

VERMONT AGENCY OF NATURAL RESOURCES  
Department of Environmental Conservation  
Air Quality & Climate Division

**TECHNICAL ANALYSIS OF AN AIR CONTAMINANT SOURCE  
FOR A TITLE V PERMIT TO CONSTRUCT AND OPERATE**

**#AOP-17-018 / DEC PIN# SJ91-0001  
#AOP-18-019 / DEC PIN# SJ91-0001**

August 3, 2018

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**SOURCE / FACILITY:** Coventry Municipal Solid Waste Facility (Facility) consisting of the Coventry Landfill (Landfill Operation) and Coventry Landfill Gas to Energy Operation (LFGTE Operation)  
21 Landfill Lane  
Orleans County  
Coventry, VT 05825

**LANDFILL OPERATION  
OWNER/OPERATOR:** New England Waste Services of Vermont, Inc. (NEWSVT)  
25 Greens Hill Lane  
Rutland, VT 05701

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New England Waste Services of Vermont, Inc.  
25 Greens Hill Lane  
Rutland, VT 05701  
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**LFGTE OPERATION  
OWNER/OPERATOR:** Coventry Clean Energy Corporation (CCEC)  
40 Church Street  
East Montpelier, VT 05651

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40 Church Street  
East Montpelier, VT 05651  
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*This Technical Support Document by the Agency of Natural Resources, Department of Environmental Conservation, Air Quality & Climate Division (hereinafter "Agency") is intended to provide additional technical information, discussion and clarification in support of the Permit. It is not intended to provide a comprehensive review of the Facility or the permit process or to duplicate the information contained in the Permit or elsewhere.*

## 1.0 INTRODUCTION

New England Waste Services of Vermont, Inc. (also referred to herein as "NEWSVT") owns and operates a municipal solid waste (MSW) landfill (Landfill Operation) on Landfill Lane in the town of Coventry, Vermont. Coventry Clean Energy Corporation (also referred to herein "CCEC") owns and operates a landfill gas to energy facility (LFGTE Operation) that is located on property leased from NEWSVT at the unlined area of the Landfill Operation. The LFGTE Operation combusts landfill gas (LFG) from the Landfill Operation in internal combustion engines, and uses these LFG-fired engines to power electrical generators, generating electrical power for sale on the regional electric grid

The Landfill Operation and the LFGTE Operation are considered to be a single source of air emissions and are collectively referred to herein as "Facility". The Landfill Operation is comprised of the original unlined landfill, also referred to as Areas A & B, that operated from approximately 1970 until 1992 when it was closed and capped. In 1993 a new, lined landfill began operations near the original landfill and consists of Phases I, II, III and IV. Phase III reached its capacity and Phase IV began acceptance of waste in 2006. A Phase V expansion and its associated gas volumes are accounted for in this permit herein, but the expansion has not yet been approved by the Waste Management Division. The LFGTE Operation was constructed in 2005, with the installation of three (3) CAT G3520C LE LFG fired internal combustion engines (CAT G3520C engines) that begin operating on July 12, 2005. A fourth CAT G3520C engine was installed and began operating of January 12, 2007, and a fifth CAT G3520C engine was installed and begin operating on June 22, 2009.

NEWSVT is required to actively collect LFG generated by waste decomposition at the Landfill Operation and route the LFG to a combustion device to thoroughly destroy the non-methane organic compounds (NMOCs) contained in the LFG. The LFG collection system consists of a series of LFG collection points including vertical wells drilled into refuse-containing areas of the Landfill Operation as well as horizontal collection trenches and leachate cleanout piping, all connected by piping to a vacuum blower that maintains a negative pressure in the lines to extract LFG from the Landfill Operation.

Collected LFG is either combusted in a flare or flares owned and operated by NEWSVT or sold to CCEC. CCEC treats the LFG with a dewatering, chilling, and filtration treatment system to remove impurities in the LFG before using the treated LFG as gaseous fuel in the five (5) CAT G3520C engines at the LFGTE Operation. The five (5) CAT G3520C engines at the LFGTE Operation are rated to generate a maximum of 8.0 megawatts (MW) of electrical power.

NEWSVT has proposed to the Solid Waste division to construct a Phase VI expansion to the Landfill Operation, which will increase landfill capacity by approximately 13,068,000 cubic yards and increase the surface area of the Landfill Operation by 51.2 acres. NEWSVT has also submitted an Air Permit application to address this expansion of the Landfill Operation. NEWSVT does not anticipate that there will be an increase in LFG generation associated with the proposed Phase VI expansion at the Landfill Operation. The composition of the waste received by the Landfill Operation likely will change in the immediate future, as Act 148 is phased in. Act 148 bans disposal of recyclables (metal,

glass, plastics #1 & #2, and paper/cardboard) by July 1, 2015; leaf and yard debris and clean wood by July 1, 2016; and food scraps by July 1, 2020. The decreasing amounts of decomposable material in the waste are anticipated to result in lower rates of LFG generation.

NEWSVT has estimated LFG generation and associated air emissions from the Landfill Operation with the inclusion of the anticipated changes in LFG generation from the Phase VI expansion and changes in the composition of the refuse in the landfill, to be the generation of 5,436 standard cubic feet per minute (scfm) of LFG, and the capture of 5,000 scfm of LFG. Emissions estimates for the previous permits for the Facility (#AOP-14-034 and #AOP-15-032) were based on the generation of 5,545 standard cubic feet per minute (scfm) of LFG, and the capture of 5,000 scfm of LFG.

The Agency has determined, at this time, that the use of the emissions estimates and allowable emissions contained in #AOP-14-034 and #AOP-15-032 will appropriately represent the emissions from the Facility after the construction of the Phase VI expansion. The Agency will review these emission estimates in subsequent permit renewals and compare these estimates to reported Facility emissions to evaluate if revisions to the emissions estimates are appropriate.

CCEC has not proposed any changes to the operation of the CAT 3520C engines. A siloxane removal system (SRS) was installed by CCEC in late 2016 as part of the LFGTE Operation. The SRS commenced operation in 2017 and is intended to remove siloxanes contained in LFG that has already been treated by dewatering, filtration and compression. Removal of siloxanes in LFG combusted as fuel in the CAT 3520C engines will minimize the formation of siliceous deposits in the CAT G3520C engines. Reducing combustion chamber deposits and accelerated wear in the engines from these deposits is anticipated to reduce engine maintenance costs.

This review of the Facility and its associated air emissions includes the following:

#AOP-17-018: Permit to Operate renewal and the Permit to Construct for modification of the Phase VI Landfill Operation to include the Phase VI construction, creating approximately 7,348,659 Megagrams (Mg) of additional capacity and increasing the surface area of the landfill by approximately 51.2 acres. This increase in the size of the Landfill operation is not anticipated to result in any change to the previous permitted rate of LFG emissions, which are estimated to be the generation of 5,545 standard cubic feet per minute (scfm) of LFG, and the capture of 5,000 scfm of LFG.

#AOP-18-019: Permit to Operate renewal for the continued operation of the five (5) CAT G3520C LFG-fired internal combustion engine generators at the LFGTE Operation, and for the continued operation of an enclosed ground flare associated with the SRS.

<b>Table 1-1: Administrative Summary</b>	
<b>Administrative Item</b>	<b>Result or Date</b>
Date Application(s) Received:	07/23/2017
Date Application(s) Administratively Complete:	07/23/2017
Date Application(s) Technically Complete:	11/21/2017
Affected State(s) Noticed & Date(s) Noticed of Draft Decision:	Massachusetts, New Hampshire and New York. 05/04/2018
Date Draft Decision	05/04/2018
Date & Location Draft Decision/Comment Period Noticed:	Newport Daily Express Environmental Notice Bulletin 05/04/2018
Date & Location Public Meeting Noticed:	Not Requested
Date & Location of Public Meeting:	Not Requested
Deadline for Public Comments:	06/04/2018
Date Submitted to U.S. EPA:	06/06/2018
Total Application Fees:	\$2,000. <sup>00</sup>
Total Application Review Fees:	\$2,000. <sup>00</sup>
Classification of Source Under §5-401:	§5-401(16) (Any source ...which would otherwise be subject to regulation pursuant to the Clean Air Act, as amended (42 USC 7401, et seq.)  §5-401(17) [Such other sources as may be designated as air contaminant sources by the Air Pollution Control Officer on a case-by-case basis]
Classification of Application:	Minor Modification / Renewal
Construction and Operating Permit: Designation of Facility:	Title V
Facility SIC/NAIC Code(s):	4953 / 562212 and 4931/221129
Facility SIC/NAIC Code Description(s):	Refuse Systems, Solid Waste Landfills and Electric and other Services Combined, Other Electric Power Generation

<b>Table 1-2: Future Allowable Facility Air Contaminant Emissions (tons/year)<sup>1</sup></b>						
<b>PM/PM<sub>10</sub>/PM<sub>2.5</sub></b>	<b>CO</b>	<b>NO<sub>x</sub></b>	<b>SO<sub>2</sub></b>	<b>VOCs</b>	<b>HAPs<sup>2</sup></b>	<b>CO<sub>2e</sub><sup>3</sup></b>
20.5	507	99	<40	<50	>10/25	274,634

<sup>1</sup> PM/PM<sub>10</sub>/PM<sub>2.5</sub> - particulate matter and particulate matter of 10 micrometers and 2.5 micrometers in size or smaller, respectively. Unless otherwise specified, all PM is assumed to be PM<sub>2.5</sub>; SO<sub>2</sub> - sulfur dioxide; NO<sub>x</sub> - oxides of nitrogen measured as NO<sub>2</sub> equivalent; CO - carbon monoxide; VOCs - volatile organic compounds; HAPs - hazardous air pollutants as defined in §112 of the federal Clean Air Act. Emissions are based on: (1) the maximum predicted gas generation rate from the Landfill Operation of 5,545 scfm (2) 50% methane in the LFG, (3) 75%-95% gas collection efficiency from the Landfill Operation (4) the worst case emissions scenario of the engines at full load (2,537.5 scfm) with the flares consuming the remaining (2,462.5 scfm) and (5) PM, NO<sub>x</sub> and CO based on manufacturer data, VOCs emissions based on NMOCs in LFG that are 39% VOCs and 98% destruction of the collected NMOCs/VOCs and the estimated formation of acetaldehyde and formaldehyde in the CAT 3520C engines as a combustion by-product, SO<sub>2</sub> based on TRS 400 ppm TRS, which is anticipated to be a conservative measure of TRS in LFG at the Facility.

- <sup>2</sup> Emissions of an individual HAP (formaldehyde) are estimated to be >10 tpy and emissions of total HAPs combined are estimated greater than 25 tpy.
- <sup>3</sup> CO<sub>2e</sub> - Carbon dioxide equivalent emissions. Includes where appropriate carbon dioxide (CO<sub>2</sub>), methane (CH<sub>4</sub>), nitrous oxide (N<sub>2</sub>O), sulfur hexafluoride (SF<sub>6</sub>), hydrofluorocarbons (HFCs), perfluorocarbons (PFCs), and other fluorinated greenhouse gases. Emissions are from both biogenic and non-biogenic sources. See Section 3.3 for further details.

## 2.0 FACILITY DESCRIPTION

### 2.1 Facility Locations and Surrounding Area

The Facility is located approximately 1.8 miles south southwest of downtown Newport. The area surrounding the Facility is primarily wooded areas and cultivated fields. The Newport State Airport is located approximately 1.5 miles south of the Facility, and the South Bay of Lake Memphremagog is located approximately 0.5 miles to the east. The Facility is located approximately 200 km from the Lye Brook Wilderness area in Manchester, Vermont and approximately 97 km from the Great Gulf and Dry River Wilderness areas in New Hampshire.

### 2.2 Facility Description

The Facility consists of two different activities, the Landfill Operation and the LFGTE Operation, which are operated by different parties. Allowable emissions from the Facility are the aggregate of emissions from the Landfill Operation and the LFGTE Operation. The Landfill Operation is classified by the Standard Industrial Classification (“SIC”) as 4953(Refuse Systems, Solid Waste Landfills) and by the North American Industrial Classification System (NAICS) as 562212 (Solid Waste Landfills). The LFGTE Operation is classified as SIC 4931 (Electric and Other Services Combined, Other Electric Power Generation), and NAICS 562212 (Solid Waste Landfills) and 221129 (Other Electric Power Generation).

The Landfill Operation and the LFGTE Operation are considered to be a single source of air emissions and are collectively referred to herein as "Facility". Allowable emissions from the Facility are the aggregate of emissions from the Landfill Operation and the LFGTE Operation. However, two separate permits have been prepared for this single Facility, to better delineate the permit conditions and responsibility for compliance between the two distinctly different operations at the Facility.

NEWSVT is responsible under #AOP-17-018 for the Landfill Operation, which consists of the original unlined landfill, the currently operating landfill, the proposed Phase VI expansion of the landfill area, the LFG collection system, and flares operated by NEWSVT that are used to combust LFG without energy recovery.

The area of the original landfill that operated from approximately 1970 until 1992 when it was closed and capped is also referred to as Areas A & B. LFG from Areas A & B is collected using a passive gas collection system and the collected LFG is combusted in two gas flares that are only connected to the passive gas collection system. In 1993 a new, lined landfill began operation near the original landfill and consists of Phases I, II, III and IV. Phase III reached its capacity and Phase IV began acceptance of waste in 2006.

NEWSVT is required to actively collect the LFG that is generated from the decomposition of wastes within the lined landfill areas and route it to a combustion device to thoroughly destroy NMOCs contained in the LFG. The LFG collection system consists of a series of gas collection points including wells drilled into the landfill as well as horizontal collection trenches and leachate cleanout piping, all connected by piping to a blower that maintains a negative pressure in the lines to extract LFG from the landfill. A demister knock-out vessel is installed to remove moisture droplets from the gas is installed in the collection lines before these lines enter the blower.

The collected LFG is sold to CCEC, who treats the LFG with a primary treatment system using filtration, dewatering and compression. This dewatered, filtered and compressed LFG is then treated in the siloxane removal system (SRS) to remove siloxanes contained in the LFG before using the treated LFG as a gaseous fuel in the internal combustion engines at the LFGTE Operation. Any LFG collected by the Landfill Operation that is not combusted in the engines at the LFGTE Operation, such as LFG generation excess to the needs of the engines or LFG generated during periods the engines are off-line is routed to on-site flares operated by NEWSVT as part of the Landfill Operation to ensure continued complete combustion of the LFG.

NEWSVT has proposed to construct a Phase VI expansion to the Landfill Operation, which will increase landfill capacity by approximately 13,068,000 cubic yards and increase the surface area of the Landfill Operation by 51.2 acres. The composition of waste in the landfill is anticipated to change with the full implementation of Act 148, which mandates the removal of the majority of compostable waste from material being landfilled by 2020. This change is anticipated to reduce the LFG generation rate of the landfill when compared to historic generation rates. Given this, even though the landfill will be larger, its annual generation of LFG is not anticipated to increase even though the period of time during which the landfill will generate LFG will increase. Currently, the landfill produces approximately 2,500 standard cubic feet per minute (scfm) of LFG. Emissions estimates in this are the same as the previous permit, which were based on up to 5,545 standard cubic feet per minute (scfm), with 5,000 scfm of this LFG being captured and combusted

NEWSVT had previously proposed a Phase V expansion to excavate and relocate the unlined landfill Areas A & B, placing the approximately 146,000 Mg of excavated refuse into the lined landfill area. The proposed Phase V landfill expansion would be located in the 11-acre footprint of the former Areas A & B and would have a capacity of approximately 1,854,738 Mg of refuse. Approval to relocate the refuse in Areas A & B and the Phase V expansion is contingent on NEWSVT obtaining all necessary permits, approvals and/or variances. At a minimum, this would require a Solid Waste Certification approval from the Agency of Natural Resources, Department of Environmental Conservation, Waste Management and Prevention Division. The potential for an increase in LFG generation from the Phase V expansion was addressed in emissions estimates previously prepared for #AOP-14-034 and #AOP-15-032.

