Pine Tree Acres Landfill

Landfill Gas-to-Energy Facility
Operation and Maintenance Plan
(Malfunction, Abatement/Preventative Maintenance Plan)

Prepared for:

Waste Management, Inc.

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1. INTRODUCTION

This document presents an Operation and Maintenance (O&M) Plan for the Pine Tree Acres Landfill Gas-To-Energy Facility (GTE Facility) in Lenox, MI.

Pine Tree Acres, Inc. (PTA) operates an eight (8) internal combustion (IC) reciprocating engine GTE Facility at 36289 29 Mile Road, Lenox, Michigan. The GTE Facility is designed to combust landfill gas (Methane) in eight (Caterpillar 3520) internal combustion reciprocating engines and generates electrical power. Landfill gas (Methane) is produced by the decomposition of material in the landfill. This gas is collected, processed, and compressed to be used as fuel to run the engine/generator set. The GTE Facility will produce approximately 12.8 megawatts (MW) of electrical power that can be transmitted through a local utility company's power distribution grid to power the equivalent of 11,000 to 11,500 homes for one year. Each Caterpillar engine is capable of combusting approximately 583 cubic feet per minute (cfm) of landfill gas.

2. ORGANIZATION

The underlying applicable requirement for this O&M Plan is State Rule 911 that provides minimum requirements for a malfunction abatement/preventative maintenance plan. This plan was developed in accordance with the provisions of Rule 911 as well as Michigan Department of Environmental Quality – Air Quality Division's Preventative Maintenance/Malfunction Abatement Plan Checklist Guidance Document. The remainder of this O&M Plan 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.
- Section 8 provides a description of the recordkeeping performed to document compliance with this O&M Plan.
- Section 9 provides a description of replacement parts maintained in inventory in accordance with Rule 911(2)(a).

3. PERSONNEL REQUIREMENTS

3.1 Management Organization

WM is responsible for the management of Pine Tree Acres 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 GTE Facility Manager is responsible for the operation and maintenance of the GTE Facility and reports to the WM Renewable Energy staff concerning the daily operation of the GTE Facility; technical repairs and diagnostic troubleshooting; and purchasing tools, equipment and supplies for the GTE Facility. The specific individuals responsible for GTE maintenance and implementation of this O&M Plan are:

David Bauman (primary)	Richard Kunze (secondary)
WMRE Plant Manager	WMRE Operations Manager
586-749-5182	231-220-4585
dbauman@wm.com	rkunze@wm.com

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) make and manage contracts with waste hauling companies, (iii) oversee any construction at the site, and (iv) ensure that the landfill is operating in compliance with the terms and conditions of the permit.

- A GTE Facility Manager and a GTE Operator are the people who will operate and maintain the landfill gas recovery plant.

- A Well Field Technician who will be responsible for maintaining and tuning the well field, and operating and maintaining the enclosed flares and landfill gas collection system.

- A Site Engineer who 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 added during scheduled and unscheduled maintenance of the facility. If conditions warrant, additional engineering and operations and safety personnel may 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 to 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:

- The landfill gas collection system
- The GTE facility gas compressor room
- The GTE facility engine room
- The GTE facility control room

Electrical power transmission to the local utilities 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 start up 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.
- 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 generators G2, G3, G4, G5, G6, G7, & G8.
- 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 shutdown 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 all eight units 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 Pine Tree Acres Landfill consist of vertical gas extraction wells and associated header piping. The collected gas was previously sent to an existing flare system and an existing landfill gas to energy facility operated by LES.

The GTE Facility is designated as one of the prime users with the flare system and the two LES plants combusting the landfill gas that the GTE Facility doesn't use. If the gas collected exceeds the gas needed to operate the WM engines and the LES engines, the existing flare system will ensure control of all the gas collected by burning off the excess gas.

