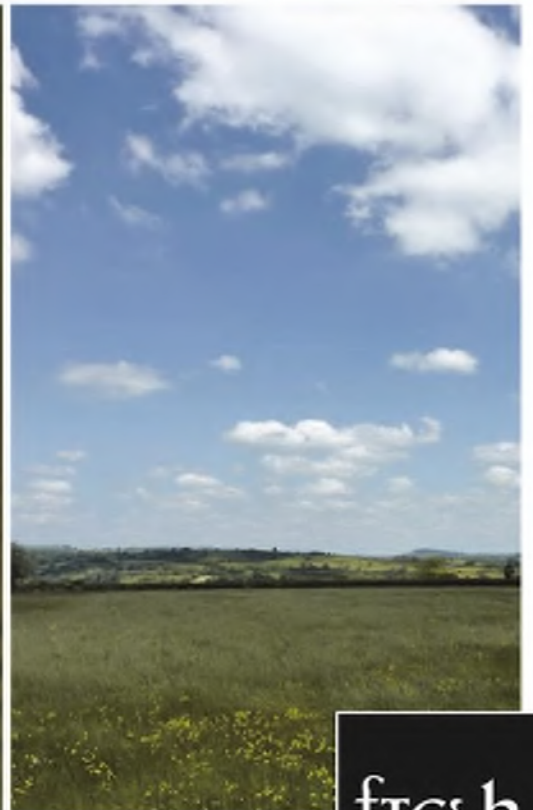
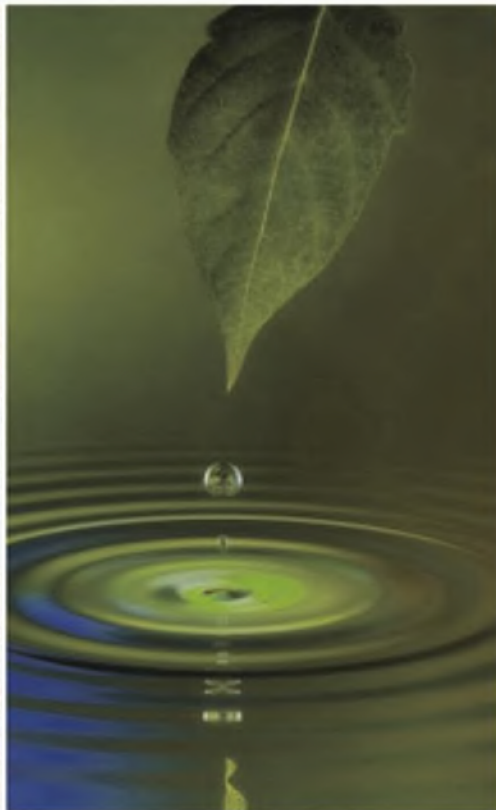


**Malfunction Abatement Plan &  
Preventative Maintenance Plan for  
Gas Turbine Generator HRSG Duct Burner Fire Pump  
Emergency Generator and Boilers A And B**

**Start-Up/Shutdown Plan for  
Gas Turbine Generator HRSG Duct Burner**

**Michigan Power Cogeneration Facility  
Michigan Power Limited Partnership**

Revised/Reveiwed  
January 4, 2018





**MALFUNCTION ABATEMENT PLAN  
AND  
PREVENTATIVE MAINTENANCE PLAN  
FOR  
GAS TURBINE GENERATOR, HRSG DUCT BURNER, FIRE PUMP,  
EMERGENCY GENERATOR, AND BOILERS A AND B  
START-UP/SHUTDOWN PLAN  
FOR  
GAS TURBINE GENERATOR, HRSG DUCT BURNER  
MICHIGAN POWER COGENERATION FACILITY**

**PREPARED FOR:  
MICHIGAN POWER LIMITED PARTNERSHIP  
LUDINGTON, MICHIGAN**

**MAY 26, 2016  
PROJECT NO. G140046B14**

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## LIST OF ABBREVIATIONS/ACRONYMS