The LFGTE Operation was originally installed under the authority of #AOP-03-044, which was issued to NEWSVT, and included approval for four (4) LFG-fired internal combustion engines. An additional LFG-fired internal combustion engine was installed under the authority of #AOP-06-060, which was also issued to NEWSVT. Subsequent to the

issuance of these permits, the Agency has determined that CCEC is responsible for the LFGTE Operation, and a separate permit (#AOP-15-032) was issued to CCEC to address their responsibilities for the LFGTE Operation. This separate permit for CCEC will be updated as #AOP-18-019 to address the air quality aspects of the Phase VI expansion at the Facility.

The LFGTE Operation currently consists of five (5) LFG-fired internal combustion engines each rated at 2,221 bhp and 1,600 kW of generation capacity, capable of producing a total of 8.0 megawatts of electric power. The LFGTE Operation also includes additional equipment for pressurizing, drying, and cleaning the LFG that is intended to improve gas quality and extend the service life of the engines, and a second blower to provide complete backup blower capability. The LFG is treated by the LFGTE Operation by passing the LFG through a non-contact heat exchanger that utilizes chilled water to cool the gas stream, removing additional moisture by condensation, then further dewatered with a liquid sorption dehumidification system that uses a series of glycol liquid (sorbent) sprays in the gas stream to absorb the remaining moisture from the LFG. The LFG then passes through four (4) coalescing polishing filters before being sent to the SRS.

The SRS, installed in 2016, consists of two sorption chambers, which will sorb siloxanes contained in LFG onto a silica media. The two chambers will alternate in operation, with one sorption chamber being operated in treatment mode, while the other chamber operates in desorption mode. When the silica media in one chamber is saturated with siloxanes, the siloxanes will be desorbed using heated air, and the heated air containing the desorbed siloxanes will be routed to an enclosed ground flare along with treated LFG to provide fuel for thermal destruction of the siloxanes and NMOCs that are also captured by and desorbed from the SRS. Operation of the SRS began in early 2017.

A 100-kW backup generator is installed at the LFGTE Operation to provide electric power for lighting and system operation in the event of an electrical power loss. The LFGTE Operation has no black-start capability.

Equipment and operations at the Facility are summarized in the following table.

<b>Landfill Operation - Specifications</b>			
Landfill Area/Phase	Years of Operation <sup>1</sup>	Refuse Capacity (Mg) <sup>2</sup> And Landfill Size (acres)	Cumulative Facility Refuse Capacity (Mg) <sup>2</sup> / Landfill size (acres) <sup>3</sup>
Unlined landfill Areas A & B	1970 - 1992	146,050 / (11 acres)	146,050 / (11 acres)
Landfill Phases I, II, III, and IV	1993 - 2020	7,504,427 / (90 acres)	7,650,477 / (90 acres)
Landfill Phase V (proposed)	2032 - 2035	1,854,738 / (13.8 acres)	9,359,165 / (92.8 acres)
Landfill Phase VI (proposed)	2021 - 2031	7,348,659 / (51.2 acres)	16,707,824 / (144 acres)

<b>Landfill Operation - LFG Combustion Devices</b>			
LFG Combustion Device	Size/Rating <sup>4</sup>	Gas capacity <sup>5</sup>	Location, stack height
One (1) John Zink Utility Ground Flare	12" dia. / 75 MMBtu/hr	2,500 scfm	Lined Landfill; 35' minimum.
One (1) Parnel Biogas Utility Ground Flare	12" dia. / 77.8 MMBtu/hr	2,500 scfm	Lined Landfill; 35' minimum.
Two (2) LTI Model CF-5 Passive Flares (to be removed with relocation of refuse in Areas A & B)	2" dia.	60 scfm each	Unlined Landfill: (1) at Area A, (1) at Area B. Minimum 8' stack height each.

<b>Landfill Operation - Miscellaneous Equipment</b>		
Equipment	Rating	Location
Two (2) Used oil Furnaces	300,000 Btu/each	Maintenance garage
Four (4) No. 2 Fuel-oil fired Portable Space Heaters	2 x 110,000 Btu/each 1 x 175,000 Btu/each 1 x 215,000 Btu/each	Maintenance garage
One (1) Fuel-oil fired Portable Space Heater	85,000 Btu/each	Scale house
One (1) Safety-Kleen parts cleaner.	---	Maintenance garage
One (1) Used Oil Tank	2,000 gallons	Maintenance garage
Two (2) Used Oil Tanks	500 gallons each	Maintenance garage / Scale House
Two (2) Diesel Fuel Tanks	10,000 gallons each	Landfill depot / Contractor staging area
Various lubricating oil, hydraulic oil, heating oil and Used oil tanks	<500 gallons each	Various
Four (4) Leachate storage tanks	1 x 20,000 gallon each 1 x 30,000 gallon each 1 x 438,000 gallon each 1 x 438,000 gallon each	Landfill Operation Landfill Operation Landfill Operation Proposed for Phase VI



LFGTE Operation - Equipment		
Equipment	Rating	Location
Five (5) CAT G3520C Engines Engine 1, 2, and 3: Installed March 2005 Engine 4: Delivered January 12, 2007 Engine 5: Delivered on June 17, 2009	2,221 bhp (1,600 kW) each engine 507 scfm LFG fuel flow each engine	LFGTE Operation; 28' minimum, proposed stack height  34' minimum installed no later than 12/31/2016.
Two (2) Ethylene Glycol Storage Tanks	1,000 gallons each	LFGTE Operation
One (1) Used Oil Tank	2,000 gallons	LFGTE Operation
One (1) Lube Oil Storage Tank	8,000 gallons	LFGTE Operation
One (1) Olympian DP100P1 100 kW emergency generator powered with a Perkins 1006-6TG manufactured April 28, 2005	140 bhp	LFGTE Operation
LFG pretreatment system: IES LFG scrubbing system including a demister knock-out vessel, four (4) gas blower units, three (3) gas cooling units with separator knock-out vessel, one (1) mechanical gas chiller for process water.	2,500 scfm	LFGTE Operation
LFG Siloxane Removal System (SRS): Two (2) temperature swing non-carbon adsorptive desiccant media beds, coalescing pre-filter and particulate after-filter, one (1) media regeneration skid with blower and electrically heated desorption hot air system, one (1) Regen Air pre-heater heat exchanger in loop with engine jacket water piping, enclosed ground flare for destruction of desorbed siloxanes, H <sub>2</sub> S, and VOCs.	2,500 scfm LFG inlet, 200 acfm desorption gas at 300F to be mixed with 100 acfm LFG at flare for combustion.	LFGTE Operation

<sup>1</sup> Years of operation are approximate and are estimated for Phase IV, V and VI.

<sup>2</sup> Mg – Mega grams. To convert to English tons, multiply the Mg value by 1.1025.

<sup>3</sup> The Phase V expansion will overlay Areas A and B and encroach into areas included as part of Phases I, II, and III, resulting in a 2.8-acre net increase to the surface area covered by Areas A and B, and Phases I, II, and III.

<sup>4</sup> bhp – brake horsepower rated output as specified by the manufacturer. kW - kilowatt electrical output.

<sup>5</sup> scfm - standard cubic feet per minute of LFG. LFG is assumed to contain 40% - 60% methane with the balance predominately carbon dioxide but also includes ~524 ppm nonmethane organic compounds (NMOCs) based on previous LFG sampling and analysis at the Landfill. The maximum LFG generation rate is predicted to be 5,436 scfm in 2036 based on the LandGEM model ver. 3.02 with values of L<sub>0</sub> of 120 M<sup>3</sup> / Mg and k of 0.06 yr<sup>-1</sup> from present to 2020. Assumed values of L<sub>0</sub> of 100 M<sup>3</sup> / Mg and k of 0.05 yr<sup>-1</sup> were assumed for the years 2021 and beyond to account for the change in refuse composition from the full implementation of Vermont's Universal Recycling Law (ACT 148). LFG capture efficiency is assumed to be 85% over the life of the Landfill. Collected gas volumes have been conservatively assumed to not exceed 5,000 scfm.

### 3.0 QUANTIFICATION OF POLLUTANTS

The quantification of emissions from a stationary source is necessary in order to establish the appropriate regulatory review process for the operating permit application and to determine applicability with various air pollution control requirements. These determinations are normally based upon allowable emissions. Allowable emissions are defined as the emission rate calculated using the maximum rated capacity of the source and, if applicable, either: (a) the applicable emission standard contained in the *Regulations*, if any, or (b) the emission rate or design, operational or equipment standard specified in any order or agreement issued under the *Regulations* that is state and federally enforceable. An applicant may impose in its application an emission rate or design, or an operational or equipment limitation which may be incorporated in the Permit to restrict operation to a lower level. Examples of such limitations may include, but are not limited to, fuel restrictions or production limits

Activities at the Facility with emissions that are not insignificant or exempt include the following:

- (1) Fugitive emissions from the Landfill Operation that are not captured by the LFG collection system. These emissions consist of NMOCs and hydrogen sulfide that are present in the LFG.
- (2) Emissions of combustion byproducts from destruction of LFG in the four (4) open utility flares, two which are located at the lined area of the Landfill Operation and two at the unlined area of the Landfill Operation. After the Phase V relocation of waste from the unlined area of the Landfill Operation, there will be two (2) flares remaining at the lined landfill. The flares on the lined landfill are currently used as a backup combustion device for the engines in the LFGTE Operation. The flares at the unlined area of the Landfill Operation operate continuously and independently of the LFGTE Operation.
- (3) Emissions of combustion byproducts from destruction of LFG in the five (5) CAT G3520C engines at the LFGTE Operation. Combustion byproducts include both criteria pollutants and VOCs formed by incomplete combustion.
- (4) Emissions of combustion byproducts from operation of the SRS flare used to treat offgas from the SRS.
- (5) Emissions of uncombusted NMOCs from the flares and engines at the Facility. These combustion devices are not 100 percent effective in controlling NMOCs, and it is assumed that approximately 2 percent of the NMOCs that pass through these devices are emitted to the ambient air.
- (6) Emissions from the emergency generator at the LFGTE Operation.
- (7) Emissions from non-road engines used for equipment support and waste and cover material placement and compaction at the Landfill Operation

Emissions were estimated on a Facility-wide basis. The individual Permittees at this Facility will each be responsible for estimating their components of overall Facility emissions. The estimation of potential to emit and allowable emissions of particulate matter (PM/PM<sub>10</sub>/PM<sub>2.5</sub>), sulfur dioxide (SO<sub>2</sub>), oxides of nitrogen (NO<sub>x</sub>), carbon monoxide (CO), volatile organic compounds (VOCs), hazardous air pollutants (HAPs) and hazardous air contaminants (HACs) from these sources are described below.

### 3.1 LFG Emissions:

The total amount of LFG generated annually by the Landfill Operation was estimated by NEWSVT with Version 3.02 of EPA's Landfill Gas Emission Model (LandGEM) model. The LandGEM model uses a first order decay equation identified in 40 Code of Federal Regulations (CFR) Part 60.754 to estimate LFG generation. Variables used in the equation include historical waste acceptance rates, proposed future waste acceptance rates, a methane generation rate constant and the methane generation potential of the waste.

To account for the anticipated changes in LFG generation at the Landfill Operation, site-specific modeling parameters were used by NEWSVT to provide a likely estimate of gas generation rates from the landfill, both with the current refuse composition, and with the likely future refuse composition. NEWSVT does not anticipate that there will be an increase in LFG generation associated with the proposed Phase VI expansion at the Landfill Operation. The composition of the waste received by the Landfill Operation likely will change in the immediate future, as Act 148 is phased in. Act 148 bans disposal of recyclables (metal, glass, plastics #1 & #2, and paper/cardboard) by July 1, 2015; leaf and yard debris and clean wood by July 1, 2016; and food scraps by July 1, 2020. The decreasing amounts of decomposable material in the refuse are anticipated to result in lower rates of LFG generation.

Based on historical LFG generation information, the methane generation potential ( $L_0$ ) of the refuse in the Landfill Operation was established as 120 cubic meters/megagram ( $m^3/Mg$ ), and the methane generation rate constant ( $k$ ) for the waste was established as  $0.06 \text{ year}^{-1}$  up until the beginning of 2021. After the full implementation of Act 148 in 2020, the  $L_0$  of the refuse in the Landfill Operation was assumed to be  $100 \text{ m}^3/Mg$ , and  $k$  for the waste was established as  $0.05 \text{ year}^{-1}$  from 2021 until anticipated closure in 2035. The future waste acceptance rate at the Landfill was assumed to be the maximum permitted acceptance rate of 600,000 tons per year from 2017 to 2035. Using these factors, the maximum methane generation from the Landfill Operation was estimated as 5,436 standard cubic feet per minute (scfm) in 2036. The maximum amount of LFG collected was estimated as 4,620 scfm assuming an 85 percent collection efficiency.

The previous determination of allowable emissions for #AOP-14-034 was based on a maximum LFG generation rate estimated at 5,545 standard cubic feet per minute (scfm) of LFG. The landfill cover and gas collection system had been estimated to collect approximately 85 percent of the generated LFG over the life of the landfill. Collection of LFG was estimated to be approximately 4,700 scfm, based on the estimated maximum LFG generation rate of 5,545 scfm and the assumed 85 percent collection efficiency.

Combustion emissions in the previous permits for the Facility (#AOP-14-034 and #AOP-15-032), were based on an assumed maximum LFG collection rate of 5,000 scfm rather than 4,700 scfm. This assumption was intended to provide conservatively high combustion emission estimates. However, fugitive emissions from the Landfill Operation were based on 15 percent of the maximum LFG generation rate of 5,545 scfm. The emission rate for fugitive LFG estimated in this fashion is approximately 832 scfm.

Given that the estimated LFG generation rate in the Application is slightly lower than for the previous permits for the Facility, and there have been no changes to the combustion equipment at the Facility, the Agency has determined that the allowable emissions for the Facility contained in #AOP-14-034 and #AOP-15-032 are a conservative representation of air emissions from the Facility, including the Phase VI expansion.

LFG contains NMOCs, and the individual compounds comprising NMOCs may also be classified as volatile organic compounds (VOCs) and/or hazardous air pollutants (HAPs) and/or hazardous air contaminants (HACs). The concentration of NMOCs in LFG was estimated from LFG samples that were collected and analyzed for NMOCs in June 2002. These NMOC concentrations were reported as 561 parts per million by volume (ppmv) as hexane, and this value was used for subsequent estimates involving NMOCs.

The concentrations of VOCs contained in LFG were estimated by using waste acceptance records, an understanding of the landfill's operational and waste acceptance history, and the previously discussed NMOC concentration in LFG of 561 ppmv as hexane. This evaluation indicated that the landfill likely contained only MSW or contained very little organic commercial/industrial wastes. Accordingly, it is likely that co-disposal did not occur at the landfill. Guidance published by the U.S. EPA in *Compilation of Air Pollutant Emission Factors, Volume I: Stationary Point and Area Sources (5th Edition including Supplements A, B and C)*, AP-42, Office of Air Quality Planning and Standards, (AP-42), Chapter 2: Solid Waste Disposal, Section 2.4, Municipal Solid Waste Landfills, Table 2.4-2 (11/1998) indicates that an appropriate VOC concentration in LFG for landfills without co-disposal is 39% of the NMOC concentration in LFG.

The concentrations of HAPs/HACs in LFG were based on analytical results from Tier 2 testing performed by New England Air Quality Testing (NEAQT) at the Landfill in August 1993. Concentration data for 12 of the 14 HACs included in NEAQT's report were used to calculate emission rates. Non-detectable concentrations for two of the HACs (carbon tetrachloride and chloroform) were reported at each test probe during Tier 2 sampling by NEAQT. Therefore, the AP-42 default values for carbon tetrachloride, chloroform, and the remaining 19 HACs for which site-specific data were not available were used to calculate the HAC emission rates.

