRODUCTION**

This document presents a Malfunction Abatement / Preventative Maintenance Plan (MAPMP) for the Eagle Valley Landfill Gas-To-Energy Facility (GTE Facility) located in Orion, MI.

Waste Management of Michigan, Inc. d.b.a. Eagle Valley Recycle and Disposal Facility (EVRDF) in association with WM Renewable Energy, LLC (WMRE) operates two (2) internal combustion (IC) reciprocating engines at the GTE Facility located at 3925 Giddings Road, Orion, Michigan. The GTE Facility is designed to combust landfill gas (LFG) (~50% methane), in two (Caterpillar 3520) internal combustion reciprocating engines and generate electrical power. LFG is produced through the natural decomposition of organic material within the landfill. LFG is collected, processed, and compressed to be used as fuel to run the engine/generator sets. The GTE Facility produces approximately 3.2 megawatts (MW) of electrical power, that is distributed through a local utility company's power grid to meet the electricity demands for the equivalent of 3,500 to 4,000 homes for one year. Each Caterpillar 3520 engine is capable of combusting approximately 588 cubic feet per minute (cfm) of landfill gas.

## **2. ORGANIZATION**

The remainder of this MAPMP is organized into the following sections:

- Section 3 provides a description of the facility supervisory personnel responsible for inspection, maintenance, and repair accordance with Rule 911(2)(a).
  - Section 4 provides a description of the operating variables monitored to detect malfunction, the normal operating range of these variables, and the method of inspection in accordance with Rule 911(2)(b).
  - Section 5 provides a description of site safety features and details corrective action in the event of a malfunction in accordance with Rule 911(2)(c).
  - Section 6 provides a description of site security and facility monitoring systems.
  - Section 7 provides a description of the procedures for emergency response and contingency plans
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- Section 8 provides a description of the recordkeeping performed to document compliance with this MAPMP.
- Section 9 provides a description of typical replacement parts maintained in inventory in accordance with Rule 911(2)(a).

### **3. PERSONNEL REQUIREMENTS**

#### **3.1 Management Organization**

Waste Management (WM) is responsible for management of Eagle Valley Recycle and Disposal Facility Landfill and related facilities including the GTE Facility. The District Manager is responsible for making all primary decisions related to the administration and operation of the site. A WMRE Plant Manager is responsible for the operation and maintenance of the GTE Facility. The WMRE Plant Manager reports to the WMRE Operations Management staff, and is responsible for daily operation and maintenance; technical repairs, diagnostic troubleshooting; and purchasing tools, equipment and supplies for the GTE Facility. The specific individuals responsible for the GTE Maintenance and implementation of this MAPMP are:

Jim Dunn (primary)

Richard Kunze (secondary)

WMRE Plant Manager

WMRE Regional Operations Manager

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#### **3.2 Personnel Responsibilities**

Operation of the GTE Facility requires a full-time staff. The staff members can vary in number and level of responsibility. However, in general, staff members and their responsibilities are as follows:

- A District Manager is one who will (i) manage all landfill operations, (ii) oversee any construction at the site, and (iii) ensure that the landfill is operating in compliance with the terms and conditions of regulations and
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permits.

- A WMRE Plant Manager will operate and maintain the GTE Facility, including engines, generators, compressors and ancillary equipment
- A Gas Well Field Technician will be responsible for maintaining and tuning the gas well field, and operating and maintaining the enclosed flares and landfill gas collection system.
- A Site Engineer will (i) ensure that the landfill and related facilities including the GTE Facility are developed according to the engineering plans; (ii) record any variations from the engineering plans; and (iii) monitor environmental compliance of the facility.

In addition to the normal full-time staff, third party contractor personnel may be hired during scheduled and unscheduled maintenance of the facility. If conditions warrant, additional engineering and operations and safety personnel may also be obtained from other Waste Management facilities in the area.

Personnel related to the GTE Facility operation are trained to perform their specific duties and recognize potentially hazardous or dangerous situations at the landfill and the GTE Facility. Training for GTE Facility related personnel includes but is not limited to the following topics under supervised review:

- Construction and Operating Permit Conditions
- Spill Prevention
- Emergency Management and Reporting Procedures
- Lock Out Tag Out Procedures
- Special Waste Management

#### **4. FACILITY OPERATIONS**

The GTE Facility operation is divided into four main segments:

- Landfill gas collection system
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- WMRE GTE Facility gas compressor room
- WMRE GTE Facility engine room
- WMRE GTE Facility control room

Electrical power transmission to the local utility's transmission lines is controlled by two main circuit breakers 52U and 52T. Tie Breaker 52T is used to control electrical power from the generators and utility circuit breaker 52U is the main breaker connecting the GTE Facility to the utility's grid system. Breaker 52U is located in a substation adjacent to the facility and breaker 52T is located in the switchgear in the control room with the generator breakers. For initial startup of the GTE Facility, power from the local electrical utility system is used via the 4.16 KV switchgear, to activate the GTE Facility systems. This is accomplished by closing the utility circuit breaker (52U), and tie breaker (52T). An electrical interlock controls the sequencing of utility breaker (52U) and tie breaker (52T). The tie breaker (52T) cannot be closed until the utility breaker (52U) breaker has been closed.