CEMS	continuous emission monitoring system
CO	carbon monoxide
gal/hr	gallon(s) per hour
HHV	high heat value
HRS	heat recovery steam generator
ISO	International Organization for Standardization 3977-2
lb/hr	pound(s) per hour
MAP	malfunction abatement plan
MDEQ	Michigan Department of Environmental Quality
MMBtu	million British thermal units
MMBtu/hr	million British thermal units per hour
MPLP	Michigan Power Limited Partnership
MW	megawatt(s)
NO <sub>x</sub>	oxides of nitrogen
O <sub>2</sub>	oxygen
PMP	Preventative Maintenance Program
ppmvd	parts per million, volumetric dry
PTI	Air Use Permit to Install
ROP	Renewable Operating Permit
scf	standard cubic foot/feet
scf/hr	standard cubic feet per hour



## 1.0 INTRODUCTION

This MAP and PMP has been prepared to comply with the MPLP MI-ROP-N4975-2014 and Rule 911. The purposes of these Plans are to define actions that will be taken by MPLP in the event of a malfunction or equipment breakdown which could result in an exceedance of emission limitations, and to maintain a PMP. These plans are both required by the ROP.

Rule 911 states:

- (1) Upon request of the department, a person responsible for the operation of a source of an air contaminant shall prepare a malfunction abatement plan to prevent, detect, and correct malfunctions or equipment failures resulting in emissions exceeding any applicable emission limitation.
- (2) A malfunction abatement plan required by subrule (1) of this rule shall be in writing and shall, at a minimum, specify all of the following:
  - (a) A complete PMP, including identification of the supervisory personnel responsible for overseeing the inspection, maintenance, and repair of air-cleaning devices, a description of the items or conditions that shall be inspected, the frequency of the inspections or repairs, and an identification of the major replacement parts that shall be maintained in inventory for quick replacement.
  - (b) An identification of the source and air-cleaning device operating variables that shall be monitored to detect a malfunction or failure, the normal operating range of these variables, and a description of the method of monitoring or surveillance procedures.
  - (c) 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.
- (3) A malfunction abatement plan required by subrule (1) of this rule shall be submitted to the department and shall be subject to review and approval by the department. If, in the opinion of the commission, the plan does not adequately carry out the objectives as set forth in subrules (1) and (2) of this rule, then the department may disapprove the plan, state its reasons for disapproval, and order the preparation of an amended plan within the time period specified in the order. If, within the time period specified in the order, an amended plan is submitted which, in the opinion of the department, fails to meet the objective, then the department, on its own initiative, may amend the plan to cause it to meet the objective.
- (4) Within 180 days after the department approves a malfunction abatement plan, a person responsible for the preparation of a malfunction abatement plan shall implement the malfunction abatement plan required by subrule (1) of this rule.



## 2.0 DEFINING MALFUNCTIONS

Rule 113(a) defines a malfunction as:

Malfunction means any sudden, infrequent and not reasonably preventable failure of a source, process, process equipment, or air pollution control equipment to operate in a normal or usual manner. Failures that are caused in part by poor maintenance or careless operation are not malfunctions.

A true malfunction must have a reasonable potential to cause an exceedance in emissions. This MAP will address the Gas Turbine Generator, HRSG Duct Burner, CO Catalytic Converter, natural gas-fired Auxiliary Boilers (Boilers A and B), Emergency Generator, and the Emergency Fire Pump.

## 3.0 AIR POLLUTANT EMISSION CONTROL TECHNOLOGY

MPLP's stacks for the Gas Turbine/HRSG (shared stack) and Auxiliary Boilers are equipped with CEMS. Each CEMS and its' dedicated data acquisition system were packaged by Custom Instrumentation Services Corporation.

The CEMS on the boilers (shared CEMS) monitors each boiler for 7.5 minutes, alternating between the two. Plant personnel utilize the CEMS data to determine continuous compliance with permit emission limitations. The variables being monitored by the Boiler CEMS are NO<sub>x</sub> and O<sub>2</sub>. The normal operating range of these variables will be at or below the permitted limitations.

The CEMS on the Gas Turbine Generator/HRSG stack will monitor NO<sub>x</sub>, CO, and O<sub>2</sub>. The normal operating range of these variables will be at or below the permitted limitations. The percentage of O<sub>2</sub> in the stack will normally range from 10 to 17%.

The fire pump and emergency generator do not have add-on air pollution controls.

