Energy Developments Coopersville
Ottawa County Farms Landfill
Coopersville, Ottawa County, Michigan

TREATMENT SYSTEM MAINTENANCE PLAN

Revision 1- October 28, 2004
Revision 2 – December 6, 2017

1. INTRODUCTION

Energy Developments Coopersville (EDC) operates landfill gas to energy facility at the Ottawa County Farms Landfill (OCFL) located in Coopersville, Michigan.

The OCFL is subject to the United States Environmental Protection Agency, (USEPA) New Source Performance Standards (NSPS) for landfills (Subpart WWW). NSPS allows landfill gas to be controlled by routing the collected gas to a treatment system that processes the gas for subsequent sale or use. USEPA considers de-watering, filtering through a 10 micron screen, and compression for combustion in energy recovery devices such as boilers, process heaters, turbines, or internal combustion engines to satisfy the definition of treatment at 40 CFR 60.752(b)(2)(iii)(C). EDC receives landfill gas collected from the OCFL and processes it through a treatment system. After the treatment system the gas is sent to one of four (4) sources: (1). 5 Caterpillar 3516 internal combustion engines, (2). an open flare, (3). an aggregate recycling process or (4) one Caterpillar 3520 internal combustion engine.

2. Equipment Function and Monitoring

The following equipment is utilized in the approved treatment system at EDC:

1. 36-inch diameter condensate/liquids knockout tank for dewatering purposes

2. 42-inch diameter carbon steel scrubber tank with scrubber pad for gas dewatering

3. Two AC Compressor 150 horsepower model 19S rotary vane compressors for compressing the gas to 12-15 pounds per square inch gauge

4. Two radiator style aftercoolers provided by AC Compressor which cool the compressed gas from approximately 200 degrees Fahrenheit to approximately 125 degrees Fahrenheit

5. Ruiter coalescing filter with 0.3-micron coalescing filters for filtering the gas

6. Pnuematech model PAD-18 GDS/37 refrigerant fuel gas dryer for dewatering the gas and temperature control for optimum combustion

Each piece of equipment provides a specific function in the treatment process and EDC personnel monitors various parameters at each piece of equipment on a scheduled basis to determine that the equipment is performing its intended function. The following summarizes the function of each piece of equipment and what EDC monitors to determine it is operating properly.

36-inch diameter condensate knockout tank – This vessel functions very similarly to a civil engineering designed manhole/pump station. Wet gas flows via headers pipes into this tank. Due to the diameter of the tank the gas slows down and as a result condensate droplets in the gas fall to the bottom of the tank. Collected condensate in the tank is pumped by one of two pneumatic pumps to the OCFL leachate collection system. Pressurized air for the pneumatic pumps is directed from the EDC facility. On a weekly basis EDC staff observes that the regulators for the pumps are indicating that air pressure is available to the pumps. On a weekly basis EDC staff observes the counters on the pneumatic pumps which indicate that the pumps are cycling therefore noting that the condensate is being pumped from the knockout tank to the leachate collection system.

42-inch diameter carbon steel scrubber tank with scrubber pad– This vessel has the same function as the condensate knockout tank, liquid removal. Wet gas flows from the plant header pipe under vacuum into the scrubber vessel. Due to the diameter of the tank the gas slows down and as a result condensate droplets in the gas fall to the bottom of the tank. Additionally a random fiber mist pack is installed horizontally at approximately ¾ the height of the tank. As the wet gas flows through the random fiber mist pack smaller droplets are forced into contact with larger droplets, and eventually the droplets reach a size where they fall to the bottom of the tank. Condensate collected in the bottom of the tank is piped directly to a storage vessel outside the building which is pumped to the OCFL leachate collection system. On a daily basis EDC staff observes the differential pressure across the

scrubber tank. Additionally, on a daily basis an operator observes liquid levels in the scrubber tank via a site glass

Two AC Compressor 150 horsepower model 19S rotary vane compressors – The rotary vane compressors move the gas. They apply a vacuum to the wellfield and they provide pressure for the landfill gas treatment system and end uses. Each compressor is powered by an explosion proof 150 horsepower electric motor. Each compressor has a lubricating device which is shieved off the compressor shaft that lubricates the compressor vanes and the bearings. EDC uses rotary vane compressors because they are mechanically simple and extremely reliable. If the electric motor is running and the lubricator is working the compressor operates. On a daily basis EDC staff observes that the compressor lubricator is pumping oil. On a daily basis an operator observes the operation of the electric motors and compressors, listens for out of the ordinary sounds and feels bearings for significant changes in vibration or temperature. On a daily basis an operator records vacuum and pressure readings on both sides of either compressor.