Estimated fugitive emissions are summarized in the following table. These are based on the measured concentrations discussed above and 15% of the maximum 5,545 scfm LFG generation being emitted fugitively from the Landfill. As the fugitive LFG emissions consist of uncombusted LFG, it has been assumed that there are no combustion emissions (SO<sub>2</sub>, NO<sub>x</sub>, PM, and CO) associated with this emissions source.

Table 3-1 Fugitive Emissions from Landfill

Parameter	Landfill Gas Generation				Fugitive Emissions					
	Molecular Weight	Concentration in LFG (ppmv)	Landfill Generation (lb/scf)	Landfill Generation (lb/hr)	Fugitive Emissions (lb/hr)	Fugitive Emissions (ton/year)				
NMOC	86.18	561	0.000128	42.52	6.381	27.95				
Estimated Fugitive VOC Emissions from Landfill	86.18	219	4.989E-05	16.60	2.491	10.91				
CAS No.	VOC (Y/N)	HAP (Y/N)	HAC (Y/N)	VOCs, Hazardous Air Pollutants (HAPs) and Hazardous Air Contaminants (HACs)						
71-55-6	N	Y	Y	1,1,1-Trichloroethane	133.41	0.480	0.00000017	0.056325	0.008451	0.04
79-00-5	Y	Y	Y	1,1,2-Trichloroethane	133.41	0.100	0.00000004	0.011734	0.001761	0.01
79-34-5	Y	Y	Y	1,1,2,2-Tetrachloroethane	167.85	1.110	0.00000049	0.163877	0.024589	0.11
75-34-3	Y	Y	Y	1,1-Dichloroethane	98.97	2.350	0.00000061	0.204572	0.030695	0.13
75-35-4	Y	Y	Y	1,1-Dichloroethene (Vinylidene Chloride) (1,1-Dichloroethylene)	96.94	0.0981	0.00000003	0.008365	0.001255	0.01
107-06-2	Y	Y	Y	1,2-Dichloroethane (Ethylene Dichloride)	98.96	0.095	0.00000002	0.008252	0.001238	0.01
78-87-5	Y	Y	Y	1,2-Dichloropropane (Propylene Dichloride)	112.99	0.180	0.00000005	0.017889	0.002684	0.01
67-64-1	N	N	Y	Acetone	58.08	7.01	0.00000108	0.358112	0.053733	0.24
107-13-1	Y	Y	Y	Acrylonitrile	53.06	0.442	0.00000006	0.020628	0.003095	0.01
106-93-4	Y	Y	Y	1,2-Dibromoethane (Ethylene dibromide)	187.88	0.001	0.00000000	0.000165	0.000025	0.00
106-46-7	Y	Y	N	1,4-Dichlorobenzene (p-dichlorobenzene)	147.00	0.21	0.00000008	0.027153	0.004074	0.02
108-10-1	Y	Y	Y	4-Methyl-2-Pentanone (Methyl isobutyl ketone)	100.16	1.870	0.00000050	0.164744	0.024719	0.11
71-43-2	Y	Y	Y	Benzene	78.11	1.01	0.00000021	0.069391	0.010412	0.05
75-27-4	Y	N	Y	Bromodichloromethane	163.83	3.130	0.00000136	0.451036	0.067676	0.30
75-15-0	Y	Y	Y	Carbon disulfide	76.13	0.58	0.00000012	0.038838	0.005827	0.03
56-23-5	Y	Y	Y	Carbon tetrachloride	153.84	0.004	0.00000000	0.000541	0.000081	0.00
463-58-1	Y	Y	N	Carbonyl sulfide	60.07	0.49	0.00000008	0.025890	0.003885	0.02
108-90-7	Y	Y	Y	Chlorobenzene	112.56	0.0834	0.00000002	0.008257	0.001239	0.01
75-00-3	Y	Y	N	Chloroethane (Ethyl Chloride)	64.52	1.25	0.00000021	0.070938	0.010644	0.05
67-66-3	Y	Y	Y	Chloroform	119.39	0.03	0.00000001	0.003150	0.000473	0.00
75-71-8	N	N	Y	Dichlorodifluoromethane	120.91	15.70	0.00000502	1.669690	0.250529	1.10
75-09-2	N	Y	Y	Dichloromethane (Methylene Chloride)	84.94	38.40	0.00000862	2.868913	0.430466	1.89
75-08-1	Y	N	Y	Ethyl mercaptan (Ethanethiol)	62.13	2.28	0.00000037	0.124598	0.018695	0.08
100-41-4	Y	Y	Y	Ethylbenzene	106.16	1.28	0.00000036	0.119521	0.017934	0.08
50-00-0	Y	Y	Y	Formaldehyde	Not Applicable					
110-54-3	Y	Y	Y	Hexane	86.18	6.57	0.00000150	0.498019	0.074725	0.33
7783-06-4	N	N	Y	Hydrogen sulfide	34.08	308	0.00002775	9.232603	1.385307	6.07
7439-97-6	N	Y	Y	Mercury	200.61	0.000292	0.00000000	0.000052	0.000008	0.00
78-93-3	Y	N	Y	Methyl ethyl ketone	72.11	7.090	0.00000135	0.449692	0.067474	0.30
108-88-3	Y	Y	Y	Toluene	92.14	12.5	0.00000304	1.013053	0.152004	0.67
79-01-6	Y	Y	Y	Trichloroethylene (Trichloroethene)	131.4	0.508	0.00000018	0.058713	0.008810	0.04
75-01-4	Y	Y	Y	Vinyl chloride	62.50	0.376	0.00000006	0.020670	0.003101	0.01
108-38-3 / 106-42-3 / 95-47-6	Y	Y	Y	Xylenes	106.16	2.82	0.00000079	0.263320	0.039510	0.17
<b>Total Quantified NMOCs</b>							0.0000542	18.03	2.71	11.85
<b>Total Quantified VOCs</b>							0.0000116	3.84	0.58	2.53
<b>Total Quantified HAPs</b>							0.0000173	5.74	0.86	3.77
<b>Total Quantified HACs</b>							0.0000538	17.90	2.69	11.77

### 3.2 LFG Combustion Emissions

Emissions from the combustion processes at the Facility, including the flares and the CAT G3520C engines were based on emission factors provided by manufacturers, site specific chemical analysis of the LFG, site-specific stack test data, and emission factors published by the U.S. EPA in AP-42.

Emissions estimates were performed using a spreadsheet named combined\_caop17018 and caop18019.xlsx, and the estimations performed with this spreadsheet are summarized in the following tables.

#### 3.2.1 LFG Flare Emissions

Emissions of CO and NO<sub>x</sub> for the landfill flares were based on emission factors provided by the flare manufacturers. Emissions of SO<sub>2</sub> were estimated using site-specific total reduced sulfur (TRS) and hydrogen sulfide (H<sub>2</sub>S) analytical results from LFG samples collected on July 8, 2014.

VOC and HAP emissions were based on chemical analytical results from LFG collected in August 1993 and June 2002, an assumed 85% collection efficiency for the LFG collection system, and an assumed 98% destruction efficiency in the combustion devices at the Facility. Chemical analytical results from the Landfill indicated that VOC concentrations in LFG were 4.99E-05 lb VOC/scf of LFG, and HAP concentrations in LFG were 1.73E-5 lb HAPs/scf of LFG.

Emissions of PM were estimated using the 0.017 lb/MMBtu emission factor for LFG flares published in AP-42, plus an additional factor to account for the silicon dioxide (SiO<sub>2</sub>) PM created from the combustion of siloxanes in the LFG. The AP-42 emission factors for flares are based on data for landfills that, to the Agency's understanding, have lower siloxane contents when compared to the LFG generated from the Coventry Landfill. To account for this difference in siloxane concentrations, a separate factor was added to the AP-42 PM emission.

This additional PM emission factor was estimated based on the assumption that untreated LFG contains 35 milligrams of silicon per cubic meter (mg Si/m<sup>3</sup>), and that all the Si contained in the LFG is oxidized to SiO<sub>2</sub> with an aerodynamic diameter that is less than the 60 μm PM threshold. Based on these assumptions, the LFG will produce 0.009 pounds of PM per million Btu of LFG. The emission factor for the flares will be the sum of these two factors (0.017 lb/MMBtu + 0.009 lb) or 0.026 lb/MMBtu.

Flare combustion emissions were estimated for two different operating conditions. One condition assumed the entire estimated amount of collected LFG (5,000 scfm) was to be combusted in the flares. The other condition assumed that 2,462.5 scfm of collected LFG was combusted in the flares, while the five (5) CAT G3520C engines at the LFGTE Operation combusted the remaining 2,537.5 scfm of collected LFG.

<b>Table 3-2 - Estimated Emissions from Landfill Operation Flares Combustion of 5,000 scfm of LFG</b>				
Pollutant	Emission Factor			Estimated Emissions tons per year
	Factor	Units	Source	
SO <sub>2</sub>	0.136	lb/MMBtu <sup>1</sup>	Site Specific Data - Application for #AOP-14-034	89.35
NO <sub>x</sub>	0.068		Vendor Supplied – Application for #AOP-14-034	44.68
PM	26	lb/MMcf methane <sup>2</sup>	AP-42, Municipal Solid Waste Landfills, Table 2.4-5 (11/98) plus PM emissions from siloxane combustion	17.31
CO	0.37	lb/MMBtu <sup>1</sup>	Vendor Supplied – Application for #AOP-14-034	243.09
VOC	2.00E-03		Site Specific Data - Application for #AOP-14-034	1.31
HAPs	6.90E-04			0.45

<sup>1</sup> lb/MMBtu equals pounds of pollutant emitted per million British thermal units of heat input.

<sup>2</sup> lb/MMcf methane equals pounds of pollutant emitted per million cubic feet of methane input.

<b>Table 3-3 - Estimated Emissions from Landfill Operation Flare Combustion of 2,462.5 scfm of LFG</b>				
Pollutant	Emission Factor			Allowable Emissions tons per year
	Factor	Units	Source	
SO <sub>2</sub>	0.136	lb/MMBtu <sup>1</sup>	Site Specific Data - Application for #AOP-14-034	44.01
NO <sub>x</sub>	0.068		Vendor Supplied – Application for #AOP-14-034	22.00
PM	26	lb/MMcf methane <sup>2</sup>	AP-42, Municipal Solid Waste Landfills, Table 2.4-5 (11/98) plus PM emissions from siloxane combustion	8.53
CO	0.37	lb/MMBtu <sup>1</sup>	Vendor Supplied – Application for #AOP-14-034	119.72
VOC	2.00E-03		Site Specific Data - Application for #AOP-14-034	0.65
HAPs	6.90E-04			0.22

<sup>1</sup> lb/MMBtu equals pounds of pollutant emitted per million British thermal units of heat input.

<sup>2</sup> lb/MMcf methane equals pounds of pollutant emitted per million cubic feet of methane input.

### 3.2.2 Reciprocating Internal Combustion Engine Combustion Emissions

#### CAT 3520C Engines

Emissions of NO<sub>x</sub> for the CAT 3520C LE engines were based on emission guarantees provided by the engine manufacturer, and emissions of CO were based on the revised MSER for these engines, which is a not-to-exceed emission rate of 3.5 g/bhp-hr. Emissions of PM were estimated using November 2012 stack test data from Engine No. 5 at the LFGTE Operation. Emissions of SO<sub>2</sub> were estimated using site-specific total reduced sulfur (TRS) and hydrogen sulfide (H<sub>2</sub>S) analytical results from LFG samples collected on July 8, 2014.

With the exception of formaldehyde and acetaldehyde, VOC and HAP emissions were based on chemical analytical results from LFG collected in August 1993 and June 2002, and an assumed 98% destruction efficiency in the combustion devices at the Facility. Total LFG flow through the five (5) CAT 3520C LE engines is estimated at 2,537.5 scfm. Each engine is rated at 2,221 bhp for a total installed horsepower rating of 11,105 bhp. Chemical analytical results from the Landfill indicated that VOC concentrations in LFG were 4.99 E-05 lb VOC/scf of LFG, and HAP concentrations in LFG were 1.73E-05 lb HAPs/scf of LFG. Based on these assumptions, the VOC and HAP emission factor for the engines, (excluding formaldehyde) are 0.006 g/bhp-hr and 0.002 g/bhp-hr, respectively.

Formaldehyde and acetaldehyde are formed in the engines as a product of incomplete combustion, and the formaldehyde emissions in #AOP-14-034 and #AOP-15-032 were based on a formaldehyde emission factor of 5.28E-02 lb/MMBtu of heat input obtained from AP-42, *Chapter 3: Stationary Internal Combustion Sources, Section 3.2, Natural Gas-fired Reciprocating Engines, Table 3.2-2 Uncontrolled Emission Factors for 4-Stroke Lean-Burn Engines, (Supplement F, August 2000)*, and by assuming a fuel heat value of 500 Btu/scf, and an LFG supply rate to each engine of 507.5 scf of LFG. This results in an estimated emission factor for formaldehyde of 0.164 g/bhp-hr. The VOC and HAP emission factor for the engines including formaldehyde are therefore 0.170 g/bhp-hr and 0.166 g/bhp-hr, respectively. Acetaldehyde emissions were assumed to be negligible.

It was previously noted that the above emission factor for formaldehyde appears to have been less than those obtained for similar engines operating on LFG. To provide a better estimate of the VOC and HAP emission factors for the CAT 3520C engines at the LFGTE Operation, stack testing was performed in 2016. Results of this stack testing indicated that the formaldehyde emission factor for the CAT 3520C engines at the LFGTE Operation is 0.302 g/bhp-hr. The emissions of formaldehyde from the Facility have been re-estimated based on the measured formaldehyde emission factor of 0.302 g/bhp-hr. Acetaldehyde emissions from the CAT 3520C engines have also been included, based on the measured acetaldehyde emission factor of 0.005 g/bhp-hr.

Based on both the AP-42 emission factors and site-specific stack testing, the estimated emissions of a single HAP (formaldehyde) are greater than 10 tons per year, classifying the Facility as a major HAP source. In addition, based on the stack testing for formaldehyde, the emissions of total HAPs from the engines will be greater than 25 tons per year, classifying the Facility a major HAP source.



Estimated emissions from the CAT 3520C engines and emission factors used for these estimates are summarized in Table 3.4.

<b>Table 3-4 – Estimated Emissions from Five (5) CAT 3520C Engines Combustion of 2,462.5 scfm of LFG-</b>				
Pollutant	Emission Factor			Allowable Emissions tons per year
	Factor	Units	Source	
SO <sub>2</sub>	0.42	g/bhp-hr <sup>1</sup>	Site Specific Data - Application for #AOP-14-034	45.14
NO <sub>x</sub>	0.5		Vendor Supplied – Application for #AOP-14-034	53.62
PM	0.153		Site Specific Data - Application for #AOP-14-034	16.41
CO	3.5		MSER Limit for AOP-14-034	375.31
VOC	0.308		Site Specific Data - 2016 stack testing results	33.05
HAPs	0.304		Site Specific Data - 2016 stack testing results	32.61

<sup>1</sup> g/bhphr equals grams of pollutant emitted per brake horsepower hour at rated load and speed.

#### LFGTE Operation – Emergency Generator

Emissions for the approximately 140 bhp Perkins 1006-6TG engine powering the 100-kW emergency generator at the LFGTE operation were based on the engine being operated for 200 hours per year. Although the engine is allowed unrestricted hours of operation during actual emergencies, Agency policy for emissions estimation from emergency generators is to assume that emergency use would not exceed 100 hours per year. Engine readiness testing, operation for maintenance and similar activities are limited to 100 hours per year in the current permit.