### 3.1 DETERMINATION OF AN EXCESS EMISSION

Plant personnel shall monitor emission limitations and other restrictive limitations (i.e., input fuel rates) for continuous compliance. In the event of an exceedance of emissions or other limitation, plant personnel shall determine whether the cause of exceedance is due to an equipment breakdown or malfunction as defined in Section 2.0.

If the exceedance is due to an equipment breakdown or malfunction, plant personnel shall determine if the repair is to be completed by the CEMS equipment manufacturer. Equipment repairs to be performed by the CEMS equipment manufacturer will be completed expeditiously. In the event that equipment is sent back to the CEMS manufacturer for repair, MPLP has spare NO<sub>x</sub>, CO, and O<sub>2</sub> analyzers which can be used until the equipment is repaired by the CEMS equipment manufacturer. 'Loaner' equipment can be requested for use by the CEMS





manufacturer if need be. Anytime spare equipment is used, equipment is repaired, or 'loaner' equipment is used, a linearity check will be performed after installation. Equipment which has undergone major repair is subject to a Relative Accuracy Test Audit as determined by the MDEQ – District Supervisor.

An exceedance of an emission limitation which is established on an hourly basis (lb/hr) or a concentration basis (ppmvd @ 15% O<sub>2</sub>) is determined by calculating the status of compliance for every one-hour period. An exceedance of an hourly input fuel rate (i.e., scf/hr, gal/hr) is determined in the same manner. A one-hour period is defined as any 60-minute period, commencing on the hour.

The Distributed Control System and Data Acquisition and Handling System assimilate stack exhaust parameters gathered by the CEMS, input fuel rates, and heat input rates. The resulting information is provided to plant personnel directly from the computer or on printed logs. The Distributed Control System is also programmed with audible alarms to alert the board operator to variations in excess of the pre-established set points. Such alarms can only be cleared through acknowledgment by the board operator. These alarms provide plant personnel with advance warning of a potential emission exceedance. The audible alarms that have been established in the Distributed Control System are summarized in Table 1.

Upon recognition of an excess emission or exceedance resulting from any reason other than tuning, an equipment breakdown/malfunction, or a startup and/or shutdown of the gas turbine, plant personnel shall follow the following steps to document the event:

1. Evaluate the situation and ensure the safety of plant personnel and the facility. Take all reasonable steps to minimize levels of emissions that exceeded emission limitations, or other restriction.
2. Make written notations of the occurrence in the Operations and Emissions logs. Notations should clearly denote the duration of the occurrence and the cause, if known.
3. If excess emissions have lasted for a duration of longer than 1 hour, contact the Plant Manager or other plant personnel delegated to receive such notification.
4. The Plant Manager, or designee, must complete a Deviation Report and fax the form to the MDEQ within 2 working days. A fax confirmation must be printed and kept on file along with the completed Deviation Report
5. Within 10 calendar days from the date the excess emissions has been corrected, a follow-up letter with certification describing the details of the occurrence shall be submitted to the MDEQ District Supervisor. The written report shall be submitted by the Plant Manager or other plant personnel delegated to submit such documentation.
6. All original documentation and copies of emissions and operator logs which are relative in providing the facility with a burden of proof of the occurrence shall be maintained onsite for a minimum of 5 years.



## 4.0 SOURCE DESCRIPTION

The following sections describe each of the major components of the Michigan Power Cogeneration Facility.

### 4.1 GAS TURBINE

One GE Model PG7111EA package Gas Turbine Generator unit with a nominal rating of 83.5 MW (ISO). The maximum hourly fuel input rate is 11,136,500 scf/hr (or 1136.5 MMBtu/hr). The Gas Turbine Generator is equipped with dry, low-NO<sub>x</sub> combustors for the control of the formation of NO<sub>x</sub>.

Dry, low-NO<sub>x</sub> combustion technology is based on lean-fuel combustion. In lean-fuel combustion, the air-to-fuel ratio at the combustion flame front is increased to lower the peak flame temperature and/or residence time, thus reducing NO<sub>x</sub> formation. The formation of CO emissions is lowered through "good combustion practices." Secondary control of CO is provided by a CO Catalytic Converter installed in the HRSG. The emissions of NO<sub>x</sub> and CO from the gas turbine are monitored continuously at the HRSG exhaust stack by the CEMS. Plant personnel utilize the CEMS to determine continuous compliance with permit emission limitations.