#### **4.1 Facility Start-Up**

After the auxiliary load has been activated, normal operation of the reciprocating engine generator set is started as follows:

- Verify that the Main Gas Inlet Valve for the well field header to the plant is in the open position.
  - Visually inspect the gas compressor. Verify that the oil level is correct and that the unit is ready for operation.
  - Open Main Header Bleed valve for re-circulation of gas to the nearest flare or logical tie in point in the existing LFG header system.
  - Start the compressor and verify compressor pressure to the main gas header.
  - Verify fluid levels and coolant and oil valve positions for each engine prior to start sequence.
  - Place Engine Control Switch to the Run position.
  - Depress start button on switchgear to initiate engine start sequence.
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- Unit should start and obtain normal operating RPM.
- After engine oil has obtained a minimum operating temperature, then the unit can be paralleled with utility and loaded to desired load. After achieving the required voltage and frequency, the generator is manually synchronized with the utility electrical system and breaker 52G1 is closed. After breaker 52G1 is closed, generator loading takes place and the generator power is supplied to the 4.16 KV switchgear and the utility system. This procedure is the same for remaining generator G2.
- After at least one unit is running the Gas Bypass Valve off of the main header can now be closed.
- Bring the engine to desired load.
- Once at load, verify proper operation by checking all panels and instrument readings.

#### **4.2 Facility Shutdown**

In the event the GTE Facility has to be shut down the following procedures are used:

- Unload engine by depressing the soft unload push button. The engine will gradually unload at a rate of 3kW per second and then will automatically trip the generator breaker at 50kW.
- Once the main generator breaker trips off-line the unit will then go into cool down mode. The engine will operate for an additional 5 minutes and will then shutdown.
- Once both engines have been shutdown then the gas compressor will be shut off by switching the compressor from “run” to “off” mode.

#### **4.3 Landfill Gas Collection System**

The existing landfill gas collection systems at the EVRDF consist of vertical gas extraction wells and associated header piping. The collected gas is sent to an

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existing flare system, the GTE Facility, and the WMRE of Michigan, LLC (WMRE MI) transmission pipeline. The WMRE MI transmission pipeline supplies the General Motors Orion Assembly Plant with landfill gas fuel from EVRDF for use in their stationary IC reciprocating engines or plant boilers.

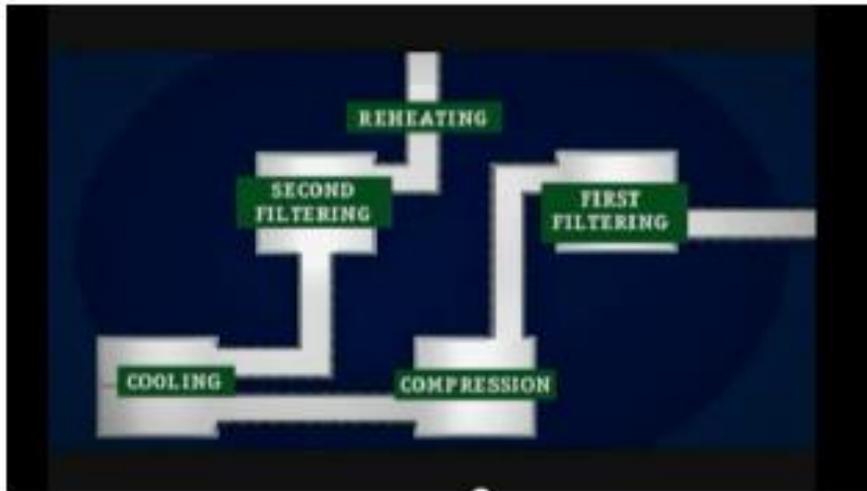
The GTE Facility and the WMRE MI pipeline are designated as the primary users of the LFG fuel. If the LFG collected exceeds the gas needed to operate the GTE Plant engines and the WMRE MI pipeline demand for the GM Orion Assembly Plant, the existing landfill flare system ensures control of all the gas collected by burning off the excess gas.

#### **4.4 Gas Compression System**

The GTE Facility compressor room contains equipment required to pull the LFG from the main header and treat the LFG prior to combustion in the engines. LFG treatment, as described below, includes filtration, compression and moisture removal.

- **Filtration** - LFG passes through two filtering steps in the treatment system. An in-line demister mesh pad, installed prior to the compressor, is designed to protect equipment by removing larger pieces of debris from the gas stream. Secondary coalescing filters, placed in-line after the gas cooler, provide additional filtration at the back end of the system prior to re-heating and delivery to the engine combustion system.
  - **Compression** - LFG is extracted from the landfill under vacuum. The compression step is required to ensure LFG fuel is delivered to the engines at a pressure required for combustion. The compression process increases the pressure and temperature of the gas.
  - **Moisture Control** – After compression heats the LFG fuel, the gas is processed through a gas cooler to lower the temperature. As the gas is cooled, entrained moisture is condensed and trapped by the in-line coalescing filters, removed from the process and managed in the condensate removal
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system.



#### 4.5 GTE Facility Engine/Generator Room

The GTE Facility engine/generator room includes the two engine/generator sets and local control cabinets, storage tanks for virgin and used motor oil, storage tanks for engine coolant, exterior radiators to cool the engine coolant, and a work area for equipment maintenance. The engine/generator sets are Caterpillar 3520 landfill gas V-20 engines driving Caterpillar 4.16 kilovolts (KV) generators. Each Caterpillar 3520 engine/generator set is rated at 2000 kVA, 1600KW, 0.80 power factor, 3-phase, 60 hertz, 4,160 volts output at 278 amperes. Each engine is equipped with an automatic air-to-fuel ratio controller (AFRC) for NO<sub>x</sub> and CO emission control. The AFRC are inspected daily for proper operation. The table below provides identifying information for each engine.

ENGINE No.	ENGINE MAKE CATERPILLAR	ENGINE MODEL	ENGINE FAMILY	MODEL YEAR	POWER (bhp)	AFRC	DISPLACEMENT (liters)
No. 1	Lean burn; 4 stroke	G3520C	Gas	2010	2,233	yes	86
No. 2	Lean burn; 4 stroke	G3520C	Gas	2010	2,233	yes	86

The generator output is connected a 4.16 KV switchgear, providing power to station auxiliary loads with the balance of power exported to the utility grid via a 3-phase station transformer which steps up the generated voltage from 4,160V to the high line voltage and provides power as "sell-back" to the utility grid.