Emission factors used to estimate emissions of SO<sub>2</sub>, NO<sub>x</sub>, CO, PM, VOCs, and HAPs from this engine were the emission factors for uncertified engines as described in *AP-42, Chapter 3, Stationary Internal Combustions Sources, Section 3.3 –Gasoline and Diesel Industrial Engines, (October 1996)*. The engine was assumed to be fueled with No. 2 diesel fuel containing a maximum of 0.05% by weight sulfur with a heating value of 140,000 Btu per gallon. Fuel consumption for the engine was estimated at 7 gallons per hour.

Estimated emissions for the Perkins 1006-6TG engine and emission factors used for these estimates are summarized in Table 3.5.

<b>Table 3-5 – Estimated Emissions from Perkins 1006-6TG engine 200 hours of Operation Annually-</b>				
Pollutant	Emission Factor			Allowable Emissions tons per year
	Factor	Units	Source	
SO <sub>2</sub>	1.01S <sup>1</sup>	lb/MMBtu <sup>2</sup>	AP-42, Chapter 3, Stationary Internal Combustion Sources, Section 3.3 <i>Stationary Internal Combustions Sources, Section 3.3 – Gasoline and Diesel Industrial Engines</i> Table 3.3-1 (10/1996)	0.005
NO <sub>x</sub>	4.41			0.42
PM	0.31			0.30
CO	0.95			0.09
VOC	0.36			0.03
HAPs	6.45E-03		AP-42, Chapter 3, Stationary Internal Combustion Sources, Section 3.3 <i>Stationary Internal Combustions Sources, Section 3.3 – Gasoline and Diesel Industrial Engines</i> , Table 3.3-2 (10/1996)	0.001

<sup>1</sup> S represents the weight % of sulfur in the oil. For example, if the fuel is 0.05% sulfur, then S=0.05

<sup>2</sup> lb/MMBtu represents pounds of pollutant emitted per million British thermal units of heat input to the engine.

### Landfill Operation – Non-Road Engine Emissions

A variety of non-road equipment is used at the Landfill Operation for internal haulage and placement and compaction of waste and cover materials. NEWSVT has indicated that estimated combustion of ULSD in this equipment from September 2016 to August 17 was approximately 127,437 gallons. Based on this usage, the extrapolated ULSD usage over a 12-month period, would be approximately 140,000 gallons. The aggregate rated horsepower of the non-road equipment fleet at the Facility has been estimated by the Agency as 5,246 bhp. Based on year of manufacture, emissions certifications on the non-road engines at the Facility range from uncertified engines to Tier 4 engines. Equipment used during construction operations would not be considered as they are a temporary emissions source and not part of the equipment used during typical Facility operations. Equipment registered for on-highway usage, regardless of the owner/operator of this equipment, would not be considered as part of the equipment associated with the Facility.

Allowable emissions for the non-road equipment fleet used for operations at the landfill were estimated by assuming the emissions for the non-road fleet, on average, would correspond to Tier 2 emission standards. A fuel consumption limit for the non-road equipment was established at 220,000 gallons per year, which is approximately 160 percent of the current fuel usage. These engines were assumed to be fueled with ultra-low sulfur diesel fuel containing a maximum of 0.0015% by weight sulfur with a heating value of 140,000 Btu per gallon. The engine efficiency for the non-road engine fleet was assumed to be 35.3%, which results in a total fuel consumption rate for the entire non-road fleet of 270 gallons per hour.

These emissions from non-road engines have always been present at the Facility but have not been accounted for in previous estimates of allowable emissions. Accordingly, these emissions have been included in the allowable emissions for the Facility but are not considered a modification.

<b>Table 3-6– Estimated Emissions from Non-Road Engines at Landfill Operation 220,000 gallons/year ULSD combustion-</b>				
Pollutant	Emission Factor			Allowable Emissions tons per year
	Factor	Units	Source	
SO <sub>2</sub>	1.01S <sup>1</sup>	lb/MMBtu <sup>2</sup>	AP-42, Chapter 3, Stationary Internal Combustion Sources, Section 3.3 <i>Stationary Internal Combustions Sources, Section 3.3 – Gasoline and Diesel Industrial Engines</i> Table 3.3-1 (10/1996)	0.02
NO <sub>x</sub>	4.8	g/bhp-hr <sup>3</sup>	40 CFR Part 89, Subpart B, Section.112 - Oxides of nitrogen, carbon monoxide, hydrocarbon, and particulate matter exhaust emission standards	22.62
PM	0.15			0.71
CO	2.6			12.25
VOC	--- <sup>4</sup>			--- <sup>4</sup>
HAPs	6.45E-03	lb/MMBtu <sup>2</sup>	AP-42, Chapter 3, Stationary Internal Combustion Sources, Section 3.3 <i>Stationary Internal Combustions Sources, Section 3.3 – Gasoline and Diesel Industrial Engines</i> , Table 3.3-2 (10/1996)	0.10

<sup>1</sup> S represents the weight % of sulfur in the oil. For example, if the fuel is 0.0015% sulfur, then S=0.0015

<sup>2</sup> lb/MMBtu represents pounds of pollutant emitted per million British thermal units of heat input to the engine.

<sup>3</sup> g/bhp-hr represents grams of pollutant emitted per each brake horsepower-hour of engine operation.

<sup>4</sup> VOC emissions for Tier 2 included in NO<sub>x</sub> emission factor.

### 3.3 Facility Greenhouse Gas (GHG) Emissions

The Facility has emissions of GHGs resulting from biological generation of CH<sub>4</sub> and CO<sub>2</sub> in the Landfill itself, and GHGs generated from the combustion of CH<sub>4</sub> contained in collected LFG. Biogenic CO<sub>2</sub> includes the CO<sub>2</sub> formed in the landfill and CO<sub>2</sub> resulting from the combustion of CH<sub>4</sub> formed in the Landfill. Emissions of CH<sub>4</sub> from the Landfill as fugitive emissions or as uncombusted CH<sub>4</sub> in the exhausts from the control devices (flares and/or CAT 3520C engines) is considered a non-biogenic emission. Nitrous oxide (N<sub>2</sub>O) is also formed during combustion processes and is considered a GHG. However, even considering the global warming potential of (GWP) of N<sub>2</sub>O which is approximately 298, the effect of N<sub>2</sub>O emissions on total GHG emissions were considered to be negligible, and accordingly were not estimated.

Emissions include actual CO<sub>2</sub> emissions, and emissions of CH<sub>4</sub> adjusted to CO<sub>2</sub> equivalent (CO<sub>2</sub>e). The GWP of CH<sub>4</sub> was assumed to be 25. Emissions of GHG's are presented in Table 3-7 for both total GHG emissions, and exclusive of biogenic CO<sub>2</sub> emissions.

<b>Table 3-7– Estimated Total Facility GHG Emissions <sup>1</sup></b>				
Emissions by Emissions Source (tons per year)	Pollutant			
	CO <sub>2</sub>	CH <sub>4</sub>	CO <sub>2</sub> e <sup>1</sup> (excluding biogenic <sup>2</sup> )	CO <sub>2</sub> e <sup>1</sup> (including biogenic <sup>2</sup> )
Fugitive Emissions	9,665	4,624	115,611	125,276
Flare Combustion Emissions	36,887	274	6,844	43,730
Collected CO <sub>2</sub> Emitted from Flare	28,606	---	---	28,606
LFGTE Engine Combustion Emissions	38,010	282	7,052	45,062
Collected CO <sub>2</sub> Emitted from LFGTE Engines	29,477	---	---	29,477
Non-Road Engine CO <sub>2</sub> e Emissions <sup>3</sup>	---	---	2,483	2,483
Total Estimated Emissions (tons/year	142,646	5,180	131,990	274,634
Total Estimated Emissions (tons/year CO <sub>2</sub> e)	142,646	129,507	131,990	274,634

<sup>1</sup> The CO<sub>2</sub>e value for CH<sub>4</sub> is based on a global warming potential (GWP) of 25. Thus, one ton of CH<sub>4</sub> has the equivalent effect on global warming of 25 tons of CO<sub>2</sub>.

<sup>2</sup> Biogenic CO<sub>2</sub> emissions exclude the emissions of CO<sub>2</sub> formed in the Landfill that are emitted as fugitive emissions or are emissions of uncombusted CO<sub>2</sub> emitted as part of the exhaust stream from a combustion process. Emissions of GHGs from combustion of CH<sub>4</sub> and fugitive CH<sub>4</sub> emissions are not considered biogenic. These emissions are converted to CO<sub>2</sub>e using the appropriate GWP and reported as CO<sub>2</sub>e emissions for the Facility.

<sup>3</sup> The CO<sub>2</sub>e emissions for fuel combustion in non-road engines is based on the default CO<sub>2</sub>e emission factor of 22.57 lb CO<sub>2</sub>e/gallon for No. 2 diesel combustion, which includes the CO<sub>2</sub>e for CH<sub>4</sub> and N<sub>2</sub>O resulting from the combustion of diesel fuel.

### 3.4 Combined Facility Emissions

Emissions from the Facility for fugitive LFG emissions and for both combustion scenarios (all LFG through the flares / all five CAT 3520C engines running at full capacity with the balance of LFG through a flare) are tabulated in Table 3-8. The scenario that resulted in the greatest emissions for each individual pollutant was used to establish allowable emissions.

The aggregated emissions of VOCs and HAPs from fugitive landfill emissions are also presented in this table and are included in the proposed allowable emissions. Emissions of individual HAPs/HACs from the Facility are discussed in greater detail in Section 7.

<b>Table 3-8 – Estimated and Allowable Emissions Summary (ton/yr)</b>						
<b>Activity</b>	<b>PM / PM<sub>10</sub>/PM<sub>2.5</sub><sup>1</sup></b>	<b>SO<sub>2</sub><sup>2</sup></b>	<b>NO<sub>x</sub></b>	<b>CO</b>	<b>VOC<sup>3</sup></b>	<b>HAP</b>
Fugitive Emissions - Landfill	---	---	---	---	<b>10.91</b>	<b>3.77</b>
Combustion Emissions						
Scenario A:						
All Collected LFG Combusted in Flares	17.31	<b>89.35</b>	44.68	243.09	1.31	0.45
Non-Road Engines at Landfill Operation.	0.71	0.023	22.62	12.25	0.00	0.099
Scenario B:						
All 5 Engines Operating,	<b>16.41</b>	45.14	<b>53.62</b>	<b>375.31</b>	<b>33.59</b>	<b>33.15</b>
Balance of LFG Combusted in Flare(s)	<b>8.53</b>	44.01	<b>22.00</b>	<b>119.72</b>	<b>0.65</b>	<b>0.22</b>
LFGTE Operation Emergency Engine	<b>0.03</b>	0.005	<b>0.42</b>	<b>0.09</b>	<b>0.03</b>	<b>0.001</b>
Non-Road Engines at Landfill Operation.	<b>0.71</b>	<b>0.023</b>	<b>22.62</b>	<b>12.25</b>	<b>0.00</b>	<b>0.099</b>
Total Estimated Emissions	25.67	89.38	98.66	507.38	45.18	37.25
<b>Allowable Emissions<sup>3</sup></b>	<b>20.5</b>	<b>&lt;40</b>	<b>99</b>	<b>507</b>	<b>&lt;50</b>	<b>&gt;10/25</b>

<sup>1</sup> The Agency and Permittee have proposed to limit allowable PM emissions to less than 20.5 tpy.

<sup>2</sup> Values for SO<sub>2</sub> emission between Scenario A and Scenario B are not equal because of rounding errors related to emission factors. The Permittee has proposed to limit allowable SO<sub>2</sub> emissions <40 tons per year.

<sup>3</sup> The Agency and Permittee have proposed to limit allowable VOC emissions <50 tons per year.

#### 4.0. APPLICABLE REQUIREMENTS

Pursuant to §5-1006(e)(4) of the *Regulations*, the Owner and/or Operator of a stationary air contaminant source applying for a Permit to Operate is required to identify and certify compliance with all applicable state and federal air pollution control requirements before a permit may be issued. These requirements include state and federal regulations, state statutes, the federal Clean Air Act, and the requirements of any construction permit issued under 10 V.S.A. §556 and §5-501 of the *Regulations*. Applicable federal regulations may include Federal New Source Performance Standards (NSPS) or National Emission Standards for Hazardous Air Pollutants (NESHAP) found in 40 CFR, Parts 60, 61, and 63. The applicable requirements and the Agency's findings are presented below. Applicability of §5-261 (Control of Hazardous Air Contaminants) is discussed separately under Section 8 below.

The Agency will assess compliance with these regulations during any inspections of the Facility. The inspections will include confirmation of the proper operation and maintenance of equipment and air pollution control devices, visual observations of emission points, and review of any records required by the Permit

#### **4.1 Vermont Air Pollution Control Regulations and Statutes**

**§§5-201, 5-202, and 5-203 - Open Burning Prohibited.** "No person shall engage in any open burning except in conformity with the provisions of Section 5-201, 5-202, and 5-203".

Based on the application submittal, and information available to the Agency, no open burning is conducted at the Facility.

**§5-211(1) - Prohibition of Visible Air Contaminants - Installations constructed prior to April 30, 1970.** "No *person* shall cause, suffer, allow or permit the *emission* of any visible *air contaminant* from installations constructed prior to April 30, 1970, for more than a period or periods aggregating six (6) minutes in any hour, which has a shade, or density, greater than 40% *opacity* (No. 2 on the *Ringelmann Chart*). At no time shall the visible *air contaminants* have a shade, density, or appearance greater than 60% *opacity* (No. 3 of the *Ringelmann Chart*)."

These emission standards do not apply to the Facility, as the entire Facility was constructed subsequent to 1970.

**§5-211(2) - Prohibition of Visible Air Contaminants - Installations constructed subsequent to April 30, 1970.** "No *person* shall cause, suffer, allow or permit the *emission* of any visible *air contaminant* from installations constructed subsequent to April 30, 1970, for more than a period or periods aggregating six (6) minutes in any hour, which has a shade, or density, greater than 20% *opacity* (No. 1 of the *Ringelmann Chart*). At no time shall the visible *air contaminants* have a shade, density, or appearance greater than 60% *opacity* (No. 3 of the *Ringelmann Chart*)."

These emission standards apply to all installations at the Facility as the entire Facility was constructed subsequent to 1970. The applicant is anticipated to comply with these emission standards based on proper equipment design, operation and maintenance.

Any emission testing conducted to demonstrate compliance with the above emission limits shall be performed in accordance with 40 *CFR* Part 51, Appendix M, Methods 203B and 203C, respectively, or equivalent methods approved in writing by the Agency

**§5-221(1)(a) - Prohibition of Potentially Polluting Materials in Fuel.** "No person shall cause or permit the use, purchase, or sale for use in stationary combustion installations within the State of Vermont for heat or power generation of:

- (i) , *fuels* containing more than 2.0% sulfur by weight, except as otherwise provided below;
- (ii) No. 2 and lighter distillate oils and animal and vegetable fuel oils with a sulfur content greater than 0.05% by weight beginning on July 1, 2014, and ending on June 30, 2018;
- (iii) No. 2 and lighter distillate oils and animal and vegetable fuel oils with a sulfur content greater than 0.0015% by weight, beginning on July 1, 2018"
- (iv) No. 4 residual oil with a sulfur content greater than 0.25% by weight, beginning on July 1, 2018; and
- (v) No. 5 and No. 6 residual oils and heavier residual oils and *used oils* with a sulfur content greater than 0.5% by weight, beginning on July 1, 2018.

Compliance with this standard is based on fuel analyses following the procedures prescribed by the American Society of Testing Materials ("ASTM").

This regulation applies to all stationary fuel burning equipment at the Facility including the five (5) CAT G3520C LE engines fired with LFG, all LFG flares, the No. 2 fuel oil and used oil fired space heating units, and the backup generator at the LFGTE Operation.