Two radiator style aftercoolers provided by AC Compressor – The purpose of the aftercoolers is to cool the gas. The gas flows through the aftercoolers tubes, and while the gas is flowing through the tubes a fan blows air over the tubes. On a daily basis EDC staff observes and documents the temperature and pressure drops across the aftercoolers. On a daily basis an operator observes the operation of the fan motor, fan and drive belts documenting abnormal sounds or operating conditions.

Ruiter coalescing filter with 0.3-micron coalescing filters for filtering the gas – The coalescing filter removes moisture from the gas. Gas enters the coalescing filter through one flange, then passes through filters and exits though a second flange. Liquids collect in the bottom of the coalescing filter and are piped from the bottom of the unit directly to a storage vessel outside the building which is pumped to the OCFL leachate collection system. On a daily basis EDC staff observe and document the differential pressure drop across the coalescing filter. Also daily, EDC staff observe liquid levels accumulated in the coalescing filter vessel via a site glass.

Pnuematech model PAD-18 GDS/37 refrigerant fuel gas dryer – The dryer is the most technically elaborate piece of equipment in the treatment process. The purpose of the dryer is to cool the landfill gas below the dew point of any moisture carried in the gas and then return the gas approximately to its original temperature. Like most cooling systems the dryer has compressed refrigerant that needs to be operating within pressure and temperature ranges. On a daily basis EDC staff monitors and documents refrigerant temperature and pressure in the dryer and well as gas temperature and pressure prior to and after the dryer. Additionally, an operator visually observes and listens to the dryer compressors documenting abnormal sounds and vibration.

Attached as Appendix A is a table indicating which treatment system operational parameters which will be observed daily. Also noted on Appendix A are historically observed and recommended ranges for each of the noted operational parameters.

3. Maintenance Activities

As discussed in previous sections EDC operations staff observe and document the operation of the treatment system on regular intervals. If an operator observes that equipment operating abnormally, or if and operator observes/document that an operating parameter from Appendix A is out of its recommended/normal range than a maintenance action will be taken. Below is a summary of anticipated maintenance activities which we might expect to occur during normal operation of the EDC treatment system. We do not anticipate this list is entirely comprehensive, and at all time we reserve the right to conduct additional preventative maintenance activities in order to ensure that the treatment system functions in accordance with its originally designed intent. In general, if any part of the treatment system is out of service, or operating out of tolerable ranges, EDC will take immediate steps to bring the equipment back into service or tolerable ranges within 24-72 hours. If a piece of equipment in the treatment system was observed to be operating within tolerable ranges but in need of preventative maintenance EDC would schedule maintenance activities within 60 days. Documentation of all maintenance activities on the treatment system will be kept on–site including at a minimum, the equipment description, the type of maintenance performed and the duration of time required to complete the maintenance.

36-inch diameter condensate knockout tank – If condensate is accumulated in the tank beyond the inlet gas pipe, the treatment system is taken down and the pump air lines, condensate discharge pumps, pipes and valves are inspected for possible blockages. EDC will document when maintenance is conducted on this piece of equipment and report this to the MDEQ in the next annual report. Typical maintenance activities would take no more than 48 hours.

42-inch diameter carbon steel scrubber tank with scrubber pad – If the differential pressure loss exceeds 2.5 inches of water column the treatment system is taken down and the scrubber pad is replaced. EDC will document when maintenance is conducted on this piece of equipment. Typical maintenance activities would take no more than 48 hours.

