

Middletown Cogeneration

Summary of Operating Modes

A. Operating Philosophy

The Middletown Cogeneration Facility has the following operating objectives:

- a. Consume Blast Furnace Gas (BFG) generated by the AK Steel Blast Furnace
- b. Supply steam to AK Steel with high reliability (i.e. maintain 3 steam generating sources whenever feasible – Gas Turbine and two Auxiliary Boilers)
- c. Improve AK Steel energy efficiency by generating electricity

B. Routine Operation

AK Steel generates approximately 1,374 MMBtu/hr HHV (dry) of BFG on a long term average basis. This will preferentially be sent to the GE 7EA Gas Turbine train, which will typically operate at 1,000 MMBtu/hr HHV (dry). The remaining 374 MMBtu/hr HHV (dry) of BFG will be split equally between the two Auxiliary (Aux) Boilers. The Flare will not see any BFG during this operating mode. Also, the Boiler burners are currently designed to use a minimal amount of natural gas supplement (BTU Basis) to maintain stable combustion.

This mode is expected to be in operation approximately 90% of the time in a typical year. Therefore, for air permitting, this will be set to 100% for purposes of estimating the facility's Potential-To-Emit (PTE).

The Gas Turbine minimum BFG firing rate is 700 MMBtu/hr and the Boilers minimum BFG firing rate is 150 MMBtu/hr (combined). Therefore, the lowest BFG generation rate that the Gas Turbine and both Boilers can operate under is 850 MMBtu/hr (700 to Gas Turbine and 150 to Boilers). Below that rate, either one Boiler will be shutdown or Natural Gas will be introduced to the Gas Turbine.

Operation above the average BFG of 1,374 MMBtu/hr will be handled by sending more BFG to the Boilers. The Gas Turbine maximum rate is 1,100 MMBtu/hr HHV (dry) so it is normally running close to maximum. The Boilers maximum rate of 703 MMBtu/hr HHV (dry) (combined) can handle the excess BFG that the Gas Turbine can't.

C. Gas Turbine Down Operation

The Gas Turbine system (including the HRSG and SCR) will typically require about 300 hours per year of planned maintenance. Every 6 years, major maintenance is required and an additional 200 hours of downtime will be required. With the Gas Turbine down, the Aux Boilers will be ramped up to maximum firing on BFG, approximately 700 MMBtu/hr HHV (dry). This will leave about 674 MMBtu/hr HHV (dry) of BFG that will need to be sent to a Flare.

D. Blast Furnace Down Operation

The AK Steel Blast Furnace will typically require about 300 hours per year of planned maintenance. Every 5 years, major maintenance is required and an additional 500 hours of downtime will be required. With the Blast Furnace down, the Gas Turbine and Aux Boilers will be operated on Natural Gas to supply steam to AK Steel. To maintain a highly reliable steam supply, it is expected that all three will be operated at minimum load most of the time. The Gas Turbine minimum load condition is 700 MMBtu/hr HHV (dry) and the Aux Boilers combined minimum load is 70 MMBtu/hr HHV (dry). Therefore, the typical Natural Gas firing rate will be about 770 MMBtu/hr HHV (dry).

To maintain operating flexibility, Air Products would like to be able to fire the Gas Turbine and Aux Boilers in any combination and with any fuel desired while still supplying AK Steel with steam. Air Products expects there will be times where a Gas Turbine shutdown will be coordinated with a Blast Furnace shutdown. Therefore, an operating mode where the Gas Turbine is not operating and all of the AK Steel steam needs will be generated with the Aux Boilers firing Natural Gas. The Boilers only need to operate at 275 MMBtu/hr (wet) to supply AK Steel with their steam needs is calculated. The PTE emission estimate assumes the maximum rate of each pollutant comparing these typical operating scenarios.

E. Other Operating Modes

As defined in the application, there are several lesser maintenance, startup and shutdown operating modes that occur sporadically. There are also two other major pieces of equipment that affect operation – a Steam Turbine and Surface Condenser. They are not emission sources. Operating changes in this equipment do not result in operation of the Gas Turbine, Aux Boilers or Flare outside of the PTE emissions coverage.

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