Hartland Landfill – Landfill Gas Monitoring

2020 Report

Capital Regional District | Parks & Environmental Services, Environmental Protection



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HARTLAND LANDFILL – LANDFILL GAS MONITORING
2020 REPORT

EXECUTIVE SUMMARY

Hartland landfill provides solid waste disposal services for the Capital Regional District (CRD). The landfill is a multi-purpose facility providing collection services for recyclable materials, household hazardous waste, items covered by product stewardship, and disposal of municipal solid waste and controlled waste. The site operates pursuant to an operational certificate under the *Environmental Management Act*, issued by the BC Ministry of Environment and Climate Change Strategy (ENV); and follows an operating plan required under the operational certificate.

The operating landfill footprint is approximately 33 hectares, with an estimated 7,700,000 tonnes of municipal solid waste in place, as of the end of 2020. Total annual disposal was 165,838 tonnes of residential, commercial and industrial waste. When the landfill reaches planned final filling elevations it will occupy approximately 43 hectares, with a volume of approximately 14,600,000 m^3 of municipal solid waste.

This report fulfills annual reporting requirements set out in the BC *Operational Certificate 12659* and the BC *Landfill Gas Management Regulation*. Landfill gas (LFG) collection/management at Hartland (described below) includes collection and utilization infrastructure, generation modelling and monitoring (utilization, perimeter gas probes, hotspot monitoring and speciation).

LFG collection and/or management at Hartland includes the following components:

- **Gas collection infrastructure**, including cover systems, collection pipes, wells and blowers to facilitate gas collection and utilization.
- **LFG utilization facility** that generates electricity for the BC Hydro grid.
- **LFG monitoring system**, including collection system, hotspot and subsurface monitoring programs.
- **Methane production and gas generation modelling** rates given landfill waste volumes and decomposition rates.

GAS GENERATION, COLLECTION AND UTILIZATION

In 2020, the gas collection system consisted of 60 vertical wells and 84 horizontal wells, for a total of 144 wells. Nine non-productive wells were removed from service, seven new wells were connected to the system, and 15 horizontal wells were installed in completed lifts in Phase 2, Cell 3. The well field was balanced monthly in 2020, as recommended by the BC *Landfill Gas Management Facilities Design Guidelines*.

A fugitive emissions, gas generation project was completed in 2020. The data were used to complete a comprehensive landfill gas mass balance for the site using three different landfill gas generation models. Report findings confirm that the current ENV model overestimates landfill gas generation and fugitive emissions at Hartland, while an alternative model (UBCi) more accurately estimates gas generation. Consequently, the existing landfill gas collection system is collecting a higher proportion of total landfill gas: approximately 76-81% over the last three years, compared to the 64-67% for the same period using the required ENV model. According to the UBCi model, which is supported by empirical, mass balance data, Hartland landfill is meeting and exceeding the 75% collection efficiency requirement set out in the *Landfill Gas Management Regulation*. A well field optimization study is planned for 2021, to further support improved gas collection and reduce fugitive emissions.

Table ES1 Modelled Methane Generation and Collection Efficiency 2020

Year	Modelled Annual Methane Generated (scfm)	Measured Annual Gas Capture (scfm)	Collection Efficiency (%) ENV Model	Collection Efficiency (%) UBCi Model
2020	1,626	1,084	66.7	81

MONITORING

Hartland landfill has several monitoring programs to assess the effectiveness of the LFG collection infrastructure. The following summarizes the components of the program:

1. **Collection and utilization system monitoring** to evaluate changes in gas quality over time and to document data for gas collection and gas utilization to assess collection efficiency and total emissions from the landfill.

2. **Monitoring of subsurface perimeter and building foundation probes** to assess the potential for subsurface LFG migration at the eastern landfill boundary and at on-site buildings for compliance with BC *Landfill Criteria*, and for worker and public health and safety.

3. **Surface emissions and hotspot monitoring** to verify the effectiveness of cover and the LFG collection system in order to identify health and safety risks associated with fugitive LFG emissions.

4. **LFG Speciation** to assess the composition of gas, including volatile organic compounds, sulphur gases and typical LFGs, in order to calculate ambient dilution concentrations for health and safety, and infrastructure integrity purposes.

COMPLIANCE SUMMARY

Table ES2 has been prepared to summarize the results of LFG monitoring programs, whether the results comply with requirements, actions taken to address non-compliance, and recommendations.

Table ES2. LFG Compliance Summary 2020

Program	Compliance Location	Criteria	Findings	Mitigation/Actions	Recommendations
Perimeter Probe Monitoring	Probes GP-1A, 1B, 2A, 2B, 3A, 3B, 11A, 11B, 12A and 12B	Methane must not exceed 5% in subsurface soils (BC *Landfill Criteria for Municipal Solid Waste* & BC *Landfill Gas Management Facilities Design Guidelines*)	No exceedances Low risk of sub-surface gas migration to adjacent properties	None	Continue quarterly monitoring.
Building Foundation Probe Monitoring	Probes GP- 4A, 5A, 6A, 6B, 7A, 7B, 8A, 9A, 13A, 14A, 17A, 18A	Maximum 1% methane in any on-site facility (BC *Landfill Criteria for Municipal Solid Waste* & BC *Landfill Gas Management Facilities Design Guidelines*)	No exceedances Low risk of subsurface gas migration to adjacent building	None	Continue quarterly monitoring.
Ambient Grid Monitoring	N/A	100 ppm total hydrocarbon (THC), as methane (CRD internal guideline)	18 grid locations >100 ppm No cover system failures suspected in the closed area of Phase 1	Investigated hot spots and mitigated, where possible.	Continue annual monitoring.
Hot Spot Monitoring	N/A	1,000 ppm THC (CRD internal guideline)	Seven hot spots (z-points) >1,000 ppm Currently 29 locations for hot spot investigation	Added new locations of hot spots to the monitoring program.	Continue annual monitoring. Investigate mitigation options.
Well Field Monitoring and Balancing	N/A	Monitor monthly. Oxygen 2.5% - gas optimization and reduction of fire potential *(BC Landfill Gas Management Facilities Design Guidelines)*	Monitoring completed monthly; Oxygen did not exceed 2.5%	None	Continue monthly monitoring at minimum.
Gas Speciation	N/A	N/A	Undiluted LFG exceeded WorkSafeBC criteria for carbon dioxide, carbon monoxide, hydrogen sulfide, vinyl chloride, and benzene; however, ambient concentrations are likely well below WorkSafeBC limits due to dilution with ambient air. Comprehensive sampling of gas identified increasing concentrations in oxygen and siloxanes.	None	Continue speciation sampling in 2021, or sooner, to support LFG utilization planning. Continue ambient monitoring program to confirm and implement health and safety protocols for hot spots.
Gas Collection	N/A	75% gas collection efficiency target by the end of 2016, as per *Landfill Gas Management Plan*	Gas collection efficiency was estimated at 66.7%, based on the ENV gas generation model. Collection efficiency using an alternative model (UBCi) and empirical data was estimated at 81%.	*Landfill Gas Management Plan* submitted to ENV.	Continue to implement the gas management plan. Conduct well field optimization study in 2021.

HARTLAND LANDFILL – LANDFILL GAS MONITORING
2020 REPORT

Table of Contents

Executive Summary i
1.0 Introduction 1
2.0 Site description 1
3.0 Regulatory framework 2
3.1 LFG Management Regulation 2
3.2 WorkSafeBC 2
3.3 BC Landfill Criteria for Municipal Solid Waste 2
4.0 Health and Safety 2
5.0 LFG Generation 3
5.1 Waste Quantity 3
5.2 Waste Composition 4
5.3 Waste Diversion 4
5.4 Gas Generation Modelling 4
6.0 LFG Collection and monitoring Infrastructure 6
6.1 Gas Extraction Wells 6
6.2 Gas Well Field Operation and Monitoring 8
7.0 LFG utilization and collection efficiency 11
7.1.1 Gas Generation, Quantification and Modelling Study 17
7.1.2 Destruction Devices and Usage 17
7.1.3 LFG Management Plan Implementation Status 18
8.0 Operational Performance 19
9.0 Monitoring Programs 20
9.1 Subsurface Gas Monitoring – Perimeter and Foundation Probes 22
9.1.1 Perimeter Probes 22
9.1.2 Foundation Probes 22
9.2 Surface Emissions and Hotspot Sampling 26
9.3 LFG Speciation 29
9.3.1 Health and Safety 29
9.3.2 LFG Composition and Trends 29
10.0 Conclusions and Recommendations 31
11.0 References 32
12.0 Report Signoff 33

List of Tables

Table 1 Waste Composition 1980 to Present 4
Table 2 Methane Generation Potential and Rate Factors Used for the ENV LFG Generation Model ... 5
Table 3 Estimated Methane Generation by Year at Hartland Landfill 5
Table 4 Number and Type of Gas Wells Installed or Operating (2015-2020) 6
Table 5 Gas Wells with the Highest Collection 2020 9
Table 6 LFG System Collection Efficiency 2010-2020 ENV Model 13
Table 7 LFG Collection System Efficiency 2014-2020 UBCi Model 13
Table 8 LFG Flows to Destruction Devices (2014-2020) 18
Table 9 Summary of 2020 Blower Downtime by Month 19
Table 10 Generator Performance 2020 19
Table 11 Summary of LFG Monitoring Programs 20
Table 12 Average Gas Concentrations in Subsurface Perimeter Probes 2014-2020 23
Table 13 Maximum Gas Concentrations in Perimeter Probes 2014-2020 23
Table 14 Average Gas Concentrations in Subsurface Foundation Probes 2014-2020 25
Table 15 Maximum Gas Concentrations in Foundation Probes 2014-2020 25
Table 16 Summary of Grid Sampling Results 2020 26
Table 17 Summary of Hotspot Results 2020 26
Table 18 Concentrations of Key LFG Parameters in Hartland LFG 2020 29
Table 19 LFG Compliance Summary 2020 30

List of Figures

Figure 1 Annual Waste Tonnages Received or Estimated for Hartland Landfill from 1980-2020 3
Figure 2 Hartland LFG Collection Infrastructure 7
Figure 3 Gas Collection in 2020 by Individual Well 10
Figure 4 Hartland LFG Plant 12
Figure 5 Fugitive GHG Emission at Hartland Landfill 2004-2020 (ENV model) 15
Figure 6 Collection Efficiency Estimates 2004-2020 (ENV Model) 16
Figure 7 Location of Gas Probes 24
Figure 8 Hartland Landfill Ambient Air Monitoring Results, July 2020 27
Figure 9 Historical Hotspot Locations 28

List of Appendices

Appendix A Gas Generation Information
Appendix B Well Field Data
Appendix C Gas Collection Data
Appendix D Subsurface Perimeter and Foundation Probe Monitoring
Appendix E Grid and Hotspot Monitoring

HARTLAND LANDFILL – LANDFILL GAS MONITORING
2020 REPORT

1.0 INTRODUCTION

Hartland landfill provides solid waste disposal services for the Capital Regional District (CRD). The landfill is a multi-purpose facility providing collection services for recyclable materials, household hazardous waste, extended producer responsibility products, salvageable items, as well as disposal services for municipal solid waste and controlled waste. Landfill operations are guided by the *Hartland Landfill Design, Operations and Closure Plan – Update*, the BC *Operational Certificate 12659* issued by the BC Ministry of Environment and Climate Change Strategy (ENV), and the CRD's *Solid Waste Management Plan*.

Landfill gas (LFG) is primarily composed of methane, carbon dioxide and nitrogen, with small amounts of water vapour, oxygen, and trace gases. Trace gases include hydrogen sulphide, ammonia, nitrous oxide, volatile organic compounds and chlorofluorocarbons. Risks associated with LFG include asphyxiation, flammability (between 5% and 15% methane by volume), toxicity, odour and greenhouse gas (GHG) emissions.

The objective of an LFG collection system is to reduce GHGs through the destruction of collected methane, mitigate fugitive emissions, and reduce the potential for subsurface, lateral gas migration. Ongoing monitoring is conducted at the landfill to assess the effectiveness of these controls, and includes gas generation modelling, gas capture assessment, and ambient and subsurface monitoring.

This report is prepared to assess operational needs and performance, meet regulatory reporting requirements and to inform the public regarding LFG management at Hartland. This report meets the reporting requirements specified in the BC *Operational Certificate 12659* and the BC *Landfill Gas Management Regulation* for annual reporting of gas collection and management.

2.0 SITE DESCRIPTION

The Hartland landfill is situated on 320 hectares within the District of Saanich. Mount Work Regional Park is located to the west, parkland and the Heal's Rifle Range lies to the north, residential properties lie to the east, and undeveloped CRD property is located to the south.

The climate in the area is classified as "Cool Mediterranean" due to warm, dry summers and cool, wet winters. Annual precipitation is around 800-1,000 mm per year. The site is surrounded by bedrock; discontinuous bedrock fractures have been identified.

The CRD took over operation of the landfill site in 1985. Prior to that, it was privately owned and operated. The landfill currently occupies approximately 33 hectares with an estimated 7,600,000 tonnes[1] of municipal solid waste in place, as of the end of 2020. When the landfill reaches final capacity, it will occupy approximately 43 hectares and contain approximately 13,500,000 tonnes[1] of municipal solid waste. The average annual disposal rate for the last five years is approximately 160,000 tonnes, which comprises residential, commercial and industrial wastes.

The landfill has two operational areas: Phase 1 was operational between the 1950s and 1997, and has final cover. Phase 2 comprises the current active area of the landfill, which began in 1997. Phase 1 is unlined and covered with a combination geomembrane/clay cap. Phase 2 was constructed within a former lake basin (now referred to as the Phase 2 basin); it is partially lined and relies on hydraulic gradients to contain leachate. Development of the Hartland landfill is guided conceptually by the cell development and filling plan that was updated in 2019 (Sperling Hansen Associates, 2020).

[1] Updated engineering estimate 2019

3.0 REGULATORY FRAMEWORK

There are a number of provincial and federal regulations that apply to LFG management, emissions management and reporting. Key regulations are listed below.

3.1 LFG Management Regulation

The BC *Landfill Gas Management Regulation* requires landfills that produce 1,000 tonnes of methane per year have a qualified professional prepare an LFG management plan. According to the regulation, the *Landfill Gas Management Plan* must be prepared in accordance with the BC *Landfill Gas Management Facilities Design Guidelines*, 2010 ('*the Guidelines*') and include:

- a description of existing or planned methods or maintenance practices and processes for LFG management on the site;
- a plan for installation, operation and maintenance of LFG management facilities (including contingencies for planned or emergency shut downs); and
- recommendations for optimizing LFG collection to meet a 75% collection efficiency target four years after implementation.

The Guidelines specify a set of design and performance objectives/standards regarding LFG management and operations, including gas collection and composition; extraction and destruction infrastructure; and gas migration and assessment.

3.2 WorkSafeBC

Many of the compounds in LFG, particularly methane, hydrogen sulphide and individual volatile organic compounds, have worker exposure limits set out within WorkSafeBC regulations. The Hartland landfill must comply with these limits.

3.3 BC Landfill Criteria for Municipal Solid Waste

The BC *Landfill Criteria for Municipal Solid Waste* (2016) stipulates compliance with the *Landfill Gas Management Regulation* and the Guidelines described above. As well, the landfill must be managed to ensure there is no public threat or nuisance/odour. Annual reporting and compliance review is a requirement under Hartland landfill's *Operational Certificate 12659.* A full compliance report for all Operational Certificate requirements is provided in the Hartland Operations Report, 2020.

4.0 HEALTH AND SAFETY

LFG is flammable, toxic and poses an asphyxiation risk to landfill employees and contractors on site. Specifically:

- LFG can accumulate in confined spaces or low-lying area with poor air circulation, which can pose an asphyxiation risk due to the displacement of oxygen.
- both trace gases and major gas constituents can result in acute toxicity if exposure occurs at high enough concentrations.
- trace gases, usually associated with sulphur compounds, can create odours.
- methane is explosive at concentrations between 5 and 15%. It is also a GHG with 25 times the global warming potential of carbon dioxide.

There is also potential for gas to laterally migrate off site. When gas pressure builds up in the landfill, gas migrates via cracks, soil pores, and/or fractures to equalize with the surrounding atmosphere. This includes migrating through permeable cover systems or subsurface migration toward adjacent properties. The main objective of an LFG collection system is to mitigate the above risks and reduce the potential for subsurface, lateral gas migration. However, while lateral movement can be mitigated with LFG collection and control, there will still be fugitive LFG emissions on site. A number of factors influence this, such as atmospheric pressure, groundwater level, gas pressure in the refuse mass, and permeability of cover systems. Gas collection system operation and utilization is discussed in sections 6.0 and 7.0, and monitoring programs are discussed in Section 9.0.

5.0 LFG GENERATION

Decomposition of refuse creates LFG; the composition and amount of gas generated varies based on factors, such as amount, type and age of waste, as well as environmental conditions, such as temperature and moisture content. LFG composition and generation rates are discussed in sections 6.0, 7.0 and 9.0.

Peak gas generation occurs during the first one to three years after disposal. Initially, decomposition of waste is an aerobic process and produces mainly carbon dioxide. As oxygen is depleted, the decomposition occurs under anaerobic conditions. The total waste input and waste composition affects overall gas generation rates. For clarity, it is important to note that gas production is the total amount of gas predicted to be produced by the landfill given waste composition, volume of existing waste in place and site-specific meteorological conditions.

5.1 Waste Quantity

The quantity of LFG production is dependent on the amount and type of waste received. In 2020, the Hartland landfill received 165,838 tonnes of waste, which included 149,538 tonnes of general refuse, 13,208 tonnes of controlled waste and 3,092 tonnes of asbestos.

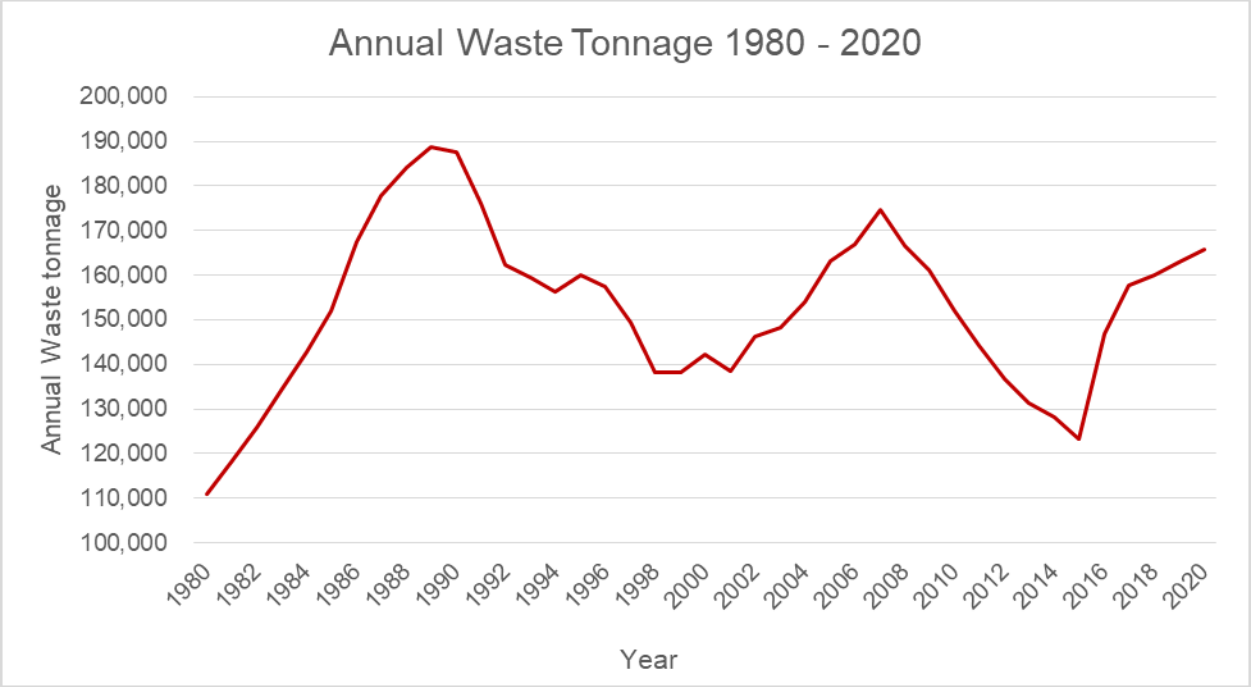


Figure 1 Annual Waste Tonnages Received or Estimated for Hartland Landfill from 1980-2020

5.2 Waste Composition

Waste composition is used to calculate methane generation rates in order to estimate overall LFG generation. Waste composition study results are included in Table 1 and with the gas generation data in Appendix A, including methane generation potential, a summary of waste sources and diversion, as required under the BC *Landfill Gas Management Regulation*.

Waste composition studies do not quantify controlled waste. Controlled waste is classified by the CRD as wastes that due to environmental or health and safety considerations require special handling. Controlled waste deposited at the site is measured by scale and classified by type. For the purpose of this report, and on consultant recommendation, controlled waste is considered relatively inert, with the exception of controlled waste classified as 'Miscellaneous', which is considered to be decomposable. Controlled waste totals are incorporated in the quantities for relatively inert and decomposable waste in the model and in Table 1.

Table 1 Waste Composition 1980 to Present

Date Range	Relatively Inert	Moderately Decomposable	Decomposable
1980 to 1995	33.7%	24.9%	41.4%
1996 to 2000	33.9%	40.5%	25.6%
2001 to 2004	26.6%	39.6%	33.8%
2005 to 2009	33.2%	37.0%	29.9%
2010 to 2013	31.5%	39.1%	29.4%
2014 to Present	37.6%	43.2%	19.2%

5.3 Waste Diversion

An organics (kitchen scraps) diversion program and ban was implemented on January 1, 2015. A conservative kitchen scraps diversion estimate of 30,000 tonnes was used for 2019 and 2020, as diversion is assumed to have increased with growing population and waste tonnages.

Diversion of a portion of highly decomposable waste from the landfill will result in a decrease in overall gas production. The 2016 waste composition study indicated organic material now comprises 21.1% of the waste stream, compared to 30% prior to the kitchen scraps ban. The Hartland *Landfill Gas Management Plan* predicted a decrease in gas production within the first one to three years, following the implementation of the diversion program. Annual modelled methane production, since the implementation of the diversion program, has confirmed a decline in LFG production since the implementation of the organics ban in 2015.

5.4 Gas Generation Modelling

LFG generation rates are estimated using the ENV model stipulated by the BC *Landfill Gas Management Regulation*. Additional modelling was completed in 2020 after a comprehensive landfill gas quantification project supported the use of the UBCi model as a more accurate representation of gas generation for Hartland landfill (summarized further in Section 7.1.1). Details on modelling inputs and methodology for the UBCi model and the landfill gas quantification project are included in Appendix A.

The following section summarizes model inputs, assumptions and results. Protocols require the model to be run from 1980 to present. The Scholl-Canyon model requires input of site-specific data, which is discussed below. The model is run annually to produce current gas generation rates and uses updated waste quantity and composition data. The following input data are required to run the ENV LFG generation model:

- historical tonnage back to 1980
- waste quantity
- waste composition (ratio of relatively inert, moderately decomposable and decomposable wastes in place)

- methane generation rate factor
- methane generation potential factor
- water addition factor
- annual rainfall

The methane generation rates and estimates were calculated by using the annual tonnage amounts and the waste composition data from studies completed in 1990, 1996, 2001, 2005, 2010 and 2016, as well as the most recent quantifiable kitchen scraps diversion data/estimates. Detailed waste composition information is provided in appendices A2a, A2b and A4 and percentages of relatively inert, moderately decomposable and decomposable wastes were estimated in accordance with ENV guidance. Prescribed methane generation potentials are shown in Table 2.

Table 2 Methane Generation Potential and Rate Factors Used for the ENV LFG Generation Model

Waste Type	Methane Generation Potential L_0 (m^3 methane/tonne)	Methane Generation Rate (k) Values
Relatively Inert	20	0.02
Moderately Decomposable	120	0.04
Decomposable	160	0.09

Table 2 shows the estimated annual methane production for Hartland landfill since 1998 when LFG collection commenced. According to the *Landfill Gas Management Plan*, gas generation is predicted to have peaked due to the kitchen scraps ban, and will slowly decline through to landfill closure.

Table 3 Estimated Methane Generation by Year at Hartland Landfill

Year	Annual Methane[1] Generation (tonnes/yr)
2000	7,112
2001	7,127
2002	7,229
2003	7,360
2004	7,493
2005	7,645
2006	7,760
2007	7,885
2008	8,034
2009	8,145
2010	8,230
2011	8,277
2012	8,293
2013	8,282
2014	8,106
2015	8,032
2016	7,979
2017	7,957
2018	7,909
2019	7,915
2020	7,934

Notes: [1]Estimates generated using the ENV model

6.0 LFG COLLECTION AND MONITORING INFRASTRUCTURE

Systems to control and monitor fugitive LFG emissions have been implemented at Hartland landfill. The objective of these controls is to:

- protect employee and public health and safety
- prevent migration of gas off-property or into on-site buildings
- reduce GHG
- capture gas for energy recovery
- control odour

The original LFG management system was installed in 1990 and upgraded in 1996. Under these early LFG systems, collected methane was destroyed via candlestick flare. Since 2004, LFG has been used to generate electricity. The current LFG management system consists of:

- An extraction well network, including vertical and horizontal wells.
- A conveyance system incorporating branch, lateral and header pipes to convey the collected LFG from the extraction network to the LFG utilization facility or flares.
- A LFG destruction facility with moisture separators, centrifugal blowers, flares, piping and electrical service.
- A 1.6-MW generator for LFG utilization.
- A LFG monitoring program.
- A subsurface gas migration monitoring network that includes gas monitoring probes located adjacent to the eastern property boundary and the perimeter of on-site building foundations.

6.1 Gas Extraction Wells

Table 4 shows the number and type of gas wells installed and operating in 2020. A complete summary of all gas wells, including installation and deactivation dates, is included in Appendix B. In 2020, 15 new wells were installed and seven were activated. Nine wells were removed from the monthly monitoring program in 2020.

Table 4 Number and Type of Gas Wells Installed or Operating (2015-2020)

Type of Gas Well	2015	2016	2017	2018	2019	2020
Vertical gas wells operating	74	74	67	63	60	60
Horizontal gas wells operating	38	40	62	69	78	78
Leachate horizontal gas wells operating	12	12	12	9	8	6
Leachate gas trench operating	5	5	0	0	0	0
Wells installed, but not connected[1]	16	12	5	15	7	15
Total	**129**	**131**	**141**	**141**	**146**	**144**

Notes:
[1] number of wells installed, but not connected are not included in the final total.

See Figure 2 for the general location and layout of the LFG infrastructure.

In 2011, the density of horizontal wells has increased from 45-50 m, to 20 m on centre. Wells are placed on each vertical lift, approximately every 4 m, with each offset from the lower trench alignment. All new horizontal wells over 150 m in length are connected to laterals at both ends. By the end of 2020, seven new horizontal wells were activated (in Cell 3).

Current vertical well design includes dual zone shallow and deep wells extending approximately 16 m and 30 m into the waste, respectively. Vertical well saturation has complicated gas extraction and, as a result, very few have been installed since the implementation of the *Landfill Gas Management Plan*. No vertical wells were installed in 2020. Installation and operation of vertical wells is continually reviewed.

Hartland Landfill

Gas Collection Infrastructure March 2021

CRD
Making a difference...together

Gas Collection Facility
- Gas Plant
- Power Plant

Gas Collection Well
- Buried Well
- Well
- Well Head Assembly

Gas Collection Node
- Cleanout
- Condensate Drain
- Condensate Drain Cleanout
- Condensate Trap
- Header Cleanout
- Inline Valve
- Sampling Port
- Trench Riser

Gas Collection Carrier Pipe
- Gas Carrier Pipe

Gas Collection Pipe
- Header
- Lateral
- Trench Riser

Horizontal Gas Wells
- 171, 175 & 179 Lifts
- 163, 165 & 167 Lifts
- 151, 155 & 159 Lifts
- 139, 143 & 147 Lifts
- Other Wells
- Landfill Designated Areas

Metres
0 20 40 60 80 100

Projection: UTM Zone 10 North, NAD 1983
This map is for general information only and may contain inaccuracies.

FUTURE LANDFILL EXTENT

PHASE 2, CELL 1 NORTH FACE CLOSURE (2012)

PHASE 2, CELL 2 CLOSURE (2016)

PHASE 1 CLOSURE (1997)

PHASE 2, CELL 3 (ACTIVE)

SOUTH WEST PROGRESSIVE CLOSURE (2008)

PHASE 2, CELL 2 (ACTIVE)

PHASE 2, CELL 1 NORTH FACE CLOSURE (2012)

North Park Road
Residual Way
High Level Road
North Hydro Road
Upper Lagoon Access
Lagoon Road
Perimeter Road North
140 Road
150 Road
160 Road
170 Road
160 to 170 Connector Road
Toune Valley Road
North Main Haul Road
East Hydro Road
East Perimeter Road
North Toe Road
South Diversion Road
Berm Road
Main Access Road
Recycle & Public Road
South Park Road

6.2 Gas Well Field Operation and Monitoring

CRD staff monitor gas wells for methane, carbon dioxide, carbon monoxide, oxygen, balance gas, static pressure, differential pressure, temperature and flow on a monthly basis. The well field must be measured and balanced at least once per month and more often if there are changes in gas composition, or if there are fluctuations in the system vacuum. There are many factors that impact gas generation, so frequent well adjustments are critical to minimize oxygen, and optimize flow and methane content. Ideally, constant vacuum is applied at a well so that gas is drawn at approximately the same rate that it is being generated (a target of >40% methane and <2.5% oxygen is desirable). A comprehensive summary of gas concentration by well is provided in Appendix C. For 2020, on average, the LFG at the gas plant was comprised of 51% methane and 0.8% oxygen.

Data from the well field, including individual well gas flows, is provided in appendices B2 and B3. The well field was balanced 12 times in 2020 (specific wells are checked more often to optimize gas extraction), as recommended by the BC *Landfill Gas Management Facilities Design Guidelines*. The full data set is included in appendices B4 and B5. Table 5 shows that the seven most productive wells contribute approximately 30% of the total gas volume. Figure 3 depicts gas collection by well as it contributes to the total gas collected. The most productive wells were installed and activated after 2016 (four of seven).

A well field optimization study is planned for 2021 to identify current LFG collection system deficiencies or limitations and make recommendations to optimize or increase gas capture and gas quality. This project will support the renewable natural gas project efforts to increase gas collection efficiency and reduce fugitive emissions. Any changes will be incorporated into an updated *Landfill Gas Management Plan* for Hartland.

Table 5 Gas Wells with the Highest Collection 2020

Name	Refuse Lift (mASL)	Year Activated	Average Methane (% by vol)	Average Flow (scfm)	Methane Annual Flow (scf)	Methane Flow (m^3)	Well Production (% of Total)	Cumulative Total (%)
HLGW016B	163 (Cell 2)	2012	52.9	146.4	30,521,590	864,280	9.5%	9.5%
HLGW028A	171 (Cell 2)	2017	54.0	58.4	15,168,599	429,529	4.7%	14.2%
HLGW021B	165 (Cell 2)	2019	52.0	47.7	11,961,295	338,708	3.7%	18.0%
HLGW0059	155 (Cell 3)	2013	53.8	55.1	11,679,126	330,718	3.6%	21.6%
HLGW0058	155 (Cell 3)	2019	57.3	47.8	10,781,786	305,308	3.3%	25.0%
HLGW0057	155 (Cell 3)	2019	56.4	48.0	10,674,340	302,265	3.3%	28.3%
HLGW032B	171 (Cell 2)	2014	53.3	31.1	7,974,308	225,808	2.5%	30.8%

If a gas well does not produce enough methane, the valve is often turned down or off. In 2020, nine wells were labelled inactive. Well production is reviewed monthly during well field balancing events. Wells with poor quality or no gas may be monitored over time for improvements before being removed from the program. It is recommended that older, non-producing wells be removed from the monitoring program and labelled as ‘inactive’ after 18 months.

HARTLAND LANDFILL

GAS COLLECTION IN 2020 BY INDIVIDUAL WELL

PHASE 2
CELL 2 CLOSURE (2016)

PHASE 2 CELL 3 (ACTIVE)

PHASE 2, CELL 1 NORTH
FACE CLOSURE (2011)

PHASE 1 CLOSURE (1997)

SOUTH WEST PROGRESSIVE
CLOSURE (2008)

HLGW0010 (0%) 139
HLGW0011 (0%) 139
HLGW0009 (0%) 139
LHGW0010 (0%) 143
HLGW0001 (0.01%) 139
LHGW0008 (0%) 143
LHGW0009 (0%) 143
LHGW0007 (0%) 143
VLGW0057 (0%)
LHGW0006 (0%) 143
LHGW0003 (0%) 147
HLGW0013 (0.16%) 147
HLGW0004 (0%) 143
VLGW0060 (0.05%) 151
LHGW0013 (0.54%) 151
LHGW002A (0%) 143
HLGW0012 (0.17%) 155
VLGW0056 (0.72%) 147
HLGW0015 (0%) 155
HLGW0003 (0.05%) 139
VLGW0059 (0.09%) 159
HLGW0014 (0.42%) 155
LHGW0004 (0.01%) 147
LHGW0023 (0.17%) 159
LHGW0022 (0.16%) 159
HLGW0005 (0.08%) 147
VLGW034S (0.07%)
VLGW033S (0.06%)
VLGW031S (0.1%)
VLGW047S (0%)
HLGW0052 (1.63%) 151
HLGW0058 (5.36%) 159
LHGW0021 (0%) 159
VLGW028S (0.13%)
HLGW0060 (0.02%) 155
HLGW0059 (3.64%) 159
VLGW0058 (0.13%) 159
VLGW0055 (0.46%) 159
VLGW0051 (0.95%)
VLGW030S (0.04%)
HLGW0053 (0.4%) 151
HLGW0057 (3.33%) 155
VLGW032S (0.3%)
VLGW022D (0.13%)
HLGW0061 (0.02%) 155
LHGW0020 (0.85%) 159
VLGW0054 (0.49%)
VLGW027D (0.5%)
VLGW022S (0.08%)
HLGW0064 (0.14%) 159
HLGW016B (9.51%) 163
VLGW029D (0.64%)
VLGW014S (0%)
HLGW0054 (0.06%) 151
HLGW0018 (0.66%) 163
HLGW006B (0%) 159
VLGW0050 (0.11%)
VLGW027S (0.1%)
HLGW065B (0.43%) 159
LHGW0019 (0.7%) 159
VLGW0053 (0.13%)
HLGW006A (0%) 159
VLGW029S (0.2%)
VLGW014D (0%)
HLGW0062 (1.83%) 155
HLGW017B (0.08%) 163
HLGW022B (0.47%) 165
HLGW029B (0.29%) 171
VLGW021S (0.2%)
HLGW0055 (5%) 151
HLGW0024 (0.83%) 163
LHGW0017 (0%) 163
HLGW040B (0.84%) 175
VLGW021D (1.55%)
HLGW013S (0.11%)
HLGW066B (1.11%) 159
HLGW019B (0%) 165
HLGW030B (1.29%) 171
VLGW026S (0.38%)
HLGW013D (0.11%)
HLGW067B (0.58%) 159
HLGW0025 (0.7%) 163
HLGW020B (0%) 165
HLGW0023 (1.08%) 165
VLGW0052 (0.8%) 171
HLGW008B (1.12%) 143
VLGW026D (0.22%)
HLGW0063 (0.31%) 155
HLGW0068 (0.72%) 159
HLGW021B (3.73%) 167
HLGW031B (1.27%) 171
VLGW0049 (0.46%)
HLGW0056 (0%) 151
HLGW0036 (0.21%) 167
HLGW042B (1.25%) 175
VLGW020S (0.06%)
RWHGW01B (0%) 155
HLGW0026 (0.91%) 171
VLGW025S (0%) 171
VLGW020D (0.18%)
HLGW027B (1.03%) 171
HLGW032B (2.49%) 171
HLGW033B (0.04%) 171
HLGW0037 (1.76%) 171
HLGW034B (1.51%) 171
HLGW028B (1.41%) 171
HLGW039B (0.57%) 175
VLGW025D (0%) 171
VLGW043S (0.18%)
HLGW041B (1.23%) 175
HLGW043B (0.95%) 175
VLGW008S (0.46%)
HLGW038B (1.18%) 175
HLGW044B (0.2%) 179
VLGW008D (0.22%)
HLGW0045 (0.05%) 179
VLGW019D (0.47%)
HLGW0046 (0.07%) 179
HLGW051B (1.13%) 179
VLGW019S (0.16%)
HLGW049B (1.21%) 179
HLGW047B (0.17%) 179
HLGW050B (1.01%) 179
VLGW012S (0.19%)
HLGW048B (0.05%) 179
VLGW007D (0.85%)
VLGW018S (0.2%)
VLGW007S (0.32%)
VLGW018D (0.25%)
HLGW032A (0.02%) 171
VLGW011S (0.32%)
HLGW050A (0.01%) 175
HLGW043A (0%) 175
VLGW006S (0.14%)
HLGW042A (0.15%) 175
HLGW051A (0%) 179
VLGW017D (0.3%)
VLGW006D (0.41%)
HLGW044A (0.81%) 179
HLGW049A (0%) 179
VLGW017S (0.67%)
HLGW048A (0.13%) 179
HLGW033A (1.33%) 171
HLGW066A (0%) 159
VLGW005D (0%)
VLGW010S (0.05%)
HLGW019C (0%) 165
HLGW040A (1.42%) 175
HLGW034A (0.02%) 171
VLGW016D (0.73%)
HLGW067A (0%) 159
HLGW017A (0%) 163
HLGW047A (1.82%) 179
VLGW005S (0.15%)
HLGW041A (0%) 175
VLGW016S (0.11%)
RWHGW01A (0.03%) 155
HLGW016A (0%) 159
HLGW031A (0.01%) 171
VLGW042S (0.54%)
VLGW009D (0.14%)
HLGW039A (0.97%) 175
VLGW024S (0%)
VLGW009S (0.23%)
HLGW030A (0.01%) 171
VLGW024D (0.42%)
VLGW015D (0.9%)
VLGW004S (0%)
HLGW027A (1.66%) 171
HLGW029A (1.36%) 171
VLGW015S (0.23%)
VLGW004D (0%)
HLGW028A (4.73%) 171
HLGW008A (1.06%) 143
VLGW023S (0.46%)
VLGW001D (0.23%)
VLGW023D (0.85%)
VLGW002D (0%)
VLGW001S (0%)
VLGW003D (0.62%)
VLGW003S (0.13%)
VLGW002S (0%)

Gas Well Production 2018

- 0.00%-049%
- 0.5%-1.49%
- 1.5%-3.99%
- >4.00%
- Decomissioned Well or Well with No Production
- Active Gas Lines
- Abandoned or Inactive Gas Lines; HorizontalWell, Inactive

HLGW0012 (4.8%) - Well ID - % of Total Production

VLGW024S (0%) Wells With no Gas Production (Not Read or Turned Off)

LHGW0009 (0%) Decomissioned Wells (no Gas Production)

147 Lift Number

Making a difference...together

Metres
0 10 20 40 60 80 100

Projection: UTM ZONE 10N NAD 83

N W E S

Important This map is for general information purposes only. The Capital Regional District (**CRD**) makes no representations or warranties regarding the accuracy or completeness of this map or the suitability of the map for any purpose. **This map is not for navigation.** The CRD **will not be liable** for any damage, loss or injury resulting from the use of the map or information on the map and the map may be changed by the CRD at any time.

CRD - Parks & Environmental Services - Jun 2, 2017 - Technologist: SR - Map Document: HartlandGasProduction2016.mxd

7.0 LFG UTILIZATION AND COLLECTION EFFICIENCY

The volume of collected LFG is measured by flow meters at the LFG plant and recorded on the CRD SCADA system. The data is compiled to determine collection and utilization rates, and then compared to the generation model to estimate the collection efficiency of the system. LFG collection refers to all gas drawn into the gas plant, while LFG utilization refers only to the gas used to generate electricity. Table 6 shows a summary of gas collection, utilization and overall collection efficiency. Figures in the following section illustrate the collection efficiency for the last several years (2010-2020) and the full set of data is provided in Appendix C1.

The LFG utilization facility shown in Figure 4 consists of six major components:

1. **Conditioning Skid:** Receives the LFG from the CRD collection/blower system. The conditioning skid cools the gas and reduces moisture, which drains into the condensate collection system. It also reduces the amount of siloxane, which increases wear and tear on generator components.
2. **Refrigeration Plant:** Provides coolant to the conditioning skid by circulating it, as required, to maintain the LFG at 2°C.
3. **Engine:** 20-cylinder, 2,200-HP Caterpillar. The engine runs a direct drive 1,200-rpm, 1.6-MW generator. Electricity produced is fed into the BC Hydro grid.
4. **Transformer:** The unit converts 600 V to 25 kV.
5. **Switch Gear:** Monitors stability of the line input to the BC Hydro grid.
6. **Master Control Building:** Houses the controls that interconnect the utilization facility with the collection system. It also provides system operation controls, such as continuous quality, flow rate and pressure monitoring. The CRD has upgraded its system controls to communicate with the utilization facility.

Gas is drawn into the facility by the blowers and passed through the conditioning skid. An automated valve maintains the required gas pressure for the generator, while excess gas is fed back to the candlestick flare. Gas is only directed to the groundflare during extended periods of generator downtime, during times of generator maintenance or BC Hydro power outages.

Figure 4 Hartland LFG Plant

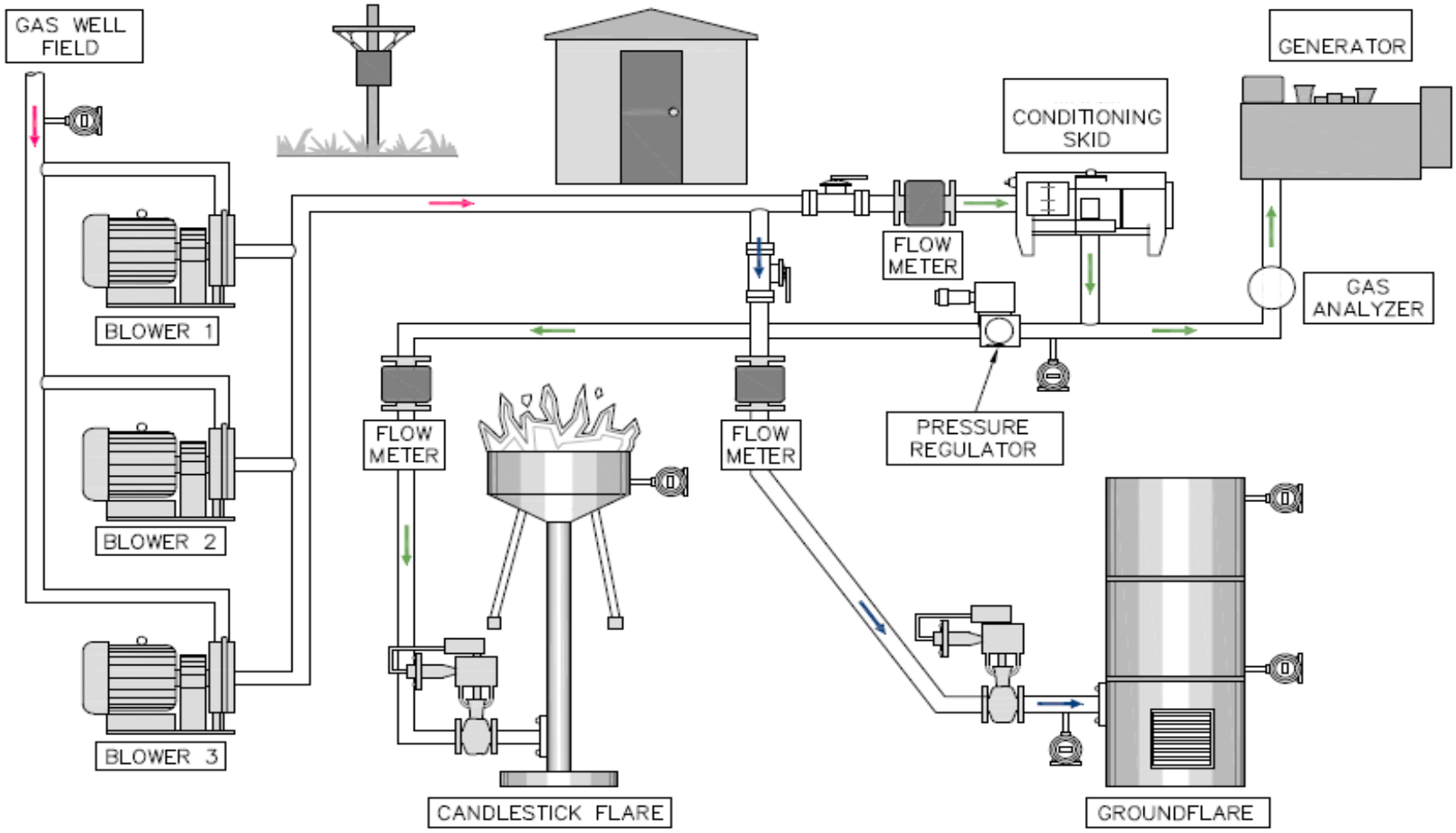


Table 6 LFG System Collection Efficiency 2010-2020 ENV Model

Year	Modelled Annual[1] Methane Generated ENV Model (scfm)[2]	Measured Annual Gas Capture (scfm)[2]	Collection Efficiency (%) ENV Model	GHG Emission (tonnes/year CO2e)
2010	1,687	546	32.4	139,133
2011	1,696	581	34.3	136,052
2012	1,700	829	48.8	106,201
2013	1,697	987	58.2	86,624
2014	1,671	942	56.4	89,474
2015	1,646	1,085	65.9	69,330
2016	1,632	1,009	61.8	75,939
2017	1,627	1,102	67.7	64,173
2018	1,621	1,037	64.0	71,219
2019	1,622	1,062	65.5	68,451
2020	1,626	1,084	66.7	66,237

Notes: [1] Generated using the ENV model; [2] Normalized to 50% methane;

Table 7 LFG Collection System Efficiency 2014-2020 UBCi Model

Year	Modelled Annual[1] Methane Generated UBCi Model (scfm)	Measured Annual Gas Capture (scfm)[1]	Collection Efficiency (%) UBCi Model	GHG Emission (tonnes/year CO2e)
2014	1,427	942	66	59,109
2015	1,409	1,085	77	39,488
2016	1,382	1,009	73	45,459
2017	1,322	1,102	80	26,813
2018	1,346	1,037	76	37,659
2019	1,363	1,062	78	36,684
2020	1362	1,084	81[2]	33,881

Notes: [1] Normalized to 50% methane; [2] calculated in June and October based on empirical study

The data above present collection efficiency using the ENV gas generation model (Table 6), as stipulated in the *Landfill Gas Management Facilities Design Guidelines*, and the UBCi model (Table 7). In 2020, landfill gas emissions were measured across the site and a methane mass balance was completed. Data was compared to three landfill gas generation models (including the required ENV model) and collection efficiency was calculated. Gas generation results from the UBCi model correlate closely with the methane mass balance and result in a higher collection efficiency. The UBCi model was used to retroactively calculate collection efficiency back to 2014. More detail on this project is provided in the next section (7.1.1).

In 2020, collection efficiency using the ENV model and UBCi model was calculated at 66.7% and 81%, with total uncollected (fugitive) GHG emissions estimated at 66,237 and 33,881 tonnes CO_2e, respectively (Figure 5). Using the UBCi model, collection efficiency was calculated at 81% in 2020. Gas collection varies as a result of refuse age, well installation/operation, and well balancing activity. Collection efficiency has improved since 2018 and may be attributed to gas wells in Cell 3 coming online.

Gas collection in 2020, is in line with the historical high reached in 2017 (1,084 scfm and 1,085 scfm captured, respectively). The increase in collection efficiency can be attributed to activation of productive wells in Cell 3, and additional staff resources available to complete well field balancing.

Overall, the following observations can be made regarding gas production and collection at Hartland:

- Phase 1 gas production is depleting. Waste in this area of the landfill has been in place for more than 30 years and a decline in gas production is expected.
- There is decreased gas production in some high producing wells in Phase 2, which is expected due to age of refuse and advanced methanogenic processes.
- Activation of gas wells in Cell 3 required sufficient refuse in place to prevent oxygen intrusion. Wells in Cell 3 are now producing sufficient gas resulting in the increase in collection efficiency. More wells will be brought online in 2021.

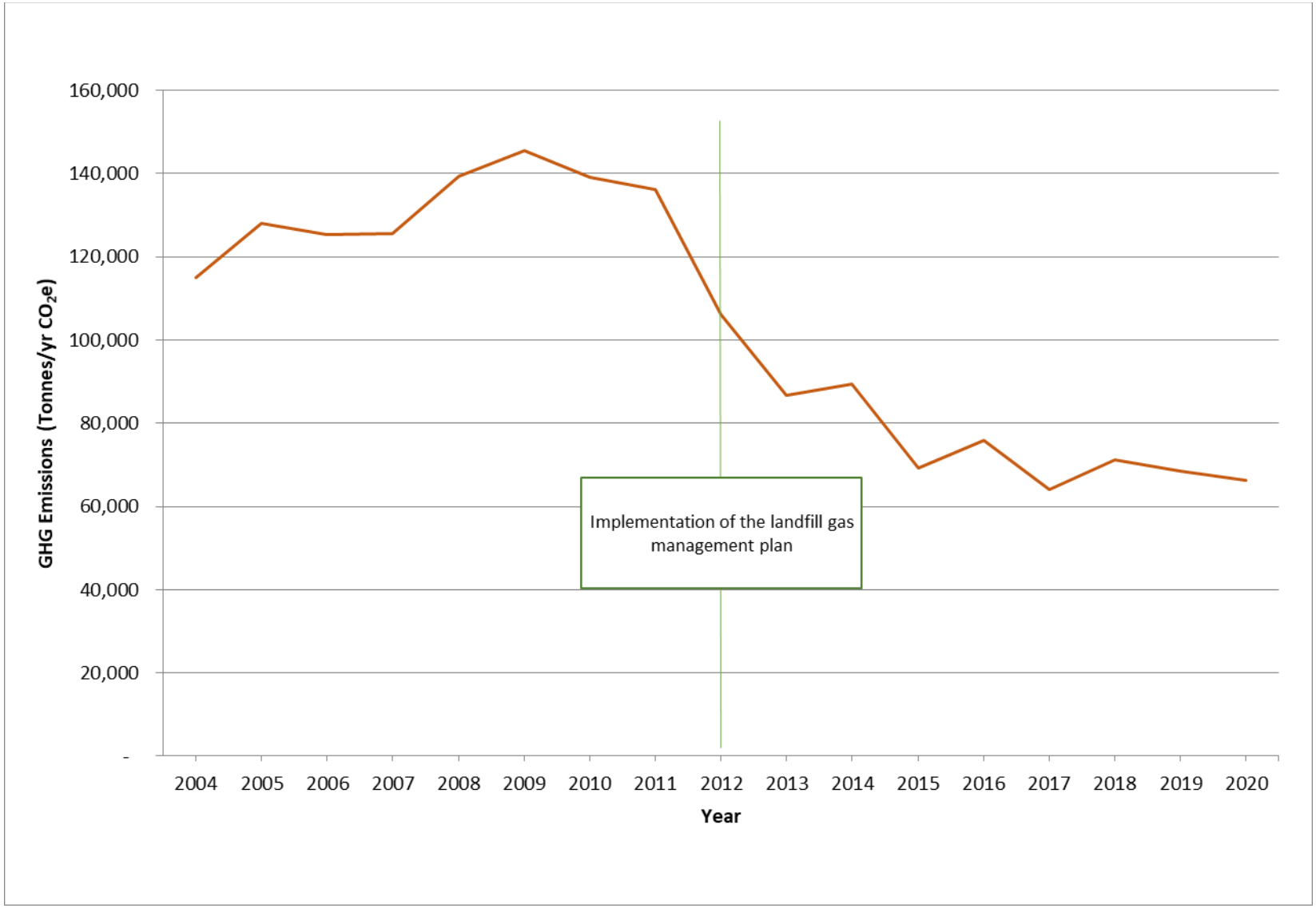


Figure 5 Fugitive GHG Emission at Hartland Landfill 2004-2020 (ENV model)

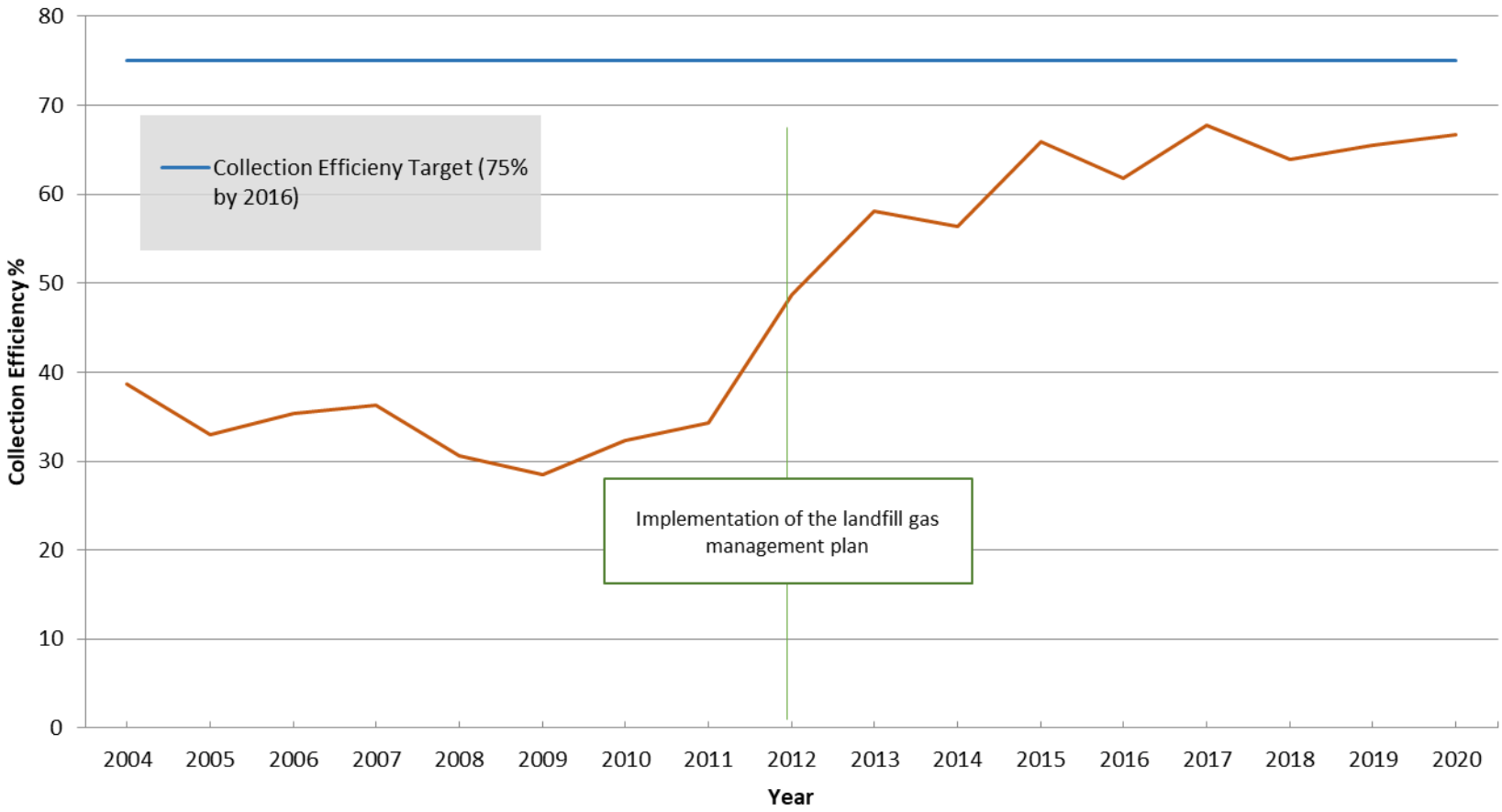


Figure 6 Collection Efficiency Estimates 2004-2020 (ENV Model)

7.1.1 Gas Generation, Quantification and Modelling Study

Over the past few years, the CRD has been completing a number of long-term LFG recovery and alternatives assessments in response to aging infrastructure and LFG production exceeding the capacity of the generator. Based on these assessments, the CRD is planning to upgrade LFG to renewable natural gas (RNG) for sale to the FortisBC natural gas network.

In 2020, to better understand LFG generation at Hartland, and to support the RNG project, CRD staff commissioned a study to:

- quantify fugitive landfill gas emissions across the landfill;
- assess the current landfill gas collection efficiency against modelled landfill gas generation; and
- identify and propose mitigation strategies for major emission hot spots.

Fugitive emissions at Hartland were empirically measured during two field events in 2020 (June and October). The data were used to complete a comprehensive landfill gas mass balance for the site across three different landfill gas generation models. Report findings confirm that the current ENV model overestimates landfill gas generation and fugitive emissions at Hartland, while the UBCi model more accurately estimates gas generation. Consequently, the calculated gas collection efficiency is higher for the UBCi model – approximately 76-81% over the last three years, compared to the 64-67% for the same period using the required ENV model. According to the UBCi model, which is supported by empirical, mass balance data, Hartland landfill is meeting and exceeding the 75% collection efficiency requirement set out in the *Landfill Gas Management Regulation*. The full report is provided in Appendix A.

The analysis also found that current landfill cover systems are estimated to biologically oxidize 29% of the total fugitive emissions. As a result, between landfill gas collection and biological oxidation of methane, it is estimated that approximately 86% of the total methane from Hartland is being beneficially utilized or destroyed.

The report also identified additional strategies that can be taken by CRD to increase collection efficiency and biological oxidization, including enhancements to the existing landfill gas collection system and application of an engineered biocover system on both closed and operational phases of the landfill.

One area was specifically targeted for enhanced collection in 2020 as empirical data estimated that it accounted for 17% of the total fugitive emissions at the landfill. This hotspot, located at the interface between bedrock and refuse presents gas collection challenges due to oxygen intrusion. Staff worked with a consultant to develop a specialized gas collector design that will be installed and operated in 2021. Additional plans for 2021 include continuing to optimize LFG collection at Hartland for beneficial use, and complete a well field optimization study.

7.1.2 Destruction Devices and Usage

Table 8 shows the average gas collected from 2014-2020 and flows through destruction devices (generator, candlestick or groundflare). Flaring of gas occurs when gas collection exceeds generator capacity or during generator downtime. The generator was down for maintenance in February, March, May and July for approximately 75 days in total. During this time, the groundflare was operational.

The BC *Landfill Gas Management Facilities Design Guidelines* specify that a candlestick flare should not be used as a primary combustion device, but can be utilized as a backup combustion device when flows exceed the capacity of other approved devices. As a result, 50% or more of the total LFG collected should be directed through high efficiency destruction devices (groundflare or generator). Since 2009, the generator and groundflare have been the primary destruction devices. In 2020, 58.4% of the gas was directed through approved destruction devices.

Table 8 LFG Flows to Destruction Devices (2014-2020)

Annual Average	Year						
	2014	2015	2016	2017	2018	2019	2020
Gas Collected (scfm)*	953	1,085	1,009	1,102	1,037	1062	1084
Destruction by Generator (scfm)*	492	319	269	467	535	439	440
Destruction by Candlestick Flare (scfm)*	427	304	314	461	470	395	434
Destruction by Groundflare (scfm)*	42	464	430	177	33	228	193
Total Gas Flared	49.2%	70.8%	73.8%	57.9%	48.5%	58.6%	57.9%
Gas through approved destruction devices	55.2%	72.1%	69.3%	58.2%	54.7%	62.9%	58.4%

Notes:
*normalized to 50% methane

7.1.3 LFG Management Plan Implementation Status

The CRD has implemented the conceptual design in the *Landfill Gas Management Plan*. However, since the plan was prepared, some operational changes have occurred, which are summarized below:

2012	Per the *Landfill Gas Management Plan*, alignment of horizontal wells changed from east-west to north-south due to the master fill plan cell phasing and progression.
2012/2013	Relocation and reconfiguration of controlled waste disposal areas. Controlled waste, initially landfilled in clay-lined cells, is now trenched into refuse. Landfilling was conducted over the controlled waste area expanding the available footprint for Cell 2. This benefits overall collection in that it allows gas wells to be installed in controlled waste areas that would otherwise be inappropriate due to clay.
2014	Installation of vertical gas wells has been delayed pending further review of efficacy due to leachate inundation or minimal gas production. Vertical gas wells installed in recent closed areas (2012) were not productive due to density of horizontal wells and overlapping areas-of-influence.
2014	Since implementation of the *Landfill Gas Management Plan*, horizontal well installation depths have been reduced (made shallower). The proposed deeper wells were intended to accelerate activation; however, this was not actualized and the deeper wells triggered odour and safety issues during installation. As a result, this part of the *Landfill Gas Management Plan* was revised to allow for shallow wells. The shallow wells have fewer health and safety considerations, are less expensive to install, and can be activated in the same timeframe, as deeper wells specified in the plan.
2015/2016	Filling plan sequencing has changed since the plan was prepared. These changes represent schedule variations rather than whole scale deviations from *the Landfill Gas Management Plan*. Changes include: • Phase 2, Cell 2 vertical extension by two lifts to allow time for completion of the cliff quarry and construction of Cell 3.
2017	A bypass line valve was opened at the gas plant to reduce backpressure on the well field and increase gas flows to the plant. As a result, flows increased by 50-100 scfm.
2018	No significant changes to the system were made in 2018.
2019	No significant changes to the system were made, but additional Cell 3 wells are now coming online, which is consistent with the *Landfill Gas Management Plan* prediction that Cell 3 well activation may take up to five years.
2020	No significant changes to the system were made. LFG generation and emissions study was completed to confirm the effectiveness of the current collection infrastructure and well field balancing programs. Additional well field optimization projects are planned for 2021.

8.0 OPERATIONAL PERFORMANCE

Detailed landfill operational updates and changes are outlined in the *Hartland Landfill 2020 Operations Report*. There were no significant changes to the operation of the LFG system in 2020. The gas collection system operates continuously, except when there is a power failure or alarms that result in system shutdown. Table 9 summarizes collection system downtime (i.e., no vacuum applied on the collection system), approximately five days. All downtime can be attributed to power outages and planned/unplanned maintenance. In August 2020, a generator was installed to provide backup power to the gas plant blowers to ensure well field operation/vacuum in the event of a power outage.

Table 10 summarizes the 2020 generator performance, including electricity production, which compares actual operating hours to available operating hours for each month. Average energy production for 2020 was 70%, an increase from 2019 at 69.3%.

Table 9 Summary of 2020 Blower Downtime by Month

Month	Downtime (hours)
January	14
February	10
March	8
April	23
May	14
June	17
July	3
August	9
September	5
October	7
November	2
December	14
Total	**125.9 (5.2 days)**

Table 10 Generator Performance 2020

Month	Engine Run Hours	Electricity Generated (MW-hour)[1]	Production (%)
January	425	582	48.9%
February	0	0	0.0%
March	284	436	36.6%
April	606	931	80.8%
May	725	1,111	93.4%
June	669	1,023	88.8%
July	684	860	72.3%
August	704	684	57.5%
September	602	761	79.0%
October	710	1,088	95.8%
November	654	1,003	95.8%
December	691	1,010	91.3%
Average	563	791	70%

Notes: [1] Reported by BC Hydro

9.0 MONITORING PROGRAMS

Annual monitoring is conducted to evaluate LFG collection and control system performance. Monitoring includes both operational monitoring, e.g., generator performance monitoring and environmental monitoring (e.g., gas quality in surface probes). This section and Table 11 summarize the LFG monitoring activities.

Table 11 Summary of LFG Monitoring Programs

Task & Objectives	Frequency	Primary Parameters	Criteria	Action if Criteria Exceeded	Monitoring By
1. Perimeter subsurface probe monitoring					
To detect potential subsurface LFG migrating off site	Quarterly at perimeter probes	CH_4, CO_2, O_2, pressure and/or vacuum	LEL for methane (5.0%)	Increase sampling frequency. Initiate off-site sampling (see Task 7 below). Evaluate effectiveness of remedial measures.	EPro Staff
2. Building foundation probes					
To detect potential subsurface LFG migration into on-site building foundations	Quarterly at foundation probes	CH_4, CO_2, O_2, pressure and/or vacuum	20% of LEL 10% of LEL – CRD internal standard	Initiate appropriate remedial action.	EPro Staff
3. On-site ambient grid sampling					
To assess on-site LFG concentrations at known grid locations across the landfill surface	Once per year	THC as methane and H_2S	100 ppm as THC (methane)	Initiate investigation of remedial measures. Identify locations >100 ppm THC for Task 4.	EPro Staff
4. On-site ambient hotspot monitoring					
To identify localized sources of LFG, or releases that could create potential health, safety, environmental or operational problems	Once per year	THC as methane and H_2S	12,500 ppm/1.25% THC (25% of the LEL) 5 ppm H_2S	Initiate investigation of remedial measures. Identify locations with THC >1,000 ppm or H_2S >5 ppm as Z points (hotspots). Personal gas detectors required in high-risk areas.	EPro Staff

Table 11, continued

Task & Objectives	Frequency	Primary Parameters	Criteria	Action if Criteria Exceeded	Monitoring By
5. Gas well field monitoring					
Monitor the concentrations and gas flows from all the wells connected to the gas collection system	Minimum of monthly	Temperature, vacuum, flow rate, CH_4, CO_2, O_2	Maintain gas flow and methane content, control oxygen intake	Adjust wellhead vacuum.	Hartland Staff
6. Blower, flare and generator station monitoring					
Monitor the performance of the moisture separators, blowers and flare and/or generation station	Continuous	Temperature, pressure, gas flow rate, CH_4, O_2	Operational	Adjust well field if outside operational criteria.	Hartland Staff
7. Off-site properties					
To measure concentrations of gases in the event of LFG migrating off site	Task 1 exceedance	THC and H_2S	Detectable above air quality guidelines and WorkSafeBC criteria	Initiate appropriate remedial action.	Hartland Staff
8. On-site building gas monitoring					
To monitor methane and H_2S levels to protect workers in on-site buildings	Task 2 exceedance	Methane and H_2S	20% of the LEL (1% CH_4) – the Guidelines 10 ppm H_2S – WorkSafeBC	Initiate appropriate remedial action.	Hartland Staff
9. LFG speciation					
To measure concentrations of compounds in the LFG at the inlet to the gas conditioning skid and power generation station	Once every two years	VOC and H_2S	WorkSafeBC criteria for individual compounds in ambient air	Initiate Task 10 if calculated ambient concentrations exceed WorkSafeBC limits.	EPro Staff
10. On-site ambient air quality measurement					
Measure ambient VOC	Task 9 exceedance	VOC and H_2S	WorkSafeBC criteria for individual compounds in ambient air	Initiate remedial action.	EPro Staff
11. Generator performance evaluation					
Monitor the performance of the groundflare (stack test emissions)	Annual	Various	ENV Air Quality Objectives and WorkSafeBC criteria	Initiate remedial action.	EPro Staff

Notes:
EPro staff = Environmental Protection staff
LEL = lower explosive limit

9.1 Subsurface Gas Monitoring – Perimeter and Foundation Probes

Perimeter probes and foundation/trench probes have been used at Hartland landfill to monitor for subsurface gas migration since 1996. Perimeter and foundation probes are required in the BC *Landfill Criteria for Municipal Solid Waste* (2016). Quarterly monitoring is conducted in five eastern perimeter monitoring probes and 12 foundation monitoring probes (Figure 7). Through long-term improvements to the LFG collection system, LFG migration potential has been mitigated and there is no indication of gas migration off site. Although the risk is minimal, ongoing monitoring is required to meet regulatory requirements and to confirm worker and public health and safety. A complete monitoring methodology, probe locations, details, and data from the perimeter and building foundation probes are provided in Appendix D.

9.1.1 Perimeter Probes

All probes were monitored according to the standard operating procedures four times in 2020; data is presented in, maximum values are shown in Table 13. There was no detectable methane recorded in 2020. Consistent with historical data, CO_2 levels are slightly higher in the shallower 'B' probes than the deeper 'A' probes. Elevated carbon dioxide levels may give an early indication of the presence of LFG; however, no unusually high CO_2 levels were observed. Ongoing monitoring will continue to determine if any trends develop.

9.1.2 Foundation Probes

Foundation probes were monitored four times in 2020, which is in compliance with ENV requirements (Table 14 and Table 15). Carbon dioxide levels were similar to previous years. There were no recorded exceedances of the ENV limit of 1.0% methane during the reporting period. Monitoring will continue to satisfy regulatory requirements and to determine if any trends develop.

Perimeter and foundation probe monitoring results for 2020 were in compliance with the ENV requirements. Methane was not detected. The data indicates minimal risk of subsurface methane migration to adjacent properties or buildings. Quarterly monitoring should continue, to meet regulatory requirements and to evaluate health and safety risks.

Table 12 Average Gas Concentrations in Subsurface Perimeter Probes 2014-2020

Probe	CH_4 (%)							Probe	CO_2 (%)							Probe	O_2 (%)						
	2014	2015	2016	2017	2018	2019	2020		2014	2015	2016	2017	2018	2019	2020		2014	2015	2016	2017	2018	2019	2020
GP-1A	0.0	0.0	0.0	0.0	0.0	0.0	0.0	GP-1A	0.1	0.0	0.1	0.0	0.0	0.0	0.0	GP-1A	19.5	20.6	20.6	20.3	20.3	20.8	20.8
GP-1B	0.0	0.0	0.0	0.0	0.0	0.0	0.0	GP-1B	1.6	2.0	1.5	0.9	0.8	1.5	2.5	GP-1B	17.9	18.7	18.9	19.3	19.4	19.1	19.1
GP-2A	0.0	0.0	0.0	0.0	0.0	0.0	0.0	GP-2A	0.0	0.0	0.1	0.0	0.0	0.0	0.0	GP-2A	19.6	20.6	20.4	20.4	20.2	20.6	20.8
GP-2B	0.0	0.0	0.0	0.0	0.0	0.0	0.0	GP-2B	2.5	2.9	3.8	1.6	3.1	3.8	4.3	GP-2B	12.1	15.2	13.2	15.6	13.9	12.5	15.7
GP-3A	0.0	0.0	0.0	0.0	0.0	0.0	0.0	GP-3A	1.3	1.7	1.8	1.8	1.4	1.9	1.5	GP-3A	14.5	13.5	14.6	12.8	14.7	13.8	15.5
GP-3B	0.0	0.0	0.0	0.0	0.0	0.0	0.0	GP-3B	4.4	4.2	4.3	3.9	3.9	5.9	6.1	GP-3B	14.3	14.8	15.0	16.2	15.4	15.5	15.3
GP-11A	0.0	0.0	0.0	0.0	0.0	0.0	0.0	GP-11A	0.1	0.1	0.1	0.1	0.0	0.0	0.0	GP-11A	19.4	20.3	20.6	20.3	20.3	20.8	20.9
GP-11B	0.0	0.0	0.0	0.0	0.0	0.0	0.0	GP-11B	1.4	0.4	0.8	1.4	1.1	1.4	2.1	GP-11B	18.1	19.7	19.9	19.2	19.5	19.8	18.6
GP-12A	0.0	0.0	0.0	0.0	0.0	0.0	0.0	GP-12A	1.6	1.2	1.2	2.0	2.0	1.3	2.3	GP-12A	14.0	18.1	15.9	13.4	13.6	16.4	13.5
GP-12B	0.0	0.0	0.0	0.0	0.0	0.0	0.0	GP-12B	3.9	4.5	6.1	4.8	4.9	7.3	7.0	GP-12B	14.0	11.4	11.3	12.9	12.9	9.0	10.5

Table 13 Maximum Gas Concentrations in Perimeter Probes 2014-2020

Probe	CH_4 (%)	CO_2 (%)
GP-1A	0.00	0.10
GP-1B	0.00	3.10
GP-2A	0.00	0.10
GP-2B	0.00	5.50
GP-3A	0.00	2.20
GP-3B	0.00	8.40
GP-11A	0.00	0.10
GP-11B	0.00	2.40
GP-12A	0.00	5.40
GP-12B	0.00	9.00

Figure 7 Location of Gas Probes



Table 14 Average Gas Concentrations in Subsurface Foundation Probes 2014-2020

Probe	CH_4 (%)							Probe	CO_2 (%)							Probe	O_2 (%)						
	2014	2015	2016	2017	2018	2019	2020		2014	2015	2016	2017	2018	2019	2020		2014	2015	2016	2017	2018	2019	2020
GP-4A	0.00	0.00	0.00	0.00	0.00	0.00	0.00	GP-4A	1.25	1.35	1.70	2.07	0.05	0.00	2.90	GP-4A	7.40	19.23	18.40	19.37	20.75	20.98	18.33
GP-5A	0.00	0.00	0.00	0.00	0.00	0.00	0.00	GP-5A	0.73	1.00	0.80	0.73	0.65	0.58	0.83	GP-5A	18.90	19.70	19.90	19.80	19.68	20.18	19.90
GP-6A	0.00	0.00	0.00	0.00	0.00	0.00	0.00	GP-6A	0.48	0.58	0.50	1.03	1.00	0.78	0.75	GP-6A	19.25	20.00	19.80	19.13	19.35	20.03	19.95
GP-6B	0.00	0.00	0.00	0.00	0.00	0.00	0.00	GP-6B	0.30	0.63	0.80	0.68	0.68	0.53	0.85	GP-6B	19.38	19.78	19.60	19.55	19.63	20.33	19.75
GP-7A	0.00	0.00	0.00	0.00	0.00	0.00	0.00	GP-7A	0.18	0.30	0.20	0.18	0.30	0.25	0.23	GP-7A	19.35	20.45	20.50	20.13	20.08	20.63	20.60
GP-7B	0.00	0.00	0.00	0.00	0.00	0.00	0.00	GP-7B	0.13	0.23	0.10	0.08	0.13	0.15	0.15	GP-7B	20.30	20.50	20.60	20.30	20.33	20.73	20.70
GP-8A	0.00	0.00	0.00	0.00	0.00	0.00	0.00	GP-8A	0.20	0.23	0.20	0.15	0.13	0.20	0.15	GP-8A	19.30	20.53	20.50	20.25	20.35	20.63	20.70
GP-9A	0.00	0.00	0.00	0.00	0.00	0.00	0.00	GP-9A	0.25	0.23	0.20	0.20	0.10	0.18	0.15	GP-9A	19.23	20.50	20.40	20.13	20.33	20.73	20.73
GP-13A	0.00	0.00	0.00	0.00	0.00	0.00	0.00	GP-13A	2.05	3.90	2.00	3.30	2.77	2.43	2.78	GP-13A	17.78	17.03	18.10	16.80	17.27	18.48	17.63
GP-14A	0.00	0.00	0.00	0.00	0.00	0.00	0.00	GP-14A	2.83	3.28	0.90	1.13	0.48	0.83	0.60	GP-14A	16.83	17.80	19.60	19.10	19.95	20.38	19.93
GP-17A	0.00	0.00	0.00	0.00	0.00	0.00	0.00	GP-17A	0.05	0.23	0.10	0.73	0.20	0.05	0.15	GP-17A	19.65	20.43	20.30	19.63	20.00	20.58	20.65
GP-18A	0.00	0.00	0.00	0.00	0.00	0.00	0.00	GP-18A	0.35	0.33	0.20	0.28	0.33	0.25	0.18	GP-18A	18.60	19.80	19.70	19.40	19.20	20.03	20.23

Table 15 Maximum Gas Concentrations in Foundation Probes 2014-2020

Probe	CH_4 (%)	CO_2 (%)
GP-4A	0.00	3.80
GP-5A	0.00	1.30
GP-6A	0.00	1.30
GP-6B	0.00	1.60
GP-7A	0.00	0.40
GP-7B	0.00	0.30
GP-8A	0.00	0.20
GP-9A	0.00	0.30
GP-13A	0.00	6.00
GP-14A	0.00	1.00
GP-17A	0.00	0.40
GP-18A	0.00	0.30

9.2 Surface Emissions and Hotspot Sampling

Fugitive emissions can occur from advection and/or diffusion via soil pores, gaps and defective cover materials and are monitored routinely through surface monitoring. This monitoring assesses landfill closure integrity, supports worker health and safety, informs operational or capital planning, and supports optimal LFG collection. This monitoring is a simple and low cost means to assess methane and non-methane emissions. Although hot spot (also known as Z-points) locations change over time they are usually located at breaks or seams of cover systems and near side slopes in Phase 2, where gas collection is a challenge. Additionally, the western-most extent of Cell 3 has localized hotspots due to challenges with gas collection at the refuse-bedrock interface. Plans are underway to design and install a specialized gas collector in this area. The locations of all grid points and hotspots, as of July 2020, are shown in Figure 8. A summary of the results is shown in Table 16 and Table 17.

A historical summary of all Z-points is provided in Appendix E. At the end of 2020, there was a total of 29 Z-points identified. There were no elevated hydrogen sulphide concentrations. The absence of hotspots in Phase 1 indicates that the cover and gas collection system in the permanent closure is functioning. Annual monitoring should continue. Hotspots have decreased significantly since the implementation of the *Landfill Gas Management Plan* in 2012.

Table 16 Summary of Grid Sampling Results 2020

Survey date	July
Grid points Monitored	147
#Grid points >100 ppm THC	18
Maximum THC (ppm)	478

Table 17 Summary of Hotspot Results 2020

Survey date	July
Total # hotspots[1]	29
New hotspots at end of survey	7
Hotspots discontinued[2]	8
Maximum CH_4 (ppm)	25,600

Notes:
[1] Total number of hotspots at the end of the survey date
[2] Hot-spots discontinued at the end of the survey date

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Landfill Gas Hot Spot Values - July 2020	
WAYPOINT	**CH4 (ppm)**
Z88	6,816
Z94	8,600
Z101	2
Z104	3
Z106	3,800
Z107	1
Z109	33
Z111	2
Z112	1
Z113	65
Z114	4
Z116	24
Z118	369
Z119	700
Z120	1
Z122	2,444
Z123	25,600
Z124	2,043
Z125	10,100
Z126	9,400
Z127	21,400
Z128	3,400
Z129	8,900
Z130	1,686
Z131	1,430
Z132	2,302

PHASE 2 CELL 2 CLOSURE (2016)

PHASE 2, CELL 1 NORTH FACE CLOSURE (2011)

PHASE 2, CELL 3 (ACTIVE FACE)

PHASE 1 CLOSURE (1997)

SOUTH WEST PROGRESSIVE CLOSURE (2008)

Making a difference...together

Metres
0 20 40 60 80 100

Projection: UTM ZONE 10N NAD 83

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Combustible Gas Result
(parts per million)
- 0-99 ppm
- 100-999 ppm
- 1,000-12,499 ppm
- >12,500 ppm

- Gas Probes
- Active Gas Wells
- Abandoned or Inactive Gas Wells
- Active Gas Lines
- Abandoned or Inactive Gas Lines
- Leachate Collection Lines
- Roads
- Final Closure Areas
- Progressive Closure Areas
- Structures
- Parking Lots
- Water Bodies

HARTLAND LANDFILL AMBIENT AIR MONITORING RESULTS - JULY 2020

CRD - Parks & Environmental Services- May 17, 2021 - Technologist: jpbezeau - Map Document: HartlandGasHistoricalZLocations2021.mxd

Lagoon Road
Perimeter Road North
Northwest Slope Road
160 Road
Tourle Valley Road
160 Road
PHASE 2, CELL 1
NORTH FACE
CLOSURE (2011)
140 Road
150 Road
160 Road
East Perimeter Road
PHASE 2 CELL 2
CLOSURE (2016)
North Main Haul Road
PHASE 2, CELL 3
(ACTIVE FACE)
PHASE 1 (CLOSED)
170 Road
East Hydro Road
High Level Road
SOUTH WEST
PROGRESSIVE
CLOSURE (2008)
South Diversion Road
Berm Road
Main Access Road
N
W
E
S

CRD
Making a difference...together

Metres
0 20 40 60 80 100

Projection: UTM ZONE 10N NAD 83

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- Historical Z-Spot Locations (Active)
- Historical Z-Spot Locations (Inactive)
- Gas Probes
- Active Gas Wells
- Abandoned or Inactive Gas Wells
- Active Gas Lines
- Abandoned or Inactive Gas Lines
- Leachate Collection Lines
- Roads
- Final Closure Areas
- Progressive Closure Areas
- Structures
- Parking Lots
- Water Bodies

HISTORICAL Z-POINT LOCATIONS

9.3 LFG Speciation

A comprehensive LFG gas speciation program that was initiated in 2019 to support LFG management and capital planning for beneficial use alternatives was extended into 2020. Raw, unconditioned gas samples were collected once per month from April 2019 to March 2020; additional sampling began again in December 2020, and is currently ongoing. A short summary of results is provided below.

9.3.1 Health and Safety

LFG speciation data from 2020 was consistent with historical data and indicated that undiluted LFG exceeded the WorkSafeBC limits for carbon dioxide, carbon monoxide, hydrogen sulfide, vinyl chloride, and benzene. Methane concentrations were similar to historical levels; however, the limit was removed in 2018 so no exceedances are flagged for 2020. Ethylbenzene and n-hexane exceeded WorkSafeBC thresholds in October for the first time. October results reported anomalously high concentrations for numerous gases, but passed laboratory QA procedures.

Exposure to undiluted LFG is unlikely, as fugitive emissions mix quickly with air. Ambient air sampling conducted in 1999 and 2001 indicated an average dilution factor greater than 100:1. To further protect worker health and safety, personal gas detectors are set to alarm at levels consistent with 100:1 dilution factor (0.5% or 5,000 ppm methane or 10% of the LEL). In addition, any areas with increased concentrations of LFG are flagged and access by staff is restricted or prohibited.

9.3.2 LFG Composition and Trends

The comprehensive landfill gas sampling program that ran from April 2019 to March 2020 resumed again in December 2020 to satisfy additional data requirements for the RNG biogas upgrading scoping/design project. LFG composition is highly variable and is influenced by numerous factors, including waste composition/quantity, ambient temperature, barometric pressure and precipitation. Data show that ambient temperature has a significant impact on LFG flux and collection rates, with gas flows increasing with increased ambient temperatures. Conversely, low temperatures, high barometric pressure and extreme levels of precipitation all result in decreased LFG flux, and ultimately result in decreased collection. Outside of extreme precipitation events, the overall wet climate at Hartland (~800 mm of precipitation per year) results in increased LFG generation, when compared to more arid landfill sites.

Key LFG constituents from the sampling program are presented in Table 18 and summarizes data spanning January to April and December 2020. Methane, nitrogen, carbon dioxide and oxygen concentrations were adjusted for sample air intrusion using field data. Nitrogen concentrations are elevated above the expected range of <10%, according to the Guidelines. Additional optimization efforts will be undertaken in 2021 to reduce nitrogen concentrations.

Table 18 Concentrations of Key LFG Parameters in Hartland LFG 2020

Property/Contaminant	Average	Max	Min
Hydrogen Sulphide	25.28 ppm	89 ppm	0.6 ppm
Nitrogen	15.27 %	18.30 %	12.20 %
Sulfur	(all < detection limit)	<100 mg/m^3	<23 mg/m^3
Carbon Dioxide	36.26 %	39.00 %	33.00 %
Oxygen	0.69 %	1.20 %	0.00 %
Siloxanes	9.52 mg/m^3	16.80 mg/m^3	0.81 mg/m^3
Carbon Monoxide	0.05 %	0.05 %	0.00 %
Ammonia	0.57 mg/m^3	3.05 mg/m^3	<0.19 mg/m^3
Methane	47.75 mg/m^3	53.10 mg/m^3	45.20 mg/m^3

The following table summarizes LFG monitoring results, compliance, mitigation actions, and recommendations.

Table 19 LFG Compliance Summary 2020

Program	Compliance Location	Criteria	Findings	Mitigation/Actions	Recommendations
Perimeter Probe Monitoring	Probes GP-1A, 1B, 2A, 2B, 3A, 3B, 11A, 11B, 12A and 12B	Methane must not exceed 5% in subsurface soils (BC *Landfill Criteria for Municipal Solid Waste* & BC *Landfill Gas Management Facilities Design Guidelines*)	No exceedances Low risk of sub-surface gas migration to adjacent properties	None	Continue quarterly monitoring.
Building Foundation Probe Monitoring	Probes GP- 4A, 5A, 6A, 6B, 7A, 7B, 8A, 9A, 13A, 14A, 17A, 18A	Maximum 1% methane in any on-site facility (BC *Landfill Criteria for Municipal Solid Waste* & BC *Landfill Gas Management Facilities Design Guidelines*)	No exceedances Low risk of subsurface gas migration to adjacent building	None	Continue quarterly monitoring.
Ambient Grid Monitoring	N/A	100 ppm total hydrocarbon (THC), as methane (CRD internal guideline)	18 grid locations >100 ppm No cover system failures suspected in the closed area of Phase 1	Investigated hot spots and mitigated, where possible.	Continue annual monitoring.
Hot Spot Monitoring	N/A	1,000 ppm THC (CRD internal guideline)	Seven hot spots (z-points) >1,000 ppm Currently 29 locations for hot spot investigation	Added new locations of hot spots to the monitoring program.	Continue annual monitoring. Investigate mitigation options.
Well Field Monitoring and Balancing	N/A	Monitor monthly. Oxygen 2.5% - gas optimization and reduction of fire potential *(BC Landfill Gas Management Facilities Design Guidelines)*	Monitoring completed monthly; Oxygen did not exceed 2.5%	None	Continue monthly monitoring at minimum.
Gas Speciation	N/A	N/A	Undiluted LFG exceeded WorkSafeBC criteria for carbon dioxide, carbon monoxide, hydrogen sulfide, vinyl chloride, and benzene; however, ambient concentrations are likely well below WorkSafeBC limits due to dilution with ambient air. Comprehensive sampling of gas identified increasing concentrations in oxygen and siloxanes.	None	Continue speciation sampling in 2021, or sooner, to support LFG utilization planning. Continue ambient monitoring program to confirm and implement health and safety protocols for hot spots.
Gas Collection	N/A	75% gas collection efficiency target by the end of 2016, as per *Landfill Gas Management Plan*	Gas collection efficiency was estimated at 66.7%, based on the ENV gas generation model. Collection efficiency using an alternative model (UBCi) and empirical data was estimated at 81%.	*Landfill Gas Management Plan* submitted to ENV.	Continue to implement the gas management plan. Conduct well field optimization study in 2021.

10.0 CONCLUSIONS AND RECOMMENDATIONS

The following section presents the key findings and recommendations developed from the 2020 LFG monitoring programs at the Hartland landfill.

GAS GENERATION

Hartland landfill generates greater than 1,000 tonnes of methane per year and is subject to the BC *Landfill Gas Management Regulation*. In 2020, according to the ENV model the Hartland landfill is estimated to have generated 7,934 tonnes of methane, or the equivalent of approximately 198,000 tonnes CO_{2e}. Of this total, 66,237 tonnes of CO_{2e} were uncaptured (fugitive emissions). Though not recognized under the regulation, alternative gas modeling, supported by empirical data, shows CO_2e emissions to be substantially less than the ENV model (33,881 tonnes CO_{2e}).

GAS GENERATION, COLLECTION AND UTILIZATION

In 2020, the gas extraction network consisted of 161 wells that captured an average of 1,084 scfm of LFG. In 2020, seven new wells were activated and seven new wells were installed. Well field balancing was completed at least monthly to optimize collection. Well field monitoring and balancing should continue at least monthly, as recommended by the BC *Landfill Gas Management Facilities Design Guidelines*.

At the end of 2020, the efficiency was 66.7% according to the ENV model. Empirical data and methane mass balance indicates that an alternative gas generation (UBCi) more accurately estimates overall gas production for Hartland. Using this model, collection efficiency in 2020 is estimated to be 81%, and ranged from 73-80% over the last five years. The CRD continues to follow the *Landfill Gas Management Plan* design specifications for reaching 75% collection efficiency. A well field optimization study is planned for 2021, to support improved gas collection and reduce fugitive emissions.

OPERATIONAL PERFORMANCE

The gas plant experienced 5.2 days' worth of downtime (i.e., no vacuum applied to the well field) due to power outages and unforeseen events. A back-up generator was installed in August 2020 to minimize blower downtime, and ensure continuous destruction of landfill gas.

MONITORING

No methane concentrations were observed during foundation and perimeter probe monitoring and, as a result, there is little risk of lateral LFG migration. This monitoring is a regulatory requirement and should continue on a quarterly schedule.

During the 2020 grid monitoring, 18 unique grid points were found to exceed 100 ppm THC. There were seven new hotspots were identified in 2020. It is recommended that grid monitoring and hotspot monitoring be conducted annually and that hotspots be mitigated where possible.

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APPENDIX A

Hartland Landfill Gas Generation Model Inputs

Appendix A Hartland Landfill Gas Generation Model Inputs

A1

Variables		Relatively Inert	Moderately Decomposable	Decomposable
Gas Production potential (m^3 CH4/tonne), Lo =		20	120	160
Waste Composition, 1980 to	1995	0.336	0.248	0.414
Waste Composition, 1996 to	2000	0.338	0.405	0.256
Waste Composition, 2001 to	2004	0.266	0.396	0.337
Waste Composition, 2005 to	2009	0.331	0.369	0.298
Waste Composition, 2010 to	2013	0.314	0.391	0.294
Waste Composition, 2014 to	future	0.327	0.427	0.201
lag time before start of gas production, lag =	1	Years		
Historical Data Used (years)	38			
1st Year of Historical Data Used	1980			
4 Years after reporting year	2024			
methane (by volume)	0.5			
carbon dioxide (by volume)	0.5			
methane (density)	0.6557	kg/m^3	(25°C,1ATM)	
carbon dioxide (density)	1.7988	kg/m^3	(25°C,1ATM)	

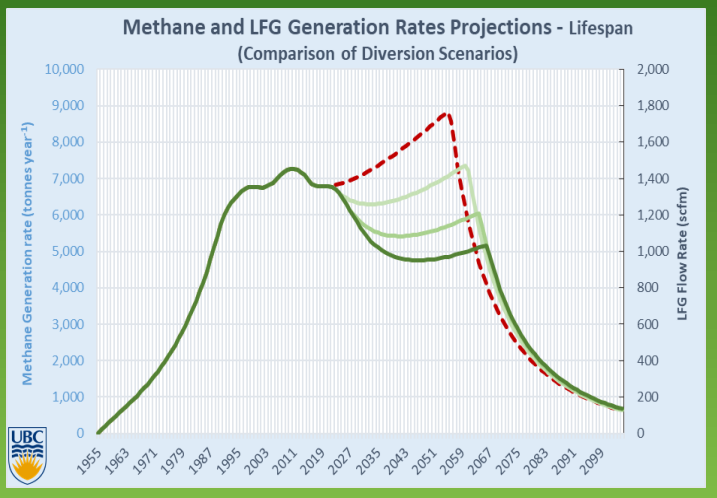
A2

Year	Annual Tonnage	Cumulative Waste-in-place	Waste Tonnage			Methane Generation Rate, k			Annual		
			Relatively Inert	Moderately Decomposable	Decomposable	Relatively Inert	Moderately Decomposable	Decomposable	Methane Production	Landfill Gas Production	Greenhouse Gas Emissions
	(tonnes)	(tonnes)	(tonnes)	(tonnes)	(tonnes)	(year-1)	(year-1)	(year-1)	(tonnes/yr)	(m3/hr)	(as CO2e/year)
2010	152,062	4,689,889	53,374	56,567	42,121	0.02	0.04	0.09	6,624	2,306	139,110
2011	144,179	4,834,068	50,607	53,635	39,938	0.02	0.04	0.09	6,740	2,347	141,550
2012	136,763	4,970,831	48,004	50,876	37,883	0.02	0.04	0.09	6,858	2,388	144,008
2013	131,418	5,102,249	46,128	48,887	36,403	0.02	0.04	0.09	6,990	2,434	146,796
2014	128,045	5,230,294	45,840	50,962	31,243	0.02	0.04	0.09	7,149	2,489	150,130
2015	123,381	5,353,675	44,170	49,106	30,105	0.02	0.04	0.09	7,313	2,546	153,566
2016	146,704	5,500,379	53,547	62,202	30,955	0.02	0.04	0.09	7,495	2,610	157,405
2017	157,638	5,658,017	57,538	66,839	33,262	0.02	0.04	0.09	7,638	2,659	160,397
2018	159,942	5,925,830	60,138	69,095	30,709	0.02	0.04	0.09	7,909	2,754	166,095
2019	163,001	6,088,831	61,288	70,416	31,296	0.02	0.04	0.09	7,915	2,756	166,220
2020	165,838	6,254,669	56,226	64,600	28,711	0.02	0.04	0.09	7,935	2,763	166,633

A3

Year Annual Total (tonnes)	Refuse	% Relatively Inert	% Moderately Decomposable	% Decomposable	Total Controlled Waste	Total Waste
Average Composition for Period (1986 to 1995)						
1986	166862	33.7	24.9	41.4	610	167,472
1987	177086	33.7	24.9	41.4	600	177,686
1988	181454	33.7	24.9	41.4	2739	184,193
1989	185409	33.7	24.9	41.4	3341	188,750
1990	183590	33.7	24.9	41.4	3886	187,476
1991	173634	33.7	24.9	41.4	2322	175,956
1992	156399	33.7	24.9	41.4	5930	162,329
1993	156255	33.7	24.9	41.4	3176	159,431
1994	153614	33.7	24.9	41.4	2671	156,285
1995	155305	33.7	24.9	41.4	4688	159,993
Average Composition for Period (1996 to 2000)						
1996	153351	33.9	40.5	25.6	4177	157,528
1997	146442	33.9	40.5	25.6	2987	149,429
1998	130604	33.9	40.5	25.6	8002	138,606
1999	134257	33.9	40.5	25.6	3917	138,174
2000	136654	33.9	40.5	25.6	5585	142,239
Average Composition for Period (2001 to 2004)						
2001	135425	26.6	39.6	33.8	3108	138,533
2002	142940	26.6	39.6	33.8	3384	146,324
2003	144043	26.6	39.6	33.8	4182	148,225
2004	150787	26.6	39.6	33.8	3326	154,113
Average Composition for Period (2005 to 2009)						
2005	158848	33.2	37	29.9	4192	163,040
2006	160260	33.2	37	29.9	6560	166,820
2007	165381	33.2	37	29.9	9156	174,537
2008	154881	33.2	37	29.9	11841	166,722
2009	153263	33.2	37	29.9	7931	161,194
Average Composition for Period (2010 to 2013)						
2010	143669	31.5	39.1	29.4	8393	152,062
2011	136414	31.5	39.1	29.4	7765	144,179
2012	129280	31.5	39.1	29.4	7483	136,763
2013	123210	31.5	39.1	29.4	8252	131,418
Average Composition for Period (2014 to present)						
2014	119306	36.5	44.1	19.4	8,739	128,045
2015	112442	36.5	44.1	19.4	10,939	123,381
2016	134167	32.7	47.2	20.1	12,537	146,704
2017	144368	32.7	47.2	20.1	13,270	157,638
2018	146431	37.6	43.2	19.2	13,511	159,942
2019	147676	38.4	44.0	18.2	15,325	163,001
2020	149538	43.4	39.4	17.2	16,300	165,838

Hartland Landfill
Advanced LFG Generation Assessment
for Different Waste Diversion Scenarios
(Final Report)







PREPARED FOR: CAPITAL REGIONAL DISTRICT

PREPARED BY: SPERLING HANSEN ASSOCIATES

PRJ19061

December 2019

SPERLING HANSEN ASSOCIATES

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SPERLING HANSEN ASSOCIATES

- Landfill Engineering
- Solid Waste Planning
- Environmental Monitoring
- Landfill Fire Control

December 12th, 2019 PRJ19061

Genevieve Tokgoz
Project Engineer
Facilities Mgmt & Engineering Services
Capital Regional District

RE: Hartland Landfill LFG Generation Assessment for Different Diversion Scenarios – Final Report

Dear Ms. Tokgoz,

Sperling Hansen Associates (SHA) is pleased to provide you with the final report of the advanced landfill gas (LFG) generation assessment for the Hartland Landfill based on different organic waste diversion Scenarios.

SHA conducted an extensive and comprehensive review and analysis regarding the existing historical data on waste disposal activities at the Hartland Landfill as well as future waste compositions based on the proposed waste diversion targets for the CRD's new Solid Waste Management Plan. We also completed volumetric analyses to predict the landfill's closure years under each diversion scenario.

Using our powerful LFG generation model, SHA concluded that the current LFG generation rate at the Hartland Landfill is 1,345 scfm, equivalent to 6,783 tonnes of methane per year. Results of our analyses showed that implementation of additional organic diversion under Scenarios 1, 2, and 3 will extend the landfill's lifespan by 5, 9 and 11 years and will result in peak methane generation reduction by 17%, 32% and 42%, respectively.

If you have any questions about our submission or require any further information, please do not hesitate to contact me.

Yours truly,
SPERLING HANSEN ASSOCIATES



Ali R. Abedini, Ph.D.
Senior Environmental Consultant
Landfill Gas Specialist

HARTLAND LANDFILL

ADVANCED LANDFILL GAS GENERATION ASSESSMENT BASED ON DIFFERENT WASTE DIVERSION SCENARIOS

(Final Report)

Prepared For:

CAPITAL REGIONAL DISTRICT

Prepared By:

SPERLING HANSEN ASSOCIATES

December, 2019

Table of Content

1 INTRODUCTION 1
1.1 Background 1
1.2 Scope of the Current Study 2
2 SITE-SPECIFIC INFORMATION 3
2.1 Waste Composition and Additional Organic Waste Diversion Scenarios 3
2.2 Waste Tonnage at Hartland Landfill 6
2.3 Climate Condition 7
2.4 Climate Change 9
3 LANDFILL GAS GENERATION ASSESSMENT 10
3.1 UBCiModel© Data Input 10
3.2 LFG Generation Assessment Results 11
3.2.1 LFG Generation Assessment under Current Conditions 12
3.2.2 Climate Change Impact 13
3.2.3 Short-term Diversion (Scenario 1) LFG Generation Assessment Results 14
3.2.4 Mid-term Diversion (Scenario 2) LFG Generation Assessment Results 15
3.2.5 Long-term (Scenario 3) LFG Generation Assessment Results 16
4 Comparison of Scenarios 18
5 STATEMENT OF LIMITATIONS 20

List of Tables

Table 2.1 - Waste Composition (Tetra Tech 2016 report) 3
Table 2.2 - Summary of Intended Waste Diversion Rates per Sector 4
Table 2.3 - Computed Waste Compositions for Target Years and Transitioning Periods 5
Table 2.4 - Summary of Estimated Closure Years for each Cell Under Different Scenarios 6
Table 2.5 - Estimated Waste Tonnage and Volume Consumption at the Hartland Landfill 7
Table 2.6 - Climate Normal Data for Saanichton CDA Station, 1981 to 2010 8
Table 2.7 - PCIC Precipitation Projections for the CRD 9

Table 2.8 - PCIC Average High Temperature Projections for the CRD 9
Table 3.1 - DOC_{dry} Ranges and Default Values Used by UBCiModel© 10
Table 3.2 - UBCiModel© Default Decay Rates 11
Table 3.3 - Waste Composition used in the UBCiModel© 11
Table 4.1 - Summary of LFG Generation under Different Scenarios (2018 – 2045) 19

List of Figures

Figure 1.1 - Predicted LFG Generation and Collection Rates at the Hartland Landfill 1
Figure 2.1 - Temperature and Precipitation Graph for 1981 to 2010 Canadian Climate Normals. 8
Figure 3.1 - Cell-by-Cell Methane and LFG Generation Estimates, Current Conditions 12
Figure 3.2 - Lifespan Methane Generation and Collection Rates Under Current Conditions 13
Figure 3.3 - Climate Change Impact on LFG Generation Estimates 14
Figure 3.4 - Lifespan Methane Generation and Collection Rates Under Scenario 1 14
Figure 3.5 - Methane and LFG Generation Estimates, cell-by-cell, Scenario 1 15
Figure 3.6 - Lifespan Methane Generation and Collection Rates Under Scenario 2 16
Figure 3.7 - Methane and LFG Generation Estimates, cell-by-cell, Scenario 2 16
Figure 3.8 - Lifespan Methane Generation and Collection Rates Under Scenario 3 17
Figure 3.9 - Methane and LFG Generation Estimates, cell-by-cell, Scenario 3 17
Figure 4.1 - Lifespan Methane and LFG Generation Estimates - Comparison of Scenarios 18

List of Appendices

Appendix A - CRD's SWMP Waste Diversion Targets
Appendix B - Waste tonnage Projections and Cell-by-cell Lifespan Volumetric Analysis
Appendix C - UBCiModel LFG Generation Full Results - Graphs and Tables
Appendix D - Lifespan LFG Generation Estimates for Different Diversion Scenarios

1 INTRODUCTION

1.1 Background

Hartland Landfill (Landfill) is owned and operated by Capital Regional District (CRD), located 14 km northwest of Victoria, British Columbia (BC) in the District of Saanich at 1 Hartland Avenue. The landfill occupies a footprint of 33 ha on a property that encompasses 293 Ha. To date, approximately 7,280,000 tonnes of municipal solid waste (MSW) have been landfilled. Hartland Landfill has been developed in two distinct phases. Phase 1 was developed between 1950 and 1996, with final capping system completed in 1997. Phase 2 has been operational since 1997, with development planned out in six distinct cells. Cells 1 and 2 have been completed to-date and landfilling is currently occurring in Cell 3.

Hartland Landfill is one of the largest landfills in BC and is required to collect and thermally combust generated methane as per the BC Ministry of Environment (ENV) landfill gas regulation (LFG Regulation). This provincial regulation stipulates that landfills generating more than 1,000 tonnes of methane per year are to install and operate an active LFG management system with a minimum gas collection efficiency of 75%.

In a recent study, Sperling Hansen Associates (SHA) concluded that a gas capture efficiency ranging between 66% to 81% was achieved at the Landfill between 2015 and 2018 (SHA-PRJ18002). SHA's report showed that the collected LFG flow rate at the Landfill will continuously increase from its 2018 value of approximately 1,000 standard cubic feet per minute (scfm) and will peak in 2054 at approximately 1,360 scfm. Therefore, a minimum capturable energy production of approximately 200,000 Gigajoules (GJ) per year is anticipated for an LFG to renewable natural gas (RNG) initiative for this Landfill. Figure 1.1 presents SHA's estimate of the LFG generation and collection rates for Hartland over it's anticipated lifespan and 25 years post closure.

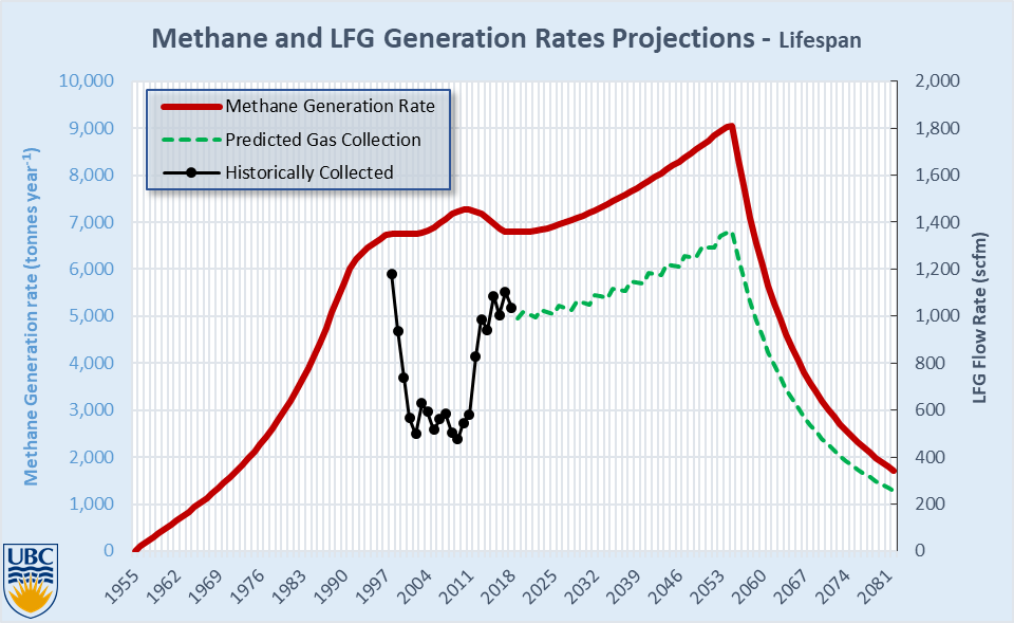


Figure 1.1 - Predicted LFG Generation and Collection Rates at the Hartland Landfill

LFG generation is a function of multiple variables including waste composition. Three LFG projections were developed based on the proposed waste diversion targets for the CRD's new Solid Waste Management Plan (SWMP) which is currently under development. These projections reflect the implications of reduced organic materials on LFG production. Scenarios 1, 2, and 3 are consistent with meeting the short-term, mid-term, and long-term waste diversion targets within the proposed plan.

1.2 Scope of the Current Study

The CRD retained SHA to complete a set of advanced LFG generation assessments for Hartland Landfill based on different organic waste diversion scenarios and associated landfill's lifespan analysis.

The purpose of the study was to execute the following key tasks:

- Review previous LFG generation assessments;
- Review the landfill's current LFG collection data;
- Review historical waste tonnages, composition studies and organic waste diversion programs, as well as planned additional organic waste diversion scenarios (3 scenarios);
- Complete advanced LFG generation assessments for each scenario using UBCiModel© and based on the updated volumetric analysis for each scenario;
- Compare results of LFG generation model for different scenarios and assess impacts of waste diversion on future LFG generation rates, and;
- Estimate capturable quantity of LFG under each diversion scenario.

2 SITE-SPECIFIC INFORMATION

2.1 Waste Composition and Additional Organic Waste Diversion Scenarios

The CRD has historically retained consultants to complete waste composition studies. The two most recent studies were completed in 2010 and 2016 by Tetra Tech.

The CRD successfully implemented a kitchen waste diversion program between 2014 and 2016 which impacted the composition of waste disposed at the Hartland Landfill. Results of this diversion program are clearly reflected in the outcomes of the 2016 waste composition study.

Table 2.1 shows the 2010 and 2016 waste composition data and the change in each waste category between these two years as reported by Tetra Tech.

Table 2.1 - Waste Composition (Tetra Tech 2016 report)

Primary Category	2009/2010[1]	2016	Change (2016-2010)
	Weighted Average % Composition		
Paper and Paperboard	15.5%	15.4%	-0.1%
Glass	1.9%	1.7%	-0.2%
Ferrous Metals	2.3%	1.8%	-0.5%
Non-ferrous Metals	0.6%	0.7%	+0.1%
Plastics	12.5%	14.3%	+1.8%
Organics	27.7%	21.1%	-6.6%
Wood and Wood Products	12.2%	17.0%	+4.8%
Construction and Demolition (non-wood)	7.4%	6.7%	-0.7%
Textiles	5.3%	5.9%	+0.7%
Tires	0.7%	0.8%	+0.1%
Bulky Objects	0.6%	1.3%	+1.3%
Household Hygiene	8.9%	6.9%	-2.0%
Hazardous Wastes	0.7%	1.8%	+1.0%
Electronics	1.8%	1.8%	0.0%
Other	1.9%	2.7%	+0.8%

Based on the 2016 waste composition analysis and the waste disposal rates at the Landfill, CRD has developed three organic waste diversion scenarios in its SWMP aiming to further reduce the quantity of organic waste disposal at the Landfill. The three SWMP diversion scenarios include different waste sectors and sources (Single Family (SF) sources, Multi Family buildings (MF), and industrial, commercial and institutional (ICI) sources). The diversion scenarios include:

1. Short-term diversion initiatives implemented between 2020 and 2023,
2. Mid-term diversion initiatives implemented between 2023 and 2025 (after the short-term targets are achieved by 2023), and

3. Long-term diversion initiatives implemented between 2025 and 2030 (after the short-term and mid-term diversion targets are achieved).

Diversion targets with breakdown for each sector as presented in CRD's SWMP are presented in Annex A. Table 2.2 summarizes the intended diversion rates for each waste component and source for each scenario.

Table 2.2 - Summary of Intended Waste Diversion Rates per Sector

	Diversion Target Years		
	2023	2025	2030
Food waste	25%SF+13%MF+25%ICI	50%SF+25%MF+50%ICI	75%SF+40%MF+60%ICI
Yard waste	25%SF+25%MF+25%ICI	50%SF+50%MF+50%ICI	75%SF+60%MF+60%ICI
Paper	25%SF+25%MF+25%ICI	50%SF+50%MF+50%ICI	75%SF+60%MF+60%ICI
Wood	70%CR&D	75%CR&D	75%CR&D
Textile	50%CR&D	50%CR&D	55%CR&D
Non-Organic Recyclables	For Simplicity, assumed 50% Plastics and metals from CR&D Depot and Building Material	For Simplicity, assumed 50% Plastics and 50% metals from CR&D Depot and Building Material and 50% Metal and Plastics from ICI Curbside and Depot	For Simplicity, assumed 50% Plastics and 50% metals from CR&D Depot and Building Material and 50% Metal and Plastics from ICI Curbside and Depot

SF: Single Family Residential, MF: Multi-Family Residential, ICI: Industrial, Commercial and Institutional, CR&D: Construction, Renovation & Demolition

In developing the diversion targets, the 2016 waste composition data was used as the base waste composition and assumed to remain the same up until 2020. SHA used this waste composition and targeted additional diversion rates for each waste component to compute future waste composition for target years as well as the transitioning period between 2020 and 2030. The computed future waste composition for Hartland Landfill is presented in Table 2.3. SHA used these computed variable waste compositions to more accurately predict future LFG generation from Hartland Landfill throughout its remaining lifespan.

As presented in Table 2.3, this analysis showed that the overall "additional" waste diversion rate will start at 5.4% in 2021 and will increase to 30.6% in 2030 under Scenario 3 on a linear incremental basis. For Scenarios 1 and 2 the maximum overall diversion rates will be 16.3% and 25.3%, respectively.

Table 2.3 - Computed Waste Compositions for Target Years and Transitioning Periods

	Existing	Transitioning Period	Transitioning Period	**Short-term Target**	Transitioning Period	**Mid-Term Target**	Transitioning Period	Transitioning Period	Transitioning Period	Transitioning Period	**Long-term Target**
Waste Categories	**2016-2020**	**2021**	**2022**	**2023**	**2024**	**2025**	**2026**	**2027**	**2028**	**2029**	**2030**
Paper & Paperboard	15.4%	14.9%	14.4%	13.9%	12.2%	10.5%	10.0%	9.6%	9.2%	8.7%	8.3%
Glass	1.7%	1.8%	1.9%	2.0%	2.2%	2.3%	2.3%	2.3%	2.4%	2.4%	2.5%
Ferrous Metals	1.8%	1.9%	2.0%	2.1%	2.2%	2.3%	2.4%	2.4%	2.4%	2.5%	2.5%
Non-ferrous Metals	0.7%	0.7%	0.8%	0.8%	0.8%	0.9%	0.9%	0.9%	0.9%	1.0%	1.0%
Plastics	14.3%	15.0%	15.8%	16.5%	17.5%	18.5%	18.8%	19.1%	19.4%	19.7%	20.0%
Food Waste	19.5%	19.0%	18.6%	18.1%	16.3%	14.5%	13.8%	13.1%	12.5%	11.8%	11.1%
Garden Waste	1.6%	1.6%	1.5%	1.5%	1.3%	1.2%	1.2%	1.1%	1.1%	1.0%	1.0%
Wood & Wood Products	17.0%	15.3%	13.5%	11.8%	12.2%	12.5%	12.7%	12.9%	13.1%	13.3%	13.5%
Construction & Demolition (non-wood)	6.7%	7.2%	7.6%	8.0%	8.5%	9.0%	9.1%	9.3%	9.4%	9.6%	9.7%
Textiles	5.9%	6.3%	6.6%	7.0%	7.4%	7.8%	8.0%	8.1%	8.2%	8.3%	8.4%
Tires	0.8%	0.9%	0.9%	1.0%	1.0%	1.1%	1.1%	1.1%	1.2%	1.2%	1.2%
Bulky Objects	1.3%	1.3%	1.4%	1.5%	1.6%	1.7%	1.7%	1.7%	1.8%	1.8%	1.8%
Household Hygiene	6.9%	7.4%	7.8%	8.3%	8.8%	9.3%	9.4%	9.5%	9.7%	9.8%	10.0%
Hazardous Wastes	1.8%	1.9%	2.0%	2.1%	2.2%	2.3%	2.4%	2.4%	2.5%	2.5%	2.5%
Electronics	1.8%	1.9%	2.0%	2.2%	2.3%	2.4%	2.5%	2.5%	2.5%	2.6%	2.6%
Other	2.7%	2.9%	3.1%	3.3%	3.5%	3.6%	3.7%	3.8%	3.8%	3.9%	3.9%
total	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%
Overall Diversion rate (based on 2016 baseline)	**0.0%**	**5.4%**	**10.8%**	**16.3%**	20.8%	**25.3%**	**26.3%**	**27.4%**	**28.5%**	**29.6%**	**30.6%**

2.2 Waste Tonnage at Hartland Landfill

SHA has completed several projects for the Landfill since 1996, including several environmental monitoring projects, MSW filling plans, leachate management designs, and cell closure designs. SHA also recently completed a master filling plan for the Landfill (PRJ18002) including completing a comprehensive volumetric analysis, fill plan, and lifespan analysis. A cell-by-cell volumetric analysis and waste tonnage estimate were prepared using recent site survey data (completed in early 2018), the most recent cell development design, and the historic tonnages of waste deposited at the Hartland Landfill.

For the current study, cell-by-cell volumetric analyses and future waste tonnage estimates were also prepared for each scenario. Future waste tonnages were calculated with the following assumptions:

- Population growth rate of 1.0%
- Constant per-capita waste generation and the three diversion rates presented in Table 2.2
- Waste to cover ratio of 6:1 vol/vol
- Waste settlement rate of 10%
- Waste density of 0.95 tonnes/m^3
- Controlled waste volume of 11,667 m^3/year

Results of the volumetric analyses showed that the Landfill will reach its full capacity in 2055, 2060, 2064, and 2066 under current conditions, Scenario 1, Scenario 2, and Scenario 3 diversion, respectively. Cell-by-bell volumetric analyses and waste tonnage estimates for the status quo and the three diversion scenarios are presented in Appendix B. Table 2.4 below shows the estimated closure year for each cell under different waste diversion scenarios.

Table 2.4 - Summary of Estimated Closure Years for each Cell Under Different Scenarios

	CRD Additional Diversion Target (2016 Base)	Estimated Closure Years			
		Cell 3	Cell 4	Cell 5	Cell 6
Current Condition	0%	2025	2026	2040	2055
Scenario 1	16%	2026	2027	2044	2060
Scenario 2	25%	2026	2028	2045	2064
Scenario 3	31%	2026	2028	2047	2066

Assumptionas		
Estimated Population Growth:	1%	
Estimated Waste Compaction:	**0.95**	tonnes/m^3
Estimated Waste to Cover Ratio:	6	:1 vol/vol
Estimated Settlement:	10%	
Esimated Vol. of Controlled Waste:	11,667	m^3/yr

A summary of waste generation tonnages as well as landfill volume consumption rates under each scenario is presented in Table 2.5.

Table 2.5 - Estimated Waste Tonnage and Volume Consumption at the Hartland Landfill

	Year	MSW Disposal Rate*	Scenario 1	Scenario 2	Scenario 3	Annual Volume of Landfill Consumed ** Volume of (MSW + CW + Soil - Settlement)			
	NOTES	MSW Only	2023 Diversion target	2025 Diversion target	2030 Diversion target	No Additional Diversion	Scenario 1 Diversion	Scenario 2 Diversion	Scenario 3 Diversion
		(tonnes/year)	(tonnes/year)	(tonnes/year)	(tonnes/year)	(m^3/yr)	(m^3/yr)	(m^3/yr)	(m^3/yr)
Additional	2018	146,431	146,431	146,431	146,431	176,081	176,081	176,081	176,081
Diversion	2019	147,895	147,895	147,895	147,895	177,725	177,725	177,725	177,725
0%	2020	149,374	149,374	149,374	149,374	179,385	179,385	179,385	179,385
5%	2021	150,868	142,685	142,685	142,685	181,063	171,874	171,874	171,874
11%	2022	152,377	135,846	135,846	135,846	182,757	164,196	164,196	164,196
16%	**2023**	153,900	128,857	128,857	128,857	184,468	156,348	156,348	156,348
21%	2024	155,439	130,145	123,159	123,159	186,196	157,795	149,951	149,951
25%	**2025**	156,994	131,447	117,335	117,335	187,941	159,256	143,411	143,411
26%	2026	158,564	132,761	118,508	116,800	189,704	160,732	144,729	142,811
27%	2027	160,149	134,089	119,693	116,242	191,484	162,223	146,059	142,185
28%	2028	161,751	135,430	120,890	115,662	193,282	163,728	147,403	141,533
30%	2029	163,368	136,784	122,099	115,059	195,098	165,249	148,761	140,856
31%	**2030**	165,002	138,152	123,320	114,431	196,933	166,785	150,131	140,151
31%	2031	166,652	139,533	124,553	115,576	198,785	168,336	151,516	141,436
31%	2032	168,319	140,929	125,799	116,731	200,656	169,903	152,915	142,734
31%	2033	170,002	142,338	127,057	117,899	202,546	171,485	154,327	144,045
31%	2034	171,702	143,761	128,327	119,078	204,455	173,083	155,754	145,368
31%	2035	173,419	145,199	129,611	120,269	206,383	174,697	157,195	146,705
31%	2036	175,153	146,651	130,907	121,471	208,330	176,328	158,650	148,056
31%	2037	176,905	148,117	132,216	122,686	210,297	177,974	160,120	149,420
31%	2038	178,674	149,598	133,538	123,913	212,283	179,637	161,604	150,797
31%	2039	180,460	151,094	134,873	125,152	214,289	181,317	163,104	152,188
31%	2039	182,265	152,605	136,222	126,403	216,315	183,013	164,618	153,594
31%	2041	184,088	154,131	137,584	127,667	218,362	184,727	166,147	155,013
31%	2042	185,929	155,673	138,960	128,944	220,429	186,457	167,692	156,446
31%	2043	187,788	157,230	140,350	130,234	222,516	188,205	169,253	157,894
31%	2044	189,666	158,802	141,753	131,536	224,625	189,971	170,828	159,356
31%	2045	191,562	160,390	143,171	132,851	226,755	191,754	172,420	160,833
31%	2046	193,478	161,994	144,602	134,180	228,905	193,555	174,028	162,325
31%	2047	195,413	163,614	146,048	135,522	231,078	195,374	175,651	163,832
31%	2048	197,367	165,250	147,509	136,877	233,272	197,211	177,291	165,353
31%	2049	199,341	166,902	148,984	138,246	235,488	199,066	178,947	166,890
31%	2050	201,334	168,571	150,474	139,628	237,726	200,940	180,620	168,442
31%	2051	203,347	170,257	151,979	141,024	239,987	202,833	182,310	170,010
31%	2052	205,381	171,960	153,498	142,435	242,270	204,744	184,016	171,594
31%	2053	207,435	173,679	155,033	143,859	244,576	206,675	185,739	173,193
31%	2054	209,509	175,416	156,584	145,298	246,905	208,625	187,480	174,808
31%	2055	211,604	177,170	158,149	146,750	249,257	210,595	189,238	176,439
31%	2056	213,720	178,942	159,731	148,218		212,584	191,014	178,087
31%	2057	215,857	180,731	161,328	149,700		214,593	192,807	179,751
31%	2058	218,016	182,539	162,942	151,197		216,623	194,619	181,432
31%	2059	220,196	184,364	164,571	152,709		218,672	196,448	183,130
31%	2060	222,398	186,208	166,217	154,236		220,742	198,296	184,845
31%	2061	224,622	188,070	167,879	155,779			200,163	186,576
31%	2062	226,868	189,950	169,558	157,336			202,047	188,325
31%	2063	229,137	191,850	171,253	158,910			203,951	190,092
31%	2064	231,428	193,768	172,966	160,499			205,874	191,876
31%	2065	233,742	195,706	174,695	162,104				193,678
31%	2066	236,080	197,663	176,442	163,725				195,498

* Reported waste tonnages EXCLUDES controlled waste and cover soil.

** Volumes of controlled wastes, soil cover and settlement are taken into account in the Volumetric Analysis.

2.3 Climate Condition

Hartland Landfill is located in a relatively wet climate. The temperature and precipitation data for 1981 to 2010 were sourced from the Environment Canada website. The nearest weather station to the site is the Saanichton CDA weather station, which is located approximately 8 km north of Hartland Landfill.

The Saanichton CDA weather station was used to estimate the average climatic conditions for the landfill. As such, the average annual precipitation estimated for the landfill is approximately 908 mm.

Table 2.6 and Figure 2.1 summarize the average monthly precipitation and temperature for the Saanichton CDA weather station.

Table 2.6 - Climate Normal Data for Saanichton CDA Station, 1981 to 2010

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Year
	Temperature												
Daily Average (°C)	4.8	5.3	7.1	9.3	12.2	14.9	17	17.1	14.6	10.3	6.6	4.5	**10.3**
Extreme Maximum (°C)	16	16.1	20.5	25.5	31.5	33.9	**34.4**	32.8	30.5	27	17.8	15	
Date (yyyy/dd)	2005/ 19	1963/ 08	1994/ 28	1998/ 30	1983/ 28	1925/ 25	**1941/ 16**	1915/ 20	1987/ 01	1987/ 01	1949/ 02	1997/ 28	
Extreme Minimum (°C)	-13.3	-12.2	-8.9	-3.3	-1.1	2.2	3.3	4.4	1.7	-3.9	-12.2	**-13.9**	
Date (yyyy/dd)	1950/ 14	1936/ 07	1955/ 05	1972/ 03	1976/ 30	1933/ 09	1922/ 08	1919/ 27	1972/ 27	1935/ 30	1955/ 15	**1964/ 16**	
	Precipitation												
Rainfall (mm)	136.9	85.4	77.4	51.5	41.5	34.7	20.5	26.5	29.6	92.6	155	134.7	886
Snowfall (cm)	8.1	4.1	1.9	0	0	0	0	0	0	0.4	0.8	6.7	22
Precipitation (mm)	145.1	89.6	79.3	51.5	41.5	34.7	20.5	26.5	29.6	93	155.8	141.3	**908**
Extreme Daily Rainfall (mm)	**73.2**	51.8	44.8	63	45.7	40.6	53	55.6	46.2	120	82.3	68.3	
Date (yyyy/dd)	**1935/ 21**	1995/ 18	1997/ 18	1991/ 03	1948/ 27	1955/ 22	1993/ 19	1975/ 22	1924/ 22	2003/ 16	1955/ 02	1972/ 25	
Extreme Daily Snowfall (cm)	35.1	52.1	20.3	2.5	0	0	0	0	0	6	22.9	**40.6**	
Date (yyyy/dd)	1935/ 20	1923/ 14	1960/ 03	1955/ 13	1914/ 01	1914/ 01	1914/ 01	1914/ 01	1914/ 01	1991/ 28	1937/ 13	**1968/ 30**	

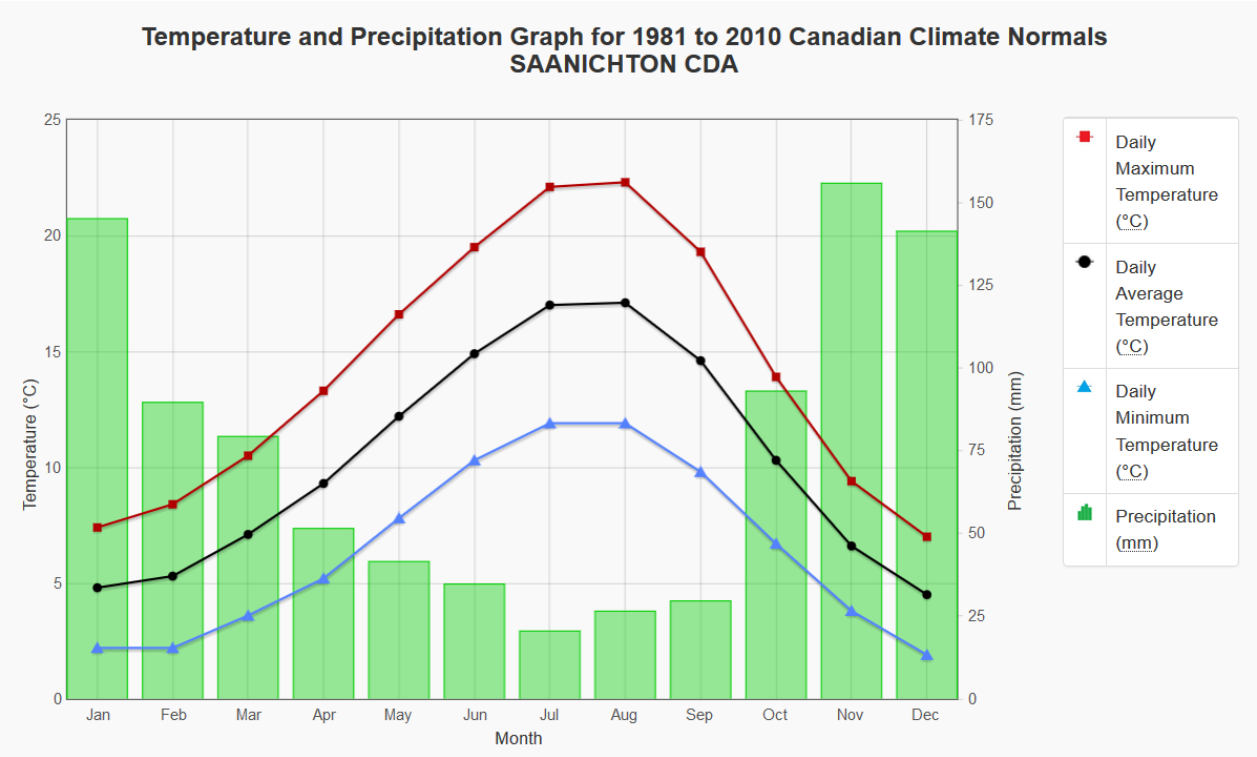


Figure 2.1 - Temperature and Precipitation Graph for 1981 to 2010 Canadian Climate Normals

2.4 Climate Change

Consequences of climate change are different for different sectors. The CRD, in preparing the region for the impacts of climate change in its various sectors, has worked with Pacific Climate Impacts Consortium (PCIC) to develop high-level regional projections by the 2050s and 2080s. PCIC concluded that the CRD will experience higher annual average precipitation as well as increased average ambient temperatures. The annual average precipitation is expected to increase 5% by 2050 and 12% by 2080 The mean annual temperature is expected to increase 2.8 °C by 2050 to 4.5 °C by 2080. Tables 2.7 and 2.8 summarize PCIC's projections for 2050s and 2080s. For additional information regarding the data presented in Tables 2.7 and 2.8, please refer to PCIC's full report: *Climate Projections for the Capital Region*, April 2017, available at https://www.crd.bc.ca/docs/default-source/climate-action-pdf/reports/2017-07-17_climateprojectionsforthecapitalregion_final.pdf.