The operating variables that shall be monitored by MPLP – to detect a malfunction or failure of the Gas Turbine Generator resulting in an excess emission – will be the CEMS data for NO<sub>x</sub>, CO, and O<sub>2</sub>. The normal operating range of these variables will be at or below the permitted limitations. The percentage of O<sub>2</sub> in the stack will normally range from 10 to 17%. MPLP will identify any additional operating variables in future updates of this document.

### 4.2 DUCT BURNER

The HRSG is equipped with supplementary firing through the utilization of one Duct Burner. The Duct Burner has a maximum natural gas heat input rating of 341 MMBtu/hr (HHV). The duct burner is equipped with low NO<sub>x</sub> burners to control the formation of [NO<sub>x</sub>, CO](#) and NO<sub>x</sub> emissions are monitored continuously at the HRSG exhaust stack by the CEMS.

The operating variables that shall be monitored by MPLP, to detect a malfunction or failure of the Duct Burner resulting in an excess emission, will be the CEMS data for NO<sub>x</sub>, CO, and O<sub>2</sub>. The normal operating range of these variables will be at or below the permitted limitations. MPLP will identify any additional operating variables in future updates of this document.

### 4.3 CO CATALYST

A CO Catalytic Converter is installed in the exhaust flow train of the gas turbine within the HRSG for the primary control of CO emissions resulting from the Gas Turbine and the Duct Burner. The emissions of CO are monitored with the CEMS to ensure continuous compliance with permit emission limitations.





The operating variables that shall be monitored by MPLP – to detect a malfunction or failure of the CO Catalytic Converter resulting in an excess emission – will be the CEMS data for CO. The normal operating range of this variable will be at or below the permitted excursion limitations. In the event of a slow increase in CO emissions over time, a catalyst sample will be taken and analyzed for degradation.

#### 4.4 FGTURBINE/HRSG ANALYZER SPECIFICATIONS

##### Gas Turbine/HRSG Stack CEMS

NO <sub>x</sub>	Rosemount Model 951C Serial No. 1000165 Chemiluminescent Range: 0-30 ppm	CO	Siemens Model U5E Serial No. ED-992 Non-Dispersive Infrared Range: 0-20/200 ppm
O <sub>2</sub>	ServoMex Model 1400 Serial No. 01420B1654 Paramagnetic Range: 0-25%		

#### 4.5 AUXILIARY BOILERS

Each Auxiliary Boiler is equipped with low NO<sub>x</sub> burners and flue gas recirculation for the control of NO<sub>x</sub> emissions. The emissions of NO<sub>x</sub> from the Auxiliary Boilers are monitored continuously at each exhaust stack by the CEMS. The Auxiliary Boilers share the same CEMS. The CEMS alternately monitors each boiler for 7.5 minutes. Plant personnel utilize the CEMS to determine continuous compliance with permit emission limitations. The facility will typically operate at or below these limitations.

The operating variables that shall be monitored by MPLP – to detect a malfunction or failure of the Auxiliary Boilers resulting in an excess emission – will be the CEMS data for NO<sub>x</sub> and O<sub>2</sub>. The normal operating range of these variables will be at or below the permitted limitations. MPLP will identify any additional operating variables in future updates of this document.

#### 4.6 FGBOILERS ANALYZER SPECIFICATIONS

##### Auxiliary Boilers CEMS

NO <sub>x</sub>	Rosemount Model 951C Serial No. 1000164 Chemiluminescent Range: 0-100 ppm	O <sub>2</sub>	Servo Mex Model 01440 Serial No. 1420B1653 Paramagnetic Range: 0-10/25%
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## **4.7 EMERGENCY GENERATOR**

The Emergency Generator shall only fire diesel fuel oil with a sulfur content of less than or equal to 0.05% by weight. The Emergency Generator and the Gas Turbine shall not be operated simultaneously except during weekly testing, maintenance, and for required regulatory purposes. The Emergency Generator shall not operate more than 500 hours per 12 month rolling time period as determined at the end of each month.