4.4 Gas Compression System

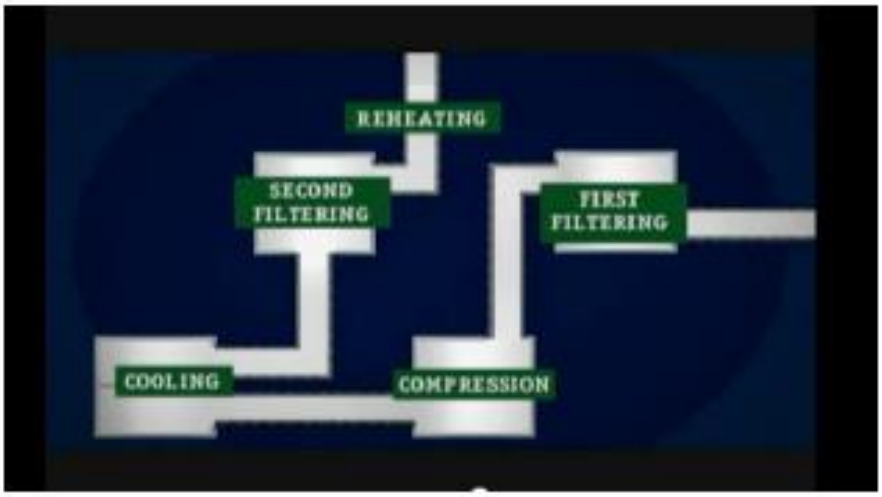
The GTE Facility compressor room contains the equipment required to pump the landfill gas from the main header and treat the landfill gas prior to combustion in the engines. The landfill gas treatment as described below includes filtration, compression and moisture removal.

- **Filtration** - Landfill gas 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 steam. Secondary coalescing filters, placed in-line after the gas cooler, to provide additional filtration at the back end of the system prior to re-heating and delivery to the engine combustion system.

- **Compression** - Landfill gas extracted from the hill under vacuum. The compression step is required to ensure gas is delivered to the engines as a fuel at a pressure required for combustion. The compression process increases the pressure and temperature of the gas.

- **Moisture Control** – After compression heats the gas, 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 system.



4.5 GTE Facility Engine/Generator Room

The GTE Facility engine/generator room includes the eight 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 comprised of a Caterpillar 3520 landfill gas V-20 engine driving a Caterpillar 4.16 kilovolts (KV) generator. The 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 NOx 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	ENGINE MODEL	ENGINE FAMILY	SERIAL No.	MODEL YEAR	POWER (bhp)	AFRC	DISPLACEMENT (liters)
No. 1	Lean burn; 4 stroke	G3520C	Gas	GZJ00469	2010	2,233	yes	86
No. 2	Lean burn; 4 stroke	G3520C	Gas	GZJ00464	2010	2,233	yes	86
No. 3	Lean burn; 4 stroke	G3520C	Gas	GZJ00467	2010	2,233	yes	86
No. 4	Lean burn; 4 stroke	G3520C	Gas	GZJ00466	2010	2,233	yes	86
No. 5	Lean burn; 4 stroke	G3520C	Gas	GZJ00462	2010	2,233	yes	86
No. 6	Lean burn; 4 stroke	G3520C	Gas	GZJ00468	2010	2,233	yes	86
No. 7	Lean burn; 4 stroke	G3520C	Gas	GZJ00463	2010	2,233	yes	86
No. 8	Lean burn; 4 stroke	G3520C	Gas	GZJ00465	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 engine room. Adjacent to these two tanks is the used oil storage. 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.

Eight control panels make up the station switchboard and include a System

Compartment, Tie Compartment, and a 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.

- Eight Engine/generator set Control Cubicles for Gen #1 (52G1), Gen #2 (52G2), Gen #3 (52G3), Gen #4 (52G4), Gen #5 (52G5), Gen #6 (52G6), Gen #7 (52G7), and Gen #8 (52G8). The cubicle contains a Digital Metering Display (DMD), generator protective relays, Operator Interface Module (OIM) with a touchscreen 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 Waste Management using the 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 Facility 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 the engine:

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

CAT 3520

Engine Preventative Maintenance Schedule

	Daily	Weekly	Monthly	750 Hrs	1500 Hrs	3 Mos	6 Mos	Yearly	As Req'd	Comments
Monitor Operations										
Check Oil Level										
Check Radiator Level										
Check Air/Fuel Ratio										
Check Engine DDT										
Read Crankcase Pressure										Adjust as required
Check Batteries										Wear proper PPE
Check Air Filter										
Lube Oil Analysis										
Add Coolant Conditioner										If required
Check Crankcase Breather										
Check Radiator Fan Belts										
Clean Radiator Fins										If needed
Change Oil										Ck oil analysis
Change Oil Filters										
Replace Spark Plugs										
Grease & Inspect Fuel Linkage										
Check Ignition Timing										
Check Valve Clearance										
Inspect Turbocharger										
Inspect Exhaust Bypass Valve										
Inspect Carburetor Diaphragm										
Replace Air Filter										Or as required
Test Safety Shutdowns										
Clean & Flush Cooling System										If required
Check Compression										If required

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 for overhauling of the engine top end (heads and valves) based on operating characteristics of the engine, once again this may be adjusted based on operational requirements.