Two AC Compressor 150 horsepower model 19S rotary vane compressors – If the compressors are not able to make enough pressure to supply the end uses or if they are not applying a vacuum to the wellfield, EDC mechanical maintenance staff are involved to troubleshoot and repair the compressor. Compressor bearings, compressor motor bearings and compressor vanes are replaced on an as needed basis in order maintain compressor performance. EDC will document when maintenance is conducted on this piece of equipment. Typical maintenance activities would take no more than 72 hours.

Two radiator style aftercoolers provided by AC Compressor – Two things can occur to impede the performance of the aftercoolers: (1) The tubes can get dirty on the inside from the gas, or (2) something can occur to stop the fan. If the temperatures fall out of normal operating ranges, and the fan and fan motor are working properly, an operator cleans the inside of the aftercooler tubes. If the fans or fan motors are not operating properly, an operator coordinates the replacement of the belts, motors, bearings or electrical systems required to return the aftercooler to normal operations. EDC will document when maintenance is conducted on this piece of equipment. Typical maintenance activities would take no more than 48 hours.

Ruiter coalescing filter with 0.3-micron coalescing filters for filtering the gas – If liquid levels do not drain from the coalescing filter EDC checks condensate valves and piping to ensure no blockage exists. If differential pressure across the coalescing filter exceeds 2.5 psig an operator bypasses landfill gas around the coalescing filter and changes the coalescing filters. Typically changing the coalescing filters takes less than 60 minutes. In a typical year the filters are not replaced more than four times. EDC will document when maintenance is conducted on this piece of equipment.

Pnuematech model PAD-18 GDS/37 refrigerant fuel gas dryer – If the gas or refrigerant temperatures or pressure are noted to be outside of typical operating ranges or the dryer compressors are not operating properly, Granger bypasses gas around the dryer and contacts a refrigerant dryer service contractor and schedules immediate maintenance activities to diagnose and repair the dryer. EDC will document when maintenance is conducted on this piece of equipment. Typical maintenance activities would take no more than 72 hours.

4. Summary

In brief, this Treatment System Maintenance Plan has been prepared by EDC at the request of the MDEQ for the NSPS treatment system at the EDC facility located at the OCFL. This plan is not intended to comprehensively address every possible maintenance activity that could be conducted on the maintenance system, but rather this plan does establish the following:

1. A general understanding of the function of each piece of equipment in the treatment system.

2. Operational parameters that will be observed and documented throughout the treatment system.

3. Typical ranges for operational parameters that are observed and documented throughout the treatment system.

4. Mechanisms for documenting and reporting maintenance activities.

The overall goals of this plan are to provide assurance to the MDEQ AQD that the treatment system is being operated and maintained in a manner that complies with the NSPS while allowing EDC the operational flexibility to maximize combustion of the landfill gas.

Appendix A

Energy Developments Coopersville
Daily Monitoring Parameters
Landfill Gas Treatment System

Gas Inlet Temperature F	Gas Inlet Vacuum Inches H20	Scrubber Differential Pressure psig	Coalescing Filter Differential Pressure Inches H20	Pressure Before Dryer psig	Temperature Before Dryer psig
< 135	**<150**	**2.5<**	**2.5<**	**5.0<P<20**	**<140**

Compressor #1 Dischage Pressure psig	Compressor #1 Discharge Temperature F	Aftercooer #1 Discharge Pressure psig	Compressor #1 Day Tank Oil Level Gallons	Day Tank Oil Added Gallons	Compressor #1 Lubricator
5.0<P<20	**275**	**5.0<P<20**	**0<**	**<35**	**OK/NOT OK**

Compressor #2 Dischage Pressure psig	Compressor #2 Discharge Temperature F	Aftercooer #2 Discharge Pressure psig	Compressor #2 Day Tank Oil Level Gallons	Day Tank Oil Added Gallons	Compressor #2 Lubricator OK/Not OK
5.0<P<20	**275**	**5.0<P<20**	**0<**	**<35**	**OK/NOT OK**

Gas Dryer Inlet Pressure psig	Gas Dryer Discharge Temperature F	Gas Dryer Dischage Pressure psig	Refrigerant Suction Pressure psig	Refrigerant Dischage Pressure psig	Gas Dryer Oil Pressure psig
<140	**<110**	**5.0<P<20**	**3.0<P<20**	**40<P<80**	**175<P<275**