The engine/generator sets are supplied lube oil and coolant from two storage tanks located in the tank area of the engine room. Adjacent to these two tanks is the used oil storage tank. A level alarm panel in the tank area monitors the tank levels and leak detection.

#### **4.6 GTE Facility Control Room**

The GTE Facility control room contains master controls for landfill gas recovery through the gas compressor, control of the engine and generator systems, synchronization control for the utility grid, and an annunciation panel and autodialer in the event of an upset condition in the GTE Facility.

Four control panels make up the station switchboard and includes a System Compartment, Tie Compartment, and two Generator Control Compartments. These compartments include the following:

- One System Compartment, which contains the station Operator Interface Module (OIM) with a touchscreen mounted on the cubicle door, system indicating lights and control switches, the utility protective relays.
  - One Tie Breaker Compartment, which contains the Digital Metering Display (DMD), a synchroscope switch and synchronizing mode selector switch for manual paralleling. The tie breaker Compartment also contains the bus tie breaker control switches, tie breaker status indicators, tie breaker protective relays, and the 86T lockout relay. The tie breaker is located in a separate cabinet in the facility switchgear room.
  - Two Engine/generator set Control Cubicles for Gen #1 (52G1) and Gen #2 (52G2). The cubicle contains a Digital Metering Display (DMD), generator protective relays, Operator Interface Module (OIM) with a touchscreen
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mounted on the cubicle door, control switches, a high-speed trip relay (86 Device) and the generator Emergency Stop Pushbutton (ESPB). The generator breaker is located in a separate cabinet in the facility switchgear room.

Each cubical is constructed of a metal cabinet with internal steel barriers. Each cabinet has hinged front and rear doors for access to the cabinet interiors.

#### 4.7 Planned and Unplanned Shutdowns

Company records indicate the average on-line time for a GTE Facility owned and operated by WMRE operating CAT 3520 engines exceeds 92%. The 8% off-line time includes planned and unplanned shutdowns.

##### 4.7.1 Planned Shutdowns

Planned shutdowns are generally performed for maintenance reasons, or at scheduled intervals as requested by the utility receiving the electrical power from the GTE Facility. The WMRE Plant Manager will use the following maintenance schedule as a general guideline. Scheduled maintenance items, shown below and on the next page, may be adjusted for specific operating conditions as required by engine performance:

<b>Fuel Gas Compressor</b>		
<b>Unit</b>	<b>Maintenance Action</b>	<b>Maintenance Interval (run hours)</b>
Fuel Gas Compressor	Change oil and oil filter	Every 1,500 to 5,000 hours based on sample results
	Change micron filters	Every 1,500 to 4,000 hours based on inspection
	All other repairs	As needed

**Engine Plant Preventative Maintenance Schedule (updated 7-18-17)**

CAT 3520	Daily (Bus. Days)	Weekly	Monthly	750 Hrs	6 Mos	Yearly	As Req'd	Comments
Monitor Operations								
Check Oil Level								
Check Radiator Level								
Check Air/Fuel Ratio								
Check for Engine Leaks								
Read Crankcase Pressure								Adjust as required
Check Ignition Timing								Checking with ET
Check Batteries								
Check Air Filter								
Lube Oil Analysis								
Check Crankcase Breather								
Check Radiator Fan Belts								
Equalize Batteries								
Change Oil and Filters				Baseline				As required by sample
Coolant Samples								
Replace Air Filter								Or as required
Test Safety Shutdowns								
High Voltage Maintenance								
Check Valve Recession								
Replace Spark Plugs								
Check Valve Clearance								
Service Fuel Gas Compressor								Per mfg guidelines based on vacuum
Add Coolant Conditioner								If required
Clean Radiator Fins								
Inspect Turbocharger								Replace every 2 years
Clean & Flush Cooling System								If required
Top End Overhaul								As required
Check Compression								If required
Inspect Engine for Replacement								50,000 hrs - inspect engine
Replace Engine (Like Kind Swap)								Based on inspection (Typical 5 to 7 years)

Planned shutdowns for regularly scheduled maintenance occur as follows:

- Each engine is typically shutdown for approximately 1.5 hours each month for general service including oil, filter, and sparkplug changes. These guidelines may be adjusted if operational characteristics require change.
  - Each engine is typically shutdown annually for approximately 8 hours to overhaul the engine top end (heads and valves) based on operating characteristics of the engine. This frequency may be adjusted based on operational requirements.
  - The GTE plant is shutdown for approximately 4 times each year in order to service the landfill gas compressor (treatment) system, and the electrical system by changing the oil and filters in the compressor and checking the safety system. Specific maintenance schedules and procedures are described in the manufacturers operation and maintenance guide, which is kept in the WMRE Plant Manager's office and can be provided upon request. Electrical maintenance is also performed at this time.
  - Electrical switchgear is maintained annually by an outside contractor. At this time, all safety shutdown devices and generator breakers are tested and re-certified to manufacturer specifications.
  - The LFG flow computer is calibrated annually in accordance with the instructions and guidelines in the Flow Computer operation and maintenance manual.
  - Leak testing of the gas header supply entry to the plant was performed prior to commissioning of the plant. Methane detection monitors are located throughout the plant. In the event of a gas leak, these methane detectors, upon detecting methane concentrations, will trigger an audible alarm, the gas supply to the GTE plant will be shut off, the engines will shutdown and the exhaust and supply fans will automatically start to supply fresh air to the building to exhaust gas from the building.
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- A leak test is also performed on the pipe connections and valves whenever an engine or compressor is replaced. This is accomplished using a bottle with leak detection solution. The solution is applied to saturate all connection points, and evaluating each joint for possible leaks.
- Major overhauls of engines are anticipated approximately every five to seven years. Typically, this entails a like-kind engine replacement in accordance with Rule 285(a)(vi) and the engine overhaul is performed off-site.