## **4.8 EMERGENCY FIRE PUMP**

The Emergency Fire Pump shall only fire diesel fuel oil with a sulfur content of less than or equal to 0.05% by weight. The Fire Pump and the Gas Turbine shall not be operated simultaneously except during weekly testing, maintenance, for required regulatory purposes, or during an emergency. The Emergency Fire Pump shall not operate more than 500 hours per 12 month rolling time period as determined at the end of each month.

## **5.0 RESPONSIBLE PERSONNEL**

Table 2 provides a list of responsible personnel for the Michigan Power Cogeneration Facility. MPLP also has a technician on staff who is trained in general maintenance and calibration of the CEMS. Extraordinary malfunctions or repairs will be handled by an independent CEMS representative.

In the event that a CEMS becomes inoperative due to a malfunction, or for maintenance, plant personnel shall follow these steps:

1. Make written notations of time of the malfunction or maintenance of the CEMS in the Operators Log and on the Emissions Log, which corresponds to the time of the occurrence. Notations should clearly denote the duration of the malfunction, cause, and repairs made or a description of the required maintenance.
2. Any instance of CEMS downtime is reported by Deviation Reports, which are submitted quarterly.

## **5.1 PERSONNEL TRAINING**

MPLP personnel are trained in the operation and maintenance of equipment to prevent and respond to emission exceedances and/or breakdowns or malfunctions that result in exceedances of applicable permit conditions or air pollution laws, rules, and regulations. Employees participate in training upon hire and annually thereafter. A sample of an Annual Training Form is provided in Appendix 1. Completed forms are maintained onsite in the Administrative Office

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## **6.0 PMP, OPERATIONAL VARIABLES, AND CORRECTIVE PROCEDURES**

A written program for maintaining and inspecting the ongoing integrity of process equipment and CEMS ensures that equipment receives appropriate, regularly scheduled maintenance. Regular inspections document and identify each equipment inspection and test.

### **6.1 ITEMS INSPECTED AND OPERATIONAL VARIABLES**

Inspections are performed in accordance with written procedures developed by and for MPLP. Inspections are performed at various intervals and are described in Table 3.

### **6.2 PREVENTATIVE MAINTENANCE SCHEDULE**

Written procedures are included with each PMP, which are to be followed when repair, maintenance, or service is being performed. These procedures include work on equipment such as CEMS, dry-low NO<sub>x</sub> burners, duct burners etc. A list of MPLP PMPs is provided in Table 4. This list will be updated as new PMPs are developed.

### **6.3 CORRECTIVE ACTION**

MPLP, to the extent reasonably possible, will operate in a manner consistent with good air pollution control practices with regard to minimizing emissions during periods of exceedances resulting from abnormal operations, start-up/shutdown, and breakdown and malfunctions.

All reasonable corrective actions shall be taken to reduce the quantity of excess emissions during such occurrences. The safety of the facility and plant personnel must be ensured at all times. Upon investigation into the cause of an excess emission and implementation of reasonable corrective actions, notify the Plant Manager or other plant personnel delegated to receive such notification and perform any further procedures deemed necessary to correct the situation.

Operators are trained to observe burner system operating parameters to detect a potential malfunction before it happens. Nonetheless, not all malfunctions can be detected prior to an actual malfunction occurring. Therefore, it is imperative to have a PMP to minimize potential malfunction events from occurring, maximize continuous compliance with air pollutant emission limits, and ensure boiler reliability and availability.

If a malfunction occurs to the Gas Turbine, HRSG, or Boiler burner system(s) which causes, or may cause, excess emissions during boiler operation, the portion of the burner system causing the possible excess emission will be evaluated as soon as practicable in accordance with safe operating procedures to determine the proper procedure to correct the problem or to determine that the malfunction will not cause excess emissions.

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The Gas Turbine, HRSG, or Boiler may continue to operate consistent with good air pollution control practices to minimize emissions in compliance with the emission limits in the ROP until the boiler can be repaired. In general, if a malfunction occurs to the Emergency Generator or Fire Pump during a weekly test, the equipment will be evaluated to determine the cause of the malfunction and the appropriate corrective action.