Table 2.7 - PCIC Precipitation Projections for the CRD

	Past (mm)	2050s (mm)	2080s (mm)	2050s Change (%)		2080s Change (%)	
Winter	680	714	782	5	*(-3 to 11)*	15	*(3 to 28)*
Spring	328	345	352	5	*(-5 to 14)*	8	*(-6 to 19)*
Summer	125	103	92	-18	*(-41 to 4)*	-26	*(-50 to -6)*
Fall	504	558	605	11	*(-4 to 26)*	21	*(7 to 40)*
Annual	1660	1743	1857	5	*(1 to 10)*	12	*(4 to 17)*

Table 2.8 - PCIC Average High Temperature Projections for the CRD

	Past (°C)	2050s Change (°C)		2080s Change (°C)	
Winter	6	2.4	*(1.3 to 3.3)*	4.4	*(2.6 to 6.4)*
Spring	12	2.7	*(1.6 to 4.5)*	4.3	*(2.7 to 7.0)*
Summer	20	3.3	*(2.1 to 4.2)*	5.2	*(3.7 to 7.0)*
Fall	13	2.6	*(1.4 to 3.8)*	4.3	*(2.8 to 5.9)*
Annual	13	2.8	*(1.5 to 3.9)*	4.5	*(2.9 to 6.2)*

Further to these high-level regional climate projections, the CRD has developed a preliminary water budget study for the Landfill. Based on this study, the precipitation levels at the Landfill will reach 1,721 mm/year by 2050. As presented in Table 2.6, the current precipitation levels at Hartland is below 1,000 mm/year. Assuming a linear increase between 2016 recorded precipitation levels of 908 mm/year and the 2050 predicted precipitation, it can be concluded that the precipitation levels at Harland will surpass the 1,000 mm/year in 2020.

Precipitation levels define landfill moisture content and have an impact on waste decomposition rates. Section 3.2.2 discusses implications of these climate projections on potential LFG production at Hartland Landfill.

3 LANDFILL GAS GENERATION ASSESSMENT

There are several LFG generation models which assist landfill designers, operators and regulating authorities to estimate the amount of methane generated in landfills. Among these models, the first order decay reaction model has been the most widely used. The first order decay reaction model assumes that degradable materials in the waste are decomposed at a constant rate over a period of time. First order decay models also assume that the total amount of carbon decreases gradually (consumed by the bacteria) and therefore the rate of gas generation also decreases every year after the deposition of organics in the landfill ceases.

In the present study we used University of British Columbia Integrated Model (UBCiModel©) which is also based on the first order decay reaction. This model has proved to provide the most realistic generation estimates based on our experience using this model for multiple sites where active gas collection systems were operational and the actual gas generation rates could be measured.

3.1 UBCiModel© Data Input

Methane Generation Potential (L_o - (m^3/tonne)): The methane generation potential of organic material is the total amount of methane (m^3) that can be produced from decomposition of 1 tonne of the material. The UBCiModel© utilizes variable methane generation potential (L_o) developed primarily based on the dry decomposable organic carbon (DOC_{dry}) historically deposited at the landfill. The variable L_o reflects the historical changes in waste consumption and recycling strategies as well as several other factors including waste moisture content, organics degradability, climate condition, waste storage and transportation mechanisms as well as landfill design and disposal strategies. These factors collectively define the ultimate bioavailability of the total deposited DOC into the landfill and are incorporated into development of the historical and future projection of L_o for each year throughout the landfill's lifespan. Table 3.1 shows the values for the DOC_{dry}.

Table 3.1 - DOC_{dry} Ranges and Default Values Used by UBCiModel©

Waste Components		DOC content in % of dry waste	
		Range	Default
A.	Paper and Cardboard	40 – 50	44
B.	Textiles and Nappies	25 – 50	30
C.	Food waste	20 – 50	38
D.	Wood	46 – 54	50
E.	Garden and park waste	45 – 55	49
F.	Rubber and Leather	47	47
G.	Plastics, Metal, Glass and other inert materials	0	0

Methane Generation Rate (k – (yr^{-1})): The methane generation rate is the rate at which the organic matter decays under anaerobic conditions and produces LFG. The k value is expressed in units of 1/year (yr^{-1}). At higher values of k, the methane generation rate at a landfill increases more rapidly during landfill operation and declines more rapidly after landfill closure. In general, the value of k depends on moisture, availability of nutrients, pH, and temperature. In UBCiModel©, a different decay rate is assigned to each type of organic waste component. The decay rates are

defined based on the waste components' biodegradation half-life which is influenced by landfill's moisture content. Therefore, mean annual precipitation is used as a basis for assigning a decay rate to each waste component. Table 3.2 provides the decay rates used by UBCiModel©. As shown in this table precipitation levels of less than 1,000 mm/year was assigned to Hartland Landfill.

Table 3.2 - UBCiModel© Default Decay Rates

Waste Components	Decay Rates (k, year $^{-1}$)		
Annual Precipitation (mm)	< 500	500 to 1000	> 1000
Food Waste	0.07	**0.15**	0.35
Yard Waste	0.04	**0.08**	0.14
Paper and Textile	0.02	**0.05**	0.07
Wood Waste	0.02	**0.03**	0.04

Variable Waste Composition: Using the historical waste composition analysis and waste composition projections presented in Table 2.3, we considered 13 different waste compositions to more accurately predict the LFG generation from the Landfill. These waste compositions were categorized according to the UBCiModel© input parameters as presented in Table 3.3 below.

Table 3.3 - Waste Composition used in the UBCiModel©

	UBCiModel - Input DOC used for Hartland Advanced LFG Modeling (SHA-PRJ19061)							
	Food	Garden	Paper	Wood	Textile	Nappies	Inerts	Total
Up to 2013	21.7%	6.0%	15.5%	12.5%	5.6%	3.9%	34.9%	100%
2014 & 2015	20.6%	3.8%	15.5%	14.9%	5.9%	3.8%	35.5%	100%
2016 to 2020	19.5%	1.6%	15.4%	17.0%	6.2%	3.5%	36.8%	100%
2021	19.0%	1.6%	14.9%	15.3%	6.6%	3.7%	39.0%	100%
2022	18.6%	1.5%	14.4%	13.5%	6.9%	3.9%	41.1%	100%
2023	18.1%	1.5%	13.9%	11.8%	7.3%	4.1%	43.3%	100%
2024	16.3%	1.3%	12.2%	12.2%	7.7%	4.4%	45.9%	100%
2025	14.5%	1.2%	10.5%	12.5%	8.2%	4.6%	48.5%	100%
2026	13.8%	1.2%	10.0%	12.7%	8.3%	4.7%	49.3%	100%
2027	13.1%	1.1%	9.6%	12.9%	8.4%	4.8%	50.0%	100%
2028	12.5%	1.1%	9.2%	13.1%	8.5%	4.8%	50.8%	100%
2029	11.8%	1.0%	8.7%	13.3%	8.7%	4.9%	51.5%	100%
2030 - future	11.1%	1.0%	8.3%	13.5%	8.8%	5.0%	52.3%	100%

3.2 LFG Generation Assessment Results

The LFG generation assessment was completed for four different conditions:

i. Current conditions (no additional waste diversion)
ii. Scenario 1 (short-term diversion goals) – overall waste diversion 16.3%
iii. Scenario 2 (mid-term diversion goals) – overall waste diversion 25.3%
iv. Scenario 3 (long-term diversion goals) – overall waste diversion 30.6%

3.2.1 LFG Generation Assessment under Current Conditions

Illustration of the cell-by-cell lifespan LFG generation for the Landfill using the UBCiModel and based on the existing waste composition and diversion rates is provided below in Figure 3.1. Full results are also provided in Appendix C.

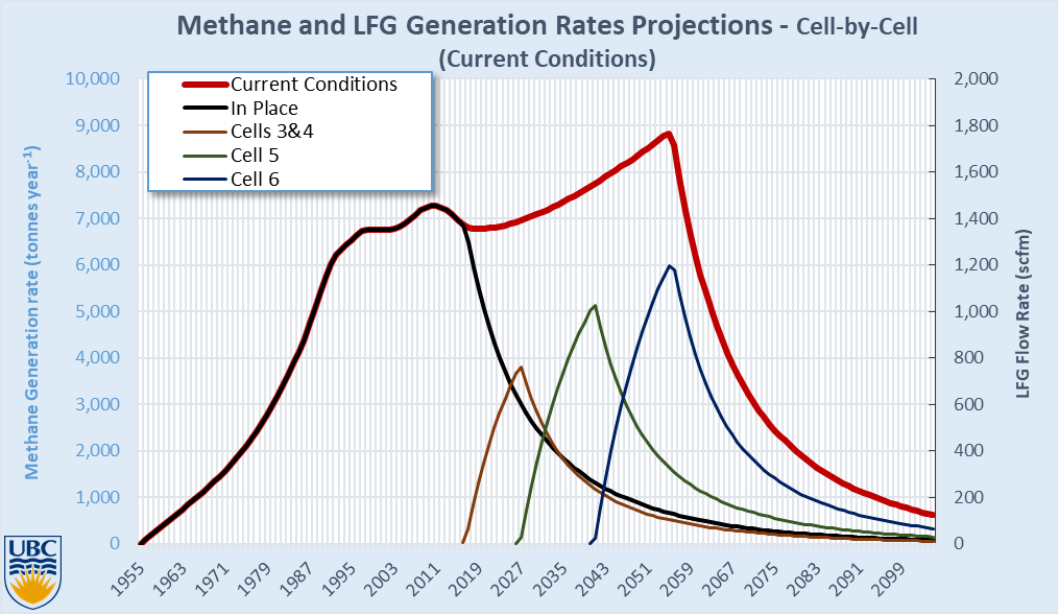


Figure 3.1 - Cell-by-Cell Methane and LFG Generation Estimates, Current Conditions

The gas generation assessment showed that the current LFG generation rate at the Hartland Landfill is 1,345 standard cubic feet per minute (scfm) (at 50% v/v CH_4), equivalent to 6,783 tonnes of methane per year. Results showed that the LFG generation rate will peak in 2055 at a maximum value of 1,750 scfm, equivalent to approximately 8,825 tonnes of methane per year.

Based on the UBCiModel© estimations methane generation in 2018 was approximately 6,786 tonnes in 2018, equivalent to an average LFG flow rate of 1,346 scfm. Therefore, taking into account the landfill's active LFG management system historical data, we estimated that the Hartland active LFG system had a methane capture efficiency of 77% in 2018. Assuming that the CRD continues to expand the LFG collection system at the Landfill, maintaining a 75% collection efficiency, and under "no additional organic waste diversion" scenario, it is expected that the collected LFG quantity will peak in 2055 at a maximum flow rate of 1,313 scfm, equivalent to approximately 6,620 tonnes of methane per year.

Figure 3.2 shows lifespan methane generation, historical gas collection rates and predicted future gas collection rates under the current waste diversion conditions at the Hartland Landfill.

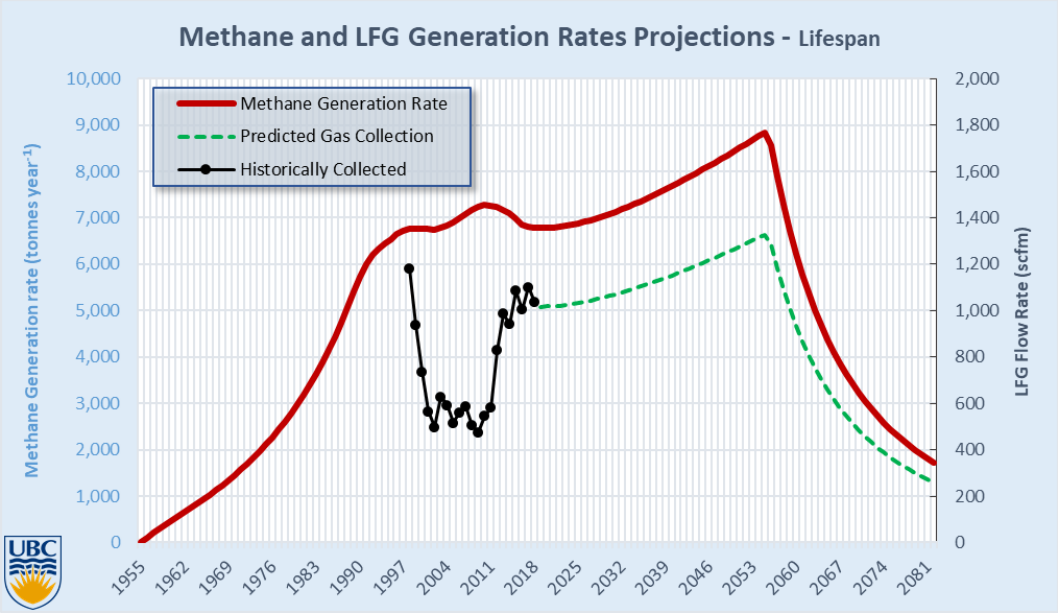


Figure 3.2 - Lifespan Methane Generation and Collection Rates Under Current Conditions

3.2.2 Climate Change Impact

In order to understand impacts of climate change on future gas generation rates, SHA completed a round of modeling based on PCIC climate projections presented in Section 2.4. Several scientific studies have shown that ambient temperature variations do not impact landfill temperature, specifically at well managed/ operated landfills such as Hartland Landfill with a depth of waste that is higher than 8 to 10 m. However, as previously mentioned, precipitation level and landfill moisture content are normally used as an indicator for waste decomposition and gas generation rates. In the UBCiModel© mean annual precipitation is used as a basis for assigning decay rates to organic waste components.

Based on PCIC climate projections and CRD's water budget study, precipitation levels at the landfill will increase from 908 mm in 2016 to 1,721 mm in 2050. Assuming a linear increase between 2016 and the 2050 precipitation levels, Harland Landfill will receive more than 1,000 mm of rain per year starting 2020. Changing toward a wetter climate will not impact the total (lifespan) methane generation, however, it will impact the rate at which the organics are decomposed, and LFG generated. Therefore, in this specific case, ignoring the projected climate change will result in more conservative results for a potential LFG to RNG project.

Assigning the historical climate parameters (i.e. < 1,000 mm/year) to the existing waste-in-place at the landfill and using the projected precipitation levels (i.e. > 1,000 mm/year) starting 2020, showed that the maximum lifespan LFG generation rate will increase about 8% from what was estimated without taking into account the climate change. This value was estimated at 1,900 scfm LFG flow rate (occurring in 2055), equivalent to approximately 9,512 tonnes of methane per year.

Illustration of cell-by-cell lifespan LFG generation, taking into account the climate change effect, and based on the existing waste composition and diversion rates is provided in Figure 3.3.

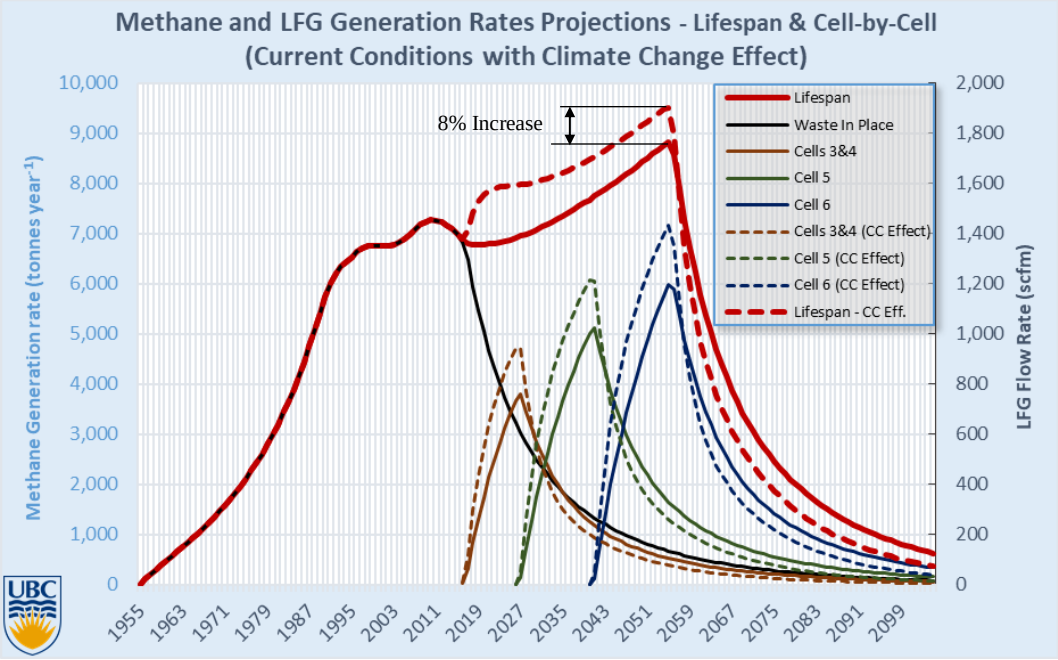


Figure 3.3 - Climate Change Impact on LFG Generation Estimates

3.2.3 Short-term Diversion (Scenario 1) LFG Generation Assessment Results

Model results for Scenario 1 diversion targets showed that the LFG generation rate will initially drop from its current value of 1,345 scfm to a flow rate of 1,248 scfm (6,293 tonnes methane per year) in 2033. Gas generation will then increase and peak in 2060 at a maximum value of 1,458 scfm, equivalent to approximately 7,352 tonnes of methane per year. This value in comparison to the maximum lifespan gas generation under current waste diversion conditions is approximately 17% lower. Figure 3.4 below shows the projected LFG generation rates for Sc. 1 diversion targets.

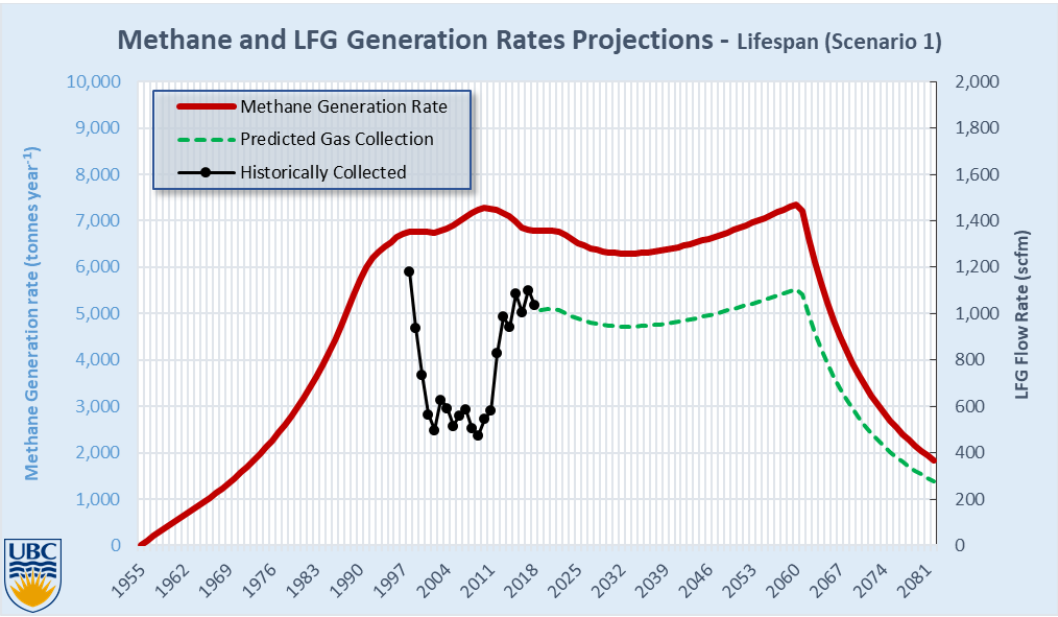


Figure 3.4 - Lifespan Methane Generation and Collection Rates Under Scenario 1

Illustrations of the cell-by-cell and lifespan LFG generation rates using the UBCiModel and based on the assumptions for Scenario 1 diversion targets are provided in Figure 3.5. Full graphical and tabulated results are provided in Appendix C of the report.

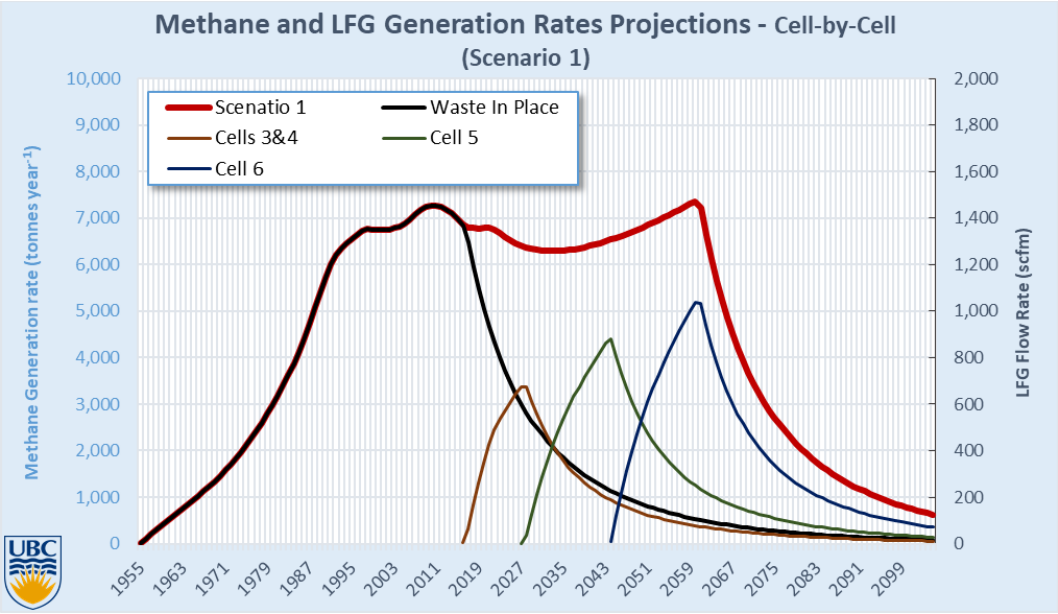


Figure 3.5 - Methane and LFG Generation Estimates, cell-by-cell, Scenario 1

3.2.4 Mid-term Diversion (Scenario 2) LFG Generation Assessment Results

Model results for Scenario 2 diversion targets showed that the LFG generation rate will initially drop from its current value of 1,345 scfm to a flow rate of 1,074 scfm (5,416 tonnes methane per year) in 2041. Gas generation will then increase and peak in 2064 at a maximum value of 1,196 scfm, equivalent to approximately 6,032 tonnes of methane per year. This value is approximately 32% lower than the maximum lifespan gas generation under current waste diversion. Figure 3.6 below shows the projected LFG generation rates for Sc. 2 diversion targets.

Illustrations of the cell-by-cell and lifespan LFG generation rates based on the assumptions for Scenario 2 diversion targets are provided in Figure 3.7. Full graphical and tabulated results are provided in Appendix C of the report.

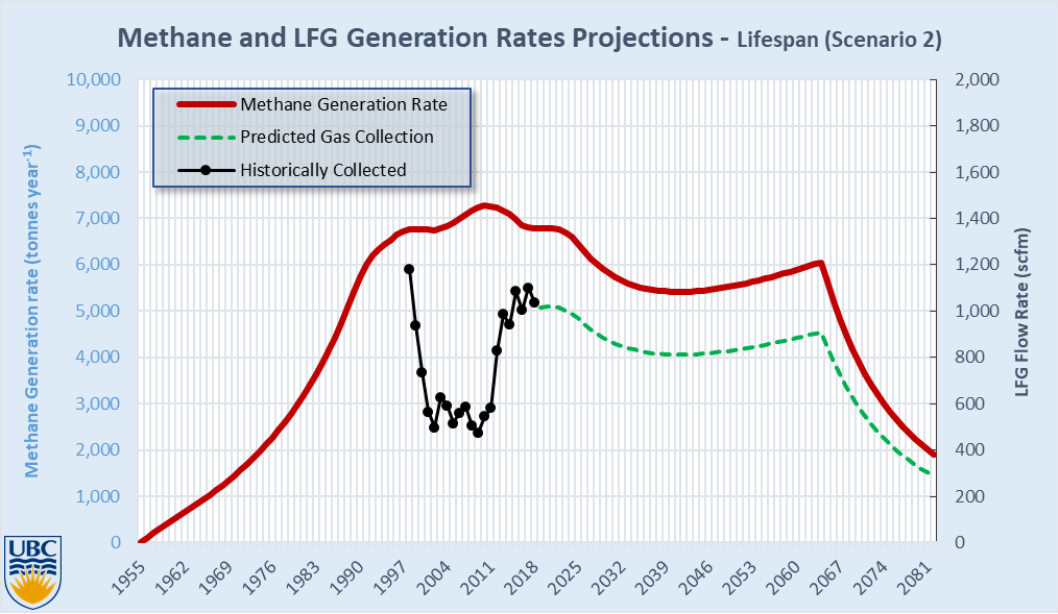


Figure 3.6 - Lifespan Methane Generation and Collection Rates Under Scenario 2

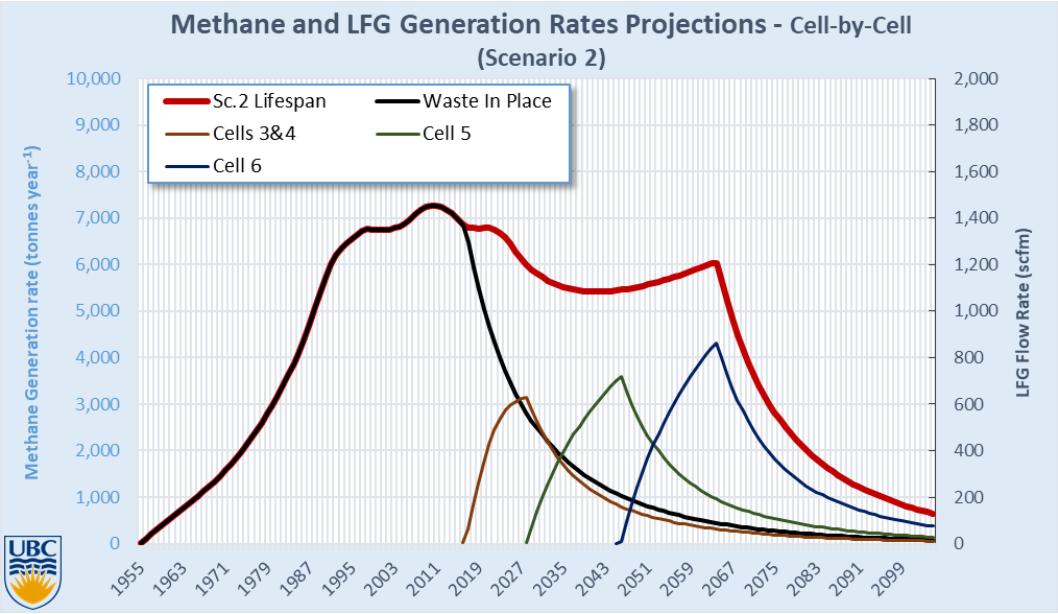


Figure 3.7 - Methane and LFG Generation Estimates, cell-by-cell, Scenario 2

3.2.5 Long-term (Scenario 3) LFG Generation Assessment Results

Model results for Scenario 3 diversion targets showed that the LFG generation rate will drop from its current value of 1,345 scfm to a flow rate of 943 scfm (4,756 tonnes methane per year) in 2047. Similar to other two scenarios, the gas generation will then increase and peak in 2066 at a maximum value of 1,022 scfm, equivalent to approximately 5,155 tonnes of methane per year. This value is approximately 42% lower than the maximum lifespan gas generation under current waste diversion. Figure 3.8 shows the projected LFG generation rates for Sc. 3 diversion targets.

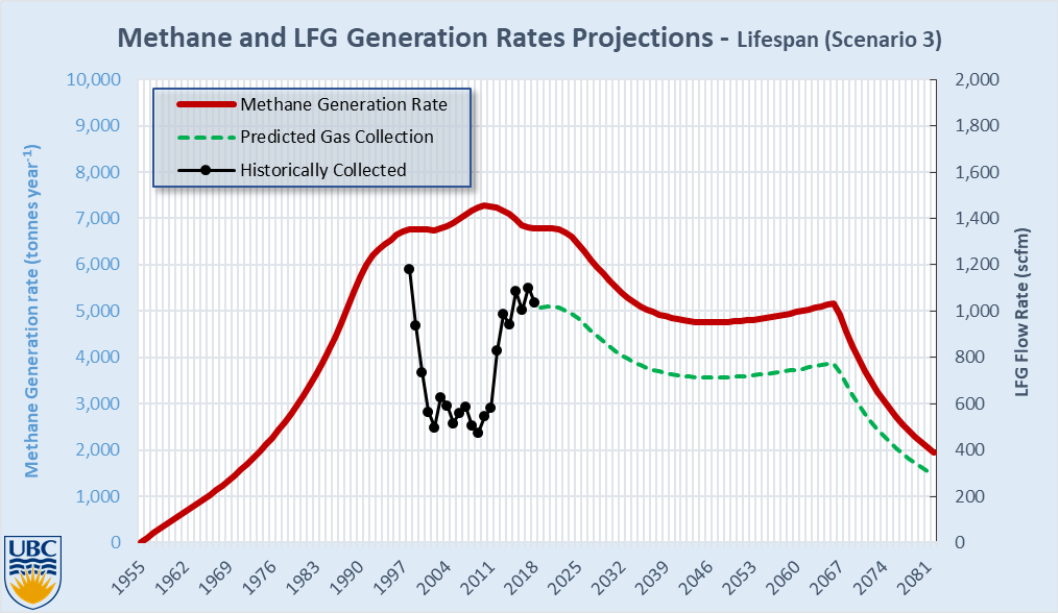


Figure 3.8 - Lifespan Methane Generation and Collection Rates Under Scenario 3

Illustrations of the cell-by-cell and lifespan LFG generation rates based on the assumptions for Scenario 3 diversion targets are provided in Figure 3.9. Full graphical and tabulated results are provided in Appendix C of the report.

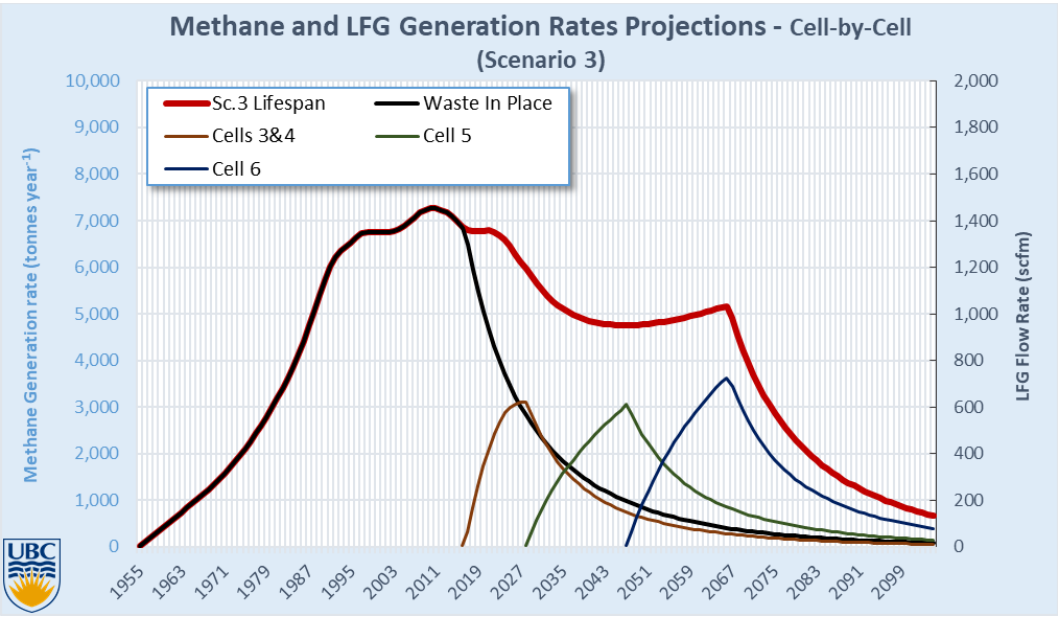


Figure 3.9 - Methane and LFG Generation Estimates, cell-by-cell, Scenario 3

4 COMPARISON OF SCENARIOS

As predicted, diversion of organic wastes will result in reduction of LFG generation at the Landfill. With the current waste composition and the assumptions presented in Section 2.2, methane generation at Hartland Landfill will continue to increase until the expected landfill closure year of 2055. Implementation of additional organic waste diversion to achieve the short-term diversion targets (Scenario 1) will extend the landfill's lifespan by 5 years. Realization of Scenario 1 diversion targets will result in reduction of the current LFG collection rate and a 17% drop in the lifespan peak LFG generation rate that will occur with a 5-year delay in 2060. Scenarios 2 and 3 diversion targets will extend the landfill's lifespan by 9 and 11 years (in comparison with the current conditions), respectively. Scenarios 2 and 3 diversion targets will also further reduce the LFG generation rates with lifespan peak rates of 32% and 42% lower than the current conditions peak LFG generation rate, respectively.

Figure 4.1 below illustrates comparison of methane and LFG generation rates from Hartland Landfill under current conditions and the three additional diversion scenarios.

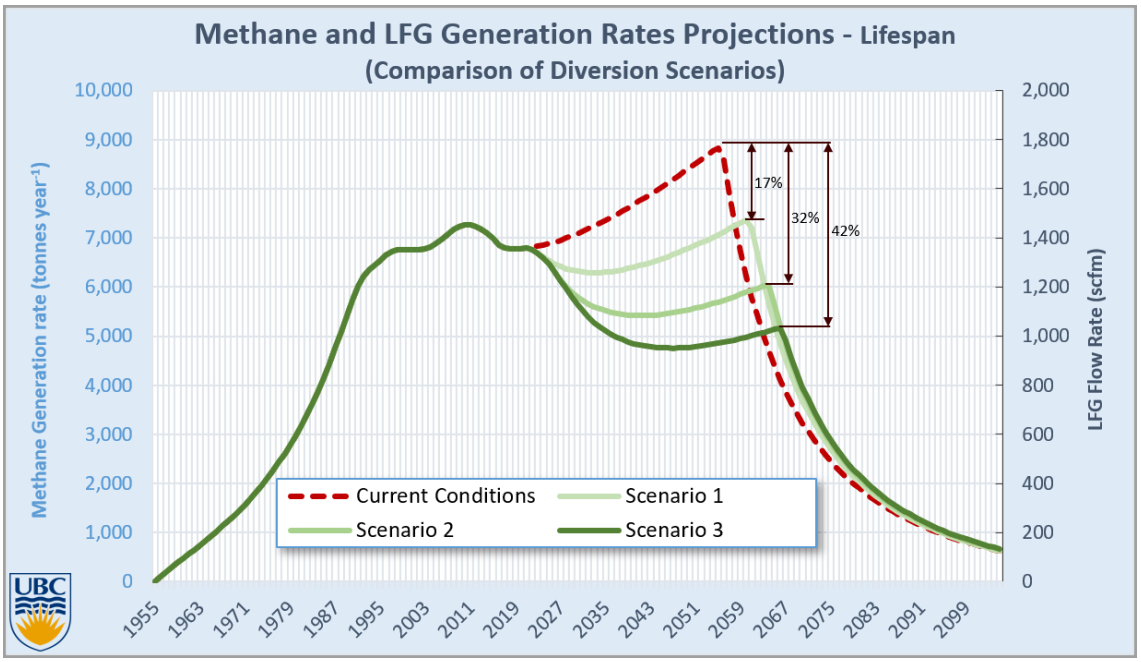


Figure 4.1 - Lifespan Methane and LFG Generation Estimates - Comparison of Scenarios

A summary of the UBCiModel© results under different scenarios for the years of 2018 to 2045 are presented in Table 4.1. Full results for all waste diversion scenarios are also compiled and presented in Appendix D.

Table 4.1 - Summary of LFG Generation under Different Scenarios (2018 – 2045)

Year	Current Conditions			Scenario 1			Scenario 2			Scenario 3		
	LFG		CH_4	LFG		CH_4	LFG		CH_4	LFG		CH_4
	scfm	m^3/hr	t/yr	scfm	m3/hr	t/yr	scfm	m^3/hr	t/yr	scfm	m^3/hr	t/yr
2018	1,346	2,287	6,786	1,346	2,287	6,786	1,346	2,287	6,786	1,346	2,287	6,786
2019	1,345	2,285	6,781	1,345	2,285	6,781	1,345	2,285	6,781	1,345	2,285	6,781
2020	1,345	2,286	6,783	1,345	2,286	6,783	1,345	2,286	6,783	1,345	2,286	6,783
2021	1,347	2,289	6,792	1,346	2,287	6,788	1,346	2,287	6,788	1,346	2,287	6,788
2022	1,350	2,294	6,807	1,340	2,277	6,756	1,340	2,277	6,756	1,340	2,277	6,756
2023	1,354	2,301	6,827	1,327	2,255	6,691	1,327	2,255	6,691	1,327	2,255	6,691
2024	1,359	2,309	6,852	1,309	2,224	6,601	1,308	2,223	6,595	1,308	2,223	6,595
2025	1,365	2,319	6,882	1,294	2,199	6,525	1,281	2,176	6,457	1,281	2,176	6,457
2026	1,372	2,330	6,915	1,282	2,178	6,463	1,247	2,118	6,287	1,247	2,118	6,285
2027	1,379	2,343	6,953	1,272	2,161	6,413	1,218	2,069	6,139	1,214	2,063	6,120
2028	1,387	2,357	6,994	1,264	2,147	6,372	1,192	2,026	6,012	1,182	2,009	5,962
2029	1,396	2,372	7,038	1,258	2,137	6,342	1,171	1,989	5,902	1,152	1,957	5,808
2030	1,405	2,388	7,085	1,253	2,129	6,319	1,152	1,957	5,808	1,122	1,907	5,659
2031	1,415	2,404	7,135	1,250	2,124	6,304	1,136	1,930	5,727	1,094	1,859	5,516
2032	1,425	2,422	7,187	1,249	2,121	6,295	1,122	1,907	5,659	1,069	1,817	5,391
2033	1,436	2,440	7,241	1,248	2,121	6,293	1,111	1,888	5,601	1,048	1,780	5,282
2034	1,448	2,459	7,298	1,249	2,122	6,295	1,101	1,871	5,553	1,029	1,748	5,188
2035	1,459	2,479	7,357	1,250	2,124	6,303	1,094	1,858	5,514	1,013	1,721	5,107
2036	1,471	2,500	7,418	1,253	2,128	6,315	1,087	1,847	5,482	999	1,698	5,038
2037	1,484	2,521	7,480	1,256	2,134	6,332	1,082	1,839	5,458	987	1,678	4,978
2038	1,496	2,543	7,545	1,260	2,140	6,352	1,079	1,833	5,439	977	1,661	4,928
2039	1,510	2,565	7,611	1,265	2,148	6,375	1,076	1,829	5,426	969	1,646	4,885
2040	1,523	2,588	7,679	1,270	2,157	6,402	1,075	1,826	5,419	962	1,635	4,850
2041	1,537	2,611	7,748	1,276	2,167	6,431	1,074	1,825	5,416	956	1,625	4,822
2042	1,551	2,635	7,818	1,282	2,178	6,464	1,074	1,825	5,417	952	1,617	4,799
2043	1,565	2,659	7,890	1,289	2,190	6,498	1,075	1,827	5,422	948	1,611	4,782
2044	1,580	2,684	7,964	1,296	2,202	6,536	1,077	1,830	5,430	946	1,607	4,769
2045	1,594	2,709	8,038	1,304	2,216	6,575	1,079	1,834	5,442	944	1,604	4,761

5 STATEMENT OF LIMITATIONS

This report has been prepared by Sperling Hansen Associates (SHA) on behalf of the Capital Regional District in accordance with generally accepted engineering practices to a level of care and skill normally exercised by other members of the engineering and science professions currently practicing under similar conditions in British Columbia, subject to the time limits and financial and physical constraints applicable to the services.

The report, which specifically includes all tables and figures, is based on engineering analysis by SHA staff of data compiled during the course of the project. Except where specifically stated to the contrary, the information on which this study is based has been obtained from external sources. This external information has not been independently verified or otherwise examined by Sperling Hansen Associates to determine its accuracy and completeness. Sperling Hansen Associates has relied in good faith on this information and does not accept responsibility of any deficiency, misstatements or inaccuracies contained in the reports as a result of omissions, misinterpretation and/or fraudulent acts of the persons interviewed or contacted, or errors or omissions in the reviewed documentation.

The report is intended solely for the use of the Capital Regional District. Any use which a third party makes of this report, or any reliance on, or decisions to be made based on it, are the responsibilities of such third parties. Sperling Hansen Associates does not accept any responsibility for other uses of the material contained herein nor for damages, if any, suffered by any third party because of decisions made or actions based on this report. Copying of this intellectual property for other purposes is not permitted.

The findings and conclusions of this report are valid only as of the date of this report. The interpretations presented in this report and the conclusions and recommendations that are drawn are based on information that was made available to Sperling Hansen Associates during the course of this project. Should additional new data become available in the future, Sperling Hansen Associates should be requested to re-evaluate the findings of this report and modify the conclusions and recommendations drawn, as required.

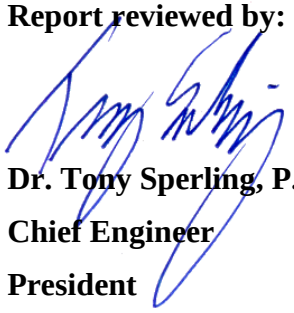
Yours truly,
SPERLING HANSEN ASSOCIATES

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President

APPENDICES

APPENDIX A

CRD's SWMP Waste Diversion Targets

					Short-Term Goal (2023)		Medium-Term Goal (2025)		Long-term Aspirational Goal (2030)	
Sector	**Sector Contribution to Landfill (%)[1]**	**Material Type**	**Material Contribution to Landfill (%)**	**Material Contribution to Landfill (tonnes)**	**Expected Diversion Potential (%)**	**Per capita diversion potential (kg per capita)**	**Expected Diversion Potential (%)**	**Per capita diversion potential (kg per capita)**	**Expected Diversion Potential (%)**	**Per capita diversion potential (kg per capita)**
Single-Family	**25%**	Curbside Recyclable Material	2.8%	4,316		0.0	20%	2.1	40%	4.2
		Depot Recyclable Material (EPR)	3.2%	5,022		0.0	35%	4.3	50%	6.1
		Wasted Food	3.8%	5,963	25%	3.6	50%	7.2	75%	10.8
		Inedible Organic Materials	4.9%	7,611	25%	4.6	50%	9.2	75%	13.8
		Clean Wood	0.1%	157		0.0		0.0		0.0
		Other Recyclable Building Materials	0.9%	1,452		0.0		0.0		0.0
		Textiles	1.8%	2,746		0.0		0.0	50%	3.3
		Bulky Objects	0.0%	0		0.0		0.0		0.0
Total Possible Divertable from SF			**17.4%**	**27,267**						
Multi-Family	**13%**	Curbside Recyclable Material	1.7%	2,652		0.0	50%	3.2	60%	3.8
		Depot Recyclable Material (EPR)	1.6%	2,448		0.0	25%	1.5	30%	1.8
		Wasted Food	2.0%	3,081	13%	0.9	25%	1.9	40%	3.0
		Inedible Organic Materials	2.9%	4,488	25%	2.7	50%	5.4	60%	6.5
		Clean Wood	0.0%	20		0.0		0.0		0.0
		Other Recyclable Building Materials	1.1%	1,734		0.0		0.0		0.0
		Textiles	0.6%	877		0.0		0.0	50%	1.1
		Bulky Objects	0.0%	0		0.0		0.0		0.0
Total Possible Divertable from MF			**9.8%**	**15,301**						
Bins	**5%**	Curbside Recyclable Material	0.1%	165		0.0		0.0		0.0
		Depot Recyclable Material (EPR)	0.4%	565		0.0		0.0		0.0
		Wasted Food	0.1%	110		0.0		0.0		0.0
		Inedible Organic Materials	0.4%	636		0.0		0.0		0.0
		Clean Wood	0.2%	369		0.0		0.0		0.0
		Other Recyclable Building Materials	0.9%	1,428		0.0		0.0		0.0
		Textiles	0.1%	157		0.0		0.0	50%	0.2
		Bulky Objects	0.3%	408		0.0		0.0		0.0
Total Possible Divertable from Bins			**2.4%**	**3,837**						
ICI	**41%**	Curbside Recyclable Material	6.4%	10,037		0.0	50%	12.1	70%	17.0
		Depot Recyclables	5.8%	9,137		0.0	25%	5.5	30%	6.6
		Wasted Food	5.8%	9,072	25%	5.5	50%	11.0	60%	13.2
		Inedible Organic Materials	7.2%	11,260	25%	6.8	50%	13.6	60%	16.3
		Clean Wood	0.2%	386		0.0		0.0		0.0
		Other Recyclable Building Materials	1.3%	2,059		0.0		0.0		0.0
		Textiles	2.6%	4,118		0.0		0.0	50%	5.0
		Bulky Objects	0.8%	1,287		0.0		0.0		0.0
Total Possible Divertable from ICI			**30.2%**	**47,355**						
CR&D	**16%**	Curbside Recyclable Material	0.1%	151		0.0		0.0		0.0
		Depot Recyclables	0.7%	1,155	50%	1.4	50%	1.4	55%	1.5
		Wasted Food	0.0%	0		0.0		0.0		0.0
		Inedible Organic Materials	0.0%	50		0.0		0.0		0.0
		Clean Wood	2.2%	3,465	70%	5.9	75%	6.3	75%	6.3
		Other Recyclable Building Materials	3.6%	5,574	60%	8.1	60%	8.1	60%	8.1
		Textiles	0.2%	251	50%	0.3	50%	0.3	55%	0.3
		Bulky Objects	0.1%	176		0.0		0.0		0.0
Total Possible Divertable from CR&D			**6.9%**	**10,822**						
				Reduction in Disposal		40		93		129
				New Disposal Rate		340		287		251
				New Disposal Target (kg/capita)		**340**		**285**		**250**

[1]The diversion potential analysis is based on the 2018 disposal of 156,931 tonnes.

APPENDIX B

Waste tonnage Projections and Cell-by-cell Lifespan Volumetric Analysis

Table 1 - Waste Tonnage and Volumetric Analysis for Different Scenarios

Year	MSW Disposal Rate*	Scenario 1	Scenario 2	Scenario 3	Annual Volume of Landfill Consumed ** Volume of (MSW + CW + Soil - Settlement)			
NOTES	MSW Only	2023 Diversion target	2025 Diversion target	2030 Diversion target	No Additional Diversion	Scenario 1 Diversion	Scenario 2 Diversion	Scenario 3 Diversion
	(tonnes/year)	(tonnes/year)	(tonnes/year)	(tonnes/year)	(m^3/yr)	(m3/yr)	(m3/yr)	(m3/yr)
1955	23,000	23,000	23,000	23,000				
1956	24,495	24,495	24,495	24,495				
1957	26,087	26,087	26,087	26,087				
1958	27,783	27,783	27,783	27,783				
1959	29,589	29,589	29,589	29,589				
1960	31,512	31,512	31,512	31,512				
1961	33,560	33,560	33,560	33,560				
1962	35,742	35,742	35,742	35,742				
1963	38,065	38,065	38,065	38,065				
1964	40,539	40,539	40,539	40,539				
1965	43,174	43,174	43,174	43,174				
1966	45,980	45,980	45,980	45,980				
1967	48,969	48,969	48,969	48,969				
1968	52,152	52,152	52,152	52,152				
1969	55,542	55,542	55,542	55,542				
1970	59,152	59,152	59,152	59,152				
1971	62,997	62,997	62,997	62,997				
1972	67,092	67,092	67,092	67,092				
1973	71,453	71,453	71,453	71,453				
1974	76,097	76,097	76,097	76,097				
1975	81,044	81,044	81,044	81,044				
1976	86,312	86,312	86,312	86,312				
1977	91,922	91,922	91,922	91,922				
1978	97,897	97,897	97,897	97,897				
1979	104,260	104,260	104,260	104,260				
1980	111,037	111,037	111,037	111,037				
1981	118,254	118,254	118,254	118,254				
1982	125,941	125,941	125,941	125,941				
1983	134,127	134,127	134,127	134,127				
1984	142,845	142,845	142,845	142,845				
1985	152,130	152,130	152,130	152,130				
1986	167,472	167,472	167,472	167,472				
1987	177,686	177,686	177,686	177,686				
1988	184,193	184,193	184,193	184,193				
1989	188,750	188,750	188,750	188,750				
1990	187,476	187,476	187,476	187,476				
1991	175,956	175,956	175,956	175,956				
1992	162,329	162,329	162,329	162,329				
1993	159,431	159,431	159,431	159,431				
1994	156,285	156,285	156,285	156,285				
1995	159,993	159,993	159,993	159,993				
1996	157,528	157,528	157,528	157,528				
1997	149,429	149,429	149,429	149,429				
1998	138,081	138,081	138,081	138,081				
1999	138,174	138,174	138,174	138,174				
2000	136,654	136,654	136,654	136,654				
2001	135,425	135,425	135,425	135,425				
2002	142,940	142,940	142,940	142,940				
2003	144,043	144,043	144,043	144,043				
2004	150,787	150,787	150,787	150,787				
2005	158,848	158,848	158,848	158,848				
2006	160,260	160,260	160,260	160,260				
2007	165,382	165,382	165,382	165,382				
2008	154,881	154,881	154,881	154,881				
2009	153,263	153,263	153,263	153,263				
2010	143,669	143,669	143,669	143,669				
2011	136,414	136,414	136,414	136,414				
2012	129,279	129,279	129,279	129,279				
2013	123,210	123,210	123,210	123,210				
2014	119,306	119,306	119,306	119,306				
2015	112,442	112,442	112,442	112,442				
2016	134,167	134,167	134,167	134,167				
2017	144,368	144,368	144,368	144,368	173,764	173,764	173,764	173,764
Additional	2018	146,431	146,431	146,431	146,431	176,081	176,081	176,081	176,081
Diversion	2019	147,895	147,895	147,895	147,895	177,725	177,725	177,725	177,725
0%	2020	149,374	149,374	149,374	149,374	179,385	179,385	179,385	179,385
5%	2021	150,868	142,685	142,685	142,685	181,063	171,874	171,874	171,874
11%	2022	152,377	135,846	135,846	135,846	182,757	164,196	164,196	164,196
16%	2023	153,900	128,857	128,857	128,857	184,468	156,348	156,348	156,348
21%	2024	155,439	130,145	123,159	123,159	186,196	157,795	149,951	149,951
25%	2025	156,994	131,447	117,335	117,335	187,941	159,256	143,411	143,411
26%	2026	158,564	132,761	118,508	116,800	189,704	160,732	144,729	142,811
27%	2027	160,149	134,089	119,693	116,242	191,484	162,223	146,059	142,185
28%	2028	161,751	135,430	120,890	115,662	193,282	163,728	147,403	141,533
30%	2029	163,368	136,784	122,099	115,059	195,098	165,249	148,761	140,856
31%	2030	165,002	138,152	123,320	114,431	196,933	166,785	150,131	140,151
31%	2031	166,652	139,533	124,553	115,576	198,785	168,336	151,516	141,436
31%	2032	168,319	140,929	125,799	116,731	200,656	169,903	152,915	142,734
31%	2033	170,002	142,338	127,057	117,899	202,546	171,485	154,327	144,045
31%	2034	171,702	143,761	128,327	119,078	204,455	173,083	155,754	145,368
31%	2035	173,419	145,199	129,611	120,269	206,383	174,697	157,195	146,705
31%	2036	175,153	146,651	130,907	121,471	208,330	176,328	158,650	148,056
31%	2037	176,905	148,117	132,216	122,686	210,297	177,974	160,120	149,420
31%	2038	178,674	149,598	133,538	123,913	212,283	179,637	161,604	150,797
31%	2039	180,460	151,094	134,873	125,152	214,289	181,317	163,104	152,188
31%	2039	182,265	152,605	136,222	126,403	216,315	183,013	164,618	153,594
31%	2041	184,088	154,131	137,584	127,667	218,362	184,727	166,147	155,013
31%	2042	185,929	155,673	138,960	128,944	220,429	186,457	167,692	156,446
31%	2043	187,788	157,230	140,350	130,234	222,516	188,205	169,253	157,894
31%	2044	189,666	158,802	141,753	131,536	224,625	189,971	170,828	159,356
31%	2045	191,562	160,390	143,171	132,851	226,755	191,754	172,420	160,833
31%	2046	193,478	161,994	144,602	134,180	228,905	193,555	174,028	162,325
31%	2047	195,413	163,614	146,048	135,522	231,078	195,374	175,651	163,832
31%	2048	197,367	165,250	147,509	136,877	233,272	197,211	177,291	165,353
31%	2049	199,341	166,902	148,984	138,246	235,488	199,066	178,947	166,890
31%	2050	201,334	168,571	150,474	139,628	237,726	200,940	180,620	168,442
31%	2051	203,347	170,257	151,979	141,024	239,987	202,833	182,310	170,010
31%	2052	205,381	171,960	153,498	142,435	242,270	204,744	184,016	171,594
31%	2053	207,435	173,679	155,033	143,859	244,576	206,675	185,739	173,193
31%	2054	209,509	175,416	156,584	145,298	246,905	208,625	187,480	174,808
31%	2055	211,604	177,170	158,149	146,750	249,257	210,595	189,238	176,439
31%	2056	213,720	178,942	159,731	148,218		212,584	191,014	178,087
31%	2057	215,857	180,731	161,328	149,700		214,593	192,807	179,751
31%	2058	218,016	182,539	162,942	151,197		216,623	194,619	181,432
31%	2059	220,196	184,364	164,571	152,709		218,672	196,448	183,130
31%	2060	222,398	186,208	166,217	154,236		220,742	198,296	184,845
31%	2061	224,622	188,070	167,879	155,779			200,163	186,576
31%	2062	226,868	189,950	169,558	157,336			202,047	188,325
31%	2063	229,137	191,850	171,253	158,910			203,951	190,092
31%	2064	231,428	193,768	172,966	160,499				191,876
31%	2065	233,742	195,706	174,695	162,104				193,678
31%	2066	236,080	197,663	176,442	163,725				
31%	2067	238,441	199,640	178,207	165,362				
31%	2068	240,825	201,636	179,989	167,016				
31%	2069	243,233	203,653	181,789	168,686				

* Reported waste tonnages EXCLUDES controlled waste and cover soil.

** Volumes of controlled wastes, soil cover and settlement are taken into account in the Volumetric Analysis.

Assumptionas:

Estimated Population Growth:	1%	
Estimated Waste Compaction:	**0.95**	tonnes/m^3
Estimated Waste to Cover Ratio:	6	:1 vol/vol
Estimated Settlement:	10%	
Esimated Vol. of Controlled Waste:	11,667	m^3/yr

Table 2 - Existing Conditions Cell Volumetric Analysis

Year	MSW Disposal Rate*	Annual Volume of Landfill Consumed ** Volume of (MSW + CW + Soil - Settlement)				Previous Phases Historical Tonnage	Cell 3 Tonnage Received (MSW)	Cell 3 Vol. Remaining	Cell 4 Tonnage Received (MSW)	Cell 4 Vol. Remaining	Cell 5 Tonnage Received (MSW)	Cell 5 Vol. Remaining	Cell 6 Tonnage Received (MSW)	Cell 6 Vol. Remaining
NOTES	MSW Only	No Additional Diversion	Scenario 1 Diversion	Scenario 2 Diversion	Scenario 3 Diversion	Active Face Moved to Cell 3 Starting July 2016	MSW Only (for LFG Generation)	Available Vol. - Annual Vol.	MSW Only (for LFG Generation)	Available Vol. - Annual Vol.	MSW Only (for LFG Generation)	Available Vol. - Annual Vol.	MSW Only (for LFG Generation)	Available Vol. - Annual Vol.
	(tonnes/year)	(m^3/yr)	(m^3/yr)	(m^3/yr)	(m^3/yr)	(tonnes/year)	(tonnes/year)	(m^3)	(tonnes/year)	(m^3)	(tonnes/year)	(m^3)	(tonnes/year)	(m^3)
1955	23,000					23,000								
1956	24,495					24,495								
1957	26,087					26,087								
1958	27,783					27,783								
1959	29,589					29,589								
1960	31,512					31,512								
1961	33,560					33,560								
1962	35,742					35,742								
1963	38,065					38,065								
1964	40,539					40,539								
1965	43,174					43,174								
1966	45,980					45,980								
1967	48,969					48,969								
1968	52,152					52,152								
1969	55,542					55,542								
1970	59,152					59,152								
1971	62,997					62,997								
1972	67,092					67,092								
1973	71,453					71,453								
1974	76,097					76,097								
1975	81,044					81,044								
1976	86,312					86,312								
1977	91,922					91,922								
1978	97,897					97,897								
1979	104,260					104,260								
1980	111,037					111,037								
1981	118,254					118,254								
1982	125,941					125,941								
1983	134,127					134,127								
1984	142,845					142,845								
1985	152,130					152,130								
1986	167,472					167,472								
1987	177,686					177,686								
1988	184,193					184,193								
1989	188,750					188,750								
1990	187,476					187,476								
1991	175,956					175,956								
1992	162,329					162,329								
1993	159,431					159,431								
1994	156,285					156,285								
1995	159,993					159,993								
1996	157,528					157,528								
1997	149,429					149,429								
1998	138,081					138,081								
1999	138,174					138,174								
2000	136,654					136,654								
2001	135,425					135,425								
2002	142,940					142,940								
2003	144,043					144,043								
2004	150,787					150,787								
2005	158,848					158,848								
2006	160,260					160,260								
2007	165,382					165,382								
2008	154,881					154,881								
2009	153,263					153,263								
2010	143,669					143,669								
2011	136,414					136,414								
2012	129,279					129,279								
2013	123,210					123,210								
2014	119,306					119,306								
2015	112,442					112,442								
2016	134,167					61,461	72,707							
2017	144,368	173,764	173,764	173,764	173,764		144,368	1,443,834	2018 Survey					
2018	146,431	176,081	176,081	176,081	176,081		146,431	1,267,753						
2019	147,895	177,725	177,725	177,725	177,725		147,895	1,090,028						
2020	149,374	179,385	179,385	179,385	179,385		149,374	910,643						
2021	150,868	181,063	171,874	171,874	171,874		150,868	729,580						
2022	152,377	182,757	164,196	164,196	164,196		152,377	546,824						
2023	153,900	184,468	156,348	156,348	156,348		153,900	362,356						
2024	155,439	186,196	157,795	149,951	149,951		155,439	176,161		175,330				
2025	156,994	187,941	159,256	143,411	143,411		147,153	0	9,840	163,550		2,859,800		
2026	158,564	189,704	160,732	144,729	142,811				136,703	0	21,861	2,833,646		
2027	160,149	191,484	162,223	146,059	142,185						160,149	2,642,162		
2028	161,751	193,282	163,728	147,403	141,533						161,751	2,448,880		
2029	163,368	195,098	165,249	148,761	140,856						163,368	2,253,782		
2030	165,002	196,933	166,785	150,131	140,151						165,002	2,056,850		
2031	166,652	198,785	168,336	151,516	141,436						166,652	1,858,064		
2032	168,319	200,656	169,903	152,915	142,734						168,319	1,657,408		
2033	170,002	202,546	171,485	154,327	144,045						170,002	1,454,862		
2034	171,702	204,455	173,083	155,754	145,368						171,702	1,250,407		
2035	173,419	206,383	174,697	157,195	146,705						173,419	1,044,024		
2036	175,153	208,330	176,328	158,650	148,056						175,153	835,694		
2037	176,905	210,297	177,974	160,120	149,420						176,905	625,397		
2038	178,674	212,283	179,637	161,604	150,797						178,674	413,114		
2039	180,460	214,289	181,317	163,104	152,188						180,460	198,825		3,428,016
2040	182,265	216,315	183,013	164,618	153,594						167,527	0	14,738	3,410,525
2041	184,088	218,362	184,727	166,147	155,013								184,088	3,192,163
2042	185,929	220,429	186,457	167,692	156,446								185,929	2,971,735
2043	187,788	222,516	188,205	169,253	157,894								187,788	2,749,218
2044	189,666	224,625	189,971	170,828	159,356								189,666	2,524,593
2045	191,562	226,755	191,754	172,420	160,833								191,562	2,297,839
2046	193,478	228,905	193,555	174,028	162,325								193,478	2,068,933
2047	195,413	231,078	195,374	175,651	163,832								195,413	1,837,855
2048	197,367	233,272	197,211	177,291	165,353								197,367	1,604,583
2049	199,341	235,488	199,066	178,947	166,890								199,341	1,369,096
2050	201,334	237,726	200,940	180,620	168,442								201,334	1,131,369
2051	203,347	239,987	202,833	182,310	170,010								203,347	891,383
2052	205,381	242,270	204,744	184,016	171,594								205,381	649,113
2053	207,435	244,576	206,675	185,739	173,193								207,435	404,537
2054	209,509	246,905	208,625	187,480	174,808								209,509	157,632
2055	211,604	249,257	210,595	189,238	176,439								133,819	0
2056	213,720		212,584	191,014	178,087								77,785	
2057	215,857		214,593	192,807	179,751									
2058	218,016		216,623	194,619	181,432									
2059	220,196		218,672	196,448	183,130									
2060	222,398		220,742	198,296	184,845									
2061	224,622			200,163	186,576									
2062	226,868			202,047	188,325									
2063	229,137			203,951	190,092									
2064	231,428			205,874	191,876									
2065	233,742				193,678									
2066	236,080				195,498									
2067	238,441													
2068	240,825													
2069	243,233													

* Reported waste tonnages EXCLUDES controlled waste and cover soil.

** Volumes of controlled wastes, soil cover and settlement are taken into account in the Volumetric Analysis.

Assumptionas:

Estimated Population Growth:	1%	
Estimated Waste Compaction:	**0.95**	tonnes/m^3
Estimated Waste to Cover Ratio:	6	:1 vol/vol
Estimated Settlement:	10%	
Esimated Vol. of Controlled Waste:	11,667	m^3/yr

Table 3 - Scenario 1 Diversion Cell Volumetric Analysis

Year	MSW Disposal Rate*	Scenario 1	Volume Consumtion**	Previous Phases Historical Tonnage	Cell 3 Tonnage Received (MSW)	Cell 3 Vol. Remaining	Cell 4 Tonnage Received (MSW)	Cell 4 Vol. Remaining	Cell 5 Tonnage Received (MSW)	Cell 5 Vol. Remaining	Cell 6 Tonnage Received (MSW)	Cell 6 Vol. Remaining
NOTES	MSW Only	2023 Diversion target	Scenario 1 Diversion	Active Face Moved to Cell 3 Starting July 2016	MSW Only (for LFG Generation)	Available Vol. - Annual Vol.	MSW Only (for LFG Generation)	Available Vol. - Annual Vol.	MSW Only (for LFG Generation)	Available Vol. - Annual Vol.	MSW Only (for LFG Generation)	Available Vol. - Annual Vol.
	(tonnes/year)	(tonnes/year)	(m^3/yr)	(tonnes/year)	(tonnes/year)	(m^3)	(tonnes/year)	(m^3)	(tonnes/year)	(m^3)	(tonnes/year)	(m^3)
1955	23,000	23,000		23,000								
1956	24,495	24,495		24,495								
1957	26,087	26,087		26,087								
1958	27,783	27,783		27,783								
1959	29,589	29,589		29,589								
1960	31,512	31,512		31,512								
1961	33,560	33,560		33,560								
1962	35,742	35,742		35,742								
1963	38,065	38,065		38,065								
1964	40,539	40,539		40,539								
1965	43,174	43,174		43,174								
1966	45,980	45,980		45,980								
1967	48,969	48,969		48,969								
1968	52,152	52,152		52,152								
1969	55,542	55,542		55,542								
1970	59,152	59,152		59,152								
1971	62,997	62,997		62,997								
1972	67,092	67,092		67,092								
1973	71,453	71,453		71,453								
1974	76,097	76,097		76,097								
1975	81,044	81,044		81,044								
1976	86,312	86,312		86,312								
1977	91,922	91,922		91,922								
1978	97,897	97,897		97,897								
1979	104,260	104,260		104,260								
1980	111,037	111,037		111,037								
1981	118,254	118,254		118,254								
1982	125,941	125,941		125,941								
1983	134,127	134,127		134,127								
1984	142,845	142,845		142,845								
1985	152,130	152,130		152,130								
1986	167,472	167,472		167,472								
1987	177,686	177,686		177,686								
1988	184,193	184,193		184,193								
1989	188,750	188,750		188,750								
1990	187,476	187,476		187,476								
1991	175,956	175,956		175,956								
1992	162,329	162,329		162,329								
1993	159,431	159,431		159,431								
1994	156,285	156,285		156,285								
1995	159,993	159,993		159,993								
1996	157,528	157,528		157,528								
1997	149,429	149,429		149,429								
1998	138,081	138,081		138,081								
1999	138,174	138,174		138,174								
2000	136,654	136,654		136,654								
2001	135,425	135,425		135,425								
2002	142,940	142,940		142,940								
2003	144,043	144,043		144,043								
2004	150,787	150,787		150,787								
2005	158,848	158,848		158,848								
2006	160,260	160,260		160,260								
2007	165,382	165,382		165,382								
2008	154,881	154,881		154,881								
2009	153,263	153,263		153,263								
2010	143,669	143,669		143,669								
2011	136,414	136,414		136,414								
2012	129,279	129,279		129,279								
2013	123,210	123,210		123,210								
2014	119,306	119,306		119,306								
2015	112,442	112,442		112,442								
2016	134,167	134,167		61,461	72,707							
2017	144,368	144,368	173,764		144,368	1,443,834	2018 Survey					
2018	146,431	146,431	176,081		146,431	1,267,753						
2019	147,895	147,895	177,725		147,895	1,090,028						
2020	149,374	149,374	179,385		149,374	910,643						
2021	150,868	142,685	171,874		142,685	738,769						
2022	152,377	135,846	164,196		135,846	574,573						
2023	153,900	128,857	156,348		128,857	418,225						
2024	155,439	130,145	157,795		130,145	260,430						
2025	156,994	131,447	159,256		131,447	101,174		175,330				
2026	158,564	132,761	160,732		83,567	0	49,194	115,772		2,859,800		
2027	160,149	134,089	162,223				95,694	0	38,395	2,813,349		
2028	161,751	135,430	163,728						135,430	2,649,621		
2029	163,368	136,784	165,249						136,784	2,484,372		
2030	165,002	138,152	166,785						138,152	2,317,587		
2031	166,652	139,533	168,336						139,533	2,149,251		
2032	168,319	140,929	169,903						140,929	1,979,349		
2033	170,002	142,338	171,485						142,338	1,807,864		
2034	171,702	143,761	173,083						143,761	1,634,781		
2035	173,419	145,199	174,697						145,199	1,460,083		
2036	175,153	146,651	176,328						146,651	1,283,756		
2037	176,905	148,117	177,974						148,117	1,105,782		
2038	178,674	149,598	179,637						149,598	926,145		
2039	180,460	151,094	181,317						151,094	744,828		
2039	182,265	152,605	183,013						152,605	561,814		
2041	184,088	154,131	184,727						154,131	377,087		
2042	185,929	155,673	186,457						155,673	190,630		
2043	187,788	157,230	188,205						157,230	2,424		3,428,016
2044	189,666	158,802	189,971						2,027	0	156,775	3,240,470
2045	191,562	160,390	191,754								160,390	3,048,716
2046	193,478	161,994	193,555								161,994	2,855,161
2047	195,413	163,614	195,374								163,614	2,659,788
2048	197,367	165,250	197,211								165,250	2,462,577
2049	199,341	166,902	199,066								166,902	2,263,511
2050	201,334	168,571	200,940								168,571	2,062,571
2051	203,347	170,257	202,833								170,257	1,859,738
2052	205,381	171,960	204,744								171,960	1,654,994
2053	207,435	173,679	206,675								173,679	1,448,318
2054	209,509	175,416	208,625								175,416	1,239,693
2055	211,604	177,170	210,595								177,170	1,029,098
2056	213,720	178,942	212,584								178,942	816,514
2057	215,857	180,731	214,593								180,731	601,921
2058	218,016	182,539	216,623								182,539	385,298
2059	220,196	184,364	218,672								184,364	166,626
2060	222,398	186,208	220,742								140,558	0
2061	224,622	188,070									45,650	
2062	226,868	189,950										
2063	229,137	191,850										
2064	231,428	193,768										
2065	233,742	195,706										
2066	236,080	197,663										
2067	238,441	199,640										

* Reported waste tonnages EXCLUDES controlled waste and cover soil.

** Volumes of controlled wastes, soil cover and settlement are taken into account in the Volumetric Analysis.

Assumptionas:

Estimated Population Growth:	1%	
Estimated Waste Compaction:	**0.95**	tonnes/m^3
Estimated Waste to Cover Ratio:	6	:1 vol/vol
Estimated Settlement:	10%	
Esimated Vol. of Controlled Waste:	11,667	m^3/yr

Table 4 - Scenario 2 Diversion Cell Volumetric Analysis

Year	MSW Disposal Rate*	Scenario 2	Volume Consumtion**	Previous Phases Historical Tonnage	Cell 3 Tonnage Received (MSW)	Cell 3 Vol. Remaining	Cell 4 Tonnage Received (MSW)	Cell 4 Vol. Remaining	Cell 5 Tonnage Received (MSW)	Cell 5 Vol. Remaining	Cell 6 Tonnage Received (MSW)	Cell 6 Vol. Remaining
NOTES	MSW Only	2025 Diversion target	Scenario 2 Diversion	Active Face Moved to Cell 3 Starting July 2016	MSW Only (for LFG Generation)	Available Vol. - Annual Vol.	MSW Only (for LFG Generation)	Available Vol. - Annual Vol.	MSW Only (for LFG Generation)	Available Vol. - Annual Vol.	MSW Only (for LFG Generation)	Available Vol. - Annual Vol.
	(tonnes/year)	(tonnes/year)	(m^3/yr)	(tonnes/year)	(tonnes/year)	(m^3)	(tonnes/year)	(m^3)	(tonnes/year)	(m^3)	(tonnes/year)	(m^3)
1955	23,000	23,000	0	23,000								
1956	24,495	24,495	0	24,495								
1957	26,087	26,087	0	26,087								
1958	27,783	27,783	0	27,783								
1959	29,589	29,589	0	29,589								
1960	31,512	31,512	0	31,512								
1961	33,560	33,560	0	33,560								
1962	35,742	35,742	0	35,742								
1963	38,065	38,065	0	38,065								
1964	40,539	40,539	0	40,539								
1965	43,174	43,174	0	43,174								
1966	45,980	45,980	0	45,980								
1967	48,969	48,969	0	48,969								
1968	52,152	52,152	0	52,152								
1969	55,542	55,542	0	55,542								
1970	59,152	59,152	0	59,152								
1971	62,997	62,997	0	62,997								
1972	67,092	67,092	0	67,092								
1973	71,453	71,453	0	71,453								
1974	76,097	76,097	0	76,097								
1975	81,044	81,044	0	81,044								
1976	86,312	86,312	0	86,312								
1977	91,922	91,922	0	91,922								
1978	97,897	97,897	0	97,897								
1979	104,260	104,260	0	104,260								
1980	111,037	111,037	0	111,037								
1981	118,254	118,254	0	118,254								
1982	125,941	125,941	0	125,941								
1983	134,127	134,127	0	134,127								
1984	142,845	142,845	0	142,845								
1985	152,130	152,130	0	152,130								
1986	167,472	167,472	0	167,472								
1987	177,686	177,686	0	177,686								
1988	184,193	184,193	0	184,193								
1989	188,750	188,750	0	188,750								
1990	187,476	187,476	0	187,476								
1991	175,956	175,956	0	175,956								
1992	162,329	162,329	0	162,329								
1993	159,431	159,431	0	159,431								
1994	156,285	156,285	0	156,285								
1995	159,993	159,993	0	159,993								
1996	157,528	157,528	0	157,528								
1997	149,429	149,429	0	149,429								
1998	138,081	138,081	0	138,081								
1999	138,174	138,174	0	138,174								
2000	136,654	136,654	0	136,654								
2001	135,425	135,425	0	135,425								
2002	142,940	142,940	0	142,940								
2003	144,043	144,043	0	144,043								
2004	150,787	150,787	0	150,787								
2005	158,848	158,848	0	158,848								
2006	160,260	160,260	0	160,260								
2007	165,382	165,382	0	165,382								
2008	154,881	154,881	0	154,881								
2009	153,263	153,263	0	153,263								
2010	143,669	143,669	0	143,669								
2011	136,414	136,414	0	136,414								
2012	129,279	129,279	0	129,279								
2013	123,210	123,210	0	123,210								
2014	119,306	119,306	0	119,306								
2015	112,442	112,442	0	112,442								
2016	134,167	134,167	0	61,461	72,707							
2017	144,368	144,368	173,764		144,368	1,443,834	2018 Survey					
2018	146,431	146,431	176,081		146,431	1,267,753						
2019	147,895	147,895	177,725		147,895	1,090,028						
2020	149,374	149,374	179,385		149,374	910,643						
2021	150,868	142,685	171,874		142,685	738,769						
2022	152,377	135,846	164,196		135,846	574,573						
2023	153,900	128,857	156,348		128,857	418,225						
2024	155,439	123,159	149,951		123,159	268,274						
2025	156,994	117,335	143,411		117,335	124,863		175,330				
2026	158,564	118,508	144,729		102,241	0	16,267	155,464				
2027	160,149	119,693	146,059				119,693	9,405		2,859,800		
2028	161,751	120,890	147,403				7,713	0	113,177	2,721,801		
2029	163,368	122,099	148,761						122,099	2,573,041		
2030	165,002	123,320	150,131						123,320	2,422,909		
2031	166,652	124,553	151,516						124,553	2,271,393		
2032	168,319	125,799	152,915						125,799	2,118,479		
2033	170,002	127,057	154,327						127,057	1,964,152		
2034	171,702	128,327	155,754						128,327	1,808,398		
2035	173,419	129,611	157,195						129,611	1,651,203		
2036	175,153	130,907	158,650						130,907	1,492,553		
2037	176,905	132,216	160,120						132,216	1,332,434		
2038	178,674	133,538	161,604						133,538	1,170,829		
2039	180,460	134,873	163,104						134,873	1,007,726		
2039	182,265	136,222	164,618						136,222	843,108		
2041	184,088	137,584	166,147						137,584	676,961		
2042	185,929	138,960	167,692						138,960	509,268		
2043	187,788	140,350	169,253						140,350	340,016		
2044	189,666	141,753	170,828						141,753	169,187		3,428,016
2045	191,562	143,171	172,420						140,486	0	2,684	3,424,783
2046	193,478	144,602	174,028								144,602	3,250,756
2047	195,413	146,048	175,651								146,048	3,075,105
2048	197,367	147,509	177,291								147,509	2,897,814
2049	199,341	148,984	178,947								148,984	2,718,867
2050	201,334	150,474	180,620								150,474	2,538,247
2051	203,347	151,979	182,310								151,979	2,355,937
2052	205,381	153,498	184,016								153,498	2,171,921
2053	207,435	155,033	185,739								155,033	1,986,182
2054	209,509	156,584	187,480								156,584	1,798,701
2055	211,604	158,149	189,238								158,149	1,609,463
2056	213,720	159,731	191,014								159,731	1,418,449
2057	215,857	161,328	192,807								161,328	1,225,642
2058	218,016	162,942	194,619								162,942	1,031,023
2059	220,196	164,571	196,448								164,571	834,574
2060	222,398	166,217	198,296								166,217	636,278
2061	224,622	167,879	200,163								167,879	436,116
2062	226,868	169,558	202,047								169,558	234,068
2063	229,137	171,253	203,951								171,253	30,117
2064	231,428	172,966	205,874								25,303	0
2065	233,742	174,695									147,663	
2066	236,080	176,442										
2067	238,441	178,207										
2068	240,825	179,989										
2069	243,233	181,789										

* Reported waste tonnages EXCLUDES controlled waste and cover soil.

** Volumes of controlled wastes, soil cover and settlement are taken into account in the Volumetric Analysis.

Assumptionas:

Estimated Population Growth:	1%	
Estimated Waste Compaction:	**0.95**	tonnes/m^3
Estimated Waste to Cover Ratio:	6	:1 vol/vol
Estimated Settlement:	10%	
Esimated Vol. of Controlled Waste:	11,667	m^3/yr

Table 5 - Scenario 3 Diversion Cell Volumetric Analysis

Year	MSW Disposal Rate*	Scenario 3	Volume Consumtion**	Previous Phases Historical Tonnage	Cell 3 Tonnage Received (MSW)	Cell 3 Vol. Remaining	Cell 4 Tonnage Received (MSW)	Cell 4 Vol. Remaining	Cell 5 Tonnage Received (MSW)	Cell 5 Vol. Remaining	Cell 6 Tonnage Received (MSW)	Cell 6 Vol. Remaining
NOTES	MSW Only	2030 Diversion target	Scenario 3 Diversion	Active Face Moved to Cell 3 Starting July 2016	MSW Only (for LFG Generation)	Available Vol. - Annual Vol.	MSW Only (for LFG Generation)	Available Vol. - Annual Vol.	MSW Only (for LFG Generation)	Available Vol. - Annual Vol.	MSW Only (for LFG Generation)	Available Vol. - Annual Vol.
	(tonnes/year)	(tonnes/year)	(m^3/yr)	(tonnes/year)	(tonnes/year)	(m^3)	(tonnes/year)	(m^3)	(tonnes/year)	(m^3)	(tonnes/year)	(m^3)
1955	23,000	23,000		23,000								
1956	24,495	24,495		24,495								
1957	26,087	26,087		26,087								
1958	27,783	27,783		27,783								
1959	29,589	29,589		29,589								
1960	31,512	31,512		31,512								
1961	33,560	33,560		33,560								
1962	35,742	35,742		35,742								
1963	38,065	38,065		38,065								
1964	40,539	40,539		40,539								
1965	43,174	43,174		43,174								
1966	45,980	45,980		45,980								
1967	48,969	48,969		48,969								
1968	52,152	52,152		52,152								
1969	55,542	55,542		55,542								
1970	59,152	59,152		59,152								
1971	62,997	62,997		62,997								
1972	67,092	67,092		67,092								
1973	71,453	71,453		71,453								
1974	76,097	76,097		76,097								
1975	81,044	81,044		81,044								
1976	86,312	86,312		86,312								
1977	91,922	91,922		91,922								
1978	97,897	97,897		97,897								
1979	104,260	104,260		104,260								
1980	111,037	111,037		111,037								
1981	118,254	118,254		118,254								
1982	125,941	125,941		125,941								
1983	134,127	134,127		134,127								
1984	142,845	142,845		142,845								
1985	152,130	152,130		152,130								
1986	167,472	167,472		167,472								
1987	177,686	177,686		177,686								
1988	184,193	184,193		184,193								
1989	188,750	188,750		188,750								
1990	187,476	187,476		187,476								
1991	175,956	175,956		175,956								
1992	162,329	162,329		162,329								
1993	159,431	159,431		159,431								
1994	156,285	156,285		156,285								
1995	159,993	159,993		159,993								
1996	157,528	157,528		157,528								
1997	149,429	149,429		149,429								
1998	138,081	138,081		138,081								
1999	138,174	138,174		138,174								
2000	136,654	136,654		136,654								
2001	135,425	135,425		135,425								
2002	142,940	142,940		142,940								
2003	144,043	144,043		144,043								
2004	150,787	150,787		150,787								
2005	158,848	158,848		158,848								
2006	160,260	160,260		160,260								
2007	165,382	165,382		165,382								
2008	154,881	154,881		154,881								
2009	153,263	153,263		153,263								
2010	143,669	143,669		143,669								
2011	136,414	136,414		136,414								
2012	129,279	129,279		129,279								
2013	123,210	123,210		123,210								
2014	119,306	119,306		119,306								
2015	112,442	112,442		112,442								
2016	134,167	134,167		61,461	72,707							
2017	144,368	144,368	173,764		144,368	**1,443,834**	2018 Survey					
2018	146,431	146,431	176,081		146,431	1,267,753						
2019	147,895	147,895	177,725		147,895	1,090,028						
2020	149,374	149,374	179,385		149,374	910,643						
2021	150,868	142,685	171,874		142,685	738,769						
2022	152,377	135,846	164,196		135,846	574,573						
2023	153,900	128,857	156,348		128,857	418,225						
2024	155,439	123,159	149,951		123,159	268,274						
2025	156,994	117,335	143,411		117,335	124,863		**175,330**				
2026	158,564	116,800	142,811		102,121	0	14,679	157,382				
2027	160,149	116,242	142,185				116,242	15,197		**2,859,800**		
2028	161,751	115,662	141,533				12,419	0	103,243	2,733,464		
2029	163,368	115,059	140,856						115,059	2,592,609		
2030	165,002	114,431	140,151						114,431	2,452,457		
2031	166,652	115,576	141,436						115,576	2,311,021		
2032	168,319	116,731	142,734						116,731	2,168,287		
2033	170,002	117,899	144,045						117,899	2,024,243		
2034	171,702	119,078	145,368						119,078	1,878,874		
2035	173,419	120,269	146,705						120,269	1,732,169		
2036	175,153	121,471	148,056						121,471	1,584,113		
2037	176,905	122,686	149,420						122,686	1,434,694		
2038	178,674	123,913	150,797						123,913	1,283,896		
2039	180,460	125,152	152,188						125,152	1,131,708		
2040	182,265	126,403	153,594						126,403	978,114		
2041	184,088	127,667	155,013						127,667	823,101		
2042	185,929	128,944	156,446						128,944	666,655		
2043	187,788	130,234	157,894						130,234	508,761		
2044	189,666	131,536	159,356						131,536	349,404		
2045	191,562	132,851	160,833						132,851	188,571		
2046	193,478	134,180	162,325						155,875	26,246		**3,428,016**
2047	195,413	135,522	163,832						21,711	0	113,811	3,290,430
2048	197,367	136,877	165,353								136,877	3,125,077
2049	199,341	138,246	166,890								138,246	2,958,187
2050	201,334	139,628	168,442								139,628	2,789,744
2051	203,347	141,024	170,010								141,024	2,619,734
2052	205,381	142,435	171,594								142,435	2,448,141
2053	207,435	143,859	173,193								143,859	2,274,948
2054	209,509	145,298	174,808								145,298	2,100,140
2055	211,604	146,750	176,439								146,750	1,923,700
2056	213,720	148,218	178,087								148,218	1,745,613
2057	215,857	149,700	179,751								149,700	1,565,862
2058	218,016	151,197	181,432								151,197	1,384,430
2059	220,196	152,709	183,130								152,709	1,201,300
2060	222,398	154,236	184,845								154,236	1,016,455
2061	224,622	155,779	186,576								155,779	829,879
2062	226,868	157,336	188,325								157,336	641,553
2063	229,137	158,910	190,092								158,910	451,461
2064	231,428	160,499	191,876								160,499	259,585
2065	233,742	162,104	193,678								162,104	65,907
2066	236,080	163,725	195,498								55,195	0
2067	238,441	165,362									108,530	
2068	240,825	167,016										
2069	243,233	168,686										

* Reported waste tonnages EXCLUDES controlled waste and cover soil.

** Volumes of controlled wastes, soil cover and settlement are taken into account in the Volumetric Analysis.

Assumptionas:

Estimated Population Growth:	1%	
Estimated Waste Compaction:	**0.95**	tonnes/m^3
Estimated Waste to Cover Ratio:	6	:1 vol/vol
Estimated Settlement:	10%	
Esimated Vol. of Controlled Waste:	11,667	m^3/yr

APPENDIX C

UBCiModel LFG Generation Full Results - Graphs and Tables

APPENDIX C.1

Current Conditions (No Additional Diversion)

Methane Generation Estimates from the Hartland Landfill Lifespan (CRD) - Current

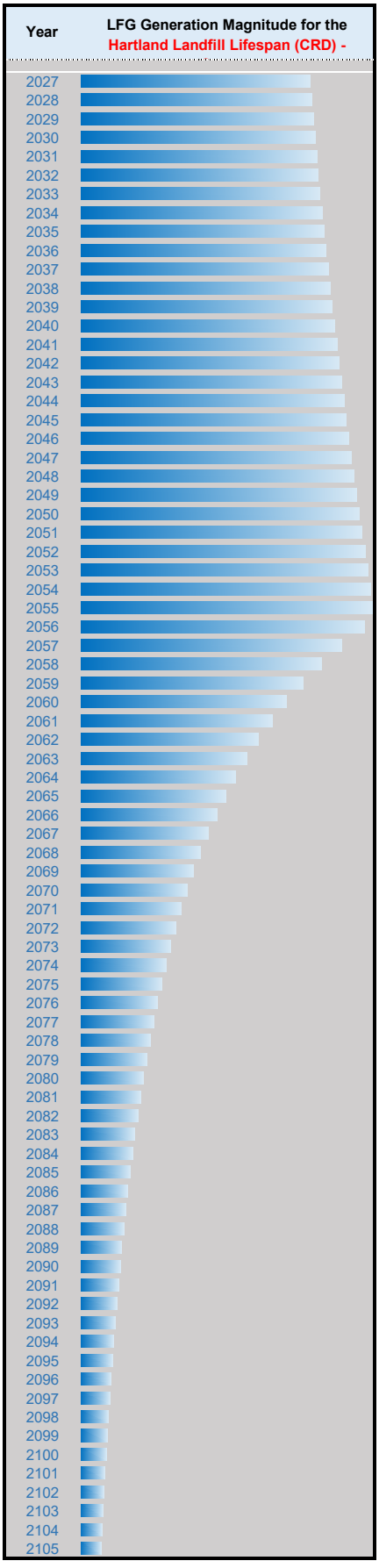
Actual CH_4 Yields

L_o (m^3/tonne)	127	157	140	66	112	101	73.8

Year	Methane generation estimates for the Hartland Landfill Lifespan (CRD) - Current							Methane Generation Potential	Total LFG Flow Rate Estimated
	Food (tonnes)	Garden (tonnes)	Paper (tonnes)	Wood (tonnes)	Textile (tonnes)	Nappies (tonnes)	Total (tonnes)	(L_o, m^3/tonne)	(scfm)
1955	5	1	1	0	0	0	9	78.7	2
1956	65	12	18	5	5	3	109	78.7	22
1957	120	23	36	9	10	6	204	78.7	41
1958	172	35	53	13	15	10	297	78.7	59
1959	221	46	71	18	20	13	388	78.7	77
1960	267	57	89	23	26	16	478	78.7	95
1961	313	68	108	28	31	20	568	78.7	113
1962	357	79	128	33	37	23	657	78.7	130
1963	401	91	148	39	42	27	748	78.7	148
1964	445	103	169	45	48	31	840	78.7	167
1965	489	115	191	51	54	35	934	78.7	185
1966	534	128	213	57	61	39	1,031	78.7	205
1967	580	141	237	64	68	43	1,132	78.7	224
1968	628	154	261	71	75	47	1,236	78.7	245
1969	677	168	287	78	82	52	1,344	78.7	267
1970	728	183	314	86	90	57	1,457	78.7	289
1971	782	198	342	94	98	62	1,576	78.7	313
1972	838	214	372	103	106	67	1,701	78.7	337
1973	897	231	404	112	115	73	1,832	78.7	363
1974	959	248	437	122	125	79	1,970	78.7	391
1975	1,025	267	472	132	135	85	2,116	78.7	420
1976	1,095	286	509	143	145	92	2,270	78.7	450
1977	1,168	307	547	154	156	99	2,433	78.7	483
1978	1,246	329	589	167	168	107	2,605	78.7	517
1979	1,329	352	632	179	181	115	2,788	78.7	553
1980	1,417	377	678	193	194	123	2,982	78.7	592
1981	1,511	403	727	208	208	132	3,188	78.7	632
1982	1,610	430	779	223	223	141	3,407	78.7	676
1983	1,716	460	834	239	238	151	3,639	78.7	722
1984	1,828	491	893	257	255	162	3,885	78.7	771
1985	1,948	524	954	275	273	173	4,147	78.7	823
1986	2,076	559	1,021	295	292	185	4,427	78.7	878
1987	2,226	599	1,094	317	313	198	4,747	78.7	942
1988	2,380	641	1,172	340	335	212	5,080	78.7	1,008
1989	2,530	682	1,250	363	357	227	5,409	78.7	1,073
1990	2,669	723	1,328	386	380	241	5,726	78.7	1,136
1991	2,783	759	1,400	409	400	254	6,004	78.7	1,191
1992	2,850	787	1,460	428	417	265	6,207	78.7	1,231
1993	2,875	806	1,508	445	431	273	6,339	78.7	1,257
1994	2,889	822	1,551	461	443	281	6,448	78.7	1,279
1995	2,895	836	1,591	476	455	288	6,540	78.7	1,297
1996	2,908	851	1,631	490	466	295	6,641	78.7	1,317
1997	2,911	862	1,666	504	476	302	6,722	78.7	1,333
1998	2,892	869	1,694	516	484	307	6,763	78.7	1,341
1999	2,849	870	1,713	526	489	310	6,758	78.7	1,340
2000	2,812	871	1,731	536	495	314	6,758	78.7	1,340
2001	2,776	872	1,746	544	499	316	6,754	78.7	1,340
2002	2,744	872	1,761	553	503	319	6,752	78.7	1,339
2003	2,734	875	1,780	563	509	323	6,784	78.7	1,345
2004	2,730	879	1,800	572	514	326	6,822	78.7	1,353
2005	2,745	886	1,823	583	521	330	6,888	78.7	1,366
2006	2,776	896	1,851	594	529	335	6,982	78.7	1,385
2007	2,808	906	1,879	606	537	340	7,077	78.7	1,404
2008	2,846	918	1,908	618	545	346	7,180	78.7	1,424
2009	2,852	923	1,929	628	551	349	7,232	78.7	1,434
2010	2,852	927	1,946	637	556	353	7,271	78.7	1,442
2011	2,827	926	1,957	644	559	355	7,268	78.7	1,442
2012	2,787	922	1,961	649	560	355	7,235	78.7	1,435
2013	2,734	915	1,960	653	560	355	7,177	78.7	1,424
2014	2,672	903	1,954	657	559	354	7,099	75.9	1,408
2015	2,593	870	1,946	663	558	352	6,983	75.9	1,385
2016	2,513	837	1,935	669	557	349	6,860	72.5	1,361
2017	2,480	790	1,939	682	561	348	6,801	72.5	1,349
2018	2,473	749	1,950	698	567	348	6,786	72.5	1,346
2019	2,472	710	1,962	714	574	349	6,781	72.5	1,345
2020	2,474	675	1,975	729	581	349	6,783	72.5	1,345
2021	2,480	643	1,988	745	587	349	6,792	72.5	1,347
2022	2,488	613	2,001	760	594	350	6,807	72.5	1,350
2023	2,499	586	2,015	775	601	351	6,827	72.5	1,354
2024	2,512	561	2,029	791	607	352	6,852	72.5	1,359
2025	2,526	539	2,044	806	614	353	6,882	72.5	1,365
2026	2,542	518	2,059	821	621	354	6,915	72.5	1,372

Year	LFG Generation Magnitude for the Hartland Landfill Lifespan (CRD) -
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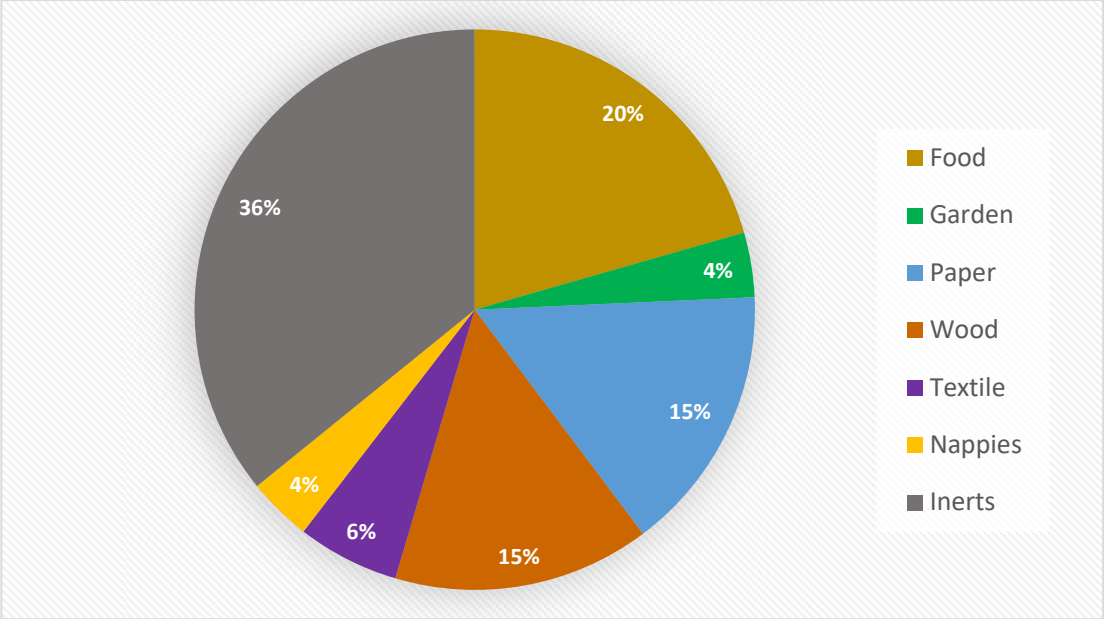
Year	Methane generation estimates for the Hartland Landfill Lifespan (CRD) - Current							Methane Generation Potential	Total LFG Flow Rate Estimated
	Food (tonnes)	Garden (tonnes)	Paper (tonnes)	Wood (tonnes)	Textile (tonnes)	Nappies (tonnes)	Total (tonnes)	(L_o, m^3/tonne)	(scfm)
2027	2,560	499	2,075	836	628	356	6,953	72.5	1,379
2028	2,579	482	2,091	851	634	357	6,994	72.5	1,387
2029	2,599	466	2,107	866	641	359	7,038	72.5	1,396
2030	2,620	452	2,124	881	648	360	7,085	72.5	1,405
2031	2,642	438	2,141	896	655	362	7,135	72.5	1,415
2032	2,665	427	2,158	911	662	364	7,187	72.5	1,425
2033	2,688	416	2,176	925	669	366	7,241	72.5	1,436
2034	2,712	406	2,195	940	676	368	7,298	72.5	1,448
2035	2,737	398	2,213	955	684	371	7,357	72.5	1,459
2036	2,762	390	2,232	970	691	373	7,418	72.5	1,471
2037	2,788	383	2,251	984	698	375	7,480	72.5	1,484
2038	2,815	377	2,271	999	705	378	7,545	72.5	1,496
2039	2,841	371	2,291	1,014	713	380	7,611	72.5	1,510
2040	2,869	366	2,311	1,029	720	383	7,679	72.5	1,523
2041	2,896	362	2,332	1,044	728	386	7,748	72.5	1,537
2042	2,925	359	2,353	1,058	735	389	7,818	72.5	1,551
2043	2,953	356	2,374	1,073	743	392	7,890	72.5	1,565
2044	2,982	353	2,396	1,088	751	395	7,964	72.5	1,580
2045	3,011	351	2,418	1,103	758	398	8,038	72.5	1,594
2046	3,041	349	2,440	1,118	766	401	8,114	72.5	1,609
2047	3,071	348	2,462	1,133	774	404	8,192	72.5	1,625
2048	3,101	346	2,485	1,148	782	407	8,270	72.5	1,640
2049	3,132	346	2,508	1,163	790	411	8,350	72.5	1,656
2050	3,163	345	2,532	1,178	798	414	8,430	72.5	1,672
2051	3,195	345	2,556	1,193	806	417	8,512	72.5	1,688
2052	3,226	346	2,580	1,208	815	421	8,595	72.5	1,705
2053	3,259	346	2,604	1,223	823	425	8,679	72.5	1,722
2054	3,291	347	2,629	1,238	831	428	8,765	72.5	1,738
2055	3,308	347	2,649	1,252	838	431	8,825	72.5	1,750
2056	3,132	336	2,609	1,246	826	425	8,574		1,701
2057	2,696	310	2,482	1,209	786	404	7,887		1,564
2058	2,320	286	2,361	1,173	747	384	7,272		1,442
2059	1,997	264	2,246	1,138	711	365	6,722		1,333
2060	1,719	244	2,136	1,105	676	348	6,228		1,235
2061	1,480	225	2,032	1,072	643	331	5,783		1,147
2062	1,274	208	1,933	1,040	612	315	5,381		1,067
2063	1,096	192	1,839	1,010	582	299	5,018		995
2064	943	177	1,749	980	554	285	4,688		930
2065	812	164	1,664	951	527	271	4,388		870
2066	699	151	1,583	923	501	258	4,114		816
2067	602	139	1,506	895	476	245	3,863		766
2068	518	129	1,432	869	453	233	3,634		721
2069	446	119	1,362	843	431	222	3,423		679
2070	384	110	1,296	818	410	211	3,228		640
2071	330	101	1,233	794	390	201	3,049		605
2072	284	93	1,172	771	371	191	2,883		572
2073	245	86	1,115	748	353	181	2,729		541
2074	211	80	1,061	726	336	173	2,585		513
2075	181	73	1,009	704	319	164	2,452		486
2076	156	68	960	684	304	156	2,327		462
2077	134	63	913	663	289	149	2,211		439
2078	116	58	869	644	275	141	2,102		417
2079	99	53	826	625	262	134	2,000		397
2080	86	49	786	606	249	128	1,904		378
2081	74	45	748	588	237	122	1,813		360
2082	63	42	711	571	225	116	1,728		343
2083	55	39	676	554	214	110	1,648		327
2084	47	36	643	538	204	105	1,572		312
2085	40	33	612	522	194	100	1,501		298
2086	35	30	582	506	184	95	1,433		284
2087	30	28	554	491	175	90	1,369		271
2088	26	26	527	477	167	86	1,308		259
2089	22	24	501	463	159	82	1,250		248
2090	19	22	477	449	151	78	1,196		237
2091	16	20	453	436	144	74	1,143		227
2092	14	19	431	423	137	70	1,094		217
2093	12	17	410	410	130	67	1,047		208
2094	10	16	390	398	124	64	1,002		199
2095	9	15	371	387	118	60	960		190
2096	8	14	353	375	112	57	919		182
2097	7	13	336	364	106	55	880		175
2098	6	12	320	353	101	52	843		167
2099	5	11	304	343	96	49	808		160
2100	4	10	289	333	92	47	775		154
2101	4	9	275	323	87	45	743		147
2102	3	8	262	313	83	43	712		141
2103	3	8	249	304	79	40	683		135
2104	2	7	237	295	75	39	655		130
2105	2	7	225	286	71	37	628		125

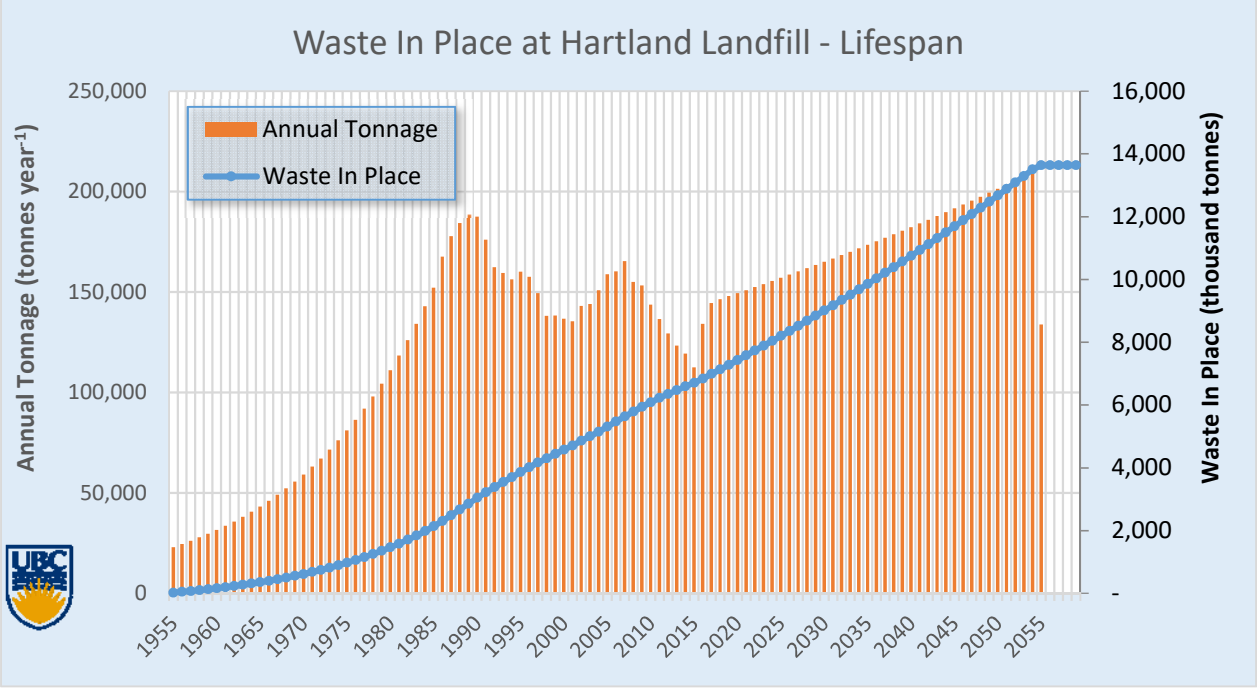


Hartland Landfill Lifespan (CRD) - Current

Landfill Gas Generation Analysis **GRAPHICAL RESULTS**

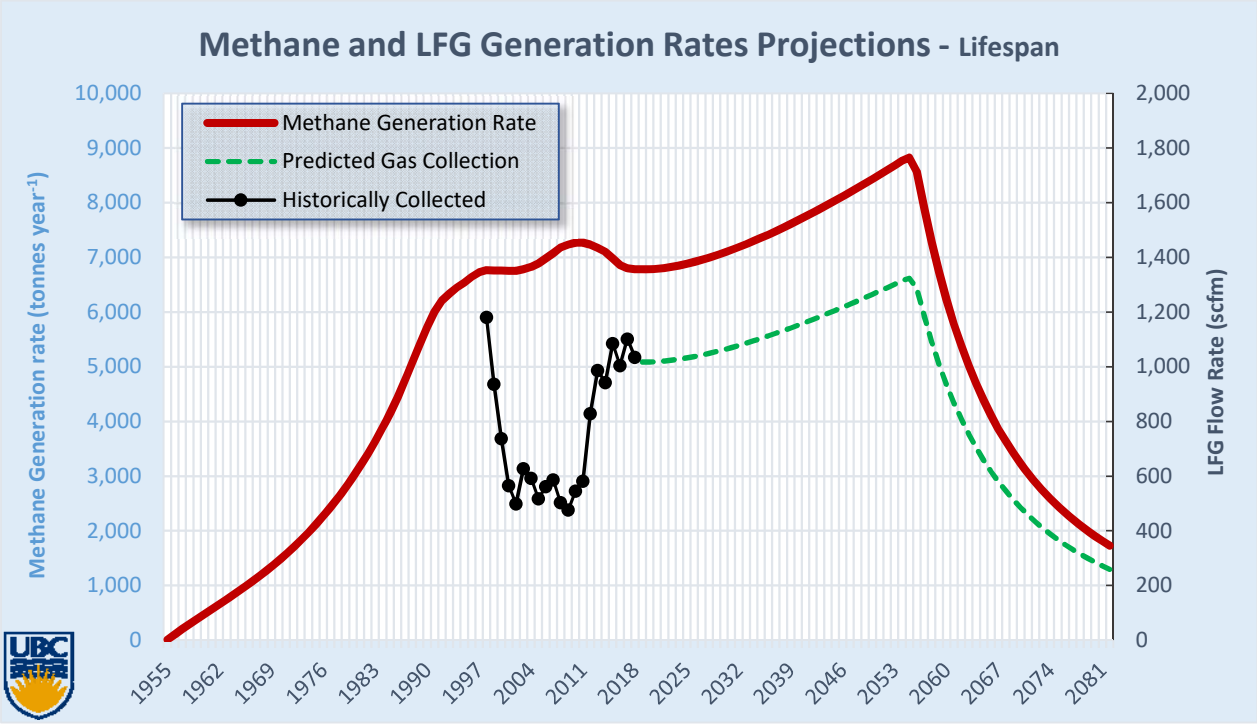
Average Deposited Waste Composition

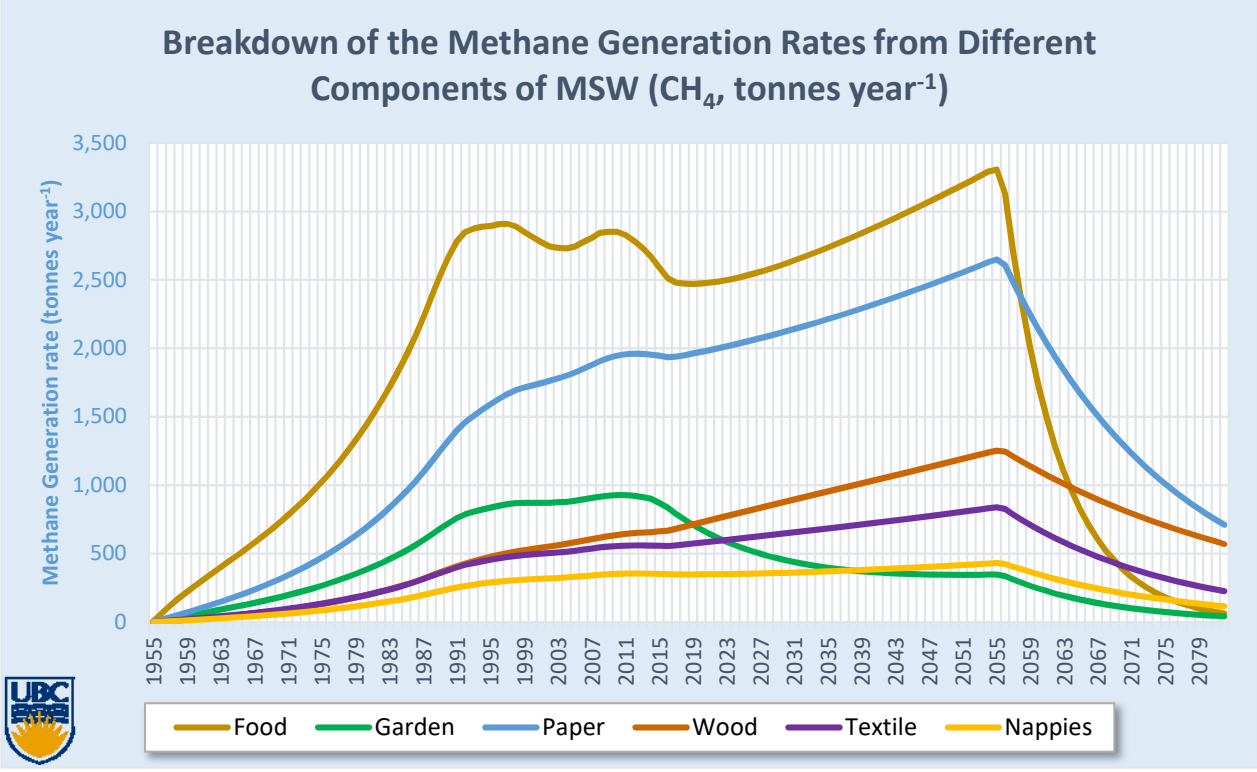




Hartland Landfill Lifespan (CRD) - Current

Landfill Gas Generation Analysis **GRAPHICAL RESULTS**





Advanced LFG Generation Assessment
Hartland Landfill
Capital Regional District
SHA-PRJ19061

UBCiModel©
Graphical Illustration of Results
2019-10-13

Methane Generation Estimates from the Hartland Landfill Lifespan (CRD) - In place

Actual CH_4 Yields

L_o (m^3/tonne)	127	157	143	70	114	102	78.1

Year	Methane generation estimates for the Hartland Landfill Lifespan (CRD) - In place							Methane Generation Potential	Total LFG Flow Rate Estimated
	Food	Garden	Paper	Wood	Textile	Nappies	Total		
	(tonnes)	(tonnes)	(tonnes)	(tonnes)	(tonnes)	(tonnes)	(tonnes)	(L_o, m^3/tonne)	(scfm)
1955	5	1	1	0	0	0	9	78.7	2
1956	65	12	18	5	5	3	109	78.7	22
1957	120	23	36	9	10	6	204	78.7	41
1958	172	35	53	13	15	10	297	78.7	59
1959	221	46	71	18	20	13	388	78.7	77
1960	267	57	89	23	26	16	478	78.7	95
1961	313	68	108	28	31	20	568	78.7	113
1962	357	79	128	33	37	23	657	78.7	130
1963	401	91	148	39	42	27	748	78.7	148
1964	445	103	169	45	48	31	840	78.7	167
1965	489	115	191	51	54	35	934	78.7	185
1966	534	128	213	57	61	39	1,031	78.7	205
1967	580	141	237	64	68	43	1,132	78.7	224
1968	628	154	261	71	75	47	1,236	78.7	245
1969	677	168	287	78	82	52	1,344	78.7	267
1970	728	183	314	86	90	57	1,457	78.7	289
1971	782	198	342	94	98	62	1,576	78.7	313
1972	838	214	372	103	106	67	1,701	78.7	337
1973	897	231	404	112	115	73	1,832	78.7	363
1974	959	248	437	122	125	79	1,970	78.7	391
1975	1,025	267	472	132	135	85	2,116	78.7	420
1976	1,095	286	509	143	145	92	2,270	78.7	450
1977	1,168	307	547	154	156	99	2,433	78.7	483
1978	1,246	329	589	167	168	107	2,605	78.7	517
1979	1,329	352	632	179	181	115	2,788	78.7	553
1980	1,417	377	678	193	194	123	2,982	78.7	592
1981	1,511	403	727	208	208	132	3,188	78.7	632
1982	1,610	430	779	223	223	141	3,407	78.7	676
1983	1,716	460	834	239	238	151	3,639	78.7	722
1984	1,828	491	893	257	255	162	3,885	78.7	771
1985	1,948	524	954	275	273	173	4,147	78.7	823
1986	2,076	559	1,021	295	292	185	4,427	78.7	878
1987	2,226	599	1,094	317	313	198	4,747	78.7	942
1988	2,380	641	1,172	340	335	212	5,080	78.7	1,008
1989	2,530	682	1,250	363	357	227	5,409	78.7	1,073
1990	2,669	723	1,328	386	380	241	5,726	78.7	1,136
1991	2,783	759	1,400	409	400	254	6,004	78.7	1,191
1992	2,850	787	1,460	428	417	265	6,207	78.7	1,231
1993	2,875	806	1,508	445	431	273	6,339	78.7	1,257
1994	2,889	822	1,551	461	443	281	6,448	78.7	1,279
1995	2,895	836	1,591	476	455	288	6,540	78.7	1,297
1996	2,908	851	1,631	490	466	295	6,641	78.7	1,317
1997	2,911	862	1,666	504	476	302	6,722	78.7	1,333
1998	2,892	869	1,694	516	484	307	6,763	78.7	1,341
1999	2,849	870	1,713	526	489	310	6,758	78.7	1,340
2000	2,812	871	1,731	536	495	314	6,758	78.7	1,340
2001	2,776	872	1,746	544	499	316	6,754	78.7	1,340
2002	2,744	872	1,761	553	503	319	6,752	78.7	1,339
2003	2,734	875	1,780	563	509	323	6,784	78.7	1,345
2004	2,730	879	1,800	572	514	326	6,822	78.7	1,353
2005	2,745	886	1,823	583	521	330	6,888	78.7	1,366
2006	2,776	896	1,851	594	529	335	6,982	78.7	1,385
2007	2,808	906	1,879	606	537	340	7,077	78.7	1,404
2008	2,846	918	1,908	618	545	346	7,180	78.7	1,424
2009	2,852	923	1,929	628	551	349	7,232	78.7	1,434
2010	2,852	927	1,946	637	556	353	7,271	78.7	1,442
2011	2,827	926	1,957	644	559	355	7,268	78.7	1,442
2012	2,787	922	1,961	649	560	355	7,235	78.7	1,435
2013	2,734	915	1,960	653	560	355	7,177	78.7	1,424
2014	2,672	903	1,954	657	559	354	7,099	75.9	1,408
2015	2,593	870	1,946	663	558	352	6,983	75.9	1,385
2016	2,498	836	1,930	667	555	349	6,836	72.5	1,356
2017	2,281	779	1,877	661	541	338	6,479		1,285
2018	1,964	719	1,786	642	515	322	5,947		1,180
2019	1,690	664	1,699	623	490	306	5,472		1,085
2020	1,455	613	1,616	604	466	291	5,045		1,001
2021	1,252	566	1,537	587	443	277	4,662		925
2022	1,078	522	1,462	569	421	263	4,316		856
2023	928	482	1,391	552	401	251	4,005		794
2024	798	445	1,323	536	381	238	3,722		738
2025	687	411	1,258	520	363	227	3,466		688
2026	591	379	1,197	505	345	216	3,233		641

Year	LFG Generation Magnitude for the Hartland Landfill Lifespan (CRD) - In
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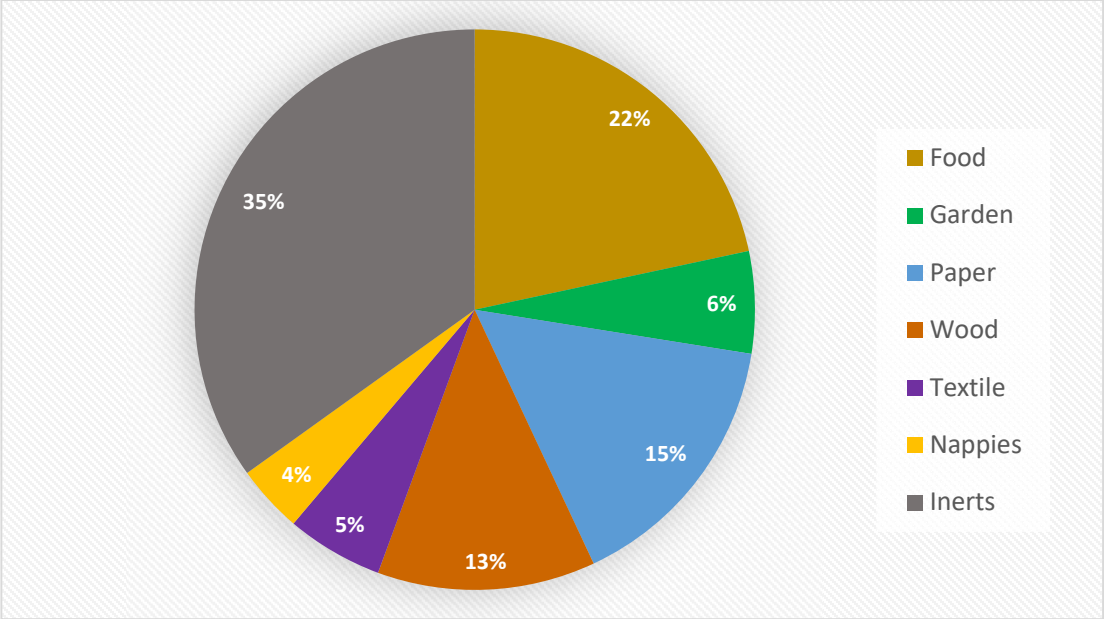
Year	Methane generation estimates for the Hartland Landfill Lifespan (CRD) - In place							Methane Generation Potential	Total LFG Flow Rate Estimated
	Food (tonnes)	Garden (tonnes)	Paper (tonnes)	Wood (tonnes)	Textile (tonnes)	Nappies (tonnes)	Total (tonnes)	(L_o, m^3/tonne)	(scfm)
2027	509	350	1,139	490	328	205	3,021		599
2028	438	323	1,083	475	312	195	2,827		561
2029	377	298	1,030	461	297	186	2,650		526
2030	325	275	980	448	283	177	2,487		493
2031	279	254	932	435	269	168	2,337		464
2032	240	235	887	422	256	160	2,199		436
2033	207	217	843	409	243	152	2,072		411
2034	178	200	802	397	231	145	1,954		387
2035	153	185	763	385	220	138	1,844		366
2036	132	170	726	374	209	131	1,743		346
2037	114	157	691	363	199	124	1,648		327
2038	98	145	657	352	189	118	1,560		309
2039	84	134	625	342	180	113	1,478		293
2040	72	124	594	332	171	107	1,401		278
2041	62	114	565	322	163	102	1,329		264
2042	54	105	538	312	155	97	1,261		250
2043	46	97	512	303	147	92	1,198		238
2044	40	90	487	294	140	88	1,139		226
2045	34	83	463	286	133	83	1,083		215
2046	29	77	440	277	127	79	1,030		204
2047	25	71	419	269	121	75	980		194
2048	22	65	398	261	115	72	933		185
2049	19	60	379	253	109	68	889		176
2050	16	56	361	246	104	65	847		168
2051	14	51	343	238	99	62	807		160
2052	12	47	326	231	94	59	770		153
2053	10	44	310	225	89	56	734		146
2054	9	40	295	218	85	53	701		139
2055	8	37	281	212	81	51	669		133
2056	7	34	267	205	77	48	638		127
2057	6	32	254	199	73	46	610		121
2058	5	29	242	193	70	44	582		116
2059	4	27	230	188	66	41	556		110
2060	4	25	219	182	63	39	532		105
2061	3	23	208	177	60	37	508		101
2062	3	21	198	171	57	36	486		96
2063	2	20	188	166	54	34	465		92
2064	2	18	179	161	52	32	445		88
2065	2	17	170	157	49	31	425		84
2066	1	15	162	152	47	29	407		81
2067	1	14	154	148	44	28	389		77
2068	1	13	147	143	42	26	373		74
2069	1	12	139	139	40	25	357		71
2070	1	11	133	135	38	24	342		68
2071	1	10	126	131	36	23	327		65
2072	1	10	120	127	35	22	313		62
2073	1	9	114	123	33	21	300		60
2074	0	8	109	120	31	20	288		57
2075	0	8	103	116	30	19	276		55
2076	0	7	98	113	28	18	264		52
2077	0	6	93	109	27	17	253		50
2078	0	6	89	106	26	16	243		48
2079	0	5	85	103	24	15	233		46
2080	0	5	80	100	23	14	223		44
2081	0	5	77	97	22	14	214		42
2082	0	4	73	94	21	13	205		41
2083	0	4	69	91	20	12	197		39
2084	0	4	66	89	19	12	189		38
2085	0	3	63	86	18	11	181		36
2086	0	3	60	83	17	11	174		35
2087	0	3	57	81	16	10	167		33
2088	0	3	54	79	16	10	161		32
2089	0	2	51	76	15	9	154		31
2090	0	2	49	74	14	9	148		29
2091	0	2	46	72	13	8	142		28
2092	0	2	44	70	13	8	137		27
2093	0	2	42	68	12	8	131		26
2094	0	2	40	66	12	7	126		25
2095	0	2	38	64	11	7	121		24
2096	0	1	36	62	10	7	116		23
2097	0	1	34	60	10	6	112		22
2098	0	1	33	58	9	6	107		21
2099	0	1	31	57	9	6	103		20
2100	0	1	30	55	9	5	99		20
2101	0	1	28	53	8	5	96		19
2102	0	1	27	52	8	5	92		18
2103	0	1	25	50	7	5	88		18
2104	0	1	24	49	7	4	85		17
2105	0	1	23	47	7	4	82		16

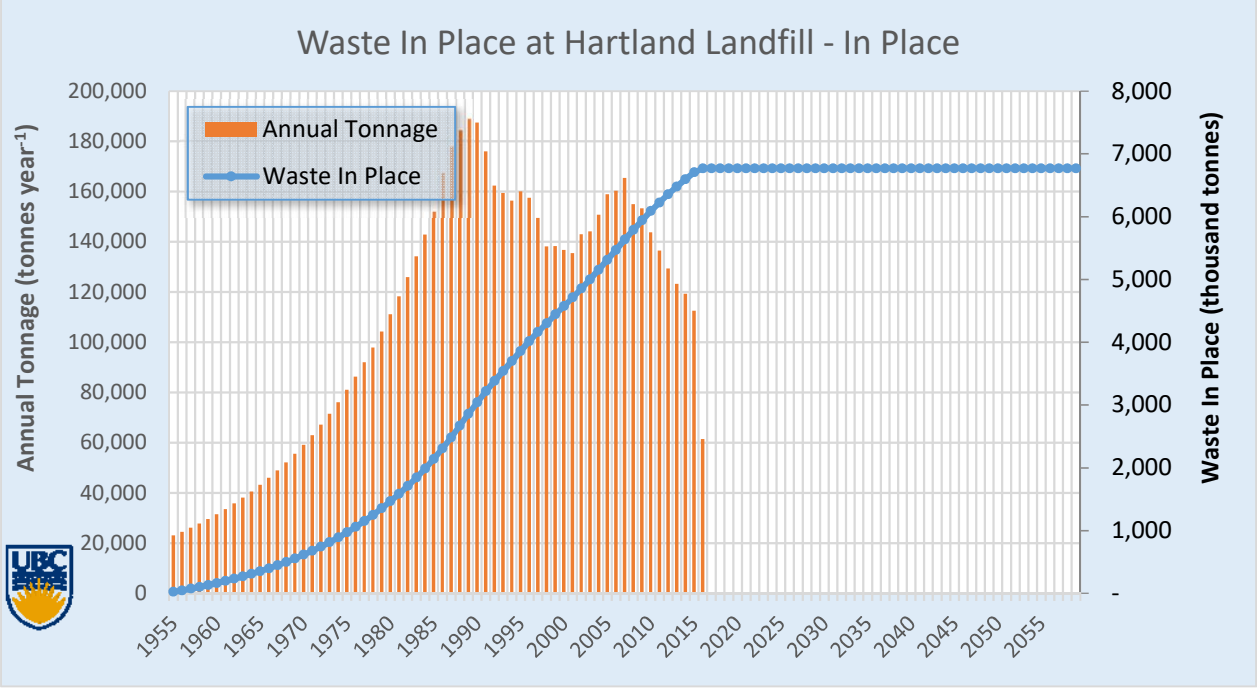
Year	LFG Generation Magnitude for the Hartland Landfill Lifespan (CRD) - In
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Hartland Landfill Lifespan (CRD) - In place