The Permittee is anticipated to comply with this regulation, as anticipated sulfur concentrations in LFG will be regularly monitored to maintain SO<sub>2</sub> emissions at less than 40 tons per year, and with this limitation, the LFG will be less than 2.0 percent sulfur by weight. Permit conditions will restrict the sulfur content of No. 2 distillate fuel and used oil combusted at the Facility to comply with the limits contained in this regulation.

**§5-221(2)(g) - Prohibition of Potentially Polluting Materials in Fuel – Used Oil – Small Fuel Burning Equipment.** "Any person operating or owning fuel burning equipment used for space heating shall be permitted to burn used oil and is exempted from this section and Section 5-261 of these regulations, provided that:

- (i) The maximum operating heat input of all fuel burning equipment designated for burning used oil at a single location aggregates to no more than 500,000 BTU per hour; and
- (ii) The used oil has properties and constituents within the allowable limits set forth in Table A prior to blending; and
- (iii) Emissions of visible air contaminants from the equipment comply with Section 5-211(2) of these regulations; and
- (iv) The user complies with the requirements of Subchapter 8 of the Vermont Hazardous Waste Management Regulations; and
- (v) All fuel burning equipment must vent to the outside atmosphere in a manner as not to impede the upward dispersion of the exhaust.

**TABLE A: USED OIL CONSTITUENTS AND PROPERTIES**  
(Prior to Blending)

Constituent/Property	Allowable
Polychlorinated Biphenyls (PCBs)	< 2 ppm maximum <sup>1</sup>
Total Halogens	1000 ppm maximum
Arsenic	5 ppm maximum
Cadmium	2 ppm maximum
Chromium	10 ppm maximum
Chlorine	500 ppm maximum
Lead	100 ppm maximum
Net Heat of Combustion	8000 BTU/lb minimum
Flash Point	140 degrees F minimum
<sup>1</sup> Note: units of parts per million (ppm) are by weight on a water free basis.	

The used oil furnaces at the Landfill Operation are subject to these standards for burning used oil. The heat input rating of the furnaces is less than the maximum 500,000 MMBtu heat input rating for this type of equipment and a permit condition will require that used oil burned in the furnaces will comply with the limitations for used oil presented in Table A.

Based on the information available to the Agency, the Facility is currently in compliance with this regulation.

**§5-231(2) - Prohibition of Particulate Matter; Incinerator Emissions.** An "Incinerator" is defined in §5-101 of the Regulations as "any structure or furnace in which combustion takes place, the primary purpose of which is the reduction in volume and weight of an unwanted material." The landfill utility flares may be considered such a device. The CAT 3520C LE engines at the LFGTE Operation are used to produce power, and accordingly are not regulated as incinerators in accordance with §5-231(2)(d).

PM emission limits for incinerators with a charging rate of less than 50 tons per day are defined §5-231(2)(a), and this limit is 0.1 pounds of PM per 100 pounds of refuse burnt (0.001 lb PM/pound refuse combusted). Incinerators with a charging rate of greater than 50 tons per day are limited to *emissions of particulate matter* not exceeding 0.08 grains per dry standard cubic foot corrected to 12 percent carbon dioxide.



The estimated LFG mass flowrate (assuming 50 percent CH<sub>4</sub>, 38 percent CO<sub>2</sub>, and 12 percent N) to the two flares for a flowrate of 5,000 scfm of LFG is approximately 21,000 pounds per hour, or approximately 10.5 tons per hour total for the two flares. Accordingly, the LFG flowrate through each flare would be approximately 5.8 tons per hour, which is greater than 50 tons per day. PM emissions from both flares at the emission limit of 17 lb/MMcf of CH<sub>4</sub> at a flowrate of 5,000 scfm are estimated to be 2.55 pounds per hour, and flare emissions have been estimated to be approximately 55,000 scfm. This would result in an emission rate of approximately 0.05 gr/dscf of exhaust gas. Accordingly, the emissions from the flares are anticipated to comply with this regulation.

**§5-231(3)(a) - Prohibition of Particulate Matter; Combustion Contaminants.** "A person shall not discharge, cause, suffer, allow or permit the *emission of particulate matter* caused by the combustion of *fossil fuel* in *fuel burning equipment* from any *stack* or chimney in excess of the following *emission* limits:

- (i) 0.5 pounds per hour per million BTUs of *heat input* in combustion installations where the *heat input* is 10 million BTUs or less per hour.
- (ii) For combustion installations where the *heat input* is greater than 10 million BTUs per hour, but where the *heat input* is equal to or less than 250 million BTUs per hour, the applicable limit is determined by using the following formula:

$$E_{PM} = 10^{[-0.47039(\log_{10} HI)+0.16936]}$$

where:

$E_{PM}$  - is the *particulate matter emission* limit, expressed to the nearest hundredth pound per hour per million BTUs; and

HI - is the *heat input* in millions of BTUs per hour."

Compliance with this emission standard shall be determined in accordance with 40 CFR, Part 60, Appendix A, Reference Method 5 or an alternative method approved in writing by the Agency.

This emission standard applies to the No. 2 fuel oil and used oil fired heating units, and the emergency generator at the Facility, which have a heat input of less than 10 MMBtu/hr, and consequently an emission limitation of 0.5 pounds per hour per MMBtu of heat input will apply to these heating units.

The Agency has previously determined that the utility flares and CAT G3520C engines at the Facility are not subject to this requirement, as LFG is not a *fossil fuel*, and the Facility is shielded from this requirement.

**§5-231(4) - Prohibition of Particulate Matter; Fugitive Particulate Matter.** "A *person* shall not cause, suffer, allow, or permit any process operation to operate that is not equipped with a *fugitive particulate matter* control system. A *person* shall not cause, suffer, allow, or permit any materials to be handled, transported, or stored; or a building, its appurtenances, or a road to be used, constructed, altered, repaired or demolished without taking reasonable precautions to prevent *particulate matter* from becoming airborne. Public roads will not be subject to this section unless a public nuisance is created."

This requirement applies to the entire Facility, and the Facility is therefore anticipated to comply with the fugitive emission limitations of this section.

**§5-241(1) and (2) - Prohibition of Nuisance and Odor.** "A *person* shall not discharge, cause, suffer, allow, or permit from any source whatsoever such quantities of *air contaminants* or other material which will cause injury, detriment, nuisance or annoyance to any considerable number of people or to the public or which endangers the comfort, repose, health or safety of any such *persons* or the public or which causes or has a natural tendency to cause injury or damage to business or property. A *person* shall not discharge, cause, suffer, allow, or permit any *emissions* of objectionable *odors* beyond the property line of a premises."

Based on the application submittal and information available to the Agency, the Facility is currently in compliance with this regulation.

**§5-253.14- Solvent Metal Cleaning.** This subsection shall apply to any solvent metal cleaning equipment, and contains several requirements designed to minimize the generation of VOCs from such equipment. Specifications are listed within this section for air pollution control devices and work practice standards.

Any solvent metal cleaning equipment operated at the Facility for equipment cleaning is subject to the standards for cold cleaning operations. Based on the information available to the Agency, the Facility is currently in compliance with this regulation

**§5-403 - Circumvention.** "No Person shall build, erect, install or use any article, machine, equipment or other contrivances, the use of which, without resulting in a reduction in the total release of air contaminants to the atmosphere, reduces or conceals an emission which otherwise would constitute a violation of these regulations."

Based on the application submittal and information available to the Agency, the Facility is currently in compliance with this regulation.

**Subchapter VIII - Registration of Air Contaminant Source.** "Each *operator* of a *source* which emits more than five *tons* of any and all *air contaminants* per year shall register the *source* with the *Secretary*, and shall renew such registration annually."

Each Permittee will be responsible for registering their emissions from the Facility that are described in their individual Permits. NEWSVT and CCEC have each been registering their portion of Facility emissions with the Agency annually.

#### 4.2. Federal Air Pollution Control Regulations and the CAA

Section 111 of the Clean Air Act establishes New Source Performance Standards (NSPS). NSPSs apply to new sources, and are promulgated under 40 CFR, Part 60. Section 112 of the Clean Air Act establishes National Emission Standards for Hazardous Air Pollutants (NESHAPs). NESHAPs are promulgated under 40 C.F.R. Part 61 and Part 63, and may apply to new or existing sources. Potentially applicable NSPSs, NESHAPs, and other Federal air quality regulations are summarized in Table 4-2.

<b>Table 4-2 Review of Requirements from Federal Regulations and the Clean Air Act</b>
<p>40 CFR Part 60 Subpart Cc – Emission Guidelines for Municipal Solid Waste Landfills. Applies to existing landfills having a design capacity greater than or equal to 2.5 million megagrams by mass and 2.5 million cubic meters by volume which commenced construction, modification, or reconstruction before May 30, 1991, and that have accepted waste at any time since November 8, 1987 or have additional capacity for future waste deposition.</p> <p><i>Emission guidelines are not directly applicable requirements to a facility but rather establish the framework on which a state must adopt a regulation to implement the respective requirements. Vermont has no landfills applicable to these Subpart Cc guidelines and has thus not adopted regulations to implement them. The Landfill Operation was modified subsequent to May 30, 1991 to increase its capacity, thus becoming subject to 40 CFR Part 60 Subpart WWW instead of the Subpart Cc emission guidelines.</i></p>
<p>40 CFR Part 60, Subpart Cf - Emission Guidelines and Compliance Times for Municipal Solid Waste Landfills. Applies to existing landfills having a design capacity greater than or equal to 2.5 million megagrams by mass and 2.5 million cubic meters by volume which commenced construction, reconstruction, or modification on or before July 17, 2014.</p> <p><i>Emission guidelines are not directly applicable requirements to a facility but rather establish the framework on which a state must adopt a regulation to implement the respective requirements. While the Landfill Operation meets the applicability criteria for the Subpart Cf guidelines, the Agency, in consultation with the US EPA, has deferred adoption of an implementing regulation at this time since the Facility is currently in compliance with the substantive requirements of the guidelines and has proposed a modification to the Facility that upon commencement of construction of that modification will become subject to 40 CFR Part 60 Subpart XXX and no longer be applicable to the guidelines. Should the Permittee not commence construction of the modification in a reasonable period of time, the Agency may pursue adoption of the emission guidelines in the future.</i></p> <p><i>Compliance with these guidelines will be addressed by complying with the requirements of 40 CFR Part 60, Subpart WWW, until actual construction has commenced on the Phase VI expansion on Landfill Operation. At the time construction is commenced on Phase VI, the Landfill Operation will have been modified subsequent to July 17, 2014 to increase its capacity and will become subject to 40 CFR Part 60 Subpart XXX.</i></p>

**Table 4-2 Review of Requirements from  
Federal Regulations and the Clean Air Act**

40 CFR Part 60, Subpart Kb - Standards of Performance for Volatile Organic Liquid Storage Vessels (Including Petroleum Liquid Storage Vessels) for Which Construction, Reconstruction, or Modification Commenced after July 23, 1984. Applicability: The affected facility to which this subpart applies is each storage vessel with a capacity greater than or equal to 75 m<sup>3</sup> (19,804 gal) that is used to store volatile organic liquids (including petroleum). This subpart does not apply to the following:

1. Any storage vessel with a capacity less than 75 m<sup>3</sup>
2. Any storage vessel storing a liquid with a vapor pressure less than 3.5 kPa
3. Any storage vessel with a capacity > 75 m<sup>3</sup> and <151 m<sup>3</sup> with a v.p. <15.0 kPa
4. Pressure vessels >29.7 psi and without emissions to the atmosphere.
5. Vessels permanently attached to mobile vehicles.
6. Vessels located at bulk gasoline plants.
7. Vessels located at gasoline service stations.

For affected facilities, there are recordkeeping requirements and depending upon the material stored there may be standards for the tank's vent system.

*The storage tanks at the Facility are used to store No. 2 fuel oil, new and used engine oil, ethylene glycol, and landfill leachate, all of which have a vapour pressure of less than 3.5 kPa. Accordingly, the Facility has no storage tanks subject to this regulation.*

40 CFR Part 60, Subpart WWW - Standards of Performance for Municipal Solid Waste Landfills. §60.752 Standards - Requires landfill gas collection and control system. §60.753 Operational Standards - Operational requirements of the gas collection and control system. Applicable to all MSW landfills with a design capacity of 2.5 million mega-grams (Mg) or greater, however the requirement to install the landfill gas collection and control system is only required once uncontrolled emissions of nonmethane organic compounds (NMOCs) from the landfill equal or exceed 50 Mg/year.

*The Facility is subject to this regulation. The Landfill Operation has an existing design capacity (unlined through Phases IV) of 7,650,477 Mg and Phase V will add an additional capacity of 1,854,738 Mg. Uncontrolled NMOC emissions were predicted to first exceed 50 Mg in the year 2001. The Facility is also subject to this regulation by virtue of it being subject to the requirements of 40 CFR Part 63, Subpart AAAA.*

*Subpart AAAA requires that the Facility comply with Subpart WWW, or an EPA approved and effective state plan that implements 40 CFR, Part 60, Subpart Cc. As Vermont does not have a state plan that implements 40 CFR, Part 60, Subpart Cc, the Facility must comply with Subpart WWW. At the time construction is commenced on Phase VI, the Landfill Operation will have been modified subsequent to July 17, 2014 to increase its capacity and will become subject to 40 CFR Part 60 Subpart XXX.*

40 CFR Part 60, Subpart XXX - Standards of Performance for Municipal Solid Waste Landfills That Commenced Construction, Reconstruction, or Modification After July 17, 2014. Requires landfill gas collection and control system. §60.762 Standards for air emissions from municipal solid waste landfills. Applicable to all MSW landfills with a design capacity of 2.5 million mega-grams (Mg) or greater, however the requirement to install the landfill gas collection and control system is only required once uncontrolled emissions of nonmethane organic compounds (NMOCs) from the landfill equal or exceed 34 Mg/year

*The Facility will become subject to this regulation at the time construction is commenced on Phase VI of the Landfill Operation. The Landfill Operation has an existing design capacity (unlined through Phases IV) of 7,650,477 Mg and Phase V will add an additional capacity of 1,854,738 Mg. Uncontrolled NMOC emissions were predicted to first exceed 34 Mg prior to 2001.*

**Table 4-2 Review of Requirements from  
Federal Regulations and the Clean Air Act**

40 CFR Part 60, Subpart IIII - Standards of Performance for Stationary Compression Ignition Internal Combustion Engines (CI ICE). Applies to CI RICE model year 2007 and later as well as those ordered after July 11, 2005 and with an engine manufacture date after April 1, 2006. This standard also applies to stationary CI RICE that are modified or reconstructed after July 11, 2005. This regulation established emission rates for affected engines, requires routine engine maintenance and sets maximum sulfur content for the diesel fuel. Beginning October 1, 2010 applicable engines shall only use diesel fuel with a maximum sulfur content of 15 ppm (ULSD).

*This regulation is not applicable to the CAT 3520C engines at the LFGTE Operation as these engines are spark ignition rather than compression ignition. Subpart IIII is not applicable to the Perkins 1006-6TG engine powering the emergency generator at the LFGTE Operation. The engine was not ordered after July 11, 2005 and was manufactured before April 1, 2006.*

40 CFR Part 60, Subpart JJJJ - Standards of Performance for Stationary Spark Ignition Internal Combustion Engines. Applies to new spark ignition engines ordered after June 12, 2006 AND manufactured on or after July 1, 2007.

*Engines No 1, 2, and 3 were ordered before June 12, 2006, and manufactured before July 1, 2007, and therefore are not subject to this regulation.*

*Engine No. 4 was ordered after June 12, 2006 (order date Nov.6, 2006) but the engine was manufactured before July 1, 2007 (build date Oct. 26, 2006), and was delivered on January 12, 2007. Accordingly, this engine is not subject to Subpart JJJJ.*

*Engine No. 5 was delivered on June 17, 2009 and Subpart JJJJ applies to this engine.*

40 CFR Part 61, Subpart M - National Emission Standards for Hazardous Air Pollutants: National Emission Standard for Asbestos. Applies to: the owner or operator of a demolition or renovation activity, including regulated asbestos-containing material (RACM) demolition and renovation operations, which are regulated under §61.145 of this Subpart. Waste generated from these activities shall be disposed on in accordance with the requirements of §61.150 of this Subpart. Waste disposal facilities receiving waste that is to be disposed of in accordance with §61.150 of this Subpart shall be operated in accordance with the provisions of §61.154 of this Subpart.