#### **4.7.2 Unplanned Shutdowns**

Unplanned shutdowns are generally the result of unexpected events such as:

- Power interruptions within the utility power grid due to increased power usage tripping main breakers or blowing transformers or lightning strikes.
- Detection of explosive concentrations of flammable gases within the GTE Facility.
- Excessive detonation and resulting vibration in the engine.
- High levels of oxygen in the landfill gas.
- Failure of a component in the engine, generator or landfill gas treatment system compressor.
- Failure of one of the components of the main facility step-up transformer.
- Acts of nature such as ice storms, electrical storms and wind.
- Premature engine failure that necessitates engine replacement. These unplanned shutdowns entail a like-kind engine replacement in accordance with Rule 285(a)(vi) and the failed engine is overhauled off-site.

In most cases, unexpected events listed above will trigger an automatic shutdown of the engine generator set, the gas compressor or the whole plant. At

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the same time, an annunciator alarm and panel light will be activated on the annunciator panel in the control room. The GTE Facility will automatically notify the WMRE Plant Manager through an autodialer that there is an issue that requires attention at the GTE Facility. The WMRE Plant Manager, as part of their job responsibilities, is required to respond to the alert and troubleshoot and correct the cause of the unexpected shutdown.

During times when the GTE Facility is shutdown for planned or unplanned reasons, landfill gas that is normally combusted in the plant, will be diverted through the enclosed flare by automatically adjusting valves.

## **5. DESCRIPTION OF SAFETY FEATURES**

The GTE Facility has been designed to detect a number of upset conditions during facility operation as described below. Upset conditions are sensed by relay elements that will cause an autodialer to be activated notifying the WMRE Plant Manager or designated person of the upset condition. The autodialer functions as a remote alarm monitor, typically monitors critical facilities which are not staffed 24 hours a day. The WMRE Plant Manager or designee is on call 24 hours a day seven days a week to respond to upset conditions at the GTE Facility.

In addition to notifying the WMRE Plant Manager of an upset condition, the relay elements can also shutdown all or a portion of the GTE Facility. An upset condition might result in the termination of electrical energy flow to the utility grid, shutdown one or more engine/generator sets, and/or shutdown the gas treatment system. For example, upset conditions in the power utilities system, within the GTE Facility or the gas collection system might activate the upset condition detection and cause all or a portion of the GTE Facility to shutdown.

The landfill gas collection and control system at the existing Eagle Valley Landfill includes the landfill gas collection system, the flare system, and the GTE Facility. In the event of a partial or complete shutdown of the GTE Facility, the flare system has the capacity to control landfill gas generated by the EVRDF.

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## 5.1 Power Interruptions

When a power failure or voltage or frequency disturbance occurs on the utility line, the event is detected by one of the relays, which will initiate a trip the utility breaker (52U). Opening breaker 52U will cause tie breaker 52T to trip. Upon restoration of the utility line voltage, the WMRE Plant Manager can close the utility breaker (52U) and the process of restarting power generation can occur.

Over power, over current or grounding fault on the utility line side of the main transformer is detected by Schweitzer relays, which will trip the utility breaker (52U) and tie breaker (52T) via lockout relays 86U and 86T. At the same time, an alarm will be annunciated as described in Section 5.3. The trip of any breaker will annunciate an alarm.

Each generator is equipped with an automatic voltage regulator and an automatic power factor controller. The generator is also protected by a multifunction Schweitzer SEL-300G relay against unbalanced current (46), instantaneous and time delay over current (50/51), reverse power (32), loss of excitation (40) and faults that cause a flow of differential currents through the generator windings (87G). Neutral grounding of the generator is achieved through the grounding resistor, to limit ground fault current to 200 Amps. In case of grounding, the fault will be sensed by relay elements 50N/51N. Actuation of any relay element will cause the associated generator breaker (52G1 & 52G2) to trip via its respective lockout relay (86G1 & 86G2). At the same time, an alarm will be annunciated as described in Section 5.4. The trip of any breaker will annunciate an alarm.

The protective relays for the system consist of a lockout switch (86 Device), a lock out relay (86T), a Schweitzer SEL-300G generator relay, a Schweitzer SEL-551 Overcurrent Relay, a Schweitzer SEL-587 Current Differential Relay, a Schweitzer SEL-351 Protection System, a Schweitzer SEL-351A Distribution Protection System Relay, and a Schweitzer SEL-551 Overcurrent Relay. All Schweitzer relays are connected through a SEL-2030 Communication Processor.

### **Emergency Stop**

Each generator breaker is also equipped with an Emergency Stop Pushbutton

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(ESPB) located at the genitor control cabinet for each unit. The emergency stop switch has a red mushroomed operator which makes it easy to locate. The switch, when activated is maintained and must be manually reset. Each generator has a local emergency stop push button at the local control panel. As with the other switch, when activated, the switch is locked in and must be manually reset.

#### **Lock Out Relay (86T)**

This lock out relay is a high speed, electrically operated, manually reset switch with a trip target. It is used to accumulate the actions of the tie protective relays to initiate tripping of the tie circuit breaker (52T).

#### **Lock Out Switch (86U Device)**

This lock out switch is a high speed, electrically operated, manually reset switch with a trip target. It is used to accumulate the actions of the tie protective relay (Schweitzer SEL-351) to initiate tripping of the utility breaker (52U) and the tie breaker (52T) through its lock out relay (86T).