Landfill Gas Generation Analysis **GRAPHICAL RESULTS**

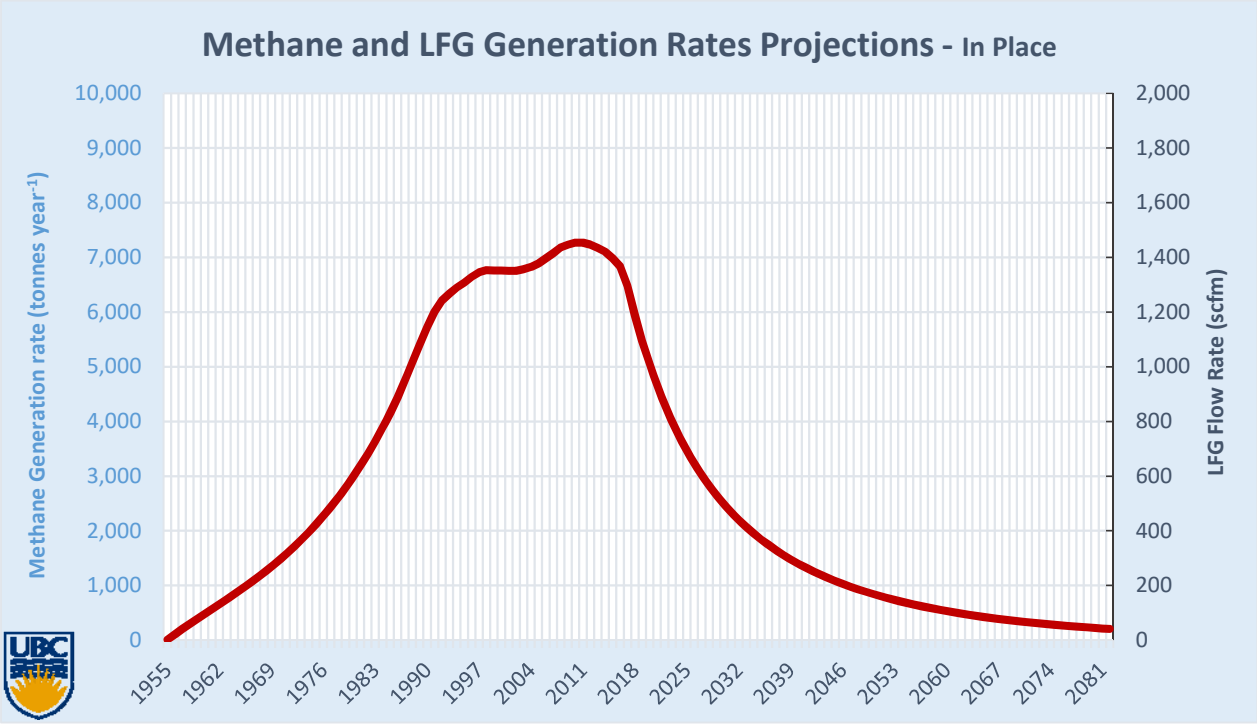
Average Deposited Waste Composition

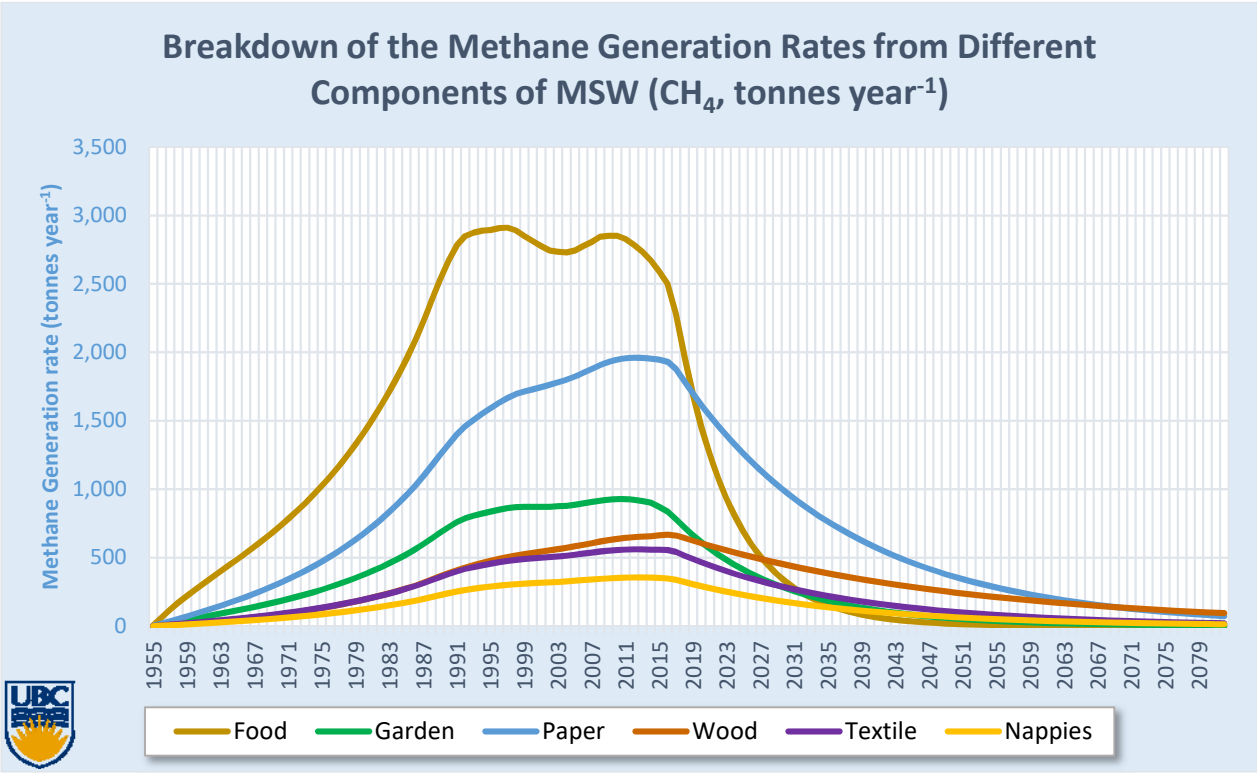




Hartland Landfill Lifespan (CRD) - In place

Landfill Gas Generation Analysis **GRAPHICAL RESULTS**





Advanced LFG Generation Assessment
Hartland Landfill
Capital Regional District
SHA-PRJ19061

UBCiModel©
Graphical Illustration of Results
2019-10-13

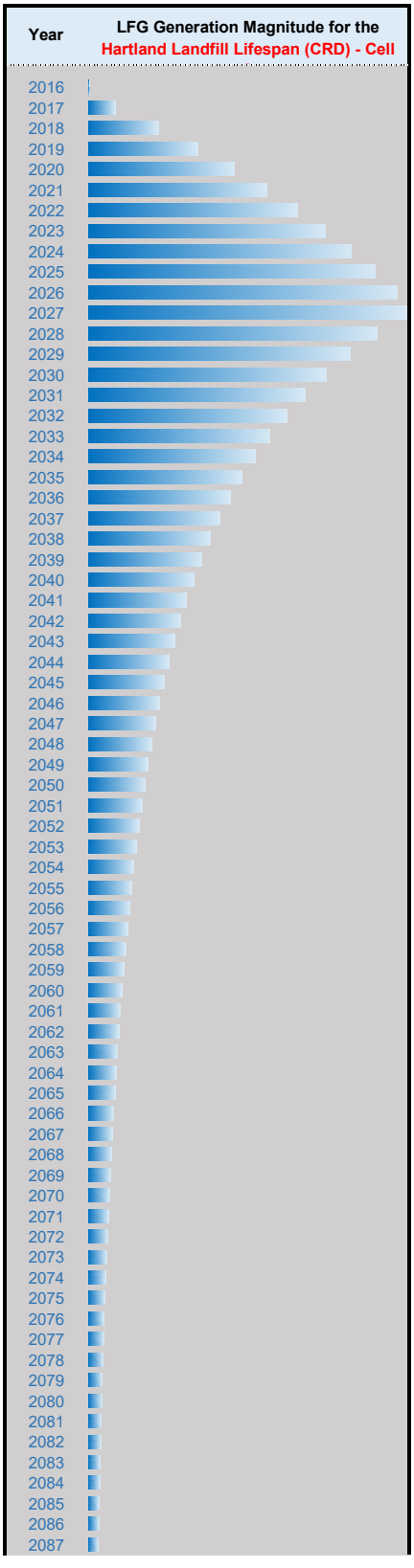
Methane Generation Estimates from the Hartland Landfill Lifespan (CRD) - Cell 3&4

Actual CH_4 Yields

L_o (m^3/tonne)	127	158	143	72	114	103	72.3

Year	Methane generation estimates for the Hartland Landfill Lifespan (CRD) - Cell 3&4							Methane Generation Potential	Total LFG Flow Rate Estimated
	Food (tonnes)	Garden (tonnes)	Paper (tonnes)	Wood (tonnes)	Textile (tonnes)	Nappies (tonnes)	Total (tonnes)	(L_o, m^3/tonne)	(scfm)
2016	15	1	5	2	1	1	24	72.5	5
2017	198	11	62	21	20	10	322	72.5	64
2018	509	29	165	56	53	26	838	72.5	166
2019	782	46	264	91	84	42	1,309	72.5	260
2020	1,020	62	359	125	115	58	1,738	72.5	345
2021	1,228	77	451	158	144	72	2,130	72.5	423
2022	1,410	91	539	191	172	87	2,490	72.5	494
2023	1,571	104	624	223	200	100	2,822	72.5	560
2024	1,713	116	706	255	226	114	3,130	72.5	621
2025	1,839	128	786	286	251	126	3,415	72.5	677
2026	1,946	138	861	316	275	138	3,675	72.5	729
2027	1,967	144	910	337	291	146	3,796		753
2028	1,693	133	866	327	277	139	3,435		681
2029	1,457	123	824	318	263	132	3,117		618
2030	1,254	113	783	308	250	126	2,836		562
2031	1,079	105	745	299	238	120	2,587		513
2032	929	97	709	290	227	114	2,365		469
2033	800	89	674	282	216	108	2,169		430
2034	688	82	641	273	205	103	1,994		395
2035	592	76	610	265	195	98	1,837		364
2036	510	70	580	257	186	93	1,697		337
2037	439	65	552	250	177	89	1,571		312
2038	378	60	525	242	168	84	1,457		289
2039	325	55	500	235	160	80	1,355		269
2040	280	51	475	228	152	76	1,263		250
2041	241	47	452	222	145	73	1,179		234
2042	207	43	430	215	137	69	1,102		219
2043	178	40	409	209	131	66	1,033		205
2044	154	37	389	203	124	63	969		192
2045	132	34	370	197	118	59	911		181
2046	114	32	352	191	113	57	857		170
2047	98	29	335	185	107	54	808		160
2048	84	27	319	180	102	51	762		151
2049	73	25	303	174	97	49	720		143
2050	62	23	288	169	92	46	681		135
2051	54	21	274	164	88	44	645		128
2052	46	19	261	159	83	42	611		121
2053	40	18	248	155	79	40	580		115
2054	34	17	236	150	75	38	550		109
2055	29	15	224	146	72	36	523		104
2056	25	14	214	141	68	34	497		99
2057	22	13	203	137	65	33	473		94
2058	19	12	193	133	62	31	450		89
2059	16	11	184	129	59	30	429		85
2060	14	10	175	125	56	28	408		81
2061	12	9	166	122	53	27	389		77
2062	10	9	158	118	51	25	371		74
2063	9	8	150	115	48	24	354		70
2064	8	7	143	111	46	23	338		67
2065	7	7	136	108	44	22	323		64
2066	6	6	130	105	41	21	308		61
2067	5	6	123	102	39	20	295		58
2068	4	5	117	99	37	19	282		56
2069	4	5	111	96	36	18	269		53
2070	3	5	106	93	34	17	258		51
2071	3	4	101	90	32	16	246		49
2072	2	4	96	87	31	15	236		47
2073	2	4	91	85	29	15	226		45
2074	2	3	87	82	28	14	216		43
2075	1	3	83	80	26	13	207		41
2076	1	3	79	78	25	13	198		39
2077	1	3	75	75	24	12	190		38
2078	1	2	71	73	23	11	182		36
2079	1	2	68	71	22	11	174		35
2080	1	2	64	69	21	10	167		33
2081	1	2	61	67	20	10	160		32
2082	1	2	58	65	19	9	153		30
2083	0	2	55	63	18	9	147		29
2084	0	2	53	61	17	8	141		28
2085	0	1	50	59	16	8	135		27
2086	0	1	48	57	15	8	130		26
2087	0	1	45	56	14	7	124		25

Year — LFG Generation Magnitude for the Hartland Landfill Lifespan (CRD) - Cell



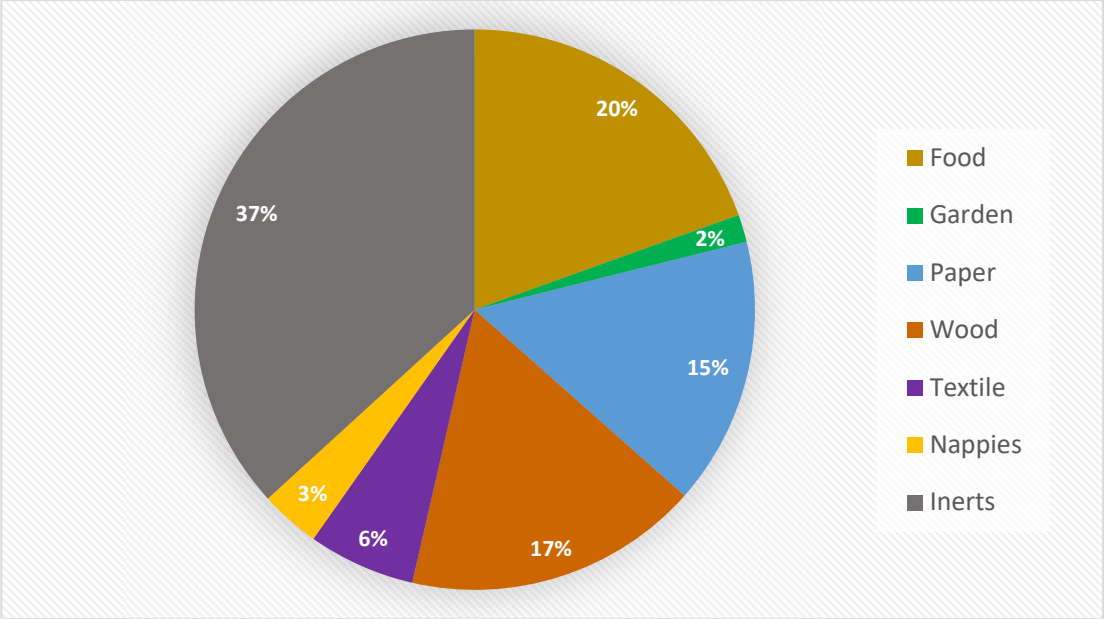
Year	Methane generation estimates for the Hartland Landfill Lifespan (CRD) - Cell 3&4							Methane Generation Potential	Total LFG Flow Rate Estimated
	Food (tonnes)	Garden (tonnes)	Paper (tonnes)	Wood (tonnes)	Textile (tonnes)	Nappies (tonnes)	Total (tonnes)	(L_o, m^3/tonne)	(scfm)
2088	0	1	43	54	14	7	119		24
2089	0	1	41	53	13	7	114		23
2090	0	1	39	51	12	6	110		22
2091	0	1	37	49	12	6	105		21
2092	0	1	35	48	11	6	101		20
2093	0	1	34	47	11	5	97		19
2094	0	1	32	45	10	5	93		18
2095	0	1	30	44	10	5	90		18
2096	0	1	29	43	9	5	86		17
2097	0	1	27	41	9	4	83		16
2098	0	0	26	40	8	4	79		16
2099	0	0	25	39	8	4	76		15
2100	0	0	24	38	8	4	73		15
2101	0	0	23	37	7	4	70		14
2102	0	0	21	36	7	3	68		13
2103	0	0	20	34	7	3	65		13
2104	0	0	19	33	6	3	62		12
2105	0	0	18	32	6	3	60		12
2106	0	0	18	32	6	3	58		11
2107	0	0	17	31	5	3	56		11
2108	0	0	16	30	5	3	53		11
2109	0	0	15	29	5	2	51		10
2110	0	0	14	28	5	2	49		10
2111	0	0	14	27	4	2	48		9
2112	0	0	13	26	4	2	46		9
2113	0	0	12	26	4	2	44		9
2114	0	0	12	25	4	2	42		8
2115	0	0	11	24	4	2	41		8
2116	0	0	11	23	3	2	39		8
2117	0	0	10	23	3	2	38		7
2118	0	0	10	22	3	2	36		7
2119	0	0	9	21	3	1	35		7
2120	0	0	9	21	3	1	34		7
2121	0	0	8	20	3	1	32		6
2122	0	0	8	20	3	1	31		6
2123	0	0	7	19	2	1	30		6
2124	0	0	7	18	2	1	29		6
2125	0	0	7	18	2	1	28		6
2126	0	0	6	17	2	1	27		5
2127	0	0	6	17	2	1	26		5
2128	0	0	6	16	2	1	25		5
2129	0	0	6	16	2	1	24		5
2130	0	0	5	15	2	1	23		5
2131	0	0	5	15	2	1	22		4
2132	0	0	5	14	2	1	22		4
2133	0	0	5	14	1	1	21		4
2134	0	0	4	14	1	1	20		4
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2136	0	0	4	13	1	1	19		4
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2141	0	0	3	11	1	0	16		3
2142	0	0	3	11	1	0	15		3
2143	0	0	3	10	1	0	14		3
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2149	0	0	2	9	1	0	12		2
2150	0	0	2	8	1	0	11		2
2151	0	0	2	8	1	0	11		2
2152	0	0	2	8	1	0	11		2
2153	0	0	2	8	1	0	10		2
2154	0	0	2	7	1	0	10		2
2155	0	0	2	7	0	0	9		2
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2157	0	0	1	7	0	0	9		2
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2159	0	0	1	6	0	0	8		2
2160	0	0	1	6	0	0	8		2
2161	0	0	1	6	0	0	8		2
2162	0	0	1	6	0	0	7		1
2163	0	0	1	6	0	0	7		1
2164	0	0	1	6	0	0	7		1
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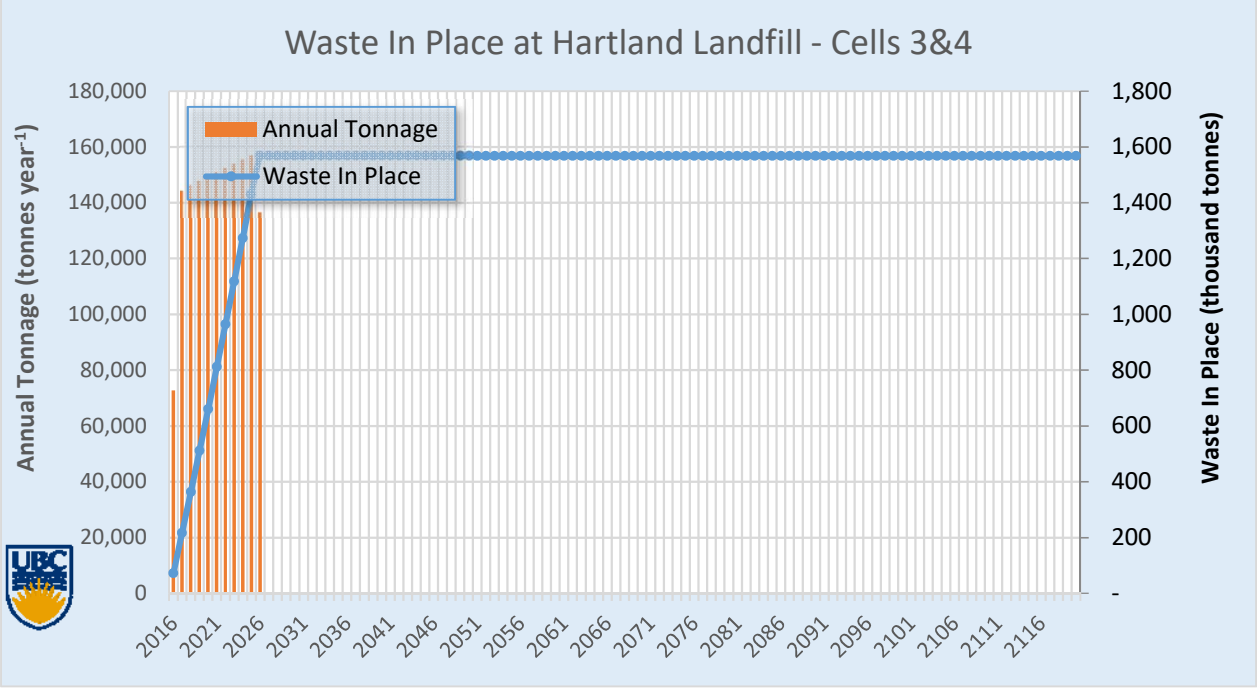
Year	LFG Generation Magnitude for the Hartland Landfill Lifespan (CRD) - Cell
2088	
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Hartland Landfill Lifespan (CRD) - Cell 3&4

Landfill Gas Generation Analysis **GRAPHICAL RESULTS**

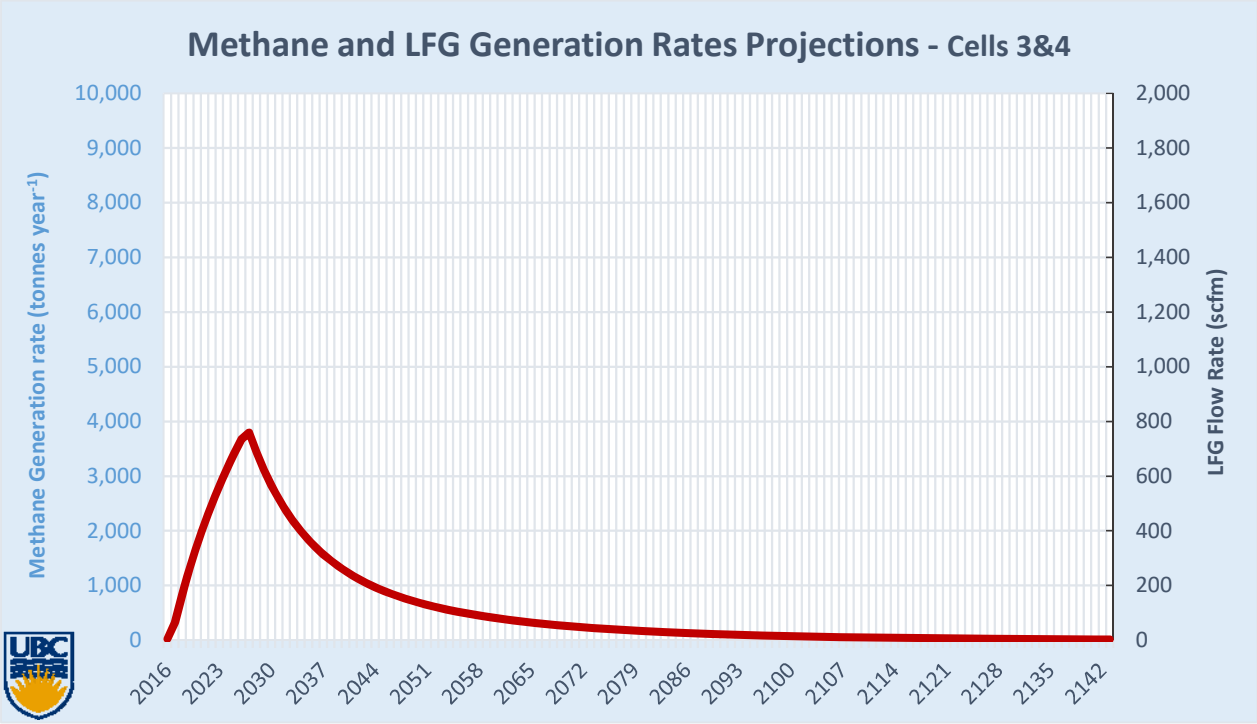
Average Deposited Waste Composition

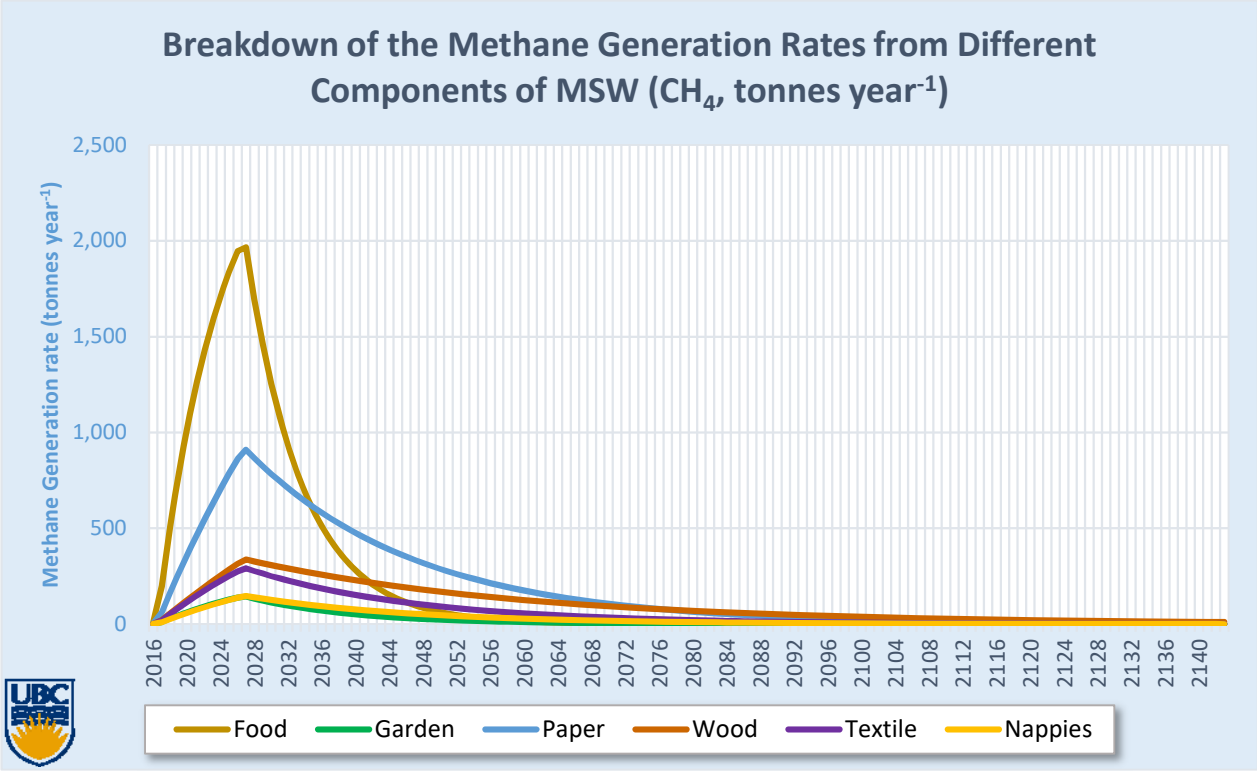




Hartland Landfill Lifespan (CRD) - Cell 3&4

Landfill Gas Generation Analysis **GRAPHICAL RESULTS**





Advanced LFG Generation Assessment
Hartland Landfill
Capital Regional District
SHA-PRJ19061

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Graphical Illustration of Results
2019-10-13

Methane Generation Estimates from the Hartland Landfill Lifespan (CRD) - Cell 5

Actual CH_4 Yields

L_o (m^3/tonne)	127	158	143	72	114	103	72.3

Year	Methane generation estimates for the Hartland Landfill Lifespan (CRD) - Cell 5							Methane Generation Potential	Total LFG Flow Rate Estimated
	Food (tonnes)	Garden (tonnes)	Paper (tonnes)	Wood (tonnes)	Textile (tonnes)	Nappies (tonnes)	Total (tonnes)	(L_o, m^3/tonne)	(scfm)
2026	5	0	1	0	0	0	7	72.5	1
2027	84	5	26	9	8	4	136	72.5	27
2028	448	25	142	48	45	23	731	72.5	145
2029	765	45	253	87	81	41	1,271	72.5	252
2030	1,041	63	360	125	115	58	1,762	72.5	350
2031	1,283	80	463	162	148	74	2,211	72.5	438
2032	1,495	95	563	199	180	90	2,622	72.5	520
2033	1,681	110	658	234	211	106	3,001	72.5	595
2034	1,846	124	751	270	240	121	3,351	72.5	665
2035	1,991	137	840	304	268	135	3,676	72.5	729
2036	2,120	149	926	338	296	149	3,978	72.5	789
2037	2,236	161	1,009	372	322	162	4,262	72.5	845
2038	2,339	172	1,089	405	348	175	4,527	72.5	898
2039	2,432	182	1,166	437	373	187	4,778	72.5	948
2040	2,513	192	1,241	468	397	199	5,010	72.5	994
2041	2,521	197	1,292	493	413	208	5,123		1,016
2042	2,170	182	1,229	478	393	198	4,649		922
2043	1,867	168	1,169	464	374	188	4,230		839
2044	1,607	155	1,112	450	356	179	3,859		765
2045	1,383	143	1,058	437	338	170	3,530		700
2046	1,191	132	1,006	424	322	162	3,237		642
2047	1,025	122	957	411	306	154	2,975		590
2048	882	113	911	399	291	146	2,742		544
2049	759	104	866	387	277	139	2,533		502
2050	653	96	824	376	263	132	2,345		465
2051	562	89	784	365	251	126	2,176		432
2052	484	82	746	354	238	120	2,024		401
2053	417	75	709	344	227	114	1,886		374
2054	359	70	675	333	216	108	1,760		349
2055	309	64	642	324	205	103	1,647		327
2056	266	59	610	314	195	98	1,543		306
2057	229	55	581	305	186	93	1,448		287
2058	197	51	552	296	177	89	1,361		270
2059	169	47	525	287	168	84	1,281		254
2060	146	43	500	279	160	80	1,207		239
2061	126	40	475	270	152	76	1,139		226
2062	108	37	452	262	145	73	1,076		214
2063	93	34	430	255	138	69	1,018		202
2064	80	31	409	247	131	66	964		191
2065	69	29	389	240	124	63	914		181
2066	59	27	370	233	118	60	867		172
2067	51	25	352	226	113	57	823		163
2068	44	23	335	219	107	54	782		155
2069	38	21	319	213	102	51	743		147
2070	33	19	303	206	97	49	707		140
2071	28	18	288	200	92	46	673		133
2072	24	16	274	194	88	44	641		127
2073	21	15	261	189	83	42	611		121
2074	18	14	248	183	79	40	582		115
2075	15	13	236	178	75	38	555		110
2076	13	12	225	172	72	36	530		105
2077	11	11	214	167	68	34	506		100
2078	10	10	203	162	65	33	483		96
2079	8	9	193	158	62	31	462		92
2080	7	9	184	153	59	30	441		87
2081	6	8	175	148	56	28	422		84
2082	5	7	166	144	53	27	403		80
2083	5	7	158	140	51	25	385		76
2084	4	6	151	136	48	24	369		73
2085	3	6	143	132	46	23	353		70
2086	3	5	136	128	44	22	338		67
2087	3	5	130	124	41	21	323		64
2088	2	5	123	120	39	20	309		61
2089	2	4	117	117	37	19	296		59
2090	2	4	112	113	36	18	284		56
2091	1	4	106	110	34	17	272		54
2092	1	3	101	107	32	16	261		52
2093	1	3	96	103	31	15	250		50
2094	1	3	91	100	29	15	239		47
2095	1	3	87	97	28	14	229		46
2096	1	2	83	95	26	13	220		44
2097	1	2	79	92	25	13	211		42

Year	LFG Generation Magnitude for the Hartland Landfill Lifespan (CRD) - Cell 5
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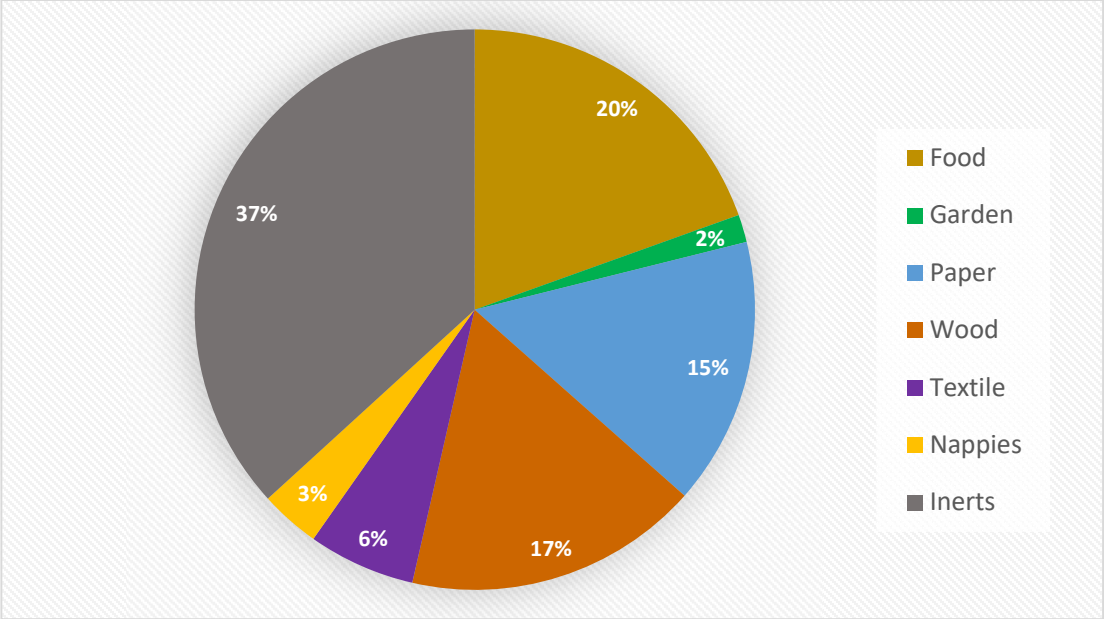
Year	Methane generation estimates for the Hartland Landfill Lifespan (CRD) - Cell 5							Methane Generation Potential	Total LFG Flow Rate Estimated
	Food (tonnes)	Garden (tonnes)	Paper (tonnes)	Wood (tonnes)	Textile (tonnes)	Nappies (tonnes)	Total (tonnes)	(L_o, m^3/tonne)	(scfm)
2098	0	2	75	89	24	12	202		40
2099	0	2	71	86	23	11	194		38
2100	0	2	68	84	22	11	186		37
2101	0	2	64	81	21	10	179		35
2102	0	1	61	79	20	10	171		34
2103	0	1	58	77	19	9	164		33
2104	0	1	55	74	18	9	158		31
2105	0	1	53	72	17	8	152		30
2106	0	1	50	70	16	8	145		29
2107	0	1	48	68	15	8	140		28
2108	0	1	45	66	14	7	134		27
2109	0	1	43	64	14	7	129		26
2110	0	1	41	62	13	7	124		25
2111	0	1	39	60	12	6	119		24
2112	0	1	37	59	12	6	114		23
2113	0	1	35	57	11	6	110		22
2114	0	1	34	55	11	5	105		21
2115	0	1	32	53	10	5	101		20
2116	0	0	30	52	10	5	97		19
2117	0	0	29	50	9	5	94		19
2118	0	0	27	49	9	4	90		18
2119	0	0	26	47	8	4	87		17
2120	0	0	25	46	8	4	83		17
2121	0	0	24	45	8	4	80		16
2122	0	0	23	43	7	4	77		15
2123	0	0	21	42	7	3	74		15
2124	0	0	20	41	7	3	71		14
2125	0	0	19	40	6	3	69		14
2126	0	0	18	38	6	3	66		13
2127	0	0	18	37	6	3	63		13
2128	0	0	17	36	5	3	61		12
2129	0	0	16	35	5	3	59		12
2130	0	0	15	34	5	2	57		11
2131	0	0	14	33	5	2	55		11
2132	0	0	14	32	4	2	52		10
2133	0	0	13	31	4	2	51		10
2134	0	0	12	30	4	2	49		10
2135	0	0	12	29	4	2	47		9
2136	0	0	11	28	4	2	45		9
2137	0	0	11	28	3	2	43		9
2138	0	0	10	27	3	2	42		8
2139	0	0	10	26	3	2	40		8
2140	0	0	9	25	3	1	39		8
2141	0	0	9	25	3	1	37		7
2142	0	0	8	24	3	1	36		7
2143	0	0	8	23	3	1	35		7
2144	0	0	7	22	2	1	34		7
2145	0	0	7	22	2	1	32		6
2146	0	0	7	21	2	1	31		6
2147	0	0	6	20	2	1	30		6
2148	0	0	6	20	2	1	29		6
2149	0	0	6	19	2	1	28		6
2150	0	0	6	19	2	1	27		5
2151	0	0	5	18	2	1	26		5
2152	0	0	5	18	2	1	25		5
2153	0	0	5	17	2	1	24		5
2154	0	0	5	17	1	1	23		5
2155	0	0	4	16	1	1	23		4
2156	0	0	4	16	1	1	22		4
2157	0	0	4	15	1	1	21		4
2158	0	0	4	15	1	1	20		4
2159	0	0	4	14	1	1	20		4
2160	0	0	3	14	1	1	19		4
2161	0	0	3	13	1	1	18		4
2162	0	0	3	13	1	0	18		3
2163	0	0	3	13	1	0	17		3
2164	0	0	3	12	1	0	16		3
2165	0	0	3	12	1	0	16		3
2166	0	0	2	12	1	0	15		3
2167	0	0	2	11	1	0	15		3
2168	0	0	2	11	1	0	14		3
2169	0	0	2	11	1	0	14		3
2170	0	0	2	10	1	0	13		3
2171	0	0	2	10	1	0	13		3
2172	0	0	2	10	1	0	12		2
2173	0	0	2	9	1	0	12		2
2174	0	0	2	9	1	0	12		2
2175	0	0	2	9	1	0	11		2
2176	0	0	2	9	0	0	11		2

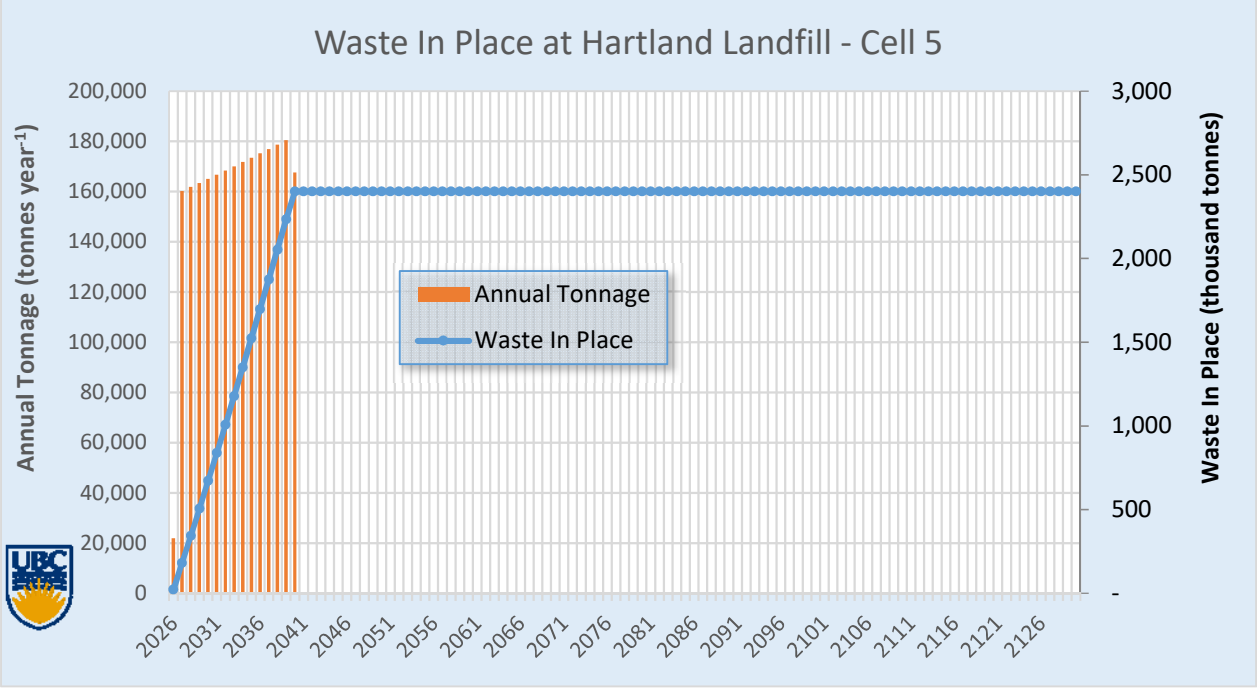
Year	LFG Generation Magnitude for the Hartland Landfill Lifespan (CRD) - Cell 5
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Hartland Landfill Lifespan (CRD) - Cell 5

Landfill Gas Generation Analysis **GRAPHICAL RESULTS**

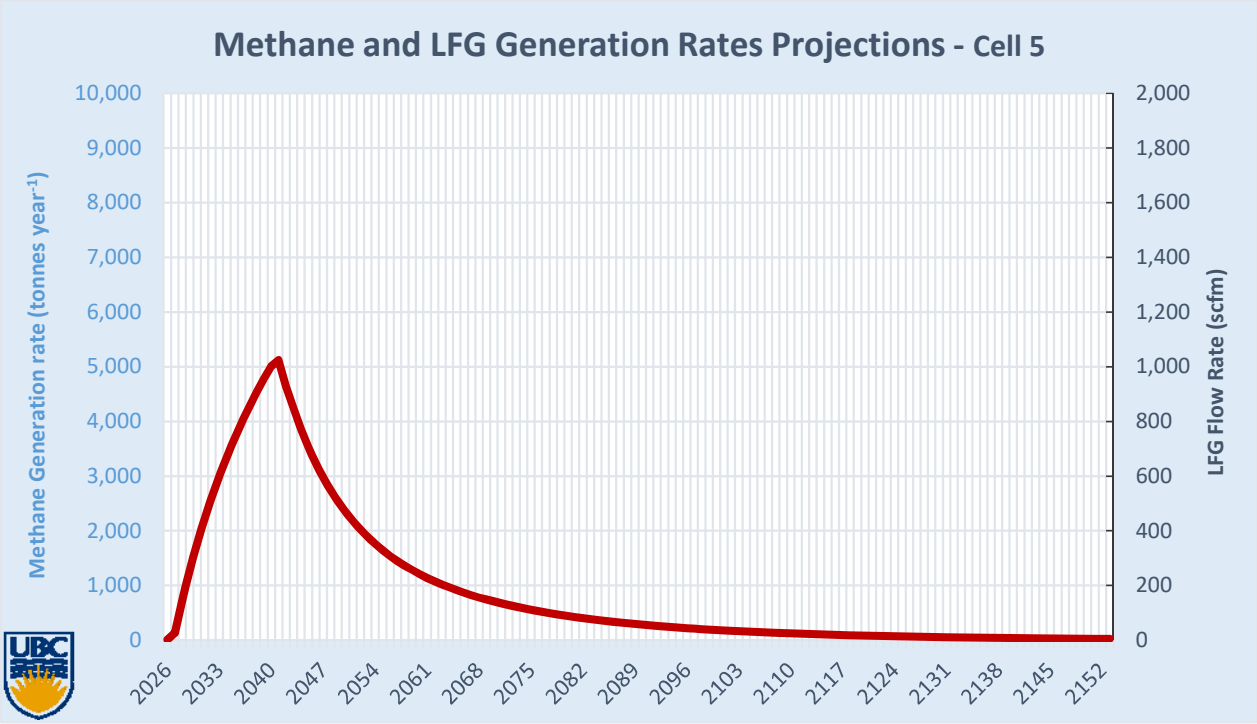
Average Deposited Waste Composition

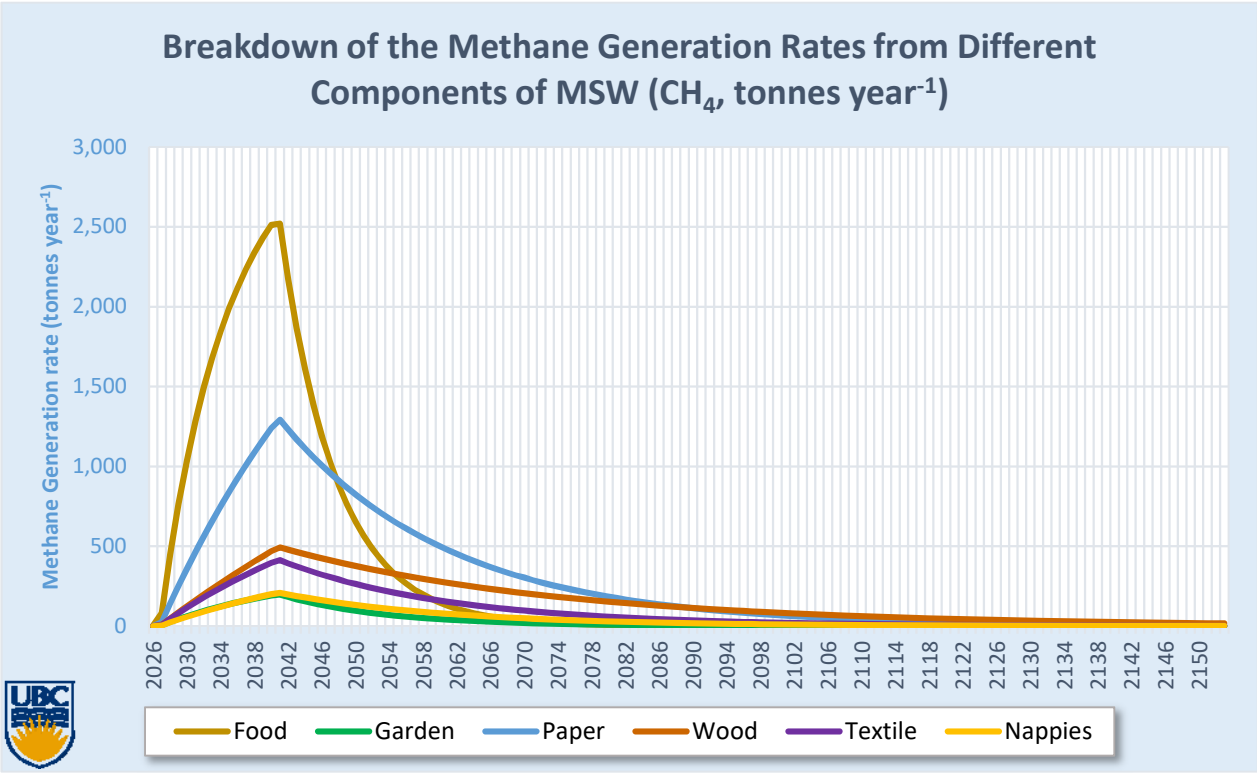




Hartland Landfill Lifespan (CRD) - Cell 5

Landfill Gas Generation Analysis **GRAPHICAL RESULTS**





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Graphical Illustration of Results
2019-10-13

Methane Generation Estimates from the Hartland Landfill Lifespan (CRD) - Cell 6

Actual CH_4 Yields

L_o (m^3/tonne)	127	158	143	72	114	103	72.3

Year	Methane generation estimates for the Hartland Landfill Lifespan (CRD) - Cell 6							Methane Generation Potential	Total LFG Flow Rate Estimated
	Food (tonnes)	Garden (tonnes)	Paper (tonnes)	Wood (tonnes)	Textile (tonnes)	Nappies (tonnes)	Total (tonnes)	(L_o, m^3/tonne)	(scfm)
2040	3	0	1	0	0	0	5	72.5	1
2041	73	4	22	7	7	4	117	72.5	23
2042	494	28	156	53	50	25	805	72.5	160
2043	861	50	284	97	91	46	1,430	72.5	284
2044	1,181	71	408	141	130	66	1,997	72.5	396
2045	1,462	91	527	184	168	85	2,516	72.5	499
2046	1,707	109	641	226	205	103	2,991	72.5	593
2047	1,923	126	751	267	240	121	3,428	72.5	680
2048	2,113	142	858	308	274	138	3,833	72.5	760
2049	2,282	157	960	348	307	154	4,208	72.5	835
2050	2,431	171	1,059	387	339	170	4,557	72.5	904
2051	2,565	184	1,155	425	369	186	4,884	72.5	969
2052	2,684	197	1,247	463	399	200	5,191	72.5	1,030
2053	2,792	209	1,337	500	427	215	5,480	72.5	1,087
2054	2,889	220	1,423	537	455	229	5,753	72.5	1,141
2055	2,962	230	1,502	571	480	241	5,987	72.5	1,187
2056	2,835	228	1,518	585	485	244	5,896		1,169
2057	2,440	211	1,444	568	462	232	5,356		1,062
2058	2,100	194	1,374	551	439	221	4,879		968
2059	1,807	179	1,307	535	418	210	4,456		884
2060	1,556	166	1,243	519	397	200	4,081		809
2061	1,339	153	1,183	503	378	190	3,746		743
2062	1,152	141	1,125	489	360	181	3,448		684
2063	992	130	1,070	474	342	172	3,181		631
2064	854	120	1,018	460	325	164	2,941		583
2065	735	111	968	446	310	156	2,726		541
2066	633	103	921	433	294	148	2,532		502
2067	544	95	876	420	280	141	2,356		467
2068	469	87	833	408	266	134	2,198		436
2069	403	81	793	396	253	127	2,053		407
2070	347	74	754	384	241	121	1,922		381
2071	299	69	717	373	229	115	1,802		357
2072	257	63	682	362	218	110	1,693		336
2073	221	59	649	351	207	104	1,592		316
2074	191	54	617	341	197	99	1,499		297
2075	164	50	587	331	188	94	1,414		280
2076	141	46	559	321	179	90	1,335		265
2077	121	43	531	312	170	85	1,262		250
2078	105	39	505	302	162	81	1,194		237
2079	90	36	481	293	154	77	1,131		224
2080	77	33	457	285	146	74	1,073		213
2081	67	31	435	276	139	70	1,018		202
2082	57	29	414	268	132	67	967		192
2083	49	26	394	260	126	63	919		182
2084	43	24	374	253	120	60	874		173
2085	37	22	356	245	114	57	831		165
2086	31	21	339	238	108	54	792		157
2087	27	19	322	231	103	52	754		150
2088	23	18	307	224	98	49	719		143
2089	20	16	292	217	93	47	685		136
2090	17	15	277	211	89	45	654		130
2091	15	14	264	205	84	42	624		124
2092	13	13	251	199	80	40	596		118
2093	11	12	239	193	76	38	569		113
2094	9	11	227	187	73	37	544		108
2095	8	10	216	182	69	35	520		103
2096	7	9	205	176	66	33	497		99
2097	6	9	195	171	62	31	475		94
2098	5	8	186	166	59	30	454		90
2099	4	7	177	161	57	28	435		86
2100	4	7	168	156	54	27	416		82
2101	3	6	160	152	51	26	398		79
2102	3	6	152	147	49	24	381		76
2103	2	5	145	143	46	23	365		72
2104	2	5	138	139	44	22	350		69
2105	2	5	131	134	42	21	335		66
2106	2	4	125	131	40	20	321		64
2107	1	4	119	127	38	19	307		61
2108	1	4	113	123	36	18	295		58
2109	1	3	107	119	34	17	282		56
2110	1	3	102	116	33	16	271		54
2111	1	3	97	112	31	16	260		51

Year	LFG Generation Magnitude for the Hartland Landfill Lifespan (CRD) - Cell 6
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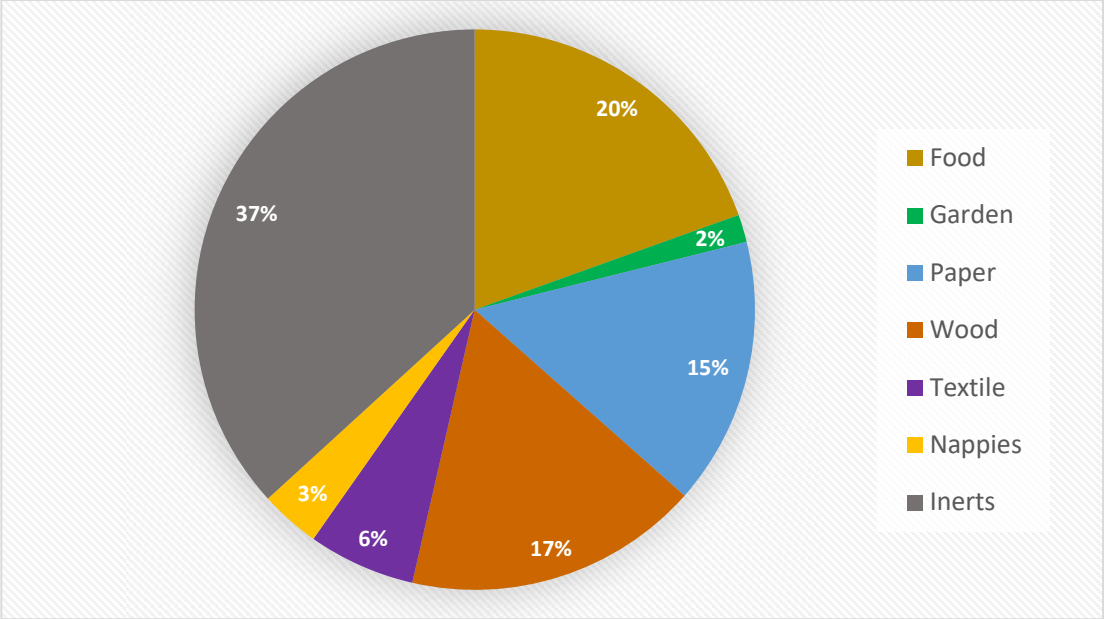
Year	Methane generation estimates for the Hartland Landfill Lifespan (CRD) - Cell 6							Methane Generation Potential	Total LFG Flow Rate Estimated
	Food (tonnes)	Garden (tonnes)	Paper (tonnes)	Wood (tonnes)	Textile (tonnes)	Nappies (tonnes)	Total (tonnes)	(L_o, m^3/tonne)	(scfm)
2112	1	3	92	109	30	15	249		49
2113	1	2	88	106	28	14	239		47
2114	0	2	84	103	27	13	229		45
2115	0	2	79	100	25	13	220		44
2116	0	2	76	97	24	12	211		42
2117	0	2	72	94	23	12	202		40
2118	0	2	68	91	22	11	194		39
2119	0	1	65	88	21	10	186		37
2120	0	1	62	86	20	10	179		35
2121	0	1	59	83	19	9	172		34
2122	0	1	56	81	18	9	165		33
2123	0	1	53	78	17	9	158		31
2124	0	1	51	76	16	8	152		30
2125	0	1	48	74	15	8	146		29
2126	0	1	46	72	15	7	140		28
2127	0	1	44	70	14	7	135		27
2128	0	1	41	67	13	7	130		26
2129	0	1	39	65	13	6	125		25
2130	0	1	38	64	12	6	120		24
2131	0	1	36	62	11	6	115		23
2132	0	1	34	60	11	5	111		22
2133	0	0	32	58	10	5	106		21
2134	0	0	31	56	10	5	102		20
2135	0	0	29	55	9	5	98		20
2136	0	0	28	53	9	4	95		19
2137	0	0	26	51	8	4	91		18
2138	0	0	25	50	8	4	88		17
2139	0	0	24	48	8	4	84		17
2140	0	0	23	47	7	4	81		16
2141	0	0	22	46	7	3	78		15
2142	0	0	21	44	7	3	75		15
2143	0	0	20	43	6	3	72		14
2144	0	0	19	42	6	3	70		14
2145	0	0	18	41	6	3	67		13
2146	0	0	17	39	5	3	64		13
2147	0	0	16	38	5	3	62		12
2148	0	0	15	37	5	2	60		12
2149	0	0	15	36	5	2	58		11
2150	0	0	14	35	4	2	55		11
2151	0	0	13	34	4	2	53		11
2152	0	0	12	33	4	2	51		10
2153	0	0	12	32	4	2	50		10
2154	0	0	11	31	4	2	48		9
2155	0	0	11	30	3	2	46		9
2156	0	0	10	29	3	2	44		9
2157	0	0	10	28	3	2	43		8
2158	0	0	9	27	3	1	41		8
2159	0	0	9	27	3	1	40		8
2160	0	0	8	26	3	1	38		8
2161	0	0	8	25	3	1	37		7
2162	0	0	8	24	2	1	36		7
2163	0	0	7	24	2	1	34		7
2164	0	0	7	23	2	1	33		7
2165	0	0	7	22	2	1	32		6
2166	0	0	6	22	2	1	31		6
2167	0	0	6	21	2	1	30		6
2168	0	0	6	20	2	1	29		6
2169	0	0	5	20	2	1	28		5
2170	0	0	5	19	2	1	27		5
2171	0	0	5	19	2	1	26		5
2172	0	0	5	18	1	1	25		5
2173	0	0	4	17	1	1	24		5
2174	0	0	4	17	1	1	23		5
2175	0	0	4	16	1	1	22		4
2176	0	0	4	16	1	1	22		4
2177	0	0	4	16	1	1	21		4
2178	0	0	3	15	1	1	20		4
2179	0	0	3	15	1	1	19		4
2180	0	0	3	14	1	0	19		4
2181	0	0	3	14	1	0	18		4
2182	0	0	3	13	1	0	17		3
2183	0	0	3	13	1	0	17		3
2184	0	0	3	13	1	0	16		3
2185	0	0	2	12	1	0	16		3
2186	0	0	2	12	1	0	15		3
2187	0	0	2	11	1	0	15		3
2188	0	0	2	11	1	0	14		3
2189	0	0	2	11	1	0	14		3
2190	0	0	2	11	1	0	13		3

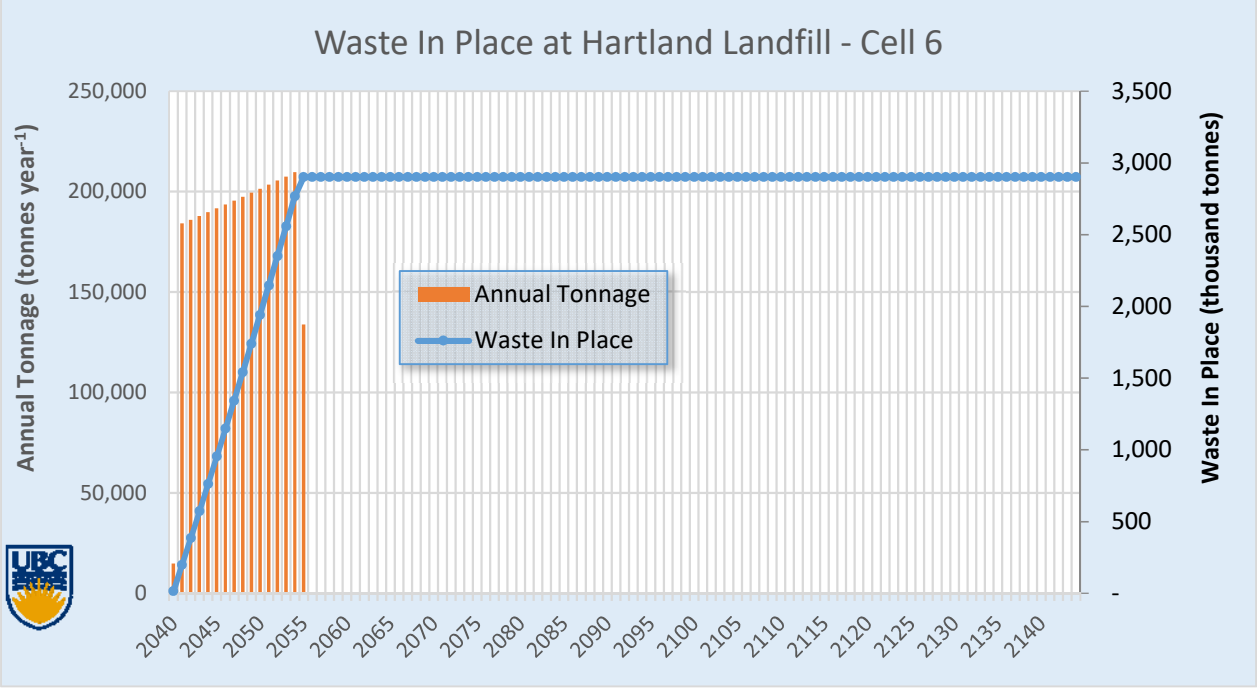
Year	LFG Generation Magnitude for the Hartland Landfill Lifespan (CRD) - Cell 6
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Hartland Landfill Lifespan (CRD) - Cell 6

Landfill Gas Generation Analysis **GRAPHICAL RESULTS**

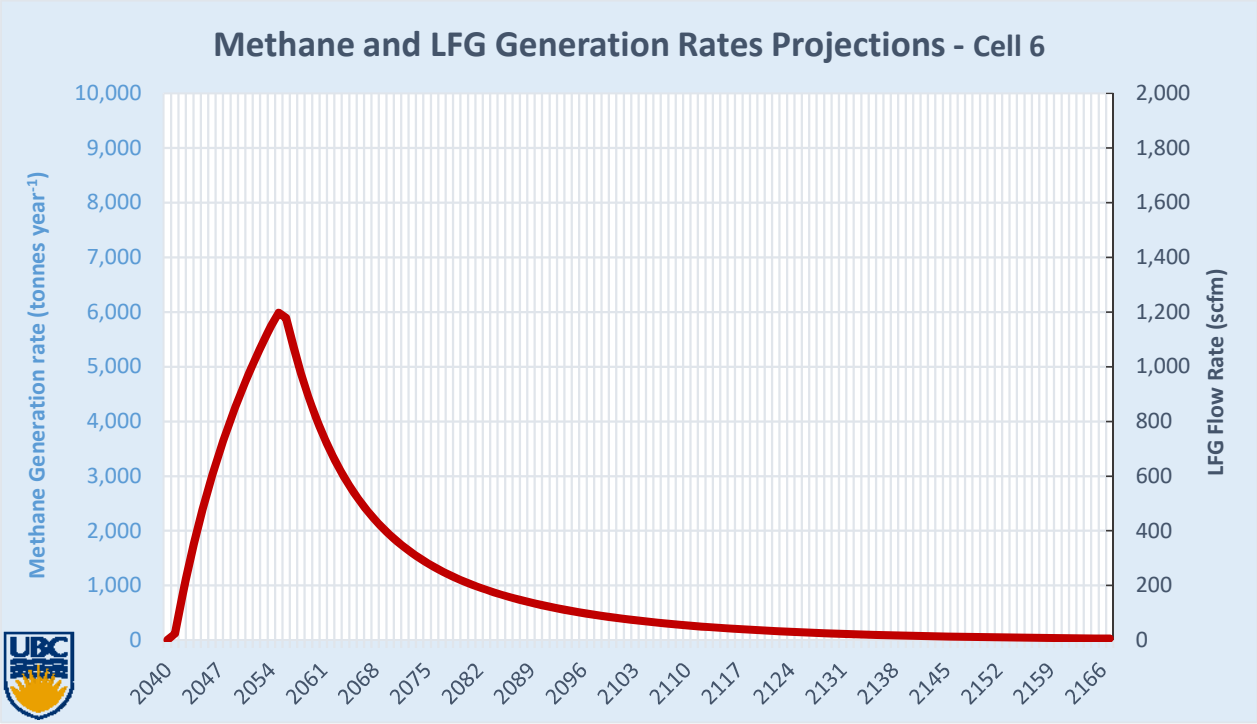
Average Deposited Waste Composition

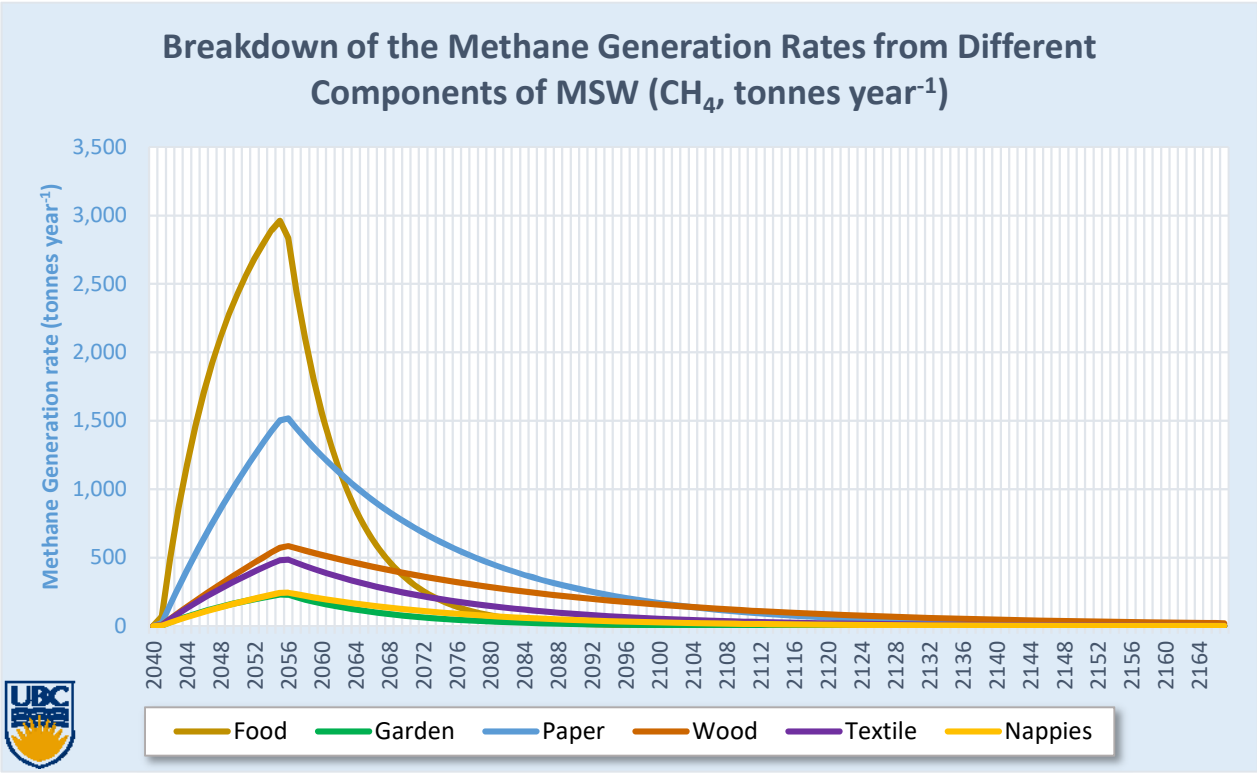




Hartland Landfill Lifespan (CRD) - Cell 6

Landfill Gas Generation Analysis **GRAPHICAL RESULTS**





Advanced LFG Generation Assessment
Hartland Landfill
Capital Regional District
SHA-PRJ19061

UBCiModel©
Graphical Illustration of Results
2019-10-13

APPENDIX C.2

Scenario 1 (Short Term Diversion Targets)

Methane Generation Estimates from the Hartland Landfill (CRD) - Sc.1 Lifespan

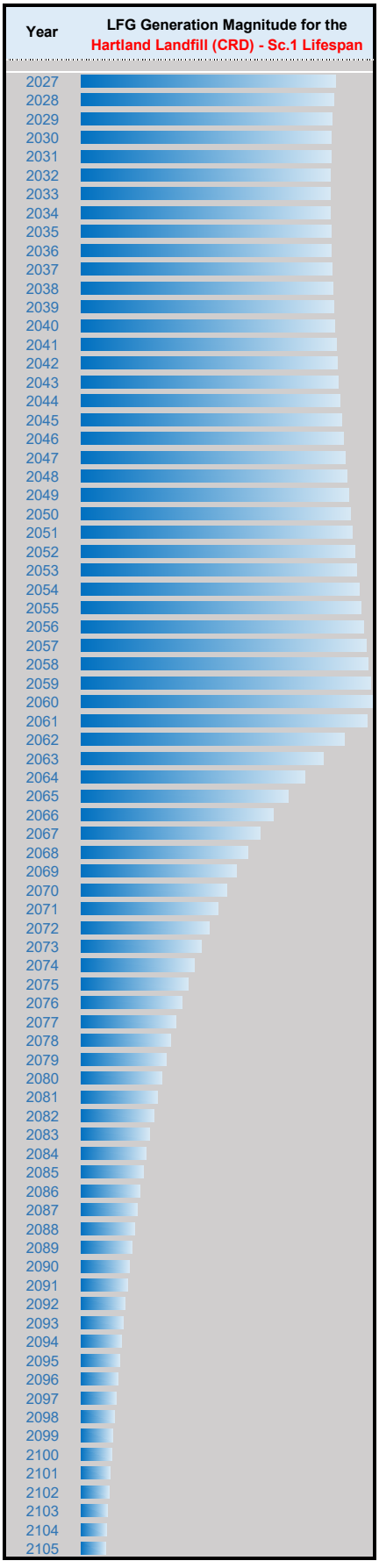
Actual CH_4 Yields

L_o (m^3/tonne)	127	157	140	66	111	100	71.2

Year	Methane generation estimates for the Hartland Landfill (CRD) - Sc.1 Lifespan							Methane Generation Potential	Total LFG Flow Rate Estimated
	Food (tonnes)	Garden (tonnes)	Paper (tonnes)	Wood (tonnes)	Textile (tonnes)	Nappies (tonnes)	Total (tonnes)	(L_o, m^3/tonne)	(scfm)
1955	5	1	1	0	0	0	9	78.7	2
1956	65	12	18	5	5	3	109	78.7	22
1957	120	23	36	9	10	6	204	78.7	41
1958	172	35	53	13	15	10	297	78.7	59
1959	221	46	71	18	20	13	388	78.7	77
1960	267	57	89	23	26	16	478	78.7	95
1961	313	68	108	28	31	20	568	78.7	113
1962	357	79	128	33	37	23	657	78.7	130
1963	401	91	148	39	42	27	748	78.7	148
1964	445	103	169	45	48	31	840	78.7	167
1965	489	115	191	51	54	35	934	78.7	185
1966	534	128	213	57	61	39	1,031	78.7	205
1967	580	141	237	64	68	43	1,132	78.7	224
1968	628	154	261	71	75	47	1,236	78.7	245
1969	677	168	287	78	82	52	1,344	78.7	267
1970	728	183	314	86	90	57	1,457	78.7	289
1971	782	198	342	94	98	62	1,576	78.7	313
1972	838	214	372	103	106	67	1,701	78.7	337
1973	897	231	404	112	115	73	1,832	78.7	363
1974	959	248	437	122	125	79	1,970	78.7	391
1975	1,025	267	472	132	135	85	2,116	78.7	420
1976	1,095	286	509	143	145	92	2,270	78.7	450
1977	1,168	307	547	154	156	99	2,433	78.7	483
1978	1,246	329	589	167	168	107	2,605	78.7	517
1979	1,329	352	632	179	181	115	2,788	78.7	553
1980	1,417	377	678	193	194	123	2,982	78.7	592
1981	1,511	403	727	208	208	132	3,188	78.7	632
1982	1,610	430	779	223	223	141	3,407	78.7	676
1983	1,716	460	834	239	238	151	3,639	78.7	722
1984	1,828	491	893	257	255	162	3,885	78.7	771
1985	1,948	524	954	275	273	173	4,147	78.7	823
1986	2,076	559	1,021	295	292	185	4,427	78.7	878
1987	2,226	599	1,094	317	313	198	4,747	78.7	942
1988	2,380	641	1,172	340	335	212	5,080	78.7	1,008
1989	2,530	682	1,250	363	357	227	5,409	78.7	1,073
1990	2,669	723	1,328	386	380	241	5,726	78.7	1,136
1991	2,783	759	1,400	409	400	254	6,004	78.7	1,191
1992	2,850	787	1,460	428	417	265	6,207	78.7	1,231
1993	2,875	806	1,508	445	431	273	6,339	78.7	1,257
1994	2,889	822	1,551	461	443	281	6,448	78.7	1,279
1995	2,895	836	1,591	476	455	288	6,540	78.7	1,297
1996	2,908	851	1,631	490	466	295	6,641	78.7	1,317
1997	2,911	862	1,666	504	476	302	6,722	78.7	1,333
1998	2,892	869	1,694	516	484	307	6,763	78.7	1,341
1999	2,849	870	1,713	526	489	310	6,758	78.7	1,340
2000	2,812	871	1,731	536	495	314	6,758	78.7	1,340
2001	2,776	872	1,746	544	499	316	6,754	78.7	1,340
2002	2,744	872	1,761	553	503	319	6,752	78.7	1,339
2003	2,734	875	1,780	563	509	323	6,784	78.7	1,345
2004	2,730	879	1,800	572	514	326	6,822	78.7	1,353
2005	2,745	886	1,823	583	521	330	6,888	78.7	1,366
2006	2,776	896	1,851	594	529	335	6,982	78.7	1,385
2007	2,808	906	1,879	606	537	340	7,077	78.7	1,404
2008	2,846	918	1,908	618	545	346	7,180	78.7	1,424
2009	2,852	923	1,929	628	551	349	7,232	78.7	1,434
2010	2,852	927	1,946	637	556	353	7,271	78.7	1,442
2011	2,827	926	1,957	644	559	355	7,268	78.7	1,442
2012	2,787	922	1,961	649	560	355	7,235	78.7	1,435
2013	2,734	915	1,960	653	560	355	7,177	78.7	1,424
2014	2,672	903	1,954	657	559	354	7,099	75.9	1,408
2015	2,593	870	1,946	663	558	352	6,983	75.9	1,385
2016	2,513	837	1,935	669	557	349	6,860	72.5	1,361
2017	2,480	790	1,939	682	561	348	6,801	72.5	1,349
2018	2,473	749	1,950	698	567	348	6,786	72.5	1,346
2019	2,472	710	1,962	714	574	349	6,781	72.5	1,345
2020	2,474	675	1,975	729	581	349	6,783	72.5	1,345
2021	2,477	643	1,987	744	587	349	6,788	70.5	1,346
2022	2,456	612	1,990	754	594	350	6,756	68.4	1,340
2023	2,415	581	1,985	758	600	351	6,691	66.4	1,327
2024	2,359	553	1,973	757	607	352	6,601	66.4	1,309
2025	2,313	526	1,963	757	613	353	6,525	66.4	1,294
2026	2,277	502	1,954	758	619	355	6,463	66.4	1,282

Year	LFG Generation Magnitude for the Hartland Landfill (CRD) - Sc.1 Lifespan
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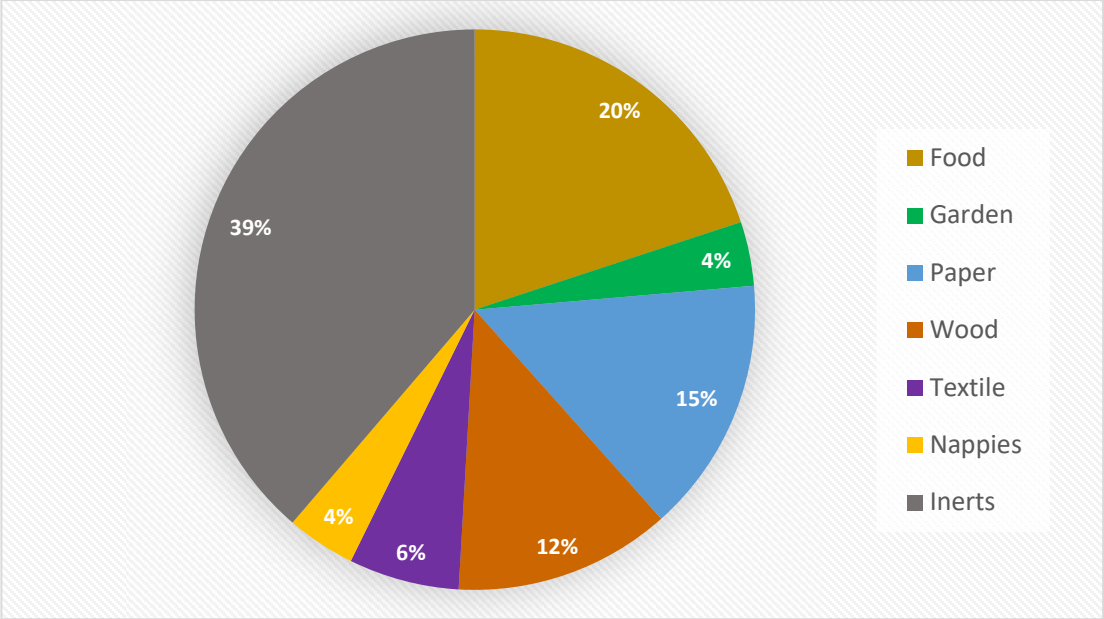
Year	Methane generation estimates for the Hartland Landfill (CRD) - Sc.1 Lifespan							Methane Generation Potential	Total LFG Flow Rate Estimated
	Food (tonnes)	Garden (tonnes)	Paper (tonnes)	Wood (tonnes)	Textile (tonnes)	Nappies (tonnes)	Total (tonnes)	(L_o, m^3/tonne)	(scfm)
2027	2,248	479	1,946	758	626	356	6,413	66.4	1,272
2028	2,226	459	1,939	759	632	357	6,372	66.4	1,264
2029	2,211	440	1,934	759	639	359	6,342	66.4	1,258
2030	2,200	423	1,930	760	645	361	6,319	66.4	1,253
2031	2,194	408	1,926	762	652	362	6,304	66.4	1,250
2032	2,192	393	1,924	763	658	364	6,295	66.4	1,249
2033	2,193	380	1,923	765	665	366	6,293	66.4	1,248
2034	2,197	369	1,923	767	672	369	6,295	66.4	1,249
2035	2,203	358	1,924	769	679	371	6,303	66.4	1,250
2036	2,212	348	1,926	771	686	373	6,315	66.4	1,253
2037	2,223	339	1,929	773	693	375	6,332	66.4	1,256
2038	2,235	331	1,932	776	700	378	6,352	66.4	1,260
2039	2,249	324	1,937	778	707	381	6,375	66.4	1,265
2040	2,264	318	1,942	781	714	383	6,402	66.4	1,270
2041	2,280	312	1,947	785	721	386	6,431	66.4	1,276
2042	2,298	307	1,954	788	728	389	6,464	66.4	1,282
2043	2,316	302	1,961	791	736	392	6,498	66.4	1,289
2044	2,335	298	1,969	795	743	395	6,536	66.4	1,296
2045	2,355	295	1,978	799	751	398	6,575	66.4	1,304
2046	2,376	292	1,987	803	758	401	6,616	66.4	1,312
2047	2,397	289	1,997	807	766	404	6,660	66.4	1,321
2048	2,419	287	2,007	811	774	407	6,705	66.4	1,330
2049	2,441	285	2,018	815	782	411	6,752	66.4	1,339
2050	2,464	284	2,030	820	789	414	6,800	66.4	1,349
2051	2,487	283	2,042	825	797	418	6,851	66.4	1,359
2052	2,511	282	2,054	829	805	421	6,902	66.4	1,369
2053	2,535	281	2,067	834	814	425	6,956	66.4	1,380
2054	2,559	281	2,081	840	822	428	7,010	66.4	1,390
2055	2,584	281	2,095	845	830	432	7,067	66.4	1,402
2056	2,609	281	2,109	850	838	436	7,124	66.4	1,413
2057	2,635	281	2,124	856	847	440	7,183	66.4	1,425
2058	2,661	282	2,140	862	855	444	7,243	66.4	1,437
2059	2,687	282	2,156	867	864	448	7,304	66.4	1,449
2060	2,704	283	2,170	873	871	451	7,352	66.4	1,458
2061	2,606	277	2,148	869	864	447	7,211		1,430
2062	2,243	255	2,044	843	822	425	6,633		1,316
2063	1,930	236	1,944	818	782	405	6,115		1,213
2064	1,662	218	1,849	794	744	385	5,651		1,121
2065	1,430	201	1,759	771	708	366	5,235		1,038
2066	1,231	185	1,673	748	673	348	4,859		964
2067	1,059	171	1,592	726	640	331	4,520		896
2068	912	158	1,514	704	609	315	4,213		836
2069	785	146	1,440	684	579	300	3,934		780
2070	676	135	1,370	663	551	285	3,680		730
2071	581	124	1,303	644	524	271	3,448		684
2072	500	115	1,239	625	499	258	3,236		642
2073	431	106	1,179	606	474	245	3,042		603
2074	371	98	1,122	588	451	233	2,863		568
2075	319	90	1,067	571	429	222	2,699		535
2076	275	83	1,015	554	408	211	2,546		505
2077	236	77	965	538	388	201	2,406		477
2078	203	71	918	522	369	191	2,275		451
2079	175	66	873	506	351	182	2,154		427
2080	151	61	831	491	334	173	2,041		405
2081	130	56	790	477	318	165	1,935		384
2082	112	52	752	463	302	157	1,837		364
2083	96	48	715	449	288	149	1,745		346
2084	83	44	680	436	274	142	1,658		329
2085	71	41	647	423	260	135	1,577		313
2086	61	37	616	411	248	128	1,501		298
2087	53	35	585	398	236	122	1,429		283
2088	45	32	557	387	224	116	1,361		270
2089	39	29	530	375	213	110	1,297		257
2090	34	27	504	364	203	105	1,237		245
2091	29	25	479	353	193	100	1,179		234
2092	25	23	456	343	183	95	1,125		223
2093	21	21	434	333	175	90	1,074		213
2094	18	20	413	323	166	86	1,026		203
2095	16	18	392	313	158	82	980		194
2096	14	17	373	304	150	78	936		186
2097	12	16	355	295	143	74	894		177
2098	10	14	338	286	136	70	855		170
2099	9	13	321	278	129	67	817		162
2100	8	12	306	270	123	64	782		155
2101	6	11	291	262	117	61	748		148
2102	6	10	277	254	111	58	715		142
2103	5	10	263	247	106	55	685		136
2104	4	9	250	239	101	52	655		130
2105	4	8	238	232	96	50	627		124

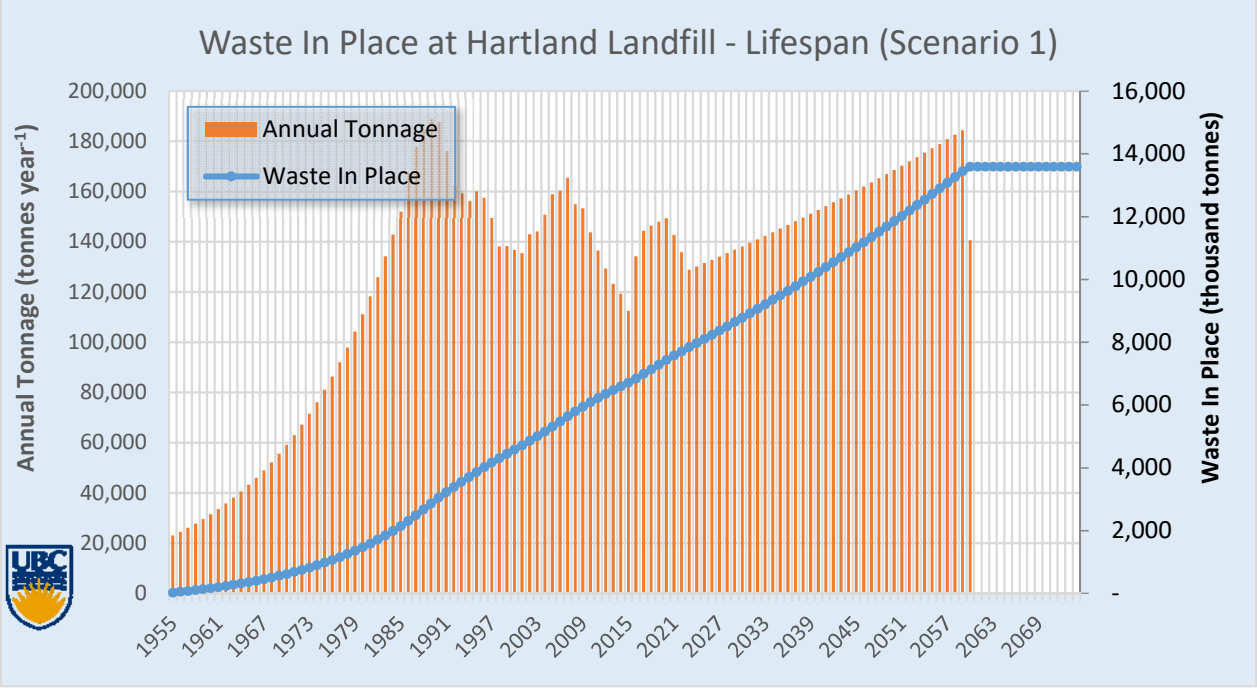


Hartland Landfill (CRD) - Sc.1 Lifespan

Landfill Gas Generation Analysis **GRAPHICAL RESULTS**

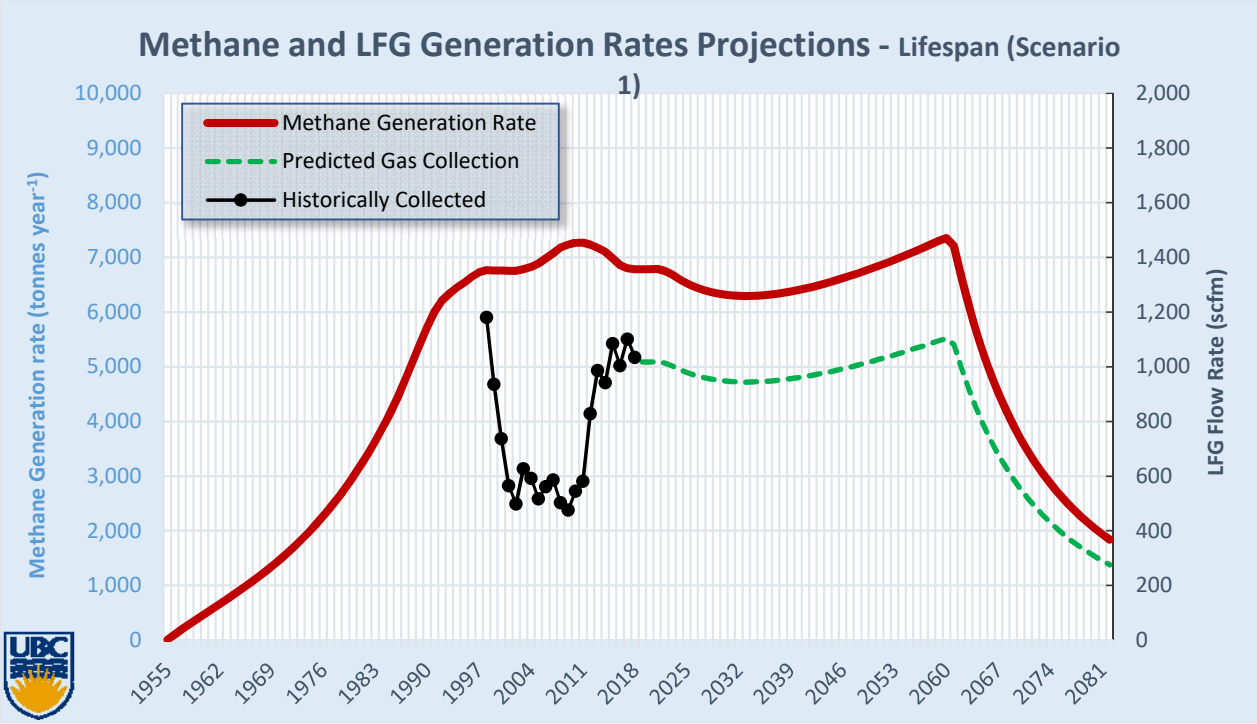
Average Deposited Waste Composition

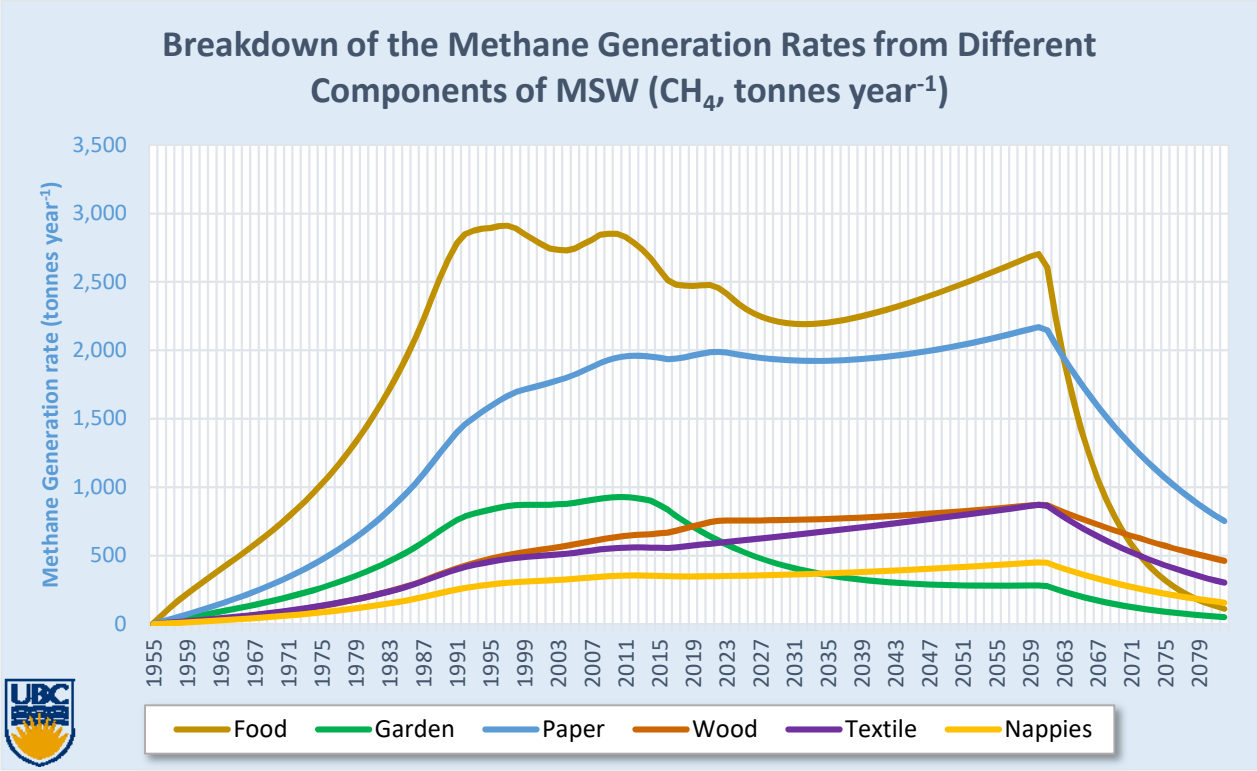




Hartland Landfill (CRD) - Sc.1 Lifespan

Landfill Gas Generation Analysis **GRAPHICAL RESULTS**





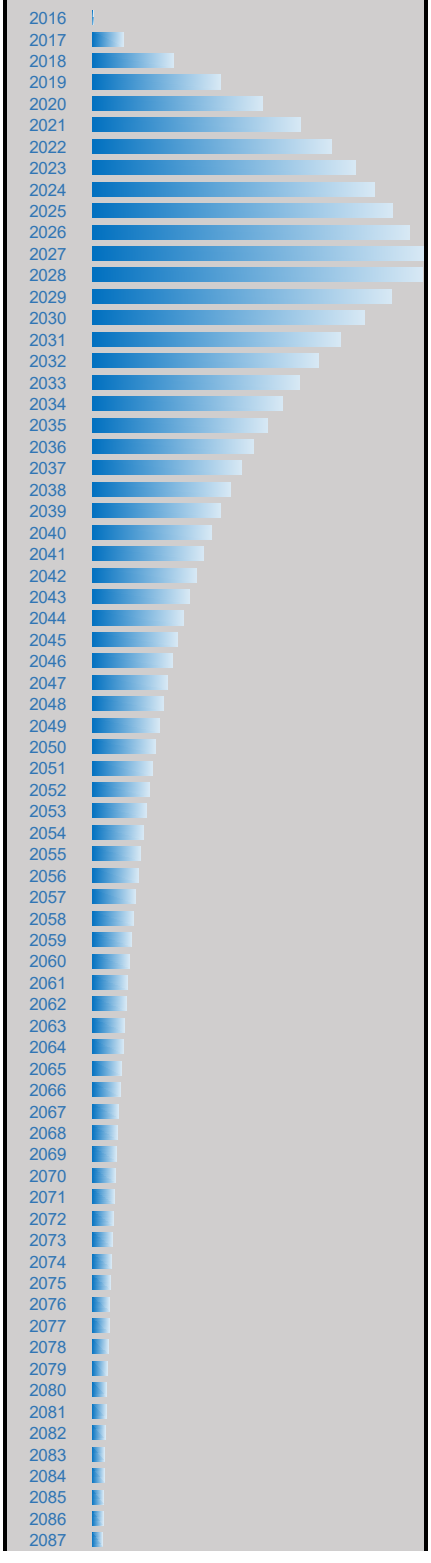
Methane Generation Estimates from the Hartland Landfill (CRD) - Sc.1 Cell 3&4

Actual CH_4 Yields

L_o (m^3/tonne)	127	158	143	72	114	103	69.4

Year	Methane generation estimates for the Hartland Landfill (CRD) - Sc.1 Cell 3&4							Methane Generation Potential	Total LFG Flow Rate Estimated
	Food (tonnes)	Garden (tonnes)	Paper (tonnes)	Wood (tonnes)	Textile (tonnes)	Nappies (tonnes)	Total (tonnes)	(L_o, m^3/tonne)	(scfm)
2016	15	1	5	2	1	1	24	72.5	5
2017	198	11	62	21	20	10	322	72.5	64
2018	509	29	165	56	53	26	838	72.5	166
2019	782	46	264	91	84	42	1,309	72.5	260
2020	1,020	62	359	125	115	58	1,738	72.5	345
2021	1,225	77	450	158	144	72	2,126	70.5	422
2022	1,379	89	528	184	172	87	2,440	68.4	484
2023	1,487	99	594	205	200	101	2,686	66.4	533
2024	1,560	107	650	221	225	114	2,878	66.4	571
2025	1,626	115	704	237	250	127	3,059	66.4	607
2026	1,685	122	757	253	274	139	3,230	66.4	641
2027	1,732	129	805	267	297	150	3,379	66.4	670
2028	1,680	130	823	275	306	155	3,368		668
2029	1,446	120	783	266	291	148	3,054		606
2030	1,244	110	745	259	277	140	2,776		551
2031	1,071	102	709	251	264	134	2,529		502
2032	922	94	674	243	251	127	2,311		458
2033	793	87	641	236	238	121	2,117		420
2034	683	80	610	229	227	115	1,944		386
2035	588	74	580	223	216	109	1,790		355
2036	506	68	552	216	205	104	1,651		328
2037	435	63	525	210	195	99	1,527		303
2038	375	58	499	203	186	94	1,416		281
2039	323	54	475	197	177	90	1,315		261
2040	278	50	452	192	168	85	1,224		243
2041	239	46	430	186	160	81	1,141		226
2042	206	42	409	180	152	77	1,066		211
2043	177	39	389	175	145	73	998		198
2044	152	36	370	170	138	70	935		186
2045	131	33	352	165	131	66	878		174
2046	113	31	335	160	124	63	826		164
2047	97	28	318	155	118	60	778		154
2048	84	26	303	151	113	57	733		145
2049	72	24	288	146	107	54	692		137
2050	62	22	274	142	102	52	654		130
2051	53	21	261	138	97	49	618		123
2052	46	19	248	134	92	47	585		116
2053	40	18	236	130	88	44	555		110
2054	34	16	224	126	83	42	526		104
2055	29	15	213	122	79	40	499		99
2056	25	14	203	119	75	38	474		94
2057	22	13	193	115	72	36	451		89
2058	19	12	184	112	68	35	429		85
2059	16	11	175	108	65	33	408		81
2060	14	10	166	105	62	31	388		77
2061	12	9	158	102	59	30	370		73
2062	10	9	150	99	56	28	352		70
2063	9	8	143	96	53	27	336		67
2064	8	7	136	93	51	26	320		64
2065	7	7	129	90	48	24	306		61
2066	6	6	123	88	46	23	292		58
2067	5	6	117	85	44	22	279		55
2068	4	5	111	83	41	21	266		53
2069	4	5	106	80	39	20	254		50
2070	3	5	101	78	37	19	243		48
2071	3	4	96	76	36	18	232		46
2072	2	4	91	73	34	17	222		44
2073	2	4	87	71	32	16	212		42
2074	2	3	83	69	31	16	203		40
2075	1	3	79	67	29	15	194		38
2076	1	3	75	65	28	14	186		37
2077	1	3	71	63	26	13	178		35
2078	1	2	68	61	25	13	170		34
2079	1	2	64	59	24	12	163		32
2080	1	2	61	58	23	12	156		31
2081	1	2	58	56	22	11	149		30
2082	1	2	55	54	21	10	143		28
2083	0	2	53	53	20	10	137		27
2084	0	1	50	51	19	9	131		26
2085	0	1	48	50	18	9	126		25
2086	0	1	45	48	17	9	120		24
2087	0	1	43	47	16	8	115		23

Year — LFG Generation Magnitude for the Hartland Landfill (CRD) - Sc.1 Cell 3&4



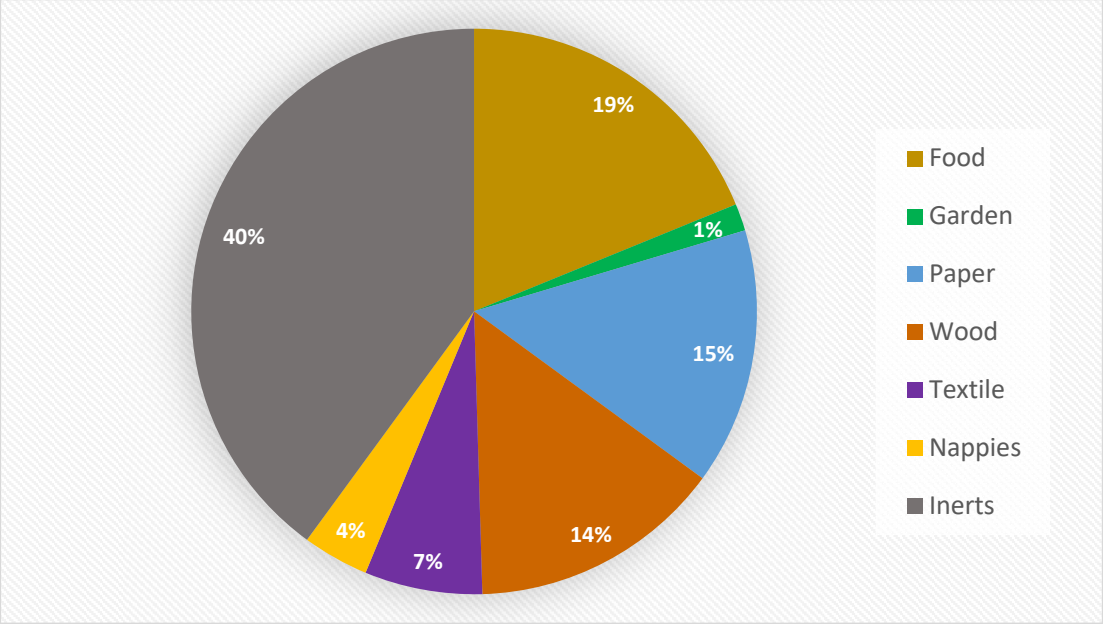
Year	Methane generation estimates for the Hartland Landfill (CRD) - Sc.1 Cell 3&4							Methane Generation Potential	Total LFG Flow Rate Estimated
	Food (tonnes)	Garden (tonnes)	Paper (tonnes)	Wood (tonnes)	Textile (tonnes)	Nappies (tonnes)	Total (tonnes)	(L_o, m^3/tonne)	(scfm)
2088	0	1	41	45	15	8	111		22
2089	0	1	39	44	14	7	106		21
2090	0	1	37	43	14	7	102		20
2091	0	1	35	41	13	7	97		19
2092	0	1	34	40	12	6	93		19
2093	0	1	32	39	12	6	90		18
2094	0	1	30	38	11	6	86		17
2095	0	1	29	37	11	5	83		16
2096	0	1	27	36	10	5	79		16
2097	0	1	26	35	10	5	76		15
2098	0	0	25	34	9	5	73		14
2099	0	0	24	33	9	4	70		14
2100	0	0	22	32	8	4	67		13
2101	0	0	21	31	8	4	65		13
2102	0	0	20	30	8	4	62		12
2103	0	0	19	29	7	4	59		12
2104	0	0	18	28	7	3	57		11
2105	0	0	18	27	7	3	55		11
2106	0	0	17	26	6	3	53		10
2107	0	0	16	26	6	3	51		10
2108	0	0	15	25	6	3	49		10
2109	0	0	14	24	5	3	47		9
2110	0	0	14	23	5	3	45		9
2111	0	0	13	23	5	2	43		9
2112	0	0	12	22	5	2	42		8
2113	0	0	12	21	4	2	40		8
2114	0	0	11	21	4	2	38		8
2115	0	0	11	20	4	2	37		7
2116	0	0	10	20	4	2	35		7
2117	0	0	10	19	4	2	34		7
2118	0	0	9	18	3	2	33		7
2119	0	0	9	18	3	2	32		6
2120	0	0	8	17	3	2	30		6
2121	0	0	8	17	3	1	29		6
2122	0	0	7	16	3	1	28		6
2123	0	0	7	16	3	1	27		5
2124	0	0	7	15	3	1	26		5
2125	0	0	6	15	2	1	25		5
2126	0	0	6	15	2	1	24		5
2127	0	0	6	14	2	1	23		5
2128	0	0	6	14	2	1	22		4
2129	0	0	5	13	2	1	22		4
2130	0	0	5	13	2	1	21		4
2131	0	0	5	12	2	1	20		4
2132	0	0	5	12	2	1	19		4
2133	0	0	4	12	2	1	19		4
2134	0	0	4	11	2	1	18		4
2135	0	0	4	11	1	1	17		3
2136	0	0	4	11	1	1	17		3
2137	0	0	4	10	1	1	16		3
2138	0	0	3	10	1	1	15		3
2139	0	0	3	10	1	1	15		3
2140	0	0	3	10	1	1	14		3
2141	0	0	3	9	1	1	14		3
2142	0	0	3	9	1	1	13		3
2143	0	0	3	9	1	0	13		3
2144	0	0	2	8	1	0	12		2
2145	0	0	2	8	1	0	12		2
2146	0	0	2	8	1	0	11		2
2147	0	0	2	8	1	0	11		2
2148	0	0	2	8	1	0	11		2
2149	0	0	2	7	1	0	10		2
2150	0	0	2	7	1	0	10		2
2151	0	0	2	7	1	0	10		2
2152	0	0	2	7	1	0	9		2
2153	0	0	2	6	1	0	9		2
2154	0	0	2	6	1	0	9		2
2155	0	0	1	6	1	0	8		2
2156	0	0	1	6	1	0	8		2
2157	0	0	1	6	0	0	8		2
2158	0	0	1	6	0	0	7		1
2159	0	0	1	5	0	0	7		1
2160	0	0	1	5	0	0	7		1
2161	0	0	1	5	0	0	7		1
2162	0	0	1	5	0	0	7		1
2163	0	0	1	5	0	0	6		1
2164	0	0	1	5	0	0	6		1
2165	0	0	1	5	0	0	6		1
2166	0	0	1	4	0	0	6		1

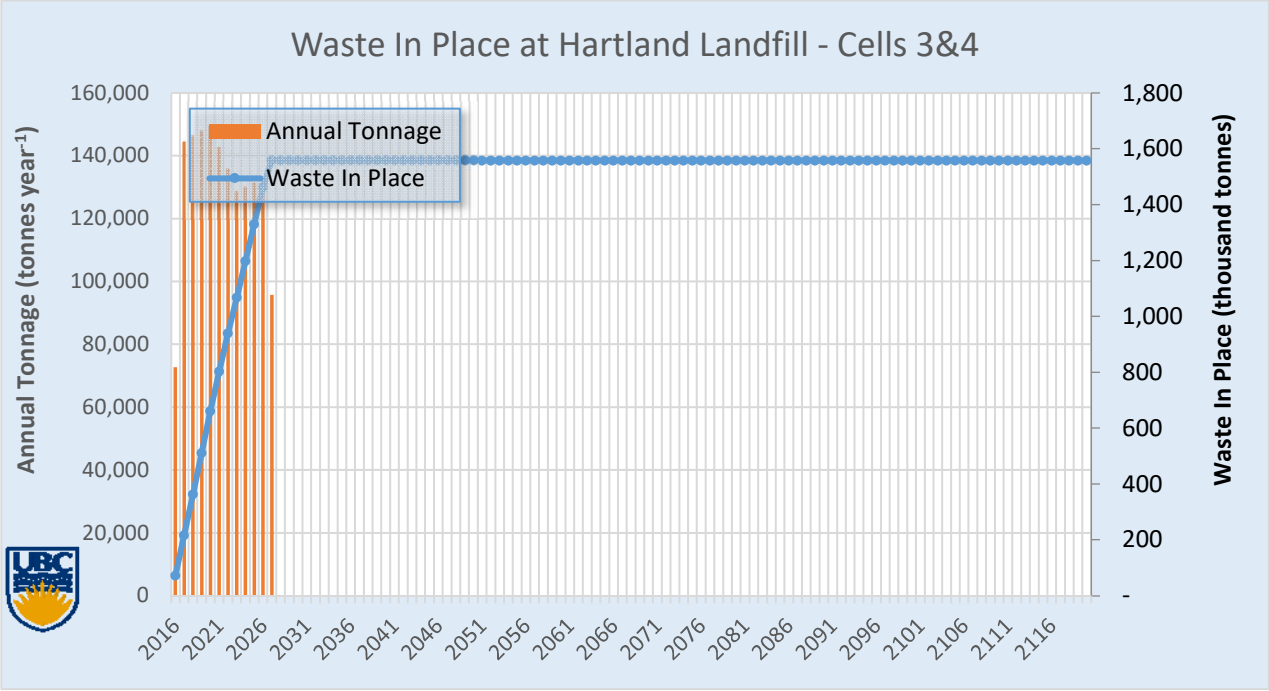
Year	LFG Generation Magnitude for the Hartland Landfill (CRD) - Sc.1 Cell 3&4
2088	
2089	
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2166	

Hartland Landfill (CRD) - Sc.1 Cell 3&4

Landfill Gas Generation Analysis **GRAPHICAL RESULTS**

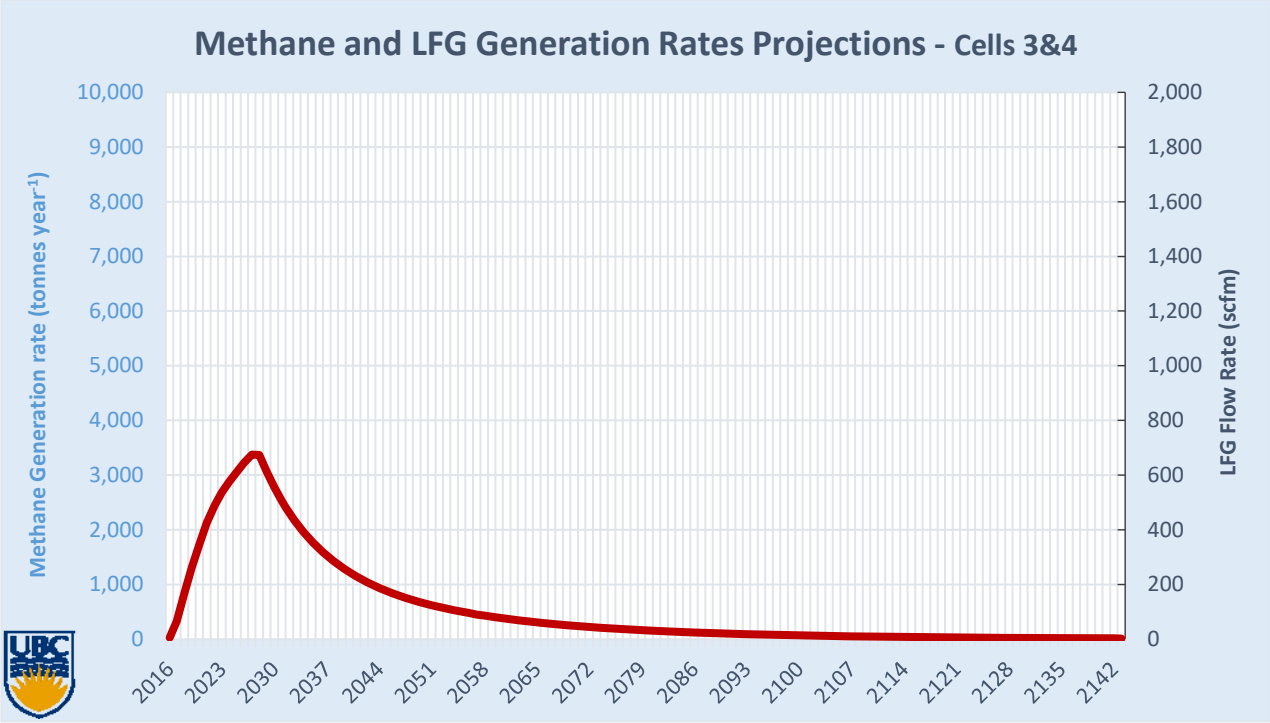
Average Deposited Waste Composition

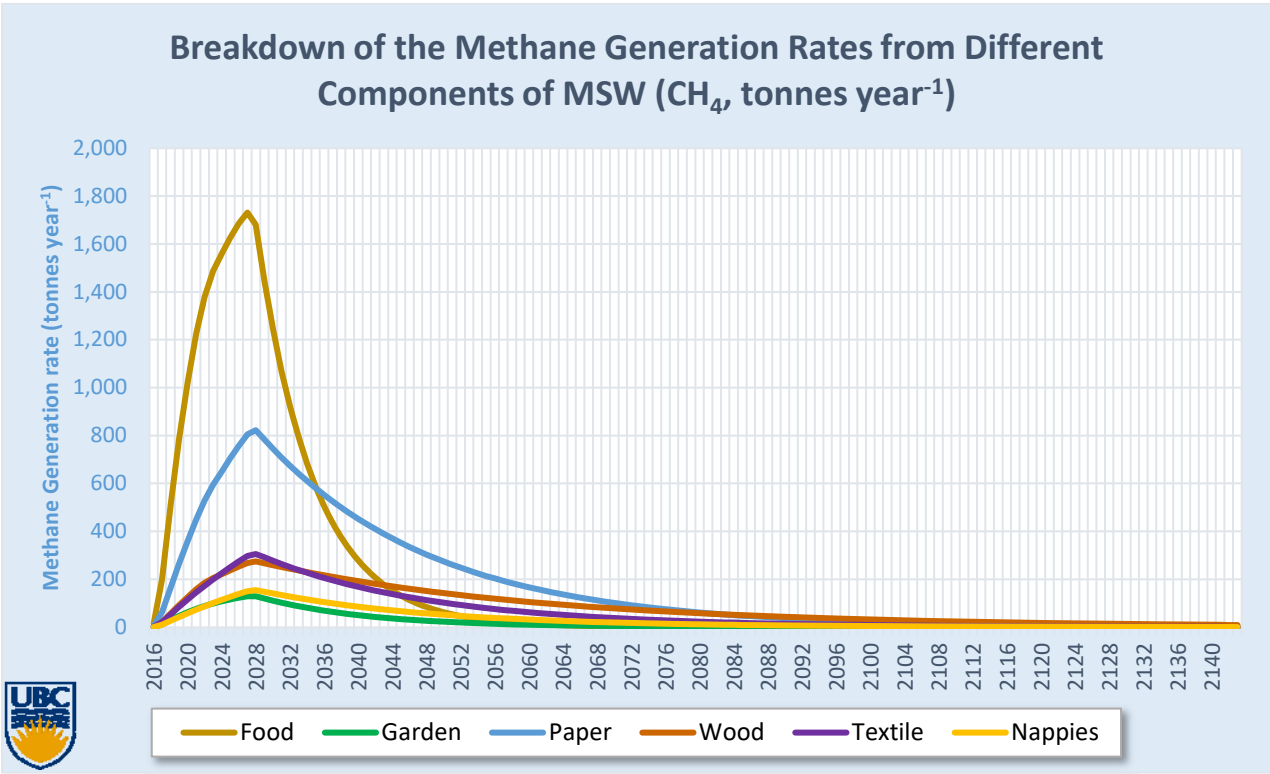




Hartland Landfill (CRD) - Sc.1 Cell 3&4

Landfill Gas Generation Analysis **GRAPHICAL RESULTS**





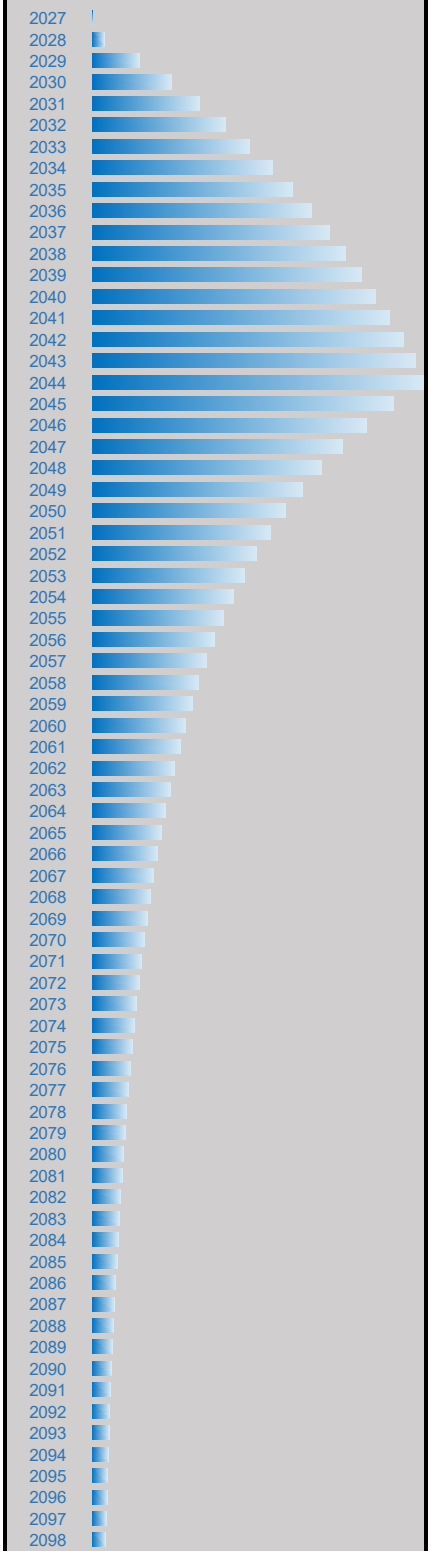
Methane Generation Estimates from the Hartland Landfill (CRD) - Sc. 1 Cell 5

Actual CH_4 Yields

L_o (m^3/tonne)	127	158	143	72	114	103	66.3

Year	Methane generation estimates for the Hartland Landfill (CRD) - Sc. 1 Cell 5							Methane Generation Potential	Total LFG Flow Rate Estimated
	Food (tonnes)	Garden (tonnes)	Paper (tonnes)	Wood (tonnes)	Textile (tonnes)	Nappies (tonnes)	Total (tonnes)	(L_o, m^3/tonne)	(scfm)
2027	7	0	2	1	1	0	12	66.4	2
2028	109	6	33	9	14	7	177	66.4	35
2029	388	22	120	32	50	26	638	66.4	127
2030	631	37	205	54	86	44	1,056	66.4	210
2031	844	51	286	76	119	61	1,437	66.4	285
2032	1,029	64	364	98	152	78	1,785	66.4	354
2033	1,192	77	439	119	184	94	2,104	66.4	417
2034	1,336	88	511	140	214	109	2,398	66.4	476
2035	1,462	99	581	161	243	124	2,669	66.4	529
2036	1,574	109	648	181	271	138	2,922	66.4	579
2037	1,674	119	713	201	298	152	3,157	66.4	626
2038	1,762	128	776	220	325	165	3,376	66.4	670
2039	1,842	136	837	239	350	178	3,583	66.4	711
2040	1,914	144	895	258	375	191	3,777	66.4	749
2041	1,979	152	952	277	398	203	3,961	66.4	786
2042	2,038	159	1,007	295	421	215	4,136	66.4	820
2043	2,093	166	1,061	313	444	226	4,302	66.4	853
2044	2,113	171	1,104	328	462	235	4,413	66.4	875
2045	1,822	158	1,051	319	440	224	4,014		796
2046	1,569	146	1,000	310	418	213	3,655		725
2047	1,350	135	951	301	398	203	3,337		662
2048	1,162	124	905	292	378	193	3,054		606
2049	1,000	115	861	283	360	183	2,802		556
2050	861	106	819	275	342	175	2,577		511
2051	741	98	779	267	326	166	2,376		471
2052	638	90	741	259	310	158	2,195		435
2053	549	83	705	251	295	150	2,033		403
2054	472	77	670	244	280	143	1,886		374
2055	407	71	638	236	267	136	1,754		348
2056	350	66	606	229	254	129	1,634		324
2057	301	60	577	223	241	123	1,526		303
2058	259	56	549	216	230	117	1,426		283
2059	223	52	522	210	218	111	1,336		265
2060	192	48	497	203	208	106	1,253		249
2061	165	44	472	197	198	101	1,177		234
2062	142	41	449	192	188	96	1,107		220
2063	122	37	427	186	179	91	1,043		207
2064	105	35	407	180	170	87	984		195
2065	91	32	387	175	162	82	929		184
2066	78	29	368	170	154	78	878		174
2067	67	27	350	165	146	75	830		165
2068	58	25	333	160	139	71	786		156
2069	50	23	317	155	132	67	745		148
2070	43	21	301	151	126	64	706		140
2071	37	20	286	146	120	61	670		133
2072	32	18	273	142	114	58	637		126
2073	27	17	259	138	108	55	605		120
2074	24	16	247	134	103	53	575		114
2075	20	14	235	130	98	50	547		108
2076	17	13	223	126	93	48	521		103
2077	15	12	212	122	89	45	496		98
2078	13	11	202	119	84	43	472		94
2079	11	10	192	115	80	41	450		89
2080	10	10	183	112	76	39	429		85
2081	8	9	174	108	73	37	409		81
2082	7	8	165	105	69	35	390		77
2083	6	8	157	102	66	34	372		74
2084	5	7	150	99	63	32	355		70
2085	5	6	142	96	60	30	339		67
2086	4	6	135	93	57	29	324		64
2087	3	5	129	91	54	27	309		61
2088	3	5	122	88	51	26	296		59
2089	2	5	116	85	49	25	282		56
2090	2	4	111	83	46	24	270		54
2091	2	4	105	80	44	22	258		51
2092	2	4	100	78	42	21	247		49
2093	1	3	95	76	40	20	236		47
2094	1	3	91	73	38	19	226		45
2095	1	3	86	71	36	18	216		43
2096	1	3	82	69	34	17	207		41
2097	1	2	78	67	33	17	198		39
2098	1	2	74	65	31	16	189		38

Year — LFG Generation Magnitude for the Hartland Landfill (CRD) - Sc. 1 Cell 5



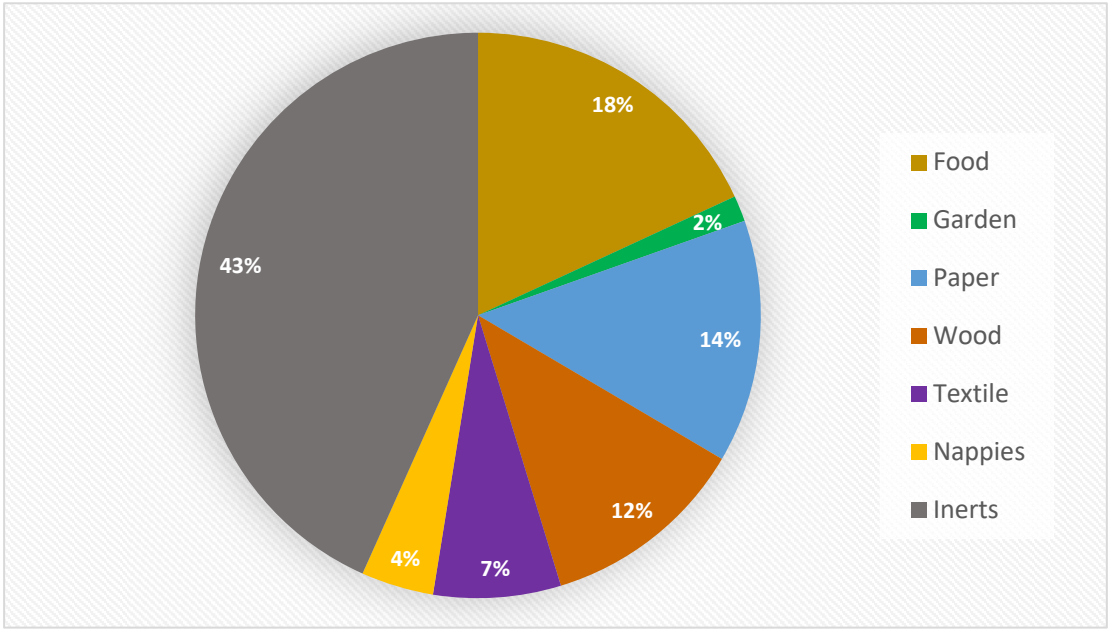
Year	Methane generation estimates for the Hartland Landfill (CRD) - Sc. 1 Cell 5							Methane Generation Potential	Total LFG Flow Rate Estimated
	Food (tonnes)	Garden (tonnes)	Paper (tonnes)	Wood (tonnes)	Textile (tonnes)	Nappies (tonnes)	Total (tonnes)	(L_o, m^3/tonne)	(scfm)
2099	1	2	71	63	30	15	181		36
2100	0	2	67	61	28	14	173		34
2101	0	2	64	59	27	14	166		33
2102	0	2	61	58	25	13	159		32
2103	0	2	58	56	24	12	152		30
2104	0	1	55	54	23	12	146		29
2105	0	1	52	53	22	11	140		28
2106	0	1	50	51	21	11	134		27
2107	0	1	47	50	20	10	128		25
2108	0	1	45	48	19	10	123		24
2109	0	1	43	47	18	9	118		23
2110	0	1	41	45	17	9	113		22
2111	0	1	39	44	16	8	108		21
2112	0	1	37	43	15	8	104		21
2113	0	1	35	41	15	7	99		20
2114	0	1	33	40	14	7	95		19
2115	0	1	32	39	13	7	91		18
2116	0	1	30	38	13	6	88		17
2117	0	0	29	37	12	6	84		17
2118	0	0	27	36	11	6	81		16
2119	0	0	26	35	11	6	78		15
2120	0	0	25	34	10	5	74		15
2121	0	0	24	33	10	5	71		14
2122	0	0	22	32	9	5	69		14
2123	0	0	21	31	9	5	66		13
2124	0	0	20	30	8	4	63		13
2125	0	0	19	29	8	4	61		12
2126	0	0	18	28	8	4	58		12
2127	0	0	17	27	7	4	56		11
2128	0	0	17	26	7	4	54		11
2129	0	0	16	26	7	3	52		10
2130	0	0	15	25	6	3	50		10
2131	0	0	14	24	6	3	48		9
2132	0	0	14	23	6	3	46		9
2133	0	0	13	23	5	3	44		9
2134	0	0	12	22	5	3	42		8
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2136	0	0	11	21	5	2	39		8
2137	0	0	11	20	4	2	38		7
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2139	0	0	10	19	4	2	35		7
2140	0	0	9	18	4	2	33		7
2141	0	0	9	18	4	2	32		6
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2147	0	0	6	15	3	1	25		5
2148	0	0	6	15	3	1	25		5
2149	0	0	6	14	2	1	24		5
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2154	0	0	5	12	2	1	20		4
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2156	0	0	4	11	2	1	18		4
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2161	0	0	3	10	1	1	15		3
2162	0	0	3	10	1	1	14		3
2163	0	0	3	9	1	1	14		3
2164	0	0	3	9	1	1	13		3
2165	0	0	3	9	1	1	13		3
2166	0	0	2	8	1	1	13		2
2167	0	0	2	8	1	1	12		2
2168	0	0	2	8	1	0	12		2
2169	0	0	2	8	1	0	11		2
2170	0	0	2	8	1	0	11		2
2171	0	0	2	7	1	0	10		2
2172	0	0	2	7	1	0	10		2
2173	0	0	2	7	1	0	10		2
2174	0	0	2	7	1	0	9		2
2175	0	0	2	6	1	0	9		2
2176	0	0	2	6	1	0	9		2
2177	0	0	1	6	1	0	8		2

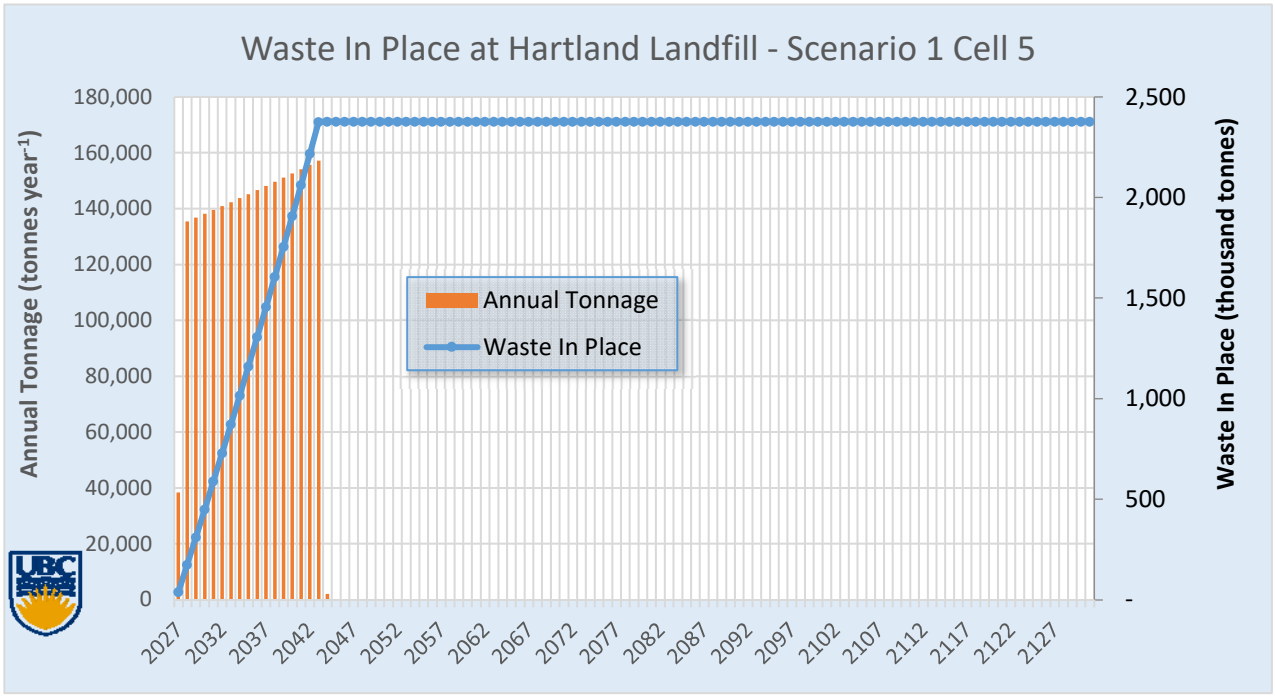
Year	LFG Generation Magnitude for the Hartland Landfill (CRD) - Sc. 1 Cell 5
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Hartland Landfill (CRD) - Sc. 1 Cell 5