Waste disposal facilities subject to this rule, shall be operated with no visible emissions to the outside air from areas of RACM disposal, or shall have barriers and signage restricting access to areas of RACM disposal, or shall cover areas of RACM disposal on a daily basis. Waste disposal facilities receiving RACM shall also maintain records of material receipt and shall submit records to the Administrator identifying areas of RACM disposal upon closure of the landfill and shall notify the Administrator prior to disturbing areas of RACM disposal.

*Subpart M is anticipated to apply to the Facility, specifically to disposal of RACM at the Landfill Operation*

**Table 4-2 Review of Requirements from  
Federal Regulations and the Clean Air Act**

40 *CFR* Part 63, Subpart AAAA - National Emission Standards for Hazardous Air Pollutants: Municipal Solid Waste Landfills. §63.1955 Standards - Requires gas collection and control system meeting the same standards as 40 *CFR* Part 60, Subpart WWW by referencing such. Applicable to all MSW landfills that are (1) a major source of Hazardous Air Pollutants (HAPs), or (2) are collocated with a major source of HAPs, or (3) are an area source with a design capacity of 2.5 million megagrams (Mg) or greater and have estimated uncontrolled emissions of NMOCs equal to or greater than 50 Mg/year.

*The Facility is subject to this regulation. The Landfill Operation is not a major source of HAPs but is collocated with the LFGTE Operation which is a major source of HAPs and the Landfill Operation has a design capacity of 2.5 million Mg or greater and has estimated uncontrolled emissions of NMOCs greater than 50 Mg/year.*

*Subpart AAAA requires that the Facility comply with Subpart WWW, or an EPA approved and effective state plan that implements 40 *CFR*, Part 60, Subpart Cc. As Vermont does not have a state plan that implements 40 *CFR*, Part 60, Subpart Cc, the Facility must comply with Subpart WWW. At the time construction is commenced on Phase VI, the Landfill Operation will have been modified subsequent to July 17, 2014 to increase its capacity, and will also become subject to 40 *CFR* Part 60 Subpart XXX.*

40 *CFR* Part 63, Subpart ZZZZ - National Emission Standards for Hazardous Air Pollutants for Reciprocating Internal Combustion Engines. Applies to new engines >500 hp that commenced construction (installed) on or after December 19, 2002 at major sources of HAPs. Also applies to existing engines of greater than 500 bhp that commenced construction (installed) prior to December 19, 2002 located at major HAP sources. Engines <500 hp that are located at major sources of HAPs are considered existing if they were installed before June 12, 2006.

A new or reconstructed stationary RICE with a site rating of more than 500 brake HP located at a major source of HAP emissions which combusts landfill or digester gas equivalent to 10 percent or more of the gross heat input on an annual basis must meet the initial notification requirements of §63.6645(f) and the requirements of §§63.6625(c), 63.6650(g), and 63.6655(c). These stationary RICE do not have to meet the emission limitations and operating limitations of Subpart ZZZZ.

An existing emergency-use only stationary RICE with a rating of < 500 hp located at a major source of HAP emissions is subject to maintenance requirements, and must install an elapsed hour meter.

*Engines No 1, 2, and 3 were installed at the Facility in March 2005, making the facility a major HAP source since HAP emissions from these three engines combined likely exceeded the 10 ton per year emission of a single HAP (formaldehyde). Thus, these three engines are subject to the new engine requirements of a major HAP source under Subpart ZZZZ.*

*Engine No. 4 was delivered on January 12, 2007 and Subpart ZZZZ at that time required new engines to comply with NSPS Subpart JJJJ. However, the applicability of NSPS Subpart JJJJ was written to apply to engines manufactured on or after July 1, 2007. Thus, Subpart ZZZZ applies to this engine but has no applicable requirements and the engine is not subject to NSPS Subpart JJJJ.*

*Engine No. 5 was delivered on June 17, 2009 and complies with the requirements of Subpart ZZZZ by conforming to the requirements of 40 *CFR* Part 60, Subpart JJJJ.*

*The Perkins 1006-6TG engine powering the emergency generator at the LFGTE Operation was installed before June 12, 2006, and is rated at approximately 140 hp. This engine is considered an existing emergency-use only stationary RICE < 500 bhp, and must install an elapsed hour meter, and is subject to maintenance requirements including changing oil & filter and, inspecting and replacing, if necessary, air filter, hoses and belts.*

**Table 4-2 Review of Requirements from  
Federal Regulations and the Clean Air Act**

Clean Air Act §§114(a)(3) Inspections, Monitoring and Entry; 502(b) Permit Programs; and 504(a)-(c) Permit Requirements and Conditions; 40 *CFR* Part 64 Compliance Assurance Monitoring; 40 *CFR* Part 70 §§70.6(a)(3)(i)(B) and 70.6(c)(1) State Operating Permit Programs - Permit content. Upon renewal of a Title V Permit to Operate, a facility must comply with enhanced monitoring and compliance assurance monitoring requirements if applicable. The CAM rule applies to each Pollutant Specific Emission Unit (PSEU) at a major source that is required to obtain a part 70 or part 71 permit if the unit satisfies all of the following criteria: **1)** The unit is subject to an emission limitation or standard for the applicable regulated air pollutant other than an emissions limitation or standard that is exempt under §64.2(b)(1) [exempt limitations include emission limitations or standards proposed by the Administrator after November 15, 1990 pursuant to Section 111 or 112 of the Act], **2)** The unit uses a control device to achieve compliance with any such limit or standard; and **3)** The unit has pre-control device emissions of the applicable regulated pollutant that are equal to or greater than 100 percent of the amount, in tons per year, required for a source to be classified as a major source.

*The CAM rule applies to the CAT 3520C engines and flares at the Facility. The engines and flares are be considered an emission control device for VOCs. CAM is being established as continuous monitoring for the presence of a flame on the flares when they are combusting LFG and continuous monitoring and recording of engine exhaust temperature and compliance testing at least once every two years for combustion efficiency of 98% or outlet NMOC concentration of 20 ppmvd and CO emission rate.*

Clean Air Act §112r Prevention of Accidental Release; 40 *CFR* Part 68 Chemical Accident Prevention Programs. Facilities that have more than the threshold quantity of a regulated substance in a process are subject to these provisions including the requirements to conduct a hazard assessment, establish a prevention program and develop a risk management plan.

*The Permittees have stated that neither Operation at the Facility stores greater than the threshold quantity of a regulated substance and thus is not subject to these requirements.*

Clean Air Act §608; 40 *CFR* Part 82, Subpart F – Recycling and Emissions Reductions. This requirement is applicable to any facility that owns, services, maintains, repairs, and disposes of appliances containing ozone depleting substances.

*This regulation is applicable to handling of material disposed of at the Landfill Operation that contains ozone depleting substances, and Trane RTAA 125-ton rotary chiller at the LFGTE Operation.*

40 *CFR* Part 98 Mandatory Greenhouse Gas Reporting. Requires reporting of GHG emissions annually to EPA for **1)** facilities in source categories listed in §98.2(a)(1) including electric utility units subject to Acid Rain, MSW landfills that generate CH<sub>4</sub> in amounts equivalent to 25,000 metric tons of CO<sub>2</sub>e or more per year and electrical transmission and distribution equipment at facilities where the total nameplate capacity of SF<sub>6</sub> and PFC containing equipment exceeds 17,820 pounds, **2)** facilities in source categories listed in §98.2(a)(2) including electronics manufacturing, iron and steel production and pulp and paper manufacturing that emit 25,000 metric tons of CO<sub>2</sub>e or more per year from such source categories as well as all stationary combustion, **3)** facilities with stationary combustion sources that aggregate to 30 MMBTU/hr or more and which emit 25,000 metric tons of CO<sub>2</sub>e or more per year from all stationary combustion sources combined, and **4)** fuel suppliers including all local natural gas distribution companies.

*The U.S. EPA has retained the implementing authority for this regulation and is responsible for determining applicability. This regulation under Part 98 is not considered to be an applicable requirement per 40 *CFR* Part 70.2 and as noted in 74 *FR* 56260 (October 30, 2009). Part 98 is anticipated to apply to the Landfill Operation at the Facility and NEWSVT has been reporting emissions for applicable years.*

**C. Non-Applicable Requirements for Which a Permit Shield Provision Has Been Requested**

Pursuant to §5-1015(a)(14) of the *Regulations*, the Owner/Operator may request a *permit shield* from specific state or federally enforceable regulations and standards which are not applicable to the source.

The Permittee has requested a permit shield with respect to several potentially applicable requirements. The Agency has reviewed this request and is hereby granting a permit shield in accordance with §5-1015(a)(14) of the *Regulations* for the following requirements which have been determined not to be applicable to the Facility based on the information provided by the Permittee.

<b>Table 4-3 Non-Applicable Requirements for which a Permit Shield is Granted</b>
§5-231(1) - Prohibition of Particulate Matter: Industrial Process Emissions. The Agency has determined that the combustion of LFG is not considered an industrial process since gaseous fuels are not considered part of the <i>process weight</i> input into a process. Therefore, the combustion of LFG is not subject to this regulation
§5-231(3) - Prohibition of Particulate Matter: Combustion Contaminants. The Agency has determined that LFG is not a <i>fossil fuel</i> under the definition in the <i>Regulations</i> therefore this regulation is not applicable to flares or engines that combust LFG. However, the other fuel burning equipment at the facility including the No.2 fuel oil space heating units, the used oil furnace, and the backup generator at the LFGTE Operation are subject.
§5-241(3) - Prohibition of Nuisance and Odor: Control of Odors from Industrial Processes. While the Facility is subject to §5-241(1) and (2), the Agency has not previously classified all landfills as industrial processes subject to §5-241(3) and does not currently consider the Facility subject to this regulation. However, in order to ensure compliance with other applicable requirements for this Facility, most of these emission control measures are required under separate authority.
§5-271 - Control of Air Contaminants from Stationary Reciprocating Internal Combustion Engines.  The Agency has determined that landfill gas is not a fossil fuel under the definition in the <i>Regulations</i> , and therefore this regulation is not applicable to engines that combust landfill gas

**5.0 CONTROL TECHNOLOGY REVIEW FOR MAJOR SOURCES AND MAJOR MODIFICATIONS**

Pursuant to §5-502 of the *Regulations* each new major source and major modification must apply control technology adequate to achieve the Most Stringent Emission Rate ("MSER") with respect to those air contaminants for which there would be a major or significant emission increase, respectively.

The proposed project is designated as a non-major modification of a stationary source and therefore is not subject to review under the MSER requirements in §5-502 of the *Regulations*.



The original MSER, established in #AOP-03-044 and re-established under #AOP-06-060, limited CO emissions from the CAT 3520C engine to 2.75 g/bhp-hr at all times. This MSER was not achievable in practice, due to siliceous material deposition in the combustion chambers of the CAT 3520C LE engines from the combustion of siloxanes contained in the LFG. As these siliceous deposits accumulate over time, they degrade the emission characteristics of the engine. The engine manufacturer recommends annual removal of these deposits from the engine components followed by a more extensive on-site in-frame cleaning every three years and an even more extensive off-site overhaul every 6 years. The standard annual cleaning is anticipated to reduce carbon monoxide emissions to 3.1 g/bhp-hr or less but it is not until the 6 year cleaning that emissions are anticipated to reliably achieve compliance with the like-new 2.75 g/bhp-hr emission limit for CO.

Treatment options for the combustion gases are generally not practicable, as the siliceous deposits from siloxane combustion would likely render any catalytic control device ineffective. Based on the Agency's understanding of the capabilities of the proposed SRS, the Agency has determined the installation of any pollution control equipment downstream of the engines would be inappropriate at this time, as there is still sufficient uncertainty regarding siloxane concentrations in LFG supplied to the engines, and the subsequent effects of these combusted siloxanes on pollution control equipment used for treatment of the engine exhaust. Accordingly, the MSER for CO emissions from the CAT 3520C LE engines was revised under #AOP-14-034 and #AOP-15-032, and is reaffirmed under these permits. This MSER as follows:

- 3.5 g/bhp-hr and 17.3 lb/hr (each) applies at all times
- 3.1 g/bhp-hr and 15.3 lb/hr (each) must be demonstrated every two years. The permit may not require each engine to be tested each year in which case the results of those being tested will be considered representative of those not tested that year.
- 2.75 g/bhp-hr and 13.5 lbs/hour (each) must be demonstrated every 6 years

The MSER for NOx emissions from the CAT G3520C LE engines fired with LFG was established as 0.5 g/bhp-hr and 2.45 lb/hour for each engine on December 16, 2004 under #AOP-03-044. This MSER was not subject to further review under #AOP-14-034 and #AOP-15-032, or under these permits, as the actual NOx emission rates had changed since the original MSER for NOx emission was established.

The MSER for CO for the John Zink flare at the Landfill Operation was previously established as 0.37 lb/MMBtu on December 16, 2004 under #AOP-03-044 and under #AOP-14-034 and #AOP-15-032 is reaffirmed under these permits. Similarly, the MSER for NOx emissions from the John Zink flare at the Landfill Operation was previously established at 0.068 lb/MMBtu, and this MSER was not subject to further review under #AOP-14-034 and #AOP-15-032, as NOx emission rates have not been increased since the imposition of this limit. The MSER for CO and NOx for the proposed Parnel Biogas flare and the SRS flare were established at the same limits as the existing John Zink flare under #AOP-14-034 and #AOP-15-032.

## 6.0. AMBIENT AIR QUALITY IMPACT EVALUATION

The Agency's implementation procedures concerning the need for an ambient air quality impact evaluation under §5-501 of the *Regulations* specifies that such analyses shall be performed when modifications result in an allowable emissions increase of 10 tpy or more of any air contaminant, excluding VOCs. Air quality impact evaluations are not required by the Agency for individual sources of VOCs.

Based on the proposed level of emissions increase from this Facility, the Agency required a revised AQIE for the pollutants CO, NO<sub>x</sub>, PM / PM<sub>10</sub> / PM<sub>2.5</sub> and SO<sub>2</sub> as part of the permit review for #AOP-14-034 and #AOP-15-032

This AQIE was prepared for the Facility (*Air Dispersion Modeling Report, New England Waste Services of Vermont, Inc. Landfill, Coventry Vermont, prepared by Sanborn, Head, and Associates*) that was submitted to the Agency on October 1, 2014. The AQIE evaluated emissions from two different operating scenarios for the Landfill. Scenario A evaluated the impacts of air emissions from the combustion of 5,000 scfm of LFG containing 50 percent methane, with the gas flow divided equally between two landfill utility flares. Scenario B evaluated the emissions from the combustion of approximately 5,000 scfm of LFG at 50 percent methane, with of approximately 2,537 scfm of LFG being combusted in five CAT 3520C LE engines at the LFGTE Operation with the balance of the LFG being combusted in a single flare. The emissions from Scenario B were greater than for Scenario A, and accordingly, Scenario B was used for evaluating Facility emissions.

Since CO emission increases also exceed the significance threshold of fifty (50) tons per year, the Agency's implementation procedures required the AQIE to determine which other nearby sources, if any, must be included in the analysis. Any other nearby source that has a significant impact area for a respective pollutant that overlaps with the proposed Facility's significant impact area for that same pollutant must be included in the AQIE. All other nearby sources are assumed to be included in the ambient background value for the pollutant. The ambient background value is determined from the Agency's ambient monitoring network throughout the State. For PM, the nearby sources potentially required to be included in the AQIE were the Columbia Forest Products facility (CFP) in Newport, Vermont and the Ethen Allen, Inc. facility (EAO) in Orleans, Vermont. However, since the significant impact areas for CFP or EAO did not overlap with the Facility's significant impact area for PM<sub>2.5</sub>, these facilities were not included in the AQIE.