#### **Schweitzer SEL-587**

The Schweitzer SEL-587 is a Current Differential Relay. This relay provides protection control, monitoring and recording for two terminal apparatus including transformers with embedded tertiary windings. This relay provides protection elements including Differential (87), Instantaneous time overcurrent (50/51) and Instantaneous ground overcurrent (50/51G), for the utility line side of the main transformer will be detected by relays 87 (Differential) and 50/51 (Instantaneous) When activated, the SEL-587 relay will initiate tripping of the utility breaker 52U and tie breaker 52T via lockout relay 86T. The relay also provides status of the tie breaker (52T) and the utility breaker (52U).

#### **Schweitzer SEL-351**

The Schweitzer SEL-351 is a Multifunction Relay. This relay provides protection elements including Undervoltage (27), Overvoltage (59), Over/Under Frequency (81O/81U), Ground Overcurrent (50/51N), Instantaneous time Overcurrent (50/51), Ground Overvoltage (59G), and Synchronizing Check (25). When activated, the

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SEL-351 relay will initiate tripping of the tie breaker (52T) and/or the utility breaker (52U) through the lock out relay (86T). The relay also provides status of the tie breaker (52T), the utility breaker (52U) and the generator output breakers (G1).

#### **Schweitzer SEL-351A**

The Schweitzer SEL-351A is a Multifunction Distribution Protection Relay. This relay provides protection elements including Undervoltage (27), Overvoltage (59), Over/Under Frequency (81O/81U), Instantaneous time Overcurrent (50/51). When activated, the SEL-351 relay will initiate tripping of the tie breaker (52T) and/or the utility breaker (52U) through the lock out relay (86T). The relay also provides status of the tie breaker (52T) and the utility breaker (52U).

#### **Schweitzer SEL-300G**

The Schweitzer SEL-300G is a comprehensive, multifunction generator protection relay intended for primary and/or backup protection for any size synchronous machine. This relay provides protection elements including Over Excitation (24), Undervoltage (27), Overvoltage (59), Over/Under Frequency (81O/81U), Reverse Power (32), Differential (87), Voltage Restraint Time Overcurrent (51V), Ground Overcurrent (50N/51N), Instantaneous Overcurrent (50), Loss of Excitation (40), Sync Check (25), and Negative Sequence (46). When activated, the SEL-300G relay will initiate tripping of the associated generator breaker 52-G1, G2, or G3 via their respective lockout relay 86-G1. This will also initiate engine shutdown. At the same time, an alarm will be annunciated as described in Section 5.4. The relay also provides status of the generator breaker (52G1) and the engine condition.

#### **Schweitzer SEL-551**

The Schweitzer SEL-551 is an Overcurrent Relay. This relay provides protection elements including Phase Instantaneous Overcurrent (50) and Phase Time Overcurrent (51). This relay also provides status of the station step-down transformer circuit breaker (52SST). Breaker 52SST provides power for the 4160/480V Station Service Transformer and MCC.

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## **5.2 Fire Prevention within the GTE Facility**

The GTE Facility has been designed so that if any of the following faults occur, the generator breaker (52Gx) is tripped and the engine/generator set is shutdown:

- High methane
- Blower failure
- High oxygen
- Fire detection alarm

The engine/generator set is shutdown in order to control the potential for fire and explosion within the plant. It should be noted that the GTE Facility building is constructed with a minimum of combustible material, so as to limit the propagation of fire. The building fire protection consists of ionization detectors, thermal detectors, smoke detectors on the ceiling and in the duct work, methane detectors, audible and visual alarm devices, and manual fire pull stations.

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### 5.3 System Alarm Screens

The GTE Facility has an Operator Interface Module (OIM) located in the system control cubicle in the control room. The OIM has two screens for system alarms. Each screen is provided with alarm windows labeled for both alarm and shutdown functions.

Examples of System alarm are listed below:

- Generator #x summary alarm
- Generator #x shutdown
- Blower failure - alarm / shutdown
- Air compressor low air pressure - alarm
- Tie breaker (52-T) trip-activated by tie cubicle 86-T device
- Main power transformer high oil temperature (26-Q)
- Main power transformer low oil level (71)
- Fire detection system operation - shutdown
- Fire detection system trouble - alarm
- High-high methane - shutdown
- High-high oxygen - shutdown
- High methane - alarm
- High oxygen - alarm
- Methane detector sensor failure - alarm
- Oxygen detector sensor failure - alarm
- Security system operation - alarm
- Low 24 VDC battery source - alarm
- Utility trip - alarm
- Condensate tank high level - alarm

The WMRE Plant Manager uses the annunciation panel as an initial diagnostic tool to determine where the upset condition is. Each screen panel provides a silence/acknowledge push button to acknowledge the alarm and silence horn. There is also a system reset push button to reset alarm once the upset condition has been corrected. The screens also have a test lamp push button used for testing the alarm windows.

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## 5.4 Generator Alarm Screens

Each generator control panel has an Operator Interface Module (OIM) located in the system control cubicle in the control room. The OIM has two screens for system alarms. Each screen is provided with alarm windows labeled for both alarm and shutdown functions.