Landfill Gas Generation Analysis **GRAPHICAL RESULTS**

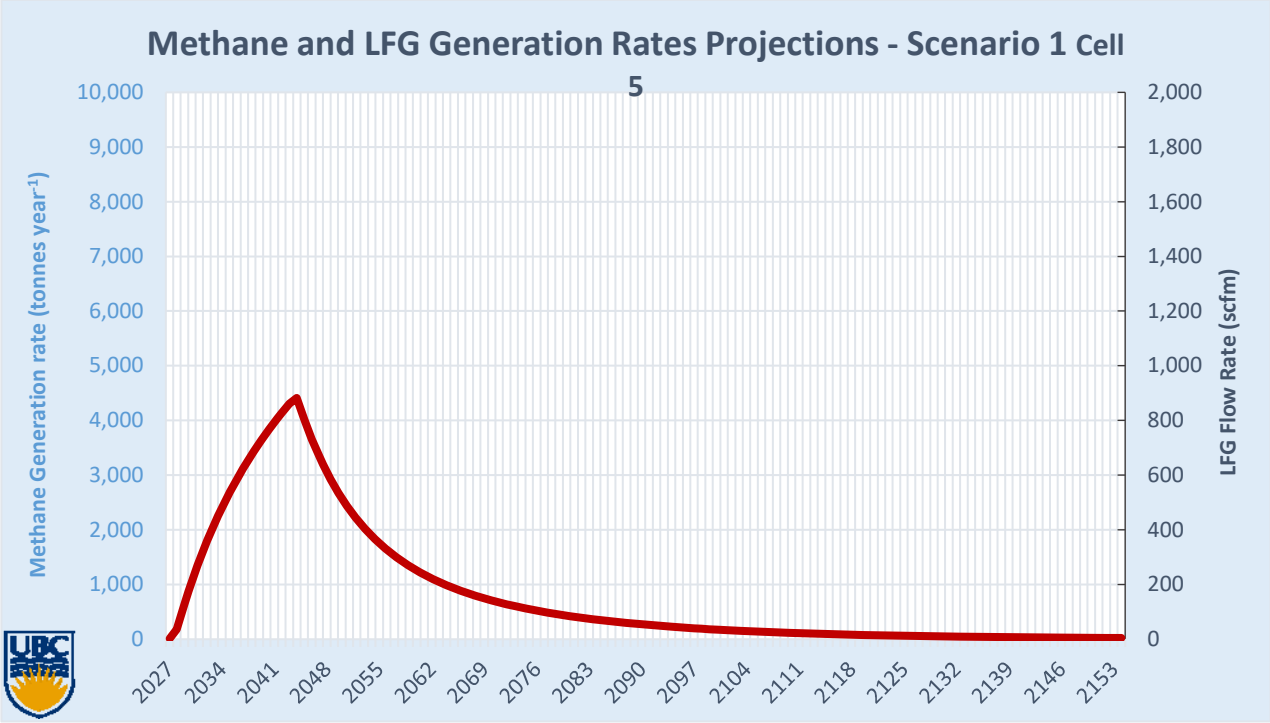
Average Deposited Waste Composition

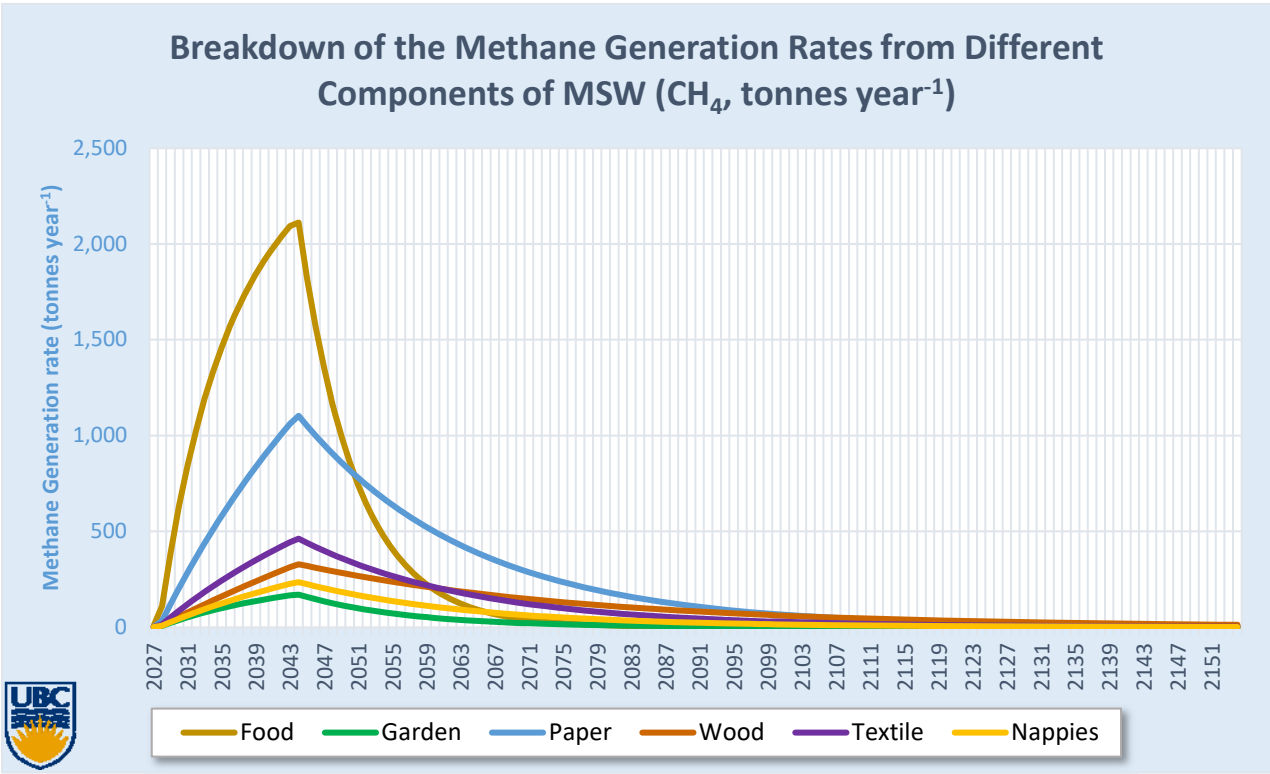




Hartland Landfill (CRD) - Sc. 1 Cell 5

Landfill Gas Generation Analysis **GRAPHICAL RESULTS**





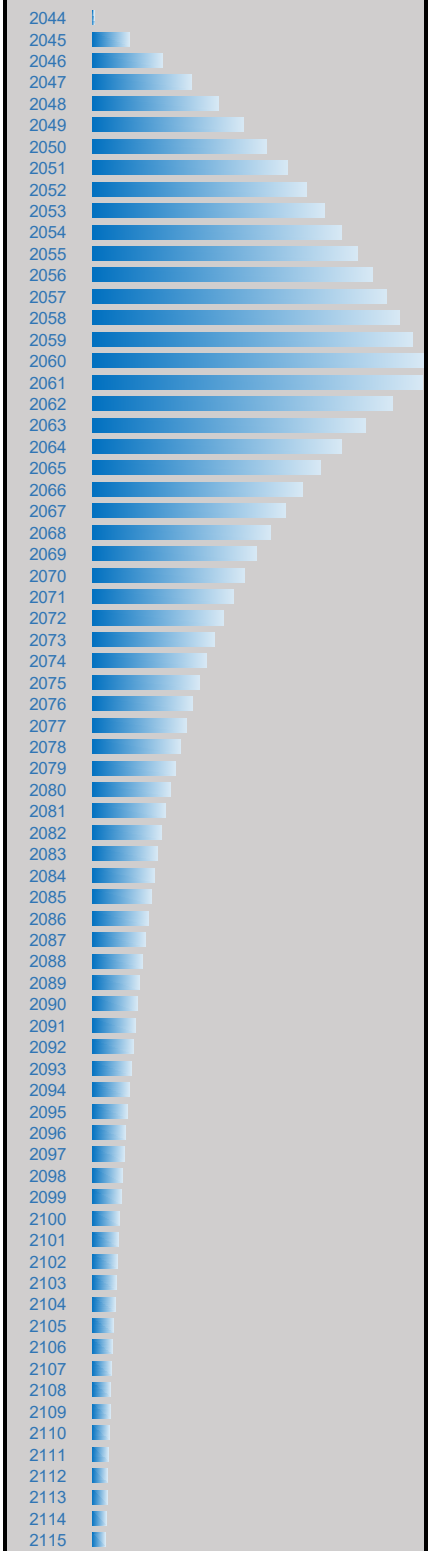
Methane Generation Estimates from the Hartland Landfill (CRD) - Sc.1 Cell 6

Actual CH_4 Yields

L_o (m^3/tonne)	127	158	143	72	114	103	66.3

Year	Methane generation estimates for the Hartland Landfill (CRD) - Sc.1 Cell 6							Methane Generation Potential	Total LFG Flow Rate Estimated
	Food (tonnes)	Garden (tonnes)	Paper (tonnes)	Wood (tonnes)	Textile (tonnes)	Nappies (tonnes)	Total (tonnes)	(L_o, m^3/tonne)	(scfm)
2044	30	2	9	2	4	2	49	66.4	10
2045	367	21	112	29	47	24	600	66.4	119
2046	665	39	212	56	89	45	1,105	66.4	219
2047	924	56	308	82	129	66	1,565	66.4	310
2048	1,151	71	401	108	168	86	1,985	66.4	394
2049	1,350	86	490	133	205	105	2,369	66.4	470
2050	1,525	100	576	158	241	123	2,723	66.4	540
2051	1,679	113	659	182	276	141	3,049	66.4	605
2052	1,815	125	739	206	309	158	3,352	66.4	665
2053	1,936	137	817	229	342	174	3,634	66.4	721
2054	2,044	147	891	252	373	190	3,897	66.4	773
2055	2,140	157	963	275	403	205	4,144	66.4	822
2056	2,227	167	1,033	297	432	220	4,377	66.4	868
2057	2,306	176	1,100	319	460	235	4,597	66.4	912
2058	2,378	185	1,166	341	488	249	4,805	66.4	953
2059	2,443	193	1,229	362	514	262	5,004	66.4	992
2060	2,495	200	1,288	382	539	275	5,179	66.4	1,027
2061	2,425	200	1,310	393	548	279	5,156		1,023
2062	2,088	185	1,246	381	521	266	4,687		930
2063	1,797	171	1,185	370	496	253	4,272		847
2064	1,547	158	1,127	359	472	240	3,903		774
2065	1,331	146	1,072	349	449	229	3,575		709
2066	1,146	134	1,020	338	427	217	3,283		651
2067	986	124	970	328	406	207	3,022		599
2068	849	115	923	319	386	197	2,788		553
2069	731	106	878	309	367	187	2,578		511
2070	629	98	835	300	349	178	2,389		474
2071	541	90	795	291	332	169	2,219		440
2072	466	83	756	283	316	161	2,065		409
2073	401	77	719	274	301	153	1,925		382
2074	345	71	684	266	286	146	1,798		357
2075	297	65	650	258	272	139	1,682		334
2076	256	60	619	251	259	132	1,576		313
2077	220	56	589	243	246	125	1,479		293
2078	189	51	560	236	234	119	1,390		276
2079	163	48	533	229	223	114	1,308		260
2080	140	44	507	222	212	108	1,233		245
2081	121	40	482	216	202	103	1,163		231
2082	104	37	458	209	192	98	1,098		218
2083	89	34	436	203	182	93	1,038		206
2084	77	32	415	197	174	88	983		195
2085	66	29	395	191	165	84	931		185
2086	57	27	375	186	157	80	882		175
2087	49	25	357	180	149	76	837		166
2088	42	23	340	175	142	72	794		158
2089	36	21	323	170	135	69	754		150
2090	31	20	307	165	129	66	717		142
2091	27	18	292	160	122	62	682		135
2092	23	17	278	155	116	59	649		129
2093	20	15	264	150	111	56	617		122
2094	17	14	252	146	105	54	588		117
2095	15	13	239	142	100	51	560		111
2096	13	12	228	138	95	49	534		106
2097	11	11	217	133	91	46	509		101
2098	9	10	206	130	86	44	485		96
2099	8	10	196	126	82	42	463		92
2100	7	9	186	122	78	40	442		88
2101	6	8	177	118	74	38	422		84
2102	5	8	169	115	71	36	403		80
2103	4	7	160	111	67	34	385		76
2104	4	6	153	108	64	33	367		73
2105	3	6	145	105	61	31	351		70
2106	3	5	138	102	58	29	335		67
2107	2	5	131	99	55	28	321		64
2108	2	5	125	96	52	27	307		61
2109	2	4	119	93	50	25	293		58
2110	2	4	113	90	47	24	280		56
2111	1	4	108	88	45	23	268		53
2112	1	3	102	85	43	22	257		51
2113	1	3	97	83	41	21	245		49
2114	1	3	93	80	39	20	235		47
2115	1	3	88	78	37	19	225		45

Year — LFG Generation Magnitude for the Hartland Landfill (CRD) - Sc.1 Cell 6



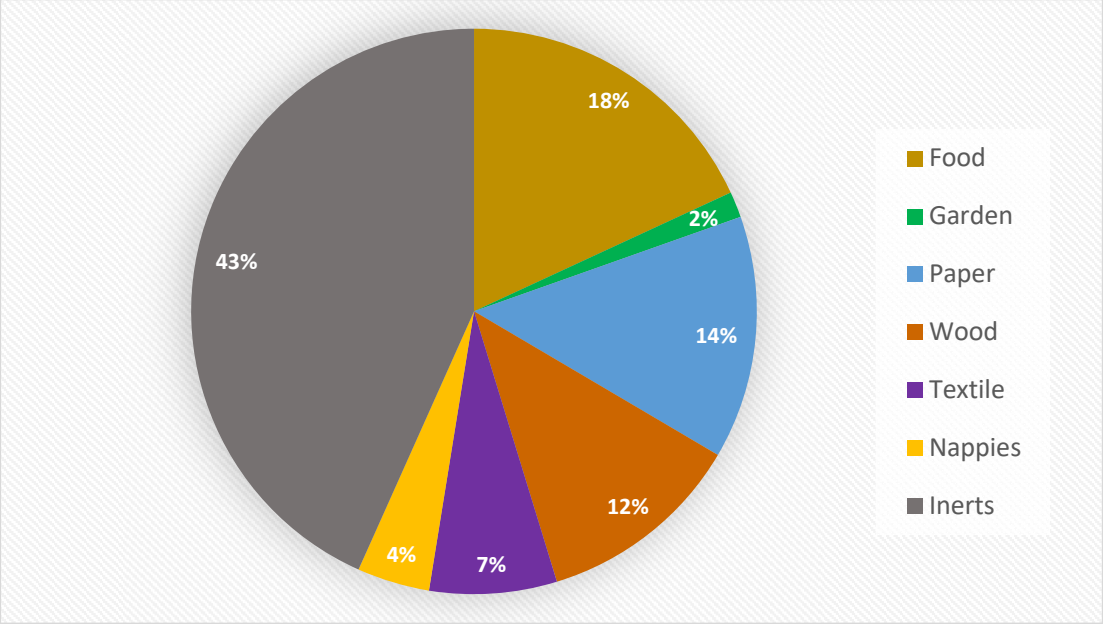
Year	Methane generation estimates for the Hartland Landfill (CRD) - Sc.1 Cell 6							Methane Generation Potential	Total LFG Flow Rate Estimated
	Food (tonnes)	Garden (tonnes)	Paper (tonnes)	Wood (tonnes)	Textile (tonnes)	Nappies (tonnes)	Total (tonnes)	(L_o, m^3/tonne)	(scfm)
2116	1	2	84	75	35	18	215		43
2117	1	2	80	73	33	17	206		41
2118	0	2	76	71	32	16	197		39
2119	0	2	72	69	30	15	189		37
2120	0	2	69	67	29	15	181		36
2121	0	2	65	65	27	14	173		34
2122	0	2	62	63	26	13	166		33
2123	0	1	59	61	25	13	159		32
2124	0	1	56	59	23	12	152		30
2125	0	1	53	58	22	11	146		29
2126	0	1	51	56	21	11	140		28
2127	0	1	48	54	20	10	134		27
2128	0	1	46	53	19	10	129		26
2129	0	1	44	51	18	9	123		24
2130	0	1	42	50	17	9	118		23
2131	0	1	40	48	17	8	113		23
2132	0	1	38	47	16	8	109		22
2133	0	1	36	45	15	8	104		21
2134	0	1	34	44	14	7	100		20
2135	0	1	32	43	14	7	96		19
2136	0	0	31	41	13	7	92		18
2137	0	0	29	40	12	6	88		18
2138	0	0	28	39	12	6	85		17
2139	0	0	27	38	11	6	82		16
2140	0	0	25	37	11	5	78		16
2141	0	0	24	36	10	5	75		15
2142	0	0	23	35	10	5	72		14
2143	0	0	22	34	9	5	69		14
2144	0	0	21	33	9	4	67		13
2145	0	0	20	32	8	4	64		13
2146	0	0	19	31	8	4	61		12
2147	0	0	18	30	7	4	59		12
2148	0	0	17	29	7	4	57		11
2149	0	0	16	28	7	3	54		11
2150	0	0	15	27	6	3	52		10
2151	0	0	15	26	6	3	50		10
2152	0	0	14	26	6	3	48		10
2153	0	0	13	25	6	3	46		9
2154	0	0	13	24	5	3	45		9
2155	0	0	12	23	5	3	43		9
2156	0	0	11	23	5	2	41		8
2157	0	0	11	22	5	2	40		8
2158	0	0	10	21	4	2	38		8
2159	0	0	10	21	4	2	37		7
2160	0	0	9	20	4	2	35		7
2161	0	0	9	20	4	2	34		7
2162	0	0	8	19	4	2	33		6
2163	0	0	8	18	3	2	32		6
2164	0	0	8	18	3	2	30		6
2165	0	0	7	17	3	2	29		6
2166	0	0	7	17	3	1	28		6
2167	0	0	7	16	3	1	27		5
2168	0	0	6	16	3	1	26		5
2169	0	0	6	15	2	1	25		5
2170	0	0	6	15	2	1	24		5
2171	0	0	5	14	2	1	23		5
2172	0	0	5	14	2	1	22		4
2173	0	0	5	14	2	1	22		4
2174	0	0	5	13	2	1	21		4
2175	0	0	4	13	2	1	20		4
2176	0	0	4	12	2	1	19		4
2177	0	0	4	12	2	1	19		4
2178	0	0	4	12	2	1	18		4
2179	0	0	4	11	2	1	17		3
2180	0	0	3	11	1	1	17		3
2181	0	0	3	11	1	1	16		3
2182	0	0	3	10	1	1	15		3
2183	0	0	3	10	1	1	15		3
2184	0	0	3	10	1	1	14		3
2185	0	0	3	10	1	1	14		3
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2189	0	0	2	8	1	0	12		2
2190	0	0	2	8	1	0	12		2
2191	0	0	2	8	1	0	11		2
2192	0	0	2	8	1	0	11		2
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2194	0	0	2	7	1	0	10		2

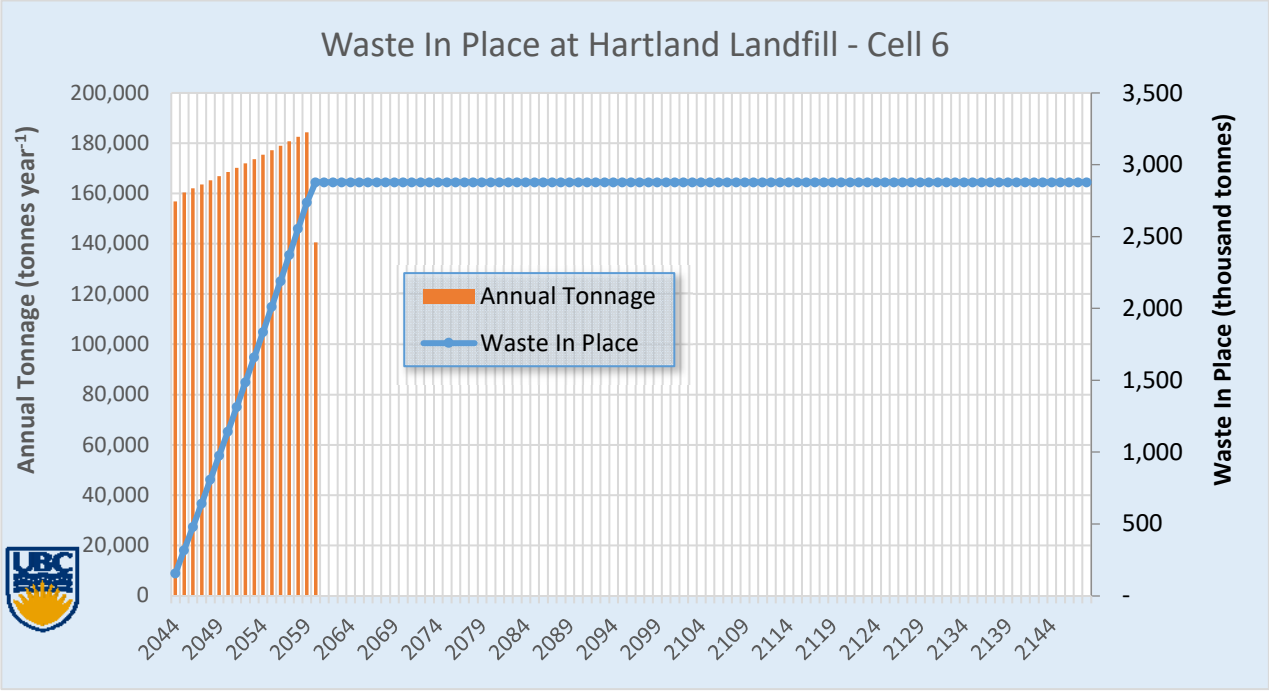
Year	LFG Generation Magnitude for the Hartland Landfill (CRD) - Sc.1 Cell 6
2116	
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Hartland Landfill (CRD) - Sc.1 Cell 6

Landfill Gas Generation Analysis **GRAPHICAL RESULTS**

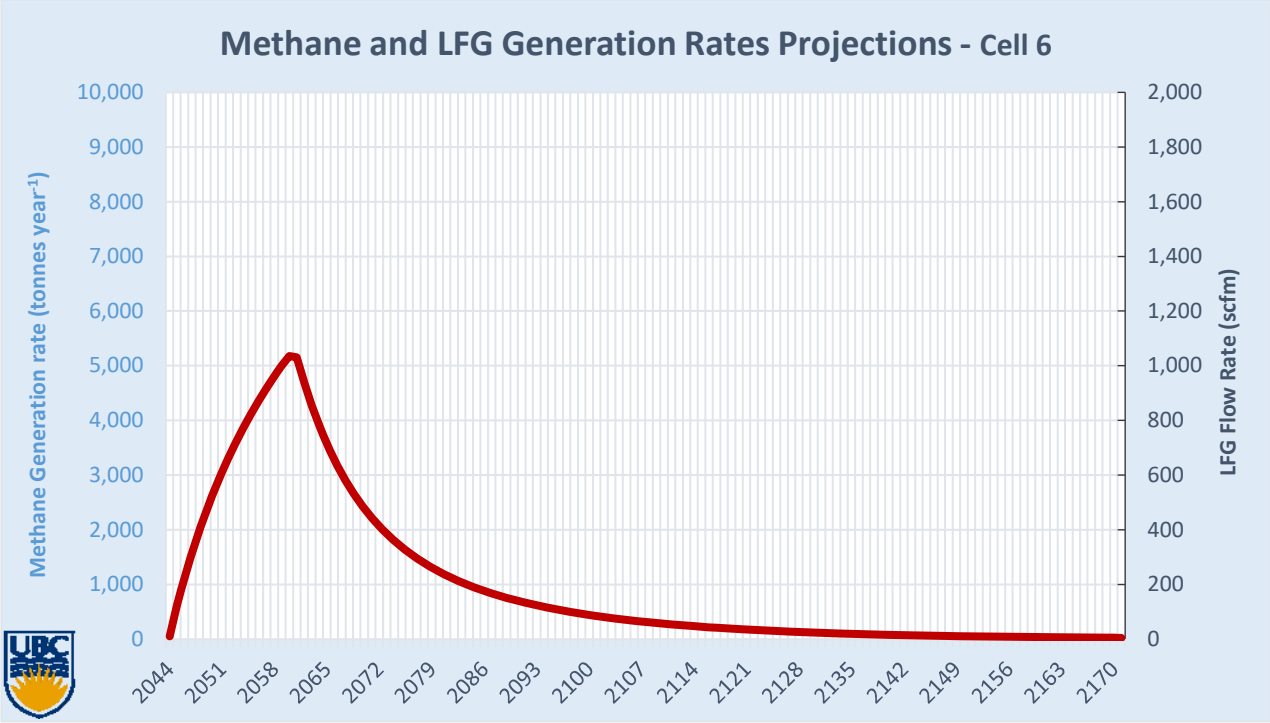
Average Deposited Waste Composition

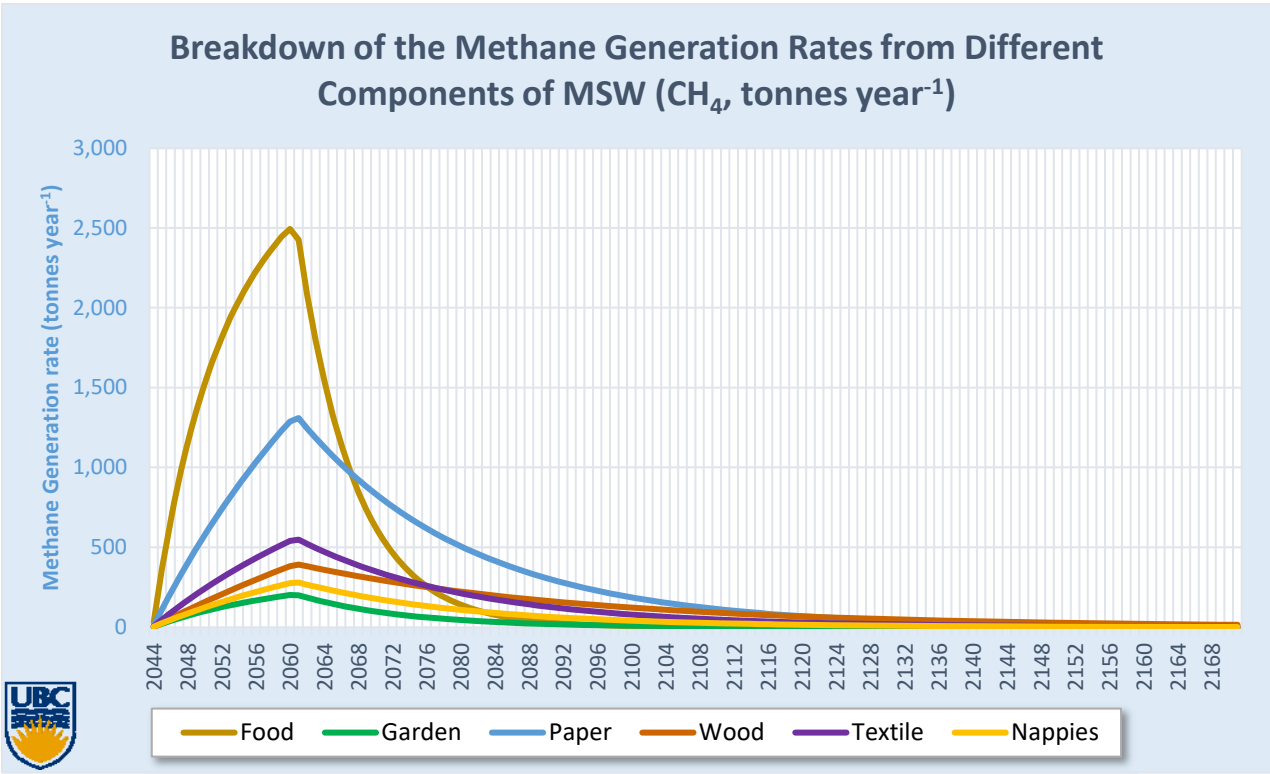




Hartland Landfill (CRD) - Sc.1 Cell 6

Landfill Gas Generation Analysis **GRAPHICAL RESULTS**





APPENDIX C.3

Scenario 2 (Mid Term Diversion Targets)

Methane Generation Estimates from the Hartland Landfill (CRD) - Sc. 2 Lifespan

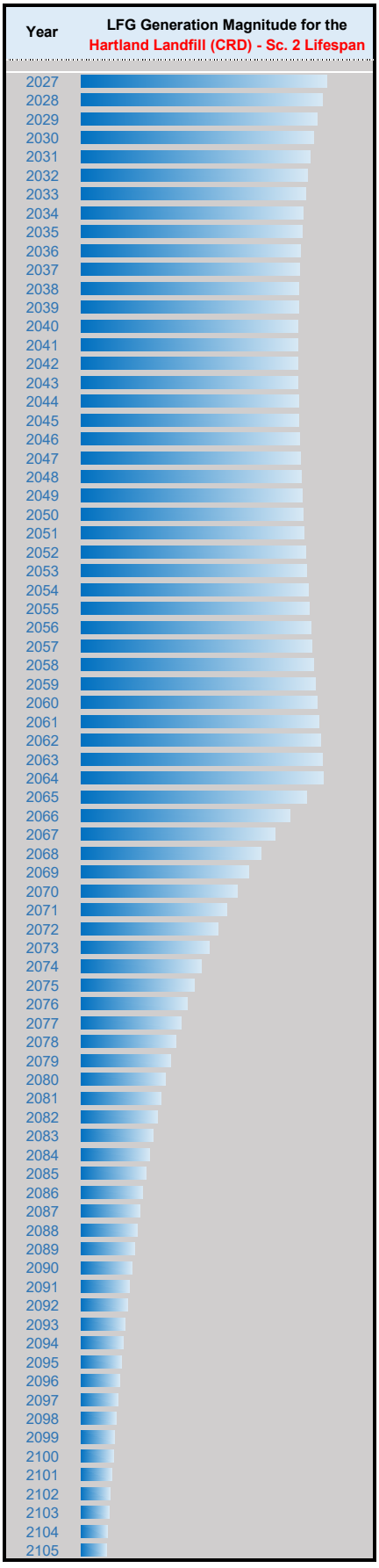
Actual CH_4 Yields

L_o (m^3/tonne)	127	157	140	66	111	100	67.8

Year	Methane generation estimates for the Hartland Landfill (CRD) - Sc. 2 Lifespan							Methane Generation Potential	Total LFG Flow Rate Estimated
	Food	Garden	Paper	Wood	Textile	Nappies	Total		
	(tonnes)	(tonnes)	(tonnes)	(tonnes)	(tonnes)	(tonnes)	(tonnes)	(L_o, m^3/tonne)	(scfm)
1955	5	1	1	0	0	0	9	78.7	2
1956	65	12	18	5	5	3	109	78.7	22
1957	120	23	36	9	10	6	204	78.7	41
1958	172	35	53	13	15	10	297	78.7	59
1959	221	46	71	18	20	13	388	78.7	77
1960	267	57	89	23	26	16	478	78.7	95
1961	313	68	108	28	31	20	568	78.7	113
1962	357	79	128	33	37	23	657	78.7	130
1963	401	91	148	39	42	27	748	78.7	148
1964	445	103	169	45	48	31	840	78.7	167
1965	489	115	191	51	54	35	934	78.7	185
1966	534	128	213	57	61	39	1,031	78.7	205
1967	580	141	237	64	68	43	1,132	78.7	224
1968	628	154	261	71	75	47	1,236	78.7	245
1969	677	168	287	78	82	52	1,344	78.7	267
1970	728	183	314	86	90	57	1,457	78.7	289
1971	782	198	342	94	98	62	1,576	78.7	313
1972	838	214	372	103	106	67	1,701	78.7	337
1973	897	231	404	112	115	73	1,832	78.7	363
1974	959	248	437	122	125	79	1,970	78.7	391
1975	1,025	267	472	132	135	85	2,116	78.7	420
1976	1,095	286	509	143	145	92	2,270	78.7	450
1977	1,168	307	547	154	156	99	2,433	78.7	483
1978	1,246	329	589	167	168	107	2,605	78.7	517
1979	1,329	352	632	179	181	115	2,788	78.7	553
1980	1,417	377	678	193	194	123	2,982	78.7	592
1981	1,511	403	727	208	208	132	3,188	78.7	632
1982	1,610	430	779	223	223	141	3,407	78.7	676
1983	1,716	460	834	239	238	151	3,639	78.7	722
1984	1,828	491	893	257	255	162	3,885	78.7	771
1985	1,948	524	954	275	273	173	4,147	78.7	823
1986	2,076	559	1,021	295	292	185	4,427	78.7	878
1987	2,226	599	1,094	317	313	198	4,747	78.7	942
1988	2,380	641	1,172	340	335	212	5,080	78.7	1,008
1989	2,530	682	1,250	363	357	227	5,409	78.7	1,073
1990	2,669	723	1,328	386	380	241	5,726	78.7	1,136
1991	2,783	759	1,400	409	400	254	6,004	78.7	1,191
1992	2,850	787	1,460	428	417	265	6,207	78.7	1,231
1993	2,875	806	1,508	445	431	273	6,339	78.7	1,257
1994	2,889	822	1,551	461	443	281	6,448	78.7	1,279
1995	2,895	836	1,591	476	455	288	6,540	78.7	1,297
1996	2,908	851	1,631	490	466	295	6,641	78.7	1,317
1997	2,911	862	1,666	504	476	302	6,722	78.7	1,333
1998	2,892	869	1,694	516	484	307	6,763	78.7	1,341
1999	2,849	870	1,713	526	489	310	6,758	78.7	1,340
2000	2,812	871	1,731	536	495	314	6,758	78.7	1,340
2001	2,776	872	1,746	544	499	316	6,754	78.7	1,340
2002	2,744	872	1,761	553	503	319	6,752	78.7	1,339
2003	2,734	875	1,780	563	509	323	6,784	78.7	1,345
2004	2,730	879	1,800	572	514	326	6,822	78.7	1,353
2005	2,745	886	1,823	583	521	330	6,888	78.7	1,366
2006	2,776	896	1,851	594	529	335	6,982	78.7	1,385
2007	2,808	906	1,879	606	537	340	7,077	78.7	1,404
2008	2,846	918	1,908	618	545	346	7,180	78.7	1,424
2009	2,852	923	1,929	628	551	349	7,232	78.7	1,434
2010	2,852	927	1,946	637	556	353	7,271	78.7	1,442
2011	2,827	926	1,957	644	559	355	7,268	78.7	1,442
2012	2,787	922	1,961	649	560	355	7,235	78.7	1,435
2013	2,734	915	1,960	653	560	355	7,177	78.7	1,424
2014	2,672	903	1,954	657	559	354	7,099	75.9	1,408
2015	2,593	870	1,946	663	558	352	6,983	75.9	1,385
2016	2,513	837	1,935	669	557	349	6,860	72.5	1,361
2017	2,480	790	1,939	682	561	348	6,801	72.5	1,349
2018	2,473	749	1,950	698	567	348	6,786	72.5	1,346
2019	2,472	710	1,962	714	574	349	6,781	72.5	1,345
2020	2,474	675	1,975	729	581	349	6,783	72.5	1,345
2021	2,477	643	1,987	744	587	349	6,788	70.5	1,346
2022	2,456	612	1,990	754	594	350	6,756	68.4	1,340
2023	2,415	581	1,985	758	600	351	6,691	66.4	1,327
2024	2,355	552	1,972	757	607	352	6,595	62.5	1,308
2025	2,264	523	1,946	757	613	353	6,457	58.5	1,281
2026	2,153	495	1,909	756	619	355	6,287	58.5	1,247

Year	LFG Generation Magnitude for the Hartland Landfill (CRD) - Sc. 2 Lifespan
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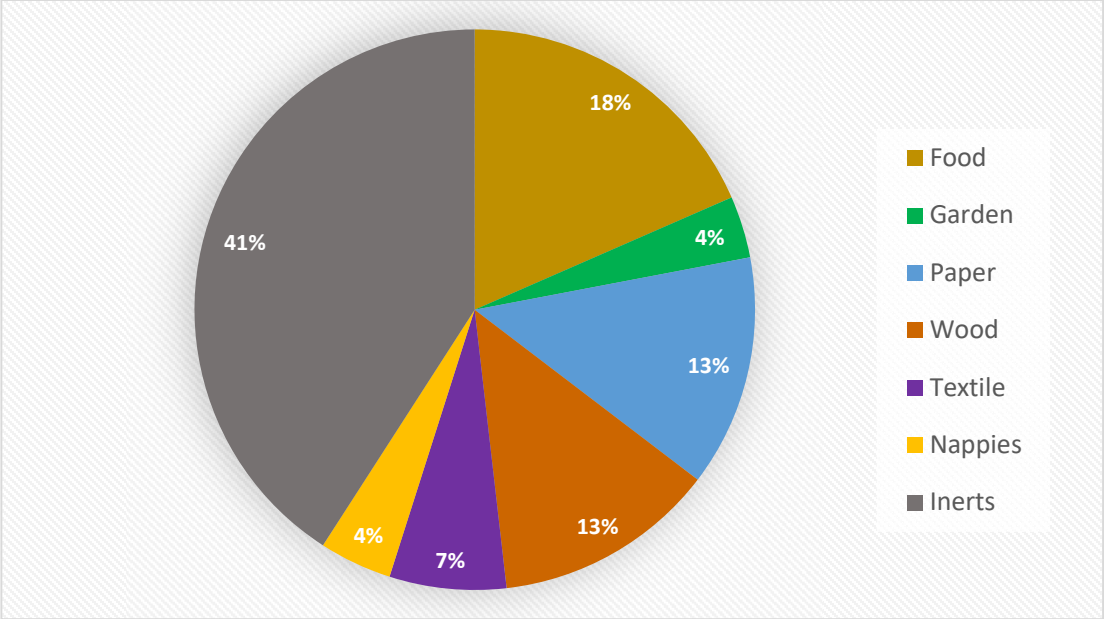
Year	Methane generation estimates for the Hartland Landfill (CRD) - Sc. 2 Lifespan							Methane Generation Potential	Total LFG Flow Rate Estimated
	Food (tonnes)	Garden (tonnes)	Paper (tonnes)	Wood (tonnes)	Textile (tonnes)	Nappies (tonnes)	Total (tonnes)	(L_o, m^3/tonne)	(scfm)
2027	2,059	468	1,875	755	626	356	6,139	58.5	1,218
2028	1,981	444	1,843	755	632	357	6,012	58.5	1,192
2029	1,915	422	1,813	754	639	359	5,902	58.5	1,171
2030	1,861	401	1,785	754	645	361	5,808	58.5	1,152
2031	1,816	383	1,760	754	652	363	5,727	58.5	1,136
2032	1,780	366	1,736	755	658	364	5,659	58.5	1,122
2033	1,750	350	1,714	755	665	366	5,601	58.5	1,111
2034	1,728	335	1,693	756	672	369	5,553	58.5	1,101
2035	1,710	322	1,674	757	679	371	5,514	58.5	1,094
2036	1,697	310	1,657	759	686	373	5,482	58.5	1,087
2037	1,689	299	1,641	760	693	375	5,458	58.5	1,082
2038	1,683	289	1,627	762	700	378	5,439	58.5	1,079
2039	1,681	280	1,614	764	707	381	5,426	58.5	1,076
2040	1,682	272	1,602	766	714	383	5,419	58.5	1,075
2041	1,684	265	1,592	768	721	386	5,416	58.5	1,074
2042	1,689	258	1,583	770	729	389	5,417	58.5	1,074
2043	1,695	252	1,575	773	736	392	5,422	58.5	1,075
2044	1,703	246	1,568	775	743	395	5,430	58.5	1,077
2045	1,713	241	1,562	778	751	398	5,442	58.5	1,079
2046	1,723	237	1,557	782	758	401	5,457	58.5	1,082
2047	1,735	233	1,553	785	766	404	5,475	58.5	1,086
2048	1,747	229	1,549	788	774	407	5,495	58.5	1,090
2049	1,760	226	1,547	792	782	411	5,518	58.5	1,094
2050	1,774	223	1,546	796	789	414	5,542	58.5	1,099
2051	1,789	221	1,545	800	797	418	5,569	58.5	1,105
2052	1,804	219	1,545	804	805	421	5,598	58.5	1,110
2053	1,820	217	1,546	808	814	425	5,629	58.5	1,117
2054	1,836	216	1,548	812	822	428	5,662	58.5	1,123
2055	1,852	215	1,550	817	830	432	5,696	58.5	1,130
2056	1,869	214	1,553	821	838	436	5,732	58.5	1,137
2057	1,887	213	1,557	826	847	440	5,770	58.5	1,144
2058	1,905	213	1,561	831	855	444	5,809	58.5	1,152
2059	1,923	212	1,566	836	864	448	5,849	58.5	1,160
2060	1,941	212	1,571	842	873	452	5,891	58.5	1,168
2061	1,960	212	1,577	847	881	456	5,934	58.5	1,177
2062	1,979	212	1,584	853	890	460	5,978	58.5	1,186
2063	1,998	213	1,591	858	899	464	6,024	58.5	1,195
2064	1,995	212	1,592	862	904	467	6,032	58.5	1,196
2065	1,757	198	1,526	841	867	448	5,637		1,118
2066	1,512	183	1,452	816	825	426	5,213		1,034
2067	1,302	169	1,381	792	785	405	4,833		959
2068	1,120	156	1,314	768	746	385	4,490		890
2069	964	144	1,249	746	710	366	4,180		829
2070	830	133	1,189	724	675	349	3,899		773
2071	714	123	1,131	702	642	332	3,644		723
2072	615	113	1,075	682	611	315	3,411		677
2073	529	104	1,023	661	581	300	3,199		635
2074	455	96	973	642	553	285	3,005		596
2075	392	89	926	623	526	271	2,827		561
2076	337	82	880	604	500	258	2,663		528
2077	290	76	838	587	476	246	2,512		498
2078	250	70	797	569	453	234	2,372		471
2079	215	65	758	552	431	222	2,243		445
2080	185	60	721	536	410	211	2,123		421
2081	159	55	686	520	390	201	2,011		399
2082	137	51	652	505	371	191	1,907		378
2083	118	47	620	490	353	182	1,810		359
2084	102	43	590	475	335	173	1,719		341
2085	87	40	561	461	319	165	1,634		324
2086	75	37	534	448	303	157	1,554		308
2087	65	34	508	435	289	149	1,479		293
2088	56	31	483	422	275	142	1,408		279
2089	48	29	460	409	261	135	1,342		266
2090	41	27	437	397	248	128	1,279		254
2091	36	25	416	385	236	122	1,220		242
2092	31	23	396	374	225	116	1,164		231
2093	26	21	376	363	214	110	1,111		220
2094	23	19	358	352	203	105	1,061		210
2095	20	18	341	342	194	100	1,013		201
2096	17	17	324	332	184	95	968		192
2097	14	15	308	322	175	90	925		184
2098	12	14	293	312	167	86	885		175
2099	11	13	279	303	158	82	846		168
2100	9	12	265	294	151	78	809		160
2101	8	11	252	286	143	74	774		154
2102	7	10	240	277	136	70	741		147
2103	6	9	228	269	130	67	709		141
2104	5	9	217	261	123	64	679		135
2105	4	8	207	253	117	61	650		129

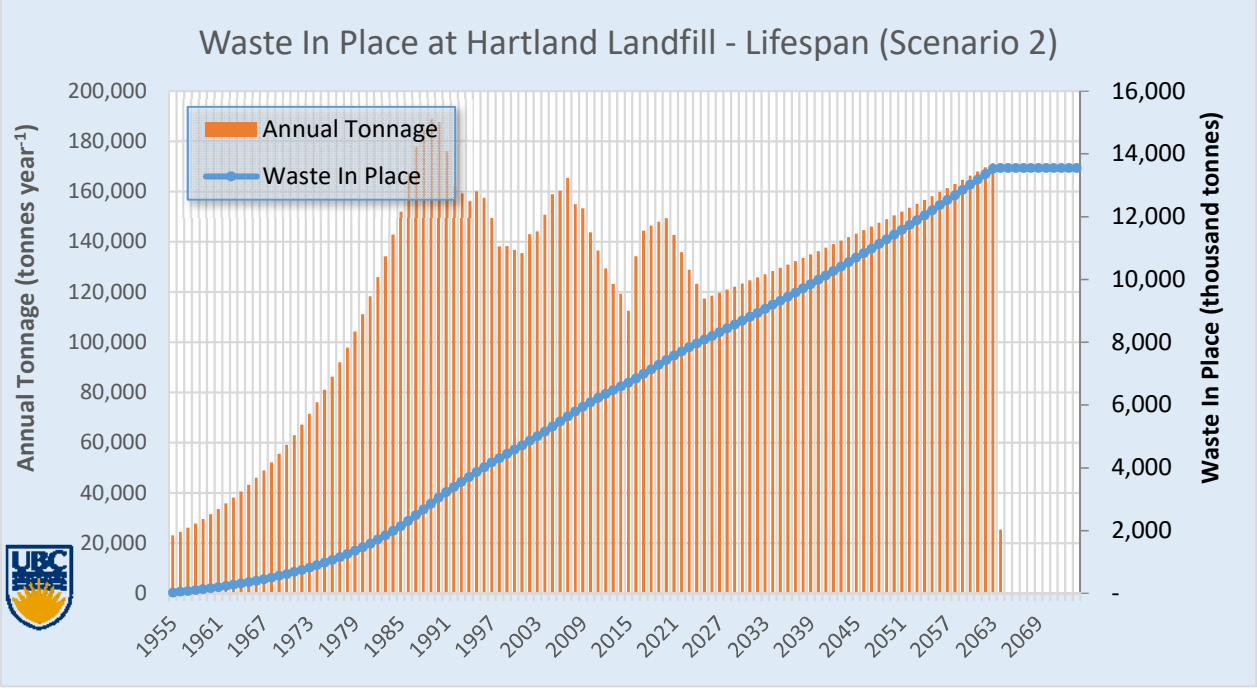


Hartland Landfill (CRD) - Sc. 2 Lifespan

Landfill Gas Generation Analysis **GRAPHICAL RESULTS**

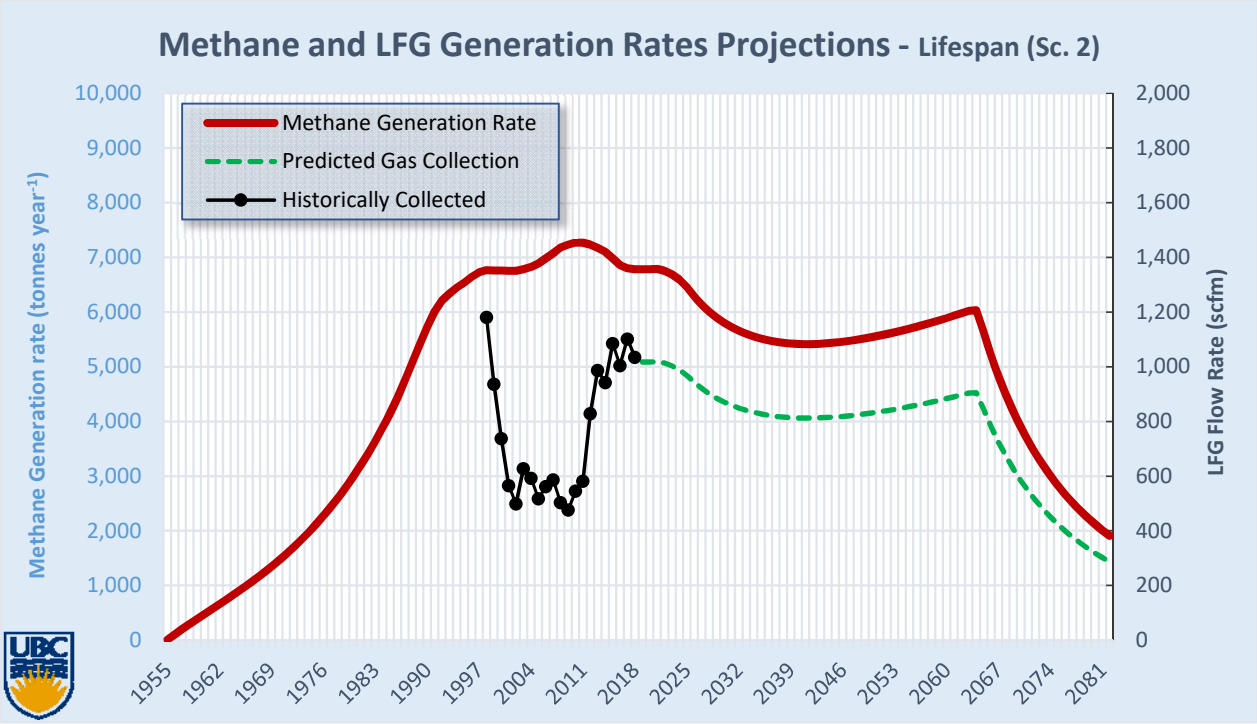
Average Deposited Waste Composition

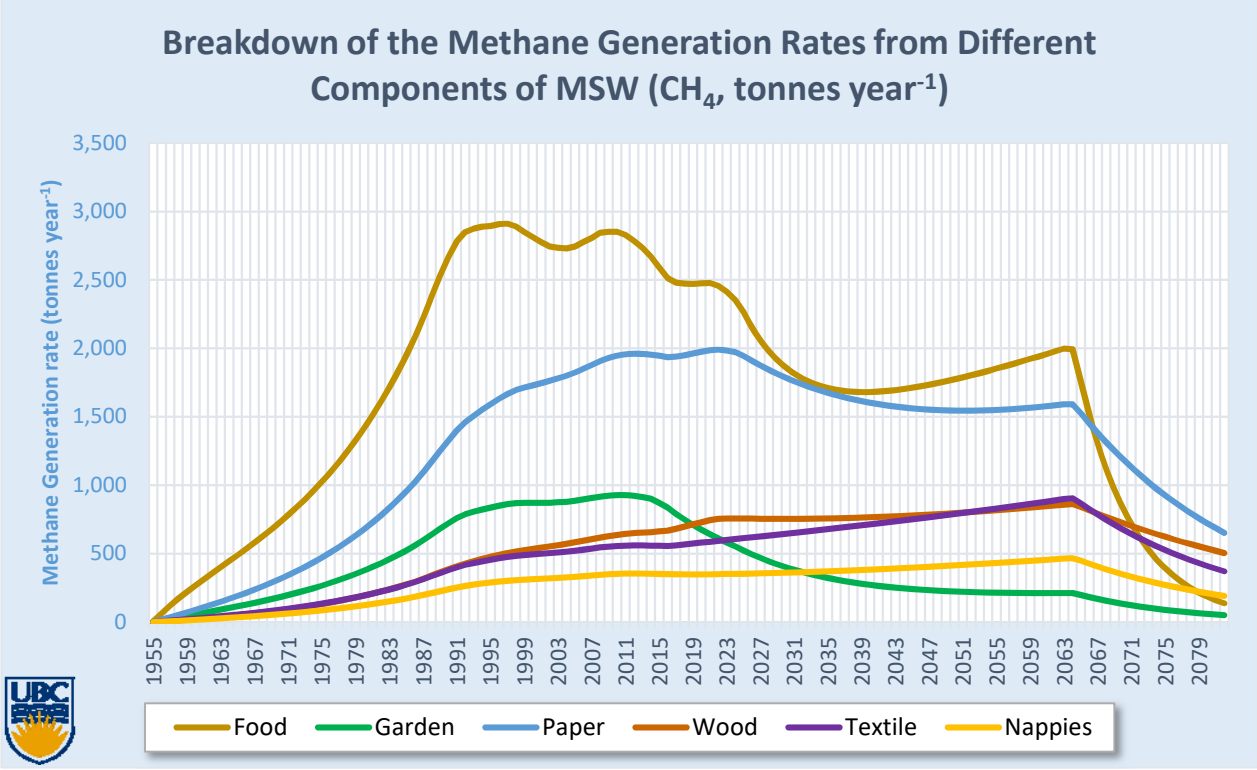




Hartland Landfill (CRD) - Sc. 2 Lifespan

Landfill Gas Generation Analysis **GRAPHICAL RESULTS**



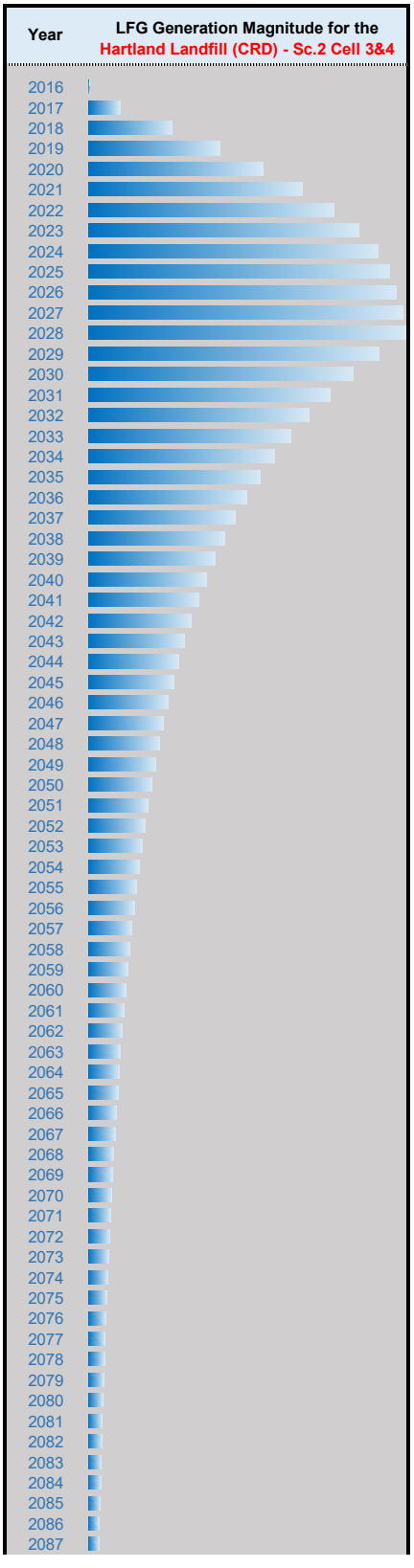


Methane Generation Estimates from the Hartland Landfill (CRD) - Sc.2 Cell 3&4

Actual CH_4 Yields

L_o (m^3/tonne)	127	158	143	72	114	103	67.2

Year	Methane generation estimates for the Hartland Landfill (CRD) - Sc.2 Cell 3&4							Methane Generation Potential	Total LFG Flow Rate Estimated
	Food (tonnes)	Garden (tonnes)	Paper (tonnes)	Wood (tonnes)	Textile (tonnes)	Nappies (tonnes)	Total (tonnes)	(L_o, m^3/tonne)	(scfm)
2016	15	1	5	2	1	1	24	72.5	5
2017	198	11	62	21	20	10	322	72.5	64
2018	509	29	165	56	53	26	838	72.5	166
2019	782	46	264	91	84	42	1,309	72.5	260
2020	1,020	62	359	125	115	58	1,738	72.5	345
2021	1,225	77	450	158	144	72	2,126	70.5	422
2022	1,379	89	528	184	172	87	2,440	68.4	484
2023	1,487	99	594	205	200	101	2,686	66.4	533
2024	1,557	107	649	221	225	114	2,873	62.5	570
2025	1,577	112	687	236	250	127	2,990	58.5	593
2026	1,562	115	712	251	274	139	3,053	58.5	606
2027	1,550	118	736	265	298	151	3,118	58.5	618
2028	1,525	120	755	277	317	161	3,155	58.5	626
2029	1,325	111	722	270	304	154	2,886		572
2030	1,140	103	687	262	289	146	2,627		521
2031	981	95	653	255	275	139	2,398		476
2032	845	88	621	247	261	133	2,195		435
2033	727	81	591	240	249	126	2,013		399
2034	626	75	562	233	237	120	1,852		367
2035	539	69	535	226	225	114	1,707		339
2036	464	64	509	219	214	108	1,577		313
2037	399	59	484	213	204	103	1,461		290
2038	343	54	460	206	194	98	1,356		269
2039	296	50	438	200	184	93	1,261		250
2040	254	46	416	194	175	89	1,175		233
2041	219	43	396	189	167	84	1,098		218
2042	188	39	377	183	159	80	1,027		204
2043	162	36	358	178	151	76	962		191
2044	140	34	341	172	143	73	903		179
2045	120	31	324	167	136	69	848		168
2046	103	29	309	162	130	66	798		158
2047	89	26	293	158	123	63	753		149
2048	77	24	279	153	117	60	710		141
2049	66	22	266	148	112	57	671		133
2050	57	21	253	144	106	54	634		126
2051	49	19	240	140	101	51	600		119
2052	42	18	229	136	96	49	569		113
2053	36	16	217	132	91	46	539		107
2054	31	15	207	128	87	44	512		102
2055	27	14	197	124	83	42	486		96
2056	23	13	187	120	79	40	462		92
2057	20	12	178	117	75	38	439		87
2058	17	11	169	113	71	36	418		83
2059	15	10	161	110	68	34	398		79
2060	13	9	153	107	64	33	379		75
2061	11	9	146	104	61	31	361		72
2062	9	8	139	100	58	30	344		68
2063	8	7	132	97	55	28	328		65
2064	7	7	125	95	53	27	313		62
2065	6	6	119	92	50	25	299		59
2066	5	6	114	89	48	24	285		57
2067	4	5	108	86	45	23	273		54
2068	4	5	103	84	43	22	260		52
2069	3	5	98	81	41	21	249		49
2070	3	4	93	79	39	20	238		47
2071	2	4	88	77	37	19	227		45
2072	2	4	84	74	35	18	217		43
2073	2	3	80	72	34	17	208		41
2074	2	3	76	70	32	16	199		39
2075	1	3	72	68	30	15	190		38
2076	1	3	69	66	29	15	182		36
2077	1	2	65	64	28	14	174		35
2078	1	2	62	62	26	13	167		33
2079	1	2	59	60	25	13	160		32
2080	1	2	56	59	24	12	153		30
2081	1	2	54	57	23	11	147		29
2082	0	2	51	55	21	11	141		28
2083	0	1	49	54	20	10	135		27
2084	0	1	46	52	19	10	129		26
2085	0	1	44	50	18	9	124		25
2086	0	1	42	49	18	9	119		24
2087	0	1	40	47	17	8	114		23



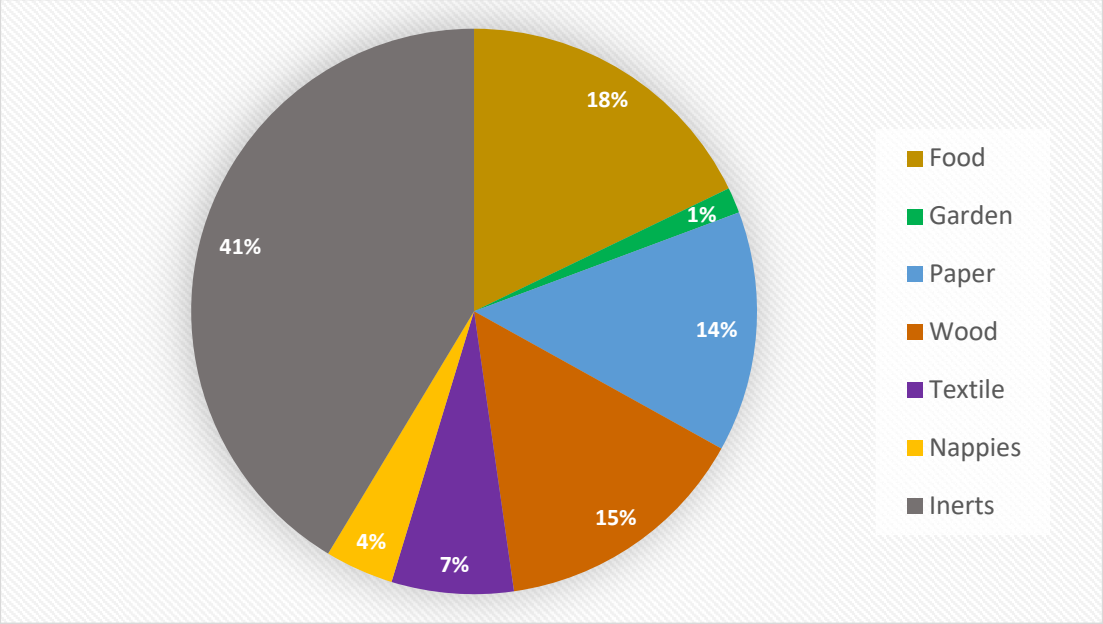
Year	Methane generation estimates for the Hartland Landfill (CRD) - Sc.2 Cell 3&4							Methane Generation Potential	Total LFG Flow Rate Estimated
	Food (tonnes)	Garden (tonnes)	Paper (tonnes)	Wood (tonnes)	Textile (tonnes)	Nappies (tonnes)	Total (tonnes)	(L_o, m^3/tonne)	(scfm)
2088	0	1	38	46	16	8	109		22
2089	0	1	36	45	15	8	104		21
2090	0	1	34	43	14	7	100		20
2091	0	1	33	42	14	7	96		19
2092	0	1	31	41	13	7	92		18
2093	0	1	29	40	12	6	88		18
2094	0	1	28	38	12	6	85		17
2095	0	1	27	37	11	6	81		16
2096	0	1	25	36	11	5	78		16
2097	0	0	24	35	10	5	75		15
2098	0	0	23	34	10	5	72		14
2099	0	0	22	33	9	5	69		14
2100	0	0	21	32	9	4	66		13
2101	0	0	20	31	8	4	64		13
2102	0	0	19	30	8	4	61		12
2103	0	0	18	29	8	4	59		12
2104	0	0	17	28	7	4	57		11
2105	0	0	16	28	7	3	54		11
2106	0	0	15	27	6	3	52		10
2107	0	0	15	26	6	3	50		10
2108	0	0	14	25	6	3	48		10
2109	0	0	13	25	6	3	46		9
2110	0	0	13	24	5	3	45		9
2111	0	0	12	23	5	3	43		8
2112	0	0	11	22	5	2	41		8
2113	0	0	11	22	5	2	40		8
2114	0	0	10	21	4	2	38		8
2115	0	0	10	20	4	2	37		7
2116	0	0	9	20	4	2	35		7
2117	0	0	9	19	4	2	34		7
2118	0	0	8	19	4	2	33		6
2119	0	0	8	18	3	2	31		6
2120	0	0	8	18	3	2	30		6
2121	0	0	7	17	3	2	29		6
2122	0	0	7	17	3	1	28		6
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2125	0	0	6	15	2	1	25		5
2126	0	0	6	15	2	1	24		5
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2139	0	0	3	10	1	1	15		3
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2142	0	0	3	9	1	1	13		3
2143	0	0	2	9	1	1	13		3
2144	0	0	2	9	1	0	12		2
2145	0	0	2	8	1	0	12		2
2146	0	0	2	8	1	0	11		2
2147	0	0	2	8	1	0	11		2
2148	0	0	2	8	1	0	11		2
2149	0	0	2	7	1	0	10		2
2150	0	0	2	7	1	0	10		2
2151	0	0	2	7	1	0	10		2
2152	0	0	2	7	1	0	9		2
2153	0	0	1	7	1	0	9		2
2154	0	0	1	6	1	0	9		2
2155	0	0	1	6	1	0	8		2
2156	0	0	1	6	1	0	8		2
2157	0	0	1	6	1	0	8		2
2158	0	0	1	6	0	0	8		1
2159	0	0	1	5	0	0	7		1
2160	0	0	1	5	0	0	7		1
2161	0	0	1	5	0	0	7		1
2162	0	0	1	5	0	0	7		1
2163	0	0	1	5	0	0	6		1
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2165	0	0	1	5	0	0	6		1
2166	0	0	1	4	0	0	6		1

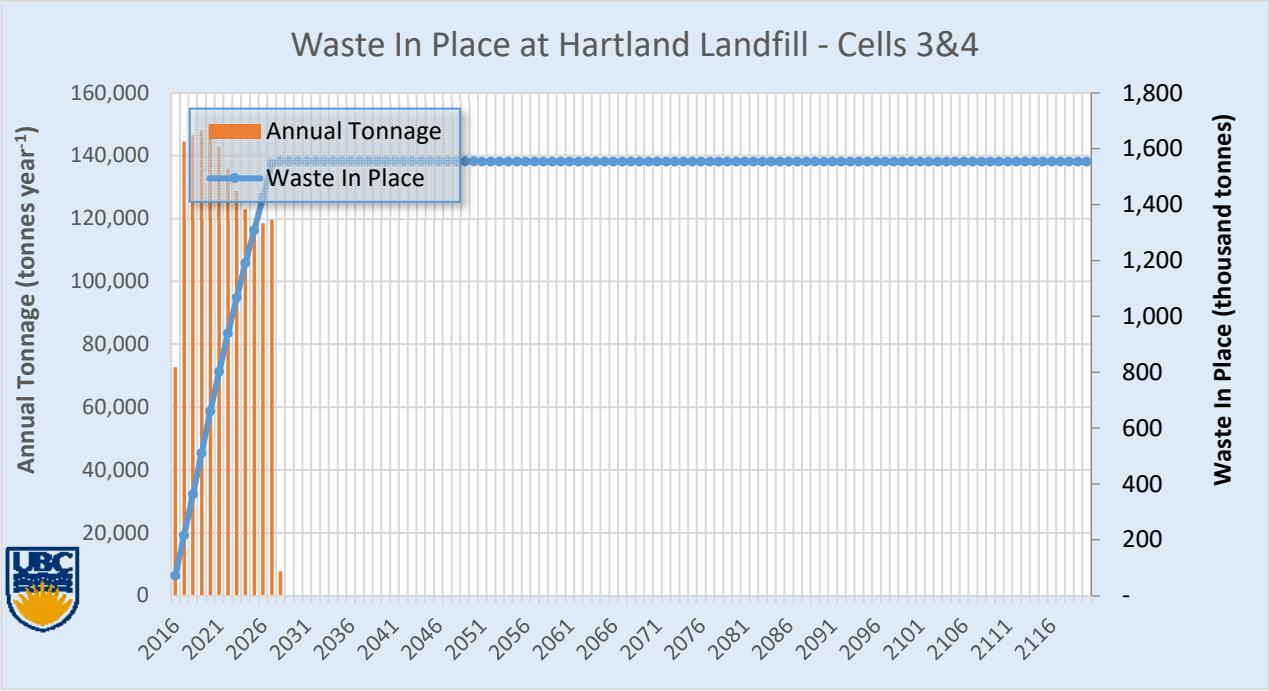
Year	LFG Generation Magnitude for the Hartland Landfill (CRD) - Sc.2 Cell 3&4
2088	
2089	
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2164	
2165	
2166	

Hartland Landfill (CRD) - Sc.2 Cell 3&4

Landfill Gas Generation Analysis **GRAPHICAL RESULTS**

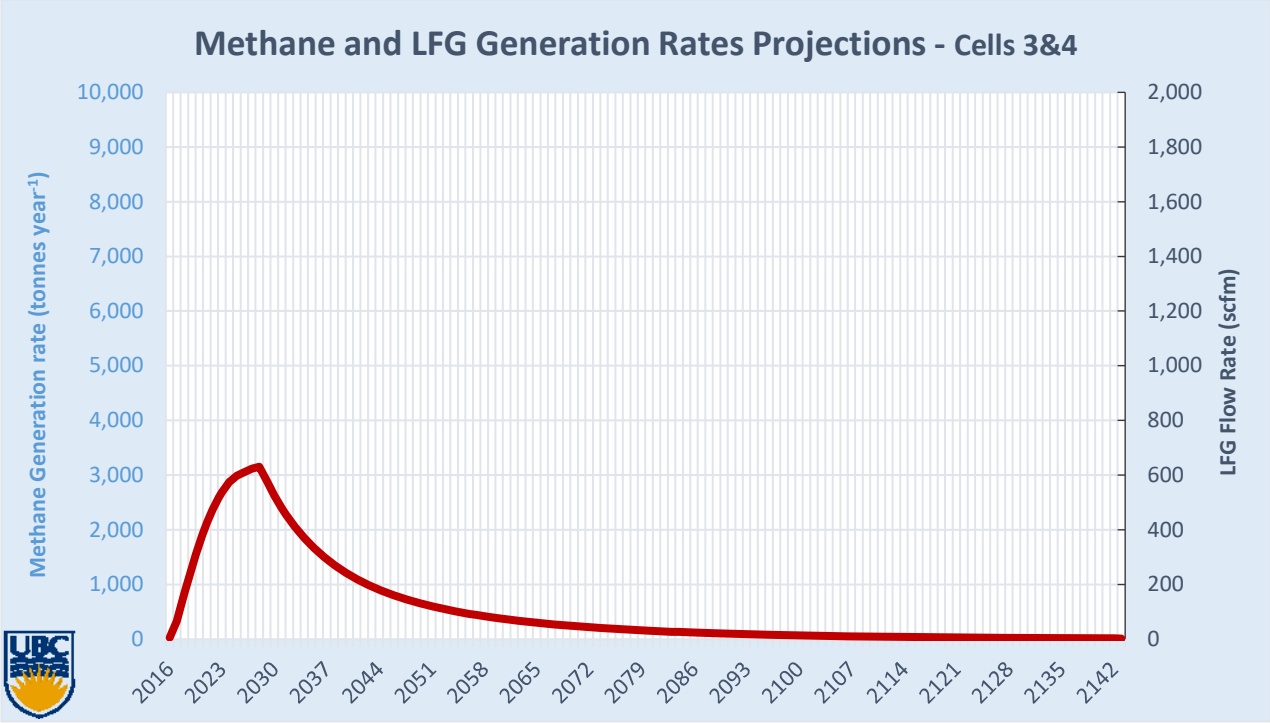
Average Deposited Waste Composition

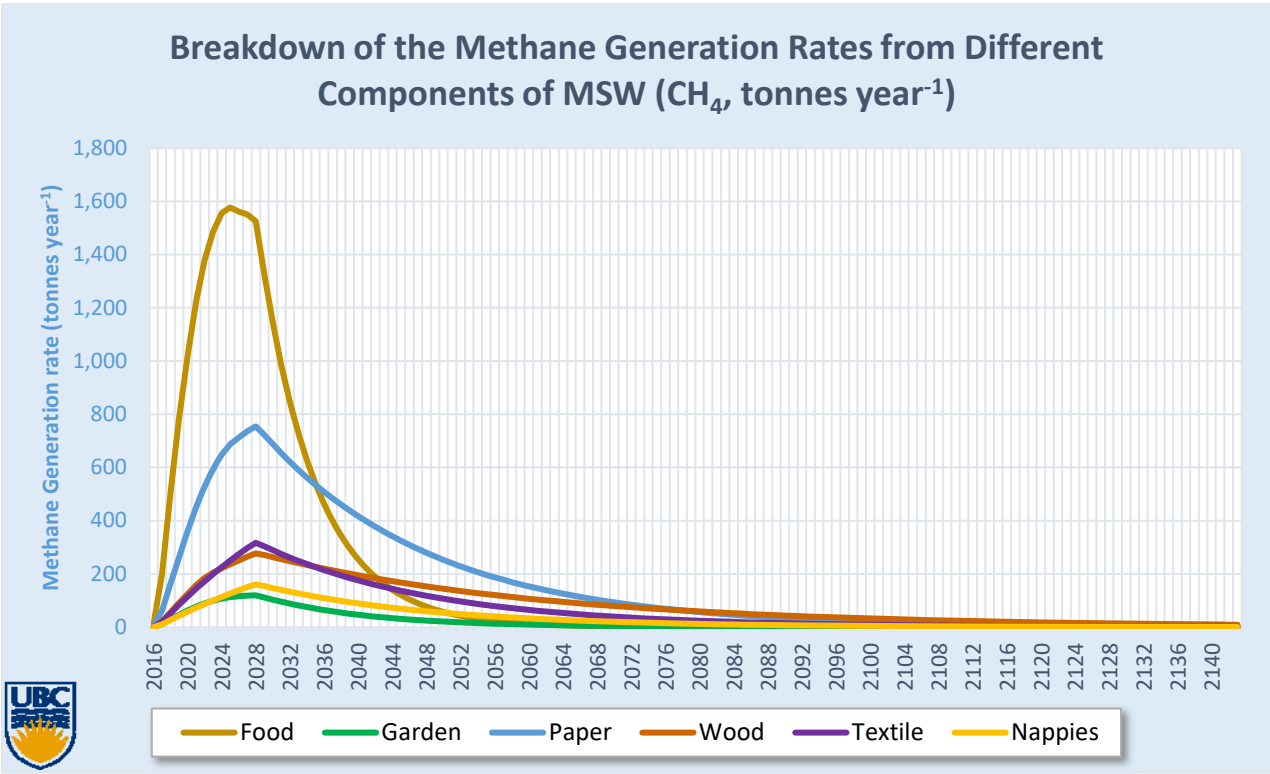




Hartland Landfill (CRD) - Sc.2 Cell 3&4

Landfill Gas Generation Analysis **GRAPHICAL RESULTS**





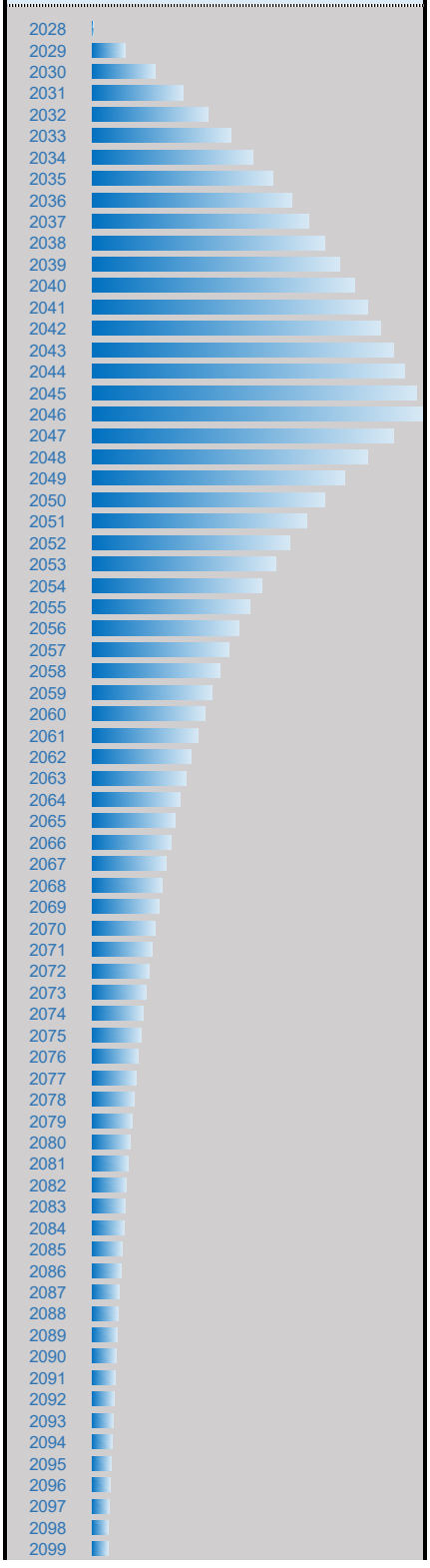
Methane Generation Estimates from the Hartland Landfill (CRD) - Sc. 2 Cell 5

Actual CH_4 Yields

L_o (m^3/tonne)	127	158	143	72	114	103	58.4

Year	Methane generation estimates for the Hartland Landfill (CRD) - Sc. 2 Cell 5							Methane Generation Potential	Total LFG Flow Rate Estimated
	Food (tonnes)	Garden (tonnes)	Paper (tonnes)	Wood (tonnes)	Textile (tonnes)	Nappies (tonnes)	Total (tonnes)	(L_o, m^3/tonne)	(scfm)
2028	18	1	5	2	3	2	30	58.5	6
2029	213	12	61	22	38	19	366	58.5	73
2030	396	23	119	44	74	38	693	58.5	138
2031	555	34	174	65	108	55	992	58.5	197
2032	694	43	228	86	141	72	1,265	58.5	251
2033	816	52	279	106	173	88	1,516	58.5	301
2034	924	61	329	126	204	104	1,748	58.5	347
2035	1,018	69	376	146	234	119	1,963	58.5	389
2036	1,102	76	423	165	262	134	2,162	58.5	429
2037	1,176	83	467	184	290	148	2,349	58.5	466
2038	1,242	90	510	203	317	161	2,523	58.5	500
2039	1,301	96	551	221	342	175	2,687	58.5	533
2040	1,355	102	592	239	367	187	2,842	58.5	564
2041	1,403	108	630	257	392	200	2,989	58.5	593
2042	1,447	113	668	275	415	211	3,129	58.5	621
2043	1,487	118	705	292	438	223	3,262	58.5	647
2044	1,524	123	740	309	460	234	3,389	58.5	672
2045	1,558	127	774	326	481	245	3,511	58.5	696
2046	1,563	130	800	339	497	253	3,583		711
2047	1,345	120	761	329	473	241	3,270		649
2048	1,158	111	724	320	450	229	2,991		593
2049	997	102	689	310	428	218	2,744		544
2050	858	94	655	301	407	207	2,523		500
2051	738	87	623	292	387	197	2,325		461
2052	636	80	593	283	368	188	2,148		426
2053	547	74	564	275	350	178	1,989		395
2054	471	69	536	267	333	170	1,846		366
2055	405	63	510	259	317	162	1,716		340
2056	349	58	485	251	301	154	1,599		317
2057	300	54	462	244	287	146	1,493		296
2058	258	50	439	237	273	139	1,396		277
2059	222	46	418	230	259	132	1,308		259
2060	191	42	397	223	247	126	1,227		243
2061	165	39	378	216	235	120	1,153		229
2062	142	36	360	210	223	114	1,085		215
2063	122	33	342	204	212	108	1,022		203
2064	105	31	325	198	202	103	964		191
2065	90	28	310	192	192	98	910		181
2066	78	26	294	186	183	93	861		171
2067	67	24	280	181	174	89	815		162
2068	58	22	266	175	165	84	772		153
2069	50	21	253	170	157	80	731		145
2070	43	19	241	165	150	76	694		138
2071	37	18	229	160	142	73	659		131
2072	32	16	218	156	135	69	626		124
2073	27	15	207	151	129	66	595		118
2074	23	14	197	147	123	62	566		112
2075	20	13	188	142	117	59	539		107
2076	17	12	179	138	111	57	513		102
2077	15	11	170	134	105	54	489		97
2078	13	10	162	130	100	51	466		92
2079	11	9	154	126	95	49	444		88
2080	10	9	146	122	91	46	424		84
2081	8	8	139	119	86	44	404		80
2082	7	7	132	115	82	42	386		77
2083	6	7	126	112	78	40	368		73
2084	5	6	120	109	74	38	352		70
2085	5	6	114	105	71	36	336		67
2086	4	5	108	102	67	34	321		64
2087	3	5	103	99	64	33	307		61
2088	3	5	98	96	61	31	294		58
2089	2	4	93	93	58	30	281		56
2090	2	4	89	91	55	28	268		53
2091	2	4	84	88	52	27	257		51
2092	2	3	80	85	50	25	246		49
2093	1	3	76	83	47	24	235		47
2094	1	3	73	80	45	23	225		45
2095	1	3	69	78	43	22	215		43
2096	1	2	66	76	41	21	206		41
2097	1	2	62	73	39	20	198		39
2098	1	2	59	71	37	19	189		38
2099	1	2	57	69	35	18	181		36

Year — LFG Generation Magnitude for the Hartland Landfill (CRD) - Sc. 2 Cell 5



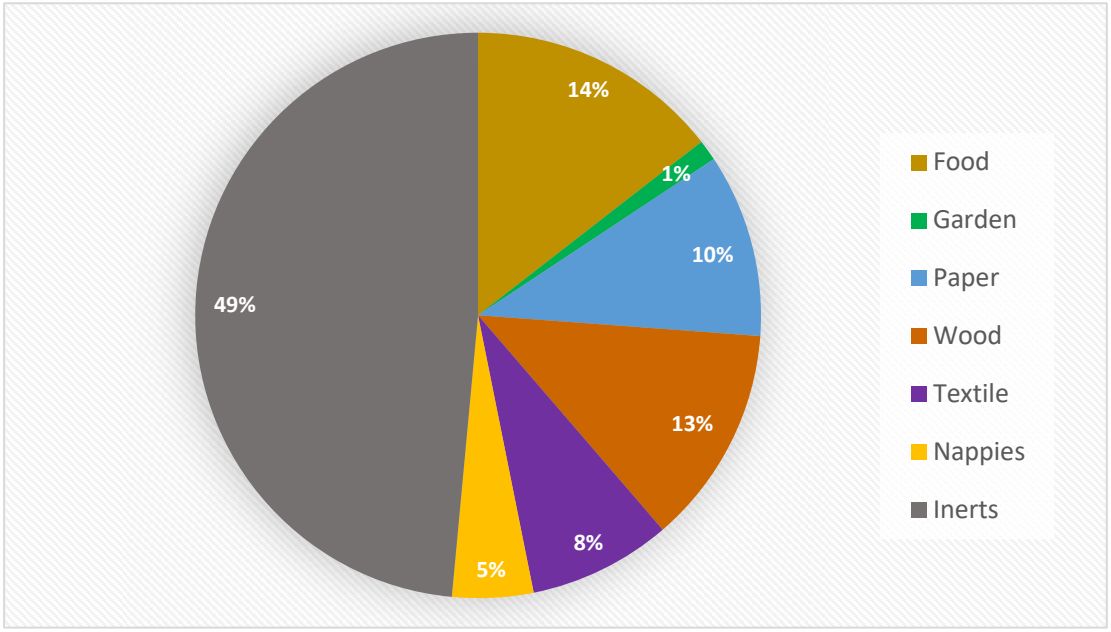
Year	Methane generation estimates for the Hartland Landfill (CRD) - Sc. 2 Cell 5							Methane Generation Potential	Total LFG Flow Rate Estimated
	Food (tonnes)	Garden (tonnes)	Paper (tonnes)	Wood (tonnes)	Textile (tonnes)	Nappies (tonnes)	Total (tonnes)	(L_o, m^3/tonne)	(scfm)
2100	0	2	54	67	33	17	174		34
2101	0	2	51	65	32	16	166		33
2102	0	1	49	63	30	15	159		32
2103	0	1	46	61	29	15	153		30
2104	0	1	44	60	27	14	146		29
2105	0	1	42	58	26	13	140		28
2106	0	1	40	56	25	13	135		27
2107	0	1	38	54	24	12	129		26
2108	0	1	36	53	22	11	124		25
2109	0	1	34	51	21	11	119		24
2110	0	1	33	50	20	10	114		23
2111	0	1	31	48	19	10	109		22
2112	0	1	30	47	18	9	105		21
2113	0	1	28	45	17	9	101		20
2114	0	1	27	44	17	8	96		19
2115	0	1	25	43	16	8	93		18
2116	0	0	24	42	15	8	89		18
2117	0	0	23	40	14	7	85		17
2118	0	0	22	39	14	7	82		16
2119	0	0	21	38	13	7	79		16
2120	0	0	20	37	12	6	76		15
2121	0	0	19	36	12	6	73		14
2122	0	0	18	35	11	6	70		14
2123	0	0	17	34	11	5	67		13
2124	0	0	16	33	10	5	64		13
2125	0	0	15	32	10	5	62		12
2126	0	0	15	31	9	5	59		12
2127	0	0	14	30	9	4	57		11
2128	0	0	13	29	8	4	55		11
2129	0	0	13	28	8	4	53		10
2130	0	0	12	27	7	4	51		10
2131	0	0	11	26	7	4	49		10
2132	0	0	11	26	7	3	47		9
2133	0	0	10	25	6	3	45		9
2134	0	0	10	24	6	3	43		9
2135	0	0	9	24	6	3	42		8
2136	0	0	9	23	6	3	40		8
2137	0	0	8	22	5	3	39		8
2138	0	0	8	21	5	3	37		7
2139	0	0	8	21	5	2	36		7
2140	0	0	7	20	5	2	34		7
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2142	0	0	7	19	4	2	32		6
2143	0	0	6	18	4	2	31		6
2144	0	0	6	18	4	2	30		6
2145	0	0	6	17	4	2	28		6
2146	0	0	5	17	3	2	27		5
2147	0	0	5	16	3	2	26		5
2148	0	0	5	16	3	2	25		5
2149	0	0	5	15	3	1	24		5
2150	0	0	4	15	3	1	24		5
2151	0	0	4	15	3	1	23		5
2152	0	0	4	14	2	1	22		4
2153	0	0	4	14	2	1	21		4
2154	0	0	4	13	2	1	20		4
2155	0	0	3	13	2	1	20		4
2156	0	0	3	13	2	1	19		4
2157	0	0	3	12	2	1	18		4
2158	0	0	3	12	2	1	18		3
2159	0	0	3	11	2	1	17		3
2160	0	0	3	11	2	1	16		3
2161	0	0	3	11	2	1	16		3
2162	0	0	2	10	2	1	15		3
2163	0	0	2	10	1	1	15		3
2164	0	0	2	10	1	1	14		3
2165	0	0	2	10	1	1	14		3
2166	0	0	2	9	1	1	13		3
2167	0	0	2	9	1	1	13		3
2168	0	0	2	9	1	1	12		2
2169	0	0	2	8	1	1	12		2
2170	0	0	2	8	1	1	11		2
2171	0	0	2	8	1	0	11		2
2172	0	0	1	8	1	0	11		2
2173	0	0	1	8	1	0	10		2
2174	0	0	1	7	1	0	10		2
2175	0	0	1	7	1	0	10		2
2176	0	0	1	7	1	0	9		2
2177	0	0	1	7	1	0	9		2
2178	0	0	1	6	1	0	9		2

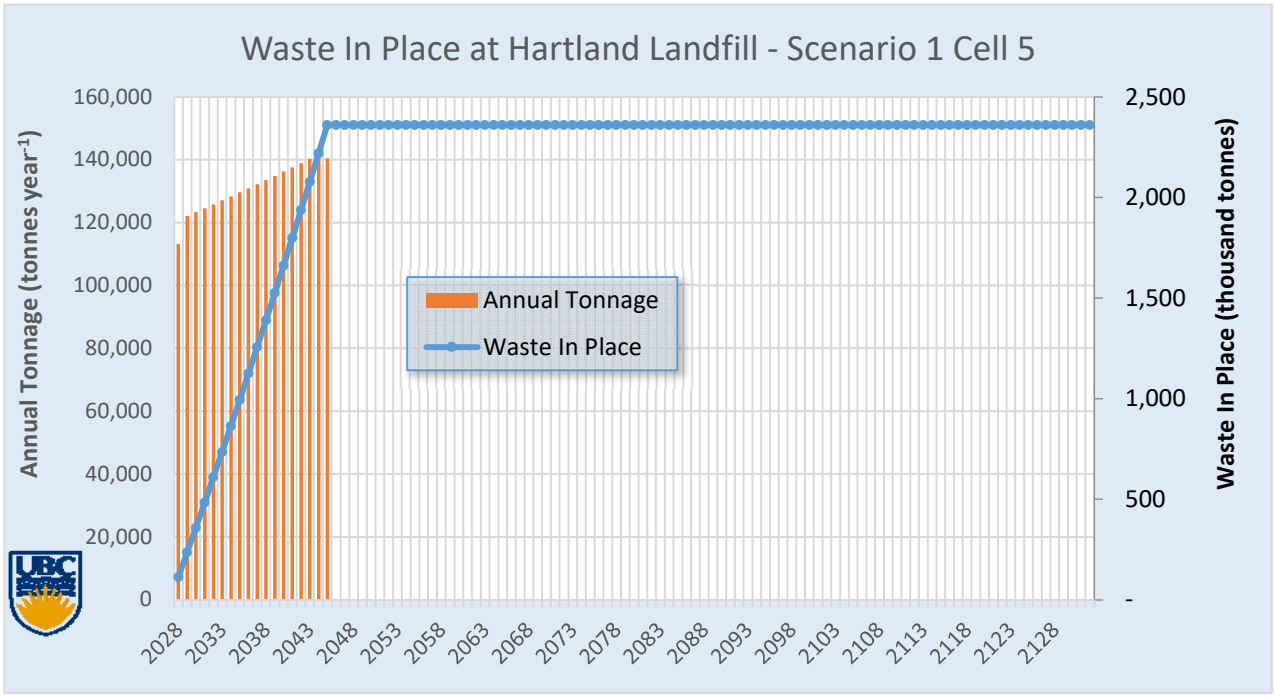
Year	LFG Generation Magnitude for the Hartland Landfill (CRD) - Sc. 2 Cell 5
2100	
2101	
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2178	

Hartland Landfill (CRD) - Sc. 2 Cell 5

Landfill Gas Generation Analysis **GRAPHICAL RESULTS**

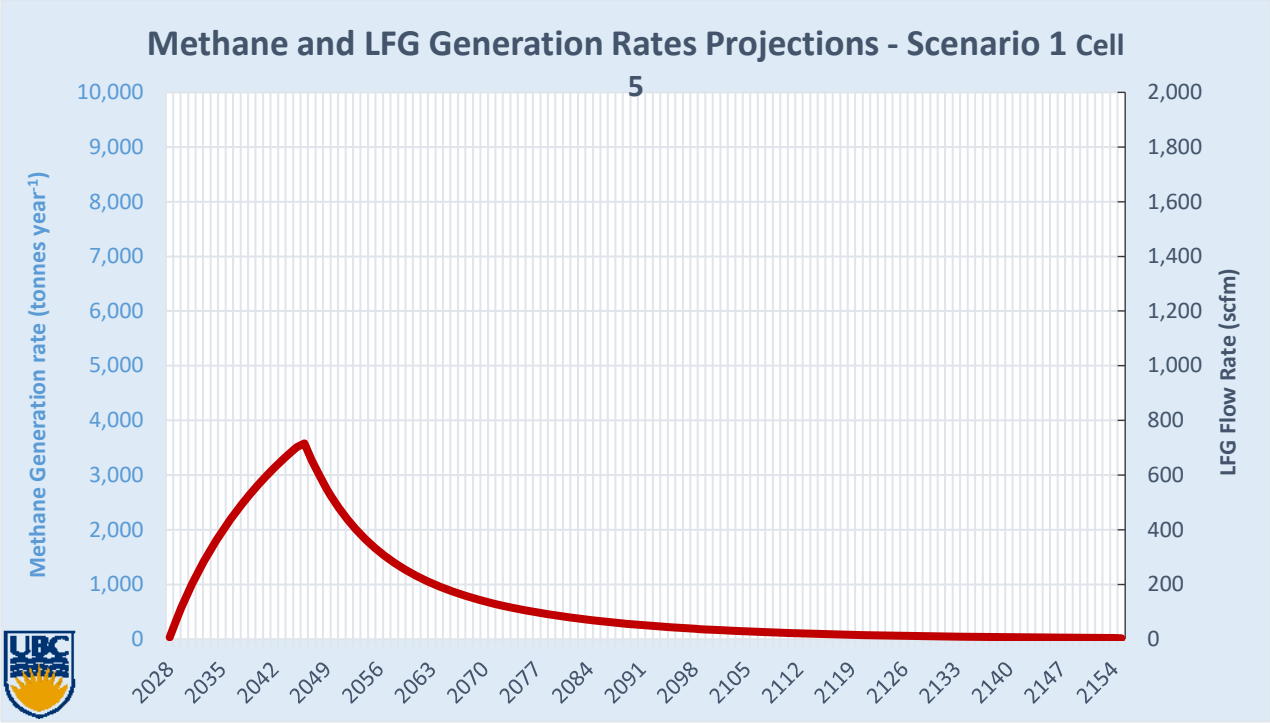
Average Deposited Waste Composition

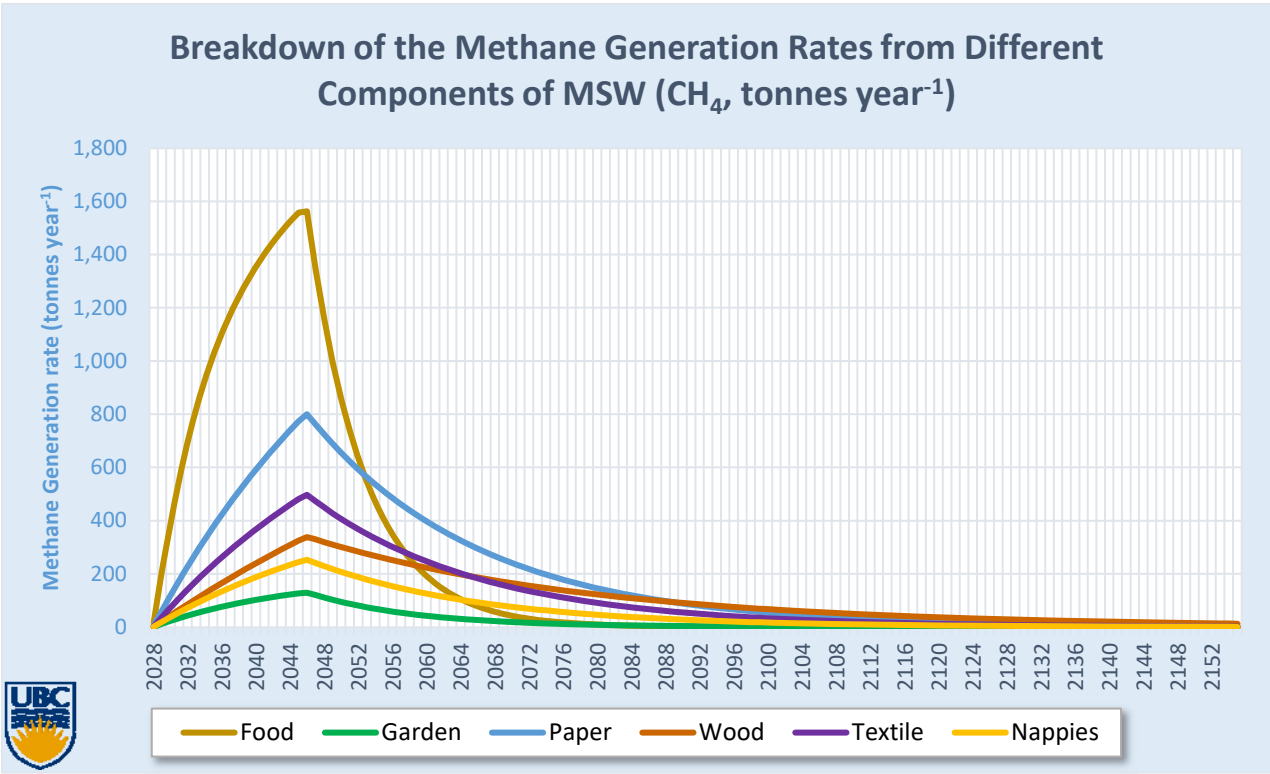




Hartland Landfill (CRD) - Sc. 2 Cell 5

Landfill Gas Generation Analysis **GRAPHICAL RESULTS**





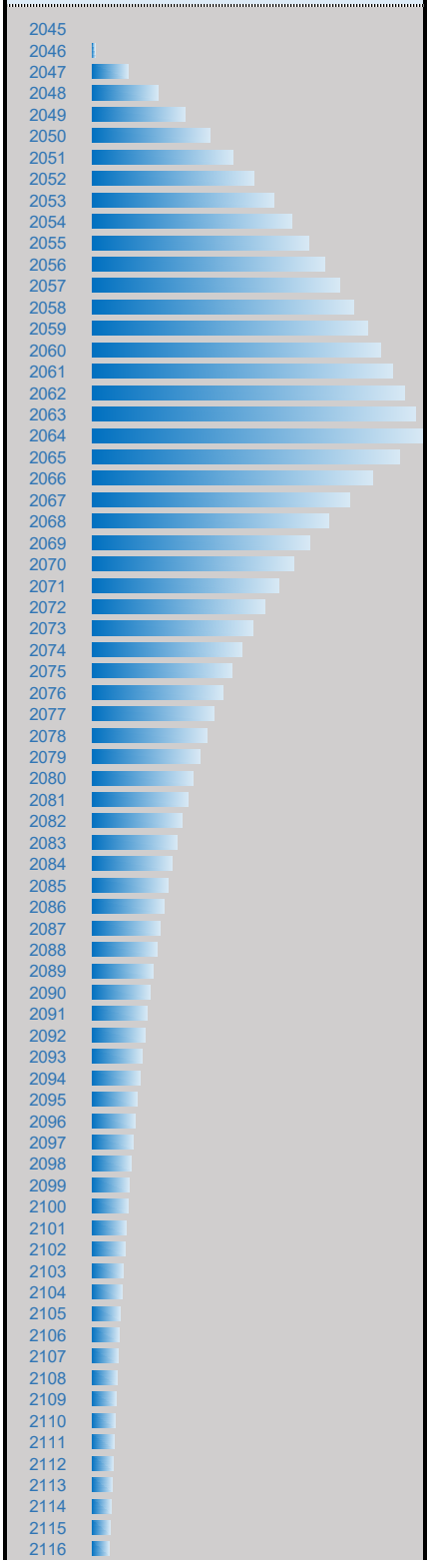
Methane Generation Estimates from the Hartland Landfill (CRD) - Sc.2 Cell 6

Actual CH_4 Yields

L_o (m^3/tonne)	127	158	143	72	114	103	58.4

Year	Methane generation estimates for the Hartland Landfill (CRD) - Sc.2 Cell 6							Methane Generation Potential	Total LFG Flow Rate Estimated
	Food (tonnes)	Garden (tonnes)	Paper (tonnes)	Wood (tonnes)	Textile (tonnes)	Nappies (tonnes)	Total (tonnes)	(L_o, m^3/tonne)	(scfm)
2045	0	0	0	0	0	0	1	58.5	0
2046	27	1	7	3	5	2	46	58.5	9
2047	275	16	79	29	49	25	472	58.5	94
2048	490	29	148	55	92	47	860	58.5	171
2049	679	41	214	80	133	68	1,214	58.5	241
2050	843	53	277	105	172	88	1,538	58.5	305
2051	988	63	339	129	210	107	1,836	58.5	364
2052	1,114	74	398	153	247	126	2,112	58.5	419
2053	1,226	83	455	177	282	144	2,366	58.5	469
2054	1,325	92	510	200	316	161	2,604	58.5	516
2055	1,413	100	562	222	349	178	2,825	58.5	560
2056	1,491	108	614	245	381	194	3,033	58.5	602
2057	1,561	116	663	266	412	210	3,228	58.5	640
2058	1,624	123	711	288	442	225	3,412	58.5	677
2059	1,681	129	757	309	470	240	3,587	58.5	711
2060	1,733	135	802	330	498	254	3,753	58.5	744
2061	1,781	141	846	351	525	268	3,912	58.5	776
2062	1,825	147	888	371	551	281	4,063	58.5	806
2063	1,866	152	929	391	577	294	4,209	58.5	835
2064	1,881	156	962	408	598	305	4,310	58.5	855
2065	1,659	147	927	400	576	293	4,002		794
2066	1,428	135	882	389	548	279	3,660		726
2067	1,229	125	839	377	521	265	3,356		666
2068	1,058	115	798	366	496	253	3,085		612
2069	910	106	759	355	471	240	2,842		564
2070	784	98	722	345	448	228	2,625		521
2071	674	91	687	334	427	217	2,430		482
2072	580	84	653	325	406	207	2,254		447
2073	500	77	621	315	386	197	2,096		416
2074	430	71	591	306	367	187	1,952		387
2075	370	66	562	297	349	178	1,822		361
2076	319	61	535	288	332	169	1,703		338
2077	274	56	509	279	316	161	1,595		316
2078	236	52	484	271	301	153	1,497		297
2079	203	48	460	263	286	146	1,406		279
2080	175	44	438	255	272	139	1,323		262
2081	150	41	417	248	259	132	1,246		247
2082	130	38	396	240	246	125	1,175		233
2083	111	35	377	233	234	119	1,110		220
2084	96	32	358	226	223	113	1,049		208
2085	83	30	341	220	212	108	993		197
2086	71	27	324	213	201	103	940		186
2087	61	25	309	207	192	98	891		177
2088	53	23	294	201	182	93	845		168
2089	45	21	279	195	173	88	803		159
2090	39	20	266	189	165	84	763		151
2091	34	18	253	184	157	80	725		144
2092	29	17	240	178	149	76	690		137
2093	25	16	229	173	142	72	656		130
2094	21	14	217	168	135	69	625		124
2095	18	13	207	163	128	65	595		118
2096	16	12	197	158	122	62	567		113
2097	14	11	187	153	116	59	541		107
2098	12	10	178	149	111	56	516		102
2099	10	10	169	144	105	54	492		98
2100	9	9	161	140	100	51	470		93
2101	7	8	153	136	95	48	449		89
2102	6	8	146	132	91	46	428		85
2103	6	7	139	128	86	44	409		81
2104	5	6	132	124	82	42	391		78
2105	4	6	125	121	78	40	374		74
2106	4	6	119	117	74	38	357		71
2107	3	5	114	114	71	36	342		68
2108	3	5	108	110	67	34	327		65
2109	2	4	103	107	64	33	313		62
2110	2	4	98	104	61	31	299		59
2111	2	4	93	101	58	29	286		57
2112	1	3	88	98	55	28	274		54
2113	1	3	84	95	52	27	262		52
2114	1	3	80	92	50	25	251		50
2115	1	3	76	89	47	24	240		48
2116	1	2	72	87	45	23	230		46

Year — LFG Generation Magnitude for the Hartland Landfill (CRD) - Sc.2 Cell 6



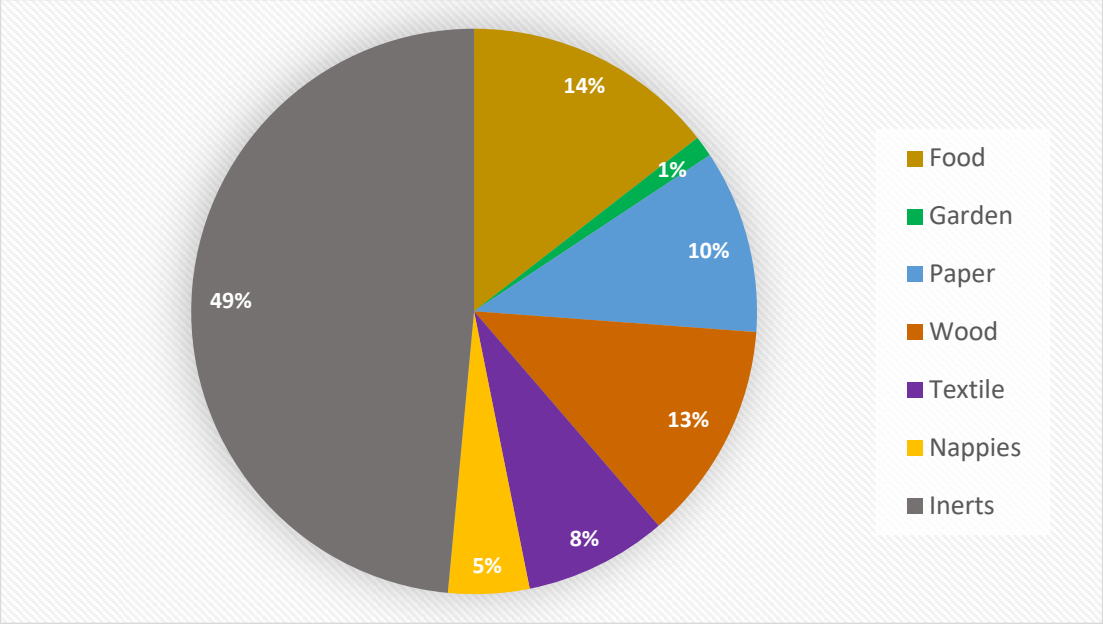
Year	Methane generation estimates for the Hartland Landfill (CRD) - Sc.2 Cell 6							Methane Generation Potential	Total LFG Flow Rate Estimated
	Food (tonnes)	Garden (tonnes)	Paper (tonnes)	Wood (tonnes)	Textile (tonnes)	Nappies (tonnes)	Total (tonnes)	(L_o, m^3/tonne)	(scfm)
2117	1	2	69	84	43	22	220		44
2118	1	2	65	82	41	21	211		42
2119	1	2	62	79	39	20	202		40
2120	0	2	59	77	37	19	194		38
2121	0	2	56	75	35	18	186		37
2122	0	2	54	72	33	17	178		35
2123	0	1	51	70	32	16	171		34
2124	0	1	49	68	30	15	164		32
2125	0	1	46	66	29	15	157		31
2126	0	1	44	64	27	14	151		30
2127	0	1	42	62	26	13	144		29
2128	0	1	40	60	25	13	139		27
2129	0	1	38	59	23	12	133		26
2130	0	1	36	57	22	11	128		25
2131	0	1	34	55	21	11	122		24
2132	0	1	33	54	20	10	117		23
2133	0	1	31	52	19	10	113		22
2134	0	1	29	51	18	9	108		21
2135	0	1	28	49	17	9	104		21
2136	0	1	27	48	17	8	100		20
2137	0	0	25	46	16	8	96		19
2138	0	0	24	45	15	8	92		18
2139	0	0	23	43	14	7	88		18
2140	0	0	22	42	14	7	85		17
2141	0	0	21	41	13	7	81		16
2142	0	0	20	40	12	6	78		16
2143	0	0	19	39	12	6	75		15
2144	0	0	18	37	11	6	72		14
2145	0	0	17	36	11	5	69		14
2146	0	0	16	35	10	5	67		13
2147	0	0	15	34	10	5	64		13
2148	0	0	15	33	9	5	62		12
2149	0	0	14	32	9	4	59		12
2150	0	0	13	31	8	4	57		11
2151	0	0	13	30	8	4	55		11
2152	0	0	12	29	7	4	53		10
2153	0	0	11	29	7	4	51		10
2154	0	0	11	28	7	3	49		10
2155	0	0	10	27	6	3	47		9
2156	0	0	10	26	6	3	45		9
2157	0	0	9	25	6	3	43		9
2158	0	0	9	25	6	3	42		8
2159	0	0	8	24	5	3	40		8
2160	0	0	8	23	5	3	39		8
2161	0	0	8	22	5	2	37		7
2162	0	0	7	22	5	2	36		7
2163	0	0	7	21	4	2	35		7
2164	0	0	7	21	4	2	33		7
2165	0	0	6	20	4	2	32		6
2166	0	0	6	19	4	2	31		6
2167	0	0	6	19	4	2	30		6
2168	0	0	5	18	3	2	29		6
2169	0	0	5	18	3	2	28		5
2170	0	0	5	17	3	2	27		5
2171	0	0	5	17	3	1	26		5
2172	0	0	4	16	3	1	25		5
2173	0	0	4	16	3	1	24		5
2174	0	0	4	15	2	1	23		5
2175	0	0	4	15	2	1	22		4
2176	0	0	4	14	2	1	21		4
2177	0	0	3	14	2	1	21		4
2178	0	0	3	13	2	1	20		4
2179	0	0	3	13	2	1	19		4
2180	0	0	3	13	2	1	18		4
2181	0	0	3	12	2	1	18		4
2182	0	0	3	12	2	1	17		3
2183	0	0	3	12	2	1	17		3
2184	0	0	2	11	2	1	16		3
2185	0	0	2	11	1	1	15		3
2186	0	0	2	11	1	1	15		3
2187	0	0	2	10	1	1	14		3
2188	0	0	2	10	1	1	14		3
2189	0	0	2	10	1	1	13		3
2190	0	0	2	9	1	1	13		3
2191	0	0	2	9	1	1	12		2
2192	0	0	2	9	1	1	12		2
2193	0	0	2	9	1	0	12		2
2194	0	0	1	8	1	0	11		2
2195	0	0	1	8	1	0	11		2

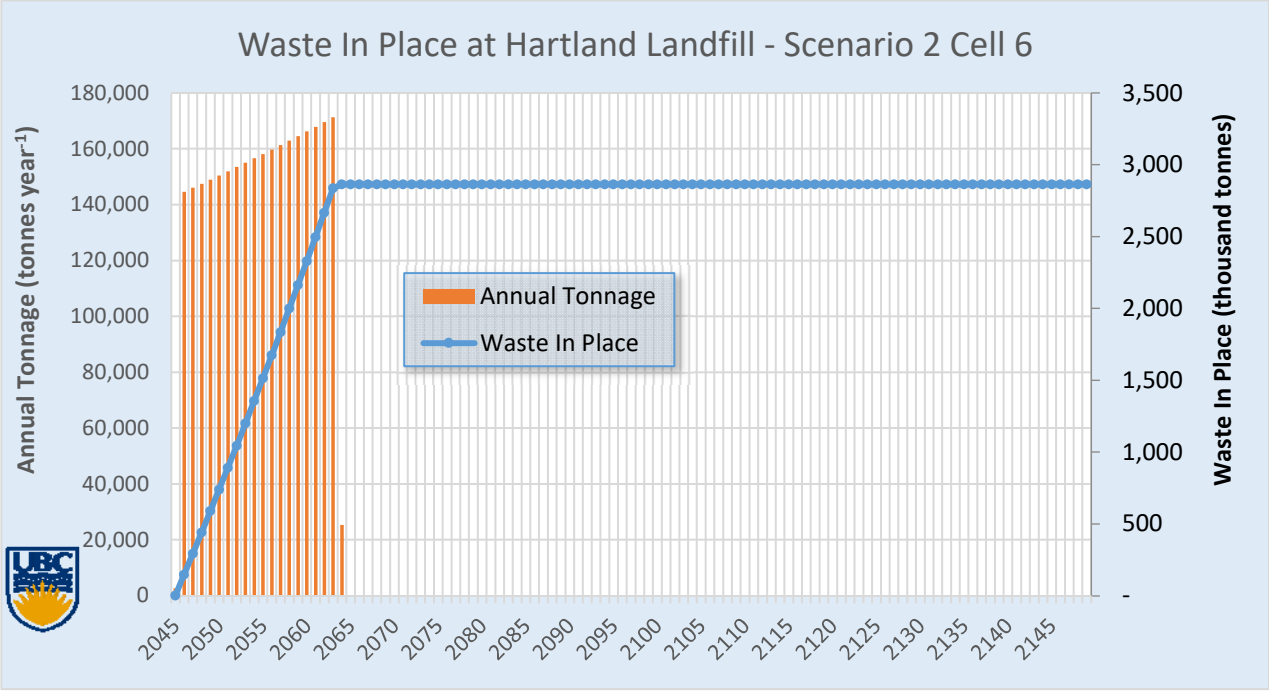
Year	LFG Generation Magnitude for the Hartland Landfill (CRD) - Sc.2 Cell 6
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Hartland Landfill (CRD) - Sc.2 Cell 6

Landfill Gas Generation Analysis **GRAPHICAL RESULTS**

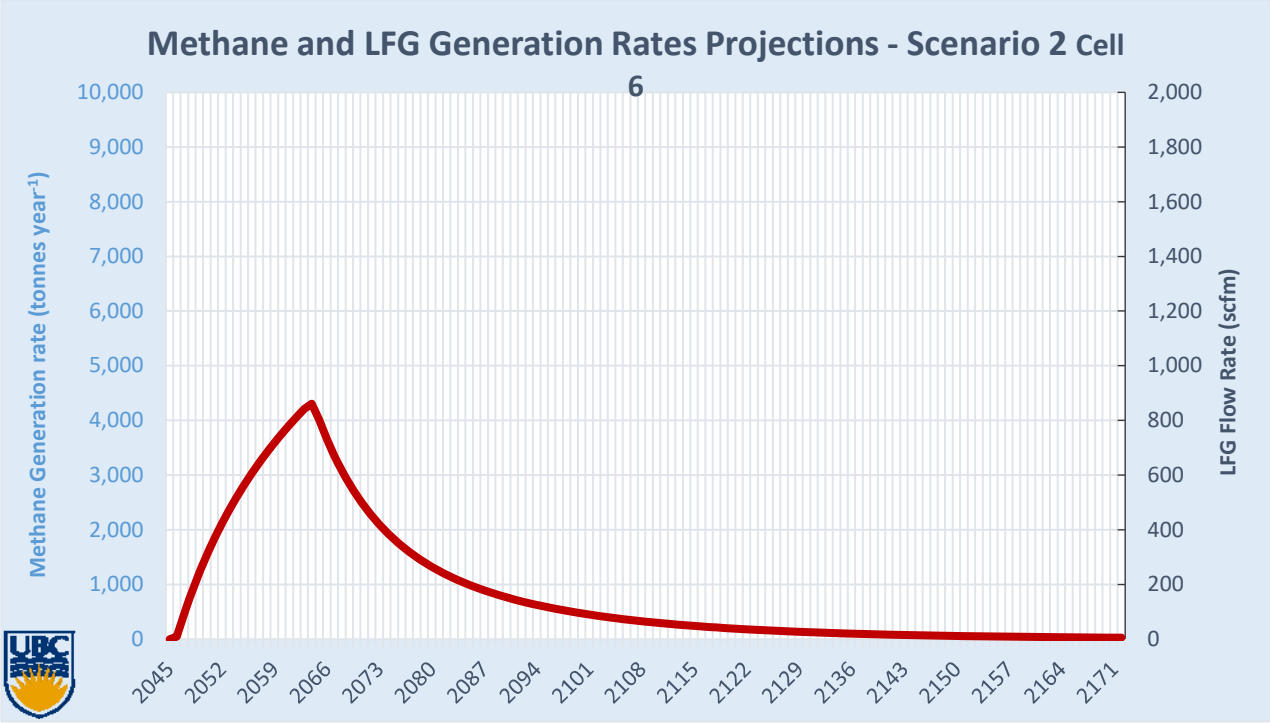
Average Deposited Waste Composition

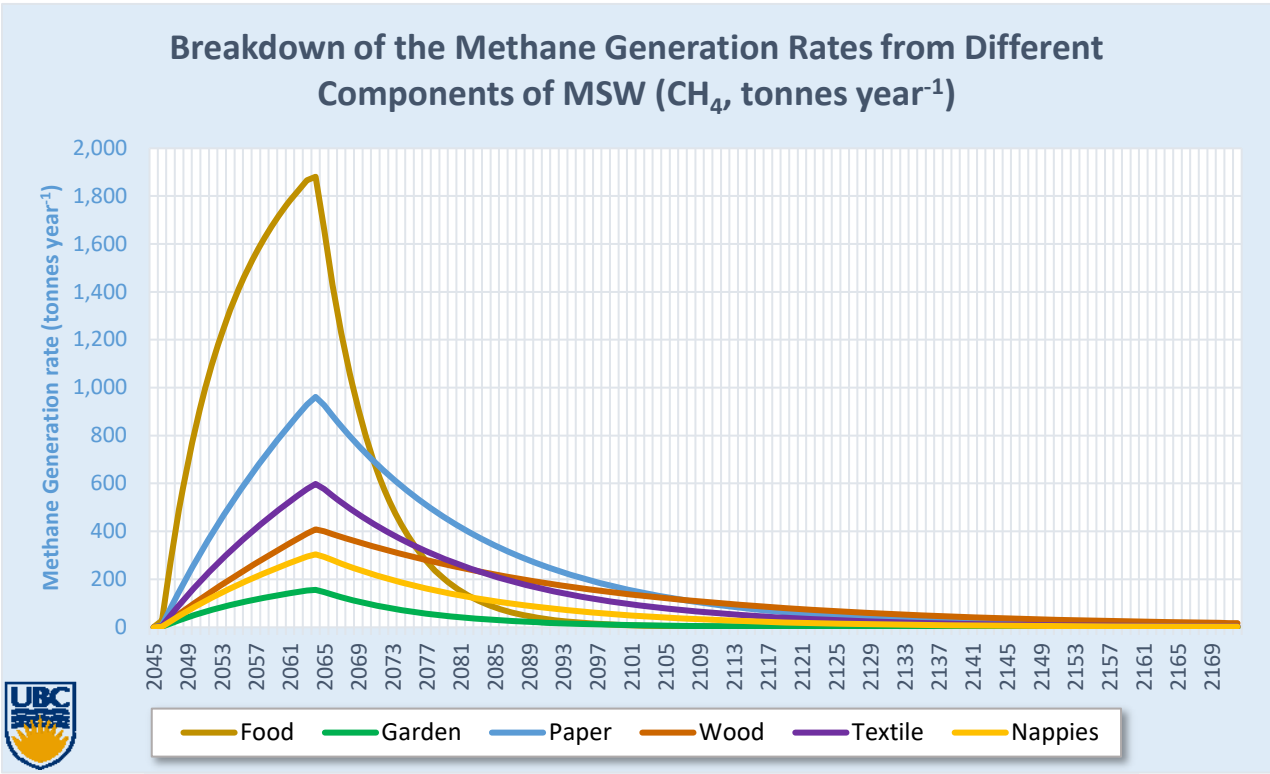




Hartland Landfill (CRD) - Sc.2 Cell 6

Landfill Gas Generation Analysis **GRAPHICAL RESULTS**





APPENDIX C.4

Scenario 3 (Long Term Diversion Targets)

Methane Generation Estimates from the Hartland Landfill (CRD) - Sc. 3 Lifespan

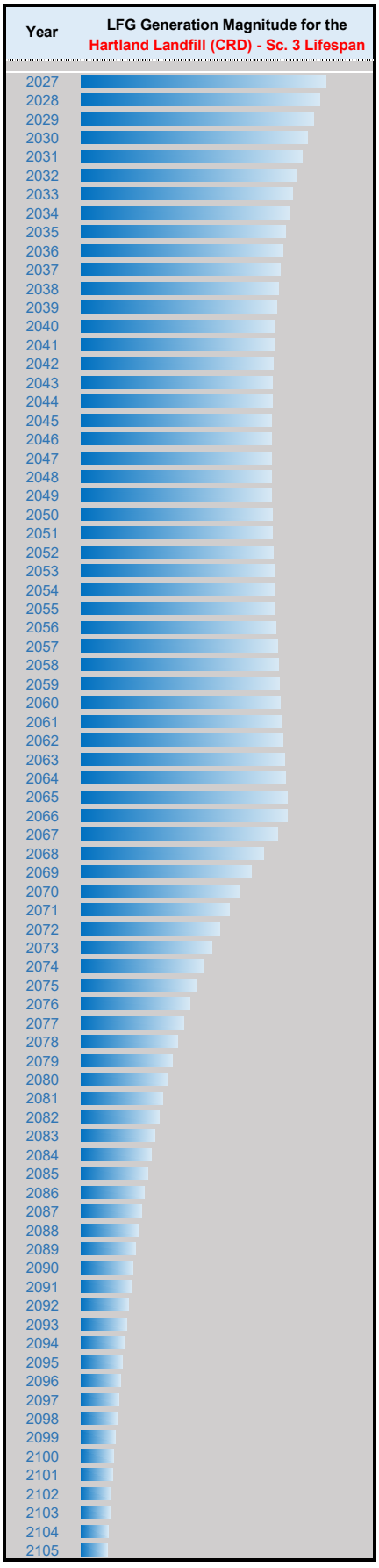
Actual CH_4 Yields

L_o (m^3/tonne)	127	157	140	65	110	99	65.5

Year	Methane generation estimates for the Hartland Landfill (CRD) - Sc. 3 Lifespan							Methane Generation Potential	Total LFG Flow Rate Estimated
	Food (tonnes)	Garden (tonnes)	Paper (tonnes)	Wood (tonnes)	Textile (tonnes)	Nappies (tonnes)	Total (tonnes)	(L_o, m^3/tonne)	(scfm)
1955	5	1	1	0	0	0	9	78.7	2
1956	65	12	18	5	5	3	109	78.7	22
1957	120	23	36	9	10	6	204	78.7	41
1958	172	35	53	13	15	10	297	78.7	59
1959	221	46	71	18	20	13	388	78.7	77
1960	267	57	89	23	26	16	478	78.7	95
1961	313	68	108	28	31	20	568	78.7	113
1962	357	79	128	33	37	23	657	78.7	130
1963	401	91	148	39	42	27	748	78.7	148
1964	445	103	169	45	48	31	840	78.7	167
1965	489	115	191	51	54	35	934	78.7	185
1966	534	128	213	57	61	39	1,031	78.7	205
1967	580	141	237	64	68	43	1,132	78.7	224
1968	628	154	261	71	75	47	1,236	78.7	245
1969	677	168	287	78	82	52	1,344	78.7	267
1970	728	183	314	86	90	57	1,457	78.7	289
1971	782	198	342	94	98	62	1,576	78.7	313
1972	838	214	372	103	106	67	1,701	78.7	337
1973	897	231	404	112	115	73	1,832	78.7	363
1974	959	248	437	122	125	79	1,970	78.7	391
1975	1,025	267	472	132	135	85	2,116	78.7	420
1976	1,095	286	509	143	145	92	2,270	78.7	450
1977	1,168	307	547	154	156	99	2,433	78.7	483
1978	1,246	329	589	167	168	107	2,605	78.7	517
1979	1,329	352	632	179	181	115	2,788	78.7	553
1980	1,417	377	678	193	194	123	2,982	78.7	592
1981	1,511	403	727	208	208	132	3,188	78.7	632
1982	1,610	430	779	223	223	141	3,407	78.7	676
1983	1,716	460	834	239	238	151	3,639	78.7	722
1984	1,828	491	893	257	255	162	3,885	78.7	771
1985	1,948	524	954	275	273	173	4,147	78.7	823
1986	2,076	559	1,021	295	292	185	4,427	78.7	878
1987	2,226	599	1,094	317	313	198	4,747	78.7	942
1988	2,380	641	1,172	340	335	212	5,080	78.7	1,008
1989	2,530	682	1,250	363	357	227	5,409	78.7	1,073
1990	2,669	723	1,328	386	380	241	5,726	78.7	1,136
1991	2,783	759	1,400	409	400	254	6,004	78.7	1,191
1992	2,850	787	1,460	428	417	265	6,207	78.7	1,231
1993	2,875	806	1,508	445	431	273	6,339	78.7	1,257
1994	2,889	822	1,551	461	443	281	6,448	78.7	1,279
1995	2,895	836	1,591	476	455	288	6,540	78.7	1,297
1996	2,908	851	1,631	490	466	295	6,641	78.7	1,317
1997	2,911	862	1,666	504	476	302	6,722	78.7	1,333
1998	2,892	869	1,694	516	484	307	6,763	78.7	1,341
1999	2,849	870	1,713	526	489	310	6,758	78.7	1,340
2000	2,812	871	1,731	536	495	314	6,758	78.7	1,340
2001	2,776	872	1,746	544	499	316	6,754	78.7	1,340
2002	2,744	872	1,761	553	503	319	6,752	78.7	1,339
2003	2,734	875	1,780	563	509	323	6,784	78.7	1,345
2004	2,730	879	1,800	572	514	326	6,822	78.7	1,353
2005	2,745	886	1,823	583	521	330	6,888	78.7	1,366
2006	2,776	896	1,851	594	529	335	6,982	78.7	1,385
2007	2,808	906	1,879	606	537	340	7,077	78.7	1,404
2008	2,846	918	1,908	618	545	346	7,180	78.7	1,424
2009	2,852	923	1,929	628	551	349	7,232	78.7	1,434
2010	2,852	927	1,946	637	556	353	7,271	78.7	1,442
2011	2,827	926	1,957	644	559	355	7,268	78.7	1,442
2012	2,787	922	1,961	649	560	355	7,235	78.7	1,435
2013	2,734	915	1,960	653	560	355	7,177	78.7	1,424
2014	2,672	903	1,954	657	559	354	7,099	75.9	1,408
2015	2,593	870	1,946	663	558	352	6,983	75.9	1,385
2016	2,513	837	1,935	669	557	349	6,860	72.5	1,361
2017	2,480	790	1,939	682	561	348	6,801	72.5	1,349
2018	2,473	749	1,950	698	567	348	6,786	72.5	1,346
2019	2,472	710	1,962	714	574	349	6,781	72.5	1,345
2020	2,474	675	1,975	729	581	349	6,783	72.5	1,345
2021	2,477	643	1,987	744	587	349	6,788	70.5	1,346
2022	2,456	612	1,990	754	594	350	6,756	68.4	1,340
2023	2,415	581	1,985	758	600	351	6,691	66.4	1,327
2024	2,355	552	1,972	757	607	352	6,595	62.5	1,308
2025	2,264	523	1,946	757	613	353	6,457	58.5	1,281
2026	2,152	495	1,909	756	619	355	6,285	57.3	1,247