- The 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 Facility 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 flow computer will be calibrated annually in accordance with the instructions and guidelines in the Flow Computer operation and maintenance manual.

- Leak testing of the gas header entry to the plant was performed prior to the commissioning of the plant. Methane detection is provided throughout the plant. In the event of methane contamination an alarm will sound, the gas supply to the 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 and exhaust the contaminated air.

- 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 and saturating all connection points, and evaluating each joint for possible leaks.

- Major overhauls of engines are anticipated approximately every five 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 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 Facility Manager through an autodialer that there is an issue that requires attention at the GTE Facility. The Facility Manager, as part of his/her 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 manually adjusting valves and starting the flare.

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 Facility 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 Facility 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 Facility 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 Pine Tree Acres Landfill includes the landfill gas collection system, the flare system, the LES Facility 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 Landfill.

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 Facility 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, 52G3, 52G4, 52G5, 52G6, 52G7, & 52G8) to trip via its respective lockout relay (86G1, 86G2, 86G3, 86G4, 86G5, 86G6, 86G7, & 86G8). 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 Over current 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 (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 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.

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.

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 Facility 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.

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
- 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 Facility 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
- Eng 3 Fault
- Eng 4 Fault
- Eng 5 Fault
- Eng 6 Fault
- Eng 7 Fault
- Eng 8 Fault
- Compressor Room Fault
- Methane Detected

The Facility 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.

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 Facility 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 GTE Facility 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 facility 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 facility 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 facility 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 facility 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 facility 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 facility 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.

Records will be maintained for any engine replacements in accordance with Rule 285(a)(vi) and Permit to Install 160-14. 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. (Caterpillar estimates that typical engine overhaul costs are 18-24% of a new replacement.)

9. SPARE PARTS

In accordance with Rule 911(2)(a), the facility maintains a stock of replacement parts to minimize down time of the engine. A list of the spare parts maintained on site is provided in Appendix 7. Note that part numbers and typical quantities in inventory are provided as examples and are subject to adjustment based on future plant operating conditions.

Appendix 1

Month _____ **Utility Readings**

Day	Time	KW	Power Factor	Hertz	Amp/Volts			Utility Hours	Comments
					A-Phase	B-Phase	C-Phase		
1.									
2.									
3.									
4.									
5.									
6.									
7.									
8.									
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29.									
30.									
31.									

Appendix 2

Month _____ **Fuel Gas Compressor Readings**

Day	Time	FGC Hours	FGC Inlet Temp	FGC Inlet Press	FGC Disc. Temp	FGC Disc. Press	Inst Air Press	FGC Oil Level	FGC Oil Temp	FGC Oil Press	Cool Inlet Temp	Cool Disch Temp	Final Disch Temp	FGC Inlet VAC	Shop Air Comp Hours
1.															
2.															
3.															
4.															
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21.															
22.															

Appendix 3

Month _____ **Engine Operating Readings**

Day	Time	Engine Hours	Batt Volt	Batt Amps	Oil PSI	Oil Temp	MAT	MAP	AFR VLV%	Oil Filter Diff	Jkt Wtr PSI	Day Tank	Aft Cooler Wtr Temp	Jacket Wtr Temp	MAN KPA	Throttle Position	Oil Level	Oil Used
1.																		
2.																		
3.																		
4.																		
5.																		
6.																		
7.																		
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20.																		
21.																		

Appendix 4

Month _____ **Generator Operating Readings**

Day	Time	KW	Power Factor	Hertz	Amps/Volts			KW/HRS	Comments
					A-Phase	B-Phase	C-Phase		
1.									
2.									
3.									
4.									
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29.									
30.									
31.									

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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6.					
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31.					

Appendix 6

Month _____					Gas Recovery Production Log						
Day	**Time**	**Amb Temp**	**Bar Press**	**Wind Speed/ Direction**	**%02**	**%N2**	**%CH4**	**Inlet VAC**	**Load (mw)**	**Plant Flow**	**Comments**
1.											
2.											
3.											
4.											
5.											
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20.											
21.											

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
B0LT 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

Description	Part Number	Quantity
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	RENR5975	1
PARTS	SEBP3872	1

ELECTRICAL PARTS		
Description	**Part Number**	**Quantity**
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