Examples of Generator alarm are listed below:

- Battery Charger Malfunction
  - High Inlet Air Temperature Alarm
  - Low Jacket Water Level Alarm
  - Air to Fuel Ratio Alarm
  - Common Engine Alarm
  - Low Aftercooler Water Level Alarm
  - Generator High Load Level Alarm
  - High Coolant Temperature Alarm
  - High Crankcase Pressure Alarm
  - Low Oil Pressure Alarm
  - Low Coolant Pressure Alarm
  - Oil Filter Differential Pressure Alarm
  - High Aftercooler Temperature Alarm
  - Generator Low Load Level Shutdown
  - High Coolant Temperature Shutdown
  - High Crankcase Pressure Shutdown
  - Low Oil Pressure Shutdown
  - Low Coolant Pressure shutdown
  - Oil Filter Differential Pressure Shutdown
  - High Aftercooler Temperature Shutdown
  - Low Gas Pressure
  - Overspeed Shutdown
  - Overcrank Shutdown
  - EMCP Diagnostic Failure Shutdown
  - Emergency Stop
  - Air Filter Restriction Alarm
  - High Exhaust Temperature Alarm
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- High Gas Pressure
- Low Oil Level Shutdown
- Multifunction Relay Failure
- Lockout Relay Tripped
- Voltage Regulator Failure
- Air Filter Restriction Shutdown
- High Exhaust Temperature Shutdown
- System Shutdown
- Common Engine Fault
- High Oil Temperature Shutdown
- Radiator High Vibration Shutdown
- High Methane Alarm Engine
- Methane Sensor Failure Engine
- High Methane Shutdown Engine

The WMRE Plant Manager uses the annunciation panel as an initial diagnostic tool to determine where the upset condition is. Each screen panel provides a silence/acknowledge push button to acknowledge the alarm. There is also a system reset push button to reset alarm once the upset condition has been corrected. The screens also have a test lamp push button used for testing the alarm windows.

## **5.5 Ventilation System Annunciation Panel**

The GTE Facility also has an annunciation panel for the ventilation system. The ventilation control panel is provided with ten back-lighted windows labeled for both alarm and fault conditions.

Examples of Ventilation alarm are listed below:

- Eng 1 Fault
- Eng 2 Fault
- Compressor Room Fault
- Methane Detected

The WMRE Plant Manager uses the annunciation panel as an initial diagnostic tool to determine where the alarm/fault condition is located. The annunciation panel is provided with a touchscreen for alarm management, an auto operation ON/OFF selector switch, and an annunciator reset push button is available to reset the annunciator once the alarm condition has been corrected.

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## **5.6 Storage Tank Level Alarm Panel**

The GTE Facility is also equipped with an alarm panel for the Oil Storage System. The tank level alarm panel has six alarm indicators as noted below. When an alarm is received, the red alarm light will illuminate as well as the red strobe light.

Examples of Tank Level alarms are listed below:

- Coolant Tank High Level
- Lube Oil High Level
- Used Oil High Level
- Coolant Tank Leak Detection
- Lube Oil Leak Detection
- Used Oil Leak Detection

The WMRE Plant Manager uses the alarm panel as an initial diagnostic tool to determine where the trouble is located. The alarm panel has a strobe cancel push button to clear the horn and strobe. The alarm indicator will remain lit until the alarm condition has been corrected.

## **6. SITE SECURITY METHODS**

The area is enclosed by fence with locking gates in all areas where the public has access. The GTE Facility is locked during times when the WMRE Plant Manager is not present. The access doors to the control room from the outside are steel insulated doors with locking hardware. Steel overhead doors provide access to the engine and generator room. The overhead doors are controlled from inside the GTE Facility. The GTE facility is also equipped with a monitored security system for all the exterior doors and windows.

## **7. SITE EMERGENCY**

Site emergencies are handled in accordance with the site emergency Response / Contingency plan. This plan covers the following:

- Fire Response
  - Medical Emergencies Response
  - Spill/Release/Emission Response
-

- Natural Disasters
- Bomb Threats
- Civil Disturbance/Demonstration

## **8. RECORD KEEPING**

Various readings are recorded at the beginning of each day. The different types of spreadsheets used at this facility are listed below.

Recording of utility readings is performed at the beginning of each day and maintained in the GTE WMRE Plant Manager's office for future reference and trending. An example of a typical utility reading spreadsheet is provided in Appendix 1.

Operation readings for the fuel gas compressor is recorded at the beginning of each day and maintained in the GTE WMRE Plant Manager's office for future reference and trending. An example of a typical spreadsheet used for recording the gas compressor readings is provided in Appendix 2.

Operating readings for the engine is recorded at the beginning of each day and maintained in the GTE WMRE Plant Manager's office for future reference and trending. An example of a typical spreadsheet used for recording the engine operating readings is provided in Appendix 3.

Operating reading for the generator is recorded at the beginning of each day and maintained in the GTE WMRE Plant Manager's office for future reference and trending. An example of a typical spreadsheet used for recording the generator readings is provided in Appendix 4.

Engine radiator levels is recorded at the beginning of each day and maintained in the GTE WMRE Plant Manager's office for future reference and trending. An example of a typical spreadsheet used for recording the radiator levels is provided in Appendix 5.

A facility production log is completed at the beginning of each day and maintained in the GTE WMRE Plant Manager's office for future reference and trending. An example of a typical spreadsheet used for recording the production readings is provided in Appendix 6.

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Records will be maintained for any engine replacements in accordance with Rule 285(a)(vi) and Permit to Install MI-PTI-N3845-2015 and ROP Permit Number MI-ROP-N3845-2015. Records will be maintained to demonstrate that reconstruction has not occurred. These records will demonstrate that the fixed capital cost of new components is less than 50% of the fixed capital cost of a comparable entirely new facility.

## **9. SPARE PARTS**

The facility maintains a stock of replacement parts to minimize down time of the engines. A list of the typical spare parts maintained on site is provided in Appendix 7. Quantities and inventory can fluctuate.

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## Appendix 5

Month _____		Engine Radiator Level Readings			
Day	Time	After Cooler Water Temp	Jacket Water Temp	Pressure	Comments
1.					
2.					
3.					
4.					
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31.					