Based on the results of the AQIE, modifications to the Facility required as part of #AOP-14-034 and #AOP-15-032. This modification consisted of increasing the stack height for the CAT 3520C engines at the LFGTE Operation from 28-feet to 34-feet. With this change, the Facility was found to comply with all applicable ambient air quality standards and prevention of significant deterioration increments. The actual installed stack height for the CAT 3520C engines was 39-feet above ground level, which is five (5) feet greater than the 34-foot stack height that was modeled.

<b>Table 6-1 NAAQS Review – AOP-14-034 / AOP-15-032</b>						
Pollutant	Averaging Period	Modeled Concentration ( $\mu\text{g}/\text{m}^3$ )	Background ( $\mu\text{g}/\text{m}^3$ )	Sum ( $\mu\text{g}/\text{m}^3$ )	AAQS ( $\mu\text{g}/\text{m}^3$ )	Pass?
CO	8-hr	480.5	1,260	1,740.5	10,305	Yes
NO <sub>x</sub>	1-hr	104.1	65.8	169.9	188	Yes
	Annual	2.1	13.4	15.5	100	Yes
PM <sub>2.5</sub>	24-hr	7.5	18.0	25.5	35	Yes
	Annual	0.86	6.8	7.7	15	Yes
PM <sub>10</sub>	24-hr	8.3	34.0	42.3	150	Yes
SO <sub>2</sub>	1-hr	139.8	47.1	186.9	196	Yes
	3-hr	103.3	47.1	150.4	1,309	Yes

<b>Table 6-2 PSD Increment Review – AOP-14-034 / AOP-15-032</b>						
Pollutant	Averaging Period	Modeled Concentration ( $\mu\text{g}/\text{m}^3$ )	Maximum Allowable Class II PSD Increment Standard ( $\mu\text{g}/\text{m}^3$ )	Previously Consumed Class II PSD Increment ( $\mu\text{g}/\text{m}^3$ )	Class II PSD Increment Available ( $\mu\text{g}/\text{m}^3$ )	Pass?
NO <sub>x</sub>	Annual	2.1	25	7.4	11.8	Yes
PM <sub>2.5</sub>	24-hr	6.4	9	0	6.8	Yes
	Annual	0.64	4	0	1.0	Yes
PM <sub>10</sub>	24-hr	8.3	30	0	22.5	Yes
SO <sub>2</sub>	3-hr	103.3	512	0	512	Yes

## 7.0 HAZARDOUS AIR CONTAMINANTS

Pursuant to §5-261 of the *Regulations*, any stationary source whose current or proposed actual emission rate of a hazardous air contaminant (“HAC”) is equal to or greater than the respective Action Level (found in Appendix C of the *Regulations*) shall achieve the Hazardous Most Stringent Emission Rate (“HMSER”) for the respective HAC.

The Facility is anticipated to have emissions of several hazardous air contaminants (HACs). Some HACs are present as NMOCs in the LFG, and these HACs are emitted as fugitive emission from the Landfill Operation. Some fraction of these NMOCs are also emitted from the control devices (flares and CAT 3520C engines) at the Facility, as these control devices are assumed to destroy approximately 98 percent of the NMOCs contained in the LFG. The estimated HACs emitted from the operation of the Facility, and

those HACs that were identified as having estimated emissions in excess of their respective Action Levels are presented in Table 7-1.

The CAT 3520C engines also create formaldehyde and acetaldehyde as a combustion byproduct. During the review for #AOP-14-034 and #AOP-15-032, emissions of acetaldehyde were assumed to be negligible and emissions of formaldehyde were estimated based on a formaldehyde emission factor of 0.164 g/bhp-hr as discussed in Section 3.2.2 of this document. Emissions testing was performed at the LFGTE Operation on February 8, 2017 to provide a site-specific emission factor for VOC emissions, including aldehydes, from the CAT 3520C engines. This stack testing indicated that the formaldehyde emission factor for these engines was approximately 0.302 g/bhp-hr, and the acetaldehyde emission factor was approximately 0.005 g/bhp-hr.

Another combustion byproduct is silicon dioxide ( $\text{SiO}_2$ ) that is emitted from the engines and flares from the combustion of siloxanes contained in the LFG. It is unclear at this time if the uncontrolled emissions of  $\text{SiO}_2$  will exceed the Action Level, as the crystallographic structure and particle size of  $\text{SiO}_2$  particles affects their toxicity. If the  $\text{SiO}_2$  particles are crystalline silica (CAS # 14808-60-7) or fused silica (CAS # 60676-86-0), then estimated  $\text{SiO}_2$  emissions likely will exceed the ALs for these forms of  $\text{SiO}_2$ , which are 0.010 lb/8-hr and 0.007 lb-8 hr respectively. If the  $\text{SiO}_2$  particles are amorphous silica (CAS # 61790-53-2), it is likely that  $\text{SiO}_2$  emissions will remain below the AL of 2.0 lb/8 hr. A condition was included in the PM testing for the CAT 3520C engines at the LFGTE Operation as part of #AOP-15-032 to evaluate the composition of PM found in the exhaust from the CAT 3520C engines to provide further insight into the particle composition emitted from these engines. It was not practicable to perform this testing, due to physical limitations associated with the stack geometry at the LFGTE operation.

Emissions of  $\text{SiO}_2$  from the CAT 3520C LE engines and/or flares may be controlled by removing the siloxanes from the LFG with the SRS before combusting the LFG. The siloxanes removed from the LFG will include some percentage of  $\text{H}_2\text{S}$  and other NMOCs, and this gas mixture will be flared to provide for destruction of the  $\text{H}_2\text{S}$  and other NMOCs. Unfortunately, flaring of the offgas from the SRS will also result in the formation of  $\text{SiO}_2$  particles, and it is unlikely that there will be any reduction in the emission of  $\text{SiO}_2$  particles with the installation and operation of the SRS

Table 7-1 HAC Emissions from Facility Operation										
Parameter				Total Emissions (Fugitive + One Flare + All Engines)			VT HAC Action Level (lbs/8-hr)	Percentage of VT HAC Action Level	VT HAC Action Level Exceeded?	
				(lb/hr)	(lb/8-hr)	(ton/yr)				
NMOC (Flare / Fugitive)				7.15	Not	31.3				
VOC (Flare / Fugitive/Engines) - Excluding formaldehyde and acetaldehyde emissions from engines				2.79	Applicable	12.2				
CAS No.	VOC (Y/N)	HAP (Y/N)	HAC (Y/N)	VOCs, HAPs) and HACs 1, 2, 3, 4, 5	(lb/hr)	(lb/8-hr)	(ton/yr)	VT HAC Action Level (lbs/8-hr)	Percentage of VT HAC Action Level	VT HAC Action Level Exceeded?
71-55-6	N	Y	Y	1,1,1-Trichloroethane	0.009467	0.075737	0.041	0.0052	1456.5%	Yes
79-00-5	Y	Y	Y	1,1,2-Trichloroethane	0.001972	0.015779	0.009	0.0052	303.4%	Yes
79-34-5	Y	Y	Y	1,1,2,2-Tetrachloroethane	0.027544	0.220355	0.121	0.0015	14690.3%	Yes
75-34-3	Y	Y	Y	1,1-Dichloroethane	0.034384	0.275074	0.151	4.2	6.5%	No
75-35-4	Y	Y	Y	1,1-Dichloroethene (Vinylidene Chloride) (1,1-Dichloroethylene)	0.001406	0.011247	0.006	1.7	0.7%	No
107-06-2	Y	Y	Y	1,2-Dichloroethane (Ethylene Dichloride)	0.001387	0.011095	0.006	0.0032	346.7%	Yes
78-87-5	Y	Y	Y	1,2-Dichloropropane (Propylene Dichloride)	0.003007	0.024054	0.013	0.0042	572.7%	Yes
75-07-0	Y	Y	Y	Acetaldehyde	0.122412	0.979294	0.536	0.0380	2577.1%	Yes
67-64-1	N	N	Y	Acetone	0.060191	0.481529	0.264	26.1	1.8%	No
107-13-1	Y	Y	Y	Acrylonitrile	0.003467	0.027738	0.015	0.0012	2311.5%	Yes
106-93-4	Y	Y	Y	1,2-Dibromoethane (Ethylene dibromide)	0.000028	0.000222	0.000	0.00037	60.1%	No
106-46-7	Y	Y	N	1,4-Dichlorobenzene (p-dichlorobenzene)	0.004564	0.036510	0.020	--	--	No
108-10-1	Y	Y	Y	4-Methyl-2-Pentanone (Methyl isobutyl ketone)	0.027690	0.221521	0.121	249	0.1%	No
71-43-2	Y	Y	Y	Benzene	0.011663	0.093305	0.051	0.011	848.2%	Yes
75-27-4	Y	N	Y	Bromodichloromethane	0.075810	0.606479	0.332	0.0046	13184.3%	Yes
75-15-0	Y	Y	Y	Carbon disulfide	0.006528	0.052223	0.029	54.5	0.1%	No
56-23-5	Y	Y	Y	Carbon tetrachloride	0.000091	0.000728	0.000	0.0055	13.2%	No
463-58-1	Y	Y	N	Carbonyl sulfide	0.004352	0.034812	0.019	--	--	No
108-90-7	Y	Y	Y	Chlorobenzene	0.001388	0.011103	0.006	0.2	5.6%	No
75-00-3	Y	Y	N	Chloroethane (Ethyl Chloride)	0.011923	0.095386	0.052	--	--	No
67-66-3	Y	Y	Y	Chloroform	0.000530	0.004236	0.002	0.0036	117.7%	Yes
75-71-8	N	N	Y	Dichlorodifluoromethane	0.280640	2.245123	1.229	16.6	13.5%	No
75-09-2	N	Y	Y	Dichloromethane (Methylene Chloride)	0.482205	3.857640	2.112	0.17	2269.2%	Yes
75-08-1	Y	N	Y	Ethyl mercaptan (Ethanethiol)	0.020942	0.167538	0.092	0.099	169.2%	Yes
100-41-4	Y	Y	Y	Ethylbenzene	0.020089	0.160712	0.088	8.3	1.9%	No
50-00-0	Y	Y	Y	Formaldehyde	7.393671	59.149368	32.384	0.0065	909990.3%	Yes
110-54-3	Y	Y	Y	Hexane	0.083707	0.669653	0.367	581	0.1%	No
7783-06-4	N	N	Y	Hydrogen sulfide	1.551810	12.414479	6.797	0.08	15518.1%	Yes
7439-97-6	N	Y	Y	Mercury	0.000054	0.000434	0.000	0.02	2.2%	No
78-93-3	Y	N	Y	Methyl ethyl ketone	0.075584	0.604672	0.331	415	0.1%	No
108-88-3	Y	Y	Y	Toluene	0.170273	1.362186	0.746	24.9	5.5%	No
79-01-6	Y	Y	Y	Trichloroethylene (Trichloroethene)	0.009868	0.078947	0.043	0.04	197.4%	Yes
75-01-4	Y	Y	Y	Vinyl chloride	0.003474	0.027794	0.015	0.0091	305.4%	Yes
108-38-3 / 106-42-3 / 95-47-6	Y	Y	Y	Xylenes	0.044259	0.354069	0.194	8.3	4.3%	No
<b>Total Quantified NMOCs</b>					3.15	25.22	13.81			
<b>Total Quantified VOCs</b>					8.16	65.30	35.75			
<b>Total Quantified HAPs</b>					8.48	67.85	37.15			
<b>Total Quantified HACs</b>					10.53	84.20	46.10			

As LFG contains a variety of NMOCs which may or may not have been quantified or identified in previous sampling efforts, it is possible that other NMOCs may be present which exceed their respective AL. However, the LFG collection and control requirement that has been implemented for the identified HACs is anticipated to be equally effective for any unidentified HACs contained in the LFG.

The Agency has determined that HMSER for all compounds present as NMOCs in LFG shall continue to be the requirement to achieve the minimum 98% destruction efficiency of the NMOCs in the LFG as required by the prior HMSER and the federal regulations or alternatively demonstrate that the outlet concentrations of NMOCs from the control devices are less than 20 ppmvd measured as hexane. In addition, the Landfill Operation must also comply with various requirements for the collection of LFG to ensure as much gas is collected as is technically feasible and for monitoring of the gas collection and control system operations.

Formaldehyde emissions from internal combustion engines are typically minimized by following the manufacturer's recommendations for operating and maintaining the engines so that they operate at design combustion efficiency.

Although the formaldehyde and acetaldehyde emissions from the CAT 3520C engines at the LFGTE Operation exceed their respective ALs, Agency has not required an impact evaluation in accordance with 5-261(3) given the location and the emission characteristics of these engines. Factors considered in this review include the following.

- The nearest receptors to the Facility are approximately 1 km from the Facility.
- The existing stack height of 39 feet, exhaust temperatures of approximately 800 degrees Fahrenheit, and an exit velocity for the engine exhaust of approximately 150 feet per second all contribute to enhancing dispersion of formaldehyde and acetaldehyde.
- Formaldehyde and acetaldehyde are ubiquitous compounds that are also found in the emissions from virgin fuel fired internal combustion engines.

The EPA has determined that carbon monoxide (CO) can be used as an appropriate surrogate for formaldehyde, as is generally described in 40 CFR Part 63, Subpart ZZZZ. Accordingly, the Agency has determined that HMSER for acetaldehyde and formaldehyde emissions from the CAT 3520C LE engines will be the same as the MSER for CO, which incorporates the effects of siloxane combustion and deposition within the combustion chambers of the engines. The HMSER for acetaldehyde and formaldehyde for the CAT 3520C LE engines will be as follows:

- 3.5 g/bhp-hr and 17.3 lb/hr (each) applies at all times
- 3.1 g/bhp-hr and 15.3 lb/hr (each) must be demonstrated annually. The permit may not require each engine to be tested each year in which case the results of those being tested will be considered representative of those not tested that year.
- 2.75 g/bhp-hr and 13.5 lbs/hour (each) must be demonstrated every 6 years

Emissions of SiO<sub>2</sub> from LFG combustion may be controlled by removing the siloxanes from the LFG before combustion. However, as previously noted, the SRS uses a flare to

control offgas from the treatment process, so the SRS likely will not provide any reduction in SIO<sub>2</sub> emissions. In addition, there is some uncertainty regarding what form of SiO<sub>2</sub> is emitted from the combustion devices at the Facility. Accordingly, based on these considerations, the HMSER for SiO<sub>2</sub> from all combustion devices at the Facility will be a restriction on PM emissions from the Facility, limiting PM emissions to less than 20.5 tons per year.

## 8.0 PERMIT CONDITION DISCUSSION

### **Condition (28) of #AOP-17-018 / Condition (18) of #AOP-18-019**

These Conditions were developed to provide an enforceable restriction on SO<sub>2</sub> emissions, such that these emissions are less than the 40 ton/year SO<sub>2</sub> emission limit proposed by the Permittee(s). This Condition requires monthly measurement of H<sub>2</sub>S in the LFG collected from the Landfill and collection of information regarding total LFG volumes delivered in that month to the combustion devices.

The formula in this Condition is based on the assumption that H<sub>2</sub>S concentrations will reflect the amount of sulfur contained in LFG, and that 100 percent of the H<sub>2</sub>S is converted to SO<sub>2</sub> during combustion. The contribution of SO<sub>2</sub> from non-road engine operation at the Facility was not included in this estimation, as the estimated emissions of SO<sub>2</sub> from non-road engine operation was estimated to be 0.023 tons from the combustion of the 220,000 gallons of ULSD allowed by #AOP-17-018. The Agency determined that the 0.023 tons of SO<sub>2</sub> emissions were determined to be an insignificant component of the 40 tons of allowable SO<sub>2</sub> emissions.