If a malfunction occurs, the Plant Manager, or designated representative, will determine whether the malfunctioning equipment can continue to operate consistent with the requirements of the ROP. If not, appropriate plant personnel will follow the procedure outlined below:

- Define and correct the problem.
- Determine if the equipment can continue to operate within compliance of the limitations specified in the ROP. If not, action will be taken to correct the problem in accordance with safe operating procedures.
- Notify the appropriate staff of any problems that occur and/or if there are any questions regarding compliance or action(s) that should be taken to correct the problem.
- If the problem is one that calls for immediate corrective action, contact any one of the individuals listed in Table 2.

## **6.4 PREVENTATIVE MAINTENANCE RECORDS**

The following records will be maintained:

- Inspection records will include the date, findings, and corrective actions taken or repairs made, if necessary.
- All significant unscheduled maintenance activities performed on the Gas Turbine, HRSG, or Boilers. Records will include the date, findings, and corrective actions taken or repairs made, if necessary.

## **7.0 REPLACEMENT PARTS INVENTORY**

MPLP maintains an inventory of replacement parts for major equipment, control equipment, and the CEMS. A list of replacement part inventories for the Gas Turbine and CEMS are provided in Table 5.

## 8.0 START-UP AND SHUTDOWN OPERATIONS FOR FGTURBINE/HRSG

### 8.1 IDENTIFICATION OF AFFECTED OPERATING SYSTEMS

Periods of startup and shutdown for FGTURBINE/HRSG shall not exceed 5 hours for start-up and 1 hour for shutdown. Emission limits do not apply during start-up and shutdown.

The Auxiliary Boilers do not have relief from emission limitations during periods of start-up and shutdown; they must comply with emission limitations at all times.

### 8.2 DEFINITION OF TERMS

The definitions for start-up and shutdown are as follows:

- **Start-up** means the setting in operation of an affected source, or portion of an affected source, for any purpose.
- **Shutdown** means the cessation of operation of an affected source, or portion of an affected source, for any purpose.

### 8.3 START-UP AND SHUTDOWN

Start-up events occur whenever one of the Boilers or the gas turbine/HRSG has been shut down for an extended period of time for scheduled maintenance or plant shutdown. Shutdown occurs when one of the boilers or the gas turbine/HRSG is scheduled for maintenance or a plant shutdown is necessary.

In the event of a start-up and/or shutdown which results in excess emissions, the following steps should be taken:

1. Make written notations of time of start-up and/or shutdown in the Operator Log and on Emissions Log. Notations should clearly denote the duration of each start-up and/or shutdown period. A start-up begins when fuel gas is introduced to the equipment for combustion. A shutdown ends when fuel gas is no longer being combusted.
2. If excess emissions resulting from the start-up/shutdown are not associated with an equipment malfunction or necessary tuning (Section 3.1) and have lasted for a duration of longer than one hour beyond the exempt period, contact the Plant Manager or other plant personnel delegated to receive such notification.
3. The Plant Manager, or designee, must complete a Deviation Report and fax the form to the MDEQ within 2 working days. A fax confirmation must be printed and kept on file along with the completed Deviation Report.

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4. Within 10 calendar days from the date the excess emissions has been corrected, a follow-up letter with certification describing the details of the occurrence shall be submitted to the MDEQ District Supervisor.

The written report shall be submitted by the Plant Manager or other plant personnel delegated to submit such documentation.

5. All original documentation and copies of Emissions Log and Operator Logs that are relative in providing the facility with a burden of proof of the occurrence shall be maintained onsite for a minimum of 5 years.

MPLP is committed to equipment care and personnel safety during all phases of boiler operation.



# Tables

**Table 1 - Audible Alarms**

Malfunction Abatement Plan

Michigan Power Limited Partnership

Ludington, Michigan

Devices	Alarm H.	Alarm H.H.
NO (PPMVD @ 15% O <sub>2</sub> )	8.0	9.0
NO (lbs/day)	744.8	844.8
CO (PPMVD @ 15% O <sub>2</sub> )	9.0	10.0
CO (lbs/day)	461.6	561.6
Fuel (MSCFH)	1,036.5	1,136.5
Gas Turbine & Duct Burner		
NO (PPMVD @ 15% O <sub>2</sub> )	12.6	13.6
NO (lb/day)	1,563.2	1,663.2
CO (PPMVD @ 15% O <sub>2</sub> )	9.7	10.7
CO (lb/day)	723.2	823.2
Fuel (Gas Turbine) (MSCFH)	1,036.5	1,136.5
Fuel (Duct Burner) (MSCFH)	300.0	341.0
Auxiliary Boilers (Each Unit)		
NO (lbs/hr)	14.9	15.9
NO (lb/MMBtu) >25% load	0.1	0.1
NO (lb/MMBtu) <25% load	0.2	0.2
Fuel (MSCFH)	200.0	265.0



