Arbor Hills Energy LLC
SRN: N2688

Landfill Gas Treatment System
Preventative Maintenance Plan

Introduction

Arbor Hills Energy, LLC (AHE) operates a landfill gas-to-energy facility at the Arbor Hills Landfill facility in Northville, Michigan. AHE receives gas collected from the adjacent Arbor Hills Landfill and processes it through a compression and treatment system. After the treatment system processes the gas, it is sent to gas combustion turbines and associated duct burners and a steam turbine. While not part of the existing AHE facility Treatment Skid, by 31 March 2023 or sooner, landfill gas (LFG) will be routed to a Sulfur Removal System (STS), a system consisting of an Inlet Separator with a vane/mesh pad, three 400 HP centrifugal blowers, an Air to LFG Cooler, an Outlet Separator with a vane/mesh pad and four 12-foot diameter by 16 foot seam to seam vessels each filled with 14 feet of Darco BG-1 granular activated carbon media.

AHE considers its landfill gas treatment system a means of controlling the landfill gas collected at the facility. NSPS allow landfill gas to be controlled by routing the collected gas to a treatment system that processes the gas for subsequent sale or use. The USEPA considers dewatering, 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.

Below is a summary of the treatment equipment which gas travels through at the facility:

- The landfill gas is filtered to remove particulate matter that may interfere with good combustion of the landfill gas.
- Up to 10,000 SCFM of LFG enters the fuel gas compressor(s). The LFG is compressed to the pressure required by the turbines (typically 260 psi). The LFG temperature is raised a minimum of 20 degrees Fahrenheit above the dewpoint by compression.
- The heated and compressed LFG passes through an air-to-gas heat exchanger to condense water vapor. A refrigeration-based chiller is installed and can also operate intermittently to further reduce the water vapor, if necessary.
- Particulates and water are removed by a minimum of a 10-micron coalescing filter.
    - Note that the Auxiliary compressors do not have 10-micron filters.
- After removal of liquids and particulates, the LFG passes through a final gas-to-gas heat exchanger. The heat exchanger reheats the LFG to approximately 20°F above its dew point. This prevents any condensation of the remaining water vapor in the LFG in the piping or turbine fuel handling systems.
- All condensate produced by the process is disposed of by approved methods.

1.0 Equipment Function and Monitoring

Each piece of equipment provides a specific function in the treatment process. AHE monitors various parameters at each piece of equipment on a regular basis to determine that the equipment is performing its intended function. The monitoring and recording of the data from the sensors and transmitters on the treatment system is variable with a normal frequency of approximately 10 seconds to 1 minute between updates. AHE will maintain records of all monitoring data as required by 40 CFR 60.785(c).

The following summarizes the function of each piece of equipment and parameters monitored to determine that it is operating as designed.

Main Gas Compressors - The four main gas compressors move the landfill gas. They also apply vacuum to the wellfield and provide pressure for the landfill gas treatment system and subsequent end uses.

The temperature of the incoming and outgoing landfill gas is measured and recorded. The incoming landfill gas has an average temperature of 65-77° Fahrenheit. The gas is compressed through several stages of compression to a discharge pressure of about 270 PSIG. There are air/gas heat exchangers between stages of compression where heat rejection is needed. Each compression skid has a chiller/heat exchanger which drops the temperature down to its dew point so that liquids can be removed from the gas. The gas is then reheated and prior to final filtration in the in the 10-micron filter. Compressor exit temperatures greater than 250 °F will cause an alarm to be recorded in the event log.

Auxiliary Compressors - The two Auxiliary Compressors also move the landfill gas and apply a vacuum on the wellfield. They provide pressure for the landfill treatment system and provide gas to the duct burners.

The temperature of the incoming and outgoing landfill gas is measured and recorded. The incoming landfill gas has an average temperature of 65-77 ° Fahrenheit. The gas is compressed to a discharge pressure of about 35 PSIG. There is an air/gas heat exchanger to manage heat rejection from the process of compression. The compressed gas then flows through a chiller/heat exchanger which drops the temperature down to its dew point so that liquids can be removed from the gas. The gas is then reheated and flows to the duct burners when the Steam plant is in operation.

Air-to-Gas Heat Exchanger - The purpose of the heat exchangers is to cool the gas. The gas flows through the exchanger's tubes while a fan blows air. The differential pressure on the unit is monitored on a daily basis. The differential pressure is monitored as it can indicate performance issues.

10-micron Coalescing Filter - The coalescing filter removes particulate from the gas. Particulate with a diameter of greater than 10 microns are removed by this filter. The differential pressure on the unit is monitored on a daily basis. The filter will be changed if it is suspected to be damaged.