The conversion factor for converting H<sub>2</sub>S concentrations and LFG flow to mass of SO<sub>2</sub> was derived as follows:

$$\begin{aligned} \text{lb SO}_2 / \text{ppmv H}_2\text{S -scf LFG} &= [\text{ppmv H}_2\text{S}] * [1 \text{ mole H}_2\text{S} / \text{ppmv H}_2\text{S} * 106 \text{ lbmol LFG}] \\ &\quad * [\text{lbmol SO}_2 / \text{lbmol H}_2\text{S}] * [64.07 \text{ lb SO}_2 / \text{lbmol}] \\ &\quad * [1 \text{ lbmol LFG} / 378.25 \text{ scf LFG}] \end{aligned}$$

$$\text{lb SO}_2 / \text{ppmv H}_2\text{S -scf LFG} = 1.694\text{E-}7 \text{ lb SO}_2 / \text{ppmv H}_2\text{S -scf LFG}$$

The SO<sub>2</sub> emissions generated by the combustion of LFG will be calculated each month, and the monthly emissions will be summed with the total of the emissions from the previous 11 months to insure that the rolling 12-month total of SO<sub>2</sub> emissions does not equal or exceed 40 tons per rolling twelve-month period.

### **Condition (29) of #AOP-17-018 / Condition (19) of #AOP-18-019**

These Conditions were developed to provide an enforceable restriction for PM emissions from the Facility. The MSER for PM emissions included a limitation that Facility PM emissions not increase from the previous allowable PM emissions of 9.8 tons by the significance threshold for PM<sub>2.5</sub> of 10 tons, which results in an MSER limit for PM emissions from the Facility of not to exceed 19.8 tons per rolling 12-month period. Emissions of PM from non-road engines were included in the allowable emissions from the Facility as part of #AOP-17-018, but the 0.71 tons of particulate matter associated with non-road engines was simply a quantification of pre-existing emissions that had been previously unaccounted for, and this was not considered an increase. This resulted

in allowable PM emissions for the Facility of 20.5 tons per rolling 12-month period. The same 20.5 tons per rolling 12-month period emission limitation was also established as HMSE for SiO<sub>2</sub> emissions.

The formulae in this condition are based on the following assumptions:

- PM emissions from the SRS will be the sum of the PM emissions estimated using the AP-42 PM emission factor for landfill flares, and the emissions of SiO<sub>2</sub> based on siloxane combustion.
- PM emission from the CAT 3520C engines will consist of the sum of the PM emissions estimated using a site-specific PM emission factor for these engines, the hours of operation for the engines, and the capacity factor for electrical generation at the LFGTE Operation.
- PM emissions from the landfill flare(s) will be the sum of the PM emissions estimated using the AP-42 PM emission factor for landfill flares, and the emissions of SiO<sub>2</sub> based on siloxane combustion.
- PM emissions from the non-road engines are based on a Tier 2 PM emission factor of 0.15 g/bhp-hr applied to the entire non-road engine fleet. The heat value for ULSD was assumed to be 140,000 Btu/gallon, and engine combustion efficiency was assumed to be 36.1%. This results in a PM emission factor for the non-road engine fleet of 0.0206 lb/gallon ULSD

The total amount of PM emitted from the Facility will be calculated each month, and the monthly emissions will be summed with the total emissions from the previous 11 months to ensure that the rolling 12-month total of VOC emissions does not equal or exceed 50 tons per rolling twelve-month period.

Monthly PM emissions shall be calculated in accordance with the following formulae:

$$\text{Equation 1: } PM_{\text{total}} = PM_{\text{siloxane removal system}} + PM_{\text{LFG flares}} + PM_{\text{engine combustion}} + PM_{\text{non-road engines}}$$

$$\text{Equation 2: } PM_{\text{siloxane removal system}} = [\text{Si Concentration}_{\text{srs inlet}} - \text{Si Concentration}_{\text{srs outlet}}] * [1 \text{ cubic meter} / 35.31 \text{ cubic feet}] * [1 \text{ lb} / 453,592 \text{ mg}] * [\text{LFG}_{\text{treated}}] * [\text{Molecular weight of SiO}_2 / \text{Molecular weight of Si}] * [1 \text{ ton} / 2,000 \text{ lb}] + ([\text{LFG}_{\text{srs}}] * [\text{LFG Heat Value}] * [\text{Flare Emission Factor}] * [1 \text{ ton} / 2,000 \text{ lb}])$$

Where:

LFG<sub>treated</sub> = Total collected LFG flow in scf treated by the SRS at the LFGTE Operation in that month

Si Concentration<sub>srs inlet</sub> = Si concentration in LFG before treatment by the SRS in mg Si / cubic meter

Si Concentration<sub>srs outlet</sub> = Si concentration in LFG after treatment in SRS in mg Si / cubic meter

LFG<sub>srs</sub> = Total LFG flow in scf used to fire the SRS flare in that month

LFG Heat Value = Heat Value of LFG in MMBtu/scf. A default value of 5.0E-4 MMBtu/scf may be used or a site specific value approved by the Agency.

Flare Emission Factor = 1.7E-2 lb/MMBtu



Equation 3:  $PM_{LFG\ flares} = ([LFG_{month\ flare}] * [LFG\ Heat\ Value] * [Flare\ Emission\ Factor]) * [1\ ton/2,000\ lb] + (([LFG_{month\ flares}] * [Si\ Concentration_{flares}] * [1\ cubic\ meter/35.31\ cubic\ feet] * [1\ lb/453,592\ mg] * [Molecular\ weight\ of\ SiO_2 / Molecular\ weight\ of\ Si]) * [1\ ton/2,000\ lb]$

Where:

$LFG_{month\ flares}$  = Total collected LFG flow in scf delivered to the flare(s) at the Facility in that month

LFG Heat Value = Heat Value of LFG in MMBtu/scf. A default value of 5.0E-4 MMBtu/scf may be used or a site specific value approved by the Agency.

Flare Emission Factor = 1.7E-2 lb/MMBtu

$Si\ Concentration_{flares}$  = Si concentration in LFG to flare(s) in mg Si / cubic meter

Molecular weight of Si = 28.09

Molecular weight of  $SiO_2$  = 60.08

Equation 4:  $PM_{engine\ combustion} = [Engine\ Emission\ Factor] * [1\ lb/453.592\ g] * [Hours\ of\ operation\ for\ 3520C\ engines] * [3520C\ engine\ rating] * [Capacity\ Factor] * [1\ ton/2,000\ lb]$

Where:

Engine Emission Factor = 0.153 g/bhp-hr OR emission factor in g/bhp-hr obtained from stack testing required by Condition (27) of #AOP-15-032 at the Agency's discretion.

Hours of operation for 3520C engines = Total number of hours of operation for all 3520C engines in that month.

3520C engine rating = 2,221 bhp or a site specific value approved by the Agency.

Capacity Factor = Measured electrical output in MW of all 3520C engines at the LFGTE Operation in that month / Electrical Output<sub>theoretical</sub>

Electrical Output<sub>theoretical</sub> = Electrical output in MW of all 3520C engines at the LFGTE Operation in that month assuming they are operated at 100 percent output for the hours operated..

Equation 5:  $PM_{non-road\ engines} = [Engine\ Emission\ Factor] * [Fuel\ Combustion\ in\ Non-Road\ Engines] [1\ ton/2,000\ lb]$

Where:

Engine Emission Factor = 0.0206 lb/gallon ULSD OR emission factor in g/bhp-hr based on Tier ratings from the actual non-road engine fleet at the Facility, at the Agency's discretion.

Fuel Combustion in Non-Road Engines = Total ULSD fuel combusted in the non-road engine fleet at the Facility in that month

Compliance with this limit shall be documented through measuring and recording:

- Monthly LFG flow treated by the SRS in standard cubic feet (scf).
- Monthly LFG flow to the CAT 3520C engines in standard cubic feet (scf)
- Monthly LFG flow to each of the flare(s) in standard cubic feet (scf)
- Silicon (Si) concentrations in untreated LFG in units of milligrams of Si per cubic meter of LFG measured every six (6) months.
- Silicon (Si) concentrations of LFG after treatment in the SRS in units of milligrams

of Si per cubic meter of LFG.

- Monthly hours of operation for the five (5) 3520C engines at the LFGTE Operation recorded to the nearest tenth (0.1) hour.
- Recording monthly fuel usage in gallons in the non-road engine fleet at the Facility to the nearest gallon.

Concentrations of Si shall be measured before and after treatment in the siloxane removal system, and shall be measured annually using sample collection and chemical analytical methods approved by the Agency

**Condition (30) of #AOP-17-018 / Condition (20) of #AOP-18-019**

These Conditions were developed to provide an enforceable restriction for the 50 ton per year VOC emission limit established for the Facility. VOCs are emitted by several sources at the Facility, including fugitive emissions from the Landfill, VOCs contained in collected LFG that are not destroyed by the flares and/or engines, and VOCs created as a result of incomplete combustion in the engines. The contribution of VOCs from non-road engine operation at the Facility was not included in this estimation, as the estimated emissions of VOCs from non-road engine operation using Tier 2 emission standards do not include any means of estimating VOCs, but rather include them in the NOx emission factor.

It has been assumed that the cover and gas collection system at the Landfill has an 85 percent capture efficiency. Thus, the total amount of captured LFG divided by 0.85 will equal the estimated total LFG generation from the Landfill, and 15 percent of the total LFG generation will be emitted as fugitive LFG. Previous sampling and analysis of LFG indicated that VOC concentrations in LFG were 219 ppmv as hexane (39% of the measured NMOC 561ppm), or 4.99E-05 lb VOC/scf LFG. Accordingly, fugitive VOC emissions will be based on this VOC concentration, and the measured volume of collected LFG multiplied by (0.15/0.85)

Combustion of LFG in the flares at the Facility is assumed to result in 98 percent destruction of any VOC compounds contained in the LFG. Accordingly, emissions of VOCs from the flare will be based on the assumption that 2 percent of the 4.99E-05 lb VOC/scf LFG is emitted from LFG combustion in the flares.

Combustion of LFG in the CAT 3520C LE engines at the LFGTE Operation is more complex, in that VOCs contained in LFG are destroyed by combustion, but VOCs (notably acetaldehyde and formaldehyde) are also created from incomplete combustion of methane in the LFG. To estimate total VOC emissions from the engines, the Agency has determined that combustion emissions of VOCs from the engines, exclusive of acetaldehyde and formaldehyde may be estimated as 39 percent of the most recent measured value for NMOC emissions from stack testing of the CAT 3520C LE engines at the LFGTE Operation. To account for formaldehyde emissions, the formaldehyde emission factor of 5.28E-02 lb/MMBtu of heat input was obtained from AP-42, *Chapter 3: Stationary Internal Combustion Sources, Section 3.2, Natural Gas-fired Reciprocating Engines, Table 3.2-2 Uncontrolled Emission Factors for 4-Stroke Lean-Burn Engines, (Supplement F, August 2000)*. Assuming a fuel heat value of 500 Btu/scf, and an LFG supply rate to each engine of 507.5 scf of LFG results in the originally estimated emission factor for formaldehyde of 0.164 g/bhp-hr. Emission of acetaldehyde were assumed to be a negligible component of overall facility VOC emissions.

Stack testing was performed to assess if the estimated emission factors for acetaldehyde and formaldehyde were appropriate. The emissions factor for compliance will be adjusted, at the discretion of the Agency, to either the factor estimated as described above, or to the stack test result obtained from emissions testing required as part of #AOP-15-032.

Total Facility emissions of VOCs will be the sum of fugitive VOC emissions, VOC emissions from the flares, and VOC emissions from the CAT 3520C engines. The equations used to calculate total VOC emissions are as follows:

The quantity of VOC emissions from the Facility shall be determined on a monthly basis in accordance with the following formulae:

$$\text{Equation 1: } \text{VOC}_{\text{total}} = \text{VOC}_{\text{fugitive}} + \text{VOC}_{\text{flares}} + \text{VOC}_{\text{engine combustion}}$$

$$\text{Equation 2: } \text{LFG}_{\text{fugitive}} = [\text{LFG}_{\text{month}} / \text{Percent Capture Efficiency}] * [1 - \text{Percent Capture Efficiency}]$$

$$\text{Equation 3: } \text{VOC}_{\text{fugitive}} = [\text{LFG}_{\text{fugitive}}] * [4.99\text{E-}5 \text{ lb VOC/scf LFG}] * [1 \text{ ton}/2,000 \text{ pounds}]$$

Where:

$\text{LFG}_{\text{month}}$  = The total collected LFG flow in scf delivered to all combustion devices at the Facility in that month

$\text{LFG}_{\text{fugitive}}$  = The total fugitive LFG emitted from the Facility in that month

Percent Capture Efficiency = 0.85

Percent Fugitive Emissions = [1 - Percent Capture Efficiency]

Percent capture efficiency is expressed as a decimal equivalent (i.e. 85% = 0.85)

$$\text{Equation 4: } \text{VOC}_{\text{flares}} = [\text{LFG flow in scf delivered to flares}] * [4.99\text{E-}5 \text{ lb VOC/scf LFG}] * [1 - \text{Destruction Efficiency}] * [1 \text{ ton}/2,000 \text{ pounds}]$$

Where:

Destruction Efficiency = 0.98

Percent destruction efficiency is expressed as a decimal equivalent (i.e. 98% = 0.98)

$$\text{Equation 5: } \text{VOC}_{\text{engine combustion}} = [\text{Total Engine Operating Hours} * \text{Engine Horsepower}] * [\text{Capacity Factor}] * [\text{VOC Emission Factor}] * [1 \text{ lb}/453.59 \text{ g}] * [1 \text{ ton}/2,000 \text{ pounds}]$$

Where:

Total Engine Operating Hours = The total operating hours for all 3520C engines at the LFGTE Operation in that month.

Engine Horsepower = Rated output of a 3520C engine, or 2,221 bhp

Capacity Factor = Measured electrical output in MW of all 3520C engines at the LFGTE Operation in that month / Electrical Output<sub>theoretical</sub>

Electrical Output<sub>theoretical</sub> = Electrical output in MW of all 3520C engines at the LFGTE Operation in that month assuming they are operated at 100 percent output for the hours operated..

VOC Emission Factor = 39 percent of the measured NMOC emission factor from the most recent yearly engine emissions testing in accordance with Condition (25) of #AOP-15-032 in grams per brake horsepower-hour plus the measured emission factor of 0.302 grams per bhp-hr for formaldehyde and 0.004 grams per bhp-hr for acetaldehyde obtained from stack testing performed in February 2017.

The total amount of VOCs emitted from the Facility will be calculated each month, and the monthly emissions will be summed with the total emissions from the previous 11 months to insure that the rolling 12-month total of VOC emissions does not equal or exceed 50 tons per rolling twelve-month period.

**Condition (27) of #AOP-18-019**

This Condition was developed to verify that emissions from the CAT 3520C engines do not exceed the limits for CO, NOx and NMOCs identified in of Condition (16) of AOP-18-019. Engine No. 5 is the only engine at the LFGTE Operation that is required to perform periodic emissions testing under 40 CFR, Part 60. Subpart JJJJ. Engines No. 1 -3 are regulated under 40 CFR, Part 63. Subpart ZZZZ, but this regulation does not require periodic testing of these engines. Engine No. 4 is not regulated under either Subpart JJJJ or Subpart ZZZZ. The combustion of siloxanes contained in LFG has a cumulative, detrimental effect of the emissions performance of these engines. Accordingly, the Agency has determined that testing of Engines No. 1-No. 4 every two years is appropriate to monitor compliance with the requirements of Condition (16) of AOP-18-019.