## Appendix 7

### CAT 3520 Spare Parts List

Description	Part Number	Quantity
SEAL-O-RING	033-6031	4
SEAL-O-RING	061-9456	4
PLUG	090-9019	1
SEAL-O-RING	095-1674	20
BOLT HEAD	0S-1590	4
BEARING	107-7330	1
GASKET	107-8505	2
SEAL-O-RING	109-2332	4
GASKET CYLINDER HEAD	110-6991	20
SPACER PLATE	110-6994	4
GASKET	111-1349	1
GASKET	111-5822	2
GEAR	116-3242	1
GASKETS	122-8856	4
BOLT HEAD	131-0420	8
SEAL-O-RING	131-3718	2
GASKET	136-3246	4
SEAL-O-RING	136-7226	8
PIN PISTON	138-8506	1
REG WATER TEMP 120C	142-9675	10
ROD AS	144-0725	1
GASKET PLATE	144-5692	20
GASKET	146-7386	2
BELLOWS	153-4045	2
SEAL-O-RING	153-4906	5
SEAL	154-7477	4
BOLT M8X1.25X25-MM	156-2603	8
PLUG	162-0177	1
PIPE PLUG	168-3349	2
SEAL O RING	172-5635	3
SEAL-O-RING	174-3357	4
GASKET	186-2558	4
GASKET	190-5082	2
SEAL INTEGRAL	192-2262	2
HOSE	195-4403	4
GASKET	197-8120	2
PLUG PIPE	1A-5822	1
GASKET	1A-9066	1
BOLT	1B-2790	10
WASHER	1B-4218	2
BOLT 5/16-18X1.25	1B-7182	10

Description	Part Number	Quantity
BOLT 5/16-18X1.625	1H-5514	10
SCREEN	1W-1564	1
RETAINER	1W-4188	2
SCREW ADJUSTER	200-2003	4
ELBOW	200-6407	1
FLANGE	200-6409	1
SEAL O RING	200-6410	10
GASKET	200-6547	4
MAN-EXH-LH	200-6551	2
MAN-EXH-RH	200-6552	2
CAP	200-6553	1
BELLOWS	200-6554	2
SEAL	200-6555	15
SHAFT	201-8290	1
BASE ROCKER	201-8292	1
ROCKER ARM	201-8296	1
ROCKER ARM	201-8301	1
SEAL	203-4571	5
GASKET	203-7859	22
SEAL-O-RING	203-9745	10
GASKET	204-3506	20
SEAL	204-5426	80
SEAL	204-5427	80
CLAMP ASSY	204-6472	2
GASKET	205-9127	8
SEAL	206-5988	20
ADAPTER	207-1316	4
ADAPTER	207-1317	1
SEAL	208-2362	4
SEAL	208-2363	4
GASKET	209-1823	3
LINER	211-7826	2
SEAL O RING	213-9397	4
REG WATER 55C DEG	219-3306	4
SEAL-O-RING	219-7000	8
SEAL	220-7191	2
COVER VALVE	222-1962	2
GASKET	226-7485	4
BELLOWS	227-9027	2
ELBOW	230-3411	1
SEAL-O-RING	235-3546	3
SEAL-O-RING	235-3548	4
PUMP GRP WATER	235-4535	1
GASKET	235-5751	2
GASKET	239-1038	2

Description	Part Number	Quantity
ADAPTER	241-6953	8
COVER BASE BREATHER	244-5626	1
CLAMP	244-8861	6
GASKET	247-3796	2
REG TEMP 98C DEG	247-7133	8
PLUG	252-5060	2
NEW TURBO	254-0789	1
SEAL	255-6466	4
BRIDGE	256-4367	2
SEAL O RING	259-4596	2
TUBE AS OIL JET	260-0135	1
SEAL	261-7952	4
SEAL	261-7954	4
BODY PITON	262-2061	1
RING TOP	262-3066	2
SEAL	262-4568	2
LIFTER	263-6679	2
GASKET	273-3967	1
REGULATOR	273-4069	2
SEAL	2G-6303	2
SEAL-O-RING	2H-3928	3
SEAL-O-RING	2H-3928	2
SEAL-O-RING	2J-0157	42
GASKET	2N-0931	2
SCREW	2N-5842	4
FILTER ENG OIL	2P-4005	8
GASKET	2W-0752	2
RING RETAINER	2W-4005	2
FILTER AIR	2W-4246	2
GEAR	2W-7320	1
CYLINDER HEADS NEW	315-2633	20
SEAL-O-RING	3D-2824	4
PLUG	3E-2331	2
NUT FULL 3/8-16	3E-6916	10
SEAL-O-RING	3J-1907	3
SEAL-O-RING	3J-7354	4
NUT JAM	3J-9196	4
SEAL-O-RING	3K-0360	8
SEAL-O-RING	3P-0654	2
SEAL-O-RING	3P-0655	2
SEAL LIP	3S-9643	10
GASKETS	4B-8407	2
SEAL-O-RING	4J-5477	4
SEAL-O-RING	4K-1388	10