2.0 Maintenance Activities

As discussed previously, staff observes the operation of the treatment system on a regular basis. If an operator observes that equipment is operating abnormally, or if it is operating outside normal parameters, then a maintenance action will be taken. Below is a summary of anticipated maintenance activities that may occur. This list is not comprehensive, and at all times the facility reserves the right to conduct additional preventative maintenance activities in order to ensure the treatment system functions in accordance with its originally designed intent.

Gas Compressors - If the compressors are not able to maintain enough pressure to supply the end user or if they are not applying a vacuum to the wellfield, troubleshooting and repair of the compressor will begin. Compressor bearings, motor and other parts are replaced on an as needed basis in order to maintain compressor performance. Daily facility logs will document when maintenance is conducted on this piece of equipment. Typical maintenance activities should take less than 72 hours.

Gas-to-Air Heat Exchanger - As stated before, the facility monitors the differential pressure on the unit. If the differential pressure is higher than normal operating parameters, staff will perform maintenance on the unit. Daily logs will document when maintenance is conducted on this piece of equipment. Typical maintenance activities should take less than 24 hours.

10-Micron Coalescing Filter - As stated before, the facility monitors the differential pressure on the unit. If the differential pressure is higher than the normal operating parameters, staff will change the filter. Daily logs will document when maintenance is conducted on this piece of equipment. Typical maintenance activities should take less than 8 hours.

3.0 Site-Specific Treatment System Monitoring Plan 40 CFR 62, Subpart OOO and 40 CFR 63, Subpart AAAA

The regulatory language in the Federal Plan Subpart OOO and NESHAP AAAA are similar but not identical, similar citations are grouped together.

This Site-Specific Treatment System Monitoring Plan is being prepared because the Arbor Hills Landfill is or will be subject to control requirements under 40 CFR 62, Subpart OOO and 40 CFR 63, Subpart AAAA. As part of the landfill gas collection and control system (GCCS) on-site, all or a portion of the landfill gas is "treated" as part of its overall management prior to sale or beneficial use. Per §62.16730/§63.1990, a treatment system is one that filters, de-waters, and compresses landfill gas for sale or beneficial use.

A treatment system is one of the acceptable "control systems" under the NSPS/NESHAP rule as set forth in §62.16714(c)(3)/§63.1959(b)(2)(iii)(C), which read that the owner may:

> *"Route the collected gas to a treatment system that processes the collected gas for subsequent sale or beneficial use such as fuel for combustion, production of vehicle fuel, production of*

high-Btu gas for pipeline injection, or use as a raw material in a chemical manufacturing process. Venting of treated landfill gas to the ambient air is not allowed. If the treated landfill gas cannot be routed for subsequent sale or beneficial use, then the treated landfill gas must be controlled according to §62.16714 (c)(1) or (c)(2)/ §63.1959(b)(2)(iii)(A) or (B)."

Since the Landfill has a treatment system which will act as a control system for the landfill gas subject to NSPS/NESHAP control, the monitoring requirements, specifically §62.16722(g)/ §63.1961(g) require that:

"The treatment system must maintain and operate all monitoring systems associated with the treatment system in accordance with the site-specific treatment system monitoring plan required in §62.16726(b)(5)(ii)/§63.1983(b)(5)(ii).

This site-specific treatment system monitoring plan satisfies the requirements of §62.16726(b)(5)(ii)/§63.1983(b)(5)(ii). Each element of the monitoring plan is listed here followed by the site-specific information related to this specific treatment system. The requirement will be shown in bold, italicized text followed by the site-specific response for the Site.

§62.16726(b)(5)(ii)(A)/§63.1983(b)(5)(ii)(A) Monitoring records of parameters that are identified in the treatment system monitoring plan and that ensure the treatment system is operating properly for each intended end use of the treated landfill gas. At a minimum, records should include records of filtration, de-watering, and compression parameters that ensure the treatment system is operating properly for each intended end use of the treated landfill gas.

Per §62.16722(g)(1)/§63.1961(g)(1), flow must be continuously (at least once every 15 minutes) monitored into the treatment system. The flow measurement devices will be maintained and calibrated per manufacturer's recommendations.

- The flow to each of the destruction devices operated by AHE is monitored via separate flowmeters.
- The flowmeters are calibrated annually per manufacturer's recommendation.
- Flow data is monitored via the plant SCADA.

Per §62.16722(g)(2)/§63.1961(g)(2), if there is a bypass line, from the treatment system, it must be secured in the closed position and inspected at least monthly to verify that gas is not being diverted to the bypass line and circumventing appropriate NSPS control.

- Under the current configuration, the gas is either handled by the flare or the treatment system. When the treatment system is down, the gas is handled by the flare. No valves need to be manipulated for this to occur.

