



Startup and Shutdown Plan

for

REO Town Cogeneration Plant

Renewable Operation Permit Number

MI-ROP-B2647-2018b

March 1, 2022

I. OVERVIEW

The REO Town Cogeneration Plant is permitted to operate under Renewable Operating Permit MIROP-B2647-2018 (the ROP), issued by the Michigan Department of Environmental Quality. The REO Plant must be operated at all times, to the extent reasonably possible, in a manner consistent with good air pollution control practices for minimizing emissions during periods of abnormal conditions, startups and shutdowns, and malfunctions. Malfunctions will be addressed in a separate Malfunction Abatement Plan. After discovery (and corrective action) of an abnormal condition, procedures to prevent a future occurrence of the condition shall be incorporated into the Malfunction Abatement Plan.

The ROP requires that the following equipment shall have an MDEQ approved plan to minimize emissions during startups and shutdowns:

1. EUAUXBOILER - A nominally rated 245 MMBtu/hr natural gas-fired auxiliary boiler,
2. EUTURBINE1 - A nominally rated 385.3 MMBtu/hr natural gas-fired turbine with an electrical generator,
3. EUTURBINE2 - A nominally rated 385.3 MMBtu/hr natural gas-fired turbine with an electrical generator,
4. FGTURB/HRSG1 - A nominally rated 385.3 MMBtu/hr natural gas-fired turbine, a HRSG with a nominally rated 66.4 MMBtu/hr natural gas-fired duct burner and an electrical generator operating in combined-cycle mode, and
5. FGTURB/HRSG2 - A nominally rated 385.3 MMBtu/hr natural gas-fired turbine, a HRSG with a nominally rated 66.4 MMBtu/hr natural gas-fired duct burner and an electrical generator operating in combined-cycle mode.

A. Limitation

This plan is one element of the Renewable Operating Permit. The procedural steps in Section II below do not include all permit requirements; they are only intended to present the steps necessary for minimizing emissions during startup and shutdown.

II. EMISSIONS MINIMIZATION PROCEDURES

All emissions exceedances are to be reported to the Environmental Department within 24 hours. Emissions during startups and shutdowns will be minimized by following the manufacturers' written procedures and by monitoring the NO_x emissions through the Continuous Emissions Monitoring Systems (equipped on the stacks of the Auxiliary Boiler and the Combustion Turbines/HRSGs). The CEMS will be recorded through a Data Acquisition and Handling System (DAHS) with a dedicated display in the operator control room. This display will also provide visual and audible alarms to alert the operators should any emissions exceed their permitted limits.

A. The Auxiliary Boiler (or the Package Boiler) - EUAUXBOILER

The Package Boiler is manufactured by Victory Energy and fired exclusively with natural gas. The Auxiliary (Package) Boiler provides steam for the downtown heating district when a combustion turbine or HRSG is out of service and also for periods of peak demand. Steam produced by the Auxiliary (Package) Boiler is not used for the production of electricity.

1. Startup Conditions

Startup is defined as the period of time from the first ignition of fuel until steam is supplied to customers. A typical startup will last between 5 and 8 hours and include the following conditions:

- i. The boiler fan is turned on to purge the system,
- ii. Fuel firing begins and boiler is brought to the design pressure and temperature, iii. Boiler load, design pressure, and temperature are maintained at steady-state conditions above the manufacturer's recommended minimum load, and
- iv. Steam is supplied to customers.

2. Shutdown Conditions

Shutdown is defined as the period of time between lowering steam output with the intent to shut down the unit until the fan has been turned off. The following conditions describe normal shutdown procedures:

- i. Boiler load is reduced below the manufacturer's recommended minimum load,
- ii. Fuel firing is stopped and load reaches zero (ii before or after iii), iii. Steam is no longer available for delivery to customers, and iv. Fans are shut off, after the system has been purged and cooled down.

B. The Combustion Turbines (EUTURBINE1 & EUTURBINE2)

There are two GE LM6000 combustion turbines fired exclusively with natural gas. The turbines can be operated in simple-cycle mode, described below in section B, or combined-cycle mode, described in Section C.

1. Startup Conditions

Startup is defined as the period of time between initiation of the combustion turbine startup sequence until electricity is available for delivery to customers. A typical startup will last approximately 15 minutes and includes the following conditions:

- i. Initiation of the startup sequence, including the system purge cycle, ii. Fuel firing begins and turbine is brought to manufacturer's recommended minimum operating criteria,
- iii. Turbine load is maintained at steady state conditions, and iv. Electricity is delivered to our customers.

2. Shutdown Conditions

Shutdown is defined as the period of time between lowering electrical output with the intent to shut down until the fans are shut off. The following conditions describe normal shutdown procedures:

- i. Turbine load is reduced below the manufacturers recommended minimum load,
- ii. Fuel firing is stopped and load reaches zero, and
- iii. Initiation of the shutdown sequence including a system purge and cool down period.

C. The Heat Recovery Steam Generators (FGTURB/HRGS1 & FGTURB/HRGS2)

Each combustion turbine is attached to an Innovative Steam Technologies Heat Recovery Steam Generator (HRSG). The HRSGs are Once-Through Steam Generators (OTSG) designed to pass all of the steam they produce out to customers or to vents. The turbines do not have bypass stacks so all of the turbine exhaust gas passes through the HRSG. The HRSGs can be operated to produce steam or in a “dry” mode in which no steam is produced. The HRSGs are also equipped with duct burners for supplemental firing. Emissions from the HRSGs occur only when the duct firing is in operation, and exit the stack with the combustion turbine exhaust.

1. Startup Conditions

Following startup of a combustion turbine, a HRSG can be started for the production of steam. For the purpose of air quality purposes, a HRSG startup is defined as the introduction of fuel to the duct burners until reaching steady state operation. Prior to the introduction of fuel, water is introduced to the system. Depending on exhaust temperature and ambient conditions, duct burners may not be required to produce the desired amount of steam. A typical duct firing startup requires approximately 5 minutes. The following conditions are characteristic of HRSG startup procedures which in total will take approximately 30 minutes:

- i. A combustion turbine has been started and reached stable load,
- ii. Valves are opened to ensure proper water flow in the HRSG,
- iii. Steam load is maintained at steady state conditions,
- iv. (Optionally) duct firing is introduced, and
- v. Steam is supplied to customers or sent to a steam turbine.

2. Shutdown Conditions

HRSG shutdown is defined as the period of time in which the fuel to the duct burners is reduced with the intent to shutdown until fuel ceases. A typical shutdown will include the following procedures:

- i. Cease duct firing operations, if applicable,
- ii. Reduce water supply and boil off all fluids, and
- iii. The combustion turbines may be shutdown following the shutdown of the HRSG.

III. RECORDKEEPING

All records shall be provided to the BWL’s Environmental Department which will be responsible for maintaining the records in accordance with the BWL’s records retention policy.

- A. Records of startups and shutdowns of the equipment will be kept in the plant log books.
- B. During an abnormal startup or shutdown, records of the event shall be recorded including the time, date, probable cause(s), duration, affected equipment, emission estimates, and the corrective actions taken in response to the abnormal event.
- C. Records of CEMS activities, including emissions readings, calibrations, analyzer maintenance, and downtime shall be maintained.

IV. PLAN REVIEWS AND REVISIONS

Date	Editor(s)	Action
3/29/2013	Scott McQuiston Bob Nicholson	Initial Version
11/29/2019	Nathan Hude	Revision for HRSG Startup and Shutdown definitions
03/01/2022	Nathan Hude	Review for ROP Renewal, no changes