Year	LFG Generation Magnitude for the Hartland Landfill (CRD) - Sc. 3 Lifespan
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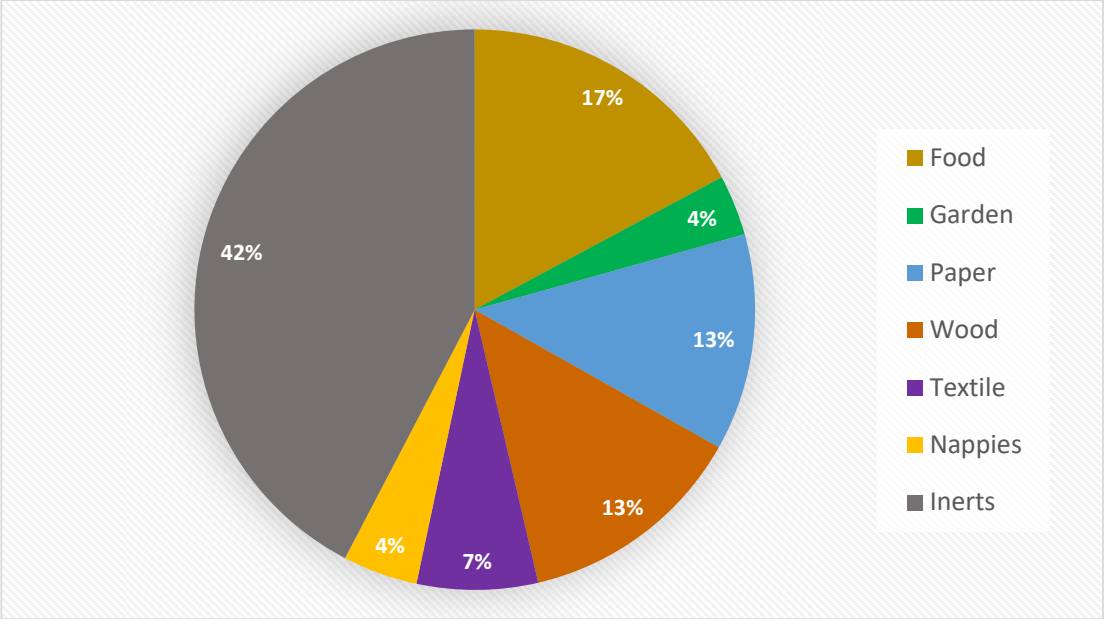
Year	Methane generation estimates for the Hartland Landfill (CRD) - Sc. 3 Lifespan							Methane Generation Potential	Total LFG Flow Rate Estimated
	Food (tonnes)	Garden (tonnes)	Paper (tonnes)	Wood (tonnes)	Textile (tonnes)	Nappies (tonnes)	Total (tonnes)	(L_o, m^3/tonne)	(scfm)
2027	2,045	468	1,871	755	626	356	6,120	56.2	1,214
2028	1,943	442	1,833	755	632	357	5,962	55.0	1,182
2029	1,844	418	1,793	754	639	359	5,808	53.8	1,152
2030	1,750	396	1,753	754	645	361	5,659	52.6	1,122
2031	1,659	374	1,713	755	652	363	5,516	52.6	1,094
2032	1,583	355	1,675	755	658	364	5,391	52.6	1,069
2033	1,519	337	1,639	756	665	367	5,282	52.6	1,048
2034	1,465	321	1,606	756	672	369	5,188	52.6	1,029
2035	1,421	305	1,574	757	679	371	5,107	52.6	1,013
2036	1,384	292	1,545	759	685	373	5,038	52.6	999
2037	1,354	279	1,517	760	692	376	4,978	52.6	987
2038	1,330	267	1,492	762	699	378	4,928	52.6	977
2039	1,310	257	1,468	764	706	381	4,885	52.6	969
2040	1,295	247	1,446	766	714	383	4,850	52.6	962
2041	1,284	238	1,425	768	721	386	4,822	52.6	956
2042	1,276	230	1,406	770	728	389	4,799	52.6	952
2043	1,271	223	1,388	773	735	392	4,782	52.6	948
2044	1,269	216	1,371	776	743	395	4,769	52.6	946
2045	1,268	210	1,356	778	750	398	4,761	52.6	944
2046	1,269	204	1,343	782	758	401	4,757	52.6	943
2047	1,272	199	1,330	785	765	404	4,756	52.6	943
2048	1,277	195	1,319	788	773	407	4,759	52.6	944
2049	1,282	191	1,308	792	781	411	4,765	52.6	945
2050	1,289	187	1,299	796	789	414	4,773	52.6	947
2051	1,296	184	1,290	800	797	418	4,785	52.6	949
2052	1,305	181	1,283	804	805	421	4,798	52.6	952
2053	1,314	179	1,277	808	813	425	4,814	52.6	955
2054	1,323	177	1,271	812	821	428	4,833	52.6	959
2055	1,334	175	1,266	817	829	432	4,853	52.6	963
2056	1,344	173	1,262	822	837	436	4,875	52.6	967
2057	1,356	172	1,259	826	846	440	4,899	52.6	972
2058	1,367	170	1,257	831	854	444	4,924	52.6	977
2059	1,379	169	1,255	836	863	448	4,951	52.6	982
2060	1,392	169	1,254	842	872	452	4,980	52.6	988
2061	1,405	168	1,254	847	880	456	5,010	52.6	994
2062	1,418	168	1,254	853	889	460	5,041	52.6	1,000
2063	1,431	167	1,255	858	898	464	5,074	52.6	1,006
2064	1,444	167	1,256	864	907	469	5,108	52.6	1,013
2065	1,458	167	1,258	870	916	473	5,143	52.6	1,020
2066	1,459	167	1,257	875	922	476	5,155	52.6	1,023
2067	1,323	158	1,215	859	894	461	4,910		974
2068	1,139	146	1,156	833	850	439	4,563		905
2069	980	134	1,100	809	809	417	4,250		843
2070	844	124	1,046	785	769	397	3,965		786
2071	726	115	995	762	732	378	3,707		735
2072	625	106	947	739	696	359	3,472		689
2073	538	98	900	717	662	342	3,257		646
2074	463	90	857	696	630	325	3,061		607
2075	399	83	815	676	599	309	2,880		571
2076	343	77	775	656	570	294	2,715		538
2077	295	71	737	636	542	280	2,562		508
2078	254	65	701	617	516	266	2,420		480
2079	219	60	667	599	491	253	2,289		454
2080	188	56	635	581	467	241	2,167		430
2081	162	51	604	564	444	229	2,054		407
2082	139	48	574	548	422	218	1,949		387
2083	120	44	546	531	402	207	1,850		367
2084	103	41	520	516	382	197	1,758		349
2085	89	37	494	500	363	187	1,672		332
2086	77	35	470	486	346	178	1,591		316
2087	66	32	447	471	329	170	1,515		300
2088	57	29	425	457	313	161	1,443		286
2089	49	27	405	444	298	154	1,375		273
2090	42	25	385	431	283	146	1,312		260
2091	36	23	366	418	269	139	1,252		248
2092	31	21	348	406	256	132	1,195		237
2093	27	20	331	394	244	126	1,141		226
2094	23	18	315	382	232	120	1,090		216
2095	20	17	300	371	220	114	1,041		207
2096	17	16	285	360	210	108	995		197
2097	15	14	271	349	199	103	952		189
2098	13	13	258	339	190	98	910		181
2099	11	12	245	329	180	93	871		173
2100	9	11	233	319	172	89	833		165
2101	8	10	222	310	163	84	798		158
2102	7	10	211	301	155	80	764		151
2103	6	9	201	292	148	76	731		145
2104	5	8	191	283	141	73	701		139
2105	4	8	182	275	134	69	671		133

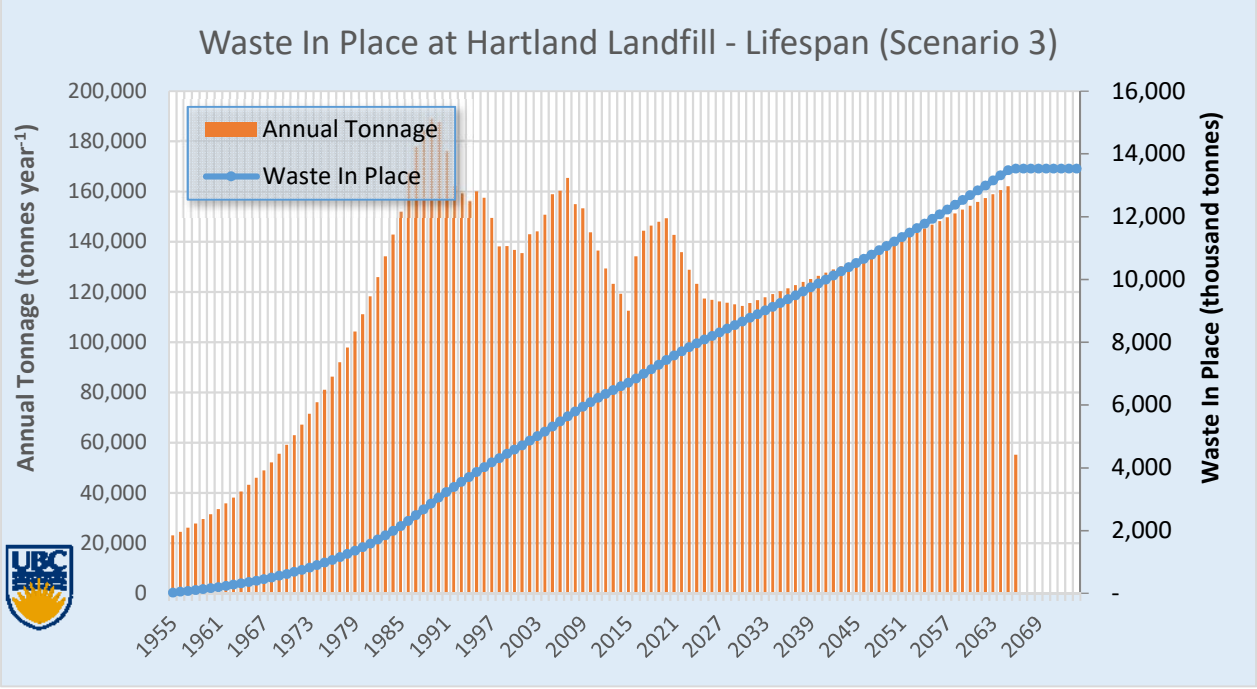


Hartland Landfill (CRD) - Sc. 3 Lifespan

Landfill Gas Generation Analysis **GRAPHICAL RESULTS**

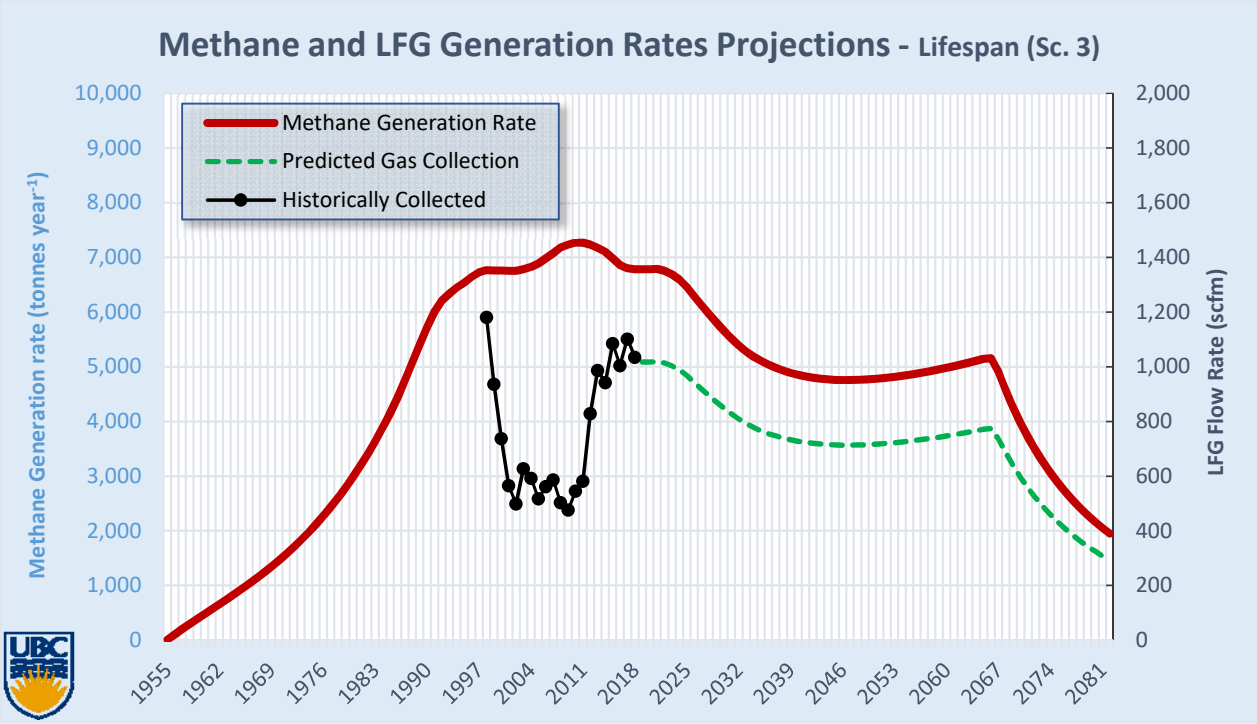
Average Deposited Waste Composition

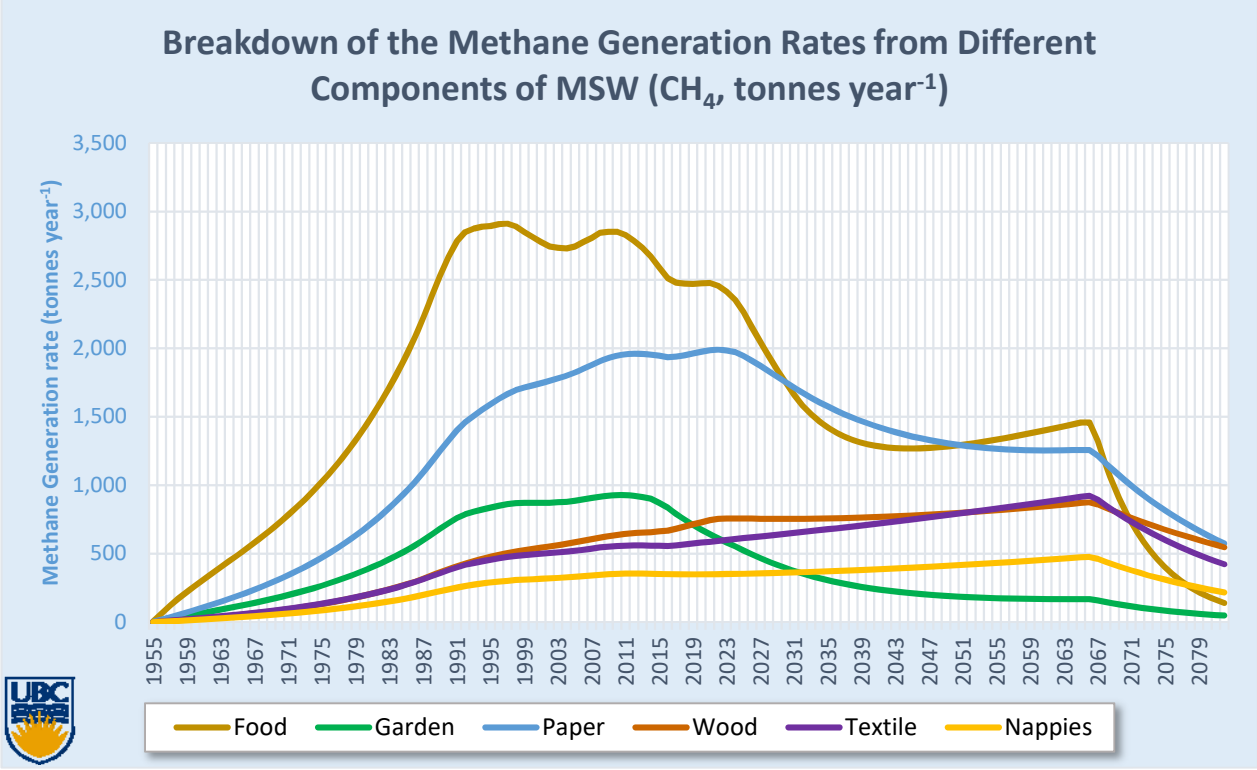




Hartland Landfill (CRD) - Sc. 3 Lifespan

Landfill Gas Generation Analysis **GRAPHICAL RESULTS**





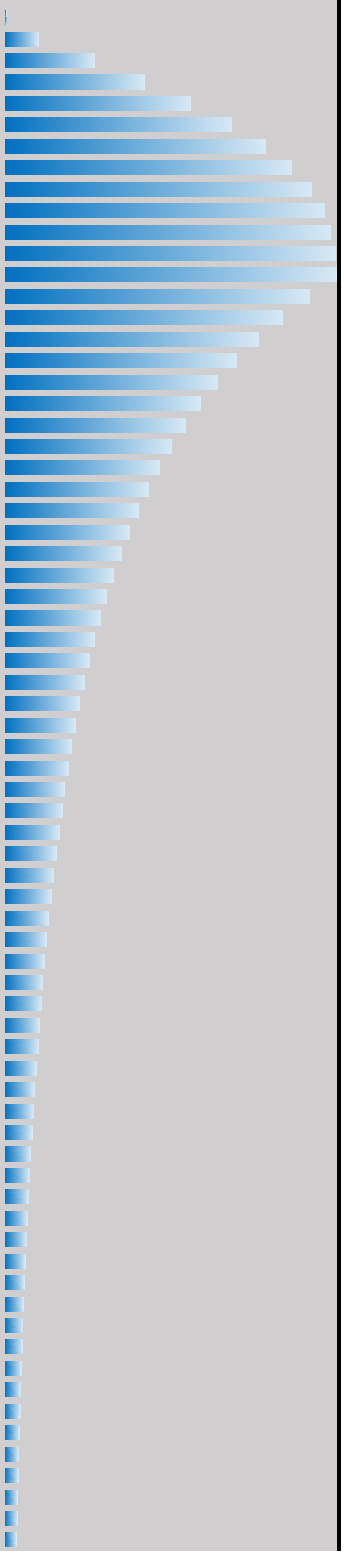
Methane Generation Estimates from the Hartland Landfill (CRD) - Sc.3 Cell 3&4

Actual CH_4 Yields

L_o (m^3/tonne)	127	158	143	72	114	103	66.9

Year	Methane generation estimates for the Hartland Landfill (CRD) - Sc.3 Cell 3&4							Methane Generation Potential	Total LFG Flow Rate Estimated
	Food (tonnes)	Garden (tonnes)	Paper (tonnes)	Wood (tonnes)	Textile (tonnes)	Nappies (tonnes)	Total (tonnes)	(L_o, m^3/tonne)	(scfm)
2016	15	1	5	2	1	1	24	72.5	5
2017	198	11	62	21	20	10	322	72.5	64
2018	509	29	165	56	53	26	838	72.5	166
2019	782	46	264	91	84	42	1,309	72.5	260
2020	1,020	62	359	125	115	58	1,738	72.5	345
2021	1,225	77	450	158	144	72	2,126	70.5	422
2022	1,379	89	528	184	172	87	2,440	68.4	484
2023	1,487	99	594	205	200	101	2,686	66.4	533
2024	1,557	107	649	221	225	114	2,873	62.5	570
2025	1,577	112	687	236	250	127	2,990	58.5	593
2026	1,560	115	712	251	274	139	3,052	57.3	605
2027	1,536	117	733	265	298	151	3,099	56.2	615
2028	1,491	118	746	277	317	161	3,110	55.0	617
2029	1,300	110	714	271	305	155	2,856		566
2030	1,119	102	679	263	290	147	2,601		516
2031	963	94	646	256	276	140	2,375		471
2032	829	87	615	248	263	133	2,174		431
2033	713	80	585	241	250	127	1,996		396
2034	614	74	556	234	238	121	1,836		364
2035	529	68	529	227	226	115	1,693		336
2036	455	63	503	220	215	109	1,565		310
2037	392	58	479	213	205	104	1,450		288
2038	337	54	455	207	195	99	1,347		267
2039	290	49	433	201	185	94	1,253		249
2040	250	46	412	195	176	89	1,168		232
2041	215	42	392	189	168	85	1,091		216
2042	185	39	373	184	159	81	1,021		202
2043	159	36	355	178	152	77	957		190
2044	137	33	337	173	144	73	898		178
2045	118	31	321	168	137	70	844		167
2046	102	28	305	163	131	66	795		158
2047	87	26	290	158	124	63	749		149
2048	75	24	276	153	118	60	707		140
2049	65	22	263	149	112	57	668		132
2050	56	21	250	145	107	54	632		125
2051	48	19	238	140	102	52	598		119
2052	41	17	226	136	97	49	567		112
2053	36	16	215	132	92	47	537		107
2054	31	15	205	128	87	44	510		101
2055	26	14	195	124	83	42	485		96
2056	23	13	185	121	79	40	461		91
2057	19	12	176	117	75	38	438		87
2058	17	11	168	114	72	36	417		83
2059	14	10	159	110	68	35	397		79
2060	12	9	152	107	65	33	378		75
2061	11	9	144	104	62	31	360		71
2062	9	8	137	101	59	30	343		68
2063	8	7	130	98	56	28	328		65
2064	7	7	124	95	53	27	313		62
2065	6	6	118	92	50	26	298		59
2066	5	6	112	89	48	24	285		57
2067	4	5	107	87	46	23	272		54
2068	4	5	102	84	43	22	260		52
2069	3	4	97	82	41	21	248		49
2070	3	4	92	79	39	20	237		47
2071	2	4	87	77	37	19	227		45
2072	2	4	83	75	36	18	217		43
2073	2	3	79	72	34	17	208		41
2074	2	3	75	70	32	16	199		39
2075	1	3	72	68	31	16	190		38
2076	1	3	68	66	29	15	182		36
2077	1	2	65	64	28	14	174		35
2078	1	2	62	62	26	13	167		33
2079	1	2	59	61	25	13	160		32
2080	1	2	56	59	24	12	153		30
2081	1	2	53	57	23	11	147		29
2082	0	2	50	55	22	11	140		28
2083	0	1	48	54	21	10	134		27
2084	0	1	46	52	20	10	129		26
2085	0	1	43	51	19	9	124		25
2086	0	1	41	49	18	9	118		23
2087	0	1	39	48	17	9	114		23

Year — LFG Generation Magnitude for the Hartland Landfill (CRD) - Sc.3 Cell 3&4



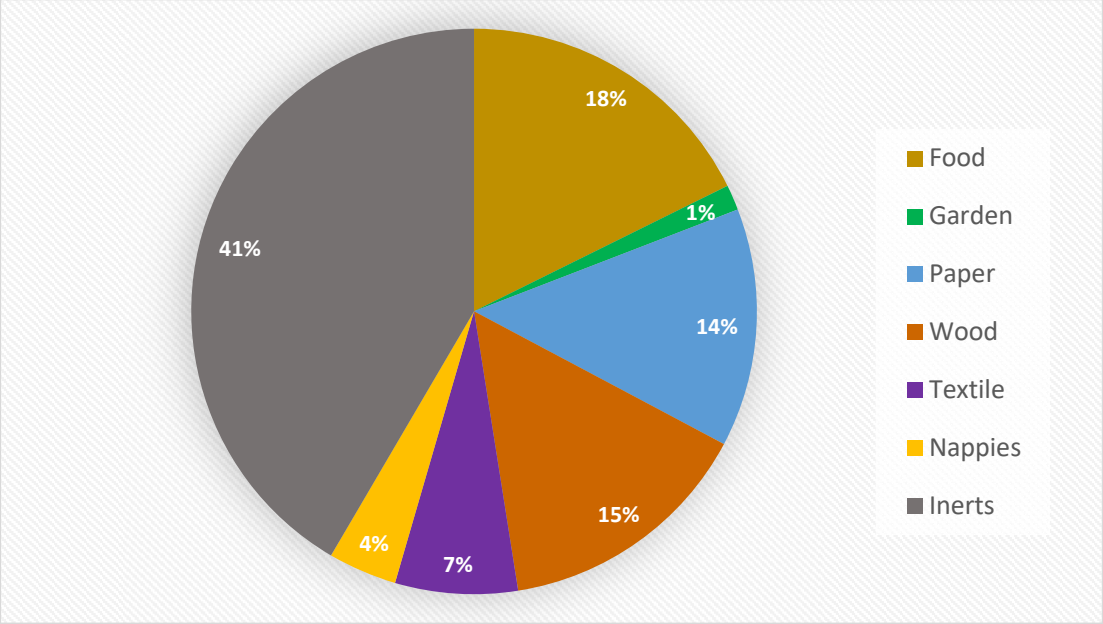
Year	Methane generation estimates for the Hartland Landfill (CRD) - Sc.3 Cell 3&4							Methane Generation Potential	Total LFG Flow Rate Estimated
	Food (tonnes)	Garden (tonnes)	Paper (tonnes)	Wood (tonnes)	Textile (tonnes)	Nappies (tonnes)	Total (tonnes)	(L_o, m^3/tonne)	(scfm)
2088	0	1	37	46	16	8	109		22
2089	0	1	36	45	15	8	104		21
2090	0	1	34	44	14	7	100		20
2091	0	1	32	42	14	7	96		19
2092	0	1	31	41	13	7	92		18
2093	0	1	29	40	12	6	88		18
2094	0	1	28	39	12	6	85		17
2095	0	1	26	37	11	6	81		16
2096	0	1	25	36	11	5	78		15
2097	0	0	24	35	10	5	75		15
2098	0	0	23	34	10	5	72		14
2099	0	0	22	33	9	5	69		14
2100	0	0	21	32	9	4	66		13
2101	0	0	20	31	8	4	64		13
2102	0	0	19	30	8	4	61		12
2103	0	0	18	29	8	4	59		12
2104	0	0	17	29	7	4	57		11
2105	0	0	16	28	7	3	54		11
2106	0	0	15	27	6	3	52		10
2107	0	0	14	26	6	3	50		10
2108	0	0	14	25	6	3	48		10
2109	0	0	13	25	6	3	46		9
2110	0	0	12	24	5	3	45		9
2111	0	0	12	23	5	3	43		8
2112	0	0	11	22	5	2	41		8
2113	0	0	11	22	5	2	40		8
2114	0	0	10	21	4	2	38		8
2115	0	0	10	21	4	2	37		7
2116	0	0	9	20	4	2	35		7
2117	0	0	9	19	4	2	34		7
2118	0	0	8	19	4	2	33		6
2119	0	0	8	18	3	2	31		6
2120	0	0	8	18	3	2	30		6
2121	0	0	7	17	3	2	29		6
2122	0	0	7	17	3	1	28		6
2123	0	0	6	16	3	1	27		5
2124	0	0	6	16	3	1	26		5
2125	0	0	6	15	3	1	25		5
2126	0	0	6	15	2	1	24		5
2127	0	0	5	14	2	1	23		5
2128	0	0	5	14	2	1	22		4
2129	0	0	5	14	2	1	21		4
2130	0	0	5	13	2	1	21		4
2131	0	0	4	13	2	1	20		4
2132	0	0	4	12	2	1	19		4
2133	0	0	4	12	2	1	18		4
2134	0	0	4	12	2	1	18		4
2135	0	0	4	11	2	1	17		3
2136	0	0	3	11	1	1	17		3
2137	0	0	3	11	1	1	16		3
2138	0	0	3	10	1	1	15		3
2139	0	0	3	10	1	1	15		3
2140	0	0	3	10	1	1	14		3
2141	0	0	3	9	1	1	14		3
2142	0	0	3	9	1	1	13		3
2143	0	0	2	9	1	1	13		3
2144	0	0	2	9	1	0	12		2
2145	0	0	2	8	1	0	12		2
2146	0	0	2	8	1	0	12		2
2147	0	0	2	8	1	0	11		2
2148	0	0	2	8	1	0	11		2
2149	0	0	2	7	1	0	10		2
2150	0	0	2	7	1	0	10		2
2151	0	0	2	7	1	0	10		2
2152	0	0	2	7	1	0	9		2
2153	0	0	1	7	1	0	9		2
2154	0	0	1	6	1	0	9		2
2155	0	0	1	6	1	0	8		2
2156	0	0	1	6	1	0	8		2
2157	0	0	1	6	1	0	8		2
2158	0	0	1	6	0	0	8		1
2159	0	0	1	5	0	0	7		1
2160	0	0	1	5	0	0	7		1
2161	0	0	1	5	0	0	7		1
2162	0	0	1	5	0	0	7		1
2163	0	0	1	5	0	0	6		1
2164	0	0	1	5	0	0	6		1
2165	0	0	1	5	0	0	6		1
2166	0	0	1	4	0	0	6		1

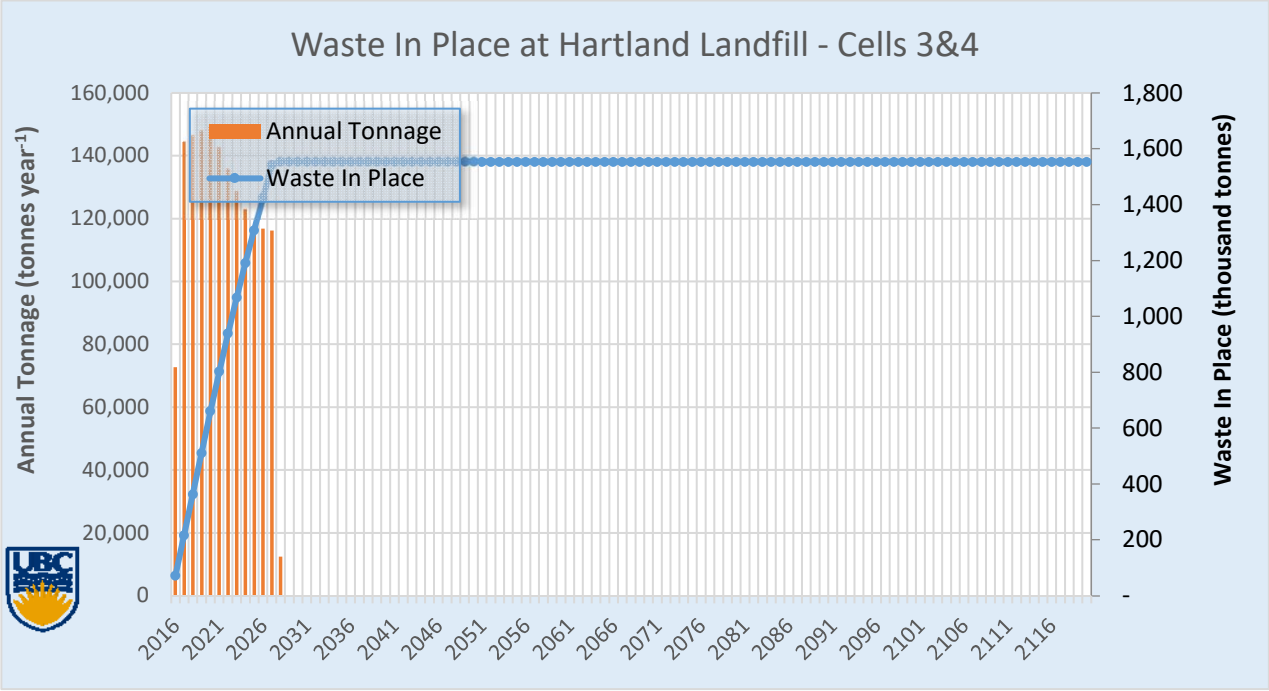
Year	LFG Generation Magnitude for the Hartland Landfill (CRD) - Sc.3 Cell 3&4
2088	
2089	
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2165	
2166	

Hartland Landfill (CRD) - Sc.3 Cell 3&4

Landfill Gas Generation Analysis **GRAPHICAL RESULTS**

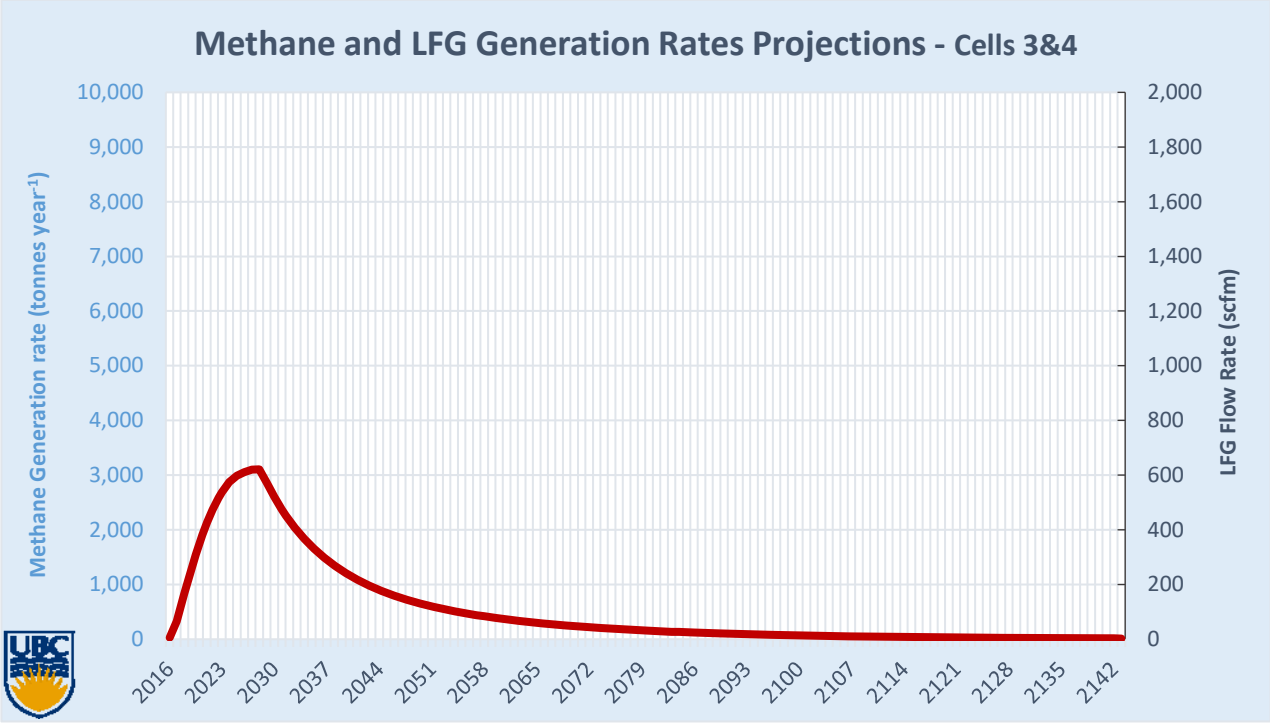
Average Deposited Waste Composition

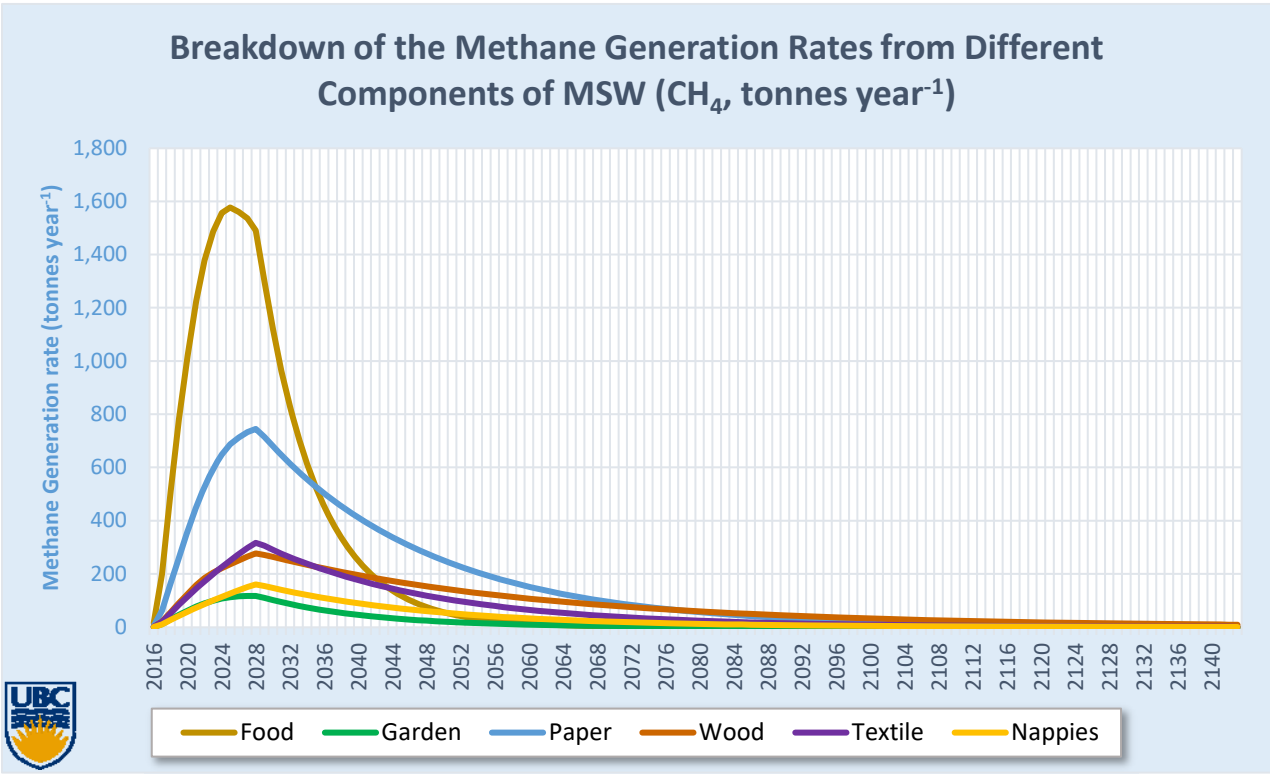




Hartland Landfill (CRD) - Sc.3 Cell 3&4

Landfill Gas Generation Analysis **GRAPHICAL RESULTS**





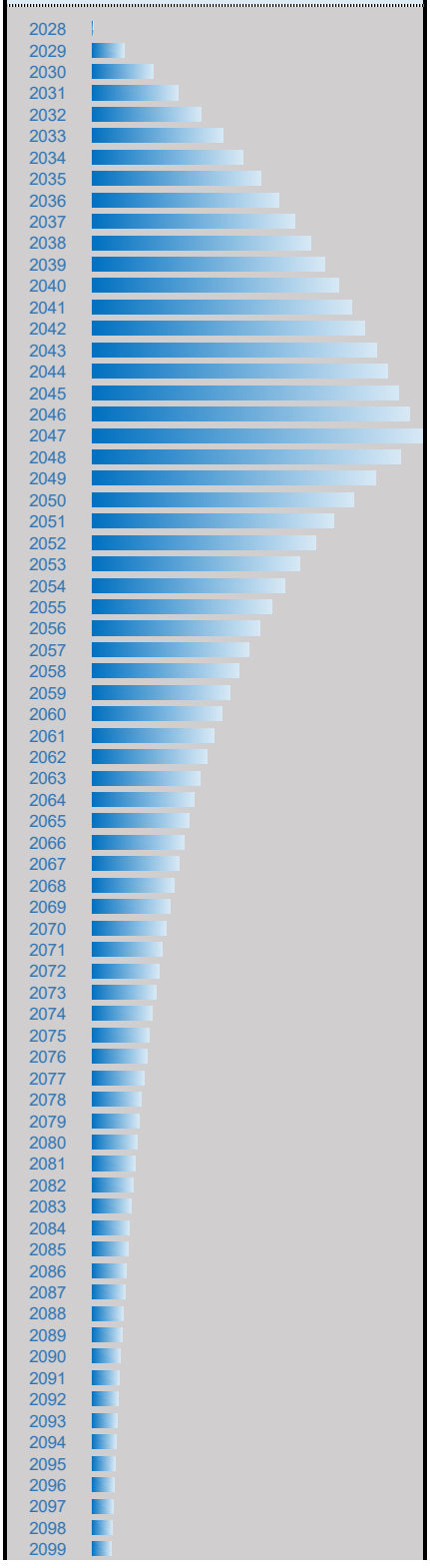
Methane Generation Estimates from the Hartland Landfill (CRD) - Sc. 3 Cell 5

Actual CH_4 Yields

L_o (m^3/tonne)	127	158	143	72	114	103	52.6

Year	Methane generation estimates for the Hartland Landfill (CRD) - Sc. 3 Cell 5							Methane Generation Potential	Total LFG Flow Rate Estimated
	Food (tonnes)	Garden (tonnes)	Paper (tonnes)	Wood (tonnes)	Textile (tonnes)	Nappies (tonnes)	Total (tonnes)	(L_o, m^3/tonne)	(scfm)
2028	14	1	4	2	3	1	24	55.0	5
2029	167	10	49	22	36	19	302	53.8	60
2030	306	19	94	43	72	37	571	52.6	113
2031	417	26	134	64	107	54	803	52.6	159
2032	514	34	173	85	140	71	1,017	52.6	202
2033	598	40	211	106	172	88	1,215	52.6	241
2034	673	47	247	126	203	103	1,399	52.6	277
2035	739	53	282	145	232	119	1,570	52.6	311
2036	797	58	316	165	261	133	1,730	52.6	343
2037	849	64	348	184	289	147	1,880	52.6	373
2038	895	68	379	202	315	161	2,021	52.6	401
2039	936	73	410	221	341	174	2,155	52.6	427
2040	973	78	439	239	366	187	2,282	52.6	453
2041	1,007	82	467	257	390	199	2,402	52.6	476
2042	1,038	86	495	274	414	211	2,517	52.6	499
2043	1,066	89	522	291	436	223	2,627	52.6	521
2044	1,092	93	547	308	458	234	2,733	52.6	542
2045	1,116	96	573	325	480	245	2,834	52.6	562
2046	1,141	100	598	342	501	256	2,937	52.6	583
2047	1,175	104	625	360	524	268	3,056	52.6	606
2048	1,038	97	603	353	505	258	2,854		566
2049	893	90	573	343	481	245	2,625		521
2050	769	83	545	333	457	233	2,421		480
2051	662	77	519	323	435	222	2,237		444
2052	569	71	493	313	414	211	2,072		411
2053	490	65	469	304	394	201	1,923		382
2054	422	60	446	295	374	191	1,789		355
2055	363	56	425	286	356	182	1,668		331
2056	313	51	404	278	339	173	1,558		309
2057	269	47	384	270	322	164	1,457		289
2058	232	44	366	262	307	156	1,366		271
2059	199	40	348	254	292	149	1,282		254
2060	172	37	331	247	277	142	1,205		239
2061	148	34	315	239	264	135	1,134		225
2062	127	32	299	232	251	128	1,069		212
2063	109	29	285	225	239	122	1,009		200
2064	94	27	271	219	227	116	954		189
2065	81	25	258	212	216	110	902		179
2066	70	23	245	206	206	105	854		169
2067	60	21	233	200	195	100	809		161
2068	52	20	222	194	186	95	768		152
2069	44	18	211	188	177	90	729		145
2070	38	17	201	183	168	86	692		137
2071	33	15	191	177	160	82	658		131
2072	28	14	182	172	152	78	626		124
2073	24	13	173	167	145	74	596		118
2074	21	12	164	162	138	70	567		113
2075	18	11	156	157	131	67	541		107
2076	16	10	149	153	125	64	515		102
2077	13	10	141	148	119	61	491		97
2078	12	9	134	144	113	58	469		93
2079	10	8	128	139	107	55	447		89
2080	9	8	122	135	102	52	427		85
2081	7	7	116	131	97	50	408		81
2082	6	6	110	127	92	47	390		77
2083	5	6	105	124	88	45	372		74
2084	5	5	100	120	84	43	356		71
2085	4	5	95	116	79	41	340		68
2086	3	5	90	113	76	39	325		65
2087	3	4	86	110	72	37	311		62
2088	3	4	82	106	68	35	298		59
2089	2	4	78	103	65	33	285		57
2090	2	3	74	100	62	32	273		54
2091	2	3	70	97	59	30	261		52
2092	1	3	67	94	56	29	250		50
2093	1	3	64	92	53	27	239		48
2094	1	2	60	89	51	26	229		45
2095	1	2	57	86	48	25	220		44
2096	1	2	55	84	46	23	211		42
2097	1	2	52	81	44	22	202		40
2098	1	2	49	79	41	21	193		38
2099	0	2	47	77	39	20	185		37

Year — LFG Generation Magnitude for the Hartland Landfill (CRD) - Sc. 3 Cell 5



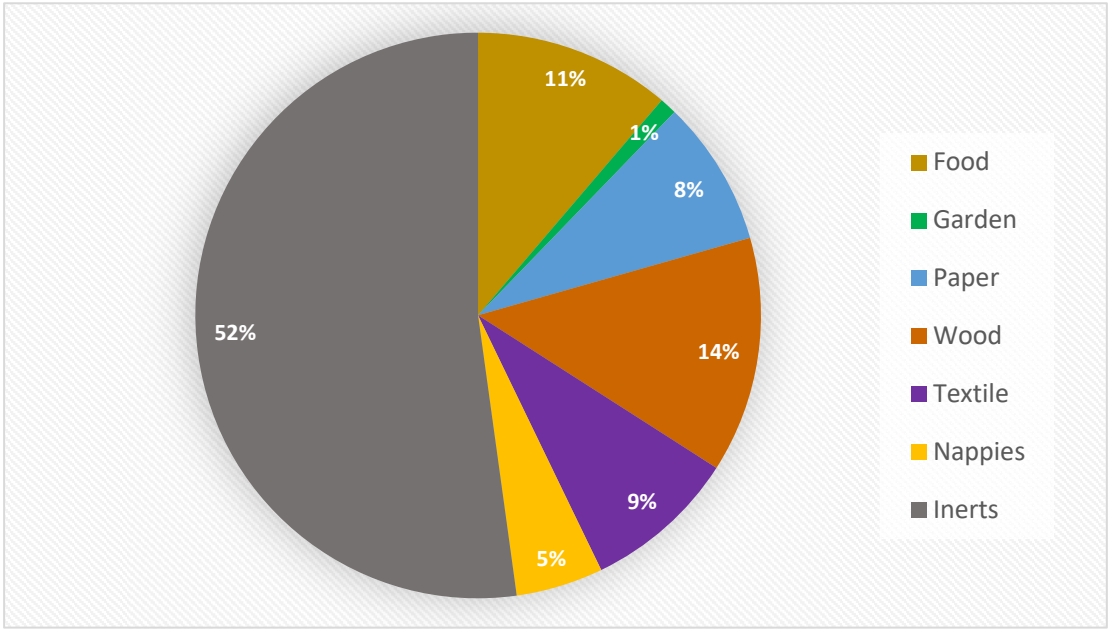
Year	Methane generation estimates for the Hartland Landfill (CRD) - Sc. 3 Cell 5							Methane Generation Potential	Total LFG Flow Rate Estimated
	Food (tonnes)	Garden (tonnes)	Paper (tonnes)	Wood (tonnes)	Textile (tonnes)	Nappies (tonnes)	Total (tonnes)	(L_o, m^3/tonne)	(scfm)
2100	0	2	45	74	38	19	178		35
2101	0	1	43	72	36	18	170		34
2102	0	1	41	70	34	17	163		32
2103	0	1	39	68	32	16	157		31
2104	0	1	37	66	31	16	150		30
2105	0	1	35	64	29	15	144		29
2106	0	1	33	62	28	14	138		27
2107	0	1	32	60	26	14	133		26
2108	0	1	30	58	25	13	127		25
2109	0	1	29	57	24	12	122		24
2110	0	1	27	55	23	12	117		23
2111	0	1	26	53	22	11	113		22
2112	0	1	25	52	21	11	108		21
2113	0	1	23	50	20	10	104		21
2114	0	0	22	49	19	10	100		20
2115	0	0	21	47	18	9	96		19
2116	0	0	20	46	17	9	92		18
2117	0	0	19	45	16	8	88		18
2118	0	0	18	43	15	8	85		17
2119	0	0	17	42	15	7	82		16
2120	0	0	16	41	14	7	78		16
2121	0	0	16	40	13	7	75		15
2122	0	0	15	38	12	6	72		14
2123	0	0	14	37	12	6	70		14
2124	0	0	13	36	11	6	67		13
2125	0	0	13	35	11	5	64		13
2126	0	0	12	34	10	5	62		12
2127	0	0	12	33	10	5	60		12
2128	0	0	11	32	9	5	57		11
2129	0	0	11	31	9	4	55		11
2130	0	0	10	30	8	4	53		11
2131	0	0	10	29	8	4	51		10
2132	0	0	9	28	8	4	49		10
2133	0	0	9	28	7	4	47		9
2134	0	0	8	27	7	4	45		9
2135	0	0	8	26	7	3	44		9
2136	0	0	7	25	6	3	42		8
2137	0	0	7	24	6	3	41		8
2138	0	0	7	24	6	3	39		8
2139	0	0	6	23	5	3	38		7
2140	0	0	6	22	5	3	36		7
2141	0	0	6	22	5	2	35		7
2142	0	0	5	21	5	2	34		7
2143	0	0	5	20	4	2	32		6
2144	0	0	5	20	4	2	31		6
2145	0	0	5	19	4	2	30		6
2146	0	0	4	19	4	2	29		6
2147	0	0	4	18	4	2	28		6
2148	0	0	4	18	3	2	27		5
2149	0	0	4	17	3	2	26		5
2150	0	0	4	17	3	2	25		5
2151	0	0	3	16	3	1	24		5
2152	0	0	3	16	3	1	23		5
2153	0	0	3	15	3	1	22		4
2154	0	0	3	15	3	1	22		4
2155	0	0	3	14	2	1	21		4
2156	0	0	3	14	2	1	20		4
2157	0	0	3	13	2	1	19		4
2158	0	0	2	13	2	1	19		4
2159	0	0	2	13	2	1	18		4
2160	0	0	2	12	2	1	17		3
2161	0	0	2	12	2	1	17		3
2162	0	0	2	12	2	1	16		3
2163	0	0	2	11	2	1	16		3
2164	0	0	2	11	2	1	15		3
2165	0	0	2	11	1	1	15		3
2166	0	0	2	10	1	1	14		3
2167	0	0	2	10	1	1	14		3
2168	0	0	1	10	1	1	13		3
2169	0	0	1	9	1	1	13		2
2170	0	0	1	9	1	1	12		2
2171	0	0	1	9	1	1	12		2
2172	0	0	1	9	1	1	11		2
2173	0	0	1	8	1	0	11		2
2174	0	0	1	8	1	0	11		2
2175	0	0	1	8	1	0	10		2
2176	0	0	1	8	1	0	10		2
2177	0	0	1	7	1	0	10		2
2178	0	0	1	7	1	0	9		2

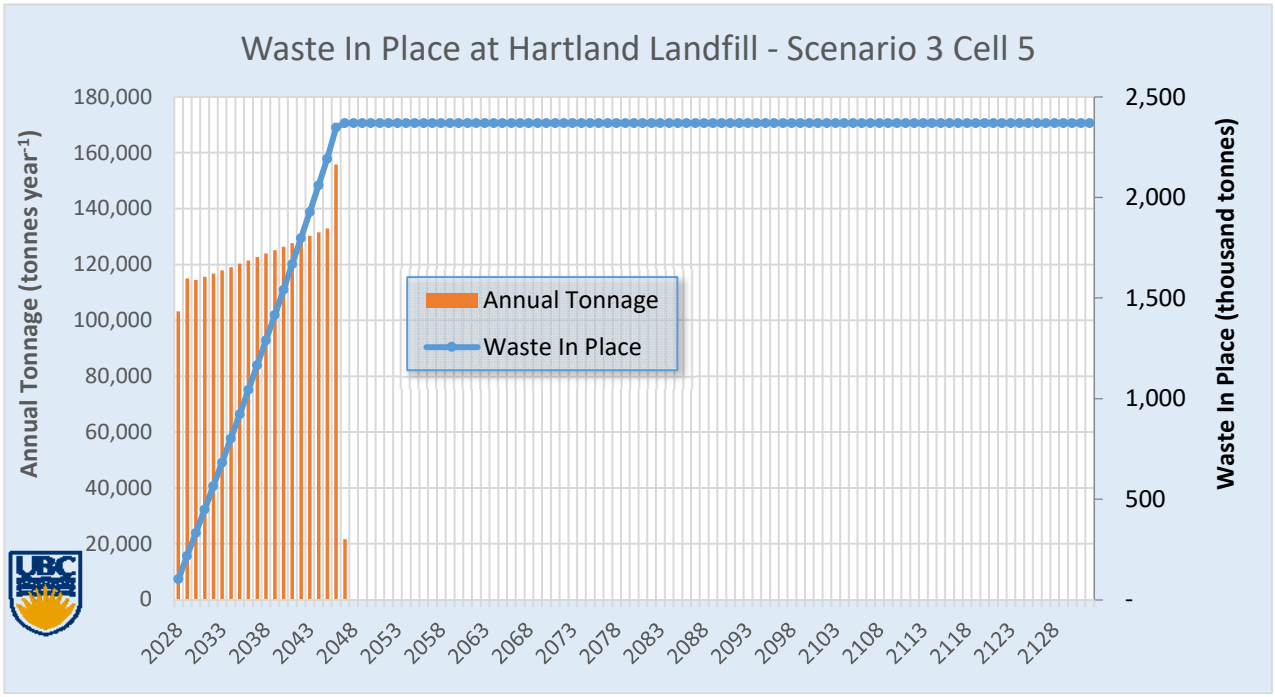
Year	LFG Generation Magnitude for the Hartland Landfill (CRD) - Sc. 3 Cell 5
2100	
2101	
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2175	
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2177	
2178	

Hartland Landfill (CRD) - Sc. 3 Cell 5

Landfill Gas Generation Analysis **GRAPHICAL RESULTS**

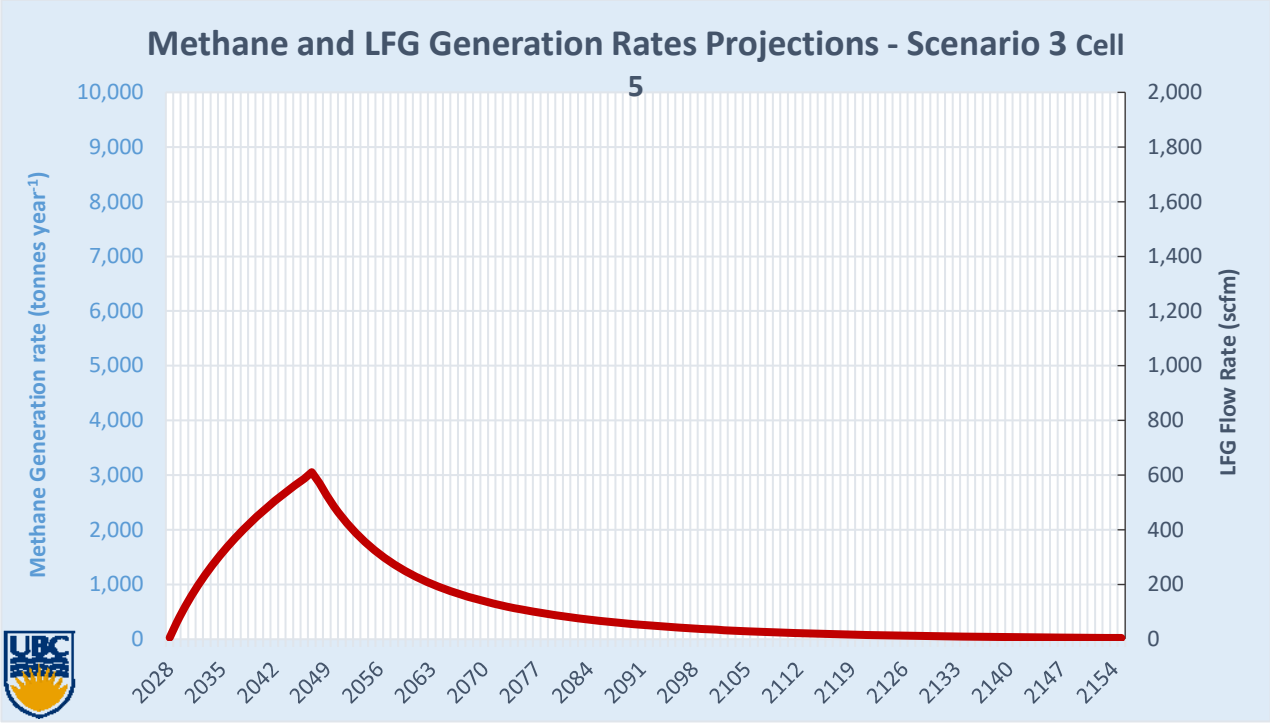
Average Deposited Waste Composition

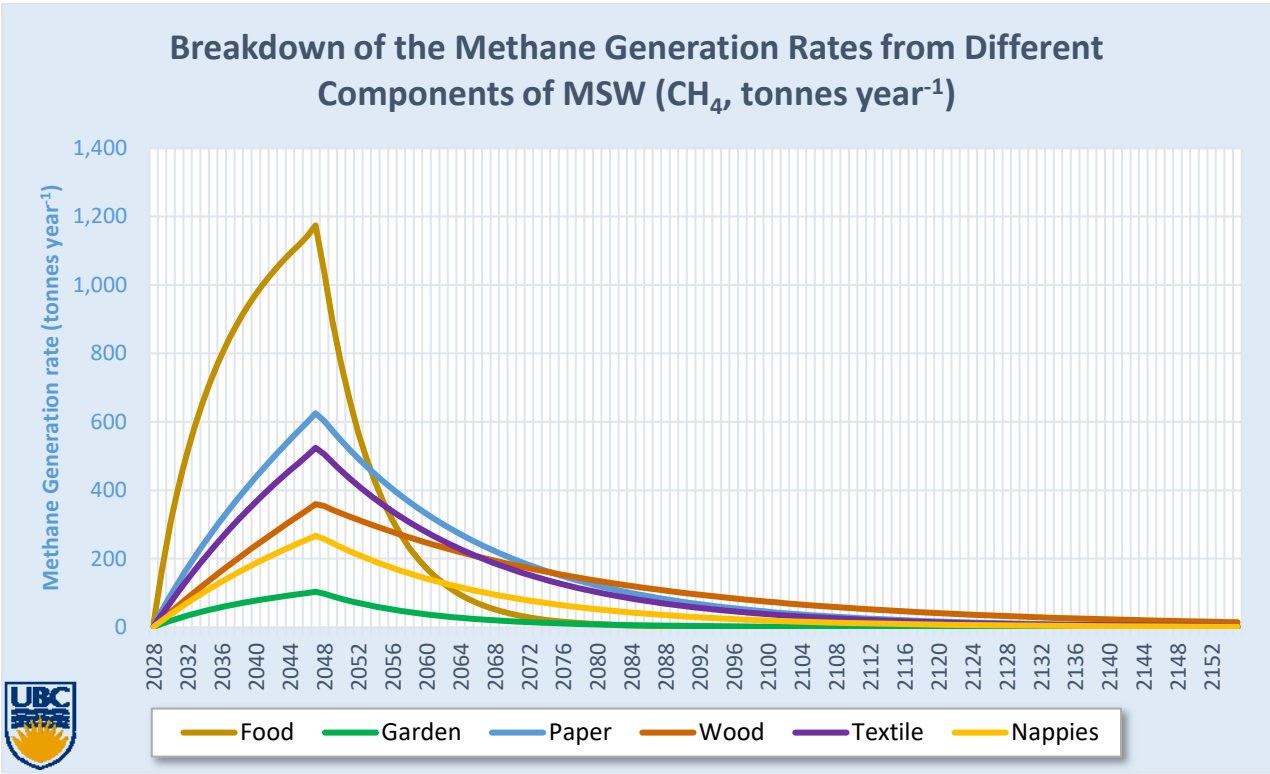




Hartland Landfill (CRD) - Sc. 3 Cell 5

Landfill Gas Generation Analysis **GRAPHICAL RESULTS**





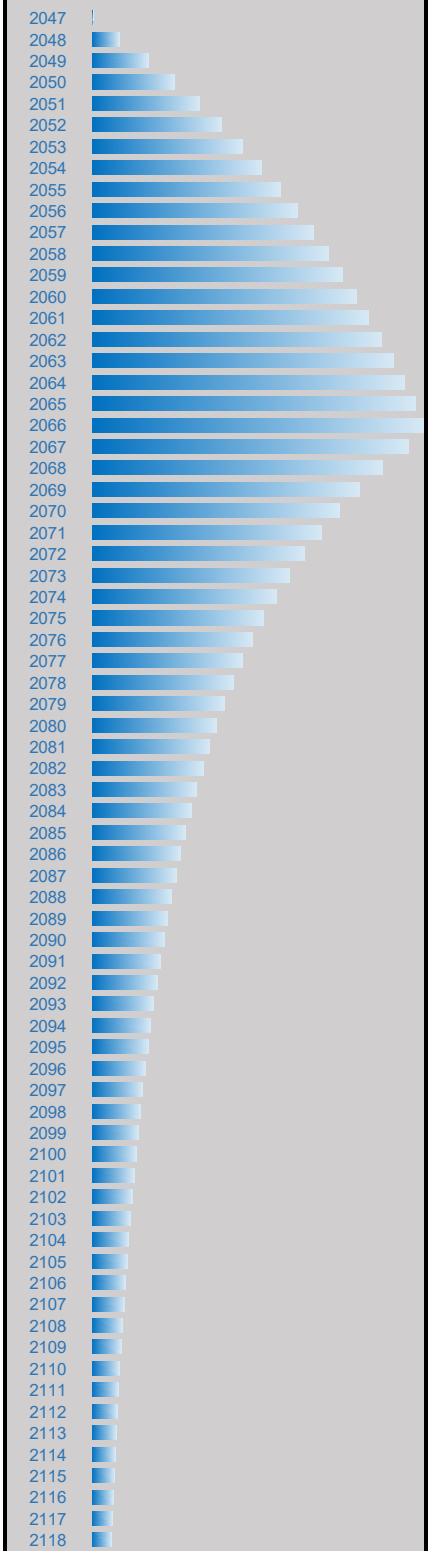
Methane Generation Estimates from the Hartland Landfill (CRD) - Sc.3 Cell 6

Actual CH_4 Yields

L_o (m^3/tonne)	127	158	143	72	114	103	52.4

Year	Methane generation estimates for the Hartland Landfill (CRD) - Sc.3 Cell 6							Methane Generation Potential	Total LFG Flow Rate Estimated
	Food (tonnes)	Garden (tonnes)	Paper (tonnes)	Wood (tonnes)	Textile (tonnes)	Nappies (tonnes)	Total (tonnes)	(L_o, m^3/tonne)	(scfm)
2047	14	1	4	2	3	2	25	52.6	5
2048	167	10	49	25	41	21	313	52.6	62
2049	327	20	101	51	85	43	627	52.6	124
2050	467	30	150	76	127	65	914	52.6	181
2051	589	39	198	102	167	85	1,179	52.6	234
2052	695	47	244	126	206	105	1,423	52.6	282
2053	789	55	288	151	243	124	1,650	52.6	327
2054	872	62	331	174	279	142	1,861	52.6	369
2055	945	69	372	198	314	160	2,057	52.6	408
2056	1,010	75	412	221	347	177	2,242	52.6	445
2057	1,068	82	450	243	379	194	2,416	52.6	479
2058	1,120	87	487	266	411	210	2,580	52.6	512
2059	1,166	93	523	287	441	225	2,735	52.6	542
2060	1,208	98	557	309	470	240	2,882	52.6	572
2061	1,247	103	591	330	498	254	3,023	52.6	600
2062	1,282	107	623	351	526	268	3,157	52.6	626
2063	1,314	112	655	372	552	282	3,286	52.6	652
2064	1,344	116	686	392	578	295	3,410	52.6	676
2065	1,372	120	716	412	603	308	3,530	52.6	700
2066	1,385	123	741	430	625	319	3,621	52.6	718
2067	1,259	117	725	427	611	312	3,451		684
2068	1,084	108	689	414	581	297	3,173		629
2069	933	100	656	402	553	282	2,925		580
2070	803	92	624	390	526	268	2,703		536
2071	691	85	593	379	500	255	2,504		497
2072	595	79	564	367	476	243	2,324		461
2073	512	73	537	357	453	231	2,162		429
2074	441	67	511	346	431	220	2,015		400
2075	379	62	486	336	410	209	1,881		373
2076	326	57	462	326	390	199	1,760		349
2077	281	53	439	316	371	189	1,649		327
2078	242	49	418	307	353	180	1,548		307
2079	208	45	398	298	335	171	1,455		289
2080	179	41	378	289	319	163	1,370		272
2081	154	38	360	280	303	155	1,291		256
2082	133	35	342	272	289	147	1,218		242
2083	114	33	326	264	275	140	1,151		228
2084	98	30	310	256	261	133	1,089		216
2085	85	28	295	249	248	127	1,031		204
2086	73	26	280	241	236	121	977		194
2087	63	24	267	234	225	115	927		184
2088	54	22	254	227	214	109	880		174
2089	46	20	241	221	203	104	836		166
2090	40	19	229	214	193	99	794		158
2091	34	17	218	208	184	94	756		150
2092	30	16	208	202	175	89	719		143
2093	25	15	197	196	167	85	685		136
2094	22	14	188	190	158	81	652		129
2095	19	12	179	184	151	77	622		123
2096	16	12	170	179	143	73	593		118
2097	14	11	162	174	136	70	566		112
2098	12	10	154	168	130	66	540		107
2099	10	9	146	163	123	63	515		102
2100	9	8	139	159	117	60	492		98
2101	8	8	132	154	112	57	470		93
2102	7	7	126	149	106	54	449		89
2103	6	7	120	145	101	52	430		85
2104	5	6	114	141	96	49	411		81
2105	4	6	108	137	91	47	393		78
2106	4	5	103	132	87	44	376		75
2107	3	5	98	129	83	42	359		71
2108	3	4	93	125	79	40	344		68
2109	2	4	89	121	75	38	329		65
2110	2	4	84	117	71	36	315		63
2111	2	3	80	114	68	35	302		60
2112	1	3	76	111	64	33	289		57
2113	1	3	73	107	61	31	277		55
2114	1	3	69	104	58	30	265		53
2115	1	3	66	101	55	28	254		50
2116	1	2	63	98	53	27	243		48
2117	1	2	59	95	50	26	233		46
2118	1	2	57	92	48	24	224		44

Year — LFG Generation Magnitude for the Hartland Landfill (CRD) - Sc.3 Cell 6



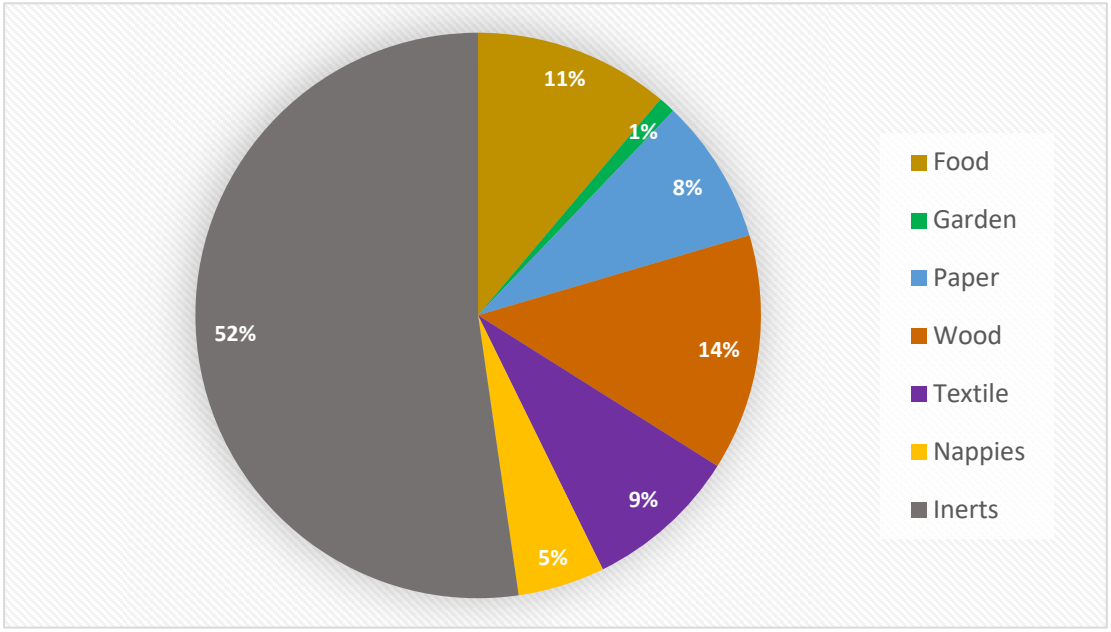
Year	Methane generation estimates for the Hartland Landfill (CRD) - Sc.3 Cell 6							Methane Generation Potential	Total LFG Flow Rate Estimated
	Food (tonnes)	Garden (tonnes)	Paper (tonnes)	Wood (tonnes)	Textile (tonnes)	Nappies (tonnes)	Total (tonnes)	(L_o, m^3/tonne)	(scfm)
2119	1	2	54	90	45	23	214		43
2120	0	2	51	87	43	22	206		41
2121	0	2	49	84	41	21	197		39
2122	0	1	46	82	39	20	189		37
2123	0	1	44	80	37	19	181		36
2124	0	1	42	77	35	18	174		35
2125	0	1	40	75	34	17	167		33
2126	0	1	38	73	32	16	160		32
2127	0	1	36	71	30	16	154		30
2128	0	1	34	68	29	15	148		29
2129	0	1	33	66	28	14	142		28
2130	0	1	31	64	26	13	136		27
2131	0	1	30	63	25	13	131		26
2132	0	1	28	61	24	12	125		25
2133	0	1	27	59	23	12	120		24
2134	0	1	25	57	21	11	116		23
2135	0	1	24	56	20	10	111		22
2136	0	0	23	54	19	10	107		21
2137	0	0	22	52	18	9	102		20
2138	0	0	21	51	18	9	98		20
2139	0	0	20	49	17	9	95		19
2140	0	0	19	48	16	8	91		18
2141	0	0	18	46	15	8	87		17
2142	0	0	17	45	14	7	84		17
2143	0	0	16	44	14	7	81		16
2144	0	0	15	42	13	7	78		15
2145	0	0	15	41	12	6	75		15
2146	0	0	14	40	12	6	72		14
2147	0	0	13	39	11	6	69		14
2148	0	0	13	38	11	5	66		13
2149	0	0	12	36	10	5	64		13
2150	0	0	11	35	10	5	62		12
2151	0	0	11	34	9	5	59		12
2152	0	0	10	33	9	4	57		11
2153	0	0	10	32	8	4	55		11
2154	0	0	9	31	8	4	53		10
2155	0	0	9	30	8	4	51		10
2156	0	0	8	30	7	4	49		10
2157	0	0	8	29	7	3	47		9
2158	0	0	8	28	6	3	45		9
2159	0	0	7	27	6	3	44		9
2160	0	0	7	26	6	3	42		8
2161	0	0	7	25	6	3	40		8
2162	0	0	6	25	5	3	39		8
2163	0	0	6	24	5	3	38		7
2164	0	0	6	23	5	2	36		7
2165	0	0	5	23	5	2	35		7
2166	0	0	5	22	4	2	34		7
2167	0	0	5	21	4	2	32		6
2168	0	0	5	21	4	2	31		6
2169	0	0	4	20	4	2	30		6
2170	0	0	4	19	4	2	29		6
2171	0	0	4	19	3	2	28		6
2172	0	0	4	18	3	2	27		5
2173	0	0	4	18	3	2	26		5
2174	0	0	3	17	3	1	25		5
2175	0	0	3	17	3	1	24		5
2176	0	0	3	16	3	1	23		5
2177	0	0	3	16	2	1	22		4
2178	0	0	3	15	2	1	22		4
2179	0	0	3	15	2	1	21		4
2180	0	0	3	14	2	1	20		4
2181	0	0	2	14	2	1	19		4
2182	0	0	2	14	2	1	19		4
2183	0	0	2	13	2	1	18		4
2184	0	0	2	13	2	1	18		3
2185	0	0	2	12	2	1	17		3
2186	0	0	2	12	2	1	16		3
2187	0	0	2	12	2	1	16		3
2188	0	0	2	11	1	1	15		3
2189	0	0	2	11	1	1	15		3
2190	0	0	2	11	1	1	14		3
2191	0	0	1	10	1	1	14		3
2192	0	0	1	10	1	1	13		3
2193	0	0	1	10	1	1	13		3
2194	0	0	1	9	1	1	12		2
2195	0	0	1	9	1	1	12		2
2196	0	0	1	9	1	0	12		2
2197	0	0	1	9	1	0	11		2

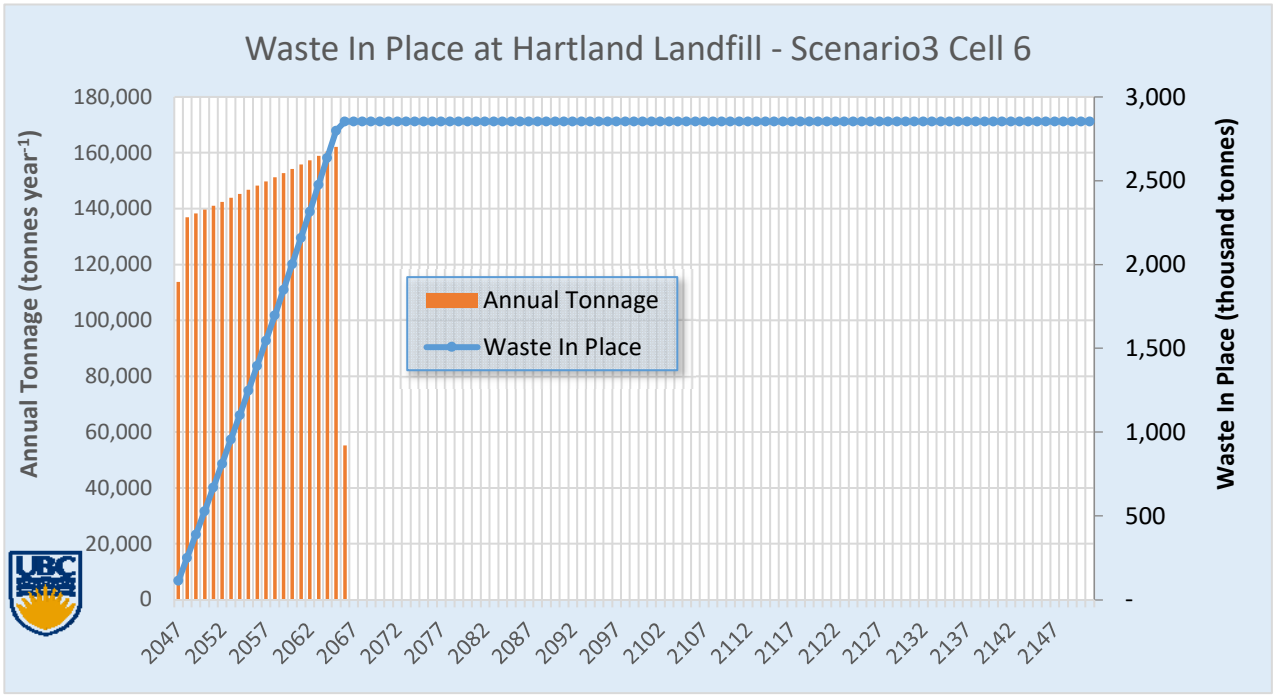
Year	LFG Generation Magnitude for the Hartland Landfill (CRD) - Sc.3 Cell 6
2119	
2120	
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Hartland Landfill (CRD) - Sc.3 Cell 6

Landfill Gas Generation Analysis **GRAPHICAL RESULTS**

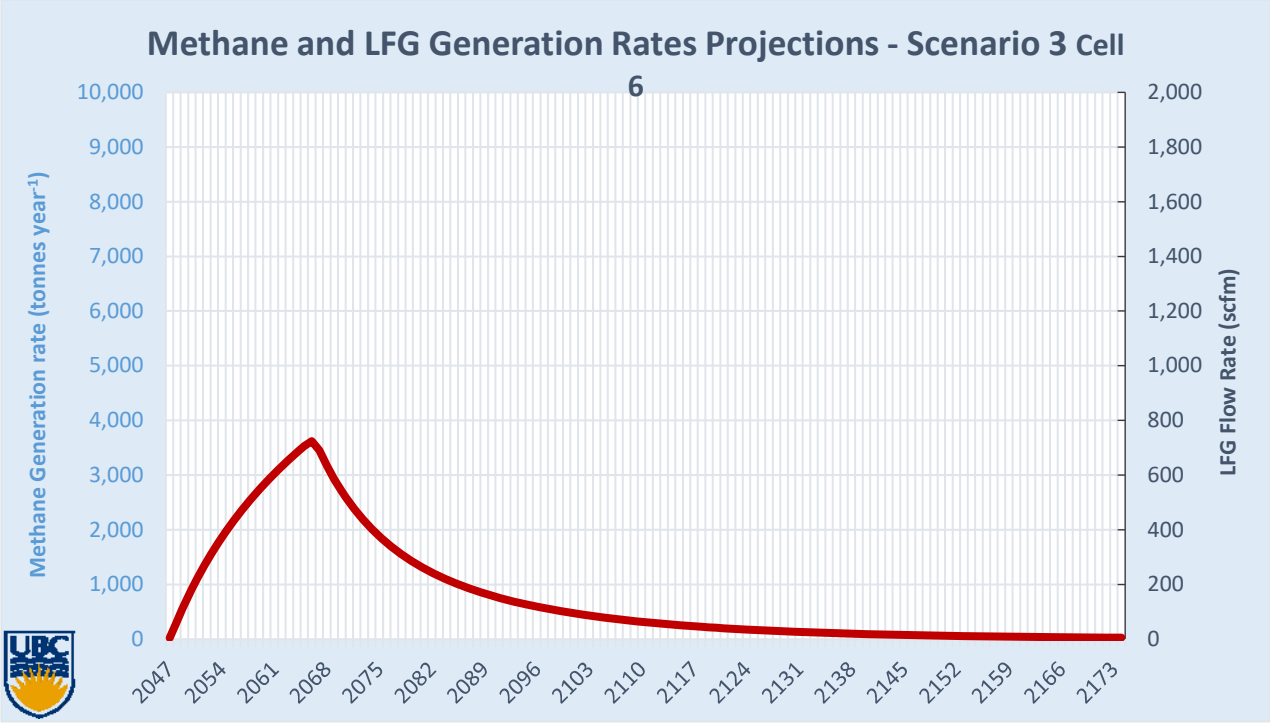
Average Deposited Waste Composition

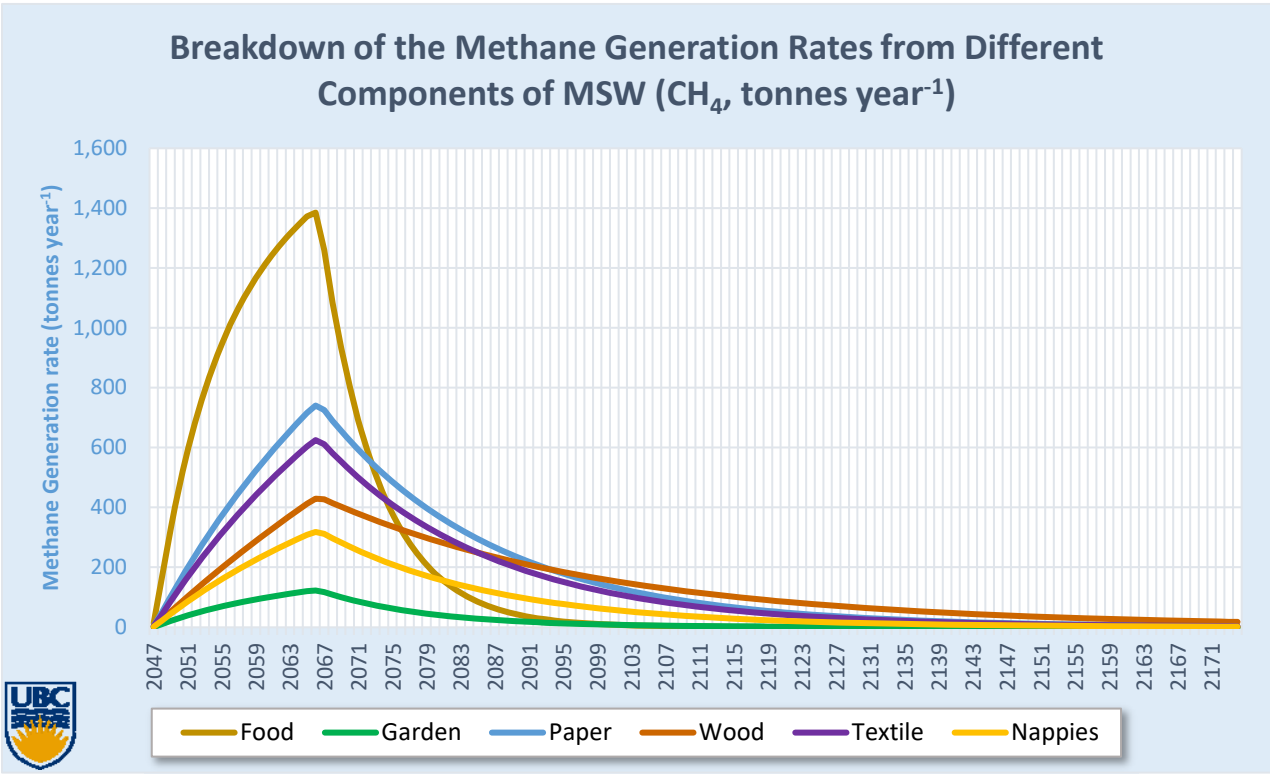




Hartland Landfill (CRD) - Sc.3 Cell 6

Landfill Gas Generation Analysis **GRAPHICAL RESULTS**





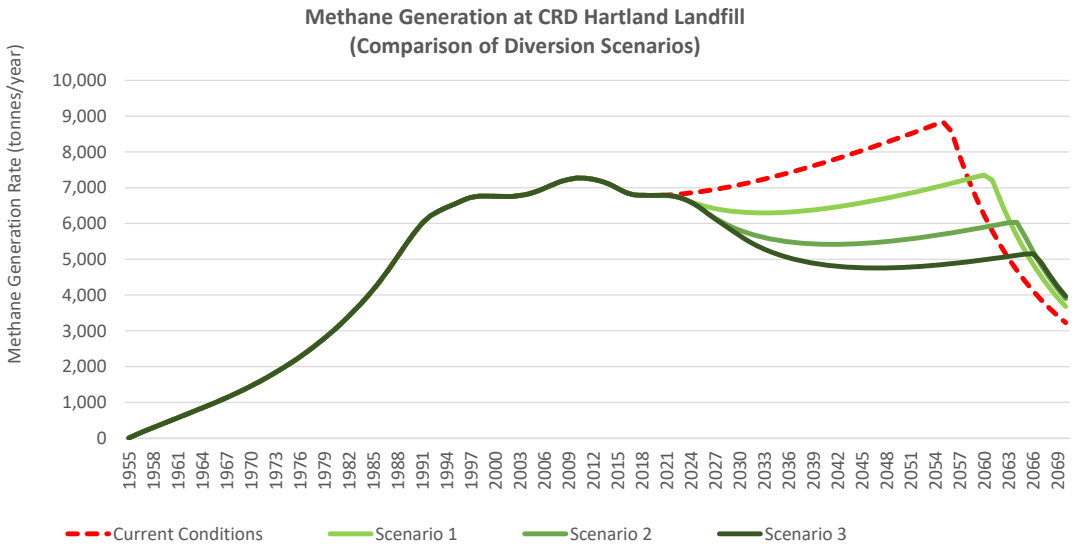
APPENDIX D

Lifespan LFG Generation Estimates for Different Diversion Scenarios

Table D.1 - Landfill Gas and Methane Generation Assessment for Different Scenarios

Year	Current Conditions			Scenario 1			Scenario 2			Scenario 3		
	LFG		CH_4	LFG		CH_4	LFG		CH_4	LFG		CH_4
	scfm	m3/hr	tonnes/yr	scfm	m3/hr	tonnes/yr	scfm	m3/hr	tonnes/yr	scfm	m3/hr	tonnes/yr
1955	2	3	9	2	3	9	2	3	9	2	3	9
1956	22	37	109	22	37	109	22	37	109	22	37	109
1957	41	69	204	41	69	204	41	69	204	41	69	204
1958	59	100	297	59	100	297	59	100	297	59	100	297
1959	77	131	388	77	131	388	77	131	388	77	131	388
1960	95	161	478	95	161	478	95	161	478	95	161	478
1961	113	191	568	113	191	568	113	191	568	113	191	568
1962	130	221	657	130	221	657	130	221	657	130	221	657
1963	148	252	748	148	252	748	148	252	748	148	252	748
1964	167	283	840	167	283	840	167	283	840	167	283	840
1965	185	315	934	185	315	934	185	315	934	185	315	934
1966	205	348	1,031	205	348	1,031	205	348	1,031	205	348	1,031
1967	224	381	1,132	224	381	1,132	224	381	1,132	224	381	1,132
1968	245	416	1,236	245	416	1,236	245	416	1,236	245	416	1,236
1969	267	453	1,344	267	453	1,344	267	453	1,344	267	453	1,344
1970	289	491	1,457	289	491	1,457	289	491	1,457	289	491	1,457
1971	313	531	1,576	313	531	1,576	313	531	1,576	313	531	1,576
1972	337	573	1,701	337	573	1,701	337	573	1,701	337	573	1,701
1973	363	617	1,832	363	617	1,832	363	617	1,832	363	617	1,832
1974	391	664	1,970	391	664	1,970	391	664	1,970	391	664	1,970
1975	420	713	2,116	420	713	2,116	420	713	2,116	420	713	2,116
1976	450	765	2,270	450	765	2,270	450	765	2,270	450	765	2,270
1977	483	820	2,433	483	820	2,433	483	820	2,433	483	820	2,433
1978	517	878	2,605	517	878	2,605	517	878	2,605	517	878	2,605
1979	553	940	2,788	553	940	2,788	553	940	2,788	553	940	2,788
1980	592	1,005	2,982	592	1,005	2,982	592	1,005	2,982	592	1,005	2,982
1981	632	1,074	3,188	632	1,074	3,188	632	1,074	3,188	632	1,074	3,188
1982	676	1,148	3,407	676	1,148	3,407	676	1,148	3,407	676	1,148	3,407
1983	722	1,226	3,639	722	1,226	3,639	722	1,226	3,639	722	1,226	3,639
1984	771	1,309	3,885	771	1,309	3,885	771	1,309	3,885	771	1,309	3,885
1985	823	1,397	4,147	823	1,397	4,147	823	1,397	4,147	823	1,397	4,147
1986	878	1,492	4,427	878	1,492	4,427	878	1,492	4,427	878	1,492	4,427
1987	942	1,600	4,747	942	1,600	4,747	942	1,600	4,747	942	1,600	4,747
1988	1,008	1,712	5,080	1,008	1,712	5,080	1,008	1,712	5,080	1,008	1,712	5,080
1989	1,073	1,823	5,409	1,073	1,823	5,409	1,073	1,823	5,409	1,073	1,823	5,409
1990	1,136	1,930	5,726	1,136	1,930	5,726	1,136	1,930	5,726	1,136	1,930	5,726
1991	1,191	2,023	6,004	1,191	2,023	6,004	1,191	2,023	6,004	1,191	2,023	6,004
1992	1,231	2,092	6,207	1,231	2,092	6,207	1,231	2,092	6,207	1,231	2,092	6,207
1993	1,257	2,136	6,339	1,257	2,136	6,339	1,257	2,136	6,339	1,257	2,136	6,339
1994	1,279	2,173	6,448	1,279	2,173	6,448	1,279	2,173	6,448	1,279	2,173	6,448
1995	1,297	2,204	6,540	1,297	2,204	6,540	1,297	2,204	6,540	1,297	2,204	6,540
1996	1,317	2,238	6,641	1,317	2,238	6,641	1,317	2,238	6,641	1,317	2,238	6,641
1997	1,333	2,265	6,722	1,333	2,265	6,722	1,333	2,265	6,722	1,333	2,265	6,722
1998	1,341	2,279	6,763	1,341	2,279	6,763	1,341	2,279	6,763	1,341	2,279	6,763
1999	1,340	2,277	6,758	1,340	2,277	6,758	1,340	2,277	6,758	1,340	2,277	6,758
2000	1,340	2,277	6,758	1,340	2,277	6,758	1,340	2,277	6,758	1,340	2,277	6,758
2001	1,340	2,276	6,754	1,340	2,276	6,754	1,340	2,276	6,754	1,340	2,276	6,754
2002	1,339	2,275	6,752	1,339	2,275	6,752	1,339	2,275	6,752	1,339	2,275	6,752
2003	1,345	2,286	6,784	1,345	2,286	6,784	1,345	2,286	6,784	1,345	2,286	6,784
2004	1,353	2,299	6,822	1,353	2,299	6,822	1,353	2,299	6,822	1,353	2,299	6,822
2005	1,366	2,321	6,888	1,366	2,321	6,888	1,366	2,321	6,888	1,366	2,321	6,888
2006	1,385	2,353	6,982	1,385	2,353	6,982	1,385	2,353	6,982	1,385	2,353	6,982
2007	1,404	2,385	7,077	1,404	2,385	7,077	1,404	2,385	7,077	1,404	2,385	7,077
2008	1,424	2,420	7,180	1,424	2,420	7,180	1,424	2,420	7,180	1,424	2,420	7,180
2009	1,434	2,437	7,232	1,434	2,437	7,232	1,434	2,437	7,232	1,434	2,437	7,232
2010	1,442	2,450	7,271	1,442	2,450	7,271	1,442	2,450	7,271	1,442	2,450	7,271
2011	1,442	2,449	7,268	1,442	2,449	7,268	1,442	2,449	7,268	1,442	2,449	7,268
2012	1,435	2,438	7,235	1,435	2,438	7,235	1,435	2,438	7,235	1,435	2,438	7,235
2013	1,424	2,419	7,177	1,424	2,419	7,177	1,424	2,419	7,177	1,424	2,419	7,177
2014	1,408	2,392	7,099	1,408	2,392	7,099	1,408	2,392	7,099	1,408	2,392	7,099
2015	1,385	2,353	6,983	1,385	2,353	6,983	1,385	2,353	6,983	1,385	2,353	6,983
2016	1,361	2,312	6,860	1,361	2,312	6,860	1,361	2,312	6,860	1,361	2,312	6,860
2017	1,349	2,292	6,801	1,349	2,292	6,801	1,349	2,292	6,801	1,349	2,292	6,801
2018	1,346	2,287	6,786	1,346	2,287	6,786	1,346	2,287	6,786	1,346	2,287	6,786
2019	1,345	2,285	6,781	1,345	2,285	6,781	1,345	2,285	6,781	1,345	2,285	6,781
2020	1,345	2,286	6,783	1,345	2,286	6,783	1,345	2,286	6,783	1,345	2,286	6,783
2021	1,347	2,289	6,792	1,346	2,287	6,788	1,346	2,287	6,788	1,346	2,287	6,788
2022	1,350	2,294	6,807	1,340	2,277	6,756	1,340	2,277	6,756	1,340	2,277	6,756
2023	1,354	2,301	6,827	1,327	2,255	6,691	1,327	2,255	6,691	1,327	2,255	6,691
2024	1,359	2,309	6,852	1,309	2,224	6,601	1,308	2,223	6,595	1,308	2,223	6,595
2025	1,365	2,319	6,882	1,294	2,199	6,525	1,281	2,176	6,457	1,281	2,176	6,457
2026	1,372	2,330	6,915	1,282	2,178	6,463	1,247	2,118	6,287	1,247	2,118	6,285
2027	1,379	2,343	6,953	1,272	2,161	6,413	1,218	2,069	6,139	1,214	2,063	6,120

Year	Current Conditions			Scenario 1			Scenario 2			Scenario 3		
	LFG		CH_4	LFG		CH_4	LFG		CH_4	LFG		CH_4
	scfm	m3/hr	tonnes/yr	scfm	m3/hr	tonnes/yr	scfm	m3/hr	tonnes/yr	scfm	m3/hr	tonnes/yr
2028	1,387	2,357	6,994	1,264	2,147	6,372	1,192	2,026	6,012	1,182	2,009	5,962
2029	1,396	2,372	7,038	1,258	2,137	6,342	1,171	1,989	5,902	1,152	1,957	5,808
2030	1,405	2,388	7,085	1,253	2,129	6,319	1,152	1,957	5,808	1,122	1,907	5,659
2031	1,415	2,404	7,135	1,250	2,124	6,304	1,136	1,930	5,727	1,094	1,859	5,516
2032	1,425	2,422	7,187	1,249	2,121	6,295	1,122	1,907	5,659	1,069	1,817	5,391
2033	1,436	2,440	7,241	1,248	2,121	6,293	1,111	1,888	5,601	1,048	1,780	5,282
2034	1,448	2,459	7,298	1,249	2,122	6,295	1,101	1,871	5,553	1,029	1,748	5,188
2035	1,459	2,479	7,357	1,250	2,124	6,303	1,094	1,858	5,514	1,013	1,721	5,107
2036	1,471	2,500	7,418	1,253	2,128	6,315	1,087	1,847	5,482	999	1,698	5,038
2037	1,484	2,521	7,480	1,256	2,134	6,332	1,082	1,839	5,458	987	1,678	4,978
2038	1,496	2,543	7,545	1,260	2,140	6,352	1,079	1,833	5,439	977	1,661	4,928
2039	1,510	2,565	7,611	1,265	2,148	6,375	1,076	1,829	5,426	969	1,646	4,885
2040	1,523	2,588	7,679	1,270	2,157	6,402	1,075	1,826	5,419	962	1,635	4,850
2041	1,537	2,611	7,748	1,276	2,167	6,431	1,074	1,825	5,416	956	1,625	4,822
2042	1,551	2,635	7,818	1,282	2,178	6,464	1,074	1,825	5,417	952	1,617	4,799
2043	1,565	2,659	7,890	1,289	2,190	6,498	1,075	1,827	5,422	948	1,611	4,782
2044	1,580	2,684	7,964	1,296	2,202	6,536	1,077	1,830	5,430	946	1,607	4,769
2045	1,594	2,709	8,038	1,304	2,216	6,575	1,079	1,834	5,442	944	1,604	4,761
2046	1,609	2,734	8,114	1,312	2,230	6,616	1,082	1,839	5,457	943	1,603	4,757
2047	1,625	2,760	8,192	1,321	2,244	6,660	1,086	1,845	5,475	943	1,603	4,756
2048	1,640	2,787	8,270	1,330	2,259	6,705	1,090	1,852	5,495	944	1,604	4,759
2049	1,656	2,814	8,350	1,339	2,275	6,752	1,094	1,859	5,518	945	1,606	4,765
2050	1,672	2,841	8,430	1,349	2,292	6,800	1,099	1,868	5,542	947	1,609	4,773
2051	1,688	2,869	8,512	1,359	2,309	6,851	1,105	1,877	5,569	949	1,612	4,785
2052	1,705	2,897	8,595	1,369	2,326	6,902	1,110	1,887	5,598	952	1,617	4,798
2053	1,722	2,925	8,679	1,380	2,344	6,956	1,117	1,897	5,629	955	1,622	4,814
2054	1,738	2,954	8,765	1,390	2,362	7,010	1,123	1,908	5,662	959	1,629	4,833
2055	1,750	2,974	8,825	1,402	2,381	7,067	1,130	1,920	5,696	963	1,635	4,853
2056	1,701	2,889	8,574	1,413	2,401	7,124	1,137	1,932	5,732	967	1,643	4,875
2057	1,564	2,658	7,887	1,425	2,420	7,183	1,144	1,944	5,770	972	1,651	4,899
2058	1,442	2,451	7,272	1,437	2,441	7,243	1,152	1,957	5,809	977	1,659	4,924
2059	1,333	2,265	6,722	1,449	2,461	7,304	1,160	1,971	5,849	982	1,668	4,951
2060	1,235	2,099	6,228	1,458	2,478	7,352	1,168	1,985	5,891	988	1,678	4,980
2061	1,147	1,949	5,783	1,430	2,430	7,211	1,177	2,000	5,934	994	1,688	5,010
2062	1,067	1,813	5,381	1,316	2,235	6,633	1,186	2,015	5,978	1,000	1,699	5,041
2063	995	1,691	5,018	1,213	2,061	6,115	1,195	2,030	6,024	1,006	1,710	5,074
2064	930	1,580	4,688	1,121	1,904	5,651	1,196	2,033	6,032	1,013	1,721	5,108
2065	870	1,479	4,388	1,038	1,764	5,235	1,118	1,899	5,637	1,020	1,733	5,143
2066	816	1,386	4,114	964	1,637	4,859	1,034	1,757	5,213	1,023	1,737	5,155
2067	766	1,302	3,863	896	1,523	4,520	959	1,629	4,833	974	1,655	4,910
2068	721	1,225	3,634	836	1,420	4,213	890	1,513	4,490	905	1,538	4,563
2069	679	1,153	3,423	780	1,326	3,934	829	1,408	4,180	843	1,432	4,250
2070	640	1,088	3,228	730	1,240	3,680	773	1,314	3,899	786	1,336	3,965



Hartland Landfill
Greenhouse Gas Emissions Quantification
(Final Report)





PREPARED FOR: CAPITAL REGIONAL DISTRICT

PREPARED BY: SPERLING HANSEN ASSOCIATES

PRJ20007

January 2021

SPERLING HANSEN ASSOCIATES

Making a difference...together

- Landfill Services
- Landfill Gas Management
- Land Reclamation
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SPERLING
HANSEN
ASSOCIATES

- Landfill Engineering
- Solid Waste Planning
- Environmental Monitoring
- Landfill Fire Control

January 30th, 2021 PRJ20007

Kelly Tradewell, BSc
Environmental Contaminants Officer
Parks & Environmental Services
Capital Regional District

RE: Hartland Landfill Greenhouse Gas Emissions Quantification – Final Report

Dear Mrs. Tradewell,

Sperling Hansen Associates (SHA) is pleased to provide you with the final report of the Hartland Landfill Greenhouse Gas (GHG) Emissions Quantification. advanced Landfill Gas (LFG) Generation assessment for the.

SHA conducted comprehensive field investigations and data analysis to quantify fugitive methane emissions from the landfill. Our field investigations and data analyses showed that Hartland Landfill is currently emitting 925 tonnes of CH_4 per year, equivalent to 184 scfm of LFG at 50% CH_4 content. Therefore, the maximum rate of GHG emissions from Hartland Landfill is estimated to be approximately 23,000 tonnes of CO2-e per year, which accounts for 14% of the generated gas from the landfill in 2020.

Results of this GHG emission quantification study showed that CH_4 emission rates at this facility are lower than what is known as industry best engineering practices, indicating a high collection efficiency of the active gas collection system at this site. To our knowledge, this is the highest gas collection efficiency currently achieved in BC. Furthermore, completing a methane mass balance during the two field measurement events showed that UBCiModel©, as a site-specific model, better represents CH_4 generation at Hartland Landfill.

If you have any questions about our submission or require any further information, please do not hesitate to contact me.

Yours truly,
SPERLING HANSEN ASSOCIATES



Ali R. Abedini, Ph.D.
Senior Environmental Consultant
Landfill Gas Specialist

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HARTLAND LANDFILL

GREENHOUSE GAS EMISSIONS QUANTIFICATION

Prepared For:

CAPITAL REGIONAL DISTRICT

Prepared By:

SPERLING HANSEN ASSOCIATES

January, 2021

Table of Content

1 INTRODUCTION 1
1.1 Background 1
1.2 Landfill Gas Generation and Collection Efficiency at Hartland Landfill 2
1.3 Scope of the Current Study 2
2 LANDFILL METHANE MASS BALANCE INVESTIGATION 2
3 METHANE EMISSIONS MEASUREMENT 3
3.1 Technique for Quantification of Fugitive Methane Emissions at Hartland 3
3.1.1 Effect of Barometric Pressure on LFG Emission 6
3.2 Gas Collection Rates during June and October 2020 Field Investigations 9
4 RESULTS 10
4.1 Methane Emission Hotspots 10
4.2 Site-Specific Correlation Factor for Hartland Landfill 15
4.3 Methane Emission Rates 16
4.4 Methane Mass Balance 22
4.4.1 Modelled Landfill Gas Generation 22
4.4.2 Methane Collection Efficiency at Hartland Landfill 24
4.5 Biological Oxidation of Methane 26
5 CONCLUSIONS AND RECOMMENDATIONS 28
6 STATEMENT OF LIMITATIONS 30
7 REFERENCES 31

List of Appendices

Appendix A – BioCover Design Recommendations (Technical Memo)

List of Tables

Table 3.1 - Hartland Landfill Active Gas Collection System Data (June & October , 2020) 9
Table 4.1 - Results of Surface Scan and Methane Emission Quantification for Hartland Landfill 19
Table 4.2 - Methane and LFG Emission Rates from Different Areas of Hartland Landfill..... 21
Table 4.3 - LFG Generation Assessment Summary using 3 Models (SHA, 2019) 22
Table 4.4 - Hartland Landfill LFG System Capture Efficiency Based on three models..... 24
Table 4.5 - Methane Mass Balance at Hartland Landfill in 2020 25
Table 4.6 - Methane Mass Balance Summary 26

List of Figures

Figure 3.1 - Surface Scan Areas at Hartland Landfill (June 2020) 5
Figure 3.2 - Atmospheric Pressure & Temperature (Saanich A Weather Station – June 17, 2020) 7
Figure 3.3 - Atmospheric Pressure & Temp. (Saanich A & Portable Weather Station – June 18, 2020) 7
Figure 3.4 - Atmospheric Pressure & Temperature (Saanich Weather Station – June 19, 2020) 8
Figure 3.5 - Atmospheric Pressure & Temperature (Saanich Weather Station – October 20, 2020)..... 8
Figure 3.6 -Atmospheric Pressure & Temperature (Saanich Weather Station – October 21, 2020)..... 9
Figure 4.1 - Major Methane Emission Hotspots at Hartland Landfill (June & October 2020)..... 11
Figure 4.2 – Cell 3 Methane Emission Hotspots for Round 2 of the Surface Scan (October 2020) 13
Figure 4.3a & 4.3b - Flux Chamber Results Graphical illustration (FC# S4-3/15 & FC# S4-5/15) 16
Figure 4.4 - Average Methane Emission Rates (MER), Hartland Landfill June 2020..... 17
Figure 4.5 - Grouping the Scan Areas Based on Average Methane Emission Rates 18
Figure 4.6 - LFG Generation Estimates for Based on Different Models (2000-2025) 23
Figure 4.7 - Predicted LFG Generation and Collection Rates at the Hartland Landfill 23
Figure 4.8 - Landfill Gas Generation, Collection and Emission Rates at Hartland Landfill..... 25
Figure 4.9 - Hartland Landfill Methane Mass Balance Schematic (2020 Average) 27
Figure 4.10 - Illustration of Methane Mass Balance for Hartland Landfill based on 2020 field works..... 27

List of Photos

Photo 1.1 - Hartland Landfill Aerial Photo..... 1
Photo 3.1a & 3.1b - Surface Methane Concentration Scan Using a Portable FID Instrument 5
Photo 4.1 - Interim Soil Cover (Area S14) 10
Photo 4.2 - Temporary Woven Liner (Area S10, S11) 10

Photo 4.3 - Textured Geomembrane (Area S1) 10
Photo 4.4 - Final Multilayer Cover (Area S9)..... 10
Photo 4.5 - Rock Wall Drainage Blanket Clay Plug, October 2020 12
Photo 4.6 - Waste Disposal at West of C1 area Over the Rock Wall Area, October 2020..... 12
Photo 4.7 - New Horizontal Collectors (Area S14) 13
Photos 4.8a & 4.8d - Emission Hotspots, Edge of Geomembrane Liner and Damaged Liner (Area S1)... 14
Photos 4.9a & 4.9b - Temporary Liner Puncture (Area S10) 14
Photo 4.10a & 4.8b - Flux Chamber Measurement at Hartland Landfill..... 15

1 INTRODUCTION

1.1 Background

Hartland Landfill (Landfill) is owned and operated by the Capital Regional District (CRD), located 14 km northwest of Victoria, British Columbia (BC) in the District of Saanich at 1 Hartland Avenue. The landfill occupies a footprint of 33 ha on a property that encompasses 293 Ha. To date, approximately 7,300,000 tonnes of municipal solid waste (MSW) have been landfilled. Hartland Landfill has been developed in two distinct phases. Phase 1 was developed between 1950 and 1996, with a final capping system completed in 1997. Phase 2 has been operational since 1997, with development planned out in six distinct cells. Cells 1 and 2 have been completed to- date and landfilling is currently occurring in Cell 3.



Photo 1.1 - Hartland Landfill Aerial Photo

Hartland Landfill is one of the largest landfills in BC and is required to collect and thermally combust generated methane as per the BC Ministry of Environment (ENV) landfill gas regulation (LFG Regulation). This provincial regulation stipulates that landfills generating more than 1,000 tonnes of methane per year are to install and operate an active LFG management system with a minimum gas collection efficiency of 75%. Since 2012, the CRD has been continuously improving and expanding the Hartland Landfill's LFG collection system. As of 2015, the active LFG system has maintained excellent performance with an increasing capture efficiency of the gas throughout the past 5 years.

1.2 Landfill Gas Generation and Collection Efficiency at Hartland Landfill

In a recent study, Sperling Hansen Associates (SHA), 2019 conducted a comprehensive LFG generation assessment study for the landfill using three different models: (i) an advanced LFG generation model (UBCiModel©), (ii) ENV's LFG Generation Model (ENV Model), and (iii) ENV Annual Reporting Tool (ENV Annual Tool). This study determined an annual gas capture efficiency of 66% to 80% at this site between 2014 and 2019 based on the UBCiModel©. However, the ENV model and ENV AR Tool showed lower collection efficiencies ranging as low as 59% in 2014 and up to 71% in 2017 (SHA, 2019). More details from results of this study are provided in Section 4.4.

1.3 Scope of the Current Study

The CRD retained SHA to complete a full-scale measurement of methane emissions at the Hartland Landfill and to further assess effectiveness of the existing gas collection system. The purpose of the study was to execute the following key tasks.

- Conduct field measurement and quantify fugitive methane emissions from different areas of the landfill.
- Assess LFG management system collection efficiency.
- Identify major emission hot spots and assess potential additional greenhouse gas (GHG) emission reduction that can be achieved through other alternative methodologies such as application of a Biocover system.

2 LANDFILL METHANE MASS BALANCE INVESTIGATION

In order to complete a full methane mass balance for a landfill, not only the fugitive methane emissions to the atmosphere need to be quantified, but also methane oxidation by methanotrophic bacteria (naturally existing in landfill cover soil) and methane capture and combustion via active LFG collection and treatment systems must be taken into account. On this basis, Abedini (2014) developed the "METRO equation" which provides a comprehensive mass balance of landfill methane. Detailes of the equation are provided below:

$$G = M + E + T + R + O \qquad \textbf{Equation 1}$$

Where:

G = Generated Methane (theoretical model)
M = Migrated Methane (i.e. offsite lateral migration)
E = Emitted Methane (i.e. atmospheric emissions)
T = Trapped Methane (insignificant in well compacted and active landfills)
R = Recovered Methane (active gas collection system)

O = Oxidized Methane (soil cover or biocover)

The METRO equation considers all possible pathways for the methane generated within a landfill. When offsite lateral migration of methane is not reported and for landfills actively generating methane at high rates, M and T can be removed and the simplified METRO equation can be used as follows (Abedini, 2014):

$$G = E + R + O \qquad \textbf{Equation 2}$$

As mentioned in Section 1.3, the main scope of the current project is to quantify fugitive methane emissions (E) from Hartland Landfill. Section 3 discusses our approach and methodology to fulfill this scope while results of our study are presented and discussed in Section 4. Section 3 also includes information regarding methane recovery data and methane oxidation estimations for the landfill.

3 METHANE EMISSIONS MEASUREMENT

There are several methods that can be used to measure fugitive CH_4 or LFG emission rate from a variety of landfill covers. The most widely attempted method, and seemingly the more favorable for the purpose of regulatory compliance assessment, is the use of a flux chamber which directly measures CH_4 emission flux from the surface of landfills.

In addition to the flux chamber method, other methods such as eddy covariance and co-advected proxy tracer plume measurements and methods relying on remote sensing and plume mapping have been used (Gardiner et al., 2017; Delre et al., 2018; Kormi et al., 2017; Goldsmith et al., 2012; Gollapalli et al., 2018; Monster et al., 2014; Innocenti et al., 2017; Delkash et al., 2016; Allen et al., 2018; Abedini et al., 2019). Many of these methods suffer considerable drawbacks in terms of associated costs, reliability, logistics and compatibility with the typically heterogeneity of landfills and fugitive CH_4 emissions.

3.1 Technique for Quantification of Fugitive Methane Emissions at Hartland

The technique adopted to quantify the fugitive CH_4 emissions in this study is a patented methodology developed through the PhD research of Dr. Ali Abedini at the University of British Columbia (UBC) (Abedini, 2014; Abedini et al., 2019). Abedini's methodology was developed based on comprehensive field investigations completed at the Vancouver Landfill and involves measurement of near-ground surface methane concentrations (SMC) from the area of interest using a flame ionization detector (FID) device.

This method overcomes the major drawbacks of the conventionally acceptable stand alone flux chamber method in terms of detection limit, cost and extensive time required to characterize

fugitive emission at a given landfill. Measurement of CH_4 concentration at the surface of a landfill is less demanding compared to the flux chamber method and is presumed to lead to more reliable results when the concentration of CH_4 at the surface of a landfill is low, as usually happens in cases where there is an active landfill gas collection system or biocover system in place. A reliable correlation between surface concentration of CH_4, which can easily be measured, and CH_4 emission measured using flux chamber provides a practical method to facilitate CH_4 emission rate characterization at a lower cost.
The techniques and procedures used for measuring SMC using a hand-held FID is an approved methodology used across the US, where it is required by the U.S. Environmental Protection Agency's (EPA) new source performance standard (NSPS) regulation. The NSPS requires that all regulated landfills in the US must measure and report CH_4 concentrations at the landfill's surface on a quarterly basis. Values registered above the NSPS threshold during the FID scan imply a malfunctioning LFG control system and the landfill owner is then required to implement control measures within a given period of time.

Abedini (2014) developed a correlation between qualitative SMC data and quantitative surface CH_4 emission rates (MER). This technique is especially useful when MER levels are very low (e.g. where a geomembrane cap and an active gas collection system are in place) and other measurement techniques such as flux chamber cannot be applied. In June 2020 an SMC scan was completed over the entire landfill footprint where historically waste has been placed. In October of the same year, a second round of SMC measurements were completed over selected areas including areas without permanent closure system in place and where relatively higher emission rates were identified in June. The two rounds of field measurements were intentionally scheduled to be completed in two different climatic conditions (cold and warm seasons) to account for the impact of cold temperature on biological methane oxidation within the landfill's soil cover.

A *Thermo Scientific TVA 2020* FID instrument was used to measure and log CH_4 concentrations at the landfill surface. Hartland landfill was divided into 32 scan areas (zones) as shown in Figure 3.1. The areas located on side slopes are tagged as S.x and flat (crest) areas are tagged as C.x. The scanned area also included the exposed top surface of a coarse leachate collection blanket (approximately 2 m x 250 m) located on the west side of C1 area known as Rock Wall, labeled R.W. The surface scan areas had an approximate total footprint of 30 ha. Some minor changes in zones took place between the two rounds of the field work primarily due to the landfill's ongoing waste disposal operations and scheduled development.

Each zone was scanned on approximately 10 m spaced pathways while logging CH_4 concentration every 3 seconds. The FID instrument was calibrated using calibration gas tanks before conducting each set of measurements and tested using the same tanks after completion of each survey to detect any calibration drift during the field work.



Figure 3.1 - Surface Scan Areas at Hartland Landfill (June 2020)

Photos 3.1a & 3.1b show a TVA 2020 and calibration gases (left) and Dr. Abedini conducting FID measurements on a similar project (right).



Photo 3.1a & 3.1b - Surface Methane Concentration Scan Using a Portable FID Instrument

Results of both rounds of field investigations at Hartland Landfill are presented in Section 4.

3.1.1 Effect of Barometric Pressure on LFG Emission

A very important aspect of measurement of fugitive methane emissions from landfills is the effect of barometric pressure (BP) on the gas flux intensity. Fluctuation in BP is known to greatly impact LFG atmospheric emissions (Abedini, 2014; Abedini et al., 2019). When the BP is increasing, the increased atmospheric pressure is applied on the ground, restricting natural LFG venting through the landfill surface, or migrating through the soil. Dropping BP reduces the pressure exerted on the ground, enabling LFG to move more freely from the landfill and increasing the potential for gas to escape through the landfill cover or via offsite lateral migration. Abedini's surface scan technique for quantification of methane emissions includes adjustments of methane emission rates (MERs) based on the magnitude and sign of the rate of change in atmospheric pressure (i.e. $\Delta P/t$) at the time of field measurements according to Equation 3 below (Abedini, 2014):

$$MER_a = MER \times (1 + 1.9731 \times |\Delta P/t|)^{\wedge (\Delta P/t \,/|\Delta P/t|)} \qquad \textbf{Equation 3}$$

where; MER_a = adjusted methane emission rate (g CH_4 m^2 d^{-1})
MER = measured methane emission rate (g CH_4 m^2 d^{-1})
$\Delta P/t$ = rate of change in barometric pressure at the time of field measurement (mbar/hr)

In this equation, $(\Delta P/t \,/|\Delta P/t|)$ would be equal to (-1) or (+1), represent the sign of the $\Delta P/t$.

Using Equation 3 and based on the BP variations that were recorded during the scans at Hartland Landfill, the field emission measurement results were adjusted for the rate of change in BP values. The BP data for the three field investigation days were acquired from the closest weather station to the landfill. Additionally, ambient pressure changes were monitored using a portable weather monitor instrument.

The data presented in Figures 3.2 through 3.6 were acquired from the Saanich Airport Weather Station during the days of field investigation on June 17th to 19th, 2020 and October 20th and 21st, 2020. Figures 3.3, 3.5 & 3.6 illustrate BP data from Saanich Airport weather station as well as onsite data measured by a portable weather station during the course of the field work. Comparing the two sets of data showed that even though the BP values measured onsite and at Saanich weather station were slightly different, the rate of change measured at two locations followed the same trend. This comparison confirmed applicability of the BP data that have been historically recorded at Saanich weather station to the emission rate calculations for Hartland Landfill (with a note that Sannich weather station has hourly records for BP).

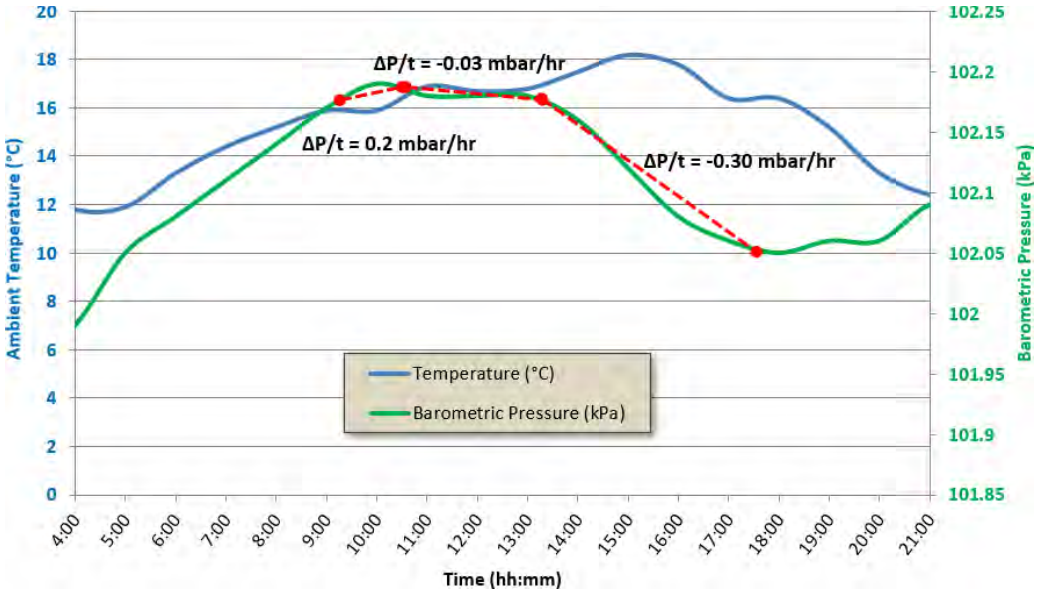


Figure 3.2 - Atmospheric Pressure & Temperature (Saanich A Weather Station – June 17, 2020)

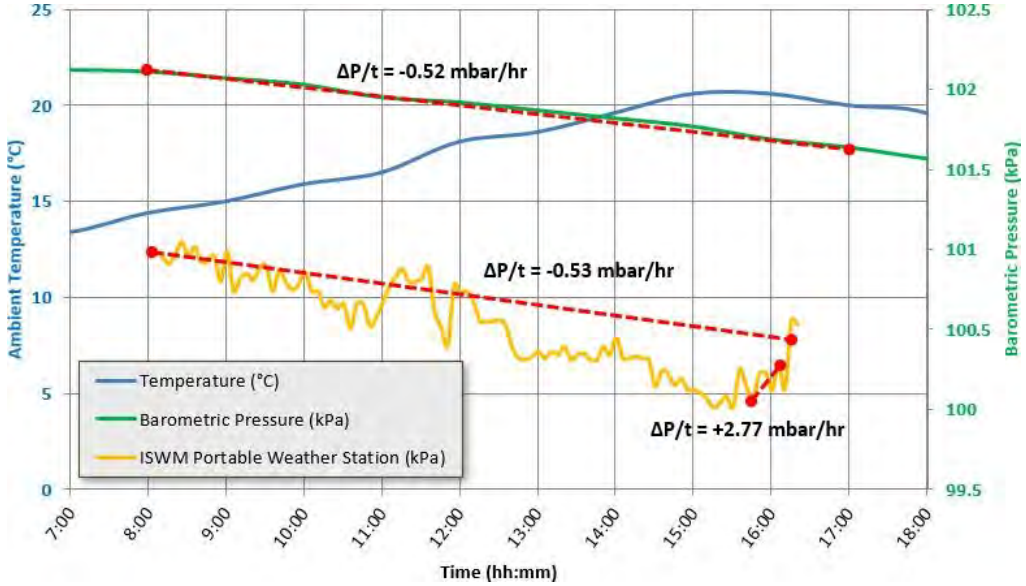


Figure 3.3 - Atmospheric Pressure & Temp. (Saanich A & Portable Weather Station – June 18, 2020)

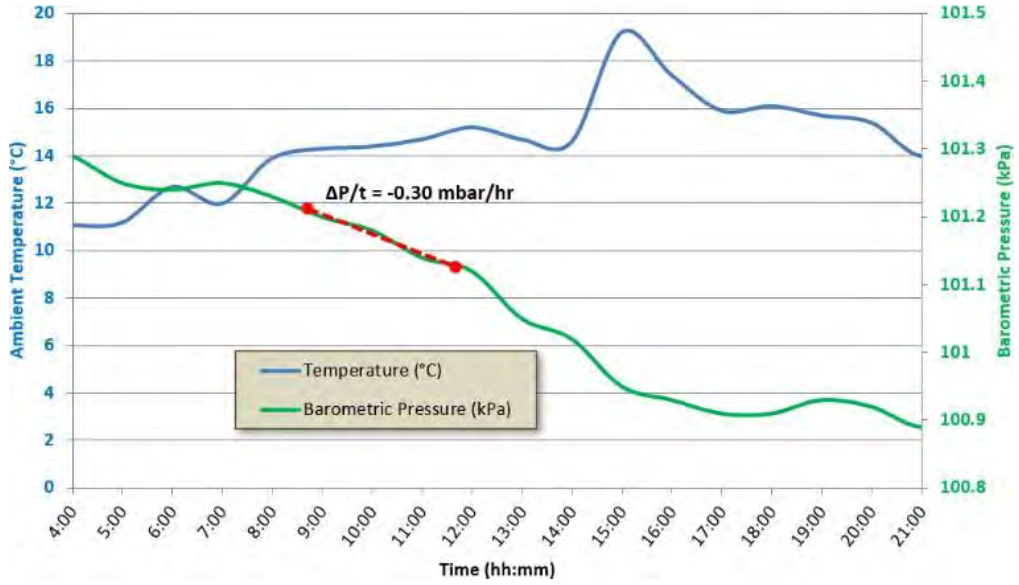


Figure 3.4 - Atmospheric Pressure & Temperature (Saanich Weather Station – June 19, 2020)

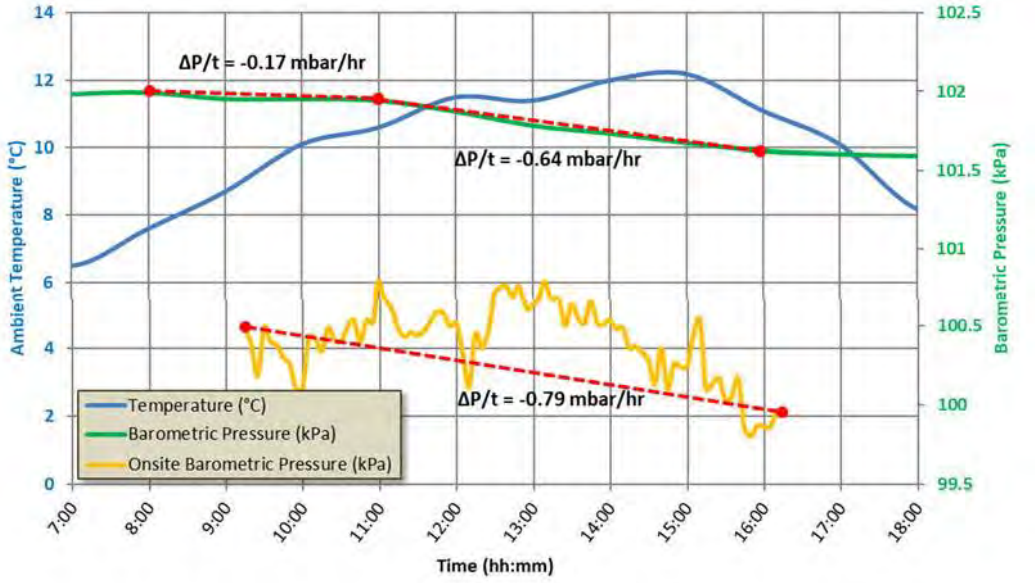


Figure 3.5 - Atmospheric Pressure & Temperature (Saanich Weather Station – October 20, 2020)

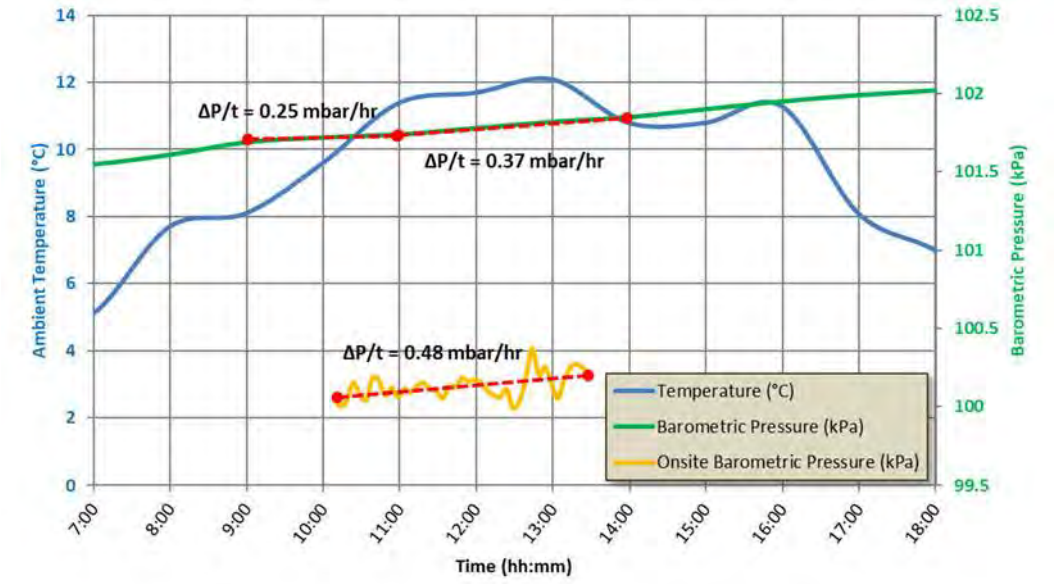


Figure 3.6 -Atmospheric Pressure & Temperature (Saanich Weather Station – October 21, 2020)

3.2 Gas Collection Rates during June and October 2020 Field Investigations

In order to conduct a system performance review and compare the level of gas emissions with gas capture at Hartland Landfill, SHA collected updated information from the landfill's active gas collection system during the days of field monitoring. Table 3.1 present data regarding the landfill's collected gas quantity and quality during the course of the field investigations for GHG emissions quantification.

Table 3.1 - Hartland Landfill Active Gas Collection System Data (June & October , 2020)

	Daily LFG Flow (scf/day)	LFG Flow Rate (scfm)	CH_4 Content (%)	Normalized Flow Rate at 50% [CH_4] (scfm)
June 17, 2020	1,518,828	1,054.7	50.1	1,057.3
June 18, 2020	1,559,397	1,082.9	51.1	1,105.7
June 19, 2020	1,565,847	1,087.4	52.5	1,141.7
Oct. 19, 2020	1,512,416	1,050.29	52.2	1,095.7
Oct. 20, 2020	1,548,480	1,075.33	52.4	1,127.6
Oct. 21, 2020	1,535,787	1,066.52	52.1	1,110.7
Oct. 22, 2020	1,528,443	1,061.42	51.1	1,084.8
June Average	**1,548,024**	**1,075.0**	**51.2**	**1,101.6**
Oct. Average	**1,548,024**	**1,063.4**	**51.9**	**1,104.7**

scf = standard cubic feet, scfm = standard cubic feet per minute, [CH_4] = Methane Concentration

4 RESULTS

Results of the surface scan field investigations are presented below in four different sections. One big advantage of the surface scan technique for quantification of methane emissions is identification of methane emission hotspots at the same time. This information allows the landfill owner/ operator to more effectively develop and implement geo-targeted mitigation strategies for reduction of fugitive CH_4 emissions (GHG emissions) from the landfill. This information is presented in Section 4.1 below. Section 4.2 presents results of Flux Chamber investigations for development of a site-specific correlation factor between surface methane concentration (SMC) and methane emission rates (MER) and Section 4.3 presents the achieved results for quantification of MER values. Lastly, Section 4.4 reports GHG and LFG emissions rates for the Hartland Landfill in 2020.

4.1 Methane Emission Hotspots

There are several types of closure/cover systems that have been applied on various surfaces of Hartland Landfill throughout its lifespan to date. These cover systems include: (i) interim soil cover, (ii) temporary geomembrane cover, (iii) permanent geomembrane cover, and (iv) multi-layer full final closure system including geomembrane liner, drainage layer, sub soil and topsoil cover etc.



Photo 4.1 - Interim Soil Cover (Area S14)



Photo 4.2 - Temporary Woven Liner (Area S10, S11)



Photo 4.3 - Textured Geomembrane (Area S1)



Photo 4.4 - Final Multilayer Cover (Area S9)

In general, lower methane emission rates are expected to occur where an impermeable liner is in place and negative pressure is applied to the area through an active gas collection system. However, closure system faults may result in localized (point source) CH_4 leaks, known as emission "hotspots". Typical CH_4 emission hotspot locations at landfills include leaking gas pipes,manholes and underground infrastructure connected to the leachate collection system, exposed leachate drainage layer, exposed geomembrane punctures, settlement cracks in compacted clay liner systems and edges of geomembrane closure system if not tied into the bottom liner or no impermeable (clay) plug is used around the edges. Hotspots on the landfill surface are normally predominant on landfill side slopes; however, high emission rates can be observed in crest areas in the case of liner punctures/cracks and in active areas of the landfill where no impermeable liner is in place. Several emission hotspots were identified during the surface scan field works. Major emission hotspots identified during the field works (Rounds 1&2) are shown on Figure 4.1.