**Table No. 2 – Responsible Personnel**

Malfunction Abatement Plan

Michigan Power Limited Partnership

Ludington, Michigan

**PLANT CONTACTS:**

<b>Name</b>	<b>Title</b>	<b>Office Number</b>	<b>After Hours</b>
Cory Anderson	Plant Manager	(231) 843-7573	(616) 295-1366
Dan Cox	Compliance Manager	(231) 843-7573	(231) 690-7253
Anthony Peplinski	Maintenance Manager	(231) 843-7573	(231) 690-7258
Robert Miller	Operations Manager	(231) 843-7573	(231) 457-8182

Contact key personnel if an air exceedence is detected, or if any other type of air episode occurs.

Fax number for plant personnel: (231) 843.7532

**AGENCY CONTACTS:**

REQUIRED NOTIFICATIONS: Notify agency via facsimile within two working days of excess emission.

Michigan Dept. of Natural Resources, Cadillac District Supervisor (231) 775-3960 (231) 775-4050 Fax

Attn: Caryn Owens (231) 876-4411 (231) 775-4050 Fax

**CEMS EQUIPMENT MANUFACTURER EMERGENCY CONTACTS:**

Custom Instrumentation Services Corporation (CISCO) (303) 790-1000

**ADDITIONAL NOTIFICATIONS:**

***Notify these agencies if emissions threaten citizens.***

Pere Marquette Township (Fire Chief - Larry Gaylord) 911 (231) 843-0324

Mason County (Emergency Preparedness) 911 (231) 845-5911



**Table 3 - Inspection Frequency**

Malfunction Abatement Plan  
 Michigan Power Limited Partnership  
 Ludington, Michigan

Inspection	Frequency
Stack outlets (when operating)	Every Shift
All equipment for visible fugitive emissions or possible circumvention	Every Shift
Cal gas tanks for leaks and volume	Every Shift
NO <sub>x</sub> , CO, and O <sub>2</sub> CEMS Data	Every Shift
CEMS low & high span checks	Daily
CEMS enclosure and equipment	Every Shift
Inventory of span gases	Weekly
CEMS equipment	Weekly
Emergency generator and emergency fire pump stack opacity	Weekly

**Table 4 - Preventative Maintenance Inspection Table and Frequency**

Malfunction Abatement Plan

Michigan Power Limited Partnership

Ludington, Michigan

<b>Devices</b>	<b>Location</b>	<b>Inspection Frequency</b>	<b>Inspection Type</b>
Dry Low NO <sub>x</sub> Burners	Gas Turbine	Every 3 years	Replace, Refurbish
Duct Burner	Heat Recovery Boiler	Every 3 years	Visual for erosion damage
CO Catalyst System	Heat Recovery Boiler	Every 3 years	Visual for erosion damage
Burners	Auxiliary Boilers	Annual	Visual for erosion damage
Flue Gas Recirculation	Auxiliary Boilers	Annual	Visual for erosion damage
Emergency Generator	Cooling Towers	Weekly	Visual, functional test run
Emergency Fire Pump	Cooling Towers	Weekly	Visual, functional test run
CEMS	Gas Turbine Stack	Daily	Calibration check
		Quarterly	Perform CGA & RATA
Air Filters	Gas Turbine Inlet	Annual	Visual for damage
	Auxiliary Boilers	Annual	Visual for damage
	Emergency Generator	Annual	Visual for damage
	Emergency Fire Pump	Annual	Visual for damage
Fuel Gas Flow Orifices	Gas Turbine	Every 3 years	Visual for damage

**Table 5 – Replacement Parts Inventory**

Malfunction Abatement Plan

Michigan Power Limited Partnership

Ludington, Michigan

Following is a list of spare parts kept onsite to facilitate quick replacement.

Description	Quantity





# Appendix