Description	Part Number	Quantity
GASKET	4L-8149	4
GASKETS	4N-0699	2
GASKETS	4N-0933	2
GASKET	4N-1320	2
GASKET	4P-3452	2
SEAL-O-RING	4S-5898	20
RING RETAINER	4W-0530	2
GASKET	4W-3100	2
PUSH ROD	4W-6682	4
PLUG	5F-0304	1
SEAL-O-RING	5F-9657	2
SEAL-O-RING	5H-6734	4
BOLT 3/8-16X5	5L-6887	20
GASKET	5M-0330	4
WASHER	5M-2894	10
BOLT 3/8-16X1.5	5P-0076	10
SEAL-O-RING	5P-0840	40
SEAL-O-RING	5P-5846	3
SEAL-O-RING	5P-7817	1
SEAL-O-RING	5P-7818	1
SEAL-O-RING	5P-8210	4
SEAL-O-RING	5P-8872	1
BOLT 3/8-16X1.75	5P-8880	8
WASHER SEALING	5R-7136	4
WASHER SEALING	5R-7137	4
GASKET	6F-4868	1
SEAL-O-RING	6V-1454	4
SEAL-O-RING	6V-1903	15
SEAL-O-RING	6V-3348	2
SEAL-O-RING	6V-3603	8
SEAL-O-RING	6V-3908	2
SEAL-O-RING	6V-4589	4
SEAL-O-RING	6V-5048	4
SEAL O RING	6V-5049	8
SEAL-O-RING	6V-5054	8
SEAL-O-RING	6V-5066	4
SEAL-O-RING	6V-5101	20
SEAL O RING	6V-5103	8
SEAL-O-RING	6V-5134	4
SEAL O RING	6V-5139	4
SEAL-O-RING	6V-5778	4
SEAL-O-RING	6V-6609	4
SEAL-O-RING	6V-7351	1
SEAL-O-RING	6V-7681	2
SEAL-O-RING	6V-8398	10

Description	Part Number	Quantity
REDUCER-O-RING	6V-8942	6
SEAL-O-RING	6V-9746	20
SEAL-O-RING	6V-9769	20
WASHER	7C-3258	1
SHAFT	7C-3259	1
SEAL-RING	7E-2326	4
GASKET	7E-6016	6
SEAL-O-RING	7J-0204	4
SEAL-O-RING	7J-9108	6
BOLT 3/8-16X2.25	7L-6443	8
SEAL-O-RING	7M-8485	6
SEAL-O-RING	7N-2046	9
BOLT ROD	7N-2405	4
GASKET	7N-3368	2
GASKETS	7N-4320	1
SPRING LIFTER GUIDE	7N-4782	2
GASKET	7N-4945	2
GASKET	7N-5057	1
OIL RING	7W-2221	2
SEAL-O-RING	7X-1547	2
SEAL-O-RING	7X-4805	3
PLUG	7X-7731	2
VALVE AS SAMPLING	8C-3446	2
SEAL	8C-5196	20
CONNECTOR	8C-6866	1
BUTTON VALVE	8F-8858	2
SEAL-O-RING	8L-2786	2
SEAL-O-RING	8L-9241	4
RING INTER	8N-1234	2
RETAINING RING	8N-1991	2
BAND-FILLER	8N-4707	2
RETAINER PIN	8N-7296	2
SEAL-O-RING	8T-1919	6
SEAL-O-RING	8T-2928	2
SEAL-O-RING	8T-2929	2
PLUG	8T-6761	1
PLUG PIPE	8T-6762	1
PLUG PIPE	8T-6763	1
PLUG PIPE	8T-6765	1
PLU PIPE	8T-6766	1
BOLT 12 PT	8T-7581	2
RING RETAINER	9F-7707	2
GASKET	9F-8127	2
GASKET	9L-1480	2
BOLT 3/8-16X2	9L-7373	20

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<b>Description</b>	<b>Part Number</b>	<b>Quantity</b>
NUT 3/8-24	9L-7712	2
WASHER	9M-1974	10
SEAL-O-RING	9M-2092	4
PLUG	9S-4182	2
PLUG O RING	9S-4185	2
PLUG	9S-4190	1
PLUG	9S-8002	1
PLUG O RING	9S-8004	2
PLUG	9S-8005	2
PLUG	9S-8007	1
PLUG O RING	9S-8008	2
PLUG	9S-8009	1
NUT 3/8-16	9S-8752	6
NUT 3/8-16X3.5	9X-2068	4
SEAL-O-RING	9X-7371	1
SEAL	9X-7523	4
SEAL	9X-7538	2
SEAL O RING	9X-7562	4
GASKET	9Y-6893	4
GASKET	9Y-8069	2
GASKET	9Y-8387	4
GASKET	9Y-8388	1
BOLT	OS-1590	4
BOLT 3/8-16X1.5	OS-1591	10
SERVICE	REN5975	1
PARTS	SEBP3872	1

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<b>ELECTRICAL PARTS</b>		
<b>Description</b>	<b>Part Number</b>	<b>Quantity</b>
SPEED SENSOR	102-9029	2
PRES SWITCH	110-1168	2
SENSOR MAIN AIR PRESSURE	130-8299	2
SENSOR TEMP	130-9811	2
SENSOR PRESSURE	149-5150	2
EXTENSION	150-2050	20
SENSOR GRP PRESSURE	163-8523	3
KIT	171-6721	1
CONTROL GRP	176-1286	1
TRANSFORMER ASSY	191-9346	8
	194-6724	1
DETONATION	195-2431	3
TEMP SENSOR	207-2371	4
C-BREAKER	207-8496	2
C-BREAKER	207-8497	2
C-BREAKER	207-8498	2
SEAL	231-9892	1
BAR BUSS (NONE ON HAND)(NONE FOUND OR HAND)	233-7424	1
VOLTAGE REGULATOR	235-5725	1
SPARK PLUG. CHECK TO SEE IF THIS IS MOST CURRENT NUMBER	243-4291	80
CONTROL GROUP BRAIN	256-7635	2
HARNESS	261-5678	1
SENSOR GP AIR	261-5731	2
SEAL-O-RING	6V-5048	3
SEAL	8L-2786	2
TOGGLE SWITCH	8N-0694	1
SWITCH	9F-3099	2
SPEED SENSOR MAG	9X-5392	1