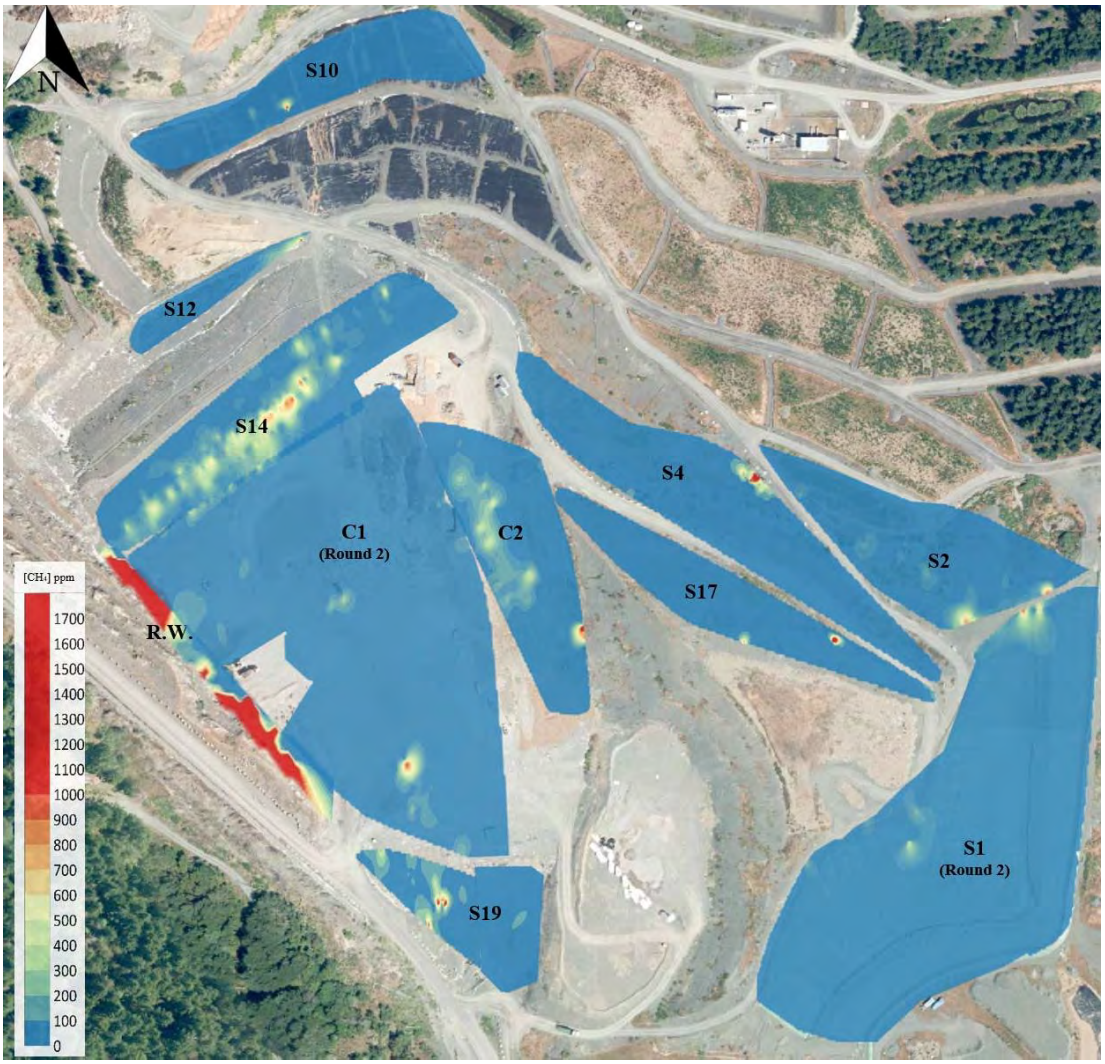


Figure 4.1 - Major Methane Emission Hotspots at Hartland Landfill (June & October 2020)

Phase 2, Cell 3 a major emission hotspot was exposed drainage blanket on the west side of the crest (C1) area. This area, known as the "Rock Wall", is the interface between the western filling extent of Cell 3 and refuse and creates challenges with respect to gas collection. Soon after round 1 of the surface scan was completed, the Hartland Landfill operations team applied a clay plug over this area and the next lift of waste continued to be placed over top of the clay plug. The second round of the surface scan showed a significant reduction in fugitive methane emissions from the Rock Wall area, however, not having a gas collection system in place at this location, the generated gas started migrating through the drainage blanket towards the north, resulting in a significant increase in CH_4 emission from west side of the north slope (marked as S14).

The second round of surface scanning identified this location as a major emission hotspot as illustrated in Figure 4.2. SHA is currently working with CRD to develop a gas collection system for the Rock Wall area. Photos 4.5 and 4.6 below show the clay plug and waste disposal operation at the Rock Wall area during the second round of field works (October 2020).



Photo 4.5 - Rock Wall Drainage Blanket Clay Plug, October 2020



Photo 4.6 - Waste Disposal at West of C1 area Over the Rock Wall Area, October 2020

North and south slopes (S14 and S19) of this cell (Phase 2, Cell 3) showed relatively high methane emission rates during both sampling rounds. Notably, the horizontal gas collectors that had been installed in the new lifts within this cell were not yet online at the time of the field works (See Photo 4.7).

In addition to S14, the second round of sampling showed higher emission rates from the crest area (C1). Two primary factors causing higher level of emissions from these areas in the second round are (i) blocking the easy pathway for gas emission from the rock wall drainage blanket, and (ii) decomposition of readily degradable organics that had been disposed in this area for the past couple years.

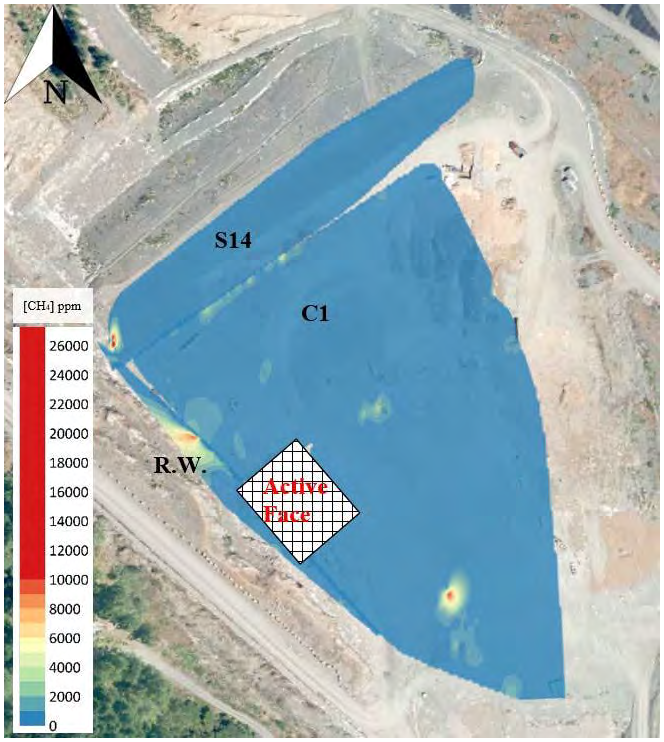


Figure 4.2 – Cell 3 Methane Emission Hotspots for Round 2 of the Surface Scan (October 2020)



Photo 4.7 - New Horizontal Collectors (Area S14)

Phase 2, Cell 2 major emission hotspots were detected at the edges of the geomembrane liner. These hotspots were identified during both rounds of field measurements with higher emission rates observed in the second round. Additional hotspots were identified in locations where the geomembrane was damaged. Photos 4.8a to 4.8d show some examples of S1 area emission hotspots.







Photos 4.8a & 4.8d - Emission Hotspots, Edge of Geomembrane Liner and Damaged Liner (Area S1)

Phase 2, Cell 1 temporary liner punctures (Photos 4.9a & 4.9b below) showed relatively high methane leaks during both sampling rounds.




Photos 4.9a & 4.9b - Temporary Liner Puncture (Area S10)

4.2 Site-Specific Correlation Factor for Hartland Landfill

During the course of the field investigations at Hartland Landfill, thirty five (35) flux chamber measurements were conducted in three (3) zones (Areas S4, S13, and S14) in order to generate a site-specific correlation factor similar to what Dr. Abedini developed for the Vancouver Landfill which were later used as default values in his methodology. Application of flux chambers at landfills to measure fugitive methane emissions from the soil surface through isolating and monitoring the emitting gas from soil is a well-established method. The flux chamber technique includes placing a closed chamber (box) on the landfill's surface and monitoring the change of methane concentration in the box over time. Based on the rate of change in methane concentration in the chamber over time, chamber volume, and area beneath the chamber, the methane flux emitted from landfill's surface can be calculated. The US-EPA guideline, "measurement of gaseous emission rates from land surfaces using an emission isolation flux chamber" (EPA/600/8-86/008), was used to determine the required number of flux chamber tests based on the footprint area of selected zones.

During these tests at the landfill, methane concentrations inside the chamber were continuously monitored using a Landtec GEM 2000+ gas analyzer. With a maximum flux chamber test duration of approximately 5 to 10 minutes, and the chamber volume of V = 0.007 m^3, as well as the gas analyzer sensitivity of ± 0.1% CH_4, the method overall detection limit was determined to be in the order of 10 to 20 g CH_4 m^{-2} d^{-1}. In five (5) locations out of fifteen (15) tested in Area S4, values higher than the instrument detection limit were recorded. However, due to the low methane emission rates in Areas S13 and S14, flux chamber measurements in these two areas did not produce meaningful results. Photos 4.10a and 4.10b below show the flux chamber test setup at Hartland Landfill.



Photo 4.10a & 4.8b - Flux Chamber Measurement at Hartland Landfill

The flux chamber test results were graphed and translated to methane emission rates (MER) based on the chamber volume and footprint area. Figures 4.3a and 4.3b show two examples of the graphical illustration of the flux chamber test results.

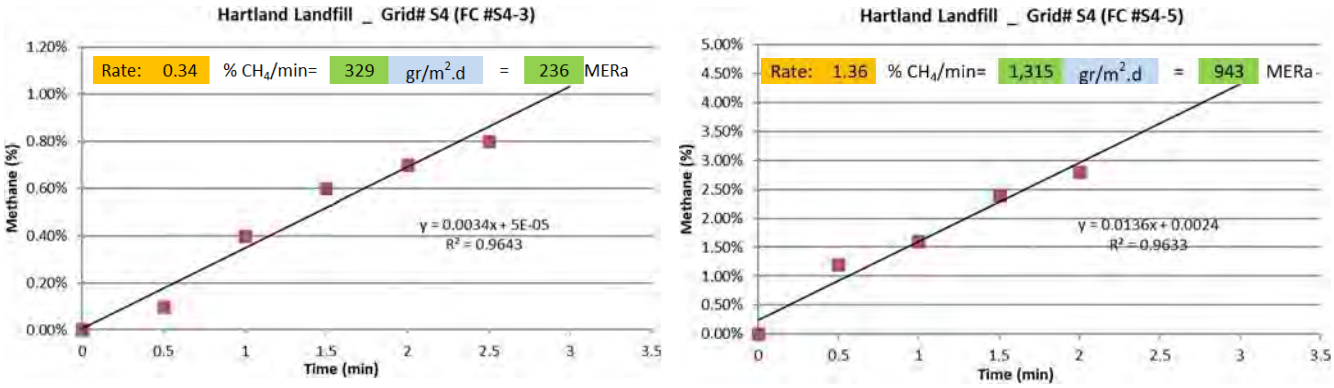


Figure 4.3a & 4.3b - Flux Chamber Results Graphical illustration (FC# S4-3/15 & FC# S4-5/15)

The resulting MER from flux chamber tests in Area S4 ranged between zero (non-detectable) to 1,315 g/m^2/day (before adjustment for barometric pressure was applied). The averaged result for this area was 14.46 g CH_4/m^2/day based on the flux chamber measurements.

4.3 Methane Emission Rates

The recorded SMC data derived from the first round of surface scan at Hartland Landfill ranged between 0 and 2,167 volumetric parts per million (ppmv) with the majority of high hits (methane emissions hotspots) in areas previously shown on Figure 4.1. The rock wall area showed significantly higher emission rates than all other areas scanned, with SMC values as high as approximately 167,000 ppmv. Further analysis of the results showed significant variation in the level of emission rates from different areas of the Landfill, with the rock wall area being responsible for approximately 18% of the overall GHG emissions from the site during the first round of sampling. Application of a clay plug in this area reduced the maximum SMC value to less than 10,000 ppmv during the follow up measurements in October, however, significant increase in SMC values were observed in western sections of S14 area in this round.

Other areas with relatively high total emissions (i.e. emission rate multiplied by area) identified during the first sampling round were S2, S4, S7, C2, and S19. After completing this round of measurements, the scanned areas were grouped into five (5) categories based on the MER associated with each area. Group 1 (coloured green) with MER less than 2.5 g/m^2/day, Group 2 (blue) with MER between 2.5 and 5.0 g/m^2/day, Group 3 (yellow) with MER between 5.0 and 10

g/m^2/day, Group 4 (orang), with MER between 10 and 15 g/m^2/day, and Group 5 (red) with MER higher than 15 g/m^2/day.

Detailed assessment of the results indicated that majority the overall emissions were sourced from small portions of the scanned areas, mainly located at the unclosed (active) cell of the landfill (Cell 3). While higher gas emissions from active phases of the landfill are inevitable, identification of major emission hotspots and application of geo-targeted mitigation measures can have a significant impact on further reduction of the overall GHG emissions from the landfill. Figure 4.4 illustrates average CH_4 emission rates from each zone. Figure 4.5 shows different scanned areas colour coded based on the associated average MER from each area in first round of surface scan.

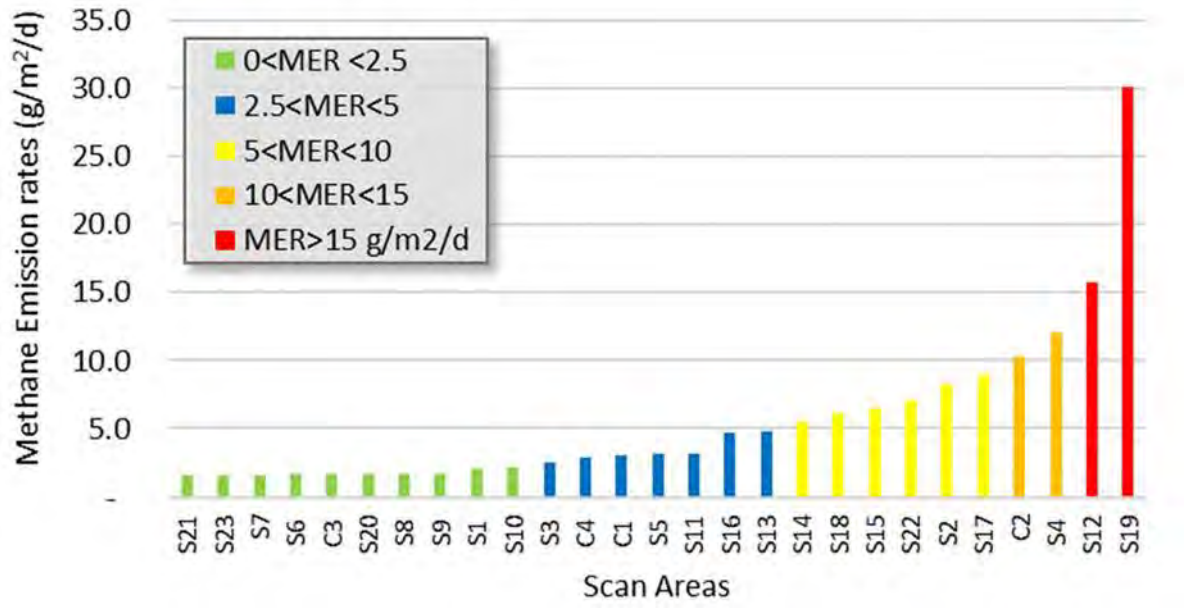


Figure 4.4 - Average Methane Emission Rates (MER), Hartland Landfill June 2020

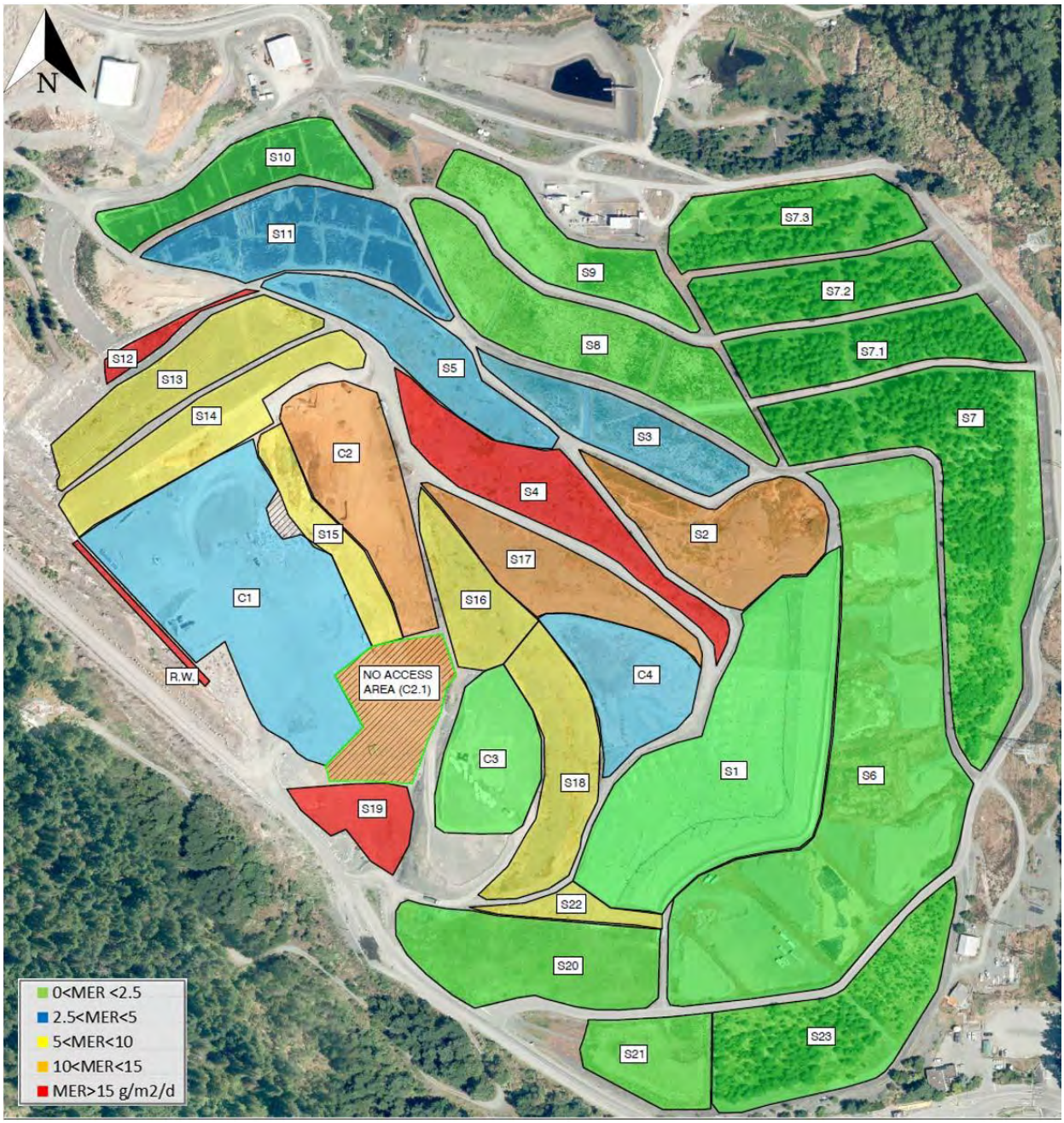


Figure 4.5 - Grouping the Scan Areas Based on Average Methane Emission Rates

Based on the default correlation factor, the SMC data was translated to average MER values ranging between 1.6 g $CH_4/m^2/d$ (Area S.21) and 30.1 g $CH_4/m^2/d$ (Area S.19) in the first round. These values in the second round ranged between 1.6 g $CH_4/m^2/d$ (Area S.8) and 34.6 g $CH_4/m^2/d$ (Area S.14). Average MER from the Rock Wall area for Rounds 1 and 2 were 480.6 g $CH_4/m^2/d$ and 190.7 g $CH_4/m^2/d$, respectively. The overall MER for the Hartland landfill for 2020 was calculated to be 17.6 g $CH_4/m^2/d$.

Table 4.1 below presents the results for SMC and MER values for both rounds as well as the site's overall average MER for 2020.

Table 4.1 - Results of Surface Scan and Methane Emission Quantification for Hartland Landfill

Grid Number	Surface Area		Surface Methane Concentration (SMC, ppm)						Methane Emission Rate (MER, $gCH_4/m^2/day$)				
	Round 1	Round 2	Round 1			Round 2			Round 1		Round 2		2020
	(m^2)	(m^2)	MIN	MAX	AVG.	MIN	MAX	AVG.	AVG.	$\pm\delta_{MER}$	AVG.	$\pm\delta_{MER}$	Average
S1	22,600	22,600	0.7	129.4	2.3	-	1,536.7	7.2	2.13	0.8	3.70	1.0	2.9
S2	9,400	9,400	1.4	644.7	21.6	0.4	240.7	9.6	8.29	1.5	4.46	1.1	6.4
S3	6,700	6,700	1.5	23.9	3.8	1.3	3.4	1.5	2.62	0.9	1.87	0.8	2.2
S4	8,500	5,000	1.5	2,167.0	33.2	0.3	3,017.1	43.8	12.01	1.9	15.39	2.2	13.7
S4.1	--	5,000	--	--	--	0.3	17.2	2.0	--	--	2.03	0.8	2.0
S5	6,700	6,600	1.4	82.6	5.4	0.3	117.2	3.4	3.13	0.9	2.49	0.9	2.8
S6	36,000	36,000	0.6	2.1	0.7	0.6	2.1	0.7	1.63	0.8	1.63	0.8	1.6
S7	45,000	45,000	0.6	1.7	0.6	0.6	1.7	0.6	1.60	0.8	1.60	0.8	1.6
S8	13,000	13,000	0.6	2.8	0.8	0.4	5.6	0.5	1.66	0.8	1.54	0.8	1.6
S9	7,000	7,000	0.6	6.2	1.0	0.5	8.6	0.9	1.71	0.8	1.69	0.8	1.7
S10	6,700	6,700	0.5	513.8	2.7	0.5	341.2	2.9	2.25	0.8	2.31	0.9	2.3
S11	9,600	9,600	0.4	1,398.3	5.5	0.5	807.4	4.6	3.16	0.9	2.86	0.9	3.0
S12	1,400	1,400	0.5	691.5	44.7	0.6	379.5	40.0	15.70	2.3	14.19	2.1	14.9
S13	7,500	7,500	0.5	160.9	10.8	0.6	336.5	14.6	4.86	1.1	6.06	1.3	5.5
S14	6,300	7,700	0.7	133.8	12.5	-	10,903.8	103.6	5.41	1.2	34.56	4.3	20.0
S14R	1,400	--	0.8	135.5	13.3	--	--	--	5.64	1.2	--	--	5.6
S15	3,700	--	0.5	211.3	16.0	--	--	--	6.51	1.3	--	--	6.5
S16	4,600	4,600	0.8	105.6	10.4	6.4	311.4	55.0	4.71	1.1	19.00	2.6	11.9
S17	6,300	6,300	0.5	1,048.4	23.5	3.1	307.9	27.3	8.92	1.6	10.14	1.7	9.5
S18	7,500	7,500	0.5	712.7	14.8	1.5	232.9	11.9	6.14	1.3	5.20	1.2	5.7
S19	3,200	3,200	0.9	1,386.4	89.7	2.9	595.2	55.3	30.10	3.8	19.09	2.6	24.6
S20	10,000	10,000	0.1	21.2	0.9	2.6	57.6	17.1	1.68	0.8	6.87	1.3	4.3
S21	5,000	5,000	0.4	5.0	0.7	0.4	5.0	0.7	1.60	0.8	1.60	0.8	1.6
S22	1,700	1,700	0.9	264.5	17.7	7.6	745.7	42.2	7.05	1.4	14.88	2.2	11.0
S23	12,000	12,000	0.6	1.6	0.7	0.6	1.6	0.7	1.62	0.8	1.62	0.8	1.6
C1	22,000	24,000	0.5	122.9	5.2	-	1,230.5	49.5	3.05	0.9	17.23	2.4	10.1
C2	15,000	16,000	0.5	1,392.4	27.7	2.6	638.4	42.3	10.24	1.7	14.91	2.2	12.6
C3	6,700	6,500	0.5	8.5	0.9	0.5	8.5	0.9	1.68	0.8	1.68	0.8	1.7
C4	6,500	6,700	0.5	45.6	4.7	0.9	50.4	7.0	2.90	0.9	3.62	1.0	3.3
Rock Wall	500	500	-	167,456.1	1,497.4	-	9,980.6	591.5	480.57	51.7	190.66	20.9	335.6
Average					**64.5**			**40.6**	**22.0**	**± 2.9**	**14.4**	**± 2.1**	**17.6**

S4.1 includes a newly developed slope in north east of C2 area (developed in Aug.- Sep. 2020) and partially overlapping with S4 area
S14R includes a smal portion of S14 area that was scanned separatly during round 1 due to instrument reaching memory capacity
$\pm\delta_{MER}$ values represent range of error of the linear regression developed by Abedini, 2014 determined for 95% confidence limit
x.x Data acquired from 1st round of the field work

Excluding the fugitive CH_4 emissions from the rock wall area, Hartland Landfill's average methane emission rate is as low as 6.6 g $CH_4/m^2/d$.

The methane emission rate from the rock wall area was significantly reduced during the second round of field measurement. This reduction was primarily caused by blocking of the methane escape pathway using clay plug and a lift of waste placed over the area between August and October 2020. However, the second round of surface scanning showed higher methane emission rates from slopes just north of the rock wall area (S14). SHA in close collaboration with the CRD engineering team designed a gas emission mitigation system (horizontal gas collector) that will be constructed in the near future.

Round 1 of field measurements, completed in June 2020, showed a total annual CH_4 emission rate of 757 ± 179 tonnes of CH_4 per year with approximately 50% of the emissions occurring in the unclosed portion of the landfill (Cell #3). The second round that was completed in October of the same year showed an annual CH_4 emission rate of 1,069 ± 212 tonnes of CH_4 per year with Cell #3 being responsible for 59% of the site's overall emissions. As shown in Table 4.2, these values are equivalent to an average LFG emission rates of 150 scfm and 212 scfm for the first and second round of sampling, respectively.

The site's overall average annual methane emission rate was determined to be 925 tonnes of CH_4 per year, equivalent to an LFG emission rate of 183 scfm at 50% methane content. The overall methane emission rate quantified in October was higher than the first round measured in June. Possible reasons for this increase may include (i) seasonal variation in methane emission, (ii) lower oxidation rate of the fugitive methane through the cover soil during colder seasonal temperatures, and (iii) increased gas generation from the active fill area (Cell #3) while no new horizontal gas collectors were brought online between June and October 2020.

Table 4.2 summarizes the annual methane and LFG emission rates for different areas of the landfill and the site's overall average based on the two rounds of GHG measurements completed in June and October of 2020.

Table 4.2 - Methane and LFG Emission Rates from Different Areas of Hartland Landfill

Grid Number	Surface Area		Annual Methane Emissions (tonnes CH_4/year)					LFG Emission Rates (scfm)				
	Round 1	Round 2	Round 1		Round 2		2020	Round 1		Round 2		2020
	(m^2)	(m^2)	AVG.	$\pm\delta_E$	AVG.	$\pm\delta_E$	Average	AVG.	$\pm\delta_{LFG}$	AVG.	$\pm\delta_{LFG}$	Average
S1	22,600	22,600	26.62	10.4	46.25	12.5	36.4	5.28	2.1	9.17	2.5	7.2
S2	9,400	9,400	43.08	7.7	23.17	5.6	33.1	8.55	1.5	4.59	1.1	6.6
S3	6,700	6,700	9.70	3.3	6.92	3.0	8.3	1.92	0.7	1.37	0.6	1.6
S4	8,500	5,000	56.47	8.9	42.57	6.2	49.5	11.20	1.8	8.44	1.2	9.8
S4.1	--	5,000	-	-	5.61	2.3	5.6	-	-	1.11	0.5	1.1
S5	6,700	6,600	11.60	3.5	9.10	3.2	10.3	2.30	0.7	1.80	0.6	2.1
S6	36,000	36,000	32.37	15.5	32.37	15.5	32.4	6.42	3.1	6.42	3.1	6.4
S7	45,000	45,000	39.76	19.3	39.76	19.3	39.8	7.89	3.8	7.89	3.8	7.9
S8	13,000	13,000	11.92	5.6	11.11	5.5	11.5	2.36	1.1	2.20	1.1	2.3
S9	7,000	7,000	6.62	3.1	6.53	3.0	6.6	1.31	0.6	1.29	0.6	1.3
S10	6,700	6,700	8.32	3.1	8.55	3.2	8.4	1.65	0.6	1.70	0.6	1.7
S11	9,600	9,600	16.75	5.0	15.20	4.8	16.0	3.32	1.0	3.02	1.0	3.2
S12	1,400	1,400	12.15	1.8	10.98	1.6	11.6	2.41	0.3	2.18	0.3	2.3
S13	7,500	7,500	20.15	4.7	25.12	5.2	22.6	4.00	0.9	4.98	1.0	4.5
S14	6,300	7,700	18.83	4.1	147.15	18.2	83.0	3.74	0.8	29.19	3.6	16.5
S14R	1,400	--	4.36	0.9	-	-	4.4	0.87	0.2	-	-	0.9
S15	3,700	--	13.33	2.7	-	-	13.3	2.64	0.5	-	-	2.6
S16	4,600	4,600	11.99	2.8	48.34	6.7	30.2	2.38	0.6	9.59	1.3	6.0
S17	6,300	6,300	31.08	5.4	35.31	5.9	33.2	6.16	1.1	7.00	1.2	6.6
S18	7,500	7,500	25.47	5.2	21.55	4.8	23.5	5.05	1.0	4.27	1.0	4.7
S19	3,200	3,200	53.27	6.7	33.79	4.7	43.5	10.57	1.3	6.70	0.9	8.6
S20	10,000	10,000	9.31	4.3	38.01	7.4	23.7	1.85	0.9	7.54	1.5	4.7
S21	5,000	5,000	4.42	2.1	4.42	2.1	4.4	0.88	0.4	0.88	0.4	0.9
S22	1,700	1,700	6.63	1.3	13.99	2.1	10.3	1.31	0.3	2.78	0.4	2.0
S23	12,000	12,000	10.75	5.2	10.75	5.2	10.8	2.13	1.0	2.13	1.0	2.1
C1	22,000	24,000	37.17	11.3	228.67	32.4	132.9	7.37	2.2	45.36	6.4	26.4
C2	15,000	16,000	84.95	14.1	131.96	19.4	108.5	16.85	2.8	26.17	3.8	21.5
C3	6,700	6,500	6.23	2.9	6.04	2.8	6.1	1.24	0.6	1.20	0.6	1.2
C4	6,500	6,700	10.41	3.3	13.41	3.7	11.9	2.06	0.7	2.66	0.7	2.4
Rock Wall	500	500	132.88	14.3	52.72	5.8	92.8	26.36	2.8	10.46	1.1	18.4
Total	**292,500**	**293,200**	**757**	**± 179**	**1,069**	**± 212**	**924.6**	**150**	**± 35**	**212**	**± 42**	**183.4**

$\pm\delta_{MER}$ values represent range of error of the linear regression developed by Abedini, 2014 determined for 95% confidence limit

x.x Data acquired from 1st round of the field work

4.4 Methane Mass Balance

4.4.1 Modelled Landfill Gas Generation

In 2019, the CRD retained SHA to conduct a comprehensive LFG generation assessment study for the landfill using three different models: (i) an advanced LFG generation model (UBCiModel©), (ii) ENV's LFG Generation Assessment Model (ENV Model), and (iii) ENV Annual Reporting Tool (ENV AR Tool).

The BC LFG Regulation requires that the LFG generation assessment reports be prepared in accordance with the LFG generation assessment procedure guidance (ENV Guidelines) using the ENV Model. ENV AR Tool, is another LFG generation estimation Tool which must be used for annual reporting to assess performance of existing active LFG systems and their methane capture efficiency. The only difference between the ENV Model and the ENV AR Tool is the historical waste disposal tonnages that are considered for gas generation modeling purposes. For the ENV model, historical waste tonnages should cover the period from the first year of landfill operations or thirty years before the year in which the gas generation assessment takes place, whichever is more recent. While for the ENV AR Tool, all waste tonnage data from 1980 to the calendar year prior to the year of assessment are taken into account, resulting in methane generation estimates being usually higher than with the ENV Model. UBCiModel© is a powerful gas generation model that utilizes numerous site-specific input parameters to estimate methane generation rates from the landfill more accurately. Based on a recent comprehensive review on existing gas generation models by Environment and Climate Change Canada (ECCC), the UBCiModel© was ranked among the most accurate models for LFG generation estimation (Jacobs 2020).

A summary of results from SHA, 2019 is provided in Table 4.3 below (SHA, 2019).

Table 4.3 - LFG Generation Assessment Summary using 3 Models (SHA, 2019)

Model	Modelled Methane Generation 2019[1] tonnes CH_4/year (scfm LFG)	Modelled Methane Generation 2020[1] tonnes CH_4/year (scfm LFG)
UBCiModel	6,872 (1,363)	6,865 (1,362)
ENV Model	6,889 (1,365)	6,947 (1,376)
ENV AR Tool	7,846 (1,554)	7,866 (1,558)

[1] - flows normalized to 50% v/v CH_4

Figure 4.6 illustrates a 25-year snapshot of LFG generation comparison between the three models as well as the landfill's LFG recovery data between 2000 and 2020.

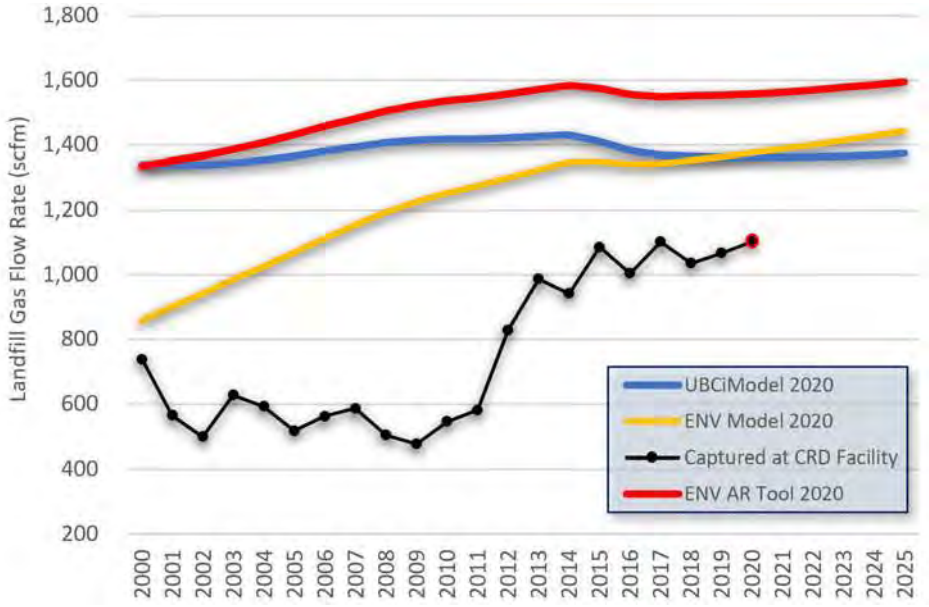


Figure 4.6 - LFG Generation Estimates for Based on Different Models (2000-2025)

Given the complexity of the UBCiModel and incorporation of site-specific information as well as the historical and planned organic diversion initiatives, SHA is of the opinion that the UBCiModel predictions provide a better representation of CH_4 generation at Hartland Landfill.

Figure 4.7 presents UBCiModel results for LFG generation compared to historical gas collection quantities that was reported by CRD, as well as SHA's estimates for LFG collection rates for landfill's anticipated lifespan including 25 years post closure.

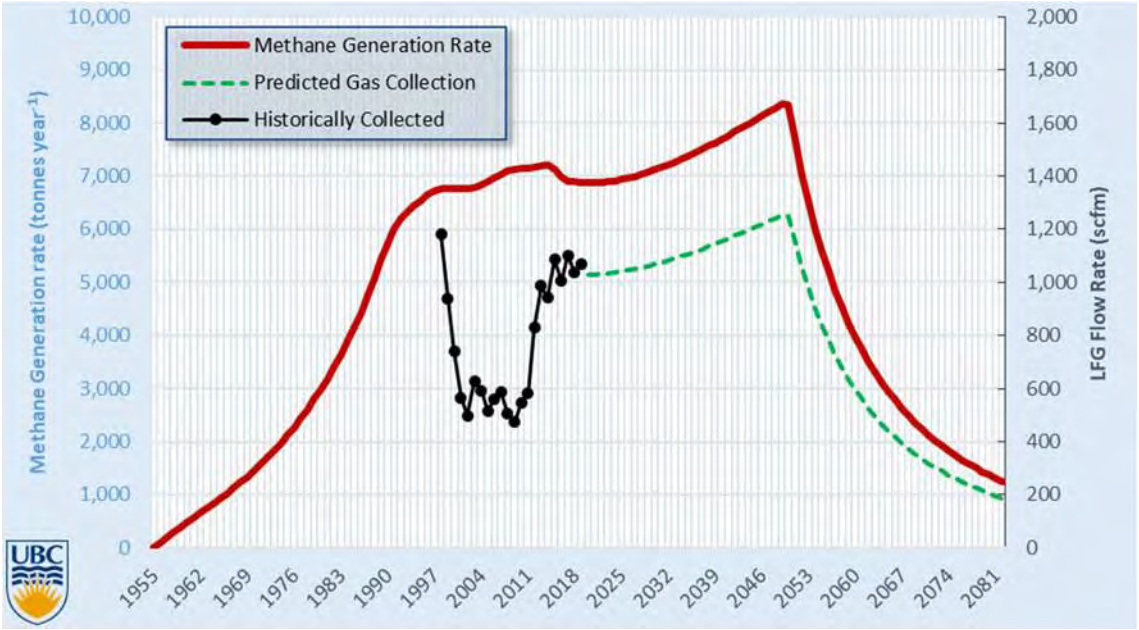


Figure 4.7 - Predicted LFG Generation and Collection Rates at the Hartland Landfill

4.4.2 Methane Collection Efficiency at Hartland Landfill

Based on the theoretical gas generation modeling and the historical landfill gas flow rate and methane content reported at the gas extraction facility, Table 4.4 below summarizes Hartland Landfill active LFG collection system's efficiency between 2014 and 2019 reported by the three models: UBCiModel©, ENV Model, and the ENV AR Tool.

Table 4.4 - Hartland Landfill LFG System Capture Efficiency Based on three models

Year	Methane Capture Efficiency		
	UBCiModel	ENV Model*	ENV AR Tool
2014	66%	64%	59%
2015	77%	75%	69%
2016	73%	71%	64%
2017	80%	79%	71%
2018	76%	75%	67%
2019	78%	78%	69%

* Based on generation estimates made in the year following year of assessment

Note that the reported collection efficiency by the ENV AR Tool, which is the model required under the BC Landfill Gas Management Guidelines, varies slightly from the collection efficiency in the CRD's LFG annual reports, due to differing interpretations related to waste composition.

Based on the results achieved from the UBCiModel©, the current methane generation at Hartland Landfill was estimated to be 1,362 scfm, equivalent to 6,865 tonnes of CH_4 per year. Based on the average collected gas flow rate and the average CH_4 content previously presented in Table 3.1, the average collected LFG flow rate in June and October of 2020 at the landfill were 1,102 scfm and 1,105 scfm for June and October when normalized to 50% CH_4 content. Therefore, the landfill's active gas collection system's average collection efficiency based on the UBCiModel was estimated to be 81% during the field works.

The site investigation showed an average annual methane emission rate of 184 scfm. Therefore, based on results of the field investigations, SHA concluded that approximately 14% of the generated methane from Hartland Landfill is emitted to the atmosphere.

Figure 4.8 illustrates UBCiModel© gas generation estimates, historical gas collection data and gas emission results from the 2020 field investigations.

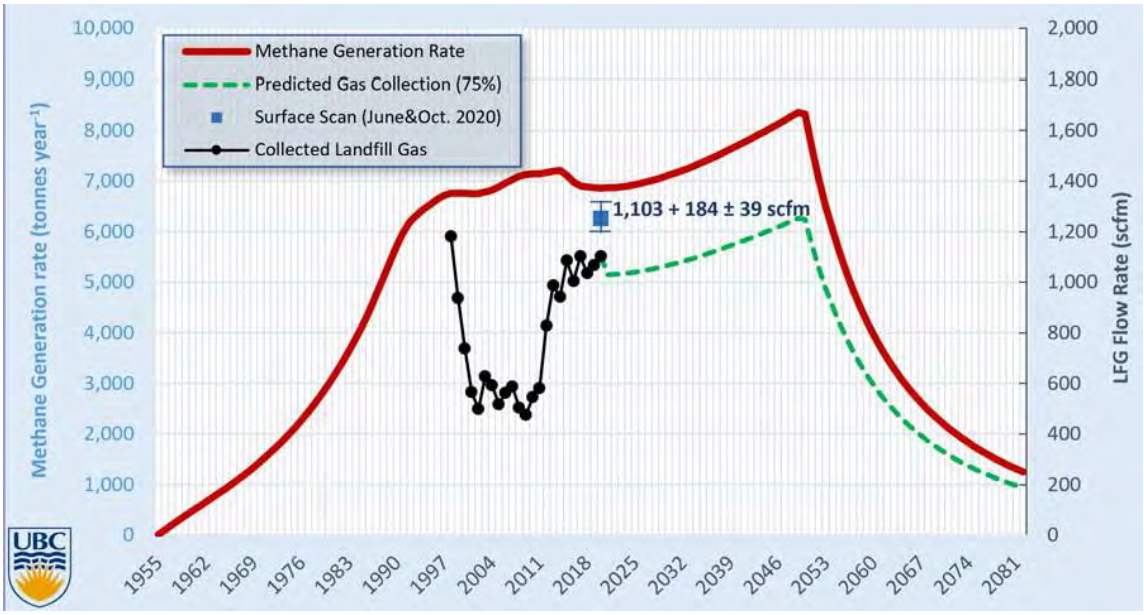


Figure 4.8 - Landfill Gas Generation, Collection and Emission Rates at Hartland Landfill

Comparing the CH_4 generation estimates for 2020 with the quantity of CH_4 collected and emitted this year, shows a difference in results. This value for UBCiModel, ENV Tool and ENV AR Tool was 6%, 7%, and 17% of modelled generated gas, respectively. This difference could be a result of model overestimation and/or the marginal error associated with Abedini's technique linear regression. Moreover, as suggested by the CH_4 mass balance METRO equation (described in Section 2), this quantity of "missing" CH_4 could be result of methane biological oxidation rates that can vary seasonally.

Table 4.5 shows the CH_4 mas balance for Hartland Landfill in 2020 based on the three gas generation models estimations and the two rounds of the fugitive methane emission measurements completed at this site.

Table 4.5 - Methane Mass Balance at Hartland Landfill in 2020

	Modelled LFG Generation Rate	Average LFG Collection Rate		Average LFG Emission Rate		Measured LFG (Collected + Emitted)	Difference Between Modelled and Measured Data	
	(scfm)	(scfm)	%	(scfm)	%	(scfm)	(scfm)	%
UBCiModel	1,362	1,103	81%	183	13%	1,287	75	6%
ENV Tool	1,376	1,103	80%	183	13%	1,287	90	7%
ENV AR Tool	1,558	1,103	71%	183	12%	1,287	272	17%

4.5 Biological Oxidation of Methane

Methane is a potent GHG with a global warming potential (GWP) of 28 to 36 times higher than CO_2 in a 100-year timeframe. Therefore, management of LFG and reducing methane emissions from MSW landfills through collection and thermal combustion of methane has become a requirement in many jurisdictions. Another effective method to control CH_4 emissions from landfills is biological oxidation. Biological oxidation of methane in landfill cover soil is historically acknowledged by a number of regulatory agencies such as ENV, U.S. Environmental Protection Agency (US EPA), and the International Panel on Climate Change (IPCC).

While landfill cover can be designed to maximize oxidation of CH_4 by promoting the growth of methanotrophic bacteria, most regulatory agencies adopted a default value of 10% oxidation rate for any type of soil cover. USEPA (2004) reported an average CH_4 oxidation rate (removal efficiency) of 10% to 25% with lower rates for clay cover soil and higher rates for topsoil. However, there are a number of published and peer reviewed scientific research papers that have reported CH_4 oxidation rates of 22% to 55% through operational soil cover (Whalen et al., 1990; Chanton et al., 2009; Chanton et al., 2011, Abedini et al. 2016). Abedini et al. (2016) conducted comprehensive investigations and analyses at Vancouver Landfill using stable isotope technique and showed approximately 30% baseline oxidation occurring within cover soils at this site.

Given the site conditions we are of the opinion that the majority of the remaining CH_4 mass is biologically oxidized in the landfill soil cover by naturally existing methanotrophic bacteria. The second round of CH_4 emissions quantification in October 2020 showed slightly higher emission rates when compared with the rates quantified in June. This could be a result of lower ambient temperature in October slowing down the shallow seated methanotrophic bacteria. Therefore, based on the UBCiModel's CH_4 generation estimates, we calculated the total quantity of oxidized CH_4 is approximately 29% of the uncollected CH_4 travelling through the soil cover in certain areas of the landfill.

Table 4.6 and Figure 4.9 summarize the CH_4 mass balance for Hartland Landfill as per the 2020 two rounds of field investigations.

Table 4.6 - Methane Mass Balance Summary

	LFG (scfm)	Methane (tonnes/year)	% of Total LFG Generated	% of LFG Not Collected
Gas Generation (Model, 2020)	1,362	6,865	100%	--
Average Collection rate	1,103	5,554	81%	--
Uncollected Gas	259	1,311	19%	--
Average Emission Rate	184	935	14%	71%
Balance (Oxidized)	75	376	5%	29%

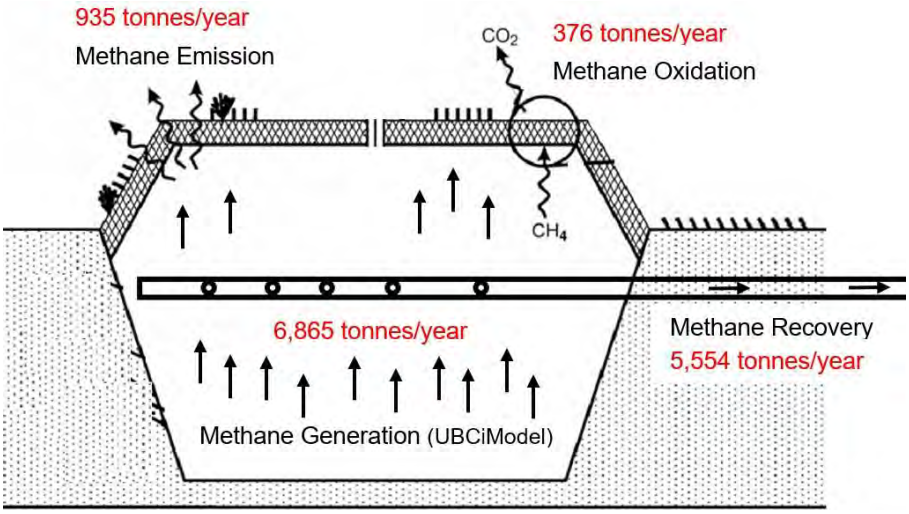


Figure 4.9 - Hartland Landfill Methane Mass Balance Schematic (2020 Average)

Figure 4.10 illustrates methane generation and collection data between 2010 and 2030, as well as estimated CH_4 emissions and oxidation based on the 2020 field investigations.

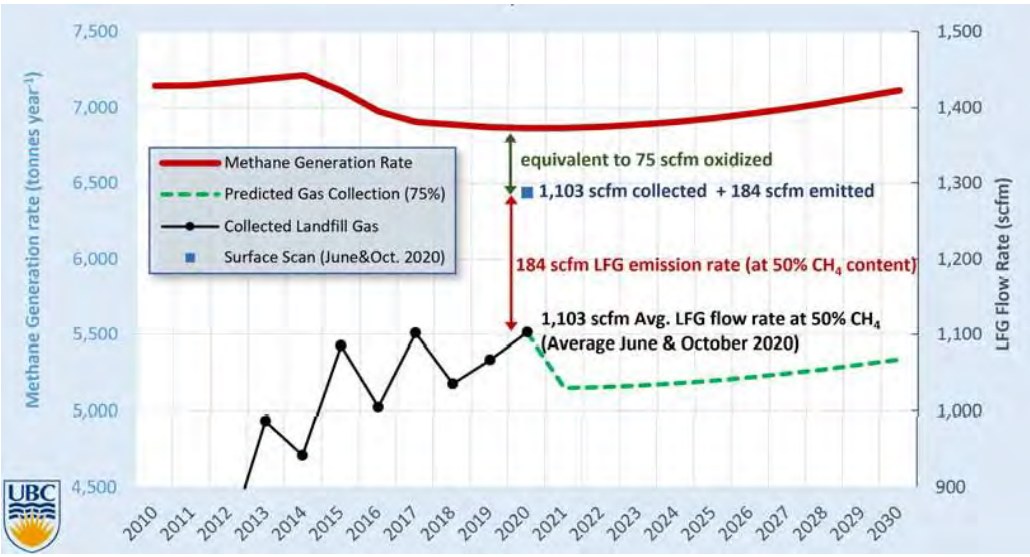


Figure 4.10 - Illustration of Methane Mass Balance for Hartland Landfill based on 2020 field works

We anticipate that there is a relatively high seasonal variation in methane oxidation levels in the landfill's soil cover as the media (soil cover) is not engineered to optimize methanotrophic activities. Landfill cover can be designed to maximize CH_4 oxidation by promoting the growth of methanotrophic bacteria. Type I and Type II methanotrophs are the primary bacterial populations that utilize CH_4 as their source of energy and carbon and convert it to CO_2, water and heat. Techniques such as bacterial DNA extraction and stable isotope technique can be used to study methanotrophic abundance and their effectiveness in methane oxidation.

Currently, there are no approved methodologies for assessment of these system's efficiencies in Canada. As a practical approach, SHA has utilized the surface scan technique to measure baseline and post-installation methane emission rates and has successfully quantified several biocover system methane removal efficiencies across BC.

Taking into account the extremely low level of CH_4 emission rates at Hartland Landfill (i.e. 6.6 g CH_4/m^2/day excluding the rock wall area), SHA believes that application of a fabricated biocover system on closed surfaces and operational phases of the landfill, in addition to an LFG collection system for the rock wall area, would result in the landfill becoming a near-zero emission facility. General recommendations for fabrication of an optimized biocover system are provided in enclosed Appendix A.

5 CONCLUSIONS AND RECOMMENDATIONS

The CRD retained SHA to conduct a full-scale GHG emissions quantification for Hartland Landfill. Site investigations were completed in two rounds of surface emission monitoring in June and October of 2020. Surface emission monitoring includes measurement of near surface methane concentrations which is a standardized methodology in the United States (US) required to assess effectiveness of active gas collection systems in regulated landfills (Reference: California Code of Regulations [CCR] Title 17 Article 4, Sub-article 6, or similarly in the US EPA regulations; 40 Code of Federal Regulations [CFR] Part 60 Subpart XXX).

Quantification of GHG emissions from Hartland Landfill was completed using the surface scan results and a patented technique developed by Dr. Abedini. In this technique, CH_4 emission rates are quantified based on landfill's surface methane concentrations and the rate of change in barometric pressure at the time of surface scanning.

Field investigations and data analyses showed that Hartland Landfill is currently emitting 925 tonnes of CH_4 per year, equivalent to 184 scfm of LFG at 50% CH_4 content. Therefore, the maximum rate of GHG emissions from Hartland Landfill is estimated to be approximately 23,000 tonnes of CO_2-e per year, which accounts for 14% of the generated gas from the landfill. SHA estimated that about 29% of the uncollected CH_4 is biologically oxidized by naturally existing methanotrophic bacteria within the soil covers of the landfill. The current methane biological oxidation rate has a significant seasonal variation due to climatic conditions, however; application of an engineered biocover system can maximize the removal efficacy of the fugitive CH_4 through biological oxidation.

Hartland Landfill has an active gas collection system that currently collects more than 1,100 scfm of the generated LFG, equivalent to 5,500 tonnes of CH_4 per year. Our previous assessments have

shown that the site's active LFG system is effectively collecting the generated gas with an approximate capture efficiency of 76% to 80% over the past 3 years. Results of the current GHG emission quantification study confirmed that CH_4 emission rates at this facility are lower than what is known as industry best engineering practices, indicating a high collection efficiency of the active gas collection system at this site. To our knowledge, this is the highest gas collection efficiency currently achieved in BC. Furthermore, completing a methane mass balance during the two field measurement events showed that UBCiModel©, as a site-specific model, better represents CH_4 generation at Hartland Landfill. We highly recommend that any future feasibility studies and engineering designs for gas collection and/or gas to energy initiatives to be based on more sophisticated models such as UBCiModel©.

Based on our detailed analyses of the field data, we concluded that the majority of the overall CH_4 emissions from Hartland Landfill are sourced from the Cell 3 area which is the only area with no permanent or temporary impermeable cap in place. We identified CH_4 emission hotspots such as exposed geomembrane liner punctures and tears, edges of geomembrane liner, side slopes of the current filling area and the exposed leachate drainage layer on west of Cell 3 area (rock wall). The level of emissions from north and south slopes of Cell 3 area will be significantly reduced as soon as the recently-installed horizontal gas collectors (lift 167m) in this area are brought online. The rock wall area (located at west of the Cell 3) was identified to be responsible for more than 18% of the site's overall GHG emissions in June 2020. This area was capped later in the summer with an impermeable clay layer and a lift of compacted waste. SHA designed a methane emission mitigation system for this area that will be constructed soon at lift 171m.

Even though the level of GHG emissions from the landfill is well below industry standards and regulatory requirements, additional GHG emission reductions can be achieved at the landfill through application of an engineered biocover system on the closed portions of the landfill, areas such as edges of the geomembrane closure system and areas with no impermeable cap that will not receive new lifts of waste within one year.

Currently, there are no regulations in place in Canada that would encourage application of biological methods to reduce the provincial and/or federal GHG emissions footprint from landfills, nor are there approved methodologies for assessment of these system's efficiencies. Nevertheless, SHA has been using best engineering practices in application of the biocover technology to reduce GHG emissions at a number of smaller landfill sites in BC. We have successfully quantified these biocover methane removal efficiencies through utilization of the surface scan technique.

6 STATEMENT OF LIMITATIONS

This report has been prepared by Sperling Hansen Associates (SHA) on behalf of the Capital Regional District in accordance with generally accepted engineering practices to a level of care and skill normally exercised by other members of the engineering and science professionscurrently practicing under similar conditions in British Columbia, subject to the time limits and financial and physical constraints applicable to the services. The report, which specificallyincludes all tables and figures, is based on engineering analysis by SHA staff of data compiled during the course of the project. Except where specifically stated to the contrary, the informationon which this study is based has been obtained from external sources. This external information has not been independently verified or otherwise examined by Sperling Hansen Associates to determine its accuracy and completeness. Sperling Hansen Associates has relied in good faith on this information and does not accept responsibility of any deficiency, misstatements or inaccuracies contained in the reports as a result of omissions, misinterpretation and/or fraudulent acts of the persons interviewed or contacted, or errors or omissions in the reviewed documentation.

The report is intended solely for the use of the Capital Regional District. Any use which a third party makes of this report, or any reliance on, or decisions to be made based on it, are the responsibilities of such third parties. Sperling Hansen Associates does not accept any responsibility for other uses of the material contained herein nor for damages, if any, suffered by any third party because of decisions made or actions based on this report. Copying of this intellectual property for other purposes is not permitted.

The findings and conclusions of this report are valid only as of the date of this report. The interpretations presented in this report and the conclusions and recommendations that are drawn are based on information that was made available to Sperling Hansen Associates during the course of this project. Should additional new data become available in the future, Sperling Hansen Associates should be requested to re-evaluate the findings of this report and modify the conclusions and recommendations drawn, as required.

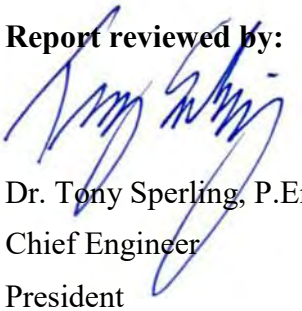
Yours truly,
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Appendix A

Biocover Design Recommendations

Biocover Design

Biocover feedstocks may consist of compost, compost and sand or a combination of biosolids, wood chips and sand. The high initial ammonium nitrogen content of fresh biosolids has the potential to negatively impact methanotrophy; however, the effect is short lived and the biocover is designed to assimilate this form of nitrogen to facilitate optimum CH_4 consumption. Alternatively, an older source of biosolids or compost can be used. Another alternative is to apply the biocover and allow it to stabilize over time. Under this scenario the biocover will not function optimally until stabilization has occurred. Based on recent research this delay can range from two weeks to a month under laboratory conditions.

Favorable Conditions for Biocover Performance

Recently, several approaches have been investigated in industry to exploit the powerful oxidizing ability of methanotrophic bacteria (methanotrophs) and potential uses in industrial processes. Methane reduction in biocover is also accomplished by methanotrophs that utilize methane monooxygenase (MMO) enzyme to oxidize CH_4 as a source of energy and carbon. Products of CH_4 oxidation are water, carbon dioxide, biomass and heat. Physical and chemical characteristics of the biocover influence the growth and performance of methanotrophs. These include temperature, moisture, organic matter content, carbon to nitrogen ratio (C:N), porosity, structure, and pH.

Temperature – The optimal temperature range for CH_4 oxidation by methanotrophic bacteria is 15 – 35 °C. Oxidation slows at cooler temperatures, although cold tolerant oxidizers show activity at temperatures as low as 2 – 5 °C (Abedini *et al.*, 2016) and above 40 °C. Oxidation stops at 50 °C (Chris A. Zeiss, 2006).

To optimize the methanotrophic activity in relation to temperature, a key factor to be considered is the depth of the biocover. Biocovers with design depths of 300mm to 600mm are proven to be more effective in methane removal than shallower biocovers. While deep sections of the biocover profile may lack methanotrophic activity due to a lack of oxygen, the mid-sections of the biocover do not experience the severe drop in ambient temperature experienced at surface and are, therefore, capable of hosting and nourishing different types of methanotrophs, and particularly Type 1 methanotrophs. In other words, from a temperature control or cold weather impact perspective, optimization of the biocover performance is achievable through adjusting the depth of a biocover.

Moisture content – Moisture in the soil facilitates the transfer of gases allowing CH_4 and O_2 to reach the methanotrophic bacteria and CO_2 to diffuse away. The optimum soil moisture concentration varies for different soils but is in the range of 10 – 30 % although CH_4 oxidation can occur in a wider moisture range of 8 – 50 % (Chris A. Zeiss, 2006). Another work suggests that the moisture content should be at least 5 % (Hettiaratchi *et al*., 2007).

Organic matter – In general an increase in CH_4 oxidation is directly related to an increase in soil organic matter content. Moderate oxidation rates have been demonstrated in soils with an organic matter content of 1 – 10%; soils with an organic matter content of up to 35% show an increased oxidation rate of 10 to 100 times more effective (Chris A. Zeiss, 2006).

It is also important to note that the optimum levels of organic matter and moisture content at which the maximum CH_4 oxidation rate (V_{max}) is expected are directly related. Figure A.1 below illustrates relation of optimum moisture content to optimum organic matter (Pokhrel et al., 2016).

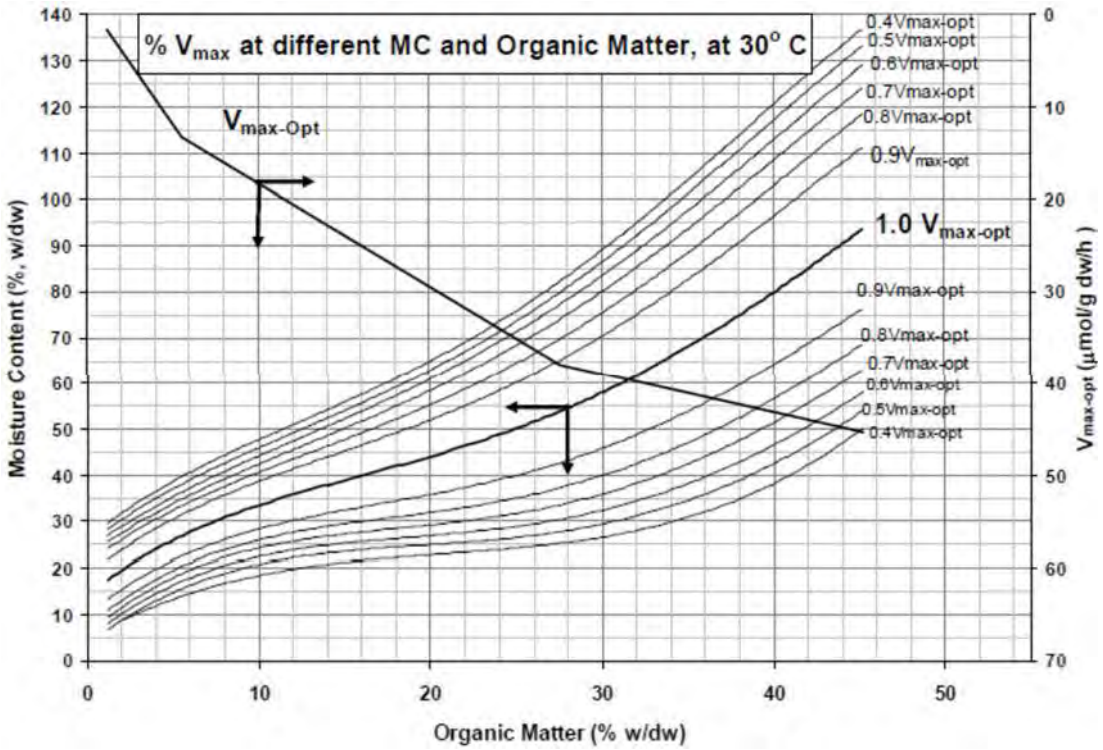


Figure A.1 - Maximum methane oxidation (Vmax) at different Moisture and Organic Content

Carbon to nitrogen ratio (C:N) – The C:N of the biocover is important as nitrogen, specifically ammonia, can inhibit performance. If the C:N ratio of the soil is lower than 12 the concentration of ammonia can inhibit CH_4 oxidation. At C:N ratios of 25 – 97 forms of nitrogen as ammonia are low (Chris A. Zeiss, 2006).

Porosity and structure – The ability of oxygen (O_2) to enter and move through the soil is vital for CH_4 oxidation thus a high porosity (the ratio of the volume of voids to the total volume of the media) is required in the biocover. Increases in bulk density of the medium lead to decreases in porosity and consequently might affect the gas permeability of the biocover. Additionally, the biocover should be structurally stable with minimal settling (Abichou *et a*l, 2004). On the other hand, too porous media allows free movement of gas, not allowing enough retention time for methane within the biocover media. Based on SHA's experience, optimum porosity for biocovers also depends on precipitation levels in the area. Porosities close to coarse sand is usually recommended as minimum value for biocover.

pH – Methanotrophs are neutrophilic with an optimal pH range of 6.5 to 8.0. Methane oxidation can occur to a maximum pH range of 8.5 – 9.0. Specific methanotroph species are tolerant of lower pH values down to a pH of 3.0 (Chris A. Zeiss, 2006).

In summary, SHA recommends the following properties to be taken into account for fabrication of a biocover system for the Hartland Landfill.

- moisture: 10 – 30 %, not less than 5%
- organic matter: increasing concentrations up to 35%
- C:N: 25 – 97, not less than 12
- porosity: high (not less than coarse sand porosity)
- pH: 6.5 – 8.0
- thickness of 400mm to 600mm

Once the available feedstock for fabrication of the media is known, lab test on each material shall be conducted and an optimized blend designed.

APPENDIX B

Well Field Data

B1 Gas Well Activation Dates

B2 Hartland Landfill Gas Well Field Data

B3 Hartland Landfill Gas Well Field Data Summary

Appendix B1 Hartland Landfill Gas Well Operation

Well Information						Gas Well Readings											
Old Well Name	New Well Name	Lift (mASL)	Installation Date	Activation Date	Deactivation Date	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	Comments
BLGW0001			2002	2003	2005												*Deactivated 2005*
BLGW0002			2002	2003	2005												*Deactivated 2005*
BLGW0003			2002	2003	2007												*Deactivated 2007*
BLGW0004			2002	2003	2007												*Deactivated 2007*
BLGW0005			2002	2003	2007												*Deactivated 2007*
BLGW0006			2002	2003	2007												*Deactivated 2007*
BLGW0007			2002	2003	2007												*Deactivated 2007*
BLGW0008			2002	2003	2004												*Deactivated 2004*
BLGW0009			2002	2003	2004												*Deactivated 2004*
BLGW0010			2002	2003	2004												*Deactivated 2004*
BLGW0011			2002	2003	2004												*Deactivated 2004*
BLGW0012			2002	2003	2004												*Deactivated 2004*
BLGW0013			2002	2003	2004												*Deactivated 2004*
BLGW0014			2002	2003	2004												*Deactivated 2004*
BLGW0015			2002	2003	2004												*Deactivated 2004*
BLGW0016			2002	2003	2008												*Deactivated 2008*
BLGW0017			2002	2003	2008												*Deactivated 2008*
BLGW0018			2002	2003	2008												*Deactivated 2008*
BLGW0019			2002	2003	2006												*Deactivated 2006*
BLGW0020			2002	2003	2006												*Deactivated 2006*
BLGW0021			2002	2003	2006												*Converted to vertical well OLGW0048s*
LHGW0001	LHGW0001		1999	2003	2011	x	x	IA									*Abandoned May 2011*
LHGW002A	LHGW002A	147	1999	2007		x	x	x	x	x	x	x	x	x	x	IA	*Disconnected for Cell 1 closure - reconnected in Dec. 2012*
LHGW002B	LHGW002B		1999	2007	2011	x	x	IA									*Abandoned in May 2011*
LHGW0003	LHGW0003	147	1999	2003		x	x	x	x	x	x	x	x	x	x	IA	*Disconnected for Cell 1 closure reconnected Jan. 2013*
LHGW0004	LHGW0004	147	1999	2003		x	x	x	x	x	x	x	x	x	x	x	
LHGW0005																	
LHGW0006	LHGW0006	143	2008	2009	2014	x	x	x	x	x	IA						*Abandoned May 2014*
LHGW0007	LHGW0007	143	2008	2009		x	x	x	x	x	x	x	x	IA			*No readings 2017-2018 - no production*
LHGW0008	LHGW0008	143	2008	2009		x	x	x	x	x	x	x	x	IA			*No readings 2017-2018 - no production*
LHGW0009	LHGW0009	143	2012	2012	2014			x	x	x	IA						*Start Feb. 2012 - abandoned May 2014*
LHGW0010	LHGW0010	143	2011	2012	2014			x	x	x	IA						*Start Feb. 2012, was 11 - abandoned May 2014*
LHGW0013	LHGW0013	151	2012	2011			x	x	x	x	x	x	x	x	x	x	*Start September 2011*
LHGW0017	LHGW0017	163	2014	2012				x	x	x	x	x	x	IA			*Start January 2012 / no readings 2017-2018 - no production*
LHGW0019	LHGW0019	---	2014	2014						x	x	x	x	x	x	x	*Started May 2014*
LHGW0020	LHGW0020	159	2014	2014						x	x	x	x	x	x	x	*Started May 2014*
LHGW0021	LHGW0021	159	2014	2014						x	x	x	x	x	IA		*Started May 2014*
LHGW0022	LHGW0022	159	2014	2014						x	x	x	x	x	x	x	*Started May 2014*
LHGW0023	LHGW0023	159	2011	2011			x	x	x	x	x	x	x	x	x	x	*Start September 2011, was 21*
OHGW0001	HLGW0001	139	1999	2001		x	x	x	x	x	x	x	x	x	x	x	*Disconnected for Cell 1 closure - reconnected Jan. 2013*
OHGW0002	HLGW0002		1999	2001	2011	x	x	IA									*Abandoned May 2011*
OHGW0003	HLGW0003	139	1999	2003		x	x	x	x	x	x	x	x	x	x	x	*Disconnected for Cell 1 closure - reconnected Jan. 2013*
OHGW0004	HLGW0004	147	1999	2003		x	x	x	x	x	x	x	x	IA			*Disconnected for Cell 1 closure - reconnected Jan. 2013 / no readings 2017-2018 - no production*
OHGW0005	HLGW0005	147	1999	2003		x	x	x	x	x	x	x	x	x	x	x	*Disconnected for Cell 1 closure - reconnected Jan. 2013*
OHGW006A	HLGW006A	159	1999	2005		x	x	x	x	x	x	x	x	x	x	x	
OHGW006B	HLGW006B	159	1999	2005		x	x	x	x	x	x	x	x	x	x	x	*Disconnected for Cell 1 closure - reconnected Jan. 2013*

Appendix B1, continued

Well Information						Gas Well Readings											
Old Well Name	New Well Name	Lift (mASL)	Installation Date	Activation Date	Deactivation Date	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	Comments
OHGW0007	HLGW0007		1999	2005	2011	x	x	IA									*Abandoned in May 2011*
OHGW008A	HLGW008A	143	1999	2006			x	x	x	x	x	x	x	x	x	x	*Disconnected for Cell 1 closure - reconnected Jan. 2013*
OHGW008B	HLGW008B	143	1999	2006		x	x	x	x	x	x	x	x	x	x	x	*Disconnected for Cell 1 closure - reconnected Jan. 2013*
OHGW0009	HLGW0009	139	2007	2008	2014	x	x	x	x	x	IA						*Disconnected for Cell 1 closure - reconnected Jan. 2013 - abandoned May 2014*
OHGW0010	HLGW0010	139	2007	2008		x	x	x	x	x	x	x	x	IA			*Disconnected for Cell 1 closure - reconnected Jan. 2013 / no readings 2017-2018 - no production*
OHGW0011	HLGW0011		2007	2008		x	x	x	x	x	x	x	x	IA			*Disconnected for Cell 1 closure - reconnected Jan. 2013 / no readings 2017-2018 - no production*
OHGW0012	HLGW0012	147		2010		x	x	x	x	x	x	x	x	x	x	x	
OHGW0013	HLGW0013	147		2010		x	x	x	x	x	x	x	x	x	x	x	
OHGW0014	HLGW0014	155		2011			x	x	x	x	x	x	x	x	x	x	
OHGW0015	HLGW0015	155		2011	2014		x	x	x	x	IA						*Abandoned May 2014*
	HLGW016A	159	2012	2012				x	x	x	x	x	x	IA			*Started Dec. 2012 / no readings 2017-2018 - no production*
OHGW0016/ HLGW0016	HLGW016B	163	2012	2012				x	x	x	x	x	x	x	x	x	*Started Jan. 2012*
	HLGW017A	163	2012	2013				x	x	x	x	x	x	x	x	IA	*Started Dec. 2012*
OHGW0017/ HLGW0017	HLGW017B	163	2012	2012				x	x	x	x	x	x	x	x	x	*Started Jan. 2012*
	HLGW0018	165	2012	2013					x	x	x	x	x	x	x	x	*Started Jan. 2013*
	HLGW019B	165	2013	2013					x	x	x	x	x	IA			*Started Jan. 2013 / no readings 2017-2018 - no production*
	HLGW019C	165	2012	2012	2020			x	x	x	x	x	x	x	x	IA	*Started Dec. 2012 - decommissioned July 2020*
	HLGW020B	165	2013	2013					x	x	x	x	x	IA			*Started Jan. 2013 / no readings 2017-2018 - no production*
	HLGW021B	165	2013	2013					x	x	x	x	x	x	x	x	*Started Jan. 2013*
	HLGW022B	165	2013	2013					x	x	x	x	x	x	x	x	*Started Jan. 2013*
Previously HLGW0023	HLGW023B	165	2013	2013					x	x	x	x	x	x	x	x	*Started Jan. 2013*
	HLGW024B	171	2014	2016								x	x	x	x	x	*Activated 2016*
	HLGW025B	171	2014	2016								x	x	x	x	x	*Activated 2016*
	HLGW026B	171	2014	2015							x	x	x	x	x	x	*Started Jan. 2015*
	HLGW027A	171	2014	2017									x	x	x	x	*Activated 2017*
	HLGW027B	171	2014	2015							x	x	x	x	x	x	*Started Jan. 2015*
	HLGW028B	171	2014	2015							x	x	x	x	x	x	*Activated Jan. 2015*
	HLGW028A	171	2014	2017									x	x	x	x	
	HLGW029B	171	2014	2015							x	x	x	x	x	x	*Activated Jan. 2015*
	HLGW029A	171	2014	2017									x	x	x	x	
	HLGW030A	171	2013	2014						x	x	x	x	x	x	x	*Activated Jan. 2014 temp disconnected Jun. 2016 for cell 3 / reactivated Oct. 2017*
	HLGW030B	171	2013	2014						x	x	x	x	x	x	x	*Activated Jan. 2014*
	HLGW031A	171	2013	2014						x	x	x	x	x	x	x	*Activated Jan. 2014 temp disconnected Jun. 2016 for cell 3 / reactivated Oct. 2017*
	HLGW031B	171	2013	2014						x	x	x	x	x	x	x	*Activated Jan. 2014*
	HLGW032A	171	2013	2014						x	x	x	x	x	x	x	*Activated Jan. 2014 temp disconnected Jun2016 for cell 3 / reactivated Oct. 2017*
	HLGW032B	171	2013	2014						x	x	x	x	x	x	x	*Activated Jan. 2014*
	HLGW033A	171	2013	2014						x	x	x	x	x	x	x	*Activated Jan. 2014 temp disconnected Jun. 2016 for cell 3 / reactivated Oct. 2017*
	HLGW033B	171	2013	2014						x	x	x	x	x	x	x	*Activated Jan. 2014*
	HLGW034A	171	2013	2014						x	x	x	x	x	x	x	*Activated Jan. 2014 temp disconnected Jun. 2016 for cell 3 / reactivated Oct. 2017*

Appendix B1, continued

Well Information						Gas Well Readings											
Old Well Name	New Well Name	Lift (mASL)	Installation Date	Activation Date	Deactivation Date	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	Comments
	HLGW034B	171	2013	2014						x	x	x	x	x	x	x	*Activated Jan. 2014*
	HLGW035A	---	---	---	---	---	---	---	---	---	---	---	---	---	---		*Wells not installed*
	HLGW035B	---	---	---	---	---	---	---	---	---	---	---	---	---	---		*Wells not installed*
	HLGW036B	175	2015	2017									x	x	x		*Installed 2015 - Temp connection Jan. 2017*
	HLGW037B	175	2015	2017									x	x	x	x	
	HLGW038B	175	2015	2017									x	x	x	x	*Installed 2015 - Temp connection Jan. 2017*
	HLGW039A	175	2015	2017									x	x	x	x	
	HLGW039B	175	2015	2017									x	x	x	x	*Installed 2015 - Temp connection Jan. 2017*
	HLGW040A	175	2015	2017									x	x	x	x	
	HLGW040B	175	2015	2018										x	x	x	*Activated Jan. 2018*
	HLGW041A	175	2015	2017									x	x	x	x	
	HLGW041B	175	2015	2017									x	x	x	x	
	HLGW042A	175	2015	2017									x	x	x	x	
	HLGW042B	175	2015	2017									x	x	x	x	*Installed 2015 - Temp Activated Jan. 2017*
	HLGW043A	175	2015	2017									x	x	x	x	
	HLGW043B	175	2015	2017									x	x	x	x	*Installed 2015 - Temp Activated Jan. 2017*
	HLGW044A	179	2015	2017									x	x	x	x	
	HLGW044B	179	2015	2017									x	x	x	x	*Installed 2015 - Temp Activated Jan. 2017*
	HLGW045A	179	2016	2019								I			x	IA	*Activated April 2019*
	HLGW045B	179	2016	2018								I		x	x	x	*Activated Jan. 2018*
	HLGW046A	179	2016	2019								I			x	IA	*Activated April 2019*
	HLGW046B	179	2016	2018								I		x	x	x	*Activated Jan. 2018*
	HLGW047A	179	2016	2017									x	x	x	x	
	HLGW047B	179	2016	2018								I		x	x	x	*Activated Jan. 2018*
	HLGW048A	179	2016	2017									x	x	x	x	
	HLGW048B	179	2016	2018								I		x	x	x	*Activated Jan. 2018*
	HLGW049A	179	2016	2017									x	x	x	IA	
	HLGW049B	179	2016	2018								I		x	x	x	*Activated Jan. 2018*
	HLGW050A	179	2016	2017									x	x	x	x	
	HLGW050B	179	2016	2018								I		x	x	x	*Activated Jan. 2018*
	HLGW051A	179	2016	2017									x	x	x	x	
	HLGW051B	179	2016	2017								I	x	x	x	x	
Cell 3	HLGW0052	151(3)	2017	2018										x	x	x	*Activated July 2018*
Cell 3	HLGW0053	151(3)	2017	2018										x	x	x	*Activated July 2018*
Cell 3	HLGW0054	151(3)	2017	2018										x	x	x	*Activated July 2018*
Cell 3	HLGW0055	151(3)	2017	2018										x	x	x	*Activated July 2018*
	HLGW0056	151(3)	2017	2018										x	x	IA	*Activated August 2018*
Cell 3	HLGW0057	155(3)	2018	2019											x	x	*Activated April 2019*
Cell 3	HLGW0058	155(3)	2018	2019											x	x	*Activated April 2019*
Cell 3	HLGW0059	155(3)	2018	2019											x	x	*Activated April 2019*
Cell 3	HLGW0060	155(3)	2018	2019											x	x	*Activated April 2019*
Cell 3	HLGW0061	155(3)	2018	2019											x	x	*Activated April 2019*
Cell 3	HLGW0062	155(3)	2018	2019											x	x	*Activated April 2019*
Cell 3	HLGW0063	155(3)	2018	2019											x	x	*Activated April 2019*
Cell 3	HLGW0064	155(3)	2018	2020											---	---	*Active May/June 2020*
Cell 3	HLGW0065	159 (3)	2018	2020												x	*Active May/June 2020*
Cell 3	HLGW0066	159 (3)	2018	2020												x	*Active May/June 2020*
Cell 3	HLGW0067B	159 (3)	2018	2020												x	*Active May/June 2020*
Cell 3	HLGW0068B	159 (3)	2018	2020												x	*Active May/June 2020*

Appendix B1, continued

Well Information						Gas Well Readings											
Old Well Name	New Well Name	Lift (mASL)	Installation Date	Activation Date	Deactivation Date	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	Comments
Cell 3	HLGW0069	159 (3)	2018	2020												x	*Active June 2020*
Cell 3	HLGW0070A		2019	2021													
Cell 3	HLGW0070B		2019														
Cell 3	HLGW0071A		2019	2021													
Cell 3	HLGW0071B		2019														
Cell 3	HLGW0072A		2019	2021													
Cell 3	HLGW0072B		2019														
Cell 3	HLGW0073A		2019	2021													
Cell 3	HLGW0073B		2019														
Cell 3	HLGW0074A		2019	2021													
Cell 3	HLGW0074B		2019														
Cell 3	HLGW0075A		2019														
Cell 3	HLGW0075B		2019	2021													
Cell 3	HLGW0076		2019														
Cell 3 Should be HLGW64?	RWHGW01A	3		2020												x	*Rock Wall gas collectors - activated Nov. 2020*
Cell 3	RWHGW01B	3		2020												x	*Rock Wall gas collectors - activated Nov. 2020*
OLGT001A	TLGW001A		1996			x	x	x	x	x	x	x	IA				
OLGT001B	TLGW001B		1996			x	x	x	x	x	x	x	IA				
OLGT002A	TLGW002A		1996			x	x	x	x	x	x	x	IA				
OLGT002B	TLGW002B		1996			x	x	x	x	x	x	x	IA				
OLGT002C	TLGW002C		1996			x	x	x	x	x	x	x	IA				
OLGT0003					2002												*Deactivated 2002*
OLGT0004					2002												*Deactivated 2002*
OLGT0005					2002												*Deactivated 2002*
OLGT0006					2002												*Deactivated 2002*
OLGT0007					2002												*Deactivated 2002*
OLGT0008					2002												*Deactivated 2002*
OLGT0009					2002												*Deactivated 2002*
OLGT0010					2002												*Deactivated 2002*
OLGT0011					2002												*Deactivated 2002*
OLGT0012					2002												*Deactivated 2002*
OLGT0013					2002												*Deactivated 2002*
OLGT0014					2002												*Deactivated 2002*
OLGT0015					2002												*Deactivated 2002*
OLGT0016					2002												*Deactivated 2002*
OLGT0017					2002												*Deactivated 2002*
OLGT0018					2002												*Deactivated 2002*
OLGT0019					2002												*Deactivated 2002*
OLGW001D	VLGW001D	---	1996	1996		x	x	x	x	x	x	x	x	IA			*no readings 2017-2018 - no production*
OLGW001S	VLGW001S	---	1996	1996		x	x	x	x	x	x	x	x	IA			*no readings 2017-2018 - no production*
OLGW002D	VLGW002D	---	1996	1996		x	x	x	x	x	x	x	x	IA			*no readings 2017-2018 - no production*
OLGW002S	VLGW002S	---	1996	1996		x	x	x	x	x	x	x	x	IA			*no readings 2017-2018 - no production*
OLGW003D	VLGW003D	---	1996	1996		x	x	x	x	x	x	x	x	x	x	x	
OLGW003S	VLGW003S	---	1996	1996		x	x	x	x	x	x	x	x	x	x	x	
OLGW004D	VLGW004D	---	1996	1996		x	x	x	x	x	x	x	IA				
OLGW004S	VLGW004S	---	1996	1996		x	x	x	x	x	x	x	x	x			

Appendix B1, continued

Well Information						Gas Well Readings											
Old Well Name	New Well Name	Lift (mASL)	Installation Date	Activation Date	Deactivation Date	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	Comments
OLGW005D	VLGW005D	---	1996	1996		x	x	x	x	x	x	x	IA				
OLGW005S	VLGW005S	---	1996	1996		x	x	x	x	x	x	x	x	x	x	x	
OLGW006D	VLGW006D	---	1996	1996		x	x	x	x	x	x	x	x	x	x	x	
OLGW006S	VLGW006S	---	1996	1996		x	x	x	x	x	x	x	x	x	x	x	
OLGW007D	VLGW007D	---	1996	1996		x	x	x	x	x	x	x	x	x	x	x	
OLGW007S	VLGW007S	---	1996	1996		x	x	x	x	x	x	x	x	x	x	x	
OLGW008D	VLGW008D	---	1996	1996		x	x	x	x	x	x	x	x	x	x	x	
OLGW008S	VLGW008S	---	1996	1996		x	x	x	x	x	x	x	x	x	x	x	
OLGW009D	VLGW009D	---	1996	1996		x	x	x	x	x	x	x	x	x	x	x	
OLGW009S	VLGW009S	---	1996	1996		x	x	x	x	x	x	x	x	x	x	x	
OLGW010S	VLGW010S	---	1996	1996		x	x	x	x	x	x	x	x	x	x	x	
OLGW011S	VLGW011S	---	1996	1996		x	x	x	x	x	x	x	x	x	x	x	
OLGW012S	VLGW012S	---	1996	1996		x	x	x	x	x	x	x	x	x	x	x	
OLGW013D	VLGW013D	---	1997	1997		x	x	x	x	x	x	x	x	x	x	x	
OLGW013S	VLGW013S	---	1997	1997		x	x	x	x	x	x	x	x	x	x	x	
OLGW014D	VLGW014D	---	1997	1997		x	x	x	x	x	x	x	IA				
OLGW014S	VLGW014S	---	1997	1997		x	x	x	x	x	x	x	IA				
OLGW015D	VLGW015D	---	1997	1997		x	x	x	x	x	x	x	x	x	x	x	
OLGW015S	VLGW015S	---	1997	1997		x	x	x	x	x	x	x	x	x	x	x	
OLGW016D	VLGW016D	---	1997	1997		x	x	x	x	x	x	x	x	x	x	x	
OLGW016S	VLGW016S	---	1997	1997		x	x	x	x	x	x	x	x	x	x	x	
OLGW017D	VLGW017D	---	1997	1997		x	x	x	x	x	x	x	x	x	x	x	
OLGW017S	VLGW017S	---	1997	1997		x	x	x	x	x	x	x	x	x	x	x	
OLGW018D	VLGW018D	---	1997	1997		x	x	x	x	x	x	x	x	x	x	x	
OLGW018S	VLGW018S	---	1997	1997		x	x	x	x	x	x	x	x	x	x	x	
OLGW019D	VLGW019D	---	1997	1997		x	x	x	x	x	x	x	x	x	x	x	
OLGW019S	VLGW019S	---	1997	1997		x	x	x	x	x	x	x	x	x	x	x	
OLGW020D	VLGW020D	---	1997	1997		x	x	x	x	x	x	x	x	x	x	x	
OLGW020S	VLGW020S	---	1997	1997		x	x	x	x	x	x	x	x	x	x	x	
OLGW021D	VLGW021D	---	1997	1997		x	x	x	x	x	x	x	x	x	x	x	
OLGW021S	VLGW021S	---	1997	1997		x	x	x	x	x	x	x	x	x	x	x	
OLGW022D	VLGW022D	---	1997	1997		x	x	x	x	x	x	x	x	x	x	x	
OLGW022S	VLGW022S	---	1997	1997		x	x	x	x	x	x	x	x	x	x	x	
OLGW023D	VLGW023D	---	1997	1997		x	x	x	x	x	x	x	x	x	x	x	
OLGW023S	VLGW023S	---	1997	1997		x	x	x	x	x	x	x	x	x	x	x	
OLGW024D	VLGW024D	---	1997	1997		x	x	x	x	x	x	x	x	x	x	x	
OLGW024S	VLGW024S	---	1997	1997		x	x	x	x	x	x	x	IA				
OLGW025D	VLGW025D	---	1997	1997		x	x	x	x	x	x	x	IA				
OLGW025S	VLGW025S	---	1997	1997		x	x	x	x	x	x	x	x	x		IA	
OLGW026D	VLGW026D	---	1997	1997		x	x	x	x	x	x	x	x	x	x	x	
OLGW026S	VLGW026S	---	1997	1997		x	x	x	x	x	x	x	x	x	x	x	
OLGW027D	VLGW027D	---	1997	1997		x	x	x	x	x	x	x	x	x	x	x	
OLGW027S	VLGW027S	---	1997	1997		x	x	x	x	x	x	x	x	x	x	x	
OLGW028S	VLGW028S	---	1997	1997		x	x	x	x	x	x	x	x	x	x	x	
OLGW029D	VLGW029D	---	1997	1997		x	x	x	x	x	x	x	x	x	x	x	
OLGW029S	VLGW029S	---	1997	1997		x	x	x	x	x	x	x	x	x	x	x	
OLGW030S	VLGW030S	---	1997	1997		x	x	x	x	x	x	x	x	x	x	x	
OLGW031S	VLGW031S	---	1997	1997		x	x	x	x	x	x	x	x	x	x	x	
OLGW032S	VLGW032S	---	1997	1997		x	x	x	x	x	x	x	x	x	x	x	

Appendix B1, continued

Well Information						Gas Well Readings											
Old Well Name	New Well Name	Lift (mASL)	Installation Date	Activation Date	Deactivation Date	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	Comments
OLGW033S	VLGW033S	---	1997	1997		x	x	x	x	x	x	x	x	x	x	x	
OLGW034S	VLGW034S	---	1997	1997			x	x	x	x	x	x	x	x	x	x	
OLGW035S		---	1997	1998	2004												*Deactivated 2004*
OLGW035D		---	1997	1998	2004												*Deactivated 2004*
OLGW036S		---	1997	1998	2004												*Deactivated 2004*
OLGW036D		---	1997	1998	2004												*Deactivated 2004*
OLGW037S		---	1997	1998	2005												*Deactivated 2005*
OLGW037D		---	1997	1998	2005												*Deactivated 2005*
OLGW038S		---	1997	1998	2004												*Deactivated 2004*
OLGW038D		---	1997	1998	2004												*Deactivated 2004*
OLGW039S		---	1997	1998	2004												*Deactivated 2004*
OLGW039D		---	1997	1998	2004												*Deactivated 2004*
OLGW040S		---	1997	1998	2004												*Deactivated 2004*
OLGW040D		---	1997	1998	2004												*Deactivated 2004*
OLGW041D		---	1997	1998	2008												*Deactivated 2008*
OLGW041S		---	1997	1998	2008												*Deactivated 2008*
OLGW042S	VLGW042S	---	2002	2003		x	x	x	x	x	x	x	x	x	x	x	
OLGW043S	VLGW043S	---	2002	2003		x	x	x	x	x	x	x	x	x	x	x	
OLGW044S	VLGW044S	---	2002	2003	2011	x	x	IA									*Abandoned in May 2011*
OLGW045S	VLGW045S	---	2002	2003	2011	x	x	IA									*Abandoned in May 2011*
OLGW046S	VLGW046S	---	2002	2003	2011	x	x	IA									*Abandoned in May 2011*
OLGW047S	VLGW047S	---	2002	2003		x	x			x	x	x	x	x	IA		*Abandoned in May 2011 -* ***Reactivated May 2014***
OLGW048S	VLGW048S	---	2002	2002	2011	x	x	**IA**									*Abandoned in May 2011*
OLGW049	VLGW0049	---	2011	2011			x	x	x	x	x	x	x	x	x	x	
OLGW050	VLGW0050	---	2011	2011			x	x	x	x	x	x	x	x	x	x	
OLGW051	VLGW0051	---	2011	2011			x	x	x	x	x	x	x	x	x	x	
OLGW052	VLGW0052	---	2011	2011			x	x	x	x	x	x	x	x	x	x	
OLGW053	VLGW0053	---	2011	2011			x	x	x	x	x	x	x	x	x	x	
OLGW054	VLGW0054	---	2011	2011			x	x	x	x	x	x	x	x	x	x	
OLGW055	VLGW0055	---	2011	2011			x	x	x	x	x	x	x	x	x	x	
OLGW056	VLGW0056	---	2011	2011			x	x	x	x	x	x	x	x	x	x	
OLGW057	VLGW0057	---	2011	2011			x	x	x	x	x	x	IA				
OLGW058	VLGW0058	---	2011	2011			x	x	x	x	x	x	x	x	x	x	
OLGW059	VLGW0059	---	2011	2011			x	x	x	x	x	x	x	x	x	x	
OLGW060	VLGW0060	---	2011	2011			x	x	x	x	x	x	x	x	x	x	

Notes:

x	indicates active during the year		2020
BLGW0001		Buried	0
LHGW0001	LHGW0001	Leachate Horizontal	6
OHGW0001	HLGW0001	Horizontal	78
OLGT001A	TLGW001A	Trench	0
OLGW001D	VLGW001D	Vertical	60
		activated in year	8
		total wells	**144**

Appendix B2 2020 LFG Well Field Data

Month	Date	CH4 %	CO2 %	O2 %	Balance %	Init. Flow SCFM	Adj. Flow SCFM
HLGW0001							
January	01/30/2020 18:34	56.2	39.0	0.2	4.6	1.0	3.0
February	---	---	---	---	---	---	---
March	---	---	---	---	---	---	---
April	---	---	---	---	---	---	---
May	---	---	---	---	---	---	---
June	---	---	---	---	---	---	---
July	---	---	---	---	---	---	---
August	8/28/20 12:33 PM	0.6	11.2	8.5	79.7	1.0	1.0
September	---	---	---	---	---	---	---
October	---	---	---	---	---	---	---
November	---	---	---	---	---	---	---
December	---	---	---	---	---	---	---
Average		**28.4**	**25.1**	**4.4**	**42.2**	**1.0**	**2.0**
HLGW0003							
January	01/30/2020 18:38	52.7	35.1	0.6	11.6	2.0	2.0
February	2/20/20 5:32 PM	33.9	28.5	2.1	35.5	2.0	1.0
March	3/25/20 2:54 PM	10.6	12.8	10.6	66.0	1.0	1.0
April	---	---	---	---	---	---	---
May	---	---	---	---	---	---	---
June	06/30/2020 11:52	49.8	33.9	1.0	15.3	2.0	2.0
July	07/31/2020 10:45	36.0	30.0	2.0	32.0	1.0	<<>>
August	8/28/20 11:29 AM	28.5	25.0	4.6	41.9	1.0	0.0
September	09/29/2020 13:33	29.3	24.1	5.2	41.4	0.0	<<>>
October	10/31/20 11:43 AM	4.9	10.4	12.2	72.5	1.0	3.0
November	12/2/20 15:10	26.3	25.3	2.8	45.6	3.0	4.0
December	12/31/20 14:15	8.9	11.7	11.6	67.8	3.0	4.0
Average		**28.1**	**23.7**	**5.3**	**43.0**	**1.6**	**2.1**
HLGW0004							
January	---	---	---	---	---	---	---
February	---	---	---	---	---	---	---
March	---	---	---	---	---	---	---
April	---	---	---	---	---	---	---
May	---	---	---	---	---	---	---
June	---	---	---	---	---	---	---
July	---	---	---	---	---	---	---
August	---	---	---	---	---	---	---
September	---	---	---	---	---	---	---
October	---	---	---	---	---	---	---
November	---	---	---	---	---	---	---
December	---	---	---	---	---	---	---
Average		**---**	**---**	**---**	**---**	**---**	**---**

Appendix B2, continued

Month	Date	CH4 %	CO2 %	O2 %	Balance %	Init. Flow SCFM	Adj. Flow SCFM
HLGW0005							
January	01/30/2020 18:43	31.7	28.2	0.0	40.1	6.0	8.0
February	2/20/20 5:28 PM	32.5	28.3	0.0	39.2	6.0	5.0
March	3/25/20 2:51 PM	27.3	26.4	0.0	46.3	8.0	0.0
April	---	---	---	---	---	---	---
May	---	---	---	---	---	---	---
June	---	---	---	---	---	---	---
July	---	---	---	---	---	---	---
August	---	---	---	---	---	---	---
September	---	---	---	---	---	---	---
October	---	---	---	---	---	---	---
November	---	---	---	---	---	---	---
December	---	---	---	---	---	---	---
Average		**30.5**	**27.6**	**0.0**	**41.9**	**6.7**	**4.3**
HLGW006A							
January	---	---	---	---	---	---	---
February	---	---	---	---	---	---	---
March	3/28/20 11:45 AM	38.9	32.6	0.0	28.5	0.0	2.0
April	---	---	---	---	---	---	---
May	---	---	---	---	---	---	---
June	---	---	---	---	---	---	---
July	---	---	---	---	---	---	---
August	8/28/20 11:55 AM	38.0	32.6	0.0	29.4	0.0	0.0
September	---	---	---	---	---	---	---
October	---	---	---	---	---	---	---
November	---	---	---	---	---	---	---
December	---	---	---	---	---	---	---
Average		**38.5**	**32.6**	**0.0**	**29.0**	**0.0**	**1.0**
HLGW006B							
January	---	---	---	---	---	---	---
February	---	---	---	---	---	---	---
March	---	---	---	---	---	---	---
April	---	---	---	---	---	---	---
May	---	---	---	---	---	---	---
June	---	---	---	---	---	---	---
July	---	---	---	---	---	---	---
August	---	---	---	---	---	---	---
September	---	---	---	---	---	---	---
October	---	---	---	---	---	---	---
November	---	---	---	---	---	---	---
December	---	---	---	---	---	---	---
Average		**---**	**---**	**---**	**---**	**---**	**---**

Appendix B2, continued

Month	Date	CH4 %	CO2 %	O2 %	Balance %	Init. Flow SCFM	Adj. Flow SCFM
HLGW008A							
January	01/14/2020 10:09	42.9	33.0	0.3	23.8	25.0	7.0
February	2/18/20 4:42 PM	45.9	33.4	0.0	20.7	18.0	19.0
March	3/20/20 3:06 PM	44.6	33.3	0.0	22.1	11.0	8.0
April	---	---	---	---	---	---	---
May	5/9/20 13:15	55.0	35.9	1.7	7.4	10.0	17.0
June	06/13/2020 12:21	49.1	35.0	0.1	15.8	10.0	15.0
July	07/31/2020 12:43	46.9	34.6	0.0	18.5	15.0	15.0
August	8/29/20 3:04 PM	46.6	34.5	0.1	18.8	16.0	16.0
September	09/25/2020 11:26	48.1	35.1	0.1	16.7	13.0	21.0
October	10/30/20 12:34 PM	44.2	34.1	0.0	21.7	19.0	20.0
November	11/28/20 12:10	40.8	33.2	0.0	26.0	16.0	19.0
December	12/23/20 18:36	39.8	32.5	0.0	27.7	17.0	24.0
Average		**45.8**	**34.1**	**0.2**	**19.9**	**15.5**	**16.5**
HLGW008B							
January	01/14/2020 13:06	42.6	33.3	0.0	24.1	28.0	27.0
February	2/20/20 2:31 PM	37.9	31.9	0.0	30.2	20.0	19.0
March	3/28/20 11:33 AM	40.5	33.1	0.0	26.4	20.0	20.0
April	---	---	---	---	---	---	---
May	5/20/20 10:17	44.1	34.2	0.0	21.7	19.0	19.0
June	06/30/2020 12:24	43.9	34.2	0.0	21.9	24.0	24.0
July	07/29/2020 15:05	42.6	34.0	0.1	23.3	23.0	20.0
August	8/28/20 11:06 AM	42.2	34.1	0.0	23.7	19.0	19.0
September	09/26/2020 13:43	41.3	33.3	0.0	25.4	19.0	20.0
October	10/30/20 4:28 PM	38.4	32.3	0.0	29.3	20.0	13.0
November	---	---	---	---	---	---	---
December	12/30/20 16:57	37.4	32.2	0.0	30.4	8.0	8.0
Average		**41.1**	**33.3**	**0.0**	**25.6**	**20.0**	**18.9**
HLGW0009							
January	---	---	---	---	---	---	---
February	---	---	---	---	---	---	---
March	---	---	---	---	---	---	---
April	Decommissioned May 2014						
May	---	---	---	---	---	---	---
June	---	---	---	---	---	---	---
July	---	---	---	---	---	---	---
August	---	---	---	---	---	---	---
September	---	---	---	---	---	---	---
October	---	---	---	---	---	---	---
November	---	---	---	---	---	---	---
December	---	---	---	---	---	---	---
Average	**---**	**---**	**---**	**---**	**---**	**---**	**---**

Appendix B2, continued

Month	Date	CH4 %	CO2 %	O2 %	Balance %	Init. Flow SCFM	Adj. Flow SCFM
HLGW0010							
January	---	---	---	---	---	---	---
February	---	---	---	---	---	---	---
March	---	---	---	---	---	---	---
April	---	---	---	---	---	---	---
May	---	---	---	---	---	---	---
June	---	---	---	---	---	---	---
July	---	---	---	---	---	---	---
August	---	---	---	---	---	---	---
September	---	---	---	---	---	---	---
October	---	---	---	---	---	---	---
November	---	---	---	---	---	---	---
December	---	---	---	---	---	---	---
Average							**0.0**
HLGW0011							
January	---	---	---	---	---	---	---
February	---	---	---	---	---	---	---
March	---	---	---	---	---	---	---
April	---	---	---	---	---	---	---
May	---	---	---	---	---	---	---
June	---	---	---	---	---	---	---
July	---	---	---	---	---	---	---
August	---	---	---	---	---	---	---
September	---	---	---	---	---	---	---
October	---	---	---	---	---	---	---
November	---	---	---	---	---	---	---
December	---	---	---	---	---	---	---
Average							**0.0**
HLGW0012							
January	01/25/2020 18:00	48.9	35.0	2.5	13.6	5.0	3.0
February	---	---	---	---	---	---	---
March	3/25/20 12:30 PM	15.7	12.5	12.7	59.1	5.0	1.0
April	---	---	---	---	---	---	---
May	---	---	---	---	---	---	---
June	10/6/20 13:29	57.0	42.9	0.0	0.1	2.0	3.0
July	07/30/2020 13:47	53.1	40.5	0.3	6.1	4.0	5.0
August	8/28/20 12:45 PM	52.6	40.1	0.1	7.2	3.0	3.0
September	09/30/2020 11:34	57.9	42.0	0.0	0.1	5.0	4.0
October	10/31/20 12:21 PM	59.7	40.0	0.2	0.1	3.0	<<>>
November	12/4/20 16:04	2.0	2.9	19.3	75.8	4.0	1.0
December	12/30/20 16:34	2.40	2.90	19.30	75.40	5.00	5.00
Average		**38.8**	**28.8**	**6.0**	**26.4**	**4.0**	**3.1**

Appendix B2, continued

Month	Date	CH4 %	CO2 %	O2 %	Balance %	Init. Flow SCFM	Adj. Flow SCFM
HLGW0013							
January	01/25/2020 18:09	36.0	31.2	3.7	29.1	3.0	5.0
February	---	---	---	---	---	---	---
March	3/25/20 12:35 PM	26.8	28.2	0.0	45.0	<<>>	0.0
April	---	---	---	---	---	---	---
May	---	---	---	---	---	---	---
June	10/6/20 13:24	40.1	33.3	0.0	26.6	2.0	0.0
July	07/30/2020 13:55	33.4	30.5	0.1	36.0	2.0	1.0
August	8/28/20 12:50 PM	58.6	41.2	0.0	0.2	3.0	9.0
September	09/30/2020 11:39	37.4	33.7	0.0	28.9	7.0	0.0
October	10/31/20 12:26 PM	36.5	33.4	0.0	30.1	5.0	2.0
November	12/4/20 16:11	34.4	31.7	0.0	33.9	3.0	0.0
December	12/30/20 16:30	50.8	38.2	0.0	11.0	2.0	2.0
Average		**39.3**	**33.5**	**0.4**	**26.8**	**3.4**	**2.1**
HLGW0014							
January	---	---	---	---	---	---	---
February	---	---	---	---	---	---	---
March	3/25/20 12:25 PM	32.5	30.7	0.8	36.0	5.0	1.0
April	---	---	---	---	---	---	---
May	---	---	---	---	---	---	---
June	10/6/20 13:31	43.7	35.5	0.0	20.8	18.0	7.0
July	07/30/2020 13:50	36.1	31.6	1.2	31.1	24.0	2.0
August	07/30/2020 13:50	---	---	---	---	---	---
September	09/30/2020 11:44	43.0	37.7	0.0	19.3	24.0	1.0
October	---	---	---	---	---	---	---
November	12/2/20 15:20	39.7	25.6	6.1	28.6	0.0	0.0
December	12/30/20 16:41	37.5	24.9	6.0	31.6	9.0	6.0
Average		**38.8**	**31.0**	**2.4**	**27.9**	**13.3**	**2.8**
HLGW0015							---
January	---	---	---	---	---	---	---
February	---	---	---	---	---	---	---
March	---	---	---	---	---	---	---
April	---	---	---	---	---	---	---
May	Decommissioned May 2014						
June	---	---	---	---	---	---	---
July	---	---	---	---	---	---	---
August	---	---	---	---	---	---	---
September	---	---	---	---	---	---	---
October	---	---	---	---	---	---	---
November	---	---	---	---	---	---	---
December	---	---	---	---	---	---	---
Average		**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**

Appendix B2, continued

Month	Date	CH4 %	CO2 %	O2 %	Balance %	Init. Flow SCFM	Adj. Flow SCFM
HLGW016A							
January	---	---	---	---	---	---	---
February	---	---	---	---	---	---	---
March	---	---	---	---	---	---	---
April	---	---	---	---	---	---	---
May	---	---	---	---	---	---	---
June	---	---	---	---	---	---	---
July	---	---	---	---	---	---	---
August	---	---	---	---	---	---	---
September	---	---	---	---	---	---	---
October	---	---	---	---	---	---	---
November	---	---	---	---	---	---	---
December	---	---	---	---	---	---	---
Average		**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**
HLGW016B							
January	---	---	---	---	---	---	---
February	2/21/20 5:15 PM	57.1	38.5	0.0	4.4	136.0	138.0
March	3/25/20 12:11 PM	53.4	37.6	0.1	8.9	136.0	130.0
April	---	---	---	---	---	---	---
May	---	---	---	---	---	---	---
June	10/6/20 13:13	49.4	36.5	0.8	13.3	135.0	134.0
July	07/30/2020 10:06	47.4	35.9	1.0	15.7	135.0	135.0
August	8/28/20 1:06 PM	46.2	35.1	0.9	17.8	134.0	134.0
September	09/30/2020 11:20	52.5	38.3	0.7	8.5	135.0	133.0
October	10/31/20 12:16 PM	54.8	39.4	0.0	5.8	135.0	135.0
November	12/2/20 18:55	55.8	39.1	0.0	5.1	186.0	186.0
December	12/30/20 15:22	59.5	40.4	0.0	0.1	186.0	180.0
Average		**52.9**	**37.9**	**0.4**	**8.8**	**146.4**	**145.0**
HLGW017A							
January	---	---	---	---	---	---	---
February	---	---	---	---	---	---	---
March	---	---	---	---	---	---	---
April	---	---	---	---	---	---	---
May	---	---	---	---	---	---	---
June	---	---	---	---	---	---	---
July	---	---	---	---	---	---	---
August	---	---	---	---	---	---	---
September	---	---	---	---	---	---	---
October	---	---	---	---	---	---	---
November	---	---	---	---	---	---	---
December	---	---	---	---	---	---	---
Average	**---**	**---**	**---**	**---**	**---**	**---**	**---**

Appendix B2, continued

Month	Date	CH4 %	CO2 %	O2 %	Balance %	Init. Flow SCFM	Adj. Flow SCFM
HLGW017B							
January	---	---	---	---	---	---	---
February	2/21/20 5:08 PM	1.2	3.2	17.1	78.5	2.0	3.0
March	3/25/20 12:05 PM	5.1	10.5	10.6	73.8	8.0	1.0
April	---	---	---	---	---	---	---
May	---	---	---	---	---	---	---
June	10/6/20 13:07	18.2	18.1	8.7	55.0	21.0	1.0
July	07/30/2020 10:00	4.6	14.5	8.1	72.8	0.0	1.0
August	8/28/20 1:10 PM	1.8	10.5	9.2	78.5	0.0	0.0
September	09/30/2020 11:14	21.7	24.5	3.8	50.0	10.0	12.0
October	10/31/20 12:12 PM	2.7	10.0	11.4	75.9	4.0	0.0
November	12/2/20 19:16	1.4	10.4	10.6	77.6	0.0	0.0
December	12/30/20 15:00	21.2	26.7	0.0	52.1	1.0	1.0
Average		**8.7**	**14.3**	**8.8**	**68.2**	**5.1**	**2.1**
HLGW0018							
January	---	---	---	---	---	---	---
February	2/21/20 4:45 PM	59.3	40.4	0.1	0.2	10.0	9.0
March	3/20/20 11:43 AM	59.4	40.4	0.0	0.2	9.0	16.0
April	---	---	---	---	---	---	---
May	5/5/20 15:16	57.8	40.6	0.0	1.6	6.0	12.0
June	5/5/20 15:16	---	---	---	---	---	---
July	07/28/2020 14:04	55.5	43.5	0.1	0.9	10.0	17.0
August	8/27/20 3:47 PM	40.1	26.6	0.8	32.5	11.0	11.0
September	---	---	---	---	---	---	---
October	10/31/20 12:08 PM	58.6	41.3	0.0	0.1	18.0	16.0
November	12/2/20 18:42	58.9	40.9	0.1	0.1	13.0	6.0
December	12/30/20 15:05	58.4	41.5	0.0	0.1	9.0	5.0
Average		**56.0**	**39.4**	**0.1**	**4.5**	**10.8**	**11.5**
HLGW019B							
January	---	---	---	---	---	---	---
February	---	---	---	---	---	---	---
March	---	---	---	---	---	---	---
April	---	---	---	---	---	---	---
May	---	---	---	---	---	---	---
June	---	---	---	---	---	---	---
July	---	---	---	---	---	---	---
August	---	---	---	---	---	---	---
September	---	---	---	---	---	---	---
October	---	---	---	---	---	---	---
November	---	---	---	---	---	---	---
December	---	---	---	---	---	---	---
Average	**---**	**---**	**---**	**---**	**---**	**---**	**---**

Appendix B2, continued

Month	Date	CH4 %	CO2 %	O2 %	Balance %	Init. Flow SCFM	Adj. Flow SCFM
HLGW019C							
January	---	---	---	---	---	---	---
February	---	---	---	---	---	---	---
March	---	---	---	---	---	---	---
April	---	---	---	---	---	---	---
May	---	---	---	---	---	---	---
June	---	---	---	---	---	---	---
July	---	---	---	---	---	---	---
August	---	---	---	---	---	---	---
September	---	---	---	---	---	---	---
October	---	---	---	---	---	---	---
November	---	---	---	---	---	---	---
December	---	---	---	---	---	---	---
Average	**---**	**---**	**---**	**---**	**---**	**---**	**---**
HLGW020B							
January	---	---	---	---	---	---	---
February	---	---	---	---	---	---	---
March	---	---	---	---	---	---	---
April	---	---	---	---	---	---	---
May	---	---	---	---	---	---	---
June	---	---	---	---	---	---	---
July	---	---	---	---	---	---	---
August	---	---	---	---	---	---	---
September	---	---	---	---	---	---	---
October	---	---	---	---	---	---	---
November	---	---	---	---	---	---	---
December	---	---	---	---	---	---	---
Average	**---**	**---**	**---**	**---**	**---**	**---**	**---**
HLGW021B							
January	11/1/20 17:05	49.5	37.4	1.2	11.9	42.0	31.0
February	2/21/20 4:51 PM	51.5	35.7	1.7	11.1	33.0	32.0
March	3/20/20 11:40 AM	48.7	35.6	1.1	14.6	31.0	31.0
April	---	---	---	---	---	---	---
May	5/5/20 15:13	53.2	38.0	0.3	8.5	28.0	29.0
June	9/6/20 15:04	51.0	38.3	0.4	10.3	35.0	35.0
July	07/28/2020 14:07	48.8	36.6	1.5	13.1	33.0	33.0
August	8/27/20 3:44 PM	48.0	36.3	1.3	14.4	59.0	59.0
September	09/29/2020 18:15	53.2	38.8	0.6	7.4	59.0	59.0
October	10/30/20 5:55 PM	52.9	39.3	0.4	7.4	70.0	71.0
November	11/27/20 15:42	57.5	40.1	0.2	2.2	67.0	67.0
December	12/30/20 14:49	58.2	40.1	0.5	1.2	68.0	68.0
Average		**52.0**	**37.8**	**0.8**	**9.3**	**47.7**	**46.8**

Appendix B2, continued

Month	Date	CH4 %	CO2 %	O2 %	Balance %	Init. Flow SCFM	Adj. Flow SCFM
HLGW022B							
January	11/1/20 17:03	54.4	40.3	0.0	5.3	2.0	19.0
February	2/21/20 4:54 PM	32.4	29.6	1.4	36.6	11.0	13.0
March	3/20/20 11:37 AM	34.2	30.8	1.6	33.4	8.0	5.0
April	---	---	---	---	---	---	---
May	5/5/20 15:11	45.5	36.8	0.0	17.7	10.0	14.0
June	9/6/20 15:06	43.0	37.4	0.0	19.6	12.0	11.0
July	07/28/2020 14:09	42.6	36.0	0.0	21.4	10.0	10.0
August	8/27/20 3:43 PM	28.7	27.4	3.0	40.9	2.0	<<>>
September	09/29/2020 18:10	42.6	35.9	0.0	21.5	7.0	14.0
October	10/30/20 5:51 PM	39.6	35.7	0.1	24.6	4.0	8.0
November	11/27/20 15:40	47.9	37.8	0.0	14.3	11.0	14.0
December	12/30/20 14:46	50.0	37.8	0.0	12.2	13.0	9.0
Average		**41.9**	**35.0**	**0.6**	**22.5**	**8.2**	**11.7**
HLGW023B							
January	11/1/20 17:00	43.7	35.8	0.3	20.2	25.0	20.0
February	2/21/20 4:58 PM	43.9	34.5	0.6	21.0	13.0	13.0
March	3/20/20 11:35 AM	44.7	35.2	0.3	19.8	11.0	6.0
April	---	---	---	---	---	---	---
May	5/5/20 15:09	55.4	39.1	0.0	5.5	11.0	13.0
June	9/6/20 15:07	45.7	37.1	0.0	17.2	11.0	11.0
July	07/28/2020 14:11	51.8	38.8	0.0	9.4	9.0	13.0
August	8/27/20 3:41 PM	41.7	35.1	2.1	21.1	4.0	2.0
September	09/29/2020 18:07	55.8	40.4	0.0	3.8	5.0	7.0
October	10/30/20 5:48 PM	51.2	39.2	0.0	9.6	31.0	26.0
November	11/27/20 15:37	52.3	39.3	0.0	8.4	6.0	3.0
December	12/30/20 14:43	57.0	39.9	1.2	1.9	34.0	48.0
Average		**49.4**	**37.7**	**0.4**	**12.5**	**14.5**	**14.7**
HLGW024B							
January	---	---	---	---	---	---	---
February	2/21/20 2:28 PM	38.4	28.0	3.5	30.1	<<>>	1.0
March	3/20/20 11:57 AM	45.0	34.7	0.0	20.3	27.0	37.0
April	---	---	---	---	---	---	---
May	---	---	---	---	---	---	---
June	9/6/20 14:53	49.1	36.9	0.0	14.0	51.0	50.0
July	07/28/2020 12:46	37.4	32.5	0.2	29.9	10.0	1.0
August	8/27/20 3:59 PM	36.7	32.0	0.4	30.9	12.0	4.0
September	09/29/2020 14:23	26.8	28.3	0.2	44.7	10.0	11.0
October	10/30/20 5:32 PM	35.0	31.5	0.4	33.1	14.0	8.0
November	11/27/20 15:29	30.1	29.6	0.1	40.2	12.0	13.0
December	12/30/20 14:55	51.2	35.1	0.1	13.6	3.0	2.0
Average		**38.9**	**32.1**	**0.5**	**28.5**	**17.4**	**14.1**

Appendix B2, continued

Month	Date	CH4 %	CO2 %	O2 %	Balance %	Init. Flow SCFM	Adj. Flow SCFM
HLGW025B							
January	11/1/20 17:38	57.9	41.9	0.0	0.2	9.0	10.0
February	2/21/20 2:31 PM	59.2	40.1	0.0	0.7	7.0	6.0
March	3/20/20 11:50 AM	55.7	38.5	0.0	5.8	9.0	10.0
April	---	---	---	---	---	---	---
May	5/5/20 15:00	46.5	35.8	0.0	17.7	15.0	17.0
June	9/6/20 15:02	41.0	31.9	3.4	23.7	8.0	6.0
July	07/28/2020 13:52	47.0	34.4	3.7	14.9	23.0	23.0
August	8/27/20 3:50 PM	32.3	26.7	7.0	34.0	29.0	11.0
September	---	---	---	---	---	---	---
October	10/31/20 12:00 PM	58.3	41.0	0.6	0.1	4.0	6.0
November	12/2/20 18:25	58.8	40.8	0.2	0.2	7.0	6.0
December	12/30/20 14:52	59.0	40.6	0.3	0.1	3.0	4.0
Average		**51.6**	**37.2**	**1.5**	**9.7**	**11.4**	**9.9**
HLGW026B							
January	11/1/20 17:32	59.1	40.8	0.0	0.1	4.0	23.0
February	2/21/20 2:36 PM	59.0	38.7	0.0	2.3	6.0	10.0
March	3/20/20 11:54 AM	56.8	38.1	0.0	5.1	3.0	12.0
April	---	---	---	---	---	---	---
May	5/5/20 15:51	60.2	39.5	0.1	0.2	7.0	19.0
June	5/5/20 15:51	59.5	40.2	0.1	0.2	4.0	22.0
July	07/28/2020 12:48	52.5	38.5	0.1	8.9	9.0	20.0
August	8/27/20 3:54 PM	51.0	37.7	0.3	11.0	14.0	23.0
September	5/5/20 15:51	46.7	36.0	0.1	17.2	8.0	8.0
October	10/30/20 5:22 PM	49.5	37.1	0.5	12.9	6.0	9.0
November	11/27/20 15:23	59.9	40.0	0.0	0.1	25.0	78.0
December	12/30/20 14:26	24.1	12.2	13.1	50.6	41.0	87.0
Average		**52.6**	**36.3**	**1.3**	**9.9**	**11.5**	**28.3**
HLGW027A							
January	01/14/2020 10:13	51.5	37.3	0.0	11.2	21.0	34.0
February	2/18/20 4:48 PM	58.6	41.3	0.0	0.1	19.0	19.0
March	3/20/20 3:11 PM	57.8	40.0	0.0	2.2	13.0	21.0
April	---	---	---	---	---	---	---
May	5/9/20 13:17	50.4	37.5	0.1	12.0	31.0	18.0
June	11/6/20 13:06	50.2	38.0	0.3	11.5	20.0	25.0
July	07/31/2020 12:39	51.1	38.7	0.0	10.2	15.0	24.0
August	8/29/20 3:06 PM	53.3	39.5	0.2	7.0	12.0	20.0
September	09/25/2020 11:30	51.0	39.1	0.1	9.8	21.0	24.0
October	10/30/20 12:37 PM	51.5	39.1	0.1	9.3	22.0	30.0
November	11/27/20 18:43	49.2	37.9	0.0	12.9	24.0	29.0
December	12/23/20 18:31	49.3	37.5	0.0	13.2	35.0	22.0
Average		**52.2**	**38.7**	**0.1**	**9.0**	**21.2**	**24.2**

Appendix B2, continued

Month	Date	CH4 %	CO2 %	O2 %	Balance %	Init. Flow SCFM	Adj. Flow SCFM
HLGW027B							
January	11/1/20 17:31	55.6	39.7	0.0	4.7	8.0	23.0
February	2/21/20 2:40 PM	50.0	36.6	0.0	13.4	16.0	16.0
March	3/20/20 11:57 AM	45.0	34.7	0.0	20.3	27.0	37.0
April	---	---	---	---	---	---	---
May	5/5/20 16:01	50.9	35.9	0.0	13.2	9.0	14.0
June	9/6/20 14:53	49.1	36.9	0.0	14.0	51.0	50.0
July	07/28/2020 12:46	37.4	32.5	0.2	29.9	10.0	1.0
August	8/27/20 3:59 PM	36.7	32.0	0.4	30.9	12.0	4.0
September	09/29/2020 14:23	26.8	28.3	0.2	44.7	10.0	11.0
October	10/30/20 5:32 PM	35.0	31.5	0.4	33.1	14.0	8.0
November	11/27/20 15:29	30.1	29.6	0.1	40.2	12.0	13.0
December	12/30/20 14:35	51.8	35.7	0.2	12.3	8.0	18.0
Average		**42.6**	**33.9**	**0.1**	**23.3**	**16.1**	**17.7**
HLGW028A							
January	01/14/2020 10:16	58.9	40.9	0.0	0.2	21.0	25.0
February	2/18/20 4:52 PM	58.3	39.6	0.0	2.1	51.0	54.0
March	3/20/20 3:13 PM	58.3	39.4	0.0	2.3	34.0	48.0
April	---	---	---	---	---	---	---
May	5/9/20 13:19	52.1	37.5	0.0	10.4	55.0	65.0
June	11/6/20 13:08	54.4	39.2	0.0	6.4	55.0	73.0
July	07/31/2020 12:37	50.4	37.9	0.0	11.7	64.0	65.0
August	8/29/20 3:08 PM	53.5	39.0	0.0	7.5	63.0	77.0
September	09/25/2020 11:32	54.2	39.6	0.0	6.2	68.0	79.0
October	10/30/20 12:39 PM	53.2	39.4	0.0	7.4	74.0	86.0
November	11/27/20 18:40	50.0	37.7	0.0	12.3	79.0	90.0
December	12/23/20 18:28	50.4	37.5	0.0	12.1	78.0	84.0
Average		**54.0**	**38.9**	**0.0**	**7.1**	**58.4**	**67.8**
HLGW028B							
January	11/1/20 17:09	57.6	42.3	0.0	0.1	5.0	13.0
February	3/20/20 11:59 AM	58.4	39.9	0.0	1.7	5.0	6.0
March	2/21/20 2:43 PM	59.8	40.1	0.0	0.1	6.0	12.0
April	---	---	---	---	---	---	---
May	5/5/20 15:05	55.2	38.7	0.0	6.1	14.0	15.0
June	9/6/20 14:47	59.2	40.7	0.0	0.1	28.0	40.0
July	07/28/2020 12:40	40.8	33.4	1.3	24.5	12.0	7.0
August	8/27/20 4:06 PM	58.5	40.5	0.0	1.0	6.0	16.0
September	09/29/2020 17:54	55.9	39.3	0.1	4.7	33.0	33.0
October	10/30/20 5:34 PM	58.5	41.4	0.0	0.1	37.0	41.0
November	11/27/20 15:15	59.2	39.9	0.0	0.9	34.0	34.0
December	12/30/20 14:37	58.3	41.6	0.0	0.1	3.0	4.0
Average		**56.5**	**39.8**	**0.1**	**3.6**	**16.6**	**20.1**

Appendix B2, continued

Month	Date	CH4 %	CO2 %	O2 %	Balance %	Init. Flow SCFM	Adj. Flow SCFM
HLGW029A							
January	01/14/2020 10:19	58.5	38.6	0.5	2.4	8.0	14.0
February	2/18/20 4:56 PM	59.0	40.8	0.0	0.2	11.0	14.0
March	3/20/20 3:16 PM	59.3	40.5	0.1	0.1	10.0	16.0
April	---	---	---	---	---	---	---
May	5/9/20 13:22	54.4	38.4	0.0	7.2	20.0	26.0
June	11/6/20 13:11	52.8	38.9	0.1	8.2	22.0	28.0
July	07/31/2020 12:36	52.8	38.7	0.0	8.5	11.0	12.0
August	8/29/20 3:10 PM	50.1	38.0	0.3	11.6	22.0	37.0
September	09/25/2020 11:35	54.7	39.1	0.3	5.9	11.0	21.0
October	10/30/20 12:41 PM	51.9	38.8	0.4	8.9	21.0	21.0
November	11/27/20 18:36	52.0	37.9	0.1	10.0	26.0	38.0
December	12/23/20 18:26	51.4	37.7	2.0	8.9	22.0	15.0
Average		**54.3**	**38.9**	**0.3**	**6.5**	**16.7**	**22.0**
HLGW029B							
January	11/1/20 17:11	58.7	41.2	0.0	0.1	<<>>	7.0
February	2/21/20 2:46 PM	37.0	29.5	3.6	29.9	2.0	4.0
March	3/20/20 12:01 PM	41.0	32.5	1.7	24.8	4.0	1.0
April	---	---	---	---	---	---	---
May	5/5/20 15:06	56.8	38.1	0.0	5.1	4.0	4.0
June	9/6/20 14:45	57.2	40.1	0.0	2.7	4.0	8.0
July	07/28/2020 12:37	35.7	30.0	2.2	32.1	3.0	2.0
August	8/27/20 4:10 PM	59.5	40.4	0.0	0.1	6.0	8.0
September	09/29/2020 18:00	51.3	37.5	0.0	11.2	7.0	8.0
October	10/30/20 5:38 PM	53.9	39.7	0.0	6.4	2.0	2.0
November	11/27/20 15:11	42.0	33.2	1.7	23.1	3.0	2.0
December	12/30/20 14:40	60.0	39.8	0.0	0.2	3.0	5.0
Average		**50.3**	**36.5**	**0.8**	**12.3**	**3.8**	**4.6**
HLGW030A							
January	---	---	---	---	---	---	---
February	2/18/20 5:02 PM	39.5	32.6	0.9	27.0	3.0	4.0
March	---	---	---	---	---	---	---
April	---	---	---	---	---	---	---
May	---	---	---	---	---	---	---
June	---	---	---	---	---	---	---
July	---	---	---	---	---	---	---
August	---	---	---	---	---	---	---
September	---	---	---	---	---	---	---
October	---	---	---	---	---	---	---
November	11/28/20 11:40	9.9	14.1	10.0	66.0	1.0	1.0
December	---	---	---	---	---	---	---
Average		**24.7**	**23.4**	**5.5**	**46.5**	**2.0**	**2.5**

Appendix B2, continued

Month	Date	CH4 %	CO2 %	O2 %	Balance %	Init. Flow SCFM	Adj. Flow SCFM
HLGW030B							
January	11/1/20 17:43	58.4	41.3	0.1	0.2	22.0	19.0
February	2/21/20 11:55 AM	60.4	39.5	0.0	0.1	13.0	13.0
March	3/25/20 11:36 AM	59.0	39.7	0.0	1.3	11.0	19.0
April	---	---	---	---	---	---	---
May	5/5/20 14:25	58.6	39.5	1.7	0.2	17.0	23.0
June	9/6/20 14:14	58.1	40.3	1.5	0.1	19.0	23.0
July	07/28/2020 12:05	51.7	37.8	0.4	10.1	29.0	30.0
August	8/27/20 4:52 PM	54.0	38.8	0.2	7.0	8.0	29.0
September	09/29/2020 18:29	57.1	39.7	0.0	3.2	14.0	15.0
October	10/30/20 4:36 PM	59.1	40.0	0.0	0.9	13.0	19.0
November	11/27/20 14:43	57.1	39.5	0.0	3.4	14.0	8.0
December	12/30/20 13:38	58.2	39.7	0.0	2.1	4.0	6.0
Average		**57.4**	**39.6**	**0.4**	**2.6**	**14.9**	**18.5**
HLGW031A							
January	---	---	---	---	---	---	---
February	---	---	---	---	---	---	---
March	---	---	---	---	---	---	---
April	---	---	---	---	---	---	---
May	---	---	---	---	---	---	---
June	---	---	---	---	---	---	---
July	---	---	---	---	---	---	---
August	---	---	---	---	---	---	---
September	---	---	---	---	---	---	---
October	---	---	---	---	---	---	---
November	11/28/20 11:43	3.7	10.9	11.4	74.0	11.0	11.0
December	---	---	---	---	---	---	---
Average		**3.7**	**10.9**	**11.4**	**74.0**	**11.0**	**11.0**
HLGW031B							
January	11/1/20 17:44	43.9	35.7	0.8	19.6	21.0	32.0
February	2/21/20 11:59 AM	37.3	30.9	1.7	30.1	28.0	32.0
March	3/25/20 11:38 AM	34.1	29.7	2.2	34.0	29.0	5.0
April	---	---	---	---	---	---	---
May	5/5/20 14:27	59.6	39.1	0.4	0.9	9.0	16.0
June	9/6/20 14:16	56.9	39.1	0.4	3.6	12.0	20.0
July	07/31/2020 10:22	35.3	18.5	4.5	41.7	0.0	0.0
August	8/27/20 4:55 PM	57.7	39.2	0.4	2.7	21.0	32.0
September	09/29/2020 18:32	53.6	38.0	0.2	8.2	15.0	19.0
October	10/30/20 4:40 PM	49.2	36.3	0.9	13.6	14.0	20.0
November	11/27/20 14:39	48.9	36.7	0.5	13.9	28.0	16.0
December	12/30/20 13:34	55.1	38.3	0.5	6.1	15.0	15.0
Average		**48.3**	**34.7**	**1.1**	**15.9**	**17.5**	**18.8**