Per §62.16726/§63.1983 all records must be 5 years up-to-date, readily accessible, on-site. Off-site records may be maintained if they are retrievable within 4 hours. Either paper copy or electronic formats are acceptable. The person(s) performing the inspection as per the frequency listed in Table 1, will record the observed value and determine if the value is within the range of operation. If the recorded value is out of the range of operation, they will immediately take corrective action, including contacting all relevant staff, as necessary. Furthermore, collected data and a description of the actions taken will be placed into the plant file.

- Records are maintained onsite and in electronic form that are retrievable within 4 hours upon request.
- The Arbor Hills.Energy, LLC duty operator is responsible for performing the inspection as per the frequency listed in Table 1.
- Observed values are reviewed to determine if the value is within the range of operation. If the recorded value is out of the range of operation, the duty operator takes the following steps:
    - Informs the Environmental Team of the anomaly observed.
    - Takes immediate take corrective action.
    - Documents steps taken to correct the anomaly in an email to the Environmental Team.

The Environmental Team follows each reported anomaly to conclusion to ensure that the issue is resolved, and documentation is complete.

§62.16726 (b)(5)(ii)(B)/§63.1983(b)(5)(ii)(B) Monitoring methods, frequencies, and operating ranges for each monitored operating parameter based on manufacturer's recommendations or engineering analysis for each intended end use of the treated landfill gas.

Table 1 describes monitoring methods, frequencies, and operating ranges for each monitored treatment operating parameter.

§62.16726 (b)(5)(ii)(C)/ §63.1983(b)(5)(ii)(C) Documentation of the monitoring methods and ranges, along with justification for their use.

The justification for the monitoring methods and ranges for each monitored treatment operating parameter is based on operational experience.

§62.16726 (b)(5)(ii)(D)/§63.1983(b)(5)(ii)(D) Identify who is responsible (by job title) for data collection.

The Arbor Hills Energy, LLC duty operator will be responsible for collecting data required by this Treatment System Monitoring Plan.

§62.16726 (b)(5)(ii)(E)/§63.1983(b)(5)(ii)(E) Processes and methods used to collect the necessary data.

Table 1 demonstrates how each type of treatment parameter (filtration, de-watering, and compression) will be monitored.

§62.16726 (b)(5)(ii)(F)/§63.1983(b)(5)(ii)(F) Description of the procedures and methods that are used for quality assurance, maintenance, and repair of all continuous monitoring systems.

The data and equipment are reviewed regularly during the month to verify accuracy and to evaluate for trends that may be characteristic of diminishing performance. Additionally, staff will perform visual inspections of the equipment and note issues as they arise. Repairs will be made as necessary. At a minimum, filters will be cleaned and or replaced as needed to maintain the listed differential pressures.

Table 1 - Landfill Gas Treatment System Monitoring Plan

Equipment	Parameter	Inspection Frequency	Monitoring Device	Range of Operation	Basis
Compressor/ Blower	Discharge Pressure (compression)	Weekly	pressure monitoring device	0-300 PSIA (Main Compressor) 0-40 PSIA (Auxiliary Compressor)	Operational Experience
Coalescing Filter Vessel / Final Gas Filter	Differential Pressure (filtration)	Weekly	pressure monitoring device	0-30 PSI (Differential pressure between inlet & outlet of filter vessel)	Operational Experience
Gas Cooler (moisture removal)	Differential Temperature (de-watering)	Weekly	temperature gauges	Differential temperature of at least 10°F	Engineering Analysis/Operational Experience

Note:
The above selected datapoints along with ranges of operation are based on engineering analysis of the operation of the plant.

4.0 STS System Maintenance

Breakthrough is determined by effluent reading by Draeger Tube Measurement calibrated gas monitor of H_2S is >5-20 ppm.

An activated carbon media STS system is installed upstream of the AHE to remove H_2S via chemical oxidation of the hydrogen sulfide to elemental sulfur in four vessels. The four vessels operate in a lead-lag system in series. The Lead vessel removes the majority of the H_2S and the Lag vessel acts as a polisher. Upon breakthrough of >5-20 ppm H_2S in the first vessel, it will be left in service, and Lead and Lag vessels will be swapped. A carbon media change-out will be scheduled. As part of a carbon media change-out procedure the lead and lag configuration will be swapped. After the change-out is complete the fresh media will be in lag position.

Once vessels have been properly purged and are safe to open, a Confined Space Entry with LEL Meters will be made by third party contractors for removal of the spent BG1 media and replacement of the interior foam pad/liner. All gaskets and seals on the vessels will be replaced after each cleanout.

The spent media is stored on site and disposed of at AHE landfill or any other landfill the material is accepted.