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Treatment System Maintenance Plan

Energy Developments

Brent Run

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TABLE OF CONTENTS

1 INTRODUCTION

Energy Developments Brent Run (EDBR) operates landfill gas to energy facility at the Brent Run Landfill (BRL) located in Brent Run, Michigan.

The BRL 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). EDBR receives landfill gas collected from the BRL and processes it through a treatment system. After the treatment system the gas is sent to five Caterpillar internal combustion engines (one CAT 3512 and four CAT 3520 engines), an open flare, or an enclosed flare.

2 EQUIPMENT FUNCTION AND MONITORING

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

1. One (1) 2″Ø condensate/liquids knockout sump for dewatering purposes
2. One (1) AMERCOOL 40-gallon aftercooler.
3. One (1) AMERCOOL 80-gallon aftercooler.
4. Two (2) JENCO 30″Ø carbon steel scrubber tank with scrubber pad for gas dewatering.
5. Two (2) PALL 0.3 micron coalescing filter for filtering gas.
6. One (1) RO-FLO air compressor with 300 horsepower blower.
7. One (1) RO-FLO air compressor with 250 horsepower blower.
8. One (1) Glauber Equipment 40-gallon aftercooler.
9. Two (2) Pneumatech air/gas dryer for dewatering gas and temperature control for optimum combustion.
10. Two (2) ORAN plate heat exchanger.

Each piece of equipment provides a specific function in the treatment process and EDBR 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 EDBR monitors to determine it is operating properly.

One (1) 2″Ø condensate knockout sump – 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 BRL leachate collection system. On a weekly basis EDBR staff observes that the regulators for the pumps are indicating that air pressure is available to the pumps. On a weekly basis EDBR staff observes that the counters on the pneumatic pumps indicate that the pumps are cycling therefore noting that the condensate is being pumped from the knockout tank to the leachate collection system.

One (1) 300 horsepower RO-FLO compressor – The compressor moves the LFG through the system. It applies a vacuum to the wellfield and it provides pressure for the landfill gas treatment system and end uses. The compressor is powered by an

explosion proof 300 horsepower electric motor. The compressor has a lubricating device which is sheaved off the compressor shaft that lubricates the compressor vanes and the bearings. EDBR 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 EDBR staff observes that the compressor lubricator is pumping oil. On a daily basis an operator observes the operation of the electric motor and compressor, 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 the compressor.

One (1) 250 horsepower RO-FLO compressor – The compressor moves the LFG through the system. It applies a vacuum to the wellfield and it provides pressure for the landfill gas treatment system and end uses. The compressor is powered by an explosion proof 250 horsepower electric motor. The compressor has a lubricating device which is sheaved off the compressor shaft that lubricates the compressor vanes and the bearings. EDBR 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 EDBR staff observes that the compressor lubricator is pumping oil. On a daily basis an operator observes the operation of the electric motor and compressor, 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 the compressor.

One (1) AMERCOOL 40-gallon and 80-gallon aftercooler – The purpose of the aftercooler 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 EDBR 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.

Two (2) JENCO carbon steel scrubber tank with scrubber pad – This vessel has the same function as the condensate knockout sump, 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 the condensate knockout sump. On a daily basis EDBR 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 (2) 0.3-micron coalescing filter 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 BRL leachate collection system. On a daily basis the EDBR staff will observe and document the differential pressure drop across the coalescing filter. Also daily the EDBR staff will observe liquid levels accumulated in the coalescing filter vessel via a site glass.

One (1) Glauber Equipment 40-gallon aftercooler – The purpose of the aftercooler 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 EDBR 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.

Two (2) Pnuematech 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 EDBR 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.

Two (2) ORAN Plate Heat Exchangers – The plate heat exchanger uses metal plates to transfer heat from the LFG as it passes through the drying system. On a daily basis EDBR staff observes and documents the temperature drops across the exchanges. On a daily basis an operator observes the operation of the fan motor, fan and drive belts documenting abnormal sounds or operating conditions.

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

3 MAINTENANCE ACTIVITIES

As discussed in previous sections EDBR 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 EDBR 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, EDBR 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 EDBR 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.

(1) 2"Ø condensate knockout sump – 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. EDBR will document when maintenance is conducted on this piece of equipment. Typical maintenance activities would take no more than 48 hours.

(2) JENCO 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. EDBR will document when maintenance is conducted on this piece of equipment. Typical maintenance activities would take no more than 48 hours.

(1) 300 horsepower and (1) 250 horsepower RO-FLO compressors – If a compressor is not able to make enough pressure to supply the end uses or if it is not applying a vacuum to the wellfield, EDBR 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. EDBR will document when maintenance is conducted on this piece of equipment. Typical maintenance activities would take no more than 72 hours.

(1) AMERCOOL 40-gallon and 80-gallon aftercooler – Two things can occur to impede the performance of the aftercooler: (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. EDBR will document when maintenance is conducted on this piece of equipment. Typical maintenance activities would take no more than 48 hours.

(1) Glauber Equipment 40-gallon aftercooler – Two things can occur to impede the performance of the aftercooler: (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. EDBR will document when maintenance is conducted on this piece of equipment. Typical maintenance activities would take no more than 48 hours

Two (2) 0.3-micron coalescing filter for filtering the gas – If liquid levels do not drain from the coalescing filter EDBR 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. EDBR will document when maintenance is conducted on this piece of equipment.

One (1) Pnuematech 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, EDBR bypasses gas around the dryer and contacts a refrigerant dryer service contractor and schedules immediate maintenance activities to diagnose and repair the dryer. EDBR will document when maintenance is conducted on this piece of equipment. Typical maintenance activities would take no more than 72 hours.

Two (2) ORAN Plate Heat Exchangers – If the temperatures are noted to be outside of typical operating ranges or the heat exchangers are not operating properly, EDBR bypasses gas around the exchanger back through the refrigerant dryer skid and schedules immediate maintenance activities to diagnose and repair the exchanger. EDBR 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 EDBR at the request of the MDEQ for the NSPS treatment system at the EDBR facility located at the BRL. 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:

- A general understanding of the function of each piece of equipment in the treatment system.
- Operational parameters that will be observed and documented throughout the treatment system.
- Typical ranges for operational parameters that are observed and documented throughout the treatment system.
- 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 EDBR the operational flexibility to maximize combustion of the landfill gas.

LIMITATIONS

The work product included in the attached was undertaken in full conformity with generally accepted professional consulting principles and practices and to the fullest extent as allowed by law we expressly disclaim all warranties, express or implied, including warranties of merchantability or fitness for a particular purpose. The work product was completed in full conformity with the contract with our client and this document is solely for the use and reliance of our client (unless previously agreed upon that a third party could rely on the work product) and any reliance on this work product by an unapproved outside party is at such party's risk.

The work product herein (including opinions, conclusions, suggestions, etc.) was prepared based on the situations and circumstances as found at the time, location, scope and goal of our performance and thus should be relied upon and used by our client recognizing these considerations and limitations. Cornerstone shall not be liable for the consequences of any change in environmental standards, practices, or regulations following the completion of our work and there is no warrant to the veracity of information provided by third parties, or the partial utilization of this work product.

APPENDIX A
COMPRESSOR LOG

Energy Developments of Brent Run, LLC

Daily Readings
Landfill Gas Treatment System

Day	
Date	
Time	
Name	

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**