Appendix B2, continued

Month	Date	CH4 %	CO2 %	O2 %	Balance %	Init. Flow SCFM	Adj. Flow SCFM
HLGW032A							
January	---	---	---	---	---	---	---
February	---	---	---	---	---	---	---
March	---	---	---	---	---	---	---
April	---	---	---	---	---	---	---
May	---	---	---	---	---	---	---
June	---	---	---	---	---	---	---
July	---	---	---	---	---	---	---
August	---	---	---	---	---	---	---
September	---	---	---	---	---	---	---
October	---	---	---	---	---	---	---
November	11/28/20 11:49	18.1	22.0	4.8	55.1	7.0	<<>>
December	12/31/20 14:31	22.3	25.4	2.5	49.8	7.0	7.0
Average		**20.2**	**23.7**	**3.7**	**52.5**	**7.0**	**7.0**
HLGW032B							
January	11/1/20 17:46	56.4	39.4	0.1	4.1	25.0	26.0
February	2/21/20 12:03 PM	48.7	35.7	0.5	15.1	15.0	26.0
March	3/25/20 11:42 AM	48.7	36.1	0.4	14.8	28.0	33.0
April	---	---	---	---	---	---	---
May	5/5/20 14:29	48.1	35.6	0.3	16.0	38.0	42.0
June	9/6/20 14:19	40.8	33.7	0.9	24.6	39.0	25.0
July	07/28/2020 12:09	59.5	39.9	0.5	0.1	38.0	32.0
August	8/27/20 4:57 PM	58.6	39.4	0.4	1.6	23.0	37.0
September	09/29/2020 18:35	58.0	38.9	0.3	2.8	32.0	29.0
October	10/30/20 4:44 PM	57.6	39.2	0.3	2.9	36.0	36.0
November	11/27/20 14:36	53.6	38.2	0.2	8.0	39.0	34.0
December	12/30/20 13:31	55.9	38.6	0.4	5.1	29.0	29.0
Average		**53.3**	**37.7**	**0.4**	**8.6**	**31.1**	**31.7**
HLGW033A							
January	01/14/2020 10:24	44.3	32.7	2.5	20.5	29.0	29.0
February	2/18/20 5:10 PM	42.8	31.2	3.5	22.5	26.0	26.0
March	3/20/20 3:34 PM	41.1	30.0	3.7	25.2	24.0	6.0
April	---	---	---	---	---	---	---
May	5/9/20 13:36	59.3	40.6	0.0	0.1	7.0	11.0
June	11/6/20 13:16	57.0	38.9	0.4	3.7	14.0	20.0
July	07/31/2020 12:22	47.0	33.9	1.9	17.2	17.0	19.0
August	8/29/20 3:22 PM	47.2	34.6	2.0	16.2	18.0	16.0
September	09/25/2020 11:47	46.1	33.5	2.3	18.1	18.0	19.0
October	10/30/20 12:51 PM	45.2	33.8	2.7	18.3	15.0	15.0
November	11/28/20 11:54	42.3	31.9	3.6	22.2	19.0	20.0
December	12/31/20 14:34	41.6	31.5	3.6	23.3	22.0	20.0
Average		**46.7**	**33.9**	**2.4**	**17.0**	**19.0**	**18.3**

Appendix B2, continued

Month	Date	CH4 %	CO2 %	O2 %	Balance %	Init. Flow SCFM	Adj. Flow SCFM
HLGW033B							
January	---	---	---	---	---	---	---
February	2/21/20 12:08 PM	6.5	3.0	0.5	90.0	<<>>	<<>>
March	---	---	---	---	---	---	---
April	---	---	---	---	---	---	---
May	---	---	---	---	---	---	---
June	---	---	---	---	---	---	---
July	07/31/2020 10:25	34.1	29.0	0.3	36.6	2.0	2.0
August	---	---	---	---	---	---	---
September	09/29/2020 18:39	0.2	14.3	3.4	82.1	25.0	23.0
October	---	---	---	---	---	---	---
November	11/27/20 14:33	1.8	11.1	8.9	78.2	2.0	0.0
December	12/30/20 13:28	7.4	12.9	8.7	71.0	2.0	3.0
Average		**10.0**	**14.1**	**4.4**	**71.6**	**7.8**	**7.0**
HLGW034A							
January	---	---	---	---	---	---	---
February	---	---	---	---	---	---	---
March	---	---	---	---	---	---	---
April	---	---	---	---	---	---	---
May	---	---	---	---	---	---	---
June	---	---	---	---	---	---	---
July	---	---	---	---	---	---	---
August	---	---	---	---	---	---	---
September	---	---	---	---	---	---	---
October	---	---	---	---	---	---	---
November	11/28/20 11:57	25.8	28.1	0.0	46.1	4.0	4.0
December	12/31/20 14:38	27.3	28.4	0.0	44.3	1.0	1.0
Average		**26.6**	**28.3**	**0.0**	**45.2**	**2.5**	**2.5**
HLGW034B							
January	11/1/20 17:49	42.7	35.8	1.1	20.4	25.0	20.0
February	2/21/20 12:12 PM	44.6	33.5	1.2	20.7	28.0	35.0
March	3/25/20 11:45 AM	54.0	37.2	0.3	8.5	12.0	12.0
April	---	---	---	---	---	---	---
May	5/5/20 14:31	56.1	37.5	0.1	6.3	36.0	41.0
June	9/6/20 14:22	47.9	35.7	0.5	15.9	37.0	39.0
July	07/31/2020 10:40	45.9	32.5	0.0	21.6	0.0	1.0
August	8/27/20 5:00 PM	45.7	34.5	0.7	19.1	24.0	24.0
September	09/29/2020 18:44	46.1	33.9	0.6	19.4	4.0	4.0
October	10/30/20 4:47 PM	43.5	33.6	1.2	21.7	23.0	25.0
November	11/27/20 14:18	43.1	33.0	1.4	22.5	14.0	12.0
December	12/30/20 13:25	46.6	34.2	1.1	18.1	33.0	32.0
Average		**46.9**	**34.7**	**0.7**	**17.7**	**21.5**	**22.3**

Appendix B2, continued

Month	Date	CH4 %	CO2 %	O2 %	Balance %	Init. Flow SCFM	Adj. Flow SCFM
HLGW036B							
January	11/1/20 17:35	19.6	17.8	8.9	53.7	1.0	1.0
February	2/21/20 1:42 PM	39.8	32.9	0.0	27.3	<<>>	<<>>
March	3/25/20 11:18 AM	37.1	32.1	0.0	30.8	8.0	6.0
April	---	---	---	---	---	---	---
May	5/5/20 14:57	59.8	40.1	0.0	0.1	5.0	6.0
June	9/6/20 15:00	37.8	33.0	0.2	29.0	2.0	2.0
July	07/28/2020 12:49	59.4	40.5	0.0	0.1	2.0	5.0
August	8/27/20 3:52 PM	44.9	35.4	0.0	19.7	5.0	5.0
September	09/29/2020 14:19	36.4	32.3	0.0	31.3	3.0	2.0
October	10/30/20 5:26 PM	60.7	39.2	0.0	0.1	4.0	4.0
November	09/29/2020 14:19	36.4	32.3	0.0	31.3	3.0	2.0
December	09/29/2020 14:19	36.4	32.3	0.0	31.3	3.0	2.0
Average		**42.6**	**33.4**	**0.8**	**23.2**	**3.6**	**3.5**
HLGW037B							
January	11/1/20 17:28	58.3	41.5	0.0	0.2	16.0	16.0
February	2/21/20 1:57 PM	58.7	41.2	0.0	0.1	21.0	27.0
March	3/25/20 11:16 AM	60.1	39.6	0.1	0.2	15.0	25.0
April	---	---	---	---	---	---	---
May	5/5/20 14:55	50.6	37.0	0.0	12.4	23.0	39.0
June	9/6/20 14:54	48.9	37.6	0.0	13.5	38.0	29.0
July	07/28/2020 12:44	47.0	36.8	0.0	16.2	23.0	24.0
August	8/27/20 3:56 PM	36.7	32.7	0.0	30.6	31.0	6.0
September	09/29/2020 14:14	58.9	41.0	0.0	0.1	16.0	29.0
October	10/30/20 5:20 PM	59.1	40.8	0.0	0.1	27.0	32.0
November	11/27/20 15:20	59.0	40.9	0.0	0.1	12.0	15.0
December	09/29/2020 14:14	58.9	41.0	0.0	0.1	16.0	29.0
Average		**54.2**	**39.1**	**0.0**	**6.7**	**21.6**	**24.6**
HLGW038B							
January	11/1/20 17:25	50.1	37.4	0.4	12.1	6.0	13.0
February	2/21/20 1:33 PM	48.9	35.8	0.1	15.2	9.0	10.0
March	3/25/20 11:14 AM	51.5	37.1	0.0	11.4	32.0	36.0
April	---	---	---	---	---	---	---
May	5/5/20 14:53	58.8	39.3	0.0	1.9	9.0	11.0
June	9/6/20 14:49	48.3	38.7	0.0	13.0	34.0	37.0
July	07/28/2020 12:41	44.3	35.9	0.0	19.8	6.0	7.0
August	8/27/20 4:01 PM	48.1	36.2	0.1	15.6	9.0	7.0
September	09/29/2020 14:11	59.1	40.8	0.0	0.1	34.0	33.0
October	10/30/20 5:16 PM	51.3	37.8	0.3	10.6	6.0	7.0
November	11/27/20 15:17	53.4	38.2	0.0	8.4	8.0	7.0
December	12/30/20 14:19	59.8	39.7	0.3	0.2	13.0	14.0
Average		**52.1**	**37.9**	**0.1**	**9.8**	**15.1**	**16.5**

Appendix B2, continued

Month	Date	CH4 %	CO2 %	O2 %	Balance %	Init. Flow SCFM	Adj. Flow SCFM
HLGW039A							
January	01/14/2020 10:37	58.1	41.7	0.1	0.1	13.0	16.0
February	2/18/20 5:30 PM	58.9	39.9	0.1	1.1	22.0	19.0
March	3/20/20 3:21 PM	56.2	39.0	0.3	4.5	16.0	30.0
April	---	---	---	---	---	---	---
May	5/9/20 13:26	50.1	36.2	0.9	12.8	14.0	15.0
June	11/6/20 13:32	47.7	36.8	0.0	15.5	16.0	18.0
July	07/31/2020 12:34	39.1	32.7	0.7	27.5	6.0	5.0
August	8/29/20 3:12 PM	42.6	33.9	1.0	22.5	10.0	11.0
September	09/25/2020 11:37	50.9	37.4	0.2	11.5	27.0	26.0
October	10/30/20 1:07 PM	37.8	31.9	1.8	28.5	6.0	5.0
November	11/27/20 18:47	52.8	37.5	0.5	9.2	6.0	7.0
December	12/23/20 18:41	51.5	36.8	0.6	11.1	7.0	6.0
Average		**49.6**	**36.7**	**0.6**	**13.1**	**13.0**	**14.4**
HLGW039B							
January	11/1/20 17:22	46.2	35.5	0.1	18.2	2.0	7.0
February	2/21/20 1:30 PM	28.1	26.9	1.0	44.0	9.0	9.0
March	3/25/20 11:12 AM	26.0	25.3	2.4	46.3	25.0	4.0
April	---	---	---	---	---	---	---
May	5/5/20 14:51	59.4	36.5	1.3	2.8	4.0	4.0
June	9/6/20 14:43	38.5	33.6	0.0	27.9	6.0	7.0
July	07/28/2020 12:34	38.4	33.4	0.2	28.0	5.0	<<>>
August	8/27/20 4:03 PM	38.9	33.0	0.0	28.1	7.0	3.0
September	09/29/2020 14:08	48.4	35.9	0.0	15.7	8.0	8.0
October	10/30/20 5:13 PM	51.8	36.8	0.3	11.1	4.0	3.0
November	11/27/20 15:08	43.5	34.2	0.0	22.3	30.0	37.0
December	12/30/20 14:17	53.7	37.0	0.2	9.1	7.0	4.0
Average		**43.0**	**33.5**	**0.5**	**23.0**	**9.7**	**8.6**
HLGW040A							
January	01/14/2020 10:31	54.1	39.5	0.0	6.4	23.0	29.0
February	2/18/20 5:22 PM	58.2	41.7	0.0	0.1	33.0	32.0
March	3/20/20 3:25 PM	58.7	41.2	0.0	0.1	30.0	30.0
April	---	---	---	---	---	---	---
May	5/9/20 13:30	47.6	36.7	0.0	15.7	35.0	34.0
June	11/6/20 13:29	46.5	37.5	0.0	16.0	30.0	30.0
July	07/31/2020 12:32	46.0	36.4	0.0	17.6	5.0	6.0
August	8/29/20 3:16 PM	45.8	36.8	0.2	17.2	4.0	0.0
September	09/25/2020 11:41	51.7	38.2	0.0	10.1	31.0	31.0
October	10/30/20 1:09 PM	39.4	33.6	1.1	25.9	3.0	2.0
November	11/28/20 11:28	50.7	38.1	0.0	11.2	7.0	9.0
December	12/23/20 18:44	58.6	40.7	0.0	0.7	4.0	4.0
Average		**50.7**	**38.2**	**0.1**	**11.0**	**18.6**	**18.8**

Appendix B2, continued

Month	Date	CH4 %	CO2 %	O2 %	Balance %	Init. Flow SCFM	Adj. Flow SCFM
HLGW040B							
January	11/1/20 17:14	45.8	36.3	0.0	17.9	14.0	20.0
February	2/21/20 1:25 PM	41.7	33.1	0.1	25.1	8.0	13.0
March	3/25/20 11:10 AM	46.4	35.3	0.0	18.3	14.0	16.0
April	---	---	---	---	---	---	---
May	5/5/20 14:49	60.1	39.7	0.0	0.2	16.0	18.0
June	9/6/20 14:41	55.4	39.5	0.0	5.1	3.0	13.0
July	07/28/2020 12:32	48.7	37.4	0.1	13.8	10.0	16.0
August	8/27/20 4:12 PM	49.9	37.7	0.1	12.3	12.0	14.0
September	09/29/2020 14:05	49.7	37.4	0.0	12.9	14.0	7.0
October	10/30/20 5:10 PM	47.5	36.3	0.3	15.9	8.0	6.0
November	11/27/20 15:05	47.7	36.2	0.0	16.1	14.0	10.0
December	12/30/20 14:12	54.8	37.9	0.2	7.1	10.0	13.0
Average		**49.8**	**37.0**	**0.1**	**13.2**	**11.2**	**13.3**
HLGW041A							
January	---	---	---	---	---	---	---
February	---	---	---	---	---	---	---
March	---	---	---	---	---	---	---
April	---	---	---	---	---	---	---
May	---	---	---	---	---	---	---
June	11/6/20 13:27	19.9	24.5	2.1	53.5	<<>>	<<>>
July	---	---	---	---	---	---	---
August	---	---	---	---	---	---	---
September	---	---	---	---	---	---	---
October	---	---	---	---	---	---	---
November	---	---	---	---	---	---	---
December	---	---	---	---	---	---	---
Average		**19.9**	**24.5**	**2.1**	**53.5**	**0.0**	**0.0**
HLGW041B							
January	11/1/20 17:16	57.6	42.3	0.0	0.1	13.0	16.0
February	2/21/20 1:22 PM	59.0	40.8	0.0	0.2	14.0	14.0
March	3/25/20 11:08 AM	58.4	41.4	0.0	0.2	10.0	18.0
April	---	---	---	---	---	---	---
May	5/5/20 14:47	58.7	41.2	0.0	0.1	14.0	24.0
June	9/6/20 14:39	56.5	40.2	0.0	3.3	7.0	10.0
July	07/28/2020 12:29	43.7	35.5	0.1	20.7	12.0	9.0
August	8/27/20 4:16 PM	46.9	36.3	0.2	16.6	10.0	8.0
September	09/29/2020 14:03	51.3	38.3	0.0	10.4	33.0	32.0
October	10/30/20 5:07 PM	44.0	34.6	1.1	20.3	19.0	21.0
November	11/27/20 15:00	53.8	38.5	0.4	7.3	32.0	32.0
December	12/30/20 14:09	58.1	41.3	0.4	0.2	5.0	7.0
Average		**53.5**	**39.1**	**0.2**	**7.2**	**15.4**	**17.4**

Appendix B2, continued

Month	Date	CH4 %	CO2 %	O2 %	Balance %	Init. Flow SCFM	Adj. Flow SCFM
HLGW042A							
January	---	---	---	---	---	---	---
February	---	---	---	---	---	---	---
March	---	---	---	---	---	---	---
April	---	---	---	---	---	---	---
May	---	---	---	---	---	---	---
June	11/6/20 13:25	55.7	32.0	0.2	12.1	1.0	4.0
July	---	---	---	---	---	---	---
August	8/29/20 3:18 PM	49.8	37.0	0.1	13.1	4.0	7.0
September	---	---	---	---	---	---	---
October	---	---	---	---	---	---	---
November	11/28/20 11:24	49.0	36.3	0.1	14.6	10.0	9.0
December	12/23/20 18:51	49.8	36.9	0.1	13.2	7.0	5.0
Average		**51.1**	**35.6**	**0.1**	**13.3**	**5.5**	**6.3**
HLGW042B							
January	11/1/20 17:58	58.3	41.6	0.0	0.1	4.0	11.0
February	2/21/20 12:25 PM	58.5	41.4	0.0	0.1	5.0	4.0
March	3/25/20 11:33 AM	58.8	41.1	0.0	0.1	8.0	8.0
April	---	---	---	---	---	---	---
May	5/5/20 14:38	59.8	40.1	0.0	0.1	15.0	22.0
June	9/6/20 14:35	54.7	38.9	0.1	6.3	17.0	25.0
July	07/28/2020 12:25	52.0	37.7	0.3	10.0	2.0	21.0
August	8/27/20 5:10 PM	52.8	37.9	0.2	9.1	20.0	27.0
September	09/29/2020 19:01	52.9	37.5	0.1	9.5	36.0	32.0
October	10/30/20 5:00 PM	51.5	37.4	0.4	10.7	15.0	4.0
November	11/27/20 14:48	50.8	37.1	0.6	11.5	22.0	28.0
December	12/30/20 13:42	55.6	38.9	0.2	5.3	23.0	33.0
Average		**55.1**	**39.1**	**0.2**	**5.7**	**15.2**	**19.5**
HLGW043A							
January	---	---	---	---	---	---	---
February	---	---	---	---	---	---	---
March	---	---	---	---	---	---	---
April	---	---	---	---	---	---	---
May	---	---	---	---	---	---	---
June	11/6/20 13:22	35.4	32.0	0.2	32.4	0.0	<<>>
July	---	---	---	---	---	---	---
August	---	---	---	---	---	---	---
September	---	---	---	---	---	---	---
October	---	---	---	---	---	---	---
November	---	---	---	---	---	---	---
December	---	---	---	---	---	---	---
Average		**35.4**	**32.0**	**0.2**	**32.4**	**0.0**	**0.0**

Appendix B2, continued

Month	Date	CH4 %	CO2 %	O2 %	Balance %	Init. Flow SCFM	Adj. Flow SCFM
HLGW043B							
January	11/1/20 17:56	59.1	40.8	0.0	0.1	10.0	14.0
February	2/21/20 12:22 PM	59.2	40.7	0.0	0.1	21.0	22.0
March	3/25/20 11:52 AM	59.6	40.3	0.0	0.1	14.0	11.0
April	---	---	---	---	---	---	---
May	5/5/20 14:36	60.4	38.8	0.0	0.8	12.0	12.0
June	9/6/20 14:30	49.5	37.0	0.0	13.5	16.0	15.0
July	07/28/2020 12:21	44.8	35.1	0.0	20.1	9.0	9.0
August	8/27/20 5:06 PM	53.4	37.4	0.0	9.2	4.0	10.0
September	09/29/2020 18:56	50.2	35.9	0.0	13.9	12.0	12.0
October	10/30/20 4:54 PM	58.3	38.6	0.0	3.1	13.0	22.0
November	11/27/20 14:28	50.8	36.4	0.0	12.8	9.0	14.0
December	12/30/20 13:51	60.2	38.8	0.0	1.0	7.0	6.0
Average		**55.0**	**38.2**	**0.0**	**6.8**	**11.5**	**13.4**
HLGW044A							
January	01/14/2020 10:27	46.5	34.9	0.7	17.9	4.0	14.0
February	2/18/20 5:16 PM	55.1	38.0	0.0	6.9	14.0	11.0
March	3/20/20 3:30 PM	51.7	36.8	0.0	11.5	12.0	22.0
April	---	---	---	---	---	---	---
May	5/9/20 13:33	51.0	36.2	0.0	12.8	21.0	22.0
June	11/6/20 13:19	51.5	37.0	0.1	11.4	8.0	19.0
July	07/31/2020 12:26	44.0	33.7	0.5	21.8	10.0	7.0
August	8/29/20 3:20 PM	50.1	36.3	0.0	13.6	7.0	22.0
September	09/25/2020 11:44	58.6	38.3	0.0	3.1	7.0	12.0
October	10/30/20 12:55 PM	52.6	37.2	0.1	10.1	17.0	11.0
November	11/27/20 19:00	55.9	37.5	0.0	6.6	9.0	19.0
December	12/23/20 18:55	58.4	38.2	0.0	3.4	5.0	15.0
Average		**52.3**	**36.7**	**0.1**	**10.8**	**10.4**	**15.8**
HLGW044B							
January	11/1/20 17:51	37.4	32.9	1.1	28.6	3.0	4.0
February	2/21/20 12:17 PM	40.9	30.5	2.8	25.8	10.0	9.0
March	3/25/20 11:48 AM	44.3	33.7	0.5	21.5	12.0	16.0
April	---	---	---	---	---	---	---
May	5/5/20 14:33	47.2	35.7	0.0	17.1	6.0	8.0
June	9/6/20 14:25	30.6	26.4	4.1	38.9	3.0	<<>>
July	07/28/2020 12:16	19.8	18.6	7.6	54.0	5.0	2.0
August	8/27/20 5:02 PM	28.5	26.8	1.6	43.1	<<>>	<<>>
September	09/29/2020 18:48	18.1	18.2	6.7	57.0	3.0	3.0
October	---	---	---	---	---	---	---
November	11/27/20 14:22	32.7	28.4	2.9	36.0	4.0	4.0
December	12/30/20 13:59	44.2	32.6	0.3	22.9	2.0	0.0
Average		**34.4**	**28.4**	**2.8**	**34.5**	**5.3**	**5.8**

Appendix B2, continued

Month	Date	CH4 %	CO2 %	O2 %	Balance %	Init. Flow SCFM	Adj. Flow SCFM
HLGW047A							
January	01/14/2020 10:34	55.4	40.2	0.0	4.4	15.0	19.0
February	2/18/20 5:27 PM	54.5	38.7	0.0	6.8	35.0	36.0
March	3/20/20 3:23 PM	52.7	37.9	0.0	9.4	14.0	16.0
April	---	---	---	---	---	---	---
May	5/9/20 13:28	51.6	37.7	0.0	10.7	18.0	20.0
June	11/6/20 13:53	46.5	37.5	0.0	16.0	24.0	24.0
July	07/31/2020 12:30	44.2	36.5	0.0	19.3	18.0	20.0
August	8/29/20 3:14 PM	45.7	36.2	0.0	18.1	20.0	18.0
September	09/25/2020 11:39	48.8	38.0	0.0	13.2	20.0	20.0
October	10/30/20 1:04 PM	47.8	38.4	0.0	13.8	35.0	35.0
November	11/27/20 18:51	51.1	38.2	0.0	10.7	32.0	33.0
December	12/23/20 19:05	52.3	38.6	0.0	9.1	35.0	36.0
Average		**50.1**	**38.0**	**0.0**	**12.0**	**24.2**	**25.2**
HLGW048A							
January	---	---	---	---	---	---	---
February	---	---	---	---	---	---	---
March	---	---	---	---	---	---	---
April	---	---	---	---	---	---	---
May	---	---	---	---	---	---	---
June	11/6/20 13:50	57.9	40.2	0.0	1.9	1.0	5.0
July	---	---	---	---	---	---	---
August	---	---	---	---	---	---	---
September	---	---	---	---	---	---	---
October	10/30/20 1:03 PM	56.6	40.2	0.0	3.2	9.0	10.0
November	11/27/20 18:55	56.2	39.0	0.0	4.8	3.0	1.0
December	12/23/20 19:01	59.7	40.2	0.0	0.1	4.0	3.0
Average		**57.6**	**39.9**	**0.0**	**2.5**	**4.3**	**4.8**
HLGW049A							
January	---	---	---	---	---	---	---
February	---	---	---	---	---	---	---
March	---	---	---	---	---	---	---
April	---	---	---	---	---	---	---
May	---	---	---	---	---	---	---
June	11/6/20 13:47	17.9	22.9	2.6	56.6	<<>>	<<>>
July	---	---	---	---	---	---	---
August	---	---	---	---	---	---	---
September	---	---	---	---	---	---	---
October	---	---	---	---	---	---	---
November	---	---	---	---	---	---	---
December	---	---	---	---	---	---	---
Average		**17.9**	**22.9**	**2.6**	**56.6**	**0.0**	**0.0**

Appendix B2, continued

Month	Date	CH4 %	CO2 %	O2 %	Balance %	Init. Flow SCFM	Adj. Flow SCFM
HLGW050A							
January	---	---	---	---	---	---	---
February	---	---	---	---	---	---	---
March	---	---	---	---	---	---	---
April	---	---	---	---	---	---	---
May	---	---	---	---	---	---	---
June	11/6/20 13:43	43.6	31.2	0.2	25.0	1.0	1.0
July	---	---	---	---	---	---	---
August	---	---	---	---	---	---	---
September	---	---	---	---	---	---	---
October	---	---	---	---	---	---	---
November	---	---	---	---	---	---	---
December	---	---	---	---	---	---	---
Average		**43.6**	**31.2**	**0.2**	**25.0**	**1.0**	**1.0**
HLGW051A							
January	---	---	---	---	---	---	---
February	---	---	---	---	---	---	---
March	---	---	---	---	---	---	---
April	---	---	---	---	---	---	---
May	---	---	---	---	---	---	---
June	11/6/20 13:38	32.6	31.3	0.0	36.1	1.0	1.0
July	---	---	---	---	---	---	---
August	---	---	---	---	---	---	---
September	---	---	---	---	---	---	---
October	---	---	---	---	---	---	---
November	---	---	---	---	---	---	---
December	---	---	---	---	---	---	---
Average		**32.6**	**31.3**	**0.0**	**36.1**	**1.0**	**0.0**
LHGW002A							
January	---	---	---	---	---	---	---
February	---	---	---	---	---	---	---
March	---	---	---	---	---	---	---
April	---	---	---	---	---	---	---
May	---	---	---	---	---	---	---
June	---	---	---	---	---	---	---
July	---	---	---	---	---	---	---
August	---	---	---	---	---	---	---
September	---	---	---	---	---	---	---
October	---	---	---	---	---	---	---
November	---	---	---	---	---	---	---
December	---	---	---	---	---	---	---
Average		**---**	**---**	**---**	**---**	**---**	**---**

Appendix B2, continued

Month	Date	CH4 %	CO2 %	O2 %	Balance %	Init. Flow SCFM	Adj. Flow SCFM
LHGW0003							
January	---	---	---	---	---	---	---
February	---	---	---	---	---	---	---
March	---	---	---	---	---	---	---
April	---	---	---	---	---	---	---
May	---	---	---	---	---	---	---
June	---	---	---	---	---	---	---
July	---	---	---	---	---	---	---
August	---	---	---	---	---	---	---
September	---	---	---	---	---	---	---
October	---	---	---	---	---	---	---
November	---	---	---	---	---	---	---
December	---	---	---	---	---	---	---
Average		**---**	**---**	**---**	**---**	**---**	**---**
LHGW0004							
January	01/30/2020 18:41	43.8	33.2	0.0	23.0	1.0	1.0
February	2/20/20 5:25 PM	34.2	29.6	0.0	36.2	1.0	1.0
March	3/25/20 2:48 PM	26.0	26.2	0.0	47.8	0.0	0.0
April	---	---	---	---	---	---	---
May	---	---	---	---	---	---	---
June	---	---	---	---	---	---	---
July	---	---	---	---	---	---	---
August	---	---	---	---	---	---	---
September	---	---	---	---	---	---	---
October	---	---	---	---	---	---	---
November	---	---	---	---	---	---	---
December	---	---	---	---	---	---	---
Average		**34.7**	**29.7**	**0.0**	**35.7**	**0.7**	**0.7**
LHGW0006							
January	---	---	---	---	---	---	---
February	---	---	---	---	---	---	---
March	---	---	---	---	---	---	---
April	Decommissioned May 2014						
May	---	---	---	---	---	---	---
June	---	---	---	---	---	---	---
July	---	---	---	---	---	---	---
August	---	---	---	---	---	---	---
September	---	---	---	---	---	---	---
October	---	---	---	---	---	---	---
November	---	---	---	---	---	---	---
December	---	---	---	---	---	---	---
Average		**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**

Appendix B2, continued

Month	Date	CH4 %	CO2 %	O2 %	Balance %	Init. Flow SCFM	Adj. Flow SCFM
LHGW0007							
January	---	---	---	---	---	---	---
February	---	---	---	---	---	---	---
March	---	---	---	---	---	---	---
April	---	---	---	---	---	---	---
May	---	---	---	---	---	---	---
June	---	---	---	---	---	---	---
July	---	---	---	---	---	---	---
August	---	---	---	---	---	---	---
September	---	---	---	---	---	---	---
October	---	---	---	---	---	---	---
November	---	---	---	---	---	---	---
December	---	---	---	---	---	---	---
Average		**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**
LHGW0008							
January	---	---	---	---	---	---	---
February	---	---	---	---	---	---	---
March	---	---	---	---	---	---	---
April	---	---	---	---	---	---	---
May	---	---	---	---	---	---	---
June	---	---	---	---	---	---	---
July	---	---	---	---	---	---	---
August	---	---	---	---	---	---	---
September	---	---	---	---	---	---	---
October	---	---	---	---	---	---	---
November	---	---	---	---	---	---	---
December	---	---	---	---	---	---	---
Average		**---**	**---**	**---**	**---**	**---**	**---**
LHGW0009							
January	---	---	---	---	---	---	---
February	---	---	---	---	---	---	---
March	---	---	---	---	---	---	---
April	Decommissioned May 2014						
May	---	---	---	---	---	---	---
June	---	---	---	---	---	---	---
July	---	---	---	---	---	---	---
August	---	---	---	---	---	---	---
September	---	---	---	---	---	---	---
October	---	---	---	---	---	---	---
November	---	---	---	---	---	---	---
December	---	---	---	---	---	---	---
Average		**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**

Appendix B2, continued

Month	Date	CH4 %	CO2 %	O2 %	Balance %	Init. Flow SCFM	Adj. Flow SCFM
LHGW0010							
January	---	---	---	---	---	---	---
February	---	---	---	---	---	---	---
March	---	---	---	---	---	---	---
April	Decommissioned May 2014						
May	---	---	---	---	---	---	---
June	---	---	---	---	---	---	---
July	---	---	---	---	---	---	---
August	---	---	---	---	---	---	---
September	---	---	---	---	---	---	---
October	---	---	---	---	---	---	---
November	---	---	---	---	---	---	---
December	---	---	---	---	---	---	---
Average		**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**
LHGW0013							
January	01/25/2020 18:02	56.2	37.9	0.7	5.2	9.0	12.0
February	---	---	---	---	---	---	---
March	3/25/20 12:32 PM	49.0	36.2	0.6	14.2	11.0	11.0
April	---	---	---	---	---	---	---
May	---	---	---	---	---	---	---
June	10/6/20 13:27	50.8	36.8	0.7	11.7	12.0	19.0
July	07/30/2020 13:53	36.5	29.3	3.4	30.8	17.0	8.0
August	8/28/20 12:47 PM	43.7	33.3	3.0	20.0	8.0	7.0
September	09/30/2020 11:37	37.2	28.1	4.8	29.9	7.0	4.0
October	10/31/20 12:24 PM	52.1	37.6	0.8	9.5	4.0	8.0
November	12/4/20 16:07	54.0	37.2	0.9	7.9	6.0	7.0
December	12/30/20 16:27	56.5	38.7	0.4	4.4	8.0	8.0
Average		**48.4**	**35.0**	**1.7**	**14.8**	**9.1**	**9.3**
LHGW0017							
January	---	---	---	---	---	---	---
February	---	---	---	---	---	---	---
March	---	---	---	---	---	---	---
April	---	---	---	---	---	---	---
May	---	---	---	---	---	---	---
June	---	---	---	---	---	---	---
July	---	---	---	---	---	---	---
August	---	---	---	---	---	---	---
September	---	---	---	---	---	---	---
October	---	---	---	---	---	---	---
November	---	---	---	---	---	---	---
December	---	---	---	---	---	---	---
Average		**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**

Appendix B2, continued

Month	Date	CH4 %	CO2 %	O2 %	Balance %	Init. Flow SCFM	Adj. Flow SCFM
LHGW0019							
January	---	---	---	---	---	---	---
February	2/21/20 5:04 PM	46.3	35.4	0.2	18.1	12.0	16.0
March	3/25/20 12:00 PM	30.1	28.8	1.6	39.5	15.0	3.0
April	---	---	---	---	---	---	---
May	---	---	---	---	---	---	---
June	10/6/20 12:58	42.3	35.8	0.2	21.7	23.0	21.0
July	07/30/2020 9:57	55.9	40.0	0.2	3.9	18.0	21.0
August	8/28/20 1:15 PM	46.0	37.5	0.0	16.5	4.0	4.0
September	09/30/2020 11:11	54.6	39.8	0.0	5.6	46.0	44.0
October	---	---	---	---	---	---	---
November	12/2/20 19:12	0.3	0.6	20.9	78.2	3.0	3.0
December	12/30/20 15:10	58.7	41.0	0.1	0.2	1.0	0.0
Average		**41.8**	**32.4**	**2.9**	**23.0**	**15.3**	**14.0**
LHGW0020							
January	---	---	---	---	---	---	---
February	2/21/20 5:12 PM	23.0	25.4	0.5	51.1	28.0	13.0
March	3/25/20 12:09 PM	21.5	25.1	0.5	52.9	17.0	1.0
April	---	---	---	---	---	---	---
May	---	---	---	---	---	---	---
June	10/6/20 13:10	57.6	40.6	1.1	0.7	31.0	48.0
July	07/30/2020 10:03	57.0	40.8	0.0	2.2	9.0	18.0
August	8/28/20 1:08 PM	42.1	34.9	0.9	22.1	4.0	8.0
September	09/30/2020 11:17	53.1	39.1	0.0	7.8	30.0	55.0
October	---	---	---	---	---	---	---
November	12/2/20 18:58	59.1	38.2	0.1	2.6	<<>>	2.0
December	---	---	---	---	---	---	---
Average		**44.8**	**34.9**	**0.4**	**19.9**	**19.8**	**20.7**
LHGW0021							
January	---	---	---	---	---	---	---
February	---	---	---	---	---	---	---
March	---	---	---	---	---	---	---
April	---	---	---	---	---	---	---
May	---	---	---	---	---	---	---
June	---	---	---	---	---	---	---
July	---	---	---	---	---	---	---
August	---	---	---	---	---	---	---
September	---	---	---	---	---	---	---
October	---	---	---	---	---	---	---
November	---	---	---	---	---	---	---
December	---	---	---	---	---	---	---
Average		**---**	**---**	**---**	**---**	**---**	**---**

Appendix B2, continued

Month	Date	CH4 %	CO2 %	O2 %	Balance %	Init. Flow SCFM	Adj. Flow SCFM
LHGW0022							
January	---	---	---	---	---	---	---
February	2/21/20 5:19 PM	42.8	31.3	0.7	25.2	4.0	4.0
March	3/25/20 12:15 PM	26.9	26.6	1.4	45.1	5.0	0.0
April	---	---	---	---	---	---	---
May	---	---	---	---	---	---	---
June	10/6/20 13:16	43.9	33.9	0.1	22.1	4.0	5.0
July	07/30/2020 10:10	33.7	31.1	0.3	34.9	6.0	5.0
August	8/28/20 1:01 PM	41.7	33.7	0.0	24.6	1.0	1.0
September	09/30/2020 11:23	49.4	36.0	0.0	14.6	5.0	5.0
October	---	---	---	---	---	---	---
November	---	---	---	---	---	---	---
December	12/30/20 16:10	60.5	39.4	0.0	0.1	2.0	2.0
Average		**42.7**	**33.1**	**0.4**	**23.8**	**3.9**	**3.1**
LHGW0023							
January	---	---	---	---	---	---	---
February	2/21/20 5:25 PM	26.8	24.3	1.1	47.8	3.0	3.0
March	3/25/20 12:21 PM	16.7	21.1	1.4	60.8	17.0	1.0
April	---	---	---	---	---	---	---
May	---	---	---	---	---	---	---
June	10/6/20 13:18	61.5	38.4	0.0	0.1	5.0	5.0
July	07/30/2020 10:23	32.9	29.7	0.6	36.8	1.0	2.0
August	8/28/20 12:58 PM	49.9	35.6	0.0	14.5	1.0	2.0
September	09/30/2020 11:27	53.1	36.4	0.0	10.5	1.0	3.0
October	---	---	---	---	---	---	---
November	---	---	---	---	---	---	---
December	12/30/20 16:13	64.7	34.2	0.0	1.1	1.0	1.0
Average		**43.7**	**31.4**	**0.4**	**24.5**	**4.1**	**2.4**
TLGW001A							
January	---	---	---	---	---	---	---
February	---	---	---	---	---	---	---
March	---	---	---	---	---	---	---
April	---	---	---	---	---	---	---
May	---	---	---	---	---	---	---
June	---	---	---	---	---	---	---
July	---	---	---	---	---	---	---
August	---	---	---	---	---	---	---
September	---	---	---	---	---	---	---
October	---	---	---	---	---	---	---
November	---	---	---	---	---	---	---
December	---	---	---	---	---	---	---
Average		**---**	**---**	**---**	**---**	**---**	**---**

Appendix B2, continued

Month	Date	CH4 %	CO2 %	O2 %	Balance %	Init. Flow SCFM	Adj. Flow SCFM
TLGW001B							
January	---	---	---	---	---	---	---
February	---	---	---	---	---	---	---
March	---	---	---	---	---	---	---
April	---	---	---	---	---	---	---
May	---	---	---	---	---	---	---
June	---	---	---	---	---	---	---
July	---	---	---	---	---	---	---
August	---	---	---	---	---	---	---
September	---	---	---	---	---	---	---
October	---	---	---	---	---	---	---
November	---	---	---	---	---	---	---
December	---	---	---	---	---	---	---
Average		**---**	**---**	**---**	**---**	**---**	**---**
TLGW002A							
January	---	---	---	---	---	---	---
February	---	---	---	---	---	---	---
March	---	---	---	---	---	---	---
April	---	---	---	---	---	---	---
May	---	---	---	---	---	---	---
June	---	---	---	---	---	---	---
July	---	---	---	---	---	---	---
August	---	---	---	---	---	---	---
September	---	---	---	---	---	---	---
October	---	---	---	---	---	---	---
November	---	---	---	---	---	---	---
December	---	---	---	---	---	---	---
Average		**---**	**---**	**---**	**---**	**---**	**---**
TLGW002B							
January	---	---	---	---	---	---	---
February	---	---	---	---	---	---	---
March	---	---	---	---	---	---	---
April	---	---	---	---	---	---	---
May	---	---	---	---	---	---	---
June	---	---	---	---	---	---	---
July	---	---	---	---	---	---	---
August	---	---	---	---	---	---	---
September	---	---	---	---	---	---	---
October	---	---	---	---	---	---	---
November	---	---	---	---	---	---	---
December	---	---	---	---	---	---	---
Average		**---**	**---**	**---**	**---**	**---**	**---**

Appendix B2, continued

Month	Date	CH4 %	CO2 %	O2 %	Balance %	Init. Flow SCFM	Adj. Flow SCFM
TLGW002C							
January	---	---	---	---	---	---	---
February	---	---	---	---	---	---	---
March	---	---	---	---	---	---	---
April	---	---	---	---	---	---	---
May	---	---	---	---	---	---	---
June	---	---	---	---	---	---	---
July	---	---	---	---	---	---	---
August	---	---	---	---	---	---	---
September	---	---	---	---	---	---	---
October	---	---	---	---	---	---	---
November	---	---	---	---	---	---	---
December	---	---	---	---	---	---	---
Average		**---**	**---**	**---**	**---**	**---**	**---**
VLGW001D							
January	01/14/2020 11:13	41.0	15.2	1.1	42.7	2.0	1.0
February	2/18/20 6:28 PM	49.6	14.3	1.8	34.3	<<>>	<<>>
March	3/25/20 4:05 PM	49.2	15.4	0.6	34.8	3.0	5.0
April	---	---	---	---	---	---	---
May	5/9/20 13:57	45.8	15.4	0.1	38.7	11.0	2.0
June	06/13/2020 12:55	42.8	14.9	0.9	41.4	2.0	2.0
July	07/31/2020 13:00	57.0	13.6	0.3	29.1	2.0	3.0
August	8/29/20 2:47 PM	45.4	13.2	1.5	39.9	0.0	1.0
September	09/25/2020 12:36	45.8	14.2	0.8	39.2	2.0	1.0
October	---	---	---	---	---	---	---
November	11/26/20 19:42	57.5	13.8	1.0	27.7	4.0	3.0
December	12/29/20 20:24	66.0	13.4	0.3	20.3	8.0	7.0
Average		**50.0**	**14.3**	**0.8**	**34.8**	**3.8**	**2.8**
VLGW001S							
January	---	---	---	---	---	---	---
February	---	---	---	---	---	---	---
March	---	---	---	---	---	---	---
April	---	---	---	---	---	---	---
May	---	---	---	---	---	---	---
June	---	---	---	---	---	---	---
July	---	---	---	---	---	---	---
August	---	---	---	---	---	---	---
September	---	---	---	---	---	---	---
October	---	---	---	---	---	---	---
November	11/26/20 19:41	21.6	20.2	4.2	54.0	3.0	3.0
December	12/29/20 20:22	24.9	23.5	1.6	50.0	4.0	3.0
Average		**---**	**---**	**---**	**---**	**---**	**0.0**

Appendix B2, continued

Month	Date	CH4 %	CO2 %	O2 %	Balance %	Init. Flow SCFM	Adj. Flow SCFM
VLGW002D							
January	---	---	---	---	---	---	---
February	---	---	---	---	---	---	---
March	---	---	---	---	---	---	---
April	---	---	---	---	---	---	---
May	---	---	---	---	---	---	---
June	---	---	---	---	---	---	---
July	---	---	---	---	---	---	---
August	---	---	---	---	---	---	---
September	---	---	---	---	---	---	---
October	---	---	---	---	---	---	---
November	---	---	---	---	---	---	---
December	---	---	---	---	---	---	---
Average		**---**	**---**	**---**	**---**	**---**	**---**
VLGW002S							
January	---	---	---	---	---	---	---
February	---	---	---	---	---	---	---
March	---	---	---	---	---	---	---
April	---	---	---	---	---	---	---
May	---	---	---	---	---	---	---
June	---	---	---	---	---	---	---
July	---	---	---	---	---	---	---
August	---	---	---	---	---	---	---
September	---	---	---	---	---	---	---
October	---	---	---	---	---	---	---
November	---	---	---	---	---	---	---
December	---	---	---	---	---	---	---
Average		**---**	**---**	**---**	**---**	**---**	**---**
VLGW003D							
January	01/14/2020 11:10	46.1	16.4	0.9	36.6	7.0	2.0
February	2/18/20 2:29 PM	41.9	21.6	0.1	36.4	<<>>	0.0
March	3/25/20 3:27 PM	45.8	20.1	0.6	33.5	37.0	32.0
April	---	---	---	---	---	---	---
May	5/14/20 9:50	59.7	22.0	0.2	18.1	8.0	10.0
June	06/13/2020 12:50	46.4	21.4	0.3	31.9	5.0	6.0
July	07/31/2020 12:55	53.0	21.6	0.1	25.3	6.0	6.0
August	8/29/20 2:52 PM	48.3	20.7	0.4	30.6	6.0	6.0
September	09/25/2020 12:30	45.6	20.5	0.2	33.7	3.0	2.0
October	10/30/20 12:25 PM	55.8	23.0	0.6	20.6	5.0	1.0
November	11/28/20 17:42	39.8	20.8	0.3	39.1	7.0	8.0
December	12/29/20 20:15	45.3	20.9	0.1	33.7	2.0	3.0
Average		**48.0**	**20.8**	**0.3**	**30.9**	**8.6**	**6.9**

Appendix B2, continued

Month	Date	CH4 %	CO2 %	O2 %	Balance %	Init. Flow SCFM	Adj. Flow SCFM
VLGW003S							
January	01/14/2020 11:09	41.5	22.3	0.6	35.6	4.0	0.0
February	2/18/20 2:25 PM	46.3	30.6	0.2	22.9	<<>>	<<>>
March	3/25/20 3:25 PM	44.6	29.4	0.6	25.4	1.0	1.0
April	---	---	---	---	---	---	---
May	5/14/20 9:48	53.4	29.8	0.9	15.9	1.0	3.0
June	06/13/2020 12:48	42.6	24.7	0.2	32.5	0.0	0.0
July	07/31/2020 12:54	50.3	28.9	0.0	20.8	1.0	2.0
August	8/29/20 2:50 PM	51.0	27.8	0.3	20.9	3.0	5.0
September	09/25/2020 12:26	51.3	25.0	0.3	23.4	1.0	3.0
October	10/30/20 12:22 PM	48.2	25.4	0.3	26.1	1.0	2.0
November	11/28/20 12:16	43.2	27.6	0.0	29.2	5.0	5.0
December	12/29/20 20:17	40.9	25.4	0.0	33.7	3.0	4.0
Average		**46.7**	**27.0**	**0.3**	**26.0**	**2.0**	**2.5**
VLGW004D							
January	---	---	---	---	---	---	---
February	---	---	---	---	---	---	---
March	---	---	---	---	---	---	---
April	---	---	---	---	---	---	---
May	---	---	---	---	---	---	---
June	---	---	---	---	---	---	---
July	---	---	---	---	---	---	---
August	---	---	---	---	---	---	---
September	---	---	---	---	---	---	---
October	---	---	---	---	---	---	---
November	---	---	---	---	---	---	---
December	---	---	---	---	---	---	---
Average		**---**	**---**	**---**	**---**	**---**	**---**
VLGW004S							
January	---	---	---	---	---	---	---
February	---	---	---	---	---	---	---
March	---	---	---	---	---	---	---
April	---	---	---	---	---	---	---
May	---	---	---	---	---	---	---
June	---	---	---	---	---	---	---
July	---	---	---	---	---	---	---
August	---	---	---	---	---	---	---
September	---	---	---	---	---	---	---
October	---	---	---	---	---	---	---
November	11/24/20 19:54	8.7	3.9	17.0	70.4	1.0	1.0
December	---	---	---	---	---	---	---
Average		**8.7**	**3.9**	**17.0**	**70.4**	**1.0**	**1.0**

Appendix B2, continued

Month	Date	CH4 %	CO2 %	O2 %	Balance %	Init. Flow SCFM	Adj. Flow SCFM
VLGW005D							
January	---	---	---	---	---	---	---
February	---	---	---	---	---	---	---
March	3/25/20 4:15 PM	89.7	10.2	0.0	0.1	6.0	36.0
April	---	---	---	---	---	---	---
May	5/9/20 13:45	10.0	1.2	17.4	71.4	3.0	0.0
June	06/13/2020 13:00	44.2	15.5	0.0	40.3	4.0	3.0
July	07/31/2020 12:05	4.7	0.6	19.5	75.2	<<>>	<<>>
August	8/29/20 12:56 PM	89.3	10.6	0.0	0.1	0.0	0.0
September	---	---	---	---	---	---	---
October	10/30/20 1:29 PM	89.0	10.6	0.2	0.2	2.0	2.0
November	11/24/20 20:06	2.4	0.5	20.3	76.8	2.0	4.0
December	12/23/20 19:24	89.3	10.6	0.0	0.1	8.0	2.0
Average		**52.3**	**7.5**	**7.2**	**33.0**	**0.0**	**0.0**
VLGW005S							
January	---	---	---	---	---	---	---
February	2/18/20 6:09 PM	29.8	19.3	0.6	50.3	<<>>	<<>>
March	3/25/20 4:14 PM	28.4	18.7	0.7	52.2	1.0	2.0
April	---	---	---	---	---	---	---
May	5/9/20 13:47	83.7	16.1	0.0	0.2	1.0	6.0
June	06/13/2020 13:09	84.2	15.5	0.2	0.1	3.0	4.0
July	07/31/2020 12:03	30.9	19.0	2.4	47.7	<<>>	<<>>
August	8/29/20 12:54 PM	56.1	17.6	0.6	25.7	3.0	0.0
September	09/25/2020 13:23	32.7	18.0	2.0	47.3	2.0	2.0
October	---	---	---	---	---	---	---
November	11/24/20 20:05	78.8	18.4	0.2	2.6	3.0	2.0
December	12/23/20 19:22	81.9	17.4	0.2	0.5	6.0	7.0
Average		**56.3**	**17.8**	**0.8**	**25.2**	**2.7**	**3.3**
VLGW006D							
January	---	---	---	---	---	---	---
February	2/20/20 12:23 PM	48.7	19.0	0.0	32.3	<<>>	<<>>
March	3/28/20 10:32 AM	44.4	19.1	0.1	36.4	2.0	4.0
April	---	---	---	---	---	---	---
May	5/20/20 9:16	47.2	18.8	0.0	34.0	4.0	3.0
June	06/30/2020 13:14	53.0	18.6	0.0	28.4	4.0	5.0
July	07/31/2020 11:10	38.5	19.5	0.1	41.9	4.0	1.0
August	8/29/20 1:00 PM	43.9	19.2	0.0	36.9	1.0	0.0
September	09/25/2020 13:41	49.3	18.7	0.0	32.0	6.0	6.0
October	10/30/20 2:19 PM	46.5	20.0	0.0	33.5	1.0	3.0
November	11/26/20 18:53	40.1	18.8	0.4	40.7	25.0	23.0
December	12/29/20 18:12	45.3	18.3	0.1	36.3	19.0	17.0
Average		**45.7**	**19.0**	**0.1**	**35.2**	**7.3**	**6.9**

Appendix B2, continued

Month	Date	CH4 %	CO2 %	O2 %	Balance %	Init. Flow SCFM	Adj. Flow SCFM
VLGW006S							
January	---	---	---	---	---	---	---
February	2/20/20 12:17 PM	62.7	17.8	0.1	19.4	<<>>	<<>>
March	3/28/20 10:31 AM	56.7	18.2	0.2	24.9	1.0	0.0
April	---	---	---	---	---	---	---
May	5/20/20 9:14	35.9	17.3	0.6	46.2	3.0	0.0
June	06/30/2020 13:13	54.8	11.9	3.2	30.1	1.0	1.0
July	07/31/2020 11:08	36.1	16.0	1.1	46.8	2.0	1.0
August	8/29/20 12:59 PM	48.5	11.8	4.0	35.7	0.0	0.0
September	09/25/2020 13:38	58.5	12.8	1.7	27.0	4.0	5.0
October	10/30/20 2:18 PM	29.1	17.9	0.5	52.5	3.0	0.0
November	11/26/20 18:51	42.7	12.4	3.8	41.1	3.0	4.0
December	12/29/20 18:10	46.6	11.9	3.3	38.2	5.0	5.0
Average		**47.2**	**14.8**	**1.9**	**36.2**	**2.4**	**1.8**
VLGW007D							
January	01/22/2020 16:46	63.2	20.5	0.0	16.3	5.0	0.0
February	2/20/20 12:51 PM	50.0	17.8	1.0	31.2	30.0	27.0
March	3/28/20 10:55 AM	64.0	19.0	0.4	16.6	10.0	8.0
April	---	---	---	---	---	---	---
May	5/20/20 10:08	62.4	18.6	1.5	17.5	6.0	5.0
June	06/30/2020 13:09	70.6	19.4	0.0	10.0	3.0	6.0
July	07/31/2020 11:57	59.4	19.0	1.6	20.0	8.0	8.0
August	8/29/20 12:28 PM	59.3	19.9	1.0	19.8	7.0	10.0
September	09/25/2020 14:07	57.3	19.8	1.6	21.3	12.0	6.0
October	10/30/20 2:14 PM	50.8	21.2	1.5	26.5	0.0	9.0
November	11/26/20 18:47	46.3	19.4	1.2	33.1	22.0	30.0
December	12/29/20 18:34	44.6	19.6	0.3	35.5	6.0	27.0
Average		**57.1**	**19.5**	**0.9**	**22.5**	**9.9**	**12.4**
VLGW007S							
January	01/22/2020 16:43	35.6	20.8	0.0	43.6	8.0	7.0
February	2/20/20 12:46 PM	62.0	13.3	4.3	20.4	<<>>	1.0
March	3/28/20 10:53 AM	81.5	15.9	0.1	2.5	5.0	7.0
April	---	---	---	---	---	---	---
May	5/20/20 10:06	51.2	17.4	0.0	31.4	1.0	2.0
June	06/30/2020 13:08	58.8	19.3	0.1	21.8	2.0	5.0
July	07/31/2020 11:55	45.6	19.9	0.0	34.5	4.0	2.0
August	8/29/20 12:27 PM	44.7	20.5	0.3	34.5	5.0	7.0
September	09/25/2020 14:05	43.5	20.2	0.0	36.3	6.0	6.0
October	10/30/20 2:12 PM	35.1	20.6	0.1	44.2	3.0	1.0
November	11/26/20 18:45	35.8	20.7	0.0	43.5	3.0	4.0
December	12/29/20 18:30	34.8	19.8	0.0	45.4	7.0	6.0
Average		**48.1**	**18.9**	**0.4**	**32.6**	**4.4**	**4.4**

Appendix B2, continued

Month	Date	CH4 %	CO2 %	O2 %	Balance %	Init. Flow SCFM	Adj. Flow SCFM
VLGW008D							
January	01/22/2020 17:00	0.1	0.1	20.0	79.8	5.0	1.0
February	2/20/20 1:06 PM	0.1	0.1	20.5	79.3	<<>>	<<>>
March	3/28/20 10:48 AM	35.6	11.3	10.5	42.6	2.0	1.0
April	---	---	---	---	---	---	---
May	5/20/20 9:57	80.5	19.4	0.0	0.1	4.0	6.0
June	06/30/2020 12:45	84.3	15.6	0.0	0.1	6.0	8.0
July	07/31/2020 11:47	44.9	18.0	0.1	37.0	0.0	4.0
August	8/29/20 12:34 PM	41.7	17.9	0.8	39.6	0.0	5.0
September	09/25/2020 16:54	82.8	17.1	0.0	0.1	8.0	9.0
October	10/30/20 2:07 PM	45.6	19.3	0.0	35.1	4.0	4.0
November	11/26/20 19:24	40.6	19.3	0.5	39.6	5.0	5.0
December	12/29/20 19:23	0.1	0.1	20.5	79.3	5.0	7.0
Average		**41.5**	**12.6**	**6.6**	**39.3**	**3.9**	**5.0**
VLGW008S							
January	01/22/2020 16:57	45.4	20.8	0.0	33.8	4.0	5.0
February	2/20/20 1:02 PM	74.1	23.2	0.0	2.7	<<>>	<<>>
March	3/28/20 10:46 AM	75.2	23.9	0.0	0.9	9.0	11.0
April	---	---	---	---	---	---	---
May	5/20/20 9:56	57.3	20.6	0.1	22.0	0.0	1.0
June	06/30/2020 12:43	51.9	19.9	0.0	28.2	2.0	1.0
July	07/31/2020 11:46	48.0	19.4	0.0	32.6	2.0	4.0
August	8/29/20 12:33 PM	46.0	20.0	0.0	34.0	9.0	9.0
September	09/25/2020 16:50	43.4	19.3	0.0	37.3	6.0	6.0
October	10/30/20 2:06 PM	45.4	20.2	0.0	34.4	1.0	2.0
November	11/26/20 19:22	45.4	20.5	0.0	34.1	5.0	4.0
December	12/29/20 19:16	44.0	20.4	0.0	35.6	27.0	26.0
Average		**52.4**	**20.7**	**0.0**	**26.9**	**6.5**	**6.9**
VLGW009D							
January	01/14/2020 10:46	88.7	11.0	0.1	0.2	4.0	6.0
February	2/18/20 6:23 PM	45.6	22.1	0.0	32.3	<<>>	<<>>
March	3/25/20 4:09 PM	46.1	21.4	0.1	32.4	4.0	4.0
April	---	---	---	---	---	---	---
May	5/9/20 13:53	41.2	21.3	0.0	37.5	0.0	1.0
June	06/13/2020 13:06	33.5	20.7	0.1	45.7	1.0	2.0
July	07/31/2020 13:06	34.6	20.9	0.0	44.5	1.0	<<>>
August	8/29/20 12:22 PM	88.0	11.7	0.1	0.2	1.0	0.0
September	09/25/2020 13:18	30.5	21.2	0.0	48.3	2.0	3.0
October	10/30/20 1:24 PM	90.0	9.9	0.0	0.1	1.0	5.0
November	11/24/20 20:15	34.9	21.3	0.3	43.5	3.0	0.0
December	12/23/20 20:10	29.2	20.4	0.0	50.4	5.0	0.0
Average		**51.1**	**18.4**	**0.1**	**30.5**	**2.2**	**2.3**

Appendix B2, continued

Month	Date	CH4 %	CO2 %	O2 %	Balance %	Init. Flow SCFM	Adj. Flow SCFM
VLGW009S							
January	01/14/2020 10:44	32.0	9.4	11.5	47.1	6.0	0.0
February	2/18/20 6:17 PM	76.1	23.8	0.0	0.1	<<>>	<<>>
March	3/25/20 4:08 PM	19.8	6.0	14.5	59.7	5.0	0.0
April	---	---	---	---	---	---	---
May	5/9/20 13:52	74.6	25.3	0.0	0.1	1.0	4.0
June	06/13/2020 13:05	7.5	1.9	18.6	72.0	2.0	0.0
July	07/31/2020 13:03	74.8	25.1	0.0	0.1	6.0	0.0
August	8/29/20 12:19 PM	7.9	2.1	18.6	71.4	2.0	0.0
September	09/25/2020 13:13	74.6	25.3	0.0	0.1	2.0	2.0
October	10/30/20 1:22 PM	3.7	1.2	18.8	76.3	1.0	0.0
November	11/24/20 20:13	75.0	24.8	0.0	0.2	4.0	4.0
December	12/23/20 20:08	75.0	24.9	0.0	0.1	7.0	8.0
Average		**47.4**	**15.4**	**7.5**	**29.7**	**3.6**	**1.8**
VLGW010S							
January	---	---	---	---	---	---	---
February	2/20/20 12:04 PM	35.0	21.6	4.8	38.6	<<>>	<<>>
March	---	---	---	---	---	---	---
April	---	---	---	---	---	---	---
May	---	---	---	---	---	---	---
June	---	---	---	---	---	---	---
July	---	---	---	---	---	---	---
August	---	---	---	---	---	---	---
September	---	---	---	---	---	---	---
October	---	---	---	---	---	---	---
November	11/26/20 18:57	31.7	21.5	4.1	42.7	4.0	3.0
December	12/23/20 20:15	45.3	25.1	1.1	28.5	6.0	4.0
Average		**37.3**	**22.7**	**3.3**	**36.6**	**5.0**	**3.5**
VLGW011S							
January	---	---	---	---	---	---	---
February	2/20/20 12:12 PM	10.2	18.0	0.1	71.7	2.0	2.0
March	3/28/20 10:57 AM	22.8	18.2	0.0	59.0	2.0	0.0
April	---	---	---	---	---	---	---
May	5/20/20 10:11	60.1	24.0	0.0	15.9	2.0	2.0
June	06/30/2020 12:50	64.4	31.0	0.0	4.6	4.0	3.0
July	07/31/2020 11:59	47.6	28.7	0.0	23.7	3.0	3.0
August	8/29/20 12:25 PM	50.3	30.0	0.0	19.7	4.0	3.0
September	09/25/2020 13:33	48.4	29.7	0.0	21.9	5.0	7.0
October	10/30/20 2:16 PM	37.9	27.1	0.3	34.7	20.0	7.0
November	11/26/20 19:34	26.8	25.5	0.3	47.4	5.0	4.0
December	12/29/20 19:32	19.8	22.6	0.1	57.5	13.0	13.0
Average		**38.8**	**25.5**	**0.1**	**35.6**	**6.0**	**4.4**

Appendix B2, continued

Month	Date	CH4 %	CO2 %	O2 %	Balance %	Init. Flow SCFM	Adj. Flow SCFM
VLGW012S							
January	01/22/2020 16:52	38.9	19.4	0.0	41.7	4.0	0.0
February	2/20/20 12:56 PM	24.6	18.4	0.0	57.0	<<>>	<<>>
March	3/28/20 10:51 AM	42.8	20.1	0.0	37.1	1.0	3.0
April	---	---	---	---	---	---	---
May	5/20/20 10:02	44.8	22.7	0.0	32.5	2.0	3.0
June	06/30/2020 12:48	49.4	23.9	0.0	26.7	5.0	6.0
July	07/31/2020 11:50	45.7	24.4	0.1	29.8	2.0	0.0
August	8/29/20 12:30 PM	44.8	24.9	0.3	30.0	8.0	9.0
September	09/25/2020 16:39	43.1	24.6	1.9	30.4	2.0	0.0
October	10/30/20 2:10 PM	43.7	25.7	0.0	30.6	4.0	5.0
November	11/26/20 19:30	30.4	22.9	0.0	46.7	2.0	5.0
December	12/29/20 19:29	19.0	20.7	0.0	60.3	6.0	5.0
Average		**38.8**	**22.5**	**0.2**	**38.4**	**3.6**	**3.6**
VLGW013D							
January	---	---	---	---	---	---	---
February	---	---	---	---	---	---	---
March	3/28/20 11:18 AM	68.1	17.7	0.0	14.2	7.0	6.0
April	---	---	---	---	---	---	---
May	5/20/20 9:51	50.1	18.9	0.0	31.0	1.0	3.0
June	---	---	---	---	---	---	---
July	07/31/2020 11:42	41.2	19.8	0.5	38.5	2.0	1.0
August	---	---	---	---	---	---	---
September	09/25/2020 17:03	43.0	19.9	0.0	37.1	4.0	0.0
October	---	---	---	---	---	---	---
November	---	---	---	---	---	---	---
December	12/29/20 19:12	28.1	21.0	0.0	50.9	4.0	2.0
Average		**46.1**	**19.5**	**0.1**	**34.3**	**3.6**	**2.4**
VLGW013S							
January	---	---	---	---	---	---	---
February	---	---	---	---	---	---	---
March	3/28/20 11:17 AM	69.8	17.5	0.0	12.7	8.0	7.0
April	---	---	---	---	---	---	---
May	5/20/20 9:49	45.7	18.1	0.0	36.2	1.0	0.0
June	---	---	---	---	---	---	---
July	07/31/2020 11:40	38.9	19.1	0.0	42.0	0.0	1.0
August	---	---	---	---	---	---	---
September	09/25/2020 17:00	33.7	17.4	1.4	47.5	4.0	0.0
October	---	---	---	---	---	---	---
November	---	---	---	---	---	---	---
December	12/29/20 19:09	38.0	21.9	1.6	38.5	5.0	1.0
Average		**45.2**	**18.8**	**0.6**	**35.4**	**3.6**	**1.8**

Appendix B2, continued

Month	Date	CH4 %	CO2 %	O2 %	Balance %	Init. Flow SCFM	Adj. Flow SCFM
VLGW014D							
January	---	---	---	---	---	---	---
February	---	---	---	---	---	---	---
March	---	---	---	---	---	---	---
April	---	---	---	---	---	---	---
May	---	---	---	---	---	---	---
June	---	---	---	---	---	---	---
July	---	---	---	---	---	---	---
August	---	---	---	---	---	---	---
September	---	---	---	---	---	---	---
October	---	---	---	---	---	---	---
November	---	---	---	---	---	---	---
December	---	---	---	---	---	---	---
Average		**---**	**---**	**---**	**---**	**---**	**---**
VLGW014S							
January	---	---	---	---	---	---	---
February	---	---	---	---	---	---	---
March	---	---	---	---	---	---	---
April	---	---	---	---	---	---	---
May	---	---	---	---	---	---	---
June	---	---	---	---	---	---	---
July	---	---	---	---	---	---	---
August	---	---	---	---	---	---	---
September	---	---	---	---	---	---	---
October	---	---	---	---	---	---	---
November	---	---	---	---	---	---	---
December	---	---	---	---	---	---	---
Average		**---**	**---**	**---**	**---**	**---**	**---**
VLGW015D							
January	01/14/2020 11:01	33.8	14.8	0.0	51.4	8.0	2.0
February	2/18/20 2:57 PM	63.1	14.9	0.3	21.7	<<>>	<<>>
March	3/31/20 2:55 PM	55.8	14.6	0.0	29.6	4.0	4.0
April	---	---	---	---	---	---	---
May	5/9/20 14:01	45.5	14.5	0.0	40.0	8.0	3.0
June	---	---	---	---	---	---	---
July	07/31/2020 12:19	50.3	15.8	0.0	33.9	4.0	5.0
August	8/29/20 2:44 PM	49.3	15.2	0.4	35.1	4.0	1.0
September	09/25/2020 12:46	51.8	15.9	0.0	32.3	38.0	38.0
October	10/30/20 1:18 PM	53.5	16.8	0.0	29.7	4.0	10.0
November	11/24/20 19:46	35.4	14.9	0.0	49.7	31.0	31.0
December	12/23/20 19:37	30.3	14.2	0.0	55.5	39.0	38.0
Average		**46.9**	**15.2**	**0.1**	**37.9**	**15.6**	**14.7**

Appendix B2, continued

Month	Date	CH4 %	CO2 %	O2 %	Balance %	Init. Flow SCFM	Adj. Flow SCFM
VLGW015S							
January	01/14/2020 11:00	43.3	24.6	1.0	31.1	5.0	5.0
February	2/18/20 2:53 PM	41.2	24.6	0.2	34.0	<<>>	<<>>
March	3/31/20 2:53 PM	39.3	24.0	0.3	36.4	3.0	1.0
April	---	---	---	---	---	---	---
May	5/9/20 14:00	49.1	23.8	0.0	27.1	4.0	2.0
June	---	---	---	---	---	---	---
July	07/31/2020 12:17	46.0	24.1	0.2	29.7	5.0	5.0
August	8/29/20 2:42 PM	46.1	23.8	0.6	29.5	9.0	9.0
September	09/25/2020 12:42	47.7	24.2	0.2	27.9	0.0	3.0
October	10/30/20 1:16 PM	47.0	25.7	0.0	27.3	1.0	1.0
November	11/24/20 19:44	50.9	25.5	0.0	23.6	3.0	4.0
December	12/23/20 19:40	50.1	25.2	0.0	24.7	6.0	3.0
Average		**46.1**	**24.6**	**0.3**	**29.1**	**4.0**	**3.7**
VLGW016D							
January	01/14/2020 10:54	35.9	20.7	0.0	43.4	2.0	2.0
February	2/18/20 6:03 PM	53.3	22.3	0.0	24.4	3.0	3.0
March	3/31/20 2:48 PM	54.6	21.8	0.0	23.6	3.0	6.0
April	---	---	---	---	---	---	---
May	5/9/20 13:42	38.2	20.6	0.0	41.2	36.0	2.0
June	06/13/2020 13:22	54.6	22.1	0.0	23.3	41.0	46.0
July	07/31/2020 12:12	39.5	22.0	0.0	38.5	5.0	2.0
August	8/29/20 12:49 PM	52.4	22.5	0.0	25.1	4.0	3.0
September	09/25/2020 13:01	54.4	22.3	0.0	23.3	0.0	5.0
October	10/30/20 1:38 PM	73.7	21.6	0.0	4.7	3.0	2.0
November	11/24/20 19:39	60.2	22.2	0.0	17.6	3.0	3.0
December	12/23/20 19:16	57.6	21.9	0.0	20.5	3.0	3.0
Average		**52.2**	**21.8**	**0.0**	**26.0**	**9.4**	**7.0**
VLGW016S							
January	01/14/2020 10:52	53.6	32.6	0.3	13.5	1.0	3.0
February	2/18/20 6:00 PM	31.2	26.2	0.6	42.0	0.0	<<>>
March	3/31/20 2:46 PM	35.7	26.2	0.2	37.9	0.0	1.0
April	---	---	---	---	---	---	---
May	5/9/20 13:40	66.8	25.9	1.3	6.0	1.0	5.0
June	06/13/2020 13:20	29.2	26.8	0.0	44.0	2.0	0.0
July	07/31/2020 12:11	48.2	23.1	5.2	23.5	5.0	5.0
August	8/29/20 12:48 PM	52.9	24.7	4.3	18.1	5.0	4.0
September	09/25/2020 12:56	64.5	29.5	0.5	5.5	0.0	3.0
October	10/30/20 1:36 PM	39.7	30.9	0.1	29.3	0.0	0.0
November	11/24/20 19:37	71.0	28.8	0.0	0.2	2.0	5.0
December	12/23/20 19:18	55.2	30.1	2.2	12.5	2.0	1.0
Average		**49.8**	**27.7**	**1.3**	**21.1**	**1.6**	**2.7**

Appendix B2, continued

Month	Date	CH4 %	CO2 %	O2 %	Balance %	Init. Flow SCFM	Adj. Flow SCFM
VLGW017D							
January	01/22/2020 16:31	73.0	26.9	0.0	0.1	3.0	2.0
February	2/20/20 12:33 PM	49.6	25.5	0.4	24.5	<<>>	<<>>
March	3/28/20 10:36 AM	22.0	20.3	1.0	56.7	4.0	1.0
April	---	---	---	---	---	---	---
May	5/20/20 9:20	70.9	28.9	0.0	0.2	8.0	7.0
June	06/30/2020 12:56	71.1	28.8	0.0	0.1	5.0	7.0
July	07/31/2020 11:16	41.3	24.6	0.7	33.4	1.0	2.0
August	8/29/20 12:45 PM	49.0	26.2	0.5	24.3	0.0	2.0
September	09/25/2020 13:53	71.6	28.3	0.0	0.1	8.0	42.0
October	10/30/20 1:42 PM	62.1	28.0	0.1	9.8	1.0	2.0
November	11/26/20 18:27	9.0	20.1	0.4	70.5	3.0	5.0
December	12/29/20 18:20	39.9	23.8	0.3	36.0	10.0	13.0
Average		**50.9**	**25.6**	**0.3**	**23.2**	**4.3**	**8.3**
VLGW017S							
January	01/22/2020 16:27	70.0	29.7	0.2	0.1	17.0	13.0
February	2/20/20 12:29 PM	70.0	28.5	1.4	0.1	<<>>	6.0
March	3/28/20 10:35 AM	60.3	27.4	0.6	11.7	3.0	18.0
April	---	---	---	---	---	---	---
May	5/20/20 9:18	62.4	28.8	0.6	8.2	4.0	6.0
June	06/30/2020 12:55	60.6	27.7	1.0	10.7	2.0	8.0
July	07/31/2020 11:14	60.8	27.8	0.8	10.6	4.0	11.0
August	8/29/20 12:44 PM	56.0	26.8	1.0	16.2	12.0	10.0
September	09/25/2020 13:48	58.5	26.3	1.7	13.5	4.0	11.0
October	10/30/20 1:41 PM	59.1	27.3	1.7	11.9	6.0	6.0
November	11/26/20 18:25	48.7	25.0	1.2	25.1	12.0	4.0
December	12/29/20 18:18	53.7	25.8	1.0	19.5	10.0	4.0
Average		**60.0**	**27.4**	**1.0**	**11.6**	**7.4**	**8.8**
VLGW018D							
January	01/22/2020 16:39	47.7	29.8	0.0	22.5	4.0	0.0
February	2/20/20 12:41 PM	41.7	27.6	0.0	30.7	2.0	<<>>
March	3/28/20 10:40 AM	42.6	27.4	0.0	30.0	6.0	8.0
April	---	---	---	---	---	---	---
May	5/20/20 9:24	43.2	27.1	0.0	29.7	9.0	8.0
June	06/30/2020 13:02	49.1	28.4	0.0	22.5	4.0	4.0
July	07/31/2020 11:21	45.7	28.5	0.9	24.9	0.0	2.0
August	8/29/20 12:41 PM	47.4	29.0	0.0	23.6	5.0	4.0
September	09/25/2020 14:00	45.3	28.7	0.0	26.0	7.0	6.0
October	10/30/20 1:49 PM	49.7	30.1	0.0	20.2	0.0	5.0
November	11/26/20 18:34	38.4	28.5	0.0	33.1	5.0	2.0
December	12/29/20 18:27	38.5	27.7	0.0	33.8	4.0	4.0
Average		**44.5**	**28.4**	**0.1**	**27.0**	**4.2**	**4.3**

Appendix B2, continued

Month	Date	CH4 %	CO2 %	O2 %	Balance %	Init. Flow SCFM	Adj. Flow SCFM
VLGW018S							
January	01/22/2020 16:36	45.1	29.1	0.0	25.8	1.0	1.0
February	2/20/20 12:38 PM	40.8	27.2	0.2	31.8	<<>>	<<>>
March	3/28/20 10:39 AM	40.7	26.8	0.0	32.5	6.0	1.0
April	---	---	---	---	---	---	---
May	5/20/20 9:23	48.3	27.5	3.9	20.3	7.0	8.0
June	06/30/2020 13:00	30.8	17.3	8.8	43.1	1.0	1.0
July	07/31/2020 11:18	29.7	18.3	9.4	42.6	0.0	1.0
August	8/29/20 12:40 PM	50.6	30.0	2.5	16.9	0.0	3.0
September	09/25/2020 13:57	42.7	28.2	0.0	29.1	7.0	6.0
October	10/30/20 1:46 PM	51.5	30.8	2.0	15.7	4.0	6.0
November	11/26/20 18:31	35.7	28.2	0.0	36.1	4.0	3.0
December	12/29/20 18:25	34.4	27.1	0.0	38.5	5.0	6.0
Average		**40.9**	**26.4**	**2.4**	**30.2**	**3.5**	**3.6**
VLGW019D							
January	01/22/2020 17:15	45.2	31.9	0.0	22.9	5.0	3.0
February	2/20/20 1:15 PM	46.8	31.7	0.1	21.4	<<>>	0.0
March	3/28/20 10:44 AM	45.9	31.5	0.0	22.6	8.0	8.0
April	---	---	---	---	---	---	---
May	5/20/20 9:28	44.4	29.8	0.0	25.8	8.0	8.0
June	06/30/2020 13:06	44.8	29.8	0.2	25.2	0.0	1.0
July	07/31/2020 11:25	46.0	30.7	0.0	23.3	4.0	4.0
August	8/29/20 12:37 PM	46.6	31.2	0.0	22.2	23.0	23.0
September	09/25/2020 16:46	47.9	31.6	0.0	20.5	6.0	6.0
October	10/30/20 1:52 PM	49.0	32.9	0.0	18.1	5.0	5.0
November	11/26/20 18:41	48.1	32.6	0.0	19.3	3.0	5.0
December	12/29/20 18:42	48.3	32.2	0.0	19.5	5.0	4.0
Average		**46.6**	**31.4**	**0.0**	**21.9**	**6.7**	**6.1**
VLGW019S							
January	01/22/2020 17:11	48.0	32.9	0.1	19.0	<<>>	2.0
February	2/20/20 1:12 PM	48.9	32.4	0.0	18.7	4.0	4.0
March	3/28/20 10:43 AM	46.7	31.6	0.0	21.7	9.0	8.0
April	---	---	---	---	---	---	---
May	5/20/20 9:27	46.7	30.4	0.0	22.9	24.0	23.0
June	06/30/2020 13:04	46.8	30.3	0.3	22.6	4.0	2.0
July	07/31/2020 11:23	47.4	30.9	0.3	21.4	40.0	41.0
August	8/29/20 12:36 PM	47.5	31.1	0.4	21.0	41.0	40.0
September	09/25/2020 16:44	48.4	31.4	0.3	19.9	6.0	7.0
October	10/30/20 1:51 PM	49.5	32.9	0.1	17.5	26.0	26.0
November	11/26/20 18:39	48.9	32.7	0.4	18.0	4.0	3.0
December	12/29/20 18:40	49.6	32.7	0.0	17.7	5.0	4.0
Average		**48.0**	**31.8**	**0.2**	**20.0**	**16.3**	**14.5**

Appendix B2, continued

Month	Date	CH4 %	CO2 %	O2 %	Balance %	Init. Flow SCFM	Adj. Flow SCFM
VLGW020D							
January	01/22/2020 17:28	48.0	32.9	0.1	19.0	<<>>	2.0
February	2/20/20 1:25 PM	48.9	32.4	0.0	18.7	4.0	4.0
March	3/28/20 11:12 AM	46.7	31.6	0.0	21.7	9.0	8.0
April	---	---	---	---	---	---	---
May	---	---	---	---	---	---	---
June	---	---	---	---	---	---	---
July	07/31/2020 11:30	42.0	31.1	0.0	26.9	3.0	2.0
August	---	---	---	---	---	---	---
September	---	---	---	---	---	---	---
October	---	---	---	---	---	---	---
November	11/26/20 19:14	41.4	31.3	0.0	27.3	4.0	5.0
December	12/29/20 18:51	43.3	31.3	0.0	25.4	4.0	4.0
Average		**45.1**	**31.8**	**0.0**	**23.2**	**4.8**	**4.2**
VLGW020S							
January	01/22/2020 17:25	25.3	25.3	0.0	49.4	5.0	24.0
February	2/20/20 1:21 PM	24.7	24.6	0.6	50.1	1.0	3.0
March	3/28/20 11:10 AM	26.5	25.2	0.1	48.2	1.0	2.0
April	---	---	---	---	---	---	---
May	---	---	---	---	---	---	---
June	---	---	---	---	---	---	---
July	---	---	---	---	---	---	---
August	---	---	---	---	---	---	---
September	---	---	---	---	---	---	---
October	---	---	---	---	---	---	---
November	11/26/20 19:12	33.6	27.6	1.0	37.8	5.0	5.0
December	12/29/20 18:48	34.7	27.4	0.7	37.2	2.0	2.0
Average		**29.0**	**26.0**	**0.5**	**44.5**	**2.8**	**7.2**
VLGW021D							
January	01/22/2020 17:39	48.0	19.1	0.3	32.6	<<>>	<<>>
February	3/28/20 11:24 AM	57.8	18.8	0.0	23.4	<<>>	<<>>
March	3/28/20 11:24 AM	62.4	20.4	0.0	17.2	29.0	23.0
April	---	---	---	---	---	---	---
May	5/20/20 9:44	52.6	18.1	0.0	29.3	67.0	64.0
June	06/30/2020 12:39	48.8	17.8	0.0	33.4	0.0	6.0
July	07/31/2020 11:36	44.9	16.8	0.3	38.0	3.0	3.0
August	8/29/20 3:00 PM	44.7	16.6	0.3	38.4	1.0	0.0
September	09/25/2020 17:10	43.3	16.8	0.0	39.9	77.0	78.0
October	10/30/20 2:03 PM	44.7	18.2	0.1	37.0	2.0	3.0
November	---	---	---	---	---	---	---
December	12/29/20 19:04	42.9	17.6	0.0	39.5	53.0	53.0
Average		**49.0**	**18.0**	**0.1**	**32.9**	**29.0**	**28.8**

Appendix B2, continued

Month	Date	CH4 %	CO2 %	O2 %	Balance %	Init. Flow SCFM	Adj. Flow SCFM
VLGW021S							
January	01/22/2020 17:34	41.2	20.5	0.0	38.3	4.0	1.0
February	2/20/20 1:57 PM	63.0	22.3	0.0	14.7	0.0	1.0
March	3/28/20 11:22 AM	68.0	20.7	0.0	11.3	1.0	4.0
April	---	---	---	---	---	---	---
May	5/20/20 9:42	43.4	20.9	0.0	35.7	3.0	3.0
June	06/30/2020 12:38	45.9	19.4	0.4	34.3	2.0	1.0
July	07/31/2020 11:35	46.1	20.7	0.0	33.2	3.0	2.0
August	8/29/20 2:58 PM	45.5	20.0	0.0	34.5	3.0	2.0
September	09/25/2020 17:08	40.1	19.0	0.0	40.9	4.0	2.0
October	10/30/20 2:01 PM	53.5	22.6	0.0	23.9	5.0	4.0
November	---	---	---	---	---	---	---
December	12/29/20 19:02	39.7	20.9	0.2	39.2	5.0	5.0
Average		**48.6**	**20.7**	**0.1**	**30.6**	**3.0**	**2.5**
VLGW022D							
January	---	---	---	---	---	---	---
February	2/20/20 4:40 PM	0.1	2.3	17.9	79.7	<<>>	0.0
March	3/31/20 4:30 PM	0.3	2.3	17.4	80.0	1.0	2.0
April	---	---	---	---	---	---	---
May	5/20/20 10:38	16.1	13.6	6.4	63.9	0.0	0.0
June	---	---	---	---	---	---	---
July	---	---	---	---	---	---	---
August	---	---	---	---	---	---	---
September	09/26/2020 14:16	69.4	28.4	0.3	1.9	6.0	6.0
October	10/30/20 6:13 PM	59.4	25.1	3.4	12.1	2.0	3.0
November	11/24/20 18:29	63.2	27.4	1.6	7.8	7.0	7.0
December	12/29/20 18:02	67.7	31.4	0.7	0.2	4.0	5.0
Average		**39.5**	**18.6**	**6.8**	**35.1**	**3.3**	**3.3**
VLGW022S							
January	---	---	---	---	---	---	---
February	---	---	---	---	---	---	---
March	3/31/20 4:28 PM	35.1	21.0	1.0	42.9	3.0	1.0
April	---	---	---	---	---	---	---
May	5/20/20 10:36	36.6	20.4	0.0	43.0	1.0	0.0
June	---	---	---	---	---	---	---
July	---	---	---	---	---	---	---
August	---	---	---	---	---	---	---
September	09/26/2020 14:13	34.6	20.3	1.0	44.1	2.0	1.0
October	10/30/20 6:11 PM	31.3	18.5	2.5	47.7	5.0	5.0
November	11/24/20 18:27	38.4	19.9	0.2	41.5	3.0	2.0
December	12/29/20 18:01	29.6	19.5	1.2	49.7	3.0	2.0
Average		**34.3**	**19.9**	**1.0**	**44.8**	**2.8**	**1.8**

Appendix B2, continued

Month	Date	CH4 %	CO2 %	O2 %	Balance %	Init. Flow SCFM	Adj. Flow SCFM
VLGW023D							
January	01/14/2020 11:06	47.2	17.4	0.0	35.4	4.0	4.0
February	2/18/20 2:37 PM	49.9	17.1	0.4	32.6	5.0	6.0
March	3/31/20 2:36 PM	48.2	17.2	0.8	33.8	5.0	7.0
April	---	---	---	---	---	---	---
May	5/9/20 14:08	58.0	17.6	0.0	24.4	2.0	5.0
June	06/13/2020 13:29	47.9	17.2	0.0	34.9	4.0	4.0
July	07/31/2020 12:50	50.3	16.9	0.1	32.7	1.0	3.0
August	8/29/20 2:38 PM	51.3	16.7	0.1	31.9	6.0	5.0
September	09/25/2020 11:56	44.2	15.6	2.6	37.6	3.0	4.0
October	10/30/20 12:29 PM	49.0	17.5	0.0	33.5	7.0	4.0
November	11/24/20 19:25	47.7	16.8	1.2	34.3	4.0	4.0
December	12/23/20 15:29	48.3	17.0	0.2	34.5	41.0	42.0
Average		**49.3**	**17.0**	**0.5**	**33.2**	**7.5**	**8.0**
VLGW023S							
January	01/14/2020 11:05	42.0	29.3	0.9	27.8	4.0	2.0
February	2/18/20 2:34 PM	32.3	24.5	0.2	43.0	<<>>	<<>>
March	3/31/20 2:34 PM	28.7	23.2	0.9	47.2	2.0	0.0
April	---	---	---	---	---	---	---
May	5/9/20 14:07	71.4	25.8	0.0	2.8	6.0	3.0
June	06/13/2020 13:28	45.9	27.7	0.5	25.9	5.0	5.0
July	07/31/2020 12:49	50.3	30.9	0.3	18.5	0.0	1.0
August	8/29/20 2:36 PM	49.7	31.4	0.2	18.7	3.0	4.0
September	09/25/2020 11:54	54.8	32.6	0.0	12.6	4.0	5.0
October	10/30/20 12:28 PM	41.9	31.0	0.0	27.1	2.0	0.0
November	11/24/20 19:23	61.6	33.2	0.0	5.2	39.0	39.0
December	12/23/20 15:27	49.8	30.3	0.0	19.9	5.0	3.0
Average		**48.0**	**29.1**	**0.3**	**22.6**	**7.0**	**6.2**
VLGW024D							
January	01/14/2020 10:57	47.1	26.0	0.5	26.4	5.0	5.0
February	2/18/20 2:47 PM	43.2	22.3	3.2	31.3	4.0	10.0
March	---	---	---	---	---	---	---
April	---	---	---	---	---	---	---
May	5/9/20 14:04	76.0	23.9	0.0	0.1	4.0	5.0
June	06/13/2020 13:25	64.2	25.8	0.3	9.7	4.0	6.0
July	07/31/2020 12:15	56.6	27.4	0.2	15.8	5.0	4.0
August	8/29/20 2:40 PM	55.2	25.9	1.2	17.7	6.0	8.0
September	09/25/2020 11:52	48.4	23.5	3.4	24.7	2.0	3.0
October	10/30/20 1:14 PM	58.4	26.7	0.3	14.6	2.0	3.0
November	11/24/20 19:31	47.3	23.5	2.3	26.9	21.0	19.0
December	12/23/20 19:12	48.7	25.9	0.0	25.4	3.0	3.0
Average		**54.5**	**25.1**	**1.1**	**19.3**	**5.6**	**6.6**

Appendix B2, continued

Month	Date	CH4 %	CO2 %	O2 %	Balance %	Init. Flow SCFM	Adj. Flow SCFM
VLGW024S							
January	---	---	---	---	---	---	---
February	---	---	---	---	---	---	---
March	---	---	---	---	---	---	---
April	---	---	---	---	---	---	---
May	---	---	---	---	---	---	---
June	---	---	---	---	---	---	---
July	---	---	---	---	---	---	---
August	---	---	---	---	---	---	---
September	---	---	---	---	---	---	---
October	---	---	---	---	---	---	---
November	---	---	---	---	---	---	---
December	---	---	---	---	---	---	---
Average		**---**	**---**	**---**	**---**	**---**	**---**
VLGW025D							
January	---	---	---	---	---	---	---
February	---	---	---	---	---	---	---
March	---	---	---	---	---	---	---
April	---	---	---	---	---	---	---
May	---	---	---	---	---	---	---
June	---	---	---	---	---	---	---
July	---	---	---	---	---	---	---
August	---	---	---	---	---	---	---
September	---	---	---	---	---	---	---
October	---	---	---	---	---	---	---
November	---	---	---	---	---	---	---
December	---	---	---	---	---	---	---
Average		**---**	**---**	**---**	**---**	**---**	**---**
VLGW025S							
January	---	---	---	---	---	---	---
February	---	---	---	---	---	---	---
March	---	---	---	---	---	---	---
April	---	---	---	---	---	---	---
May	---	---	---	---	---	---	---
June	---	---	---	---	---	---	---
July	---	---	---	---	---	---	---
August	---	---	---	---	---	---	---
September	---	---	---	---	---	---	---
October	---	---	---	---	---	---	---
November	---	---	---	---	---	---	---
December	---	---	---	---	---	---	---
Average		**---**	**---**	**---**	**---**	**---**	**---**

Appendix B2, continued

Month	Date	CH4 %	CO2 %	O2 %	Balance %	Init. Flow SCFM	Adj. Flow SCFM
VLGW026D							
January	01/22/2020 17:50	42.1	29.0	0.0	28.9	3.0	0.0
February	2/20/20 2:10 PM	37.5	26.6	0.2	35.7	<<>>	1.0
March	3/28/20 11:28 AM	39.0	26.9	0.2	33.9	2.0	2.0
April	---	---	---	---	---	---	---
May	5/20/20 9:39	63.7	36.2	0.0	0.1	4.0	7.0
June	06/30/2020 12:35	65.1	34.8	0.0	0.1	2.0	7.0
July	07/31/2020 10:55	48.9	30.3	0.0	20.8	3.0	3.0
August	8/29/20 2:57 PM	46.4	29.4	0.4	23.8	3.0	3.0
September	09/25/2020 17:17	45.7	29.5	0.0	24.8	5.0	0.0
October	10/30/20 1:58 PM	36.5	28.1	0.8	34.6	5.0	1.0
November	---	---	---	---	---	---	---
December	12/29/20 18:58	63.3	36.6	0.0	0.1	3.0	3.0
Average		**48.8**	**30.7**	**0.2**	**20.3**	**3.3**	**2.7**
VLGW026S							
January	01/22/2020 17:45	36.3	26.0	0.0	37.7	4.0	2.0
February	2/20/20 2:08 PM	35.1	24.4	0.2	40.3	<<>>	1.0
March	3/28/20 11:27 AM	38.3	25.2	0.0	36.5	1.0	1.0
April	---	---	---	---	---	---	---
May	5/20/20 9:37	66.2	33.6	0.0	0.2	1.0	4.0
June	06/30/2020 12:34	68.4	31.5	0.0	0.1	2.0	3.0
July	07/31/2020 10:53	49.0	28.8	0.1	22.1	2.0	4.0
August	8/29/20 2:56 PM	46.5	28.0	0.4	25.1	1.0	2.0
September	09/25/2020 17:15	43.0	27.8	0.0	29.2	5.0	4.0
October	10/30/20 1:57 PM	35.3	28.1	0.4	36.2	32.0	2.0
November	---	---	---	---	---	---	---
December	12/29/20 18:55	65.9	34.0	0.0	0.1	4.0	3.0
Average		**48.4**	**28.7**	**0.1**	**22.8**	**5.8**	**2.6**
VLGW027D							
January	---	---	---	---	---	---	---
February	2/20/20 4:36 PM	32.1	22.1	0.2	45.6	9.0	5.0
March	3/31/20 4:26 PM	44.4	22.5	0.3	32.8	5.0	9.0
April	---	---	---	---	---	---	---
May	5/20/20 10:33	49.7	23.2	0.0	27.1	9.0	11.0
June	---	---	---	---	---	---	---
July	07/29/2020 15:19	49.8	24.4	0.0	25.8	18.0	16.0
August	8/28/20 11:46 AM	47.3	24.9	0.0	27.8	7.0	13.0
September	09/26/2020 14:23	45.8	24.2	0.0	30.0	10.0	10.0
October	10/30/20 6:19 PM	44.9	25.0	0.0	30.1	8.0	13.0
November	11/24/20 18:35	43.4	24.9	0.0	31.7	10.0	13.0
December	12/29/20 17:56	37.4	23.2	0.5	38.9	8.0	7.0
Average		**43.9**	**23.8**	**0.1**	**32.2**	**9.3**	**10.8**

Appendix B2, continued

Month	Date	CH4 %	CO2 %	O2 %	Balance %	Init. Flow SCFM	Adj. Flow SCFM
VLGW027S							
January	---	---	---	---	---	---	---
February	---	---	---	---	---	---	---
March	---	---	---	---	---	---	---
April	---	---	---	---	---	---	---
May	---	---	---	---	---	---	---
June	---	---	---	---	---	---	---
July	---	---	---	---	---	---	---
August	---	---	---	---	---	---	---
September	09/26/2020 14:21	47.3	17.7	0.5	34.5	6.0	6.0
October	10/30/20 6:17 PM	63.4	17.2	1.2	18.2	1.0	3.0
November	11/24/20 18:33	46.2	18.4	0.2	35.2	8.0	7.0
December	12/29/20 17:54	14.9	9.9	8.8	66.4	2.0	1.0
Average		**43.0**	**15.8**	**2.7**	**38.6**	**4.3**	**4.3**
VLGW028S							
January	---	---	---	---	---	---	---
February	2/20/20 4:46 PM	38.0	25.5	0.2	36.3	<<>>	0.0
March	3/31/20 4:20 PM	39.0	25.8	0.0	35.2	2.0	1.0
April	---	---	---	---	---	---	---
May	---	---	---	---	---	---	---
June	---	---	---	---	---	---	---
July	07/31/2020 10:16	68.4	26.4	1.0	4.2	2.0	7.0
August	8/28/20 11:43 AM	46.4	29.4	0.5	23.7	1.0	4.0
September	09/26/2020 14:52	34.0	25.2	0.4	40.4	5.0	6.0
October	10/30/20 7:15 PM	33.9	25.8	0.2	40.1	2.0	4.0
November	11/24/20 18:50	33.1	25.5	0.4	41.0	3.0	4.0
December	12/29/20 14:11	31.1	25.0	0.1	43.8	5.0	6.0
Average		**40.5**	**26.1**	**0.4**	**33.1**	**2.9**	**4.0**
VLGW029D							
January	---	---	---	---	---	---	---
February	2/20/20 4:32 PM	32.7	26.0	0.0	41.3	11.0	11.0
March	3/31/20 4:24 PM	38.9	26.0	0.0	35.1	10.0	5.0
April	---	---	---	---	---	---	---
May	5/20/20 10:30	46.7	25.8	0.0	27.5	33.0	30.0
June	---	---	---	---	---	---	---
July	07/29/2020 15:16	52.3	26.7	0.1	20.9	17.0	15.0
August	8/28/20 11:50 AM	48.0	26.0	0.2	25.8	10.0	10.0
September	09/26/2020 14:30	45.2	25.8	0.0	29.0	9.0	9.0
October	10/30/20 6:29 PM	43.4	26.8	0.0	29.8	7.0	3.0
November	11/24/20 18:42	42.7	27.1	0.0	30.2	10.0	10.0
December	12/29/20 17:51	37.6	25.8	0.2	36.4	2.0	11.0
Average		**43.1**	**26.2**	**0.1**	**30.7**	**12.1**	**11.6**

Appendix B2, continued

Month	Date	CH4 %	CO2 %	O2 %	Balance %	Init. Flow SCFM	Adj. Flow SCFM
VLGW029S							
January	---	---	---	---	---	---	---
February	2/20/20 4:29 PM	67.0	32.9	0.0	0.1	<<>>	2.0
March	3/31/20 4:23 PM	66.5	33.4	0.0	0.1	5.0	5.0
April	---	---	---	---	---	---	---
May	5/20/20 10:29	34.5	22.0	0.0	43.5	5.0	1.0
June	---	---	---	---	---	---	---
July	07/29/2020 15:15	67.4	32.4	0.1	0.1	1.0	2.0
August	8/28/20 11:48 AM	42.2	24.5	0.3	33.0	4.0	4.0
September	09/26/2020 14:27	36.7	23.7	0.1	39.5	7.0	5.0
October	10/30/20 6:26 PM	31.4	23.6	0.0	45.0	3.0	1.0
November	---	---	---	---	---	---	---
December	12/29/20 17:49	28.6	21.7	0.0	49.7	2.0	5.0
Average		**46.8**	**26.8**	**0.1**	**26.4**	**3.9**	**3.1**
VLGW030S							
January	---	---	---	---	---	---	---
February	---	---	---	---	---	---	---
March	3/31/20 4:18 PM	14.5	12.6	9.4	63.5	0.0	1.0
April	---	---	---	---	---	---	---
May	---	---	---	---	---	---	---
June	---	---	---	---	---	---	---
July	07/31/2020 10:13	29.9	18.4	6.5	45.2	2.0	0.0
August	8/28/20 11:40 AM	28.0	19.3	5.0	47.7	0.0	1.0
September	09/26/2020 14:48	2.2	1.7	18.5	77.6	3.0	3.0
October	10/31/20 10:16 AM	6.1	5.7	16.0	72.2	1.0	4.0
November	11/24/20 18:54	26.6	22.6	2.8	48.0	2.0	2.0
December	12/29/20 14:08	15.9	16.4	6.3	61.4	8.0	8.0
Average		**17.6**	**13.8**	**9.2**	**59.4**	**2.3**	**2.7**
VLGW031S							
January	---	---	---	---	---	---	---
February	2/20/20 6:31 PM	18.6	20.8	0.2	60.4	<<>>	<<>>
March	3/31/20 4:11 PM	19.6	20.5	0.6	59.3	3.0	1.0
April	---	---	---	---	---	---	---
May	---	---	---	---	---	---	---
June	---	---	---	---	---	---	---
July	---	---	---	---	---	---	---
August	8/28/20 12:29 PM	38.5	20.6	2.6	38.3	<<>>	<<>>
September	09/26/2020 15:00	33.1	17.0	5.8	44.1	2.0	3.0
October	10/31/20 10:26 AM	37.6	21.7	3.7	37.0	8.0	8.0
November	11/24/20 19:15	47.2	25.5	0.8	26.5	4.0	0.0
December	12/29/20 13:55	38.5	25.4	1.3	34.8	6.0	4.0
Average		**33.3**	**21.6**	**2.1**	**42.9**	**4.6**	**3.2**

Appendix B2, continued

Month	Date	CH4 %	CO2 %	O2 %	Balance %	Init. Flow SCFM	Adj. Flow SCFM
VLGW032S							
January	---	---	---	---	---	---	---
February	2/20/20 4:54 PM	36.8	26.2	0.0	37.0	<<>>	<<>>
March	3/31/20 4:16 PM	37.2	26.4	0.0	36.4	4.0	5.0
April	---	---	---	---	---	---	---
May	---	---	---	---	---	---	---
June	---	---	---	---	---	---	---
July	07/31/2020 10:11	67.5	30.3	0.9	1.3	3.0	5.0
August	8/28/20 11:38 AM	65.0	28.3	0.2	6.5	6.0	6.0
September	09/26/2020 14:42	46.1	26.2	0.0	27.7	4.0	5.0
October	10/31/20 10:20 AM	38.9	27.3	0.0	33.8	7.0	7.0
November	11/24/20 18:58	40.1	28.0	0.2	31.7	3.0	3.0
December	12/29/20 14:05	34.1	27.2	0.1	38.6	21.0	21.0
Average		**45.7**	**27.5**	**0.2**	**26.6**	**6.9**	**7.4**
VLGW033S							
January	---	---	---	---	---	---	---
February	2/20/20 6:27 PM	8.0	21.8	0.3	69.9	2.0	4.0
March	3/31/20 4:09 PM	17.9	25.2	0.5	56.4	1.0	1.0
April	---	---	---	---	---	---	---
May	---	---	---	---	---	---	---
June	---	---	---	---	---	---	---
July	---	---	---	---	---	---	---
August	8/28/20 12:27 PM	32.9	28.7	0.1	38.3	<<>>	0.0
September	09/26/2020 15:05	33.0	27.7	0.0	39.3	3.0	2.0
October	10/31/20 10:30 AM	33.0	27.8	0.0	39.2	4.0	0.0
November	11/24/20 19:12	25.7	27.5	0.2	46.6	3.0	2.0
December	12/29/20 13:58	6.6	21.2	2.9	69.3	5.0	5.0
Average		**22.4**	**25.7**	**0.6**	**51.3**	**3.0**	**2.0**
VLGW034S							
January	---	---	---	---	---	---	---
February	2/20/20 6:23 PM	22.9	27.1	0.0	50.0	<<>>	<<>>
March	3/31/20 4:06 PM	23.9	25.6	0.1	50.4	0.0	0.0
April	---	---	---	---	---	---	---
May	---	---	---	---	---	---	---
June	---	---	---	---	---	---	---
July	---	---	---	---	---	---	---
August	8/28/20 12:25 PM	48.1	34.8	0.2	16.9	2.0	2.0
September	09/26/2020 15:10	45.0	32.7	0.0	22.3	3.0	3.0
October	10/31/20 10:34 AM	32.5	31.4	0.0	36.1	2.0	2.0
November	11/24/20 19:08	35.8	33.0	0.0	31.2	2.0	2.0
December	12/29/20 14:01	27.1	29.7	0.0	43.2	7.0	7.0
Average		**33.6**	**30.6**	**0.0**	**35.7**	**2.7**	**2.7**

Appendix B2, continued

Month	Date	CH4 %	CO2 %	O2 %	Balance %	Init. Flow SCFM	Adj. Flow SCFM
VLGW042S							
January	01/14/2020 10:49	49.9	22.6	0.1	27.4	8.0	8.0
February	2/18/20 6:13 PM	47.1	22.8	0.2	29.9	3.0	4.0
March	3/25/20 4:18 PM	44.7	22.1	0.2	33.0	7.0	6.0
April	---	---	---	---	---	---	---
May	5/9/20 13:49	46.1	21.2	0.2	32.5	2.0	7.0
June	06/13/2020 13:17	43.4	21.1	0.0	35.5	6.0	7.0
July	07/31/2020 12:09	46.5	20.9	0.2	32.4	5.0	5.0
August	8/29/20 12:52 PM	47.4	21.5	0.0	31.1	7.0	3.0
September	09/25/2020 13:05	48.6	21.3	0.0	30.1	4.0	5.0
October	10/30/20 1:32 PM	48.8	22.1	0.0	29.1	13.0	5.0
November	11/24/20 19:51	50.7	22.7	0.0	26.6	3.0	2.0
December	12/23/20 19:27	48.8	22.3	0.0	28.9	25.0	19.0
Average		**47.5**	**21.9**	**0.1**	**30.6**	**7.5**	**6.5**
VLGW043S							
January	01/22/2020 17:20	61.9	34.8	1.4	1.9	<<>>	<<>>
February	2/20/20 1:31 PM	52.0	29.7	4.2	14.1	<<>>	0.0
March	3/28/20 11:14 AM	54.2	31.7	3.2	10.9	5.0	5.0
April	---	---	---	---	---	---	---
May	5/10/20 13:49	37.6	27.5	0.0	34.9	7.0	1.0
June	---	---	---	---	---	---	---
July	07/31/2020 11:28	36.6	21.4	8.2	33.8	1.0	0.0
August	---	---	---	---	---	---	---
September	---	---	---	---	---	---	---
October	---	---	---	---	---	---	---
November	11/26/20 19:09	46.3	28.6	5.4	19.7	6.0	4.0
December	12/29/20 18:45	50.9	30.3	4.1	14.7	4.0	4.0
Average		48.5	29.1	3.8	18.6	4.6	2.3
VLGW047S							
January	---	---	---	---	---	---	---
February	---	---	---	---	---	---	---
March	---	---	---	---	---	---	---
April	---	---	---	---	---	---	---
May	---	---	---	---	---	---	---
June	---	---	---	---	---	---	---
July	---	---	---	---	---	---	---
August	---	---	---	---	---	---	---
September	---	---	---	---	---	---	---
October	---	---	---	---	---	---	---
November	---	---	---	---	---	---	---
December	---	---	---	---	---	---	---
Average		**---**	**---**	**---**	**---**	**---**	**---**

Appendix B2, continued

Month	Date	CH4 %	CO2 %	O2 %	Balance %	Init. Flow SCFM	Adj. Flow SCFM
VLGW0049							
January	01/14/2020 13:04	52.8	26.5	4.1	16.6	0.0	3.0
February	2/20/20 2:27 PM	40.8	19.6	7.5	32.1	10.0	16.0
March	3/28/20 11:31 AM	63.8	30.6	1.4	4.2	8.0	19.0
April	---	---	---	---	---	---	---
May	5/20/20 10:15	59.3	28.7	2.5	9.5	8.0	14.0
June	06/30/2020 12:17	59.9	30.2	0.3	9.6	7.0	10.0
July	07/29/2020 15:00	57.2	30.4	0.9	11.5	6.0	11.0
August	8/28/20 11:04 AM	50.5	30.8	0.5	18.2	12.0	16.0
September	09/26/2020 13:38	53.7	29.1	0.4	16.8	10.0	5.0
October	10/30/20 4:26 PM	50.7	29.6	0.2	19.5	3.0	<<>>
November	---	---	---	---	---	---	---
December	12/30/20 17:01	39.0	20.7	7.4	32.9	7.0	10.0
Average		**52.8**	**27.6**	**2.5**	**17.1**	**7.1**	**11.6**
VLGW0050							
January	---	---	---	---	---	---	---
February	2/20/20 2:46 PM	35.8	27.8	0.0	36.4	2.0	2.0
March	3/28/20 11:41 AM	38.0	28.3	0.0	33.7	2.0	2.0
April	---	---	---	---	---	---	---
May	---	---	---	---	---	---	---
June	---	---	---	---	---	---	---
July	07/31/2020 10:04	38.6	28.2	0.7	32.5	1.0	0.0
August	---	---	---	---	---	---	---
September	09/29/2020 13:12	35.6	27.6	0.6	36.2	0.0	1.0
October	10/31/20 11:02 AM	73.3	26.6	0.0	0.1	2.0	3.0
November	12/2/20 14:55	73.3	26.6	0.0	0.1	4.0	1.0
December	12/31/20 14:06	72.7	27.2	0.0	0.1	4.0	4.0
Average		**52.5**	**27.5**	**0.2**	**19.9**	**2.1**	**1.9**
VLGW0051							
January	01/30/2020 18:20	40.2	30.0	0.1	29.7	16.0	12.0
February	2/20/20 5:02 PM	39.0	29.6	0.0	31.4	10.0	12.0
March	3/25/20 2:33 PM	41.0	29.1	0.1	29.8	16.0	7.0
April	---	---	---	---	---	---	---
May	5/20/20 10:43	57.4	30.7	0.0	11.9	12.0	12.0
June	06/30/2020 11:29	59.1	32.2	0.1	8.6	9.0	12.0
July	07/31/2020 10:07	54.6	32.2	0.0	13.2	13.0	13.0
August	8/28/20 11:34 AM	53.5	32.2	0.0	14.3	12.0	16.0
September	09/29/2020 13:17	51.0	32.1	0.0	16.9	14.0	12.0
October	10/31/20 11:06 AM	48.6	32.5	0.0	18.9	14.0	12.0
November	12/2/20 14:59	45.4	31.7	0.0	22.9	14.0	16.0
December	12/31/20 14:11	43.8	31.2	0.0	25.0	14.0	16.0
Average		**48.5**	**31.2**	**0.0**	**20.2**	**13.1**	**12.7**

Appendix B2, continued

Month	Date	CH4 %	CO2 %	O2 %	Balance %	Init. Flow SCFM	Adj. Flow SCFM
VLGW0052							
January	01/14/2020 13:08	44.4	33.1	0.0	22.5	6.0	2.0
February	2/20/20 2:35 PM	41.9	32.1	0.0	26.0	7.0	6.0
March	3/28/20 11:35 AM	43.9	32.7	0.0	23.4	25.0	23.0
April	---	---	---	---	---	---	---
May	5/20/20 10:20	48.2	33.6	0.0	18.2	8.0	8.0
June	06/30/2020 12:26	48.3	34.0	0.0	17.7	4.0	8.0
July	07/29/2020 15:07	48.6	34.3	0.0	17.1	10.0	10.0
August	8/28/20 11:09 AM	48.7	34.9	0.0	16.4	12.0	13.0
September	09/26/2020 13:47	48.2	34.8	0.0	17.0	5.0	4.0
October	10/30/20 4:30 PM	42.7	32.6	0.0	24.7	42.0	43.0
November	---	---	---	---	---	---	---
December	12/30/20 16:53	44.8	33.2	0.0	22.0	9.0	12.0
Average		**46.0**	**33.5**	**0.0**	**20.5**	**12.8**	**12.9**
VLGW0053							
January	01/14/2020 13:13	55.9	34.8	0.0	9.3	3.0	3.0
February	2/20/20 2:39 PM	42.1	31.7	0.0	26.2	<<>>	1.0
March	3/28/20 11:38 AM	43.6	32.4	0.0	24.0	3.0	1.0
April	---	---	---	---	---	---	---
May	5/20/20 10:23	46.8	32.6	0.0	20.6	3.0	4.0
June	06/30/2020 12:29	49.6	33.4	0.0	17.0	1.0	2.0
July	07/29/2020 15:10	38.9	30.9	0.0	30.2	1.0	<<>>
August	8/28/20 11:13 AM	37.2	30.4	0.0	32.4	2.0	3.0
September	09/26/2020 13:54	49.0	34.0	0.0	17.0	3.0	2.0
October	10/30/20 4:33 PM	45.8	32.8	0.0	21.4	2.0	2.0
November	---	---	---	---	---	---	---
December	12/30/20 16:49	49.0	33.8	0.0	17.2	3.0	4.0
Average		**45.8**	**32.7**	**0.0**	**21.5**	**2.3**	**2.4**
VLGW0054							
January	01/30/2020 18:23	46.5	31.4	0.0	22.1	4.0	4.0
February	2/20/20 5:08 PM	38.1	29.6	0.0	32.3	<<>>	<<>>
March	3/25/20 2:36 PM	35.2	28.9	0.0	35.9	7.0	2.0
April	---	---	---	---	---	---	---
May	5/20/20 10:46	53.2	30.4	0.0	16.4	4.0	5.0
June	06/30/2020 11:32	53.6	31.8	0.0	14.6	6.0	6.0
July	07/31/2020 9:59	49.9	32.2	0.0	17.9	2.0	1.0
August	8/28/20 11:19 AM	48.9	31.9	0.0	19.2	3.0	2.0
September	09/29/2020 13:20	45.2	31.5	0.0	23.3	6.0	7.0
October	10/31/20 10:55 AM	43.0	31.5	0.0	25.5	12.0	10.0
November	12/2/20 14:50	43.0	31.0	0.0	26.0	2.0	2.0
December	12/31/20 14:01	38.9	30.4	0.0	30.7	33.0	33.0
Average		**45.0**	**31.0**	**0.0**	**24.0**	**7.9**	**7.2**

Appendix B2, continued

Month	Date	CH4 %	CO2 %	O2 %	Balance %	Init. Flow SCFM	Adj. Flow SCFM
VLGW0055							
January	01/30/2020 18:26	42.4	31.7	0.0	25.9	4.0	1.0
February	2/20/20 5:14 PM	40.9	30.9	0.0	28.2	2.0	3.0
March	3/25/20 2:39 PM	37.9	29.7	0.0	32.4	7.0	1.0
April	---	---	---	---	---	---	---
May	5/20/20 10:48	62.4	37.5	0.0	0.1	4.0	5.0
June	06/30/2020 11:36	59.0	34.8	0.2	6.0	3.0	4.0
July	07/31/2020 9:56	54.4	34.6	0.1	10.9	25.0	26.0
August	8/28/20 11:22 AM	54.9	34.8	0.0	10.3	4.0	4.0
September	09/29/2020 13:24	47.2	33.7	0.0	19.1	8.0	9.0
October	10/31/20 10:51 AM	44.4	33.6	0.0	22.0	5.0	2.0
November	12/2/20 14:46	43.6	32.5	0.0	23.9	4.0	4.0
December	12/31/20 13:32	40.8	31.3	0.0	27.9	5.0	5.0
Average		**48.0**	**33.2**	**0.0**	**18.8**	**6.5**	**5.8**
VLGW0056							
January	01/30/2020 18:29	29.9	27.0	0.0	43.1	2.0	0.0
February	2/20/20 5:18 PM	36.8	28.1	0.0	35.1	<<>>	<<>>
March	3/25/20 2:43 PM	34.5	27.4	0.0	38.1	3.0	0.0
April	---	---	---	---	---	---	---
May	5/20/20 10:51	61.9	33.4	0.0	4.7	5.0	5.0
June	06/30/2020 11:38	52.7	31.3	0.0	16.0	2.0	3.0
July	07/31/2020 9:53	49.6	32.4	0.2	17.8	25.0	25.0
August	8/28/20 11:25 AM	50.3	32.9	0.0	16.8	7.0	6.0
September	09/29/2020 13:28	41.8	31.9	0.0	26.3	5.0	8.0
October	10/31/20 10:47 AM	35.1	30.5	0.0	34.4	38.0	37.0
November	12/2/20 14:43	34.6	29.2	0.0	36.2	37.0	37.0
December	12/31/20 13:28	32.4	27.9	0.1	39.6	3.0	3.0
Average		**41.8**	**30.2**	**0.0**	**28.0**	**12.7**	**12.4**
VLGW0057							
January	---	---	---	---	---	---	---
February	---	---	---	---	---	---	---
March	---	---	---	---	---	---	---
April	---	---	---	---	---	---	---
May	---	---	---	---	---	---	---
June	---	---	---	---	---	---	---
July	---	---	---	---	---	---	---
August	---	---	---	---	---	---	---
September	---	---	---	---	---	---	---
October	---	---	---	---	---	---	---
November	---	---	---	---	---	---	---
December	---	---	---	---	---	---	---
Average		---	---	---	---	---	---

Appendix B2, continued

Month	Date	CH4 %	CO2 %	O2 %	Balance %	Init. Flow SCFM	Adj. Flow SCFM
VLGW0058							
January	---	---	---	---	---	---	---
February	---	---	---	---	---	---	---
March	---	---	---	---	---	---	---
April	---	---	---	---	---	---	---
May	---	---	---	---	---	---	---
June	---	---	---	---	---	---	---
July	---	---	---	---	---	---	---
August	8/28/20 1:03 PM	40.9	33.6	0.1	25.4	0.0	0.0
September	---	---	---	---	---	---	---
October	---	---	---	---	---	---	---
November	12/2/20 19:01	57.6	42.3	0.0	0.1	8.0	9.0
December	12/30/20 15:26	57.3	42.6	0.0	0.1	10.0	9.0
Average		**51.9**	**39.5**	**0.0**	**8.5**	**6.0**	**6.0**
VLGW0059							
January	---	---	---	---	---	---	---
February	---	---	---	---	---	---	---
March	---	---	---	---	---	---	---
April	---	---	---	---	---	---	---
May	---	---	---	---	---	---	---
June	10/6/20 13:21	42.9	34.7	0.0	22.4	1.0	0.0
July	---	---	---	---	---	---	---
August	8/28/20 12:56 PM	52.2	36.8	0.0	11.0	2.0	3.0
September	09/30/2020 11:31	55.9	39.3	0.0	4.8	3.0	5.0
October	---	---	---	---	---	---	---
November	---	---	---	---	---	---	---
December	12/30/20 16:18	47.6	36.2	0.0	16.2	8.0	7.0
Average		**49.7**	**36.8**	**0.0**	**13.6**	**3.5**	**3.8**
VLGW0060							
January	---	---	---	---	---	---	---
February	---	---	---	---	---	---	---
March	---	---	---	---	---	---	---
April	---	---	---	---	---	---	---
May	---	---	---	---	---	---	---
June	---	---	---	---	---	---	---
July	---	---	---	---	---	---	---
August	8/28/20 12:53 PM	48.0	34.3	0.0	17.7	1.0	3.0
September	---	---	---	---	---	---	---
October	---	---	---	---	---	---	---
November	12/2/20 15:26	17.8	23.5	0.2	58.5	7.0	5.0
December	12/30/20 16:22	25.1	25.0	0.2	49.7	5.0	6.0
Average		**30.3**	**27.6**	**0.1**	**42.0**	**4.3**	**4.7**

Appendix B2, continued

Month	Date	CH4 %	CO2 %	O2 %	Balance %	Init. Flow SCFM	Adj. Flow SCFM
HLGW049B							
January	11/1/20 17:19	58.3	41.6	0.0	0.1	9.0	24.0
February	2/21/20 2:10 PM	56.9	39.6	0.0	3.5	18.0	19.0
March	3/25/20 11:06 AM	56.5	39.1	0.2	4.2	2.0	35.0
April	---	---	---	---	---	---	---
May	5/5/20 14:45	53.7	38.3	0.0	8.0	14.0	21.0
June	9/6/20 14:37	47.2	36.8	0.8	15.2	22.0	30.0
July	07/28/2020 12:27	45.6	35.8	0.7	17.9	16.0	13.0
August	8/27/20 4:15 PM	44.9	35.1	0.9	19.1	14.0	21.0
September	09/29/2020 14:00	46.2	36.2	0.5	17.1	18.0	25.0
October	10/30/20 5:03 PM	43.9	34.4	1.6	20.1	21.0	24.0
November	11/27/20 14:57	45.8	35.3	1.6	17.3	21.0	22.0
December	12/30/20 14:04	48.2	36.3	1.1	14.4	23.0	19.0
Average		**49.7**	**37.1**	**0.7**	**12.4**	**16.2**	**23.0**
HLGW040B							
January	11/1/20 17:14	45.8	36.3	0.0	17.9	14.0	20.0
February	2/21/20 1:25 PM	41.7	33.1	0.1	25.1	8.0	13.0
March	3/25/20 11:10 AM	46.4	35.3	0.0	18.3	14.0	16.0
April	---	---	---	---	---	---	---
May	5/5/20 14:49	60.1	39.7	0.0	0.2	16.0	18.0
June	9/6/20 14:41	55.4	39.5	0.0	5.1	3.0	13.0
July	07/28/2020 12:32	48.7	37.4	0.1	13.8	10.0	16.0
August	8/27/20 4:12 PM	49.9	37.7	0.1	12.3	12.0	14.0
September	09/29/2020 14:05	49.7	37.4	0.0	12.9	14.0	7.0
October	10/30/20 5:10 PM	47.5	36.3	0.3	15.9	8.0	6.0
November	11/27/20 15:05	47.7	36.2	0.0	16.1	14.0	10.0
December	12/30/20 14:12	54.8	37.9	0.2	7.1	10.0	13.0
Average		**49.8**	**37.0**	**0.1**	**13.2**	**11.2**	**13.3**
HLGW045B							
January	---	---	---	---	---	---	---
February	---	---	---	---	---	---	---
March	3/25/20 11:22 AM	31.3	28.3	0.0	40.4	0.0	1.0
April	---	---	---	---	---	---	---
May	---	---	---	---	---	---	---
June	11/6/20 13:00	41.4	35.0	0.0	23.6	5.0	5.0
July	---	---	---	---	---	---	---
August	8/27/20 2:13 PM	29.0	30.6	0.0	40.4	3.0	0.0
September	---	---	---	---	---	---	---
October	---	---	---	---	---	---	---
November	12/2/20 16:04	2.2	2.6	19.3	75.9	7.0	2.0
December	---	---	---	---	---	---	---
Average		**26.0**	**24.1**	**4.8**	**45.1**	**3.8**	**2.0**

Appendix B2, continued

Month	Date	CH4 %	CO2 %	O2 %	Balance %	Init. Flow SCFM	Adj. Flow SCFM
HLGW046B							
January	---	---	---	---	---	---	---
February	---	---	---	---	---	---	---
March	3/25/20 11:24 AM	35.0	29.0	1.8	34.2	0.0	0.0
April	---	---	---	---	---	---	---
May	---	---	---	---	---	---	---
June	11/6/20 12:50	41.5	35.8	0.0	22.7	7.0	4.0
July	---	---	---	---	---	---	---
August	8/27/20 2:10 PM	27.0	30.0	0.0	43.0	4.0	0.0
September	09/29/2020 13:53	35.8	33.9	0.0	30.3	3.0	2.0
October	---	---	---	---	---	---	---
November	12/2/20 16:06	0.0	0.1	20.8	79.1	5.0	5.0
December	---	---	---	---	---	---	---
Average		**27.9**	**25.8**	**4.5**	**41.9**	**3.8**	**2.2**
HLGW047B							
January	---	---	---	---	---	---	---
February	2/21/20 2:05 PM	23.3	19.9	9.6	47.2	3.0	2.0
March	3/25/20 11:26 AM	44.8	32.8	2.9	19.5	2.0	2.0
April	---	---	---	---	---	---	---
May	---	---	---	---	---	---	---
June	11/6/20 12:45	49.5	36.2	2.1	12.2	5.0	5.0
July	---	---	---	---	---	---	---
August	8/27/20 2:08 PM	31.1	32.8	0.0	36.1	30.0	3.0
September	09/29/2020 13:49	0.1	0.2	20.3	79.4	1.0	2.0
October	---	---	---	---	---	---	---
November	12/2/20 16:09	14.5	12.0	14.0	59.5	6.0	6.0
December	---	---	---	---	---	---	---
Average		**27.2**	**22.3**	**8.2**	**42.3**	**7.8**	**3.3**
HLGW048B							
January	---	---	---	---	---	---	---
February	2/21/20 2:08 PM	37.7	32.6	0.0	29.7	2.0	2.0
March	3/25/20 11:28 AM	26.0	29.9	0.0	44.1	1.0	1.0
April	---	---	---	---	---	---	---
May	---	---	---	---	---	---	---
June	11/6/20 12:42	50.7	38.3	0.6	10.4	2.0	4.0
July	---	---	---	---	---	---	---
August	8/27/20 2:05 PM	14.8	25.0	0.1	60.1	1.0	0.0
September	09/29/2020 13:44	18.6	25.8	0.2	55.4	2.0	2.0
October	---	---	---	---	---	---	---
November	12/2/20 16:12	28.0	29.7	0.6	41.7	5.0	4.0
December	---	---	---	---	---	---	---
Average		**29.3**	**30.2**	**0.3**	**40.2**	**2.2**	**2.2**

Appendix B2, continued

Month	Date	CH4 %	CO2 %	O2 %	Balance %	Init. Flow SCFM	Adj. Flow SCFM
HLGW050B							
January	11/1/20 18:00	53.4	39.1	0.0	7.5	7.0	12.0
February	2/21/20 2:13 PM	49.9	36.9	0.0	13.2	16.0	18.0
March	3/25/20 11:30 AM	47.6	36.5	0.0	15.9	15.0	17.0
April	---	---	---	---	---	---	---
May	5/5/20 14:40	51.4	37.7	0.0	10.9	20.0	23.0
June	9/6/20 14:33	45.3	36.7	0.0	18.0	33.0	33.0
July	07/28/2020 12:23	45.3	36.2	0.0	18.5	14.0	16.0
August	8/27/20 5:07 PM	46.0	36.8	0.0	17.2	11.0	16.0
September	09/29/2020 18:58	45.2	35.5	0.0	19.3	13.0	16.0
October	10/30/20 4:57 PM	43.0	35.3	0.0	21.7	12.0	2.0
November	11/27/20 14:51	52.8	38.2	0.0	9.0	7.0	6.0
December	12/30/20 13:48	55.4	39.0	0.0	5.6	4.0	7.0
Average		**48.7**	**37.1**	**0.0**	**14.3**	**13.8**	**15.1**
HLGW051B							
January	11/1/20 17:54	55.5	39.8	0.0	0.1	9.0	24.0
February	2/21/20 2:10 PM	46.0	36.0	0.0	3.5	18.0	19.0
March	3/25/20 11:06 AM	46.4	35.6	0.0	4.2	2.0	35.0
April	---	---	---	---	---	---	---
May	5/5/20 14:42	46.5	36.1	0.0	8.0	14.0	21.0
June	9/6/20 14:28	41.3	34.9	0.0	15.2	22.0	30.0
July	07/28/2020 12:19	45.5	36.0	0.0	17.9	16.0	13.0
August	8/27/20 4:15 PM	43.8	35.5	0.0	19.1	14.0	21.0
September	09/29/2020 14:00	43.5	34.7	0.0	17.1	18.0	25.0
October	10/30/20 5:03 PM	39.6	33.4	0.0	20.1	21.0	24.0
November	11/27/20 14:57	54.9	38.7	0.0	17.3	21.0	22.0
December	12/30/20 14:04	48.2	39.9	0.0	14.4	23.0	19.0
Average		**46.5**	**36.4**	**0.0**	**12.4**	**16.2**	**23.0**
HLGW0052							
January	11/1/20 14:07	51.2	39.4	0.6	8.8	47.0	60.0
February	2/21/20 6:25 PM	51.6	38.7	0.0	9.7	63.0	64.0
March	---	---	---	---	---	---	---
April	---	---	---	---	---	---	---
May	---	---	---	---	---	---	---
June	9/6/20 10:50	40.6	34.9	1.5	23.0	31.0	27.0
July	07/25/2020 13:28	51.0	39.8	0.0	9.2	30.0	28.0
August	---	---	---	---	---	---	---
September	09/30/2020 12:42	50.2	40.0	0.0	9.8	31.0	29.0
October	---	---	---	---	---	---	---
November	12/2/20 20:06	48.5	38.9	0.4	12.2	25.0	29.0
December	12/30/20 19:20	52.3	38.5	0.4	8.8	15.0	43.0
Average		**49.3**	**38.6**	**0.4**	**11.6**	**34.6**	**40.0**

Appendix B2, continued

Month	Date	CH4 %	CO2 %	O2 %	Balance %	Init. Flow SCFM	Adj. Flow SCFM
HLGW0053							
January	11/1/20 14:03	52.2	39.8	0.6	7.4	3.0	8.0
February	2/21/20 6:22 PM	52.8	39.9	0.0	7.3	21.0	22.0
March	3/18/20 4:08 PM	37.1	31.8	1.8	29.3	19.0	3.0
April	---	---	---	---	---	---	---
May	---	---	---	---	---	---	---
June	9/6/20 10:47	28.1	30.4	1.1	40.4	1.0	2.0
July	07/25/2020 13:26	57.1	42.8	0.0	0.1	0.0	6.0
August	---	---	---	---	---	---	---
September	09/30/2020 12:40	56.7	43.2	0.0	0.1	0.0	7.0
October	10/31/20 1:09 PM	56.4	43.5	0.0	0.1	1.0	9.0
November	12/2/20 20:04	54.8	41.8	0.0	3.4	4.0	4.0
December	12/30/20 19:13	54.5	41.3	0.0	4.2	9.0	11.0
Average		**50.0**	**39.4**	**0.4**	**10.3**	**6.4**	**8.0**
HLGW0054							
January	---	---	---	---	---	---	---
February	2/21/20 6:15 PM	26.8	24.7	5.2	43.3	4.0	5.0
March	3/18/20 4:06 PM	7.9	10.4	11.7	70.0	5.0	1.0
April	---	---	---	---	---	---	---
May	---	---	---	---	---	---	---
June	9/6/20 10:45	9.2	15.0	9.3	66.5	0.0	1.0
July	07/25/2020 13:23	57.0	42.9	0.0	0.1	0.0	13.0
August	---	---	---	---	---	---	---
September	09/30/2020 12:37	40.6	36.1	0.0	23.3	2.0	1.0
October	10/31/20 1:07 PM	32.2	33.5	0.8	33.5	2.0	2.0
November	12/2/20 19:54	40.8	35.6	0.0	23.6	1.0	1.0
December	---	---	---	---	---	---	---
Average		**30.6**	**28.3**	**3.9**	**37.2**	**2.0**	**3.4**
HLGW0055							
January	11/1/20 13:59	50.5	40.3	0.1	9.1	15.0	26.0
February	2/21/20 6:03 PM	52.0	38.4	0.1	9.5	25.0	25.0
March	3/18/20 4:03 PM	48.4	37.4	0.2	14.0	23.0	24.0
April	---	---	---	---	---	---	---
May	---	---	---	---	---	---	---
June	9/6/20 10:39	42.1	37.1	0.4	20.4	25.0	13.0
July	07/25/2020 13:21	47.6	39.0	0.0	13.4	13.0	13.0
August	---	---	---	---	---	---	---
September	09/30/2020 12:35	48.0	39.2	0.0	12.8	12.0	11.0
October	10/31/20 1:05 PM	47.1	38.8	0.0	14.1	16.0	20.0
November	12/2/20 19:51	48.5	38.4	0.5	12.6	5.0	17.0
December	12/30/20 19:08	53.4	40.1	0.1	6.4	17.0	10.0
Average		**48.6**	**38.7**	**0.2**	**12.5**	**16.8**	**17.7**

Appendix B2, continued

Month	Date	CH4 %	CO2 %	O2 %	Balance %	Init. Flow SCFM	Adj. Flow SCFM
HLGW0056							
January	---	---	---	---	---	---	---
February	---	---	---	---	---	---	---
March	---	---	---	---	---	---	---
April	---	---	---	---	---	---	---
May	---	---	---	---	---	---	---
June	---	---	---	---	---	---	---
July	---	---	---	---	---	---	---
August	---	---	---	---	---	---	---
September	---	---	---	---	---	---	---
October	---	---	---	---	---	---	---
November	---	---	---	---	---	---	---
December	---	---	---	---	---	---	---
Average		**---**	**---**	**---**	**---**	**---**	**---**
HLGW0057							
January	11/1/20 16:40	59.1	40.8	0.0	0.1	11.0	13.0
February	2/21/20 5:33 PM	58.1	41.8	0.0	0.1	36.0	36.0
March	3/18/20 3:42 PM	58.0	41.8	0.0	0.2	36.0	43.0
April	---	---	---	---	---	---	---
May	---	---	---	---	---	---	---
June	9/6/20 10:17	53.7	43.3	0.0	3.0	56.0	61.0
July	07/25/2020 13:03	53.5	42.7	0.0	3.8	60.0	63.0
August	---	---	---	---	---	---	---
September	09/30/2020 12:11	57.1	42.8	0.0	0.1	54.0	61.0
October	10/31/20 12:48 PM	54.0	40.9	0.0	5.1	57.0	65.0
November	12/2/20 20:19	55.6	41.0	0.1	3.3	72.0	69.0
December	12/30/20 18:43	58.9	40.9	0.1	0.1	50.0	57.0
Average		**56.4**	**41.8**	**0.0**	**1.8**	**48.0**	**52.0**
HLGW0058							
January	11/1/20 13:45	58.1	41.7	0.1	0.1	19.0	30.0
February	2/21/20 5:36 PM	57.2	42.7	0.0	0.1	45.0	47.0
March	3/18/20 3:44 PM	57.4	42.5	0.0	0.1	45.0	51.0
April	---	---	---	---	---	---	---
May	---	---	---	---	---	---	---
June	9/6/20 10:19	56.6	43.3	0.0	0.1	57.0	59.0
July	07/25/2020 13:06	56.8	43.1	0.0	0.1	56.0	58.0
August	---	---	---	---	---	---	---
September	09/30/2020 12:15	56.9	43.0	0.0	0.1	53.0	55.0
October	10/31/20 12:50 PM	57.3	42.6	0.0	0.1	52.0	56.0
November	12/2/20 20:16	57.7	41.9	0.3	0.1	50.0	50.0
December	12/30/20 18:46	57.5	42.3	0.0	0.2	53.0	52.0
Average		**57.3**	**42.6**	**0.0**	**0.1**	**47.8**	**50.9**

Appendix B2, continued

Month	Date	CH4 %	CO2 %	O2 %	Balance %	Init. Flow SCFM	Adj. Flow SCFM
HLGW0059							
January	11/1/20 13:48	57.6	42.2	0.0	0.2	33.0	44.0
February	2/21/20 5:39 PM	57.7	41.5	0.0	0.8	56.0	56.0
March	3/18/20 3:47 PM	54.7	40.4	0.0	4.9	57.0	59.0
April	---	---	---	---	---	---	---
May	---	---	---	---	---	---	---
June	9/6/20 10:21	51.4	41.2	0.0	7.4	60.0	64.0
July	07/25/2020 13:08	52.8	41.7	0.0	5.5	59.0	61.0
August	---	---	---	---	---	---	---
September	09/30/2020 12:19	54.5	41.6	0.0	3.9	40.0	41.0
October	10/31/20 12:52 PM	52.1	41.1	0.0	6.8	60.0	63.0
November	12/2/20 20:13	49.4	39.9	0.1	10.6	66.0	64.0
December	12/30/20 18:48	53.9	40.4	0.0	5.7	65.0	66.0
Average		**53.8**	**41.1**	**0.0**	**5.1**	**55.1**	**57.6**
HLGW0060							
January	---	---	---	---	---	---	---
February	---	---	---	---	---	---	---
March	3/18/20 3:51 PM	23.6	18.9	0.0	57.5	6.0	1.0
April	---	---	---	---	---	---	---
May	---	---	---	---	---	---	---
June	12/6/20 12:40	12.3	17.8	6.9	63.0	7.0	2.0
July	07/25/2020 13:11	5.0	11.9	9.9	73.2	0.0	0.0
August	---	---	---	---	---	---	---
September	---	---	---	---	---	---	---
October	---	---	---	---	---	---	---
November	---	---	---	---	---	---	---
December	12/30/20 18:54	13.2	9.3	8.6	68.9	0.0	1.0
Average		**13.5**	**14.5**	**6.4**	**65.7**	**3.3**	**1.0**
HLGW0061							
January	---	---	---	---	---	---	---
February	---	---	---	---	---	---	---
March	3/18/20 3:54 PM	8.2	22.3	0.0	69.5	1.0	1.0
April	---	---	---	---	---	---	---
May	---	---	---	---	---	---	---
June	9/6/20 10:32	25.5	27.8	2.2	44.5	1.0	2.0
July	07/25/2020 13:14	15.5	20.4	6.1	58.0	2.0	1.0
August	---	---	---	---	---	---	---
September	09/30/2020 12:27	25.7	27.4	2.8	44.1	0.0	0.0
October	---	---	---	---	---	---	---
November	12/2/20 20:01	28.0	28.0	3.5	40.5	4.0	3.0
December	12/30/20 18:58	18.2	26.4	0.0	55.4	1.0	1.0
Average		**20.2**	**25.4**	**2.4**	**52.0**	**1.5**	**1.3**

Appendix B2, continued

Month	Date	CH4 %	CO2 %	O2 %	Balance %	Init. Flow SCFM	Adj. Flow SCFM
HLGW0062							
January	11/1/20 13:54	57.3	41.9	0.0	0.8	26.0	29.0
February	---	---	---	---	---	---	---
March	3/18/20 3:58 PM	53.3	39.6	0.0	7.1	36.0	38.0
April	---	---	---	---	---	---	---
May	---	---	---	---	---	---	---
June	9/6/20 10:34	45.0	38.3	0.0	16.7	40.0	38.0
July	07/25/2020 13:16	46.9	38.9	0.0	14.2	38.0	38.0
August	---	---	---	---	---	---	---
September	09/30/2020 12:30	45.9	38.6	0.0	15.5	36.0	34.0
October	10/31/20 12:59 PM	44.2	38.4	0.0	17.4	35.0	33.0
November	12/2/20 19:57	44.6	37.9	0.0	17.5	35.0	34.0
December	12/30/20 19:01	49.0	39.0	0.0	12.0	32.0	32.0
Average		**48.3**	**39.1**	**0.0**	**12.7**	**34.8**	**34.5**
HLGW0063							
January	11/1/20 13:57	57.6	42.3	0.0	0.1	6.0	13.0
February	---	---	---	---	---	---	---
March	3/18/20 4:00 PM	49.1	37.6	0.0	13.3	13.0	14.0
April	---	---	---	---	---	---	---
May	---	---	---	---	---	---	---
June	9/6/20 10:37	57.6	42.3	0.0	0.1	1.0	9.0
July	07/25/2020 13:19	47.9	38.5	0.1	13.5	5.0	7.0
August	---	---	---	---	---	---	---
September	09/30/2020 12:32	52.5	39.8	0.0	7.7	4.0	8.0
October	10/31/20 1:01 PM	47.9	38.5	0.0	13.6	4.0	5.0
November	12/2/20 19:49	58.3	41.6	0.0	0.1	4.0	4.0
December	12/30/20 19:05	58.8	41.0	0.0	0.2	5.0	6.0
Average		**53.7**	**40.2**	**0.0**	**6.1**	**5.3**	**8.3**
HLGW064B							
January	---	---	---	---	---	---	---
February	---	---	---	---	---	---	---
March	---	---	---	---	---	---	---
April	---	---	---	---	---	---	---
May	---	---	---	---	---	---	---
June	---	---	---	---	---	---	---
July	---	---	---	---	---	---	---
August	---	---	---	---	---	---	---
September	---	---	---	---	---	---	---
October	---	---	---	---	---	---	---
November	12/2/20 19:29	53.7	40.9	0.3	5.1	19.0	21.0
December	---	---	---	---	---	---	---
Average		**53.7**	**40.9**	**0.3**	**5.1**	**19.0**	**21.0**

Appendix B2, continued

Month	Date	CH4 %	CO2 %	O2 %	Balance %	Init. Flow SCFM	Adj. Flow SCFM
HLGW065B							
January	---	---	---	---	---	---	---
February	---	---	---	---	---	---	---
March	---	---	---	---	---	---	---
April	---	---	---	---	---	---	---
May	---	---	---	---	---	---	---
June	---	---	---	---	---	---	---
July	---	---	---	---	---	---	---
August	8/21/20 5:39 PM	54.4	45.3	0.1	0.2	18.0	22.0
September	09/30/2020 12:08	52.7	42.8	0.0	4.5	7.0	13.0
October	10/31/20 12:45 PM	49.3	41.1	0.0	9.6	16.0	19.0
November	---	---	---	---	---	---	---
December	12/30/20 19:25	57.4	42.5	0.0	0.1	18.0	21.0
Average		**53.5**	**42.9**	**0.0**	**3.6**	**14.8**	**18.8**
HLGW066B							
January	---	---	---	---	---	---	---
February	---	---	---	---	---	---	---
March	---	---	---	---	---	---	---
April	---	---	---	---	---	---	---
May	---	---	---	---	---	---	---
June	44141.53	55.0	43.9	0.0	1.1	7.0	12.0
July	07/25/2020 12:59	52.9	44.0	0.0	3.1	15.0	19.0
August	8/20/20 11:37 AM	51.6	43.1	0.0	5.3	18.0	23.0
September	09/30/2020 12:05	54.0	45.2	0.0	0.8	27.0	31.0
October	10/31/20 12:43 PM	52.7	42.4	0.0	4.9	27.0	30.0
November	44167.81	56.4	41.6	0.1	1.9	32.0	33.0
December	44195.81	58.1	41.8	0.0	0.1	23.0	26.0
Average		**54.4**	**43.1**	**0.0**	**2.5**	**21.3**	**24.9**
HLGW067B							
January	---	---	---	---	---	---	---
February	---	---	---	---	---	---	---
March	---	---	---	---	---	---	---
April	---	---	---	---	---	---	---
May	---	---	---	---	---	---	---
June	9/6/20 10:11	47.3	43.5	0.1	9.1	11.0	17.0
July	07/25/2020 12:56	46.2	42.3	0.3	11.2	16.0	16.0
August	8/20/20 11:34 AM	45.1	40.8	0.6	13.5	17.0	19.0
September	09/30/2020 12:02	51.0	42.4	0.4	6.2	21.0	24.0
October	10/31/20 12:40 PM	49.3	40.0	0.9	9.8	18.0	19.0
November	12/2/20 19:36	46.2	37.4	1.3	15.1	6.0	8.0
December	---	---	---	---	---	---	---
Average		**47.5**	**41.1**	**0.6**	**10.8**	**14.8**	**17.2**

Appendix B2, continued

Month	Date	CH4 %	CO2 %	O2 %	Balance %	Init. Flow SCFM	Adj. Flow SCFM
HLGW068B							
January	---	---	---	---	---	---	---
February	---	---	---	---	---	---	---
March	---	---	---	---	---	---	---
April	---	---	---	---	---	---	---
May	---	---	---	---	---	---	---
June	9/6/20 10:14	54.2	45.7	0.0	0.1	25.0	30.0
July	07/25/2020 12:53	53.1	44.8	0.1	2.0	30.0	35.0
August	8/20/20 11:32 AM	52.4	43.8	0.1	3.7	35.0	37.0
September	09/30/2020 12:00	50.1	40.1	0.7	9.1	14.0	13.0
October	10/31/20 12:36 PM	30.8	29.3	5.2	34.7	8.0	7.0
November	12/2/20 19:41	8.0	22.6	5.0	64.4	7.0	7.0
December	12/30/20 20:05	47.3	33.2	0.4	19.1	6.0	3.0
Average		**42.3**	**37.1**	**1.6**	**19.0**	**17.9**	**18.9**
RWHGW01A							
January	---	---	---	---	---	---	---
February	---	---	---	---	---	---	---
March	---	---	---	---	---	---	---
April	---	---	---	---	---	---	---
May	---	---	---	---	---	---	---
June	---	---	---	---	---	---	---
July	---	---	---	---	---	---	---
August	---	---	---	---	---	---	---
September	---	---	---	---	---	---	---
October	---	---	---	---	---	---	---
November	11/20/20 18:40	31.7	31.8	0.9	35.6	4.0	4.0
December	12/31/20 14:45	36.1	33.8	0.9	29.2	3.0	2.0
Average		**33.9**	**32.8**	**0.9**	**32.4**	**3.5**	**3.0**
RWHGW01B							
January	---	---	---	---	---	---	---
February	---	---	---	---	---	---	---
March	---	---	---	---	---	---	---
April	---	---	---	---	---	---	---
May	---	---	---	---	---	---	---
June	---	---	---	---	---	---	---
July	---	---	---	---	---	---	---
August	---	---	---	---	---	---	---
September	---	---	---	---	---	---	---
October	---	---	---	---	---	---	---
November	11/21/20 13:20	16.5	17.5	8.1	57.9	1.0	1.0
December	---	---	---	---	---	---	---
Average		**16.5**	**17.5**	**8.1**	**57.9**	**1.0**	**1.0**

Note: <<>> = under or over range of instrument

Appendix B3 2020 Hartland Landfill Gas Well Field Data Summary

Name	Refuse Lift (mASL)	Year Activated	Average Methane (% by vol)	Average Flow (scfm)	Months in Operation	Methane Annual Flow (scf)	Methane Flow (m3)	Energy (GJ)	Well Production (% of Total)	Cumulative Total (%)
HLGW016B	163	2012	52.9	146.4	9	30,521,590	864,280	31,028	9.51%	9.51%
HLGW028A	171	2017	54.0	58.4	11	15,168,599	429,529	15,420	4.73%	14.24%
HLGW021B	165	2013	52.0	47.7	11	11,961,295	338,708	12,160	3.73%	17.97%
HLGW0059	155(3)	2019	53.8	55.1	9	11,679,126	330,718	11,873	3.64%	21.61%
HLGW0058	155(3)	2019	57.3	47.8	9	10,781,786	305,308	10,961	3.36%	24.97%
HLGW0057	155(3)	2019	56.4	48.0	9	10,674,340	302,265	10,851	3.33%	28.30%
HLGW032B	171	2014	53.3	31.1	11	7,974,308	225,808	8,107	2.49%	30.79%
HLGW0062	155(3)	2019	48.3	34.8	8	5,874,936	166,361	5,972	1.83%	32.62%
HLGW047A	179	2017	50.1	24.2	11	5,828,559	165,047	5,925	1.82%	34.43%
HLGW0037	175	2017	54.2	21.6	11	5,646,929	159,904	5,741	1.76%	36.20%
HLGW027A	171	2017	52.2	21.2	11	5,321,518	150,689	5,410	1.66%	37.85%
HLGW0052	151(3)	2018	49.3	34.6	7	5,227,280	148,021	5,314	1.63%	39.48%
VLGW021D	---	1997	49.0	29.0	8	4,977,471	140,947	5,060	1.55%	41.04%
HLGW034B	171	2014	46.9	21.5	11	4,848,120	137,284	4,929	1.51%	42.55%
HLGW040A	175	2017	50.7	18.6	11	4,546,595	128,746	4,622	1.42%	43.96%
HLGW028B	171	2015	56.5	16.6	11	4,525,491	128,148	4,601	1.41%	45.37%
HLGW029A	171	2017	54.3	16.7	11	4,370,819	123,768	4,443	1.36%	46.74%
HLGW033A	171	2014	46.7	19.0	11	4,274,332	121,036	4,345	1.33%	48.07%
HLGW030B	171	2014	57.4	14.9	11	4,122,856	116,747	4,191	1.29%	49.35%
HLGW031B	171	2014	48.3	17.5	11	4,061,903	115,021	4,129	1.27%	50.62%
HLGW042B	175	2017	55.1	15.2	11	4,025,478	113,989	4,092	1.25%	51.88%
HLGW041B	175	2017	53.5	15.4	11	3,954,644	111,984	4,020	1.23%	53.11%
HLGW049B	179	2018	49.7	16.2	11	3,876,229	109,763	3,940	1.21%	54.32%
HLGW038B	175	2017	52.1	15.1	11	3,789,314	107,302	3,852	1.18%	55.50%
VLGW019S	---	1997	48.0	16.3	11	3,770,392	106,766	3,833	1.18%	56.67%
HLGW051B	179	2017	46.5	16.2	11	3,621,214	102,542	3,681	1.13%	57.80%
HLGW008B	143	2006	41.1	20.0	10	3,597,512	101,871	3,657	1.12%	58.92%
HLGW066B	---	---	54.4	21.3	7	3,547,376	100,451	3,606	1.11%	60.03%
HLGW0023	165	2013	49.4	14.5	11	3,458,782	97,942	3,516	1.08%	61.11%
HLGW023B	165	2013	49.4	14.5	11	3,458,782	97,942	3,516	1.08%	62.19%
HLGW008A	143	2006	45.8	15.5	11	3,409,076	96,535	3,466	1.06%	63.25%
HLGW027B	171	2015	42.6	16.1	11	3,299,389	93,429	3,354	1.03%	64.28%
HLGW050B	179	2018	48.7	13.8	11	3,238,055	91,692	3,292	1.01%	65.29%

Appendix B3, continued

Name	Refuse Lift (mASL)	Year Activated	Average Methane (% by vol)	Average Flow (scfm)	Months in Operation	Methane Annual Flow (scf)	Methane Flow (m3)	Energy (GJ)	Well Production (% of Total)	Cumulative Total (%)
HLGW0055	151(3)	2018	48.6	16.8	9	3,214,014	91,011	3,267	1.00%	66.29%
HLGW039A	175	2017	49.6	13.0	11	3,105,513	87,939	3,157	0.97%	67.26%
HLGW043B	175	2017	55.0	11.5	11	3,060,281	86,658	3,111	0.95%	68.21%
VLGW0051	---	2011	48.5	13.1	11	3,057,889	86,590	3,109	0.95%	69.16%
HLGW0026	171	2015	52.6	11.5	11	2,922,808	82,765	2,971	0.91%	70.07%
VLGW015D	---	1997	46.9	15.6	9	2,873,106	81,358	2,921	0.90%	70.97%
VLGW007D	---	1996	57.1	9.9	11	2,723,707	77,127	2,769	0.85%	71.82%
LHGW0020	159	2014	44.8	19.8	7	2,721,014	77,051	2,766	0.85%	72.67%
HLGW040B	175	2018	49.8	11.2	11	2,680,966	75,917	2,725	0.84%	73.50%
HLGW0024	171	2016	38.9	17.4	9	2,659,846	75,319	2,704	0.83%	74.33%
HLGW044A	179	2017	52.3	10.4	11	2,610,466	73,921	2,654	0.81%	75.15%
VLGW0052	---	2011	46.0	12.8	10	2,575,850	72,940	2,619	0.80%	75.95%
VLGW016D	---	1997	52.2	9.4	11	2,354,480	66,672	2,394	0.73%	76.68%
VLGW0056	---	2011	41.8	12.7	10	2,322,882	65,777	2,361	0.72%	77.41%
HLGW068B	---	---	42.3	17.9	7	2,313,093	65,500	2,351	0.72%	78.13%
HLGW0025	171	2016	51.6	9.9	10	2,234,953	63,287	2,272	0.70%	78.82%
LHGW0019	---	2014	41.8	15.3	8	2,231,066	63,177	2,268	0.70%	79.52%
VLGW017S	---	1997	60.0	7.4	11	2,138,344	60,551	2,174	0.67%	80.19%
HLGW0018	165	2013	56.0	10.8	8	2,108,252	59,699	2,143	0.66%	80.84%
VLGW029D	---	1997	43.1	12.1	9	2,054,432	58,175	2,088	0.64%	81.48%
VLGW003D	---	1996	48.0	8.6	11	1,986,651	56,256	2,020	0.62%	82.10%
HLGW067B	---	---	47.5	14.8	6	1,851,280	52,423	1,882	0.58%	82.68%
HLGW039B	175	2017	43.0	9.7	10	1,830,644	51,838	1,861	0.57%	83.25%
VLGW023D	---	1997	49.3	7.5	11	1,768,710	50,085	1,798	0.55%	83.80%
LHGW0013	151	2011	48.4	9.1	9	1,738,977	49,243	1,768	0.54%	84.35%
VLGW042S	---	2003	47.5	7.5	11	1,724,217	48,825	1,753	0.54%	84.88%
VLGW027D	---	1997	43.9	9.3	9	1,613,058	45,677	1,640	0.50%	85.39%
VLGW0054	---	2011	45.0	7.9	10	1,557,809	44,112	1,584	0.49%	85.87%
VLGW019D	---	1997	46.6	6.7	11	1,504,625	42,606	1,530	0.47%	86.34%
HLGW022B	165	2013	41.9	8.2	10	1,500,721	42,496	1,526	0.47%	86.81%
VLGW0055	---	2011	48.0	6.5	11	1,491,604	42,238	1,516	0.46%	87.27%
VLGW008S	---	1996	52.4	6.5	10	1,490,235	42,199	1,515	0.46%	87.74%
VLGW0049	---	2011	52.8	7.1	9	1,476,128	41,800	1,501	0.46%	88.20%
VLGW023S	---	1997	48.0	7.0	10	1,471,988	41,682	1,496	0.46%	88.66%
HLGW065B	---	---	53.5	14.8	4	1,380,498	39,092	1,403	0.43%	89.09%

Appendix B3, continued

Name	Refuse Lift (mASL)	Year Activated	Average Methane (% by vol)	Average Flow (scfm)	Months in Operation	Methane Annual Flow (scf)	Methane Flow (m3)	Energy (GJ)	Well Production (% of Total)	Cumulative Total (%)
HLGW0014	155	2011	38.8	13.3	6	1,357,056	38,428	1,380	0.42%	89.51%
VLGW024D	---	1997	54.5	5.6	10	1,336,289	37,840	1,358	0.42%	89.93%
VLGW006D	---	1996	45.7	7.3	9	1,320,083	37,381	1,342	0.41%	90.34%
HLGW0053	151(3)	2018	50.0	6.4	9	1,268,658	35,925	1,290	0.40%	90.73%
VLGW026S	---	1997	48.4	5.8	10	1,224,172	34,665	1,244	0.38%	91.11%
VLGW011S	---	1996	38.8	6.0	10	1,019,893	28,880	1,037	0.32%	91.43%
VLGW007S	---	1996	48.1	4.4	11	1,018,160	28,831	1,035	0.32%	91.75%
HLGW0063	155(3)	2019	53.7	5.3	8	987,554	27,965	1,004	0.31%	92.06%
VLGW032S	---	1997	45.7	6.9	7	960,533	27,199	976	0.30%	92.36%
VLGW017D	---	1997	50.9	4.3	10	957,441	27,112	973	0.30%	92.66%
HLGW029B	171	2015	50.3	3.8	11	920,075	26,054	935	0.29%	92.94%
VLGW018D	---	1997	44.5	4.2	10	814,299	23,058	828	0.25%	93.20%
VLGW009S	---	1996	47.4	3.6	10	746,421	21,136	759	0.23%	93.43%
VLGW001D	---	1996	50.0	3.8	9	744,341	21,077	757	0.23%	93.66%
VLGW015S	---	1997	46.1	4.0	9	726,034	20,559	738	0.23%	93.89%
VLGW026D	---	1997	48.8	3.3	10	712,381	20,173	724	0.22%	94.11%
VLGW008D	---	1996	41.5	3.9	10	708,204	20,054	720	0.22%	94.33%
HLGW0036	175	2017	42.6	3.6	10	670,919	18,998	682	0.21%	94.54%
HLGW044B	179	2017	34.4	5.3	8	641,955	18,178	653	0.20%	94.74%
VLGW021S	---	1997	48.6	3.0	10	638,779	18,088	649	0.20%	94.94%
VLGW029S	---	1997	46.8	3.9	8	632,007	17,897	642	0.20%	95.14%
VLGW018S	---	1997	40.9	3.5	10	627,211	17,761	638	0.20%	95.33%
VLGW012S	---	1996	38.8	3.6	10	612,036	17,331	622	0.19%	95.52%
VLGW043S	---	2003	48.5	4.6	6	585,986	16,593	596	0.18%	95.70%
VLGW020D	---	1997	45.1	4.8	6	567,967	16,083	577	0.18%	95.88%
HLGW047B	179	2018	27.2	7.8	6	559,975	15,857	569	0.17%	96.06%
LHGW0023	159	2011	43.7	4.1	7	554,229	15,694	563	0.17%	96.23%
HLGW0012	147	2010	38.8	4.0	8	543,678	15,395	553	0.17%	96.40%
HLGW0013	147	2010	39.3	3.4	9	523,014	14,810	532	0.16%	96.56%
LHGW0022	159	2014	42.7	3.9	7	504,694	14,291	513	0.16%	96.72%
HLGW042A	175	2017	51.1	5.5	4	491,889	13,929	500	0.15%	96.87%
VLGW005S	---	1996	56.3	2.7	7	468,087	13,255	476	0.15%	97.02%
VLGW006S	---	1996	47.2	2.4	9	454,185	12,861	462	0.14%	97.16%
HLGW064B	---	---	53.7	19.0	1	446,647	12,648	454	0.14%	97.30%
VLGW009D	---	1996	51.1	2.2	9	443,074	12,547	450	0.14%	97.44%

Appendix B3, continued

Name	Refuse Lift (mASL)	Year Activated	Average Methane (% by vol)	Average Flow (scfm)	Months in Operation	Methane Annual Flow (scf)	Methane Flow (m3)	Energy (GJ)	Well Production (% of Total)	Cumulative Total (%)
HLGW048A	179	2017	57.6	4.3	4	428,655	12,138	436	0.13%	97.57%
VLGW0053	---	2011	45.8	2.3	9	420,946	11,920	428	0.13%	97.70%
VLGW0058	---	2011	51.9	6.0	3	409,218	11,588	416	0.13%	97.83%
VLGW003S	---	1996	46.7	2.0	10	408,549	11,569	415	0.13%	97.96%
VLGW028S	---	1997	40.5	2.9	8	405,116	11,472	412	0.13%	98.08%
VLGW022D	---	1997	39.5	3.3	7	403,031	11,413	410	0.13%	98.21%
VLGW013D	---	1997	46.1	3.6	5	363,253	10,286	369	0.11%	98.32%
VLGW016S	---	1997	49.8	1.6	10	356,865	10,105	363	0.11%	98.43%
VLGW013S	---	1997	45.2	3.6	5	356,319	10,090	362	0.11%	98.54%
VLGW0050	---	2011	52.5	2.1	7	344,548	9,757	350	0.11%	98.65%
VLGW031S	---	1997	33.3	4.6	5	335,280	9,494	341	0.10%	98.76%
VLGW027S	---	1997	43.0	4.3	4	319,630	9,051	325	0.10%	98.86%
VLGW0059	---	2011	49.7	3.5	4	304,287	8,616	309	0.09%	98.95%
HLGW0005	147	2003	30.5	6.7	3	267,034	7,562	271	0.08%	99.03%
VLGW022S	---	1997	34.3	2.8	6	255,010	7,221	259	0.08%	99.11%
VLGW034S	---	1997	33.6	2.7	6	235,440	6,667	239	0.07%	99.19%
HLGW0046	179	2018	27.9	3.8	5	231,724	6,562	236	0.07%	99.26%
VLGW033S	---	1997	22.4	3.0	7	206,316	5,842	210	0.06%	99.32%
HLGW0054	151(3)	2018	30.6	2.0	7	187,799	5,318	191	0.06%	99.38%
VLGW020S	---	1997	29.0	2.8	5	177,485	5,026	180	0.06%	99.44%
HLGW017B	163	2012	8.7	5.1	9	174,297	4,936	177	0.05%	99.49%
VLGW0060	---	2011	30.3	4.3	3	172,434	4,883	175	0.05%	99.55%
HLGW0045	179	2018	26.0	3.8	4	170,562	4,830	173	0.05%	99.60%
HLGW048B	179	2018	29.3	2.2	6	166,743	4,722	170	0.05%	99.65%
VLGW010S	---	1996	37.3	5.0	2	163,430	4,628	166	0.05%	99.70%
HLGW0003	139	2003	28.1	1.6	8	157,397	4,457	160	0.05%	99.75%
HLGW033B	171	2014	10.0	7.8	4	135,706	3,843	138	0.04%	99.79%
VLGW030S	---	1997	17.6	2.3	7	123,273	3,491	125	0.04%	99.83%
RWHGW01A	3	2020	33.9	3.5	2	103,880	2,942	106	0.03%	99.86%
HLGW0061	155(3)	2019	20.2	1.5	6	79,519	2,252	81	0.02%	99.89%
HLGW0060	155(3)	2019	13.5	3.3	4	76,969	2,180	78	0.02%	99.91%
HLGW032A	171	2014	20.2	7.0	1	61,899	1,753	63	0.02%	99.93%
HLGW034A	171	2014	26.6	2.5	2	58,113	1,646	59	0.02%	99.95%
HLGW030A	171	2014	24.7	2.0	2	43,251	1,225	44	0.01%	99.96%
LHGW0004	147	2003	34.7	0.7	3	30,351	859	31	0.01%	99.97%

Appendix B3, continued

Name	Refuse Lift (mASL)	Year Activated	Average Methane (% by vol)	Average Flow (scfm)	Months in Operation	Methane Annual Flow (scf)	Methane Flow (m3)	Energy (GJ)	Well Production (% of Total)	Cumulative Total (%)
HLGW0001	139	2001	28.4	1.0	2	24,865	704	25	0.01%	99.98%
HLGW050A	179	2017	43.6	1.0	1	19,086	540	19	0.01%	99.99%
HLGW031A	171	2014	3.7	11.0	1	17,817	505	18	0.01%	99.99%
HLGW051A	179	2017	32.6	1.0	1	14,271	404	15	0.00%	100.00%
RWHGW01B	3	2020	16.5	1.0	1	7,223	205	7	0.00%	100.00%
VLGW004S	---	1996	8.7	1.0	1	3,809	108	4	0.00%	100.00%
HLGW0004	147	2003	---	---	0	0	0	0	0.00%	100.00%
HLGW0009	139	2008	---	---	0	0	0	0	0.00%	100.00%
HLGW006B	159	2005	---	---	0	0	0	0	0.00%	100.00%
HLGW017A	163	2013	---	---	0	0	0	0	0.00%	100.00%
HLGW019B	165	2013	---	---	0	0	0	0	0.00%	100.00%
HLGW019C	165	2012	---	---	0	0	0	0	0.00%	100.00%
HLGW020B	165	2013	---	---	0	0	0	0	0.00%	100.00%
LHGW0003	147	2003	---	---	0	0	0	0	0.00%	100.00%
LHGW0008	143	2009	---	---	0	0	0	0	0.00%	100.00%
LHGW0021	159	2014	---	---	0	0	0	0	0.00%	100.00%
LHGW002A	147	2007	---	---	0	0	0	0	0.00%	100.00%
TLGW001A	---	---	---	---	0	0	0	0	0.00%	100.00%
TLGW001B	---	---	---	---	0	0	0	0	0.00%	100.00%
TLGW002A	---	---	---	---	0	0	0	0	0.00%	100.00%
TLGW002B	---	---	---	---	0	0	0	0	0.00%	100.00%
TLGW002C	---	---	---	---	0	0	0	0	0.00%	100.00%
VLGW001S	---	1996	---	---	2	0	0	0	0.00%	100.00%
VLGW002D	---	1996	---	---	0	0	0	0	0.00%	100.00%
VLGW002S	---	1996	---	---	0	0	0	0	0.00%	100.00%
VLGW004D	---	1996	---	---	0	0	0	0	0.00%	100.00%
VLGW0057	---	2011	---	---	0	0	0	0	0.00%	100.00%
VLGW014D	---	1997	---	---	0	0	0	0	0.00%	100.00%
VLGW014S	---	1997	---	---	0	0	0	0	0.00%	100.00%
VLGW024S	---	1997	---	---	0	0	0	0	0.00%	100.00%
VLGW025D	---	1997	---	---	0	0	0	0	0.00%	100.00%
VLGW025S	---	1997	---	---	0	0	0	0	0.00%	100.00%
VLGW047S	---	2003	---	---	0	0	0	0	0.00%	100.00%
HLGW0056	151(3)	2018	---	---	0	0	0	0	0.00%	100.00%
HLGW066A	---	---	---	---	0	0	0	0	0.00%	100.00%

Appendix B3, continued

Name	Refuse Lift (mASL)	Year Activated	Average Methane (% by vol)	Average Flow (scfm)	Months in Operation	Methane Annual Flow (scf)	Methane Flow (m3)	Energy (GJ)	Well Production (% of Total)	Cumulative Total (%)
HLGW067A	---	---	---	---	0	0	0	0	0.00%	100.00%
HLGW068A	---	---	---	---	0	0	0	0	0.00%	100.00%
HLGW0010	139	2008	0.0	0.0	0	0	0	0	0.00%	100.00%
HLGW0011	0	2008	0.0	0.0	0	0	0	0	0.00%	100.00%
HLGW0015	155	2011	0.0	0.0	0	0	0	0	0.00%	100.00%
HLGW006A	159	2005	38.5	0.0	2	0	0	0	0.00%	100.00%
HLGW016A	159	2012	0.0	0.0	0	0	0	0	0.00%	100.00%
LHGW0006	143	2009	0.0	0.0	0	0	0	0	0.00%	100.00%
LHGW0007	143	2009	0.0	0.0	0	0	0	0	0.00%	100.00%
LHGW0009	143	2012	0.0	0.0	0	0	0	0	0.00%	100.00%
LHGW0010	143	2012	0.0	0.0	0	0	0	0	0.00%	100.00%
LHGW0017	163	2012	0.0	0.0	0	0	0	0	0.00%	100.00%
VLGW005D	---	1996	52.3	0.0	7	0	0	0	0.00%	100.00%
HLGW041A	175	2017	19.9	0.0	0	0	0	0	0.00%	100.00%
HLGW043A	175	2017	35.4	0.0	0	0	0	0	0.00%	100.00%
HLGW049A	179	2017	17.9	0.0	0	0	0	0	0.00%	100.00%

APPENDIX C

Hartland Landfill Gas Collection Data

Appendix C1 Hartland Landfill Gas Collection Data

Date	Methane Daily Avg	Oxygen Daily Avg	Field Pressure ("H20)	Flare 1 Temp Avg	Flare 2 Temp Avg	Groundflare Daily Flow	Candlestick Flare 2 Daily Flow	Gen Flow	Total Flow	Comments
1-Jan-20	53.13	0.72	-28.61	80.64	525.50	0	570,354	793946	1,364,300	
2-Jan-20	54.00	0.67	-10.52	78.07	497.28	0	665,714	780480	1,446,194	
3-Jan-20	---	0.91	-23.72	288.90	331.31	188,328	629,180	578496	1,396,004	
4-Jan-20	54.10	0.76	-31.92	80.07	569.41	0	489,185	779055	1,268,240	
5-Jan-20	51.30	1.03	-31.98	75.12	670.04	0	443,980	816726	1,260,706	
6-Jan-20	51.78	0.91	-31.93	72.89	603.63	0	480,389	777376	1,257,765	
7-Jan-20	52.60	0.86	-31.98	77.70	530.95	0	473,423	793386	1,266,809	
8-Jan-20	54.08	0.81	-31.98	79.76	657.47	0	439,378	755321	1,194,699	
9-Jan-20	52.92	1.02	-31.98	75.64	697.73	0	416,523	802398	1,218,921	
10-Jan-20	51.38	1.03	-31.97	72.87	528.26	0	450,598	818859	1,269,457	
11-Jan-20	54.20	0.84	-31.92	77.14	532.20	0	492,940	785950	1,278,890	
12-Jan-20	52.87	0.93	-31.99	77.96	515.28	0	538,257	810012	1,348,269	
13-Jan-20	52.88	1.00	-32.00	75.02	482.39	0	635,244	815916	1,451,160	
14-Jan-20	50.12	1.35	-32.01	70.28	553.69	0	601,384	858851	1,460,235	
15-Jan-20	48.64	1.35	-32.00	69.85	483.52	0	605,651	868961	1,474,612	
16-Jan-20	44.18	0.86	-27.29	71.19	381.71	0	547,850	746726	1,294,576	
17-Jan-20	---	0.60	-25.91	229.61	313.73	162,080	530,162	570243	1,262,485	
18-Jan-20	48.13	1.38	-31.98	75.56	357.01	0	745,404	798108	1,543,512	
19-Jan-20	48.85	1.17	-31.99	78.96	371.91	0	689,953	855280	1,545,233	
20-Jan-20	---	0.46	-27.12	395.94	217.47	324,564	480,400	516803	1,321,767	
21-Jan-20	---	0.31	-31.97	1,553.59	32.39	1,473,457	-	0	1,473,457	
22-Jan-20	---	---	-31.97	1,552.28	33.10	1,450,094	-	0	1,450,094	
23-Jan-20	52.10	0.40	-32.18	1,551.16	33.78	1,421,382	-	0	1,421,382	
24-Jan-20	51.00	0.50	-32.69	1,551.03	33.64	1,335,184	-	0	1,335,184	
25-Jan-20	51.20	0.50	-32.05	1,516.55	37.76	1,314,219	15,918	0	1,330,137	
26-Jan-20	---	---	-32.13	1,551.43	33.60	1,393,445	-	0	1,393,445	
27-Jan-20	52.00	0.40	-32.03	1,552.88	31.55	1,407,928	-	0	1,407,928	
28-Jan-20	50.80	0.50	-32.15	1,551.73	33.66	1,427,033	-	0	1,427,033	
29-Jan-20	51.90	0.50	-32.39	1,550.59	33.70	1,400,365	-	0	1,400,365	
30-Jan-20	51.90	0.40	-32.14	1,146.36	96.15	1,006,656	362,812	0	1,369,468	
31-Jan-20	50.40	0.60	-32.78	1,552.22	34.76	1,383,081	-	0	1,383,081	

Appendix C1, continued

Date	Methane Daily Avg	Oxygen Daily Avg	Field Pressure ("H20)	Flare 1 Temp Avg	Flare 2 Temp Avg	Groundflare Daily Flow	Candlestick Flare 2 Daily Flow	Gen Flow	Total Flow	Comments
1-Feb-20	49.80	0.80	-30.83	1,466.64	33.87	1,277,683	-	0	1,277,683	
2-Feb-20	---	---	-35.11	1,529.79	30.90	1,176,407	-	0	1,176,407	
3-Feb-20	50.60	0.60	-34.85	1,545.96	32.97	1,246,230	-	0	1,246,230	
4-Feb-20	52.90	0.50	-34.85	1,549.49	31.06	1,277,834	-	0	1,277,834	
5-Feb-20	53.20	0.50	-34.65	1,550.69	33.96	1,309,256	-	0	1,309,256	
6-Feb-20	53.20	0.40	-34.45	1,548.50	33.45	1,288,062	-	0	1,288,062	
7-Feb-20	54.60	0.30	-34.64	1,550.33	33.49	1,263,553	-	0	1,263,553	
8-Feb-20	---	---	-34.64	1,550.09	33.54	1,244,660	-	0	1,244,660	
9-Feb-20	---	---	-35.03	1,550.25	28.63	1,227,030	-	0	1,227,030	
10-Feb-20	51.30	0.50	-35.13	1,549.08	32.79	1,269,303	-	0	1,269,303	
11-Feb-20	53.70	0.60	-34.50	1,551.48	33.42	1,306,266	-	0	1,306,266	
12-Feb-20	52.60	0.90	-36.57	1,464.24	30.14	1,279,241	-	0	1,279,241	
13-Feb-20	51.60	0.90	-34.34	1,452.95	33.31	1,383,543	-	0	1,383,543	
14-Feb-20	49.10	1.20	-31.32	1,525.67	32.23	1,456,788	-	0	1,456,788	
15-Feb-20	---	---	-32.03	1,551.63	29.58	1,484,542	-	0	1,484,542	
16-Feb-20	---	---	-32.02	1,553.10	32.85	1,488,618	-	0	1,488,618	
17-Feb-20	---	---	-32.01	1,552.21	31.92	1,485,181	-	0	1,485,181	---
18-Feb-20	47.90	1.10	-32.03	1,551.60	30.23	1,493,819	-	0	1,493,819	---
19-Feb-20	48.90	1.10	-32.02	1,549.36	29.24	1,496,793	-	0	1,496,793	---
20-Feb-20	48.20	0.90	-30.81	1,468.43	33.31	1,421,940	-	0	1,421,940	---
21-Feb-20	49.00	1.00	-32.02	1,551.22	27.06	1,509,058	-	0	1,509,058	---
22-Feb-20	---	---	-32.03	1,552.77	30.89	1,551,032	-	0	1,551,032	---
23-Feb-20	---	---	-24.61	1,214.43	30.15	1,268,885	-	0	1,268,885	---
24-Feb-20	48.70	1.00	-31.63	1,540.32	33.14	1,616,308	-	0	1,616,308	---
25-Feb-20	48.50	1.10	-32.04	1,578.09	32.78	1,599,040	-	0	1,599,040	---
26-Feb-20	48.60	1.10	-32.02	1,606.78	32.95	1,557,781	-	0	1,557,781	---
27-Feb-20	48.00	1.20	-32.02	1,581.32	30.37	1,554,743	-	0	1,554,743	---
28-Feb-20	49.80	1.10	-32.02	1,571.69	32.44	1,547,250	-	0	1,547,250	---
29-Feb-20	---	---	-32.02	1,551.57	33.52	1,532,834	-	0	1,532,834	---

Appendix C1, continued

Date	Methane Daily Avg	Oxygen Daily Avg	Field Pressure ("H20)	Flare 1 Temp Avg	Flare 2 Temp Avg	Groundflare Daily Flow	Candlestick Flare 2 Daily Flow	Gen Flow	Total Flow	Comments
1-Mar-20	---	---	-32.01	1,560.41	27.83	1,515,277	-	0	1,515,277	#N/A
2-Mar-20	48.60	1.10	-32.02	1,550.82	32.89	1,516,873	-	0	1,516,873	---
3-Mar-20	49.00	1.10	-32.02	1,550.10	33.96	1,517,280	-	0	1,517,280	All manual gas readings
4-Mar-20	47.40	1.30	-32.02	1,552.01	32.97	1,511,197	-	0	1,511,197	---
5-Mar-20	48.70	1.30	-32.02	1,551.67	27.74	1,509,357	-	0	1,509,357	---
6-Mar-20	48.90	1.20	-32.01	1,551.59	32.58	1,510,554	-	0	1,510,554	---
7-Mar-20	48.60	1.20	-32.01	1,551.26	27.91	1,505,901	-	0	1,505,901	---
8-Mar-20	---	---	-32.02	1,551.70	32.36	1,497,649	-	0	1,497,649	---
9-Mar-20	46.90	1.40	-33.28	1,612.76	31.41	1,434,739	-	0	1,434,739	---
10-Mar-20	48.30	1.20	-32.02	1,550.97	26.75	1,499,272	-	0	1,499,272	---
11-Mar-20	---	---	-32.01	1,551.05	33.08	1,503,050	-	0	1,503,050	---
12-Mar-20	48.00	1.10	-31.78	1,074.49	105.10	1,059,463	470,251	0	1,529,714	---
13-Mar-20	48.80	1.00	-31.62	1,095.27	101.19	1,067,746	446,680	0	1,514,426	calculated from hourly SCADA averages due to malfunction in reporting system
14-Mar-20	46.00	1.20	-31.77	1,219.90	88.14	1,213,524	330,460	0	1,543,984	calculated from hourly SCADA averages due to malfunction in reporting system
15-Mar-20	---	---	-32.02	1,550.16	28.46	1,553,063	-	0	1,553,063	calculated from hourly SCADA averages due to malfunction in reporting system
16-Mar-20	46.30	1.20	-32.01	1,549.89	25.92	1,570,036	-	0	1,570,036	---
17-Mar-20	47.70	1.30	-32.01	1,547.94	24.95	1,577,113	-	0	1,577,113	---
18-Mar-20	47.80	1.00	-31.79	1,039.49	109.28	1,002,460	510,236	0	1,512,696	---
19-Mar-20	47.60	1.00	-31.76	893.54	181.63	842,025	422,014	277899	1,541,938	calculated from hourly SCADA averages due to malfunction in reporting system
20-Mar-20	46.90	1.10	-31.66	564.63	275.52	495,860	471,989	582956	1,550,805	calculated from hourly SCADA averages due to malfunction in reporting system
21-Mar-20	48.90	0.90	-31.53	79.71	326.11	0	758,605	804571	1,563,176	calculated from hourly SCADA averages due to malfunction in reporting system
22-Mar-20	48.36	1.26	-31.53	78.40	372.76	0	658,115	908636	1,566,751	calculated from hourly SCADA averages due to malfunction in reporting system

Appendix C1, continued

Date	Methane Daily Avg	Oxygen Daily Avg	Field Pressure ("H20)	Flare 1 Temp Avg	Flare 2 Temp Avg	Groundflare Daily Flow	Candlestick Flare 2 Daily Flow	Gen Flow	Total Flow	Comments
23-Mar-20	51.50	0.70	-31.51	83.92	435.93	0	668,060	891176	1,559,236	calculated from hourly SCADA averages due to malfunction in reporting system
24-Mar-20	48.82	0.90	-28.99	345.06	357.35	277,193	530,249	643552	1,450,994	calculated from hourly SCADA averages due to malfunction in reporting system
25-Mar-20	46.37	0.80	-31.14	563.45	278.47	490,763	467,965	607073	1,565,801	calculated from hourly SCADA averages due to malfunction in reporting system
26-Mar-20	49.29	0.80	-31.52	79.55	418.67	10,345	635,777	904211	1,550,333	calculated from hourly SCADA averages due to malfunction in reporting system
27-Mar-20	49.81	0.70	-30.56	82.83	404.00	3,667	646,090	831506	1,481,263	calculated from hourly SCADA averages due to malfunction in reporting system
28-Mar-20	52.00	0.70	-26.62	82.22	313.50	0	562,831	742078	1,304,909	calculated from hourly SCADA averages due to malfunction in reporting system
29-Mar-20	51.12	---	-31.52	86.18	420.48	0	640,089	873308	1,513,397	calculated from hourly SCADA averages due to malfunction in reporting system
30-Mar-20	51.22	0.90	-31.52	81.33	440.82	0	630,163	874454	1,504,617	calculated from hourly SCADA averages due to malfunction in reporting system
31-Mar-20	50.92	0.80	-31.52	78.68	510.41	0	609,302	883319	1,492,621	calculated from hourly SCADA averages due to malfunction in reporting system

Appendix C1, continued

Date	Methane Daily Avg	Oxygen Daily Avg	Field Pressure ("H20)	Flare 1 Temp Avg	Flare 2 Temp Avg	Groundflare Daily Flow	Candlestick Flare 2 Daily Flow	Gen Flow	Total Flow	Comments
1-Apr-20	49.81	1.28	-31.51	81.36	440.90	0.00	-	817926	817,926	#N/A
2-Apr-20	---	---	-31.13	108.03	457.38	32,337.00	580,264	863037	1,475,638	---
3-Apr-20	---	---	-25.00	507.39	250.11	414,524.00	360,130	456317	1,230,971	---
4-Apr-20	50.55	1.41	-29.17	80.42	440.48	0.00	606,739	792436	1,399,175	---
5-Apr-20	51.57	1.22	-31.53	82.16	442.50	0.00	688,587	865563	1,554,150	---
6-Apr-20	50.18	1.23	-30.70	81.70	438.86	0.00	671,452	885394	1,556,846	---
7-Apr-20	48.82	1.35	-31.13	79.44	401.21	0.00	659,392	915114	1,574,506	---
8-Apr-20	---	---	-30.98	405.02	323.92	337,084.00	521,518	719392	1,577,994	---
9-Apr-20	47.94	1.25	-31.53	78.82	406.20	0.00	637,521	915644	1,553,165	---
10-Apr-20	48.83	1.23	-31.27	201.18	369.34	125,372.00	569,233	803680	1,498,285	---
11-Apr-20	47.57	1.28	-31.36	558.28	314.29	473,377.00	433,442	597792	1,504,611	---
12-Apr-20	47.71	1.24	-30.40	415.47	343.38	338,895.00	479,460	638525	1,456,880	---
13-Apr-20	---	---	-30.44	1,321.17	101.95	1,239,950.00	91,670	126256	1,457,876	---
14-Apr-20	---	---	-30.79	1,266.44	119.77	1,186,004.00	125,924	168383	1,480,311	---
15-Apr-20	---	---	-31.30	641.39	292.31	555,608.00	399,500	553984	1,509,092	---
16-Apr-20	49.21	1.16	-31.53	81.22	450.37	0.00	620,818	887984	1,508,802	---
17-Apr-20	49.49	1.20	-31.52	82.21	424.99	0.00	627,793	881316	1,509,109	---
18-Apr-20	50.83	1.31	-31.52	82.33	434.55	0.00	635,834	869556	1,505,390	---
19-Apr-20	50.45	1.31	-31.53	81.91	453.58	0.00	612,804	881403	1,494,207	---
20-Apr-20	49.59	1.42	-31.51	82.21	417.77	0.00	610,550	890880	1,501,430	---
21-Apr-20	49.65	1.32	-31.52	83.42	444.67	0.00	610,433	887876	1,498,309	---
22-Apr-20	---	0.72	-20.91	80.55	311.76	0.00	445,574	568941	1,014,515	
23-Apr-20	50.78	1.28	-31.52	85.57	383.46	0.00	642,992	869818	1,512,810	
24-Apr-20	49.56	1.27	-31.51	83.63	434.14	0.00	647,447	854555	1,502,002	
25-Apr-20	46.20	1.44	-27.88	85.49	367.79	0.00	583,710	768790	1,352,500	
26-Apr-20	50.82	1.29	-31.53	84.89	468.48	0.00	627,089	872504	1,499,593	
27-Apr-20	50.44	1.30	-31.51	84.80	486.25	0.00	618,655	877223	1,495,878	
28-Apr-20	50.01	1.31	-31.52	83.53	485.46	0.00	601,939	886523	1,488,462	
29-Apr-20	48.81	1.42	-31.52	84.04	425.82	0.00	666,247	852225	1,518,472	
30-Apr-20	45.21	0.94	-27.62	83.40	383.98	0.00	609,242	754135	1,363,377	

Appendix C1, continued

Date	Methane Daily Avg	Oxygen Daily Avg	Field Pressure ("H20)	Flare 1 Temp Avg	Flare 2 Temp Avg	Groundflare Daily Flow	Candlestick Flare 2 Daily Flow	Gen Flow	Total Flow	Comments
1-May-20	---	1.31	-30.62	146.06	402.14	58,333.00	825,798	604,954	1,489,085	
2-May-20	49.94	1.23	-31.53	84.37	421.55	0.00	643,598	888,347	1,531,945	
3-May-20	50.61	1.33	-31.52	85.35	416.43	0.00	641,319	885,974	1,527,293	
4-May-20	48.21	1.51	-31.52	81.72	460.68	0.00	611,562	918,736	1,530,298	
5-May-20	48.85	1.42	-31.52	82.55	404.44	0.00	628,945	905,259	1,534,204	
6-May-20	49.42	1.16	-31.48	81.97	422.61	0.00	661,698	894,450	1,556,148	
7-May-20	47.54	1.37	-31.52	83.55	464.68	0.00	653,140	928,523	1,581,663	
8-May-20	47.48	1.26	-31.53	83.19	421.80	0.00	696,748	890,629	1,587,377	
9-May-20	48.76	0.95	-31.53	87.99	446.43	0.00	678,664	899,063	1,577,727	
10-May-20	49.52	0.88	-31.47	88.16	392.67	0.00	698,264	888,997	1,587,261	
11-May-20	49.92	0.82	-31.46	89.64	416.96	0.00	708,840	883,915	1,592,755	
12-May-20	49.98	1.05	-31.49	86.21	397.70	0.00	704,109	886,351	1,590,460	
13-May-20	49.05	1.24	-31.52	82.26	416.81	0.00	692,319	900,067	1,592,386	
14-May-20	49.32	0.99	-31.52	84.22	403.36	0.00	656,928	891,097	1,548,025	
15-May-20	50.47	0.74	-31.53	85.95	357.44	0.00	725,207	786,111	1,511,318	
16-May-20	48.32	1.26	-25.12	82.68	305.04	0.00	553,587	685,894	1,239,481	
17-May-20	52.89	0.66	-31.52	84.87	354.23	0.00	676,680	849,234	1,525,914	
18-May-20	52.35	0.70	-31.51	84.57	380.46	0.00	651,906	862,093	1,513,999	
19-May-20	51.27	0.76	-31.52	83.05	395.58	0.00	642,971	875,411	1,518,382	
20-May-20	50.55	0.70	-31.51	85.14	431.77	0.00	634,317	880,143	1,514,460	
21-May-20	50.78	0.74	-31.50	84.10	446.42	0.00	646,118	864,680	1,510,798	
22-May-20	50.99	0.85	-31.51	81.83	466.77	0.00	641,809	874,619	1,516,428	
23-May-20	50.49	0.83	-31.50	84.01	492.87	0.00	630,992	881,840	1,512,832	
24-May-20	49.99	0.81	-31.51	84.19	434.05	0.00	630,493	885,319	1,515,812	
25-May-20	50.38	0.72	-31.51	85.42	408.99	0.00	643,291	869,734	1,513,025	
26-May-20	51.13	0.71	-31.52	84.65	413.08	0.00	639,937	867,122	1,507,059	
27-May-20	50.60	0.30	-19.70	101.72	253.55	18,150.00	461,891	508,529	988,570	
28-May-20	51.44	0.59	-31.51	85.53	412.63	0.00	680,390	843,488	1,523,878	
29-May-20	51.64	0.49	-31.52	89.96	428.79	0.00	660,086	835,457	1,495,543	
30-May-20	52.12	0.49	-31.53	89.09	405.51	0.00	661,375	841,969	1,503,344	
31-May-20	52.45	0.68	-31.52	85.80	415.07	0.00	652,454	849,268	1,501,722	

Appendix C1, continued

Date	Methane Daily Avg	Oxygen Daily Avg	Field Pressure ("H20)	Flare 1 Temp Avg	Flare 2 Temp Avg	Groundflare Daily Flow	Candlestick Flare 2 Daily Flow	Gen Flow	Total Flow	Comments
1-Jun-20	50.70	0.78	-31.50	83.92	473.38	0.00	642,481	858,839	1,501,320	
2-Jun-20	50.15	0.83	-31.52	84.51	419.12	0.00	636,970	876,059	1,513,029	
3-Jun-20	50.30	0.80	-31.51	84.77	425.57	0.00	635,434	875,960	1,511,394	
4-Jun-20	50.64	0.79	-31.52	83.65	411.46	0.00	643,598	869,420	1,513,018	
5-Jun-20	51.44	0.74	-31.51	84.81	406.18	0.00	653,599	852,420	1,506,019	
6-Jun-20	52.86	0.69	-31.36	84.66	427.10	0.00	661,234	841,710	1,502,944	
7-Jun-20	52.25	0.80	-31.42	83.84	431.53	0.00	649,383	855,141	1,504,524	
8-Jun-20	51.10	0.81	-31.52	84.83	453.65	0.00	646,899	861,690	1,508,589	
9-Jun-20	50.15	0.83	-31.51	83.49	461.21	0.00	630,038	879,071	1,509,109	
10-Jun-20	51.06	0.82	-31.52	86.45	335.22	0.00	974,675	535,142	1,509,817	
11-Jun-20	54.69	0.76	-22.84	85.39	291.30	0.00	514,844	583,450	1,098,294	
12-Jun-20	54.70	0.00	-25.16	102.45	279.84	0.00	644,213	573,438	1,217,651	
13-Jun-20	52.60	0.30	-25.96	510.49	179.04	0.00	562,928	269,196	832,124	
14-Jun-20	50.79	0.62	-31.34	519.76	306.63	0.00	530,678	555,570	1,086,248	
15-Jun-20	51.53	0.73	-31.50	88.91	424.35	0.00	657,598	851,122	1,508,720	
16-Jun-20	51.68	0.74	-31.51	89.92	375.80	0.00	713,733	793,099	1,506,832	
17-Jun-20	50.49	0.76	-31.51	89.34	426.43	0.00	641,636	864,281	1,505,917	
18-Jun-20	50.23	0.70	-31.51	91.34	407.11	0.00	653,522	867,743	1,521,265	
19-Jun-20	51.09	0.64	-31.52	91.00	389.79	0.00	678,522	852,244	1,530,766	
20-Jun-20	52.50	0.59	-31.52	91.84	380.04	0.00	690,008	837,850	1,527,858	
21-Jun-20	52.22	0.59	-31.51	93.11	386.16	0.00	677,087	845,720	1,522,807	
22-Jun-20	50.98	0.69	-31.51	92.85	472.76	0.00	662,369	859,007	1,521,376	
23-Jun-20	50.84	0.67	-31.52	91.80	370.00	0.00	672,069	858,356	1,530,425	
24-Jun-20	52.24	0.58	-31.52	93.75	363.51	0.00	683,902	839,619	1,523,521	
25-Jun-20	52.61	0.60	-28.27	92.45	360.52	0.00	656,748	716,590	1,373,338	
26-Jun-20	52.10	0.56	-31.52	93.19	384.27	0.00	686,900	843,273	1,530,173	
27-Jun-20	52.21	0.61	-31.52	92.42	401.35	0.00	683,878	843,041	1,526,919	
28-Jun-20	52.00	0.67	-31.50	92.34	467.35	0.00	677,662	844,053	1,521,715	
29-Jun-20	52.30	0.59	-31.49	90.83	411.45	0.00	674,080	846,372	1,520,452	
30-Jun-20	52.11	0.61	-31.51	93.04	439.64	0.00	670,298	846,828	1,517,126	

Appendix C1, continued

Date	Methane Daily Avg	Oxygen Daily Avg	Field Pressure ("H20)	Flare 1 Temp Avg	Flare 2 Temp Avg	Groundflare Daily Flow	Candlestick Flare 2 Daily Flow	Gen Flow	Total Flow	Comments
1-Jul-20	51.59	0.71	-31.49	92.02	498.06	0.00	659,408	834,468	1,493,876	
2-Jul-20	51.72	0.68	-31.51	92.06	485.66	0.00	662,510	828,095	1,490,605	
3-Jul-20	51.21	0.70	-31.51	89.32	452.87	0.00	654,173	825,950	1,480,123	
4-Jul-20	49.78	0.73	-31.42	200.31	352.05	131,934.00	608,157	757,026	1,497,117	
5-Jul-20	48.08	0.77	-31.10	506.31	256.37	426,310.00	645,270	612,888	1,684,468	
6-Jul-20	51.19	0.66	-31.51	91.86	397.12	0.00	668,825	861,502	1,530,327	
7-Jul-20	51.71	0.68	-31.50	92.75	429.42	0.00	667,019	850,929	1,517,948	
8-Jul-20	51.53	0.67	-31.50	90.70	441.61	0.00	654,433	833,140	1,487,573	
9-Jul-20	51.77	0.59	-31.50	89.84	416.74	0.00	671,136	844,669	1,515,805	
10-Jul-20	51.70	0.58	-31.49	91.35	383.00	0.00	707,719	879,445	1,587,164	
11-Jul-20	50.24	0.69	-31.51	91.90	382.43	0.00	714,820	905,282	1,620,102	
12-Jul-20	50.49	0.67	-31.50	93.57	322.38	0.00	869,380	904,647	1,774,027	
13-Jul-20	50.33	0.67	-31.50	90.08	331.25	0.00	863,462	903,943	1,767,405	
14-Jul-20	50.32	0.67	-31.49	90.91	297.84	0.00	864,619	910,148	1,774,767	
15-Jul-20	50.41	0.61	-31.51	93.36	291.27	0.00	865,317	918,900	1,784,217	
16-Jul-20	50.92	0.56	-31.42	94.48	286.78	0.00	851,159	909,963	1,761,122	
17-Jul-20	51.48	0.56	-31.37	94.51	311.33	0.00	845,683	885,059	1,730,742	
18-Jul-20	50.58	0.62	-31.50	92.57	290.56	0.00	1,051,044	886,202	1,937,246	
19-Jul-20	50.28	0.58	-31.52	94.11	290.11	0.00	853,717	870,654	1,724,371	
20-Jul-20	51.19	0.50	-31.50	94.51	313.68	0.00	862,354	833,384	1,695,738	
21-Jul-20	51.63	0.45	-31.51	97.26	250.89	0.00	1,048,365	838,842	1,887,207	
22-Jul-20	52.32	0.46	-31.42	95.00	301.22	0.00	868,411	825,486	1,693,897	
23-Jul-20	57.18	0.56	-31.46	96.96	282.98	0.00	971,605	756,160	1,727,765	
24-Jul-20	49.40	0.50	-31.70	142.00	---	745,584.00	502,366	422,526	1,670,476	
25-Jul-20	48.50	0.60	-31.30	140.00	---	440,628.00	713,686	586,788	1,741,102	
26-Jul-20	51.02	0.61	---	---	---	0.00	976,078	823,547	1,799,625	
27-Jul-20	52.10	0.46	-31.30	---	---	0.00	980,767	830,129	1,810,896	
28-Jul-20	51.79	0.54	-31.50	---	---	0.00	974,821	826,446	1,801,267	
29-Jul-20	51.43	0.58	-31.50	---	---	9,416.00	981,278	826,706	1,817,400	
30-Jul-20	51.58	0.49	-31.30	---	---	0.00	1,006,372	806,025	1,812,397	
31-Jul-20	51.56	1.44	-31.49	89.51	277.85	8,507.00	1,044,088	567,614	1,620,209	

Appendix C1, continued

Date	Methane Daily Avg	Oxygen Daily Avg	Field Pressure ("H20)	Flare 1 Temp Avg	Flare 2 Temp Avg	Groundflare Daily Flow	Candlestick Flare 2 Daily Flow	Gen Flow	Total Flow	Comments
1-Aug-20	51.30	0.50	-31.50	90.80	299.77	0.00	1,050,444	577,696	1,628,140	
2-Aug-20	50.36	0.60	-31.50	89.79	290.78	0.00	1,039,188	599,821	1,639,009	
3-Aug-20	50.48	0.63	-31.49	88.83	284.97	0.00	1,037,108	601,195	1,638,303	
4-Aug-20	50.16	0.63	-31.49	91.66	291.59	0.00	1,030,446	604,544	1,634,990	
5-Aug-20	50.90	0.54	-31.49	89.63	281.80	0.00	1,044,970	587,443	1,632,413	
6-Aug-20	51.81	0.54	-31.49	89.39	305.24	0.00	1,041,140	584,305	1,625,445	
7-Aug-20	50.79	0.71	-31.49	87.92	360.78	0.00	1,019,947	599,271	1,619,218	
8-Aug-20	49.00	0.60	-31.22	242.80	283.45	173,639.00	955,848	496,856	1,626,343	
9-Aug-20	---	---	-31.50	90.35	294.93	11,150.00	1,037,490	598,265	1,646,905	
10-Aug-20	49.59	0.68	-31.35	88.90	279.05	0.00	1,037,320	588,937	1,626,257	
11-Aug-20	50.97	0.62	-31.49	90.87	301.33	0.00	1,045,135	579,875	1,625,010	
12-Aug-20	---	---	-26.06	102.82	268.38	19,732.00	892,897	452,991	1,365,620	
13-Aug-20	52.10	0.40	-25.31	509.91	161.42	476,658.00	657,344	184,787	1,318,789	
14-Aug-20	49.40	0.60	-29.66	851.42	146.91	844,769.00	470,797	224,099	1,539,665	
15-Aug-20	50.61	0.62	-31.50	88.78	277.10	0.00	1,053,136	568,629	1,621,765	
16-Aug-20	51.65	0.70	-31.49	89.35	289.58	0.00	1,043,714	559,936	1,603,650	
17-Aug-20	52.09	0.67	-31.51	88.79	293.93	0.00	1,026,680	558,304	1,584,984	
18-Aug-20	51.28	0.51	-31.50	89.29	299.18	0.00	1,015,492	567,360	1,582,852	
19-Aug-20	51.05	0.54	-31.50	88.96	277.74	0.00	1,023,980	560,260	1,584,240	
20-Aug-20	51.77	0.63	-31.50	90.55	276.84	0.00	1,025,072	567,011	1,592,083	
21-Aug-20	52.16	0.62	-31.50	90.15	281.36	0.00	1,035,999	570,707	1,606,706	
22-Aug-20	51.91	0.64	-31.50	90.79	305.99	0.00	1,032,127	574,143	1,606,270	
23-Aug-20	50.29	0.66	-31.50	88.37	293.35	0.00	1,030,957	585,192	1,616,149	
24-Aug-20	51.22	0.61	-31.50	88.78	279.83	0.00	1,042,334	574,112	1,616,446	
25-Aug-20	51.32	0.62	-31.50	88.90	284.93	0.00	1,038,192	572,598	1,610,790	
26-Aug-20	51.20	0.62	-31.49	88.26	276.82	0.00	1,036,421	572,922	1,609,343	
27-Aug-20	51.17	0.62	-31.50	87.67	272.25	0.00	1,034,245	572,335	1,606,580	
28-Aug-20	51.12	0.62	-31.51	88.57	281.73	0.00	1,027,009	572,313	1,599,322	
29-Aug-20	50.97	0.64	-31.51	87.69	273.29	0.00	1,035,496	574,360	1,609,856	
30-Aug-20	50.56	0.78	-31.51	89.38	284.06	0.00	1,048,019	578,586	1,626,605	
31-Aug-20	49.83	0.79	-31.51	85.45	299.94	0.00	1,051,517	589,190	1,640,707	

Appendix C1, continued

Date	Methane Daily Avg	Oxygen Daily Avg	Field Pressure ("H20)	Flare 1 Temp Avg	Flare 2 Temp Avg	Groundflare Daily Flow	Candlestick Flare 2 Daily Flow	Gen Flow	Total Flow	Comments
1-Sep-20	50.86	0.80	-31.60	---	---	0.00	1,046,508	725,957	1,772,465	
2-Sep-20	49.80	0.70	-31.60	87.30	253.60	0.00	1,407,448	746,067	2,153,515	
3-Sep-20	50.10	0.40	-31.60	654.90	122.60	654,424.00	679,687	324,600	1,658,711	
4-Sep-20	50.30	0.40	-31.60	497.10	213.70	462,855.00	837,791	538,703	1,839,349	
5-Sep-20	50.72	0.50	-31.60	87.80	296.00	0.00	1,040,261	723,684	1,763,945	
6-Sep-20	49.80	0.60	-31.60	87.90	270.70	0.00	1,022,950	718,390	1,741,340	
7-Sep-20	50.00	0.50	-31.60	86.30	279.30	0.00	1,028,422	721,870	1,750,292	
8-Sep-20	49.95	0.50	-31.60	86.00	344.90	0.00	1,017,729	720,328	1,738,057	
9-Sep-20	50.25	0.50	-31.60	84.10	290.70	0.00	1,033,548	728,162	1,761,710	
10-Sep-20	51.32	1.10	-31.60	82.90	283.30	0.00	1,188,797	722,205	1,911,002	
11-Sep-20	51.41	1.40	-31.60	84.90	278.90	0.00	1,032,925	710,063	1,742,988	
12-Sep-20	51.20	0.50	-31.60	86.70	262.40	0.00	1,036,372	708,937	1,745,309	
13-Sep-20	50.79	0.50	-31.60	91.20	262.70	0.00	1,042,748	693,373	1,736,121	
14-Sep-20	51.10	0.50	-31.60	91.00	287.20	0.00	1,039,256	689,365	1,728,621	
15-Sep-20	50.71	0.60	-31.60	89.50	277.40	0.00	1,030,170	687,386	1,717,556	
16-Sep-20	50.00	0.30	-31.30	757.40	154.20	767,098.00	672,270	375,981	1,815,349	
17-Sep-20	50.30	0.20	-31.10	1,535.30	30.60	1,638,875.00	286	53	1,639,214	
18-Sep-20	50.20	0.20	-31.20	992.90	134.30	1,019,748.00	319,450	311,842	1,651,040	
19-Sep-20	51.30	0.50	-31.60	2,277.00	8,168.20	0.00	761,280	839,272	1,600,552	
20-Sep-20	50.80	0.60	-31.00	91.40	375.20	0.00	741,812	860,544	1,602,356	
21-Sep-20	50.90	0.60	-30.80	86.00	351.00	0.00	745,656	878,775	1,624,431	
22-Sep-20	51.38	0.50	-30.50	88.80	359.80	0.00	736,306	864,143	1,600,449	
23-Sep-20	51.26	0.60	-30.70	86.00	347.20	0.00	746,292	864,446	1,610,738	
24-Sep-20	52.84	0.50	-30.00	89.00	349.60	0.00	824,337	824,963	1,649,300	
25-Sep-20	51.28	0.60	-30.90	85.60	376.90	0.00	738,845	839,678	1,578,523	
26-Sep-20	52.32	0.60	-29.80	85.20	410.00	0.00	714,729	806,389	1,521,118	
27-Sep-20	50.19	0.70	-31.10	87.30	418.60	0.00	719,188	816,924	1,536,112	
28-Sep-20	49.19	0.70	-31.50	84.80	362.50	0.00	722,818	850,307	1,573,125	
29-Sep-20	50.89	0.50	-31.10	81.50	381.80	0.00	726,000	834,614	1,560,614	
30-Sep-20	52.17	0.50	-29.90	82.20	387.60	0.00	708,015	815,370	1,523,385	

Appendix C1, continued

Date	Methane Daily Avg	Oxygen Daily Avg	Field Pressure ("H20)	Flare 1 Temp Avg	Flare 2 Temp Avg	Groundflare Daily Flow	Candlestick Flare 2 Daily Flow	Gen Flow	Total Flow	Comments
1-Oct-20	51.60	0.50	-29.70	85.30	347.50	0.00	706,251	843,337	1,549,588	
2-Oct-20	51.80	0.50	-29.90	87.70	360.80	0.00	712,871	841,005	1,553,876	
3-Oct-20	52.20	0.50	-29.70	85.10	352.40	0.00	707,697	836,119	1,543,816	
4-Oct-20	51.70	0.50	-29.90	85.10	309.10	0.00	763,870	799,052	1,562,922	
5-Oct-20	49.40	0.60	-31.50	90.40	349.50	0.00	786,129	843,774	1,629,903	
6-Oct-20	51.20	0.30	-31.50	---	---	0.00	779,216	848,718	1,627,934	
7-Oct-20	52.10	0.50	-505.60	83.00	333.20	0.00	784,631	838,198	1,622,829	
8-Oct-20	52.60	0.50	-28.70	87.40	347.10	0.00	741,344	750,497	1,491,841	
9-Oct-20	53.60	0.50	-28.50	88.80	355.80	0.00	726,423	765,878	1,492,301	
10-Oct-20	53.30	0.60	-30.10	84.20	384.20	0.00	747,013	827,679	1,574,692	
11-Oct-20	52.80	0.70	-30.50	86.90	393.30	0.00	1,023,701	534,997	1,558,698	
12-Oct-20	51.10	0.70	-31.20	82.80	372.70	0.00	751,952	848,839	1,600,791	
13-Oct-20	50.20	1.20	-31.50	82.70	400.30	0.00	737,783	865,530	1,603,313	
14-Oct-20	48.80	0.70	-26.60	369.70	312.70	0.00	707,184	672,347	1,379,531	
15-Oct-20	50.50	0.30	-30.80	86.50	376.80	296,616.00	581,200	675,756	1,553,572	
16-Oct-20	53.10	0.50	-31.50	87.00	419.20	0.00	726,365	857,188	1,583,553	
17-Oct-20	52.10	0.60	-31.40	88.20	355.90	0.00	752,362	822,860	1,575,222	
18-Oct-20	53.10	0.50	-31.50	86.10	372.40	0.00	751,283	841,661	1,592,944	
19-Oct-20	50.90	0.50	-31.50	87.20	411.00	0.00	759,193	830,341	1,589,534	
20-Oct-20	52.50	0.60	-30.50	82.50	361.60	0.00	730,352	800,436	1,530,788	
21-Oct-20	52.20	0.60	-31.20	80.30	358.20	0.00	743,865	832,138	1,576,003	
22-Oct-20	51.10	0.70	-31.30	78.90	358.40	0.00	739,611	839,264	1,578,875	
23-Oct-20	53.40	0.60	-31.50	82.80	403.10	0.00	731,528	849,777	1,581,305	
24-Oct-20	50.40	0.80	-31.20	74.60	519.40	0.00	743,019	809,654	1,552,673	
25-Oct-20	50.00	0.70	-30.80	73.60	461.30	0.00	686,404	862,874	1,549,278	
26-Oct-20	50.90	0.60	-30.20	80.80	348.20	0.00	707,262	828,361	1,535,623	
27-Oct-20	51.90	0.50	-30.10	86.30	389.00	0.00	736,684	817,392	1,554,076	
28-Oct-20	52.30	0.50	-30.80	87.40	436.20	0.00	739,012	838,054	1,577,066	
29-Oct-20	52.70	0.50	-31.50	89.60	380.40	0.00	760,033	824,371	1,584,404	
30-Oct-20	52.30	0.60	-31.50	81.60	383.90	0.00	982,682	593,217	1,575,899	
31-Oct-20	49.90	0.70	-31.50	78.90	290.10	0.00	774,342	843,252	1,617,594	

Appendix C1, continued

Date	Methane Daily Avg	Oxygen Daily Avg	Field Pressure ("H20)	Flare 1 Temp Avg	Flare 2 Temp Avg	Groundflare Daily Flow	Candlestick Flare 2 Daily Flow	Gen Flow	Total Flow	Comments
1-Nov-20	51.99	0.94	---	---	---	0.00	794,568	887,077	1,681,645	
2-Nov-20	51.77	0.59	-30.47	80.78	280.03	0.00	800,675	850,058	1,650,733	
3-Nov-20	52.72	0.58	-30.65	86.21	342.66	0.00	786,755	846,464	1,633,219	
4-Nov-20	52.44	0.57	-30.98	87.54	387.44	0.00	784,356	849,890	1,634,246	
5-Nov-20	51.12	0.59	-30.82	235.00	333.51	158,555.00	710,763	742,317	1,611,635	
6-Nov-20	52.40	0.60	-30.88	76.74	382.73	0.00	752,742	842,959	1,595,701	
7-Nov-20	52.81	0.64	-30.81	79.86	377.12	0.00	793,489	840,076	1,633,565	
8-Nov-20	50.57	0.80	-31.50	75.53	400.61	0.00	801,829	874,442	1,676,271	
9-Nov-20	51.44	0.67	-31.40	82.30	327.03	0.00	824,531	859,017	1,683,548	
10-Nov-20	49.60	0.40	-31.27	1,075.34	119.89	1,111,339.00	265,533	317,348	1,694,220	
11-Nov-20	---	0.71	-30.70	792.44	152.00	784,685.00	429,387	455,598	1,669,670	
12-Nov-20	51.50	0.30	-30.96	1,001.04	115.93	1,034,691.00	347,742	313,881	1,696,314	
13-Nov-20	51.50	0.20	-31.03	666.79	243.20	638,777.00	615,385	360,113	1,614,275	
14-Nov-20	52.53	0.62	-31.40	81.07	401.90	0.00	748,747	849,751	1,598,498	
15-Nov-20	51.87	0.67	-31.47	81.21	417.60	0.00	737,698	859,157	1,596,855	
16-Nov-20	52.98	0.55	-31.43	83.16	355.63	0.00	762,208	838,801	1,601,009	
17-Nov-20	55.79	0.51	-30.90	82.82	417.19	0.00	714,873	783,306	1,498,179	
18-Nov-20	53.96	0.62	-32.46	81.94	401.28	0.00	706,358	830,322	1,536,680	
19-Nov-20	50.37	0.86	-30.74	84.18	374.62	---	700,576	791,691	---	
20-Nov-20	50.91	0.64	-32.52	81.72	360.15	0.00	764,782	853,686	1,618,468	
21-Nov-20	51.06	0.64	-32.53	82.10	318.20	0.00	814,613	850,832	1,665,445	
22-Nov-20	53.32	0.55	-31.69	81.84	325.51	0.00	813,135	825,261	1,638,396	
23-Nov-20	52.33	0.61	-31.59	82.48	323.92	0.00	792,565	841,497	1,634,062	
24-Nov-20	53.09	0.58	-31.93	82.75	364.37	0.00	816,395	831,653	1,648,048	
25-Nov-20	51.10	0.71	-32.52	82.29	341.31	0.00	794,497	854,923	1,649,420	
26-Nov-20	49.59	0.62	-31.52	83.63	328.66	0.00	813,974	814,249	1,628,223	
27-Nov-20	51.83	0.61	-32.52	83.83	370.69	0.00	829,359	841,967	1,671,326	
28-Nov-20	50.35	0.70	-32.52	78.90	313.65	0.00	809,465	863,711	1,673,176	
29-Nov-20	52.08	0.59	-32.43	82.12	316.39	0.00	833,766	839,059	1,672,825	
30-Nov-20	51.41	0.71	-32.25	79.83	398.44	0.00	801,815	854,869	1,656,684	

Appendix C1, continued

Date	Methane Daily Avg	Oxygen Daily Avg	Field Pressure ("H20)	Flare 1 Temp Avg	Flare 2 Temp Avg	Groundflare Daily Flow	Candlestick Flare 2 Daily Flow	Gen Flow	Total Flow	Comments
1-Dec-20	49.30	0.74	-32.10	76.77	313.74	0.00	795,270	873,923	1,669,193	
2-Dec-20	51.64	0.61	-31.51	75.33	338.99	0.00	799,872	840,217	1,640,089	
3-Dec-20	50.52	0.72	-27.79	80.45	226.96	0.00	755,048	709,308	1,464,356	
4-Dec-20	51.13	0.59	-31.50	78.48	272.13	0.00	807,853	846,991	1,654,844	
5-Dec-20	52.72	0.55	-31.91	84.81	286.20	0.00	814,606	828,878	1,643,484	
6-Dec-20	48.07	1.25	-26.83	84.53	267.74	0.00	715,199	708,387	1,423,586	
7-Dec-20	52.34	0.55	-31.49	85.43	309.89	0.00	825,397	833,416	1,658,813	
8-Dec-20	52.07	0.58	-238.58	651.87	2,846.89	0.00	808,004	840,974	1,648,978	
9-Dec-20	51.01	0.82	-31.91	84.81	286.20	0.00	808,004	840,974	1,648,978	
10-Dec-20	52.27	0.98	-68.11	171.52	709.41	0.00	868,423	771,204	1,639,627	
11-Dec-20	51.37	1.07	-31.50	83.16	293.59	0.00	873,272	770,111	1,643,383	
12-Dec-20	51.22	1.08	-31.49	80.85	335.68	0.00	785,943	855,053	1,640,996	
13-Dec-20	51.89	1.04	-31.49	80.41	348.39	0.00	813,304	832,191	1,645,495	
14-Dec-20	50.68	0.98	-31.51	80.88	285.52	0.00	950,164	684,293	1,634,457	
15-Dec-20	50.46	1.20	-31.51	79.86	305.41	0.00	816,547	828,903	1,645,450	
16-Dec-20	53.54	0.84	-25.64	80.79	258.66	0.00	823,774	516,022	1,339,796	
17-Dec-20	50.31	1.02	-32.48	83.86	356.95	0.00	843,279	823,150	1,666,429	
18-Dec-20	50.80	0.90	-32.45	79.50	380.17	0.00	777,666	855,717	1,633,383	
19-Dec-20	50.69	0.91	-32.14	82.58	358.16	0.00	804,162	813,922	1,618,084	
20-Dec-20	49.84	0.91	-32.51	83.69	372.13	0.00	768,305	846,332	1,614,637	
21-Dec-20	48.00	0.75	-32.51	83.87	400.69	0.00	743,938	847,419	1,591,357	
22-Dec-20	49.48	1.16	-29.42	75.89	365.91	0.00	722,641	708,385	1,431,026	
23-Dec-20	49.95	1.09	-31.40	71.41	314.98	0.00	760,883	756,428	1,517,311	
24-Dec-20	51.91	0.92	-32.51	76.18	356.10	0.00	743,788	849,333	1,593,121	
25-Dec-20	53.47	0.82	-32.51	77.15	346.58	0.00	762,420	825,295	1,587,715	
26-Dec-20	52.12	0.88	-31.44	80.92	349.16	0.00	746,711	809,408	1,556,119	
27-Dec-20	49.66	0.88	-32.21	82.26	414.24	0.00	718,439	829,807	1,548,246	
28-Dec-20	--	--	-32.40	446.69	221.75	378,416.00	758,594	400,466	1,537,476	
29-Dec-20	47.90	0.20	-32.27	592.80	192.15	522,250.00	670,912	352,518	1,545,680	
30-Dec-20	53.47	0.77	-32.51	83.16	263.08	0.00	1,097,884	471,994	1,569,878	
31-Dec-20	51.76	0.81	-32.02	82.12	292.76	0.00	923,723	629,523	1,553,246	
Total						**101522193**	**228,139,872**	**232,548,461.00**	**559,924,313**	
Daily Average	**50.8**	**0.8**	**-33.2**			**278,907**	**625,041**	**634,944**	**1,538,254**	
scfm						**193.69**	**434.06**	**440.93**	**1,068**	
normalize to 50% methane						**196.8**	**441.06**	**448.0**	**1,085**	

APPENDIX D

Subsurface Perimeter and Foundation Probe Monitoring

D1 Subsurface Perimeter and Foundation Probe Monitoring Methodology

D2 Probe Location and Completion Information

D3 Hartland Landfill Gas Monitoring Program Gas Probe Data

Appendix D1 Subsurface Perimeter and Foundation Probe Monitoring Methodology

The following is the subsurface probe and foundation monitoring field methodology, as outlined in *Hartland Landfill Standard Operating Procedures* (2019). All monitoring is completed with a LANDTEC Gas Analyzer and Extraction Monitor (GEM) 2000+.

CALIBRATION

Prior to each monitoring event, the gas analyzer is calibrated using the calibration gases at Hartland. Prior to calibration, the gas monitor is set to Gas Analyzer (GA) mode for ambient measurements.

Methane and carbon dioxide gases are used to calibrate the methane and carbon dioxide sensors, and zero the oxygen sensor. Oxygen gas is used to calibrate the oxygen sensor and zero the methane sensor. All calibration values should be recorded on the field sheet.

MONITORING

Weather conditions, including barometric pressure, precipitation and temperature are recorded prior to commencing work.

The following monitoring procedure is followed for each gas probe:

1. Zero pressure.
2. Connect tubing to the gas sample port (ensure pump is off), open valve, wait until pressure reading stabilizes and record value.
3. Turn on pump and wait at least 200 seconds.
4. Watch for any methane or carbon dioxide spikes.
5. At the end of 200 seconds, record the gas concentrations and any spikes on the field sheet.
6. Quickly navigate to the pressure screen and record the static pressure reading (this helps determine whether the screen is plugged/open, or water is covering the screen).
7. Disconnect the tubing from the sampling port and close the gas monitoring valve.
8. Open the water level monitoring port (not all wells will have a water level monitoring port).
9. Follow the same procedure (steps 1-8) for gas probe B.
10. Once monitoring for probe B is completed measure the water level for probe A, followed by probe B.
11. Before moving to the next station, ensure that all valves are closed.

At the end of the day, check gas levels using the calibration gas and record on the field sheet.

Appendix D2 Probe Location and Completion Information

Probe	Probe Location	Well Information
East Property Boundary Perimeter Probes		
GP-1A	90 m north of main gate	Depth: 10.37 m, Screen height: 2.91 m
GP-1B	90 m north of main gate	Depth: 5.82 m, Screen height: 2.91 m
GP-2A	70 m north of GP-1	Depth: 10.61 m, Screen height: 2.91 m
GP-2B	70 m north of GP-1	Depth: 6.36 m, Screen height: 2.91 m
GP-3A	120 m north of GP-1	Depth: 10.63 m, Screen height: 2.91 m
GP-3B	120 m north of GP-1	Depth: 4.83 m, Screen height: unknown
GP-11A	20 m north of main gate in mountain biking parking lot	Depth: 10.72 m, Screen height: unknown
GP-11B	20 m north of main gate in mountain biking parking lot	Depth: 5.23 m, Screen height: unknown
GP-12A	50 m north of GP-3 along perimeter road	Depth: 9.00 m, Screen height: unknown
GP-12B	50 m north of GP-3 along perimeter road	Depth: 5.72 m, Screen height: unknown
Horizontal Subsurface Building Gas Probes		
GP-4A	South east corner of workshop	2.4 m from southeast corner of building in gravel road
GP-5A	Admin building parking lot, behind mountain bike washrooms	3 m along west side of mountain bike washroom building
GP-6A	Northeast corner of admin building	15 m west along north side of building
GP-6B	Northeast corner of admin building	15 m west along north side of building
GP-7A	Against north wall of Hartland admin office	10 m south toward southeast corner of building
GP-7B	Against wall in southwest corner of Hartland admin building	Follows 'H' pattern under building extension
GP-8A	Eastside of auto-scale building	Unknown
GP-9A	Westside of auto-scale building	Unknown
GP-13A	2 m south of Hartland workshop entrance	Unknown
GP-14A	Westside of Hartland workshop	12 m along east side of workshop
GP-17A	North corner of Hartland Interpretive Centre (monitoring initiated January 2011)	Follows building perimeter
GP-18A	Northwest corner of the contractor's workshop	Follows building perimeter

Appendix D3 Hartland Landfill Gas Monitoring Program 2020 Gas Probe Data

GAS PROBE 01A

Date	Reporting Year	Time	Pressure/Vacuum	Static water level	Exposed screen above water	Methane (CH_4)	Carbon Dioxide (Co_2)	Oxygen (O_2)	Comment
			inches of water	metres	metres	percent in air	percent in air	percent in air	
26/03/2020	2020	13:45	14	4.36	-3.10	0.0	0.0	21.1	
25/06/2020	2020	12:05	-25.0	4.59	-2.87	0.0	0.0	21.7	
28/09/2020	2020	12:30	-36.0	3.71	-3.75	0.0	0.1	20.8	

GAS PROBE 01B

Date	Reporting Year	Time	Pressure/Vacuum	Static water level	Exposed screen above water	Methane (CH_4)	Carbon Dioxide (Co_2)	Oxygen (O_2)	Comment
			inches of water	metres	metres	percent in air	percent in air	percent in air	
26/03/2020	2020	13:49	4.00	4.36	1.45	0.0	0.0	21.1	
25/06/2020	2020	12:10	-15.00	4.48	1.57	0.0	2.2	19.2	
28/09/2020	2020	12:34	-15.00	3.99	1.08	0.0	2.5	17.7	

GAS PROBE 02A

Date	Reporting Year	Time	Pressure/Vacuum	Static water level	Exposed screen above water	Methane (CH_4)	Carbon Dioxide (Co_2)	Oxygen (O_2)	Comment
			inches of water	metres	metres	percent in air	percent in air	percent in air	
26/03/2020	2020	13:36	2.00	6.01	-1.69	0.0	0.0	21.0	
25/06/2020	2020	12:23	-20.00	5.89	-1.81	0.0	0.1	21.6	Pump stopped due to vacuum (screen under water)
28/09/2020	2020	12:13	-24.00	7.13	-0.57	0.0	0.0	20.8	

GAS PROBE 02B

Date	Reporting Year	Time	Pressure/Vacuum	Static water level	Exposed screen above water	Methane (CH_4)	Carbon Dioxide (Co_2)	Oxygen (O_2)	Comment
			inches of water	metres	metres	percent in air	percent in air	percent in air	
26/03/2020	2020	13:40	5	5.54	2.09	0.0	2.4	12.5	
25/06/2020	2020	12:32	-23	6.27	2.82	0.0	5.1	8.9	
28/09/2020	2020	12:17	-15.0	6.34	2.89	0.0	5.5	15.4	

Appendix D3, continued

GAS PROBE 03A

Date	Reporting Year	Time	Pressure/Vacuum	Static water level	Exposed screen above water	Methane (CH_4)	Carbon Dioxide (Co_2)	Oxygen (O_2)	Comment
			inches of water	metres	metres	percent in air	percent in air	percent in air	
26/03/2020	2020	13:13	10.0	10.63	2.91	0.0	1.0	17.1	Dry
25/06/2020	2020	12:48	-20.0	10.63	2.91	0.0	2.1	13.4	Dry
28/09/2020		11:59	-17.0	10.48	2.76	0.0	2.2	13.3	

GAS PROBE 03B

Date	Reporting Year	Time	Pressure/Vacuum	Static water level	Exposed screen above water	Methane (CH_4)	Carbon Dioxide (Co_2)	Oxygen (O_2)	Comment
			inches of water	metres	metres	percent in air	percent in air	percent in air	
26/03/2020	2020	13:17	2.0	4.76	2.84	0.0	5.3	16.2	
25/06/2020	2020	12:15	-6.0	4.76	2.84	0.0	2.1	13.4	Dry
28/09/2020	2020	12:05	-15.0	4.24	2.32	0.0	2.8	15.7	

GAS PROBE 04A

Date	Reporting Year	Time	Pressure/Vacuum	Methane (CH_4)	Carbon Dioxide (Co_2)	Oxygen (O_2)	Comment
			inches of water	percent in air	percent in air	percent in air	
26/03/2020	2020	---	---	---	---	---	Not measured. Probe port damaged.
25/06/2020	2020	12:15	-6.0	0.0	1.6	20.2	Sample port replaced 1 week prior
28/09/2020	2020	13:00	4.0	0.0	3.3	13.0	

GAS PROBE 05A

Date	Reporting Year	Time	Pressure/Vacuum	Methane (CH_4)	Carbon Dioxide (Co_2)	Oxygen (O_2)	Comment
			inches of water	percent in air	percent in air	percent in air	
26/03/2020	2020	11:44	-10.0	0.0	0.7	20.2	
25/06/2020	2020	10:30	-7.0	0.0	0.4	21.1	
28/09/2020	2020	10:05	-14.0	0.0	1.3	19.2	

GAS PROBE 06A

Date	Reporting Year	Time	Pressure/Vacuum	Methane (CH_4)	Carbon Dioxide (Co_2)	Oxygen (O_2)	Comment
			inches of water	percent in air	percent in air	percent in air	
26/03/2020	2020	11:49	-14.0	0.0	0.9	19.9	
25/06/2020	2020	10:35	-8.0	0.0	0.4	21.1	
28/09/2020	2020	10:13	-13.0	0.0	0.4	20.4	

Appendix D3, continued

GAS PROBE 06B

Date	Reporting Year	Time	Pressure/Vacuum inches of water	Methane (CH_4) percent in air	Carbon Dioxide (Co_2) percent in air	Oxygen (O_2) percent in air	Comment
26/03/2020	2020	11:53	-20.0	0.0	1.2	19.6	
25/06/2020	2020	10:41	-12.0	0.0	0.3	21.2	
28/09/2020	2020	10:17	-13.0	0.0	0.3	20.5	

GAS PROBE 07A

Date	Reporting Year	Time	Pressure/Vacuum inches of water	Methane (CH_4) percent in air	Carbon Dioxide (Co_2) percent in air	Oxygen (O_2) percent in air	Comment
26/03/2020	2020	11:57	-19.0	0.0	0.2	20.8	
25/06/2020	2020	10:45	-13.0	0.0	0.0	21.5	
28/09/2020	2020	10:33	-7.0	0.0	0.3	20.6	

GAS PROBE 7B

Date	Reporting Year	Time	Pressure/Vacuum inches of water	Methane (CH_4) percent in air	Carbon Dioxide (Co_2) percent in air	Oxygen (O_2) percent in air	Comment
26/03/2020	2020	12:04	-20.0	0.0	0.0	21.0	
25/06/2020	2020	10:51	-15.0	0.0	0.1	21.5	
28/09/2020	2020	10:37	-14.0	0.0	0.3	20.5	

GAS PROBE 08A

Date	Reporting Year	Time	Pressure/Vacuum inches of water	Methane (CH_4) percent in air	Carbon Dioxide (Co_2) percent in air	Oxygen (O_2) percent in air	Comment
26/03/2020	2020	12:14	11.0	0.0	0.1	20.9	
25/06/2020	2020	10:56	-16.0	0.0	0.2	21.4	
28/09/2020	2020	10:43	-16.0	0.0	0.2	20.6	

GAS PROBE 09A

Date	Reporting Year	Time	Pressure/Vacuum inches of water	Methane (CH_4) percent in air	Carbon Dioxide (Co_2) percent in air	Oxygen (O_2) percent in air	Comment
26/03/2020	2020	12:19	10.0	0.0	0.1	21.0	
25/06/2020	2020	11:02	-17.0	0.0	0.1	21.5	
28/09/2020	2020	10:48	-17.0	0.0	0.3	20.4	

Appendix D3, continued

GAS PROBE 11A

Date	Reporting Year	Time	Pressure/Vacuum	Static water level	Exposed screen above water	Methane (CH_4)	Carbon Dioxide (Co_2)	Oxygen (O_2)	Comment
			inches of water	metres	metres	percent in air	percent in air	percent in air	
26/03/2020	2020	12:28	10.0	4.88	-2.93	0.0	0.0	21.1	
25/06/2020	2020	11:10	-13.0	5.33	-2.48	0.0	0.0	21.8	
28/09/2020	2020	10:58	-20.0	6.15	-1.66	0.0	0.1	20.6	

GAS PROBE 11B

Date	Reporting Year	Time	Pressure/Vacuum	Static water level	Exposed screen above water	Methane (CH_4)	Carbon Dioxide (Co_2)	Oxygen (O_2)	Comment
			inches of water	metres	metres	percent in air	percent in air	percent in air	
26/03/2020	2020	12:32	5.0	4.92	2.60	0.0	2.0	19.2	
25/06/2020	2020	11:14	-16.0	5.25	2.93	0.0	2.1	19.8	
28/09/2020	2020	11:02	-14.0	5.57	3.25	0.0	1.9	17.9	

GAS PROBE 12A

Date	Reporting Year	Time	Pressure/Vacuum	Static water level	Exposed screen above water	Methane (CH_4)	Carbon Dioxide (Co_2)	Oxygen (O_2)	Comment
			inches of water	metres	metres	percent in air	percent in air	percent in air	
26/03/2020	2020	12:56	5.0	7.71	1.62	0.0	0.0	21.0	Dry
25/06/2020	2020	13:05	-23.0	9.43	3.34	0.0	3.8	5.7	Dry
28/09/2020	2020	11:46	-15.0	10.72	4.63	0.0	5.4	7.8	

GAS PROBE 12B

Date	Reporting Year	Time	Pressure/Vacuum	Static water level	Exposed screen above water	Methane (CH_4)	Carbon Dioxide (Co_2)	Oxygen (O_2)	Comment
			inches of water	metres	metres	percent in air	percent in air	percent in air	
26/03/2020	2020	13:00	3.0	6.53	3.72	0.0	2.8	13.2	Dry
25/06/2020	2020	13:09	-20.0	6.53	3.72	0.0	9.0	9.0	Dry
28/09/2020	2020	11:42	-23.0	6.53	3.72	0.0	8.1	13.8	

Appendix D3, continued

GAS PROBE 13A

Date	Reporting Year	Time	Pressure/Vacuum inches of water	Methane (CH_4) percent in air	Carbon Dioxide (Co_2) percent in air	Oxygen (O_2) percent in air	Comment
26/03/2020	2020	13:06	---	0.0	0.9	20.3	
25/06/2020	2020	11:45	-13.0	0.0	6.0	15.3	Sample port was replaced 1 week prior
28/09/2020	2020	12:48	-1.0	0.0	2.5	17.0	

GAS PROBE 14A

Date	Reporting Year	Time	Pressure/Vacuum inches of water	Methane (CH_4) percent in air	Carbon Dioxide (Co_2) percent in air	Oxygen (O_2) percent in air	Comment
26/03/2020	2020	13:10	8.0	0.0	0.4	20.8	
25/06/2020	2020	11:52	-15.0	0.0	1.0	20.8	
28/09/2020	2020	12:53	1.0	0.0	0.6	20.0	

GAS PROBE 17A HLC

Date	Reporting Year	Time	Pressure/Vacuum inches of water	Methane (CH_4) percent in air	Carbon Dioxide (Co_2) percent in air	Oxygen (O_2) percent in air	Comment
26/03/2020	2020	14:00	8.0	0.0	0.0	21.1	
25/06/2020	2020	11:23	-15.0	0.0	0.4	21.3	
28/09/2020	2020	12:43	4.0	0.0	0.1	20.8	

GAS PROBE 18A

Date	Reporting Year	Time	Pressure/Vacuum inches of water	Methane (CH_4) percent in air	Carbon Dioxide (Co_2) percent in air	Oxygen (O_2) percent in air	Comment
26/03/2020	2020	12:46	13.0	0.0	0.1	20.8	
25/06/2020	2020	11:29	-17.0	0.0	0.2	21.2	
28/09/2020	2020	11:30	-17.0	0.0	0.3	19.7	

APPENDIX E

Grid and Hot Spot Monitoring

E1 Grid and Hot Spot Monitoring Methodology

E2 Grid and Z Point Monitoring Data

E3 Hartland Landfill Historic Z Point Data

Appendix E1 Grid and Hot Spot Monitoring Methodology

The following is the grid sampling field methodology, as outlined in *Hartland Landfill Standard Operating Procedures* (2012).

Monitoring usually takes two full days, beginning at 0730 hours and ending between 1600 and 1630. Prior to each monitoring day, the gas analyzer must be calibrated using the calibration gases at Hartland. At the beginning of each field day, the fuel cell for the Flame Ionization Detector (FID) is filled with hydrogen gas and the unit is warmed up for at least 30 minutes before calibration. Calibration is conducted with two methane span gases (currently 500 ppm and 14,990 ppm methane), and a zero gas to generate a proper calibration slope. After successful calibration, as span check is completed and recorded on the calibration sheet. In addition, the Jerome sensor is regenerated at the beginning and end of each day to remove any residual hydrogen sulphide on the gold sensor.

The Jerome analyzer is factory calibrated and, therefore, does not require field calibration. After regeneration, the instrument is turned on for 30 minutes before zeroing. Once it is zeroed, the zero filter is attached to the unit and a sample is taken.

MONITORING

There is an established walking pattern over the grid points and it denotes two distinct monitoring areas (Phase 1 and Phase 2/Active Face). These areas are monitored separately, due to the distinct differences in gas concentrations, level of landfilling activity, and placement of litter fences. This results in acquisition of data from a similar area under similar environmental conditions, as monitoring typically takes two days. In each area, the grid points are traversed alphabetically (e.g., B1, B2, B3, B4, etc.) where physically possible. In some cases, litter fences, controlled waste trenches or active filling areas limit or restrict access resulting in deviation from the standard protocol. These deviations should be recorded on the field sheet.

Weather conditions dictate when this monitoring can be completed. The FID cannot operate in rainy conditions and monitoring should be delayed until two consecutive days of dry weather are predicted. In addition, high to moderate winds blow gases away from their origin and dilute gas concentrations. These conditions are not representative of typical landfill conditions and monitoring does not take place on these days.

The following procedure is used to collect methane and H_2S readings at each grid point:

1. Place the hydrogen sulphide (H_2S) analyzer on the ground then press the “Sample” button.
2. The second staff person should place the FID intake controller 4 inches from the ground surface for 30 seconds.
3. Once the H_2S analyzer has reported a value (approximately 30 seconds), the methane value should be read from the FID and both values recorded on the field sheet.
4. The FID is programmed to alarm if methane levels exceed 100 ppm. If the alarm sounds while walking a traverse, staff must investigate the area for the source of elevated methane by means of a detailed 10-by-10 metre (m) grid. The 10-by-10 m grid should be traversed between all adjacent grid points. Obvious sources of methane include bird poles or a seam/edge of a temporary closure lining.
5. Once the source has been identified, record the source description, methane and H_2S values, as well as the location coordinates. This data represents a “hot spot” (>1,000 ppm of methane) or “Z-spot” (>12,500 ppm of methane), identified on figures 5 and 6 as a red, or purple, ‘X’, respectively.
6. If an obvious source cannot be identified, the location and data/observations from the highest localized reading should be recorded.
7. Continue with this method until all grid points, background stations, and pre-existing Z-spots have been monitored. Pre-existing Z-spots can be removed from the monitoring list if methane levels are below 1,000 ppm for three consecutive monitoring events.
8. At the end of each field day, a span check is completed on the FID and recorded on the field sheet.

Appendix E2 2020 Grid and Z Point Monitoring Data

Table 1. Hartland Landfill VOC & TRS Grid Data

July 2020		
WAYPOINT	Methane (ppm)	H_2S (ppm)
B1	0.00	0.000
B2	0.00	0.000
B3	0.00	0.000
B4	0.00	0.000
B5	0.00	0.000
B6	0.00	0.001
B7	0.00	0.000
BACK-1	0.00	0.000
BACK-10	0.00	0.000
BACK-11	0.00	0.000
BACK-12	0.00	0.000
BACK-13	0.00	0.000
BACK-20	0.00	0.000
BACK-21	0.00	0.000
BACK-6	0.00	0.000
BACK-7	0.00	0.000
C7	0.00	0.001
F1	0.00	0.000
F2	0.00	0.000
G1	0.00	0.000
G2	0.00	0.000
H1	0.00	0.000
H2	0.00	0.000
I1	0.00	0.000
I2	0.00	0.000
J1	0.00	0.000
J2	0.00	0.000
J8	0.00	0.000
K1	0.00	0.000
K2	0.00	0.000
K3	0.00	0.000
K4	0.00	0.000
K5	0.00	0.000
K7	0.00	0.000
K8	0.00	0.001
L1	0.00	0.000
L2	0.00	0.000
L6	0.00	0.000
L7	0.00	0.000
L8	0.00	0.000
M1	0.00	0.000
M2	0.00	0.000
M3	0.00	0.000
M4	0.00	0.000
M5	0.00	0.000
M6	0.00	0.000
M7	0.00	0.000

Appendix E2
Table 1, continued

July 2020		
WAYPOINT	Methane (ppm)	H_2S (ppm)
M9	0.00	0.000
N1	0.00	0.000
N2	0.00	0.000
K6	0.03	0.000
L3	0.05	0.000
B8	0.11	0.000
C9	0.11	0.000
N10	0.16	0.000
C8	0.19	0.000
C4	0.22	0.001
M11	0.22	0.001
D3	0.24	0.000
N11	0.25	0.000
C1	0.28	0.001
E2	0.29	0.000
H4	0.29	0.001
L4	0.30	0.000
C6	0.33	0.000
L11	0.35	0.000
L5	0.36	0.000
B9	0.40	0.000
C2	0.40	0.001
C5	0.42	0.001
L10	0.43	0.000
N4	0.45	0.000
F3	0.46	0.001
D6	0.47	0.000
D4	0.50	0.000
N3	0.50	0.000
D7	0.53	0.000
F4	0.60	0.002
E4	0.63	0.001
F5	0.65	0.001
C10	0.66	0.000
J5	0.66	0.002
D2	0.70	0.001
E3	0.73	0.001
B10	0.74	0.001
E5	0.74	0.002
H3	0.75	0.002
N5	0.75	0.000
G4	0.76	0.001
H5	0.78	0.002
J4	0.79	0.000
Z112	0.81	0.000
G5	0.83	0.001
L9	0.83	0.000
E6	0.85	0.001
D8	0.92	0.000
J3	0.95	0.001

Appendix E2
Table 1, continued

July 2020		
WAYPOINT	Methane (ppm)	H_2S (ppm)
D5	0.98	0.001
G3	1.01	0.001
I4	1.01	0.001
Z107	1.02	0.000
D1	1.12	0.000
Z120	1.24	0.000
D11	1.29	0.001
E7	1.30	0.002
I3	1.33	0.001
D10	1.34	0.001
F7	1.34	0.002
N8	1.50	0.002
P2	1.52	0.001
P4	1.66	0.002
N7	2.01	0.001
M8	2.05	0.000
Z101	2.05	0.000
J6	2.18	0.001
P3	2.32	0.001
Z111	2.40	0.000
C11	2.91	0.001
N9	3.03	0.002
I9	3.07	0.001
Z104	3.15	0.001
P1	3.22	0.001
D9	4.05	0.001
Z114	4.09	0.000
I10	4.60	0.000
H9	4.83	0.002
J9	4.92	0.001
C3	5.16	0.000
H7	5.17	0.001
I7	5.36	0.002
J7	5.36	0.002
K11	5.42	0.002
N6	6.01	0.000
F11	6.48	0.001
F6	7.05	0.002
F8	7.24	0.001
I6	7.34	0.002
N12	9.41	0.001
K10	10.00	0.000
H8	10.35	0.002
G9	12.03	0.002
H10	13.46	0.002
M12	13.56	0.001
G7	13.76	0.002
I8	16.80	0.002
I11	17.23	0.002
I12	20.20	0.002

Appendix E2
Table 1, continued

July 2020		
WAYPOINT	Methane (ppm)	H_2S (ppm)
G8	22.03	0.001
L12	23.97	0.000
Z116	24.00	0.000
H6	25.00	0.001
K9	30.10	0.003
Z109	33.01	0.002
E8	34.00	0.001
E9	40.00	0.002
I5	45.00	0.002
K12	51.00	0.005
Z113	65.00	0.000
E10	105.00	0.002
M13	108.00	0.000
N13	108.00	0.000
M14	124.00	0.000
G6	152.00	0.001
L14	161.00	0.000
L13	183.00	0.000
E11	189.00	0.002
G12	323.00	0.002
Z118	369.00	0.001
M10	377.00	0.001
K13	478.00	0.001
Z119	700.00	0.000
Z131	1430.00	0.000
Z130	1686.00	0.000
Z124	2043.00	0.002
Z132	2302.00	0.000
Z122	2,444.00	0.004
Z128	3400.00	---
Z106	3800.00	0.000
Z88	6816.00	0.000
Z94	8600.00	0.000
Z129	8900.00	0.003
Z126	9400.00	0.001
Z125	10100.00	0.009
Z127	21400.00	0.016
Z123	25600.00	0.000

Appendix E2, continued

Table 2. Hartland Landfill VOC from Walkabout

DATE	WAYPOINT	Methane ppm	H_2S ppm	Comments
14-17, July 2020	Z88	6816	0.000	Infrastructure hatch
14-17, July 2020	Z94	8600	0.000	Hole in tarp (rock poking out)
14-17, July 2020	Z100	1511	0.000	Hole in tarp beside black pipe, approximately 20 ft downhill of gas well
14-17, July 2020	Z101	2	0.000	Side of Bench Road between L11 to M11
14-17, July 2020	Z104	3	0.001	West face closure - Bench Road by K8
14-17, July 2020	Z106	3800	0.000	Hatch (partially buried)
14-17, July 2020	Z107	1	0.000	Edge of bench road
14-17, July 2020	Z109	33	0.002	Tarp seam along west face closure
14-17, July 2020	Z111	2	0.000	LFG infrastructure (small culvert with a 2" gas line running through it - W. face closure near gas well
14-17, July 2020	Z112	1	0.000	Edge of tarp on north side of bench road, just west of L11
14-17, July 2020	Z113	65	0.000	Hole in tarp
14-17, July 2020	Z114	4	0.000	Hole in tarp
14-17, July 2020	Z116	24	0.000	Hole in tarp could not located on March 2018 event. May be covered.
14-17, July 2020	Z118	369	0.001	Hole in tarp
14-17, July 2020	Z119	700	0.000	4 holes along LFG pipe
14-17, July 2020	Z120	1	0.000	3 large holes in tarp, 10 ft west of L14
14-17, July 2020	Z122	2444	0.004	Concrete box infrastructure with black lid
14-17, July 2020	Z123	25600	0.000	Yellow manhole lid, near Z122
14-17, July 2020	Z124	2043	0.002	Concrete box infrastructure with silver lid by road
14-17, July 2020	Z125	10100	0.009	Box adjacent to Z124, slightly south
14-17, July 2020	Z126	9400	0.001	Hatch on road, uphill of Z125
14-17, July 2020	Z127	21400	0.016	Culvert parallel to road
14-17, July 2020	Z128	3400	---	Inside casing of wells 90-1-1 and 90-2-1
14-17, July 2020	Z129	8900	0.003	Hole in tarp south of wells 90-1-1 and 90-2-1
14-17, July 2020	Z130	1686	0.000	Hole in tarp
14-17, July 2020	Z131	1430	0.000	Hole in tarp between bench roads, downhill of Z130
14-17, July 2020	Z132	2302	0.000	Hole in tarp (large rock poking through), near bench road and black pipe

Appendix E3 Hartland Landfill Historical Z-Point Data

Northing	Easting	Point	Sort Order	Created	Active?	Oct-2009	Jan-2010	Jun-2010	Jan-2011	Dec-2011	Mar-2012	May-2012	Jul-2012	Dec-2012	Mar-2013	Oct-2013	Mar-2014	Jul-2014	Mar-2015	Sep-2015	Sep-2016	Mar-2017	Aug-2017	Mar-2018	Mar-2019	Jul-2020	Source
5376376.24	465770.27	Z1	1	Apr-2001	N																						
5376382.91	465752.09	Z2	2	Apr-2001	N																						
5376390.19	465731.55	Z3	3	Apr-2001	N																						
5376404.12	465695.20	Z4	4	Apr-2001	N																						
5376409.56	465682.96	Z5	5	Apr-2001	N																						
5376307.82	465646.30	Z6	6	Apr-2001	N																						
5376379.40	465641.99	Z7	7	Apr-2001	N																						
5376358.61	465629.59	Z8	8	Apr-2001	N																						
5376294.56	465571.38	Z9	9	Apr-2001	N																						
5376288.59	465571.74	Z10	10	Apr-2001	N																						
5376301.61	465588.85	Z11	11	Apr-2001	N																						
5376153.49	465921.77	Z12	12	Apr-2001	N																						
5376069.56	465700.69	Z13	13	Jun-2003	N																						
---	---	Z14	14	n/a	N																						
---	---	Z15	15	n/a	N																						
---	---	Z16	16	n/a	N																						
---	---	Z17	17	n/a	N																						
---	---	Z18	18	n/a	N																						
---	---	Z19	19	n/a	N																						
5376240.81	465682.72	Z20	20	Dec-2001	N																						
5376249.22	465672.08	Z21	21	Nov-2002	N																						
5376140.63	465682.91	Z22	22	Dec-2001	N																						
5376199.46	465617.53	Z23	23	Dec-2001	N																						
5376344.34	465719.78	Z24	24	Dec-2001	N																						
5376341.83	465741.15	Z25	25	Dec-2001	N																						
5376332.13	465767.23	Z26	26	Dec-2001	N																						
5376157.75	465907.15	Z27	27	Jun-2003	N																						
5376127.51	465683.22	Z28	28	Jun-2003	N																						
5376305.09	465604.31	Z29	29	Nov-2003	N																						
5376154.49	465756.65	Z30	30	Nov-2003	N																						
5375849.50	465901.32	Z31	31	Dec-2004	N																						
5376179.56	465851.44	Z32	32	Dec-2004	N																						
5376200.63	465818.31	Z33	33	Dec-2004	N																						
5376157.59	465835.86	Z34	34	Dec-2004	N																						
5376147.38	465848.08	Z35	35	Dec-2004	N																						
5376099.41	465792.74	Z36	36	Dec-2004	N																						
5376298.24	465750.39	Z37	37	Dec-2004	N					15																	
5376283.62	465801.38	Z38	38	Dec-2004	N																						
5376322.83	465824.59	Z39	39	Dec-2004	N																						
5375817.05	465744.70	Z40	40	Mar-2005	N																						
5376147.36	465850.85	Z41	41	Sep-2005	N																						
5376155.19	465838.23	Z42	42	Sep-2005	N					14,400		---	1,285	1,116	1,442	667	---	565	---	4.27	10.56	DISCONTINUED					
5376256.03	465630.94	Z43	43	Mar-2005	N																						

Appendix E3, continued

Northing	Easting	Point	Sort Order	Created	Active?	Oct-2009	Jan-2010	Jun-2010	Jan-2011	Dec-2011	Mar-2012	May-2012	Jul-2012	Dec-2012	Mar-2013	Oct-2013	Mar-2014	Jul-2014	Mar-2015	Sep-2015	Sep-2016	Mar-2017	Aug-2017	Mar-2018	Mar-2019	Jul-2020	Source
5376364.18	465792.37	Z44	44	Mar-2005	N																						
5376338.64	465774.39	Z45	45	Feb-2006	N																						
5376322.08	465752.91	Z46	46	Feb-2006	N																						
5376175.39	465850.23	Z47	47	Feb-2006	N					16,700																	
5376101.47	465847.01	Z48	48	Feb-2006	N					121																	
5375901.10	465848.17	Z49	49	Feb-2006	N					13																	
5375953.93	465888.09	Z50	50	Feb-2006	N					43																	
5376100.18	465962.24	Z51	51	Feb-2006	N					3																	
5375975.37	465696.95	Z52	52	Feb-2006	N					18																	
5376194.67	465817.08	Z53	53	Feb-2006	N																						
5376112.28	465834.80	Z54	54	Feb-2007	N					56																	
5376360.04	465590.39	Z55	55	Feb-2007	N																						
5376230.52	465707.61	Z56	56	Feb-2007	N																						
5376146.42	465711.45	Z57	57	Feb-2007	N					13,500																	
5376156.98	465740.43	Z58	58	Feb-2007	N					14																	
5376179.09	465731.85	Z59	59	Feb-2007	N																						
		Z60	60	n/a	N																						
5375826.01	465743.17	Z61	61	Mar-2007	N																						
		Z62	62	n/a	N																						
5376202.48	465808.02	Z63	63	Mar-2007	N					432																	
5376222.89	465785.18	Z64	64	Mar-2007	N					61,300	1,020	23,500		467		52	53				34.34	DISCON TINUED					
5376022.24	465735.25	Z65	65	Mar-2007	N																						
5376254.13	465648.75	Z66	66	Mar-2007	N																						
5376200.88	465678.92	Z67	67	Mar-2007	N					10,100																	
5376231.00	465640.00	Z68	68	Nov-2007	N					17																	
5376259.00	465772.00	Z69	69	Mar-2008	N					2																	
5376112.00	465801.00	Z70	70	Nov-2007	N																						
5376097.00	465704.00	Z71	71	Sep-2008	N					573																	
5376153.49	465921.77	Z72	72	Sep-2008	N																						
5376307.59	465739.45	Z73	73	Sep-2008	N					3																	
5376230.77	465743.00	Z74	74	Sep-2008	N																						
5375953.74	465849.99	Z75	75	Sep-2008	N					26																	
5376050.48	465710.00	Z76	76	Feb-2009	N					33																	
5376051.20	465820.81	Z77	77	Feb-2009	N					13																	
5376222.29	465772.39	Z78	78	Feb-2009	N					97																	
5376120.72	465805.84	Z79	79	Feb-2009	N					88																	
5376199.66	465562.00	Z80	80	Oct-2009	N					26,800	13,100	48,600	21,100	15,000	12,500	14	66.1	5,048	326	5032	MISSED	MISSED	0	79	72	DISCON TINUED	
5376249.92	465708.55	Z81	81	Oct-2009	N					106																	
5376240.56	465727.11	Z82	82	Oct-2009	N																						
5376354.32	465720.64	Z83	83	Oct-2009	N					5																	
5375847.24	465856.80	Z84	84	Jan-2010	N					56		9,890	3,706	12,000	886	12	174	DISCON TINUED									
5375908.06	465797.51	Z85	85	Jan-2010	N					24																	
5376299.34	465738.10	Z86	86	Jan-2010	N					21,000	11,700	32,200	28,800	2,798	4	38	18,600	3,076	8	35	4.01	DISCON TINUED					

Appendix E3, continued

Northing	Easting	Point	Sort Order	Created	Active?	Oct-2009	Jan-2010	Jun-2010	Jan-2011	Dec-2011	Mar-2012	May-2012	Jul-2012	Dec-2012	Mar-2013	Oct-2013	Mar-2014	Jul-2014	Mar-2015	Sep-2015	Sep-2016	Mar-2017	Aug-2017	Mar-2018	Mar-2019	Jul-2020	Source
5376293.64	465535.40	Z87	87	Jan-2010	N					60,000	51,700	38,000	11,700	15,000	7,200	29	10,800	20,800	1,326	13	0.7	MISSED	10.27	MISSED	DISCON TINUED		
5376317.71	465627.16	Z88	88	Jan-2010	ACTIVE		50,000	0	2,395	15,000	22,000	15,000	10,300	15,000	8,720	3,600	41,700	8,919	10,500	15,400	15700	4,700	10,300	6,370	2,874	6,816	Infrastructure box near top of N. face closure tarp
		Z89	89		N					170																	
		Z90	90		N					3,028																	
		Z91	91		N					364																	
		Z92	92		N					1,049		15,000	19,200	52	463	DISCON TINUED											
		Z93	93		N					23		3,791				56	70.9										
5376339.03	465598.07	Z94	94	Jan-2011	ACTIVE				12,500	20,000	15,000	15,000	79,700	15,000	12,500	MISSED	23,800	73,200	42,100	41,400	134	14,000	11,300	16,700	2,859	8,600	Ripped tarp - north closure
		Z95	95		N					1,490	34,400	34,400		3	29	12	DISCON TINUED										
		Z96	96		N					927			3,668	423	261	28	DISCON TINUED										
		Z97	97		N					1,750			2,280	2	5	37	DISCON TINUED										
		Z98	98		N					5,364			1,032	7	1	1	DISCON TINUED										
		Z99	99		N					3,800					---												
5376298.15	465682.45	Z100	100		ACTIVE					2,300	15,000	15,000	10,800	15,000	12,500	1,088	18,900	314	5,685	11,200	3.21	MISSED	MISSED	MISSED	7	MISSED	
5376283.35	465708.83	Z101	101	Dec-2011	ACTIVE					11,700	23	17,800	30,900	15,000	12,500	127	14,500	17,600	2,803	28,200	52	8,500	85.81	1,400	39	2	Side of Bench Road between L11 to M11
		Z102	102		N						9,657	14,700		352	360	13	3	DISCON TINUED									
		Z103	103		N						13,700	15,000	6,400	2,531	12,500	27	5.4	DISCON TINUED									
5376171.21	465831.76	Z104	104	Mar-2012	ACTIVE						32,500	18,000	19,400	5,325	12,500	2,510	36,500	12,300	19,700	1,168	84	6,600	172	4	4	DISCON TINUED	West face closure - Bench Road by K8
		Z105	105		N							6,766	3,865	1,531	360	88	36	DISCON TINUED									
5376327.32	465654.99	Z106	106	May-2012	ACTIVE							61,300	35,700	42,000	12,500	6,566	2,693	9,300	2,072	8,086	50,300	11,000	1989	0	3950	3,800	LFG infrastructure on N. face interim closure
5376291.17	465680.05	Z107	107		ACTIVE							1,600	3,376		25	113	25,000	12,200	83	23,500	8		0	MISSED	9	1	
		Z108	108		ACTIVE										12,500	7	0.31	15,500	3								
5376181.69	465671.86	Z109	109	Dec-2012	ACTIVE									1,800	88	52	7,559	13	30,100	3	7,924	13,000	1,199	1	0	33	Tarp seam along W. face closure
		Z110	110																								
5376292.76	465689.88	Z111	111	Dec-2012	ACTIVE									138,900	10,900	4,200	53.2	26,900	385	5,270	84	1,200	1,127	2	0	2	LFG infrastructure (small culvert with a 2" gas line running through it - W. face closure near gas well
		Z112	112		ACTIVE										12,500	12	76,800	32	48,400	7,000	105		MISSED	1	0	1	
5376254.68	465641.39	Z113	113	Oct-2013	ACTIVE											9,466	5,900	30,000	31,600	MISSED	26,700	25,000	17,300	9	38	65	Hole in tarp
5376257.42	465644.69	Z114	114	Oct-2013	ACTIVE											48,400	---	34,400	11,400	MISSED	185	25,000	13,100	12	0	4	Hole in tarp
		Z115	115		ACTIVE											61,800	---	6,560	12,900	MISSED	1	MISSED	MISSED	MISSED			
5376251.73	465651.90	Z116	116	Mar-2013	ACTIVE												---	MISSED	MISSED	MISSED	MISSED	25,000	23,500	21	48	24	Hole in tarp could not located on March 2018 event. May be covered.
		Z117	117		ACTIVE												26,500	MISSED	30,700	MISSED	6	MISSED	MISSED	9	0	MISSED	
5376314.21	465611.88	Z118	118	Jul-2014	ACTIVE												12,600	3600	MISSED	9,639	10	25	1,032	1,407	0	369	Hole in tarp
5376296.43	465718.43	Z119	119	Jul-2014	ACTIVE												15,900	15,900	16,200	7,000	4,773	6,966	8,890	3,100	0	700	4 holes along LFG pipe
5376250.71	465549.48	Z120	120	Mar-2015	N														16,900	MISSED	2	17,000	-0.66	4	0	DISCON TINUED	3 large holes in tarp, 10 ft west of L14
		Z121	121		N															1,000							
5375893.77	465680.50	Z122	122	Mar-2017	ACTIVE																MISSED	8,500	7,224	MISSED	64.80	2,444	Concrete box infrastructure with black lid
5376018.60	465942.74	Z123	123	Mar-2017	ACTIVE																MISSED	8,400	365	MISSED	28747.00	25,600	Yellow manhole lid, near Z122
5376156.54	465848.29	Z124	124	Mar-2017	ACTIVE																MISSED	6,300	6,645	3,288	0.00	2,043	Concrete box infrastructure with silver lid by road
5376155.12	465848.01	Z125	125	Mar-2017	ACTIVE																MISSED	14,000	3,002	5,028	MISSED	10,100	Box adjacent to Z124, slightly South
5376147.43	465854.57	Z126	126	Mar-2019	ACTIVE																					9,400	

Appendix E3, continued

Northing	Easting	Point	Sort Order	Created	Active?	Oct-2009	Jan-2010	Jun-2010	Jan-2011	Dec-2011	Mar-2012	May-2012	Jul-2012	Dec-2012	Mar-2013	Oct-2013	Mar-2014	Jul-2014	Mar-2015	Sep-2015	Sep-2016	Mar-2017	Aug-2017	Mar-2018	Mar-2019	Jul-2020	Source
5376276.39	465621.81	Z127	127	Apr-2019	ACTIVE																					21,400	
5376286.65	465651.33	Z128	128	May-2019	ACTIVE																					3,400	
5376281.02	465652.79	Z129	129	Jun-2019	ACTIVE																					8,900	
5376282.15	465729.97	Z130	130	Jul-2019	ACTIVE																					1,686	
5376286.60	465730.09	Z131	131	Aug-2019	ACTIVE																					1,430	
5376359.74	465654.26	Z132	132	Sep-2019	ACTIVE																					2,302	
Existing hot spots surveyed						0	1	1	2	44	12	19	18	22	25	29	32	26	23	23	27	22	24	24	20	26	
Missed (m)						0	0	0	0	0	0	0	0	0	0	1	0	2	2	6	6	5	4	6	1	2	
Active z pts at start						0	1	1	2	44	12	19	18	22	25	29	32	26	23	23	27	25	24	24	23	29	
Added - new (n)						4	5	0	1	1	1	1	0	2	1	2	0	2	0	0	0	4	0	0	0	0	
Discontinued at end of survey						0	0	0	0	0	0	0	0	0	0	1	4	4	0	0	0	3	0	0	3	3	
Max Methane Concentration						0	50,000	0	12,500	61,300	51,700	61,300	79,700	138,900	12,500	61,800	76,800	73,200	48,400	41,400	50,300	25,000	23,500	16,700	28,747	25,600	

Notes:

	Methane over 1,000 ppm
	Methane under 1,000 ppm

APPENDIX F

Landfill Gas Speciation Data

F1 Hartland Monthly Gas Composition Data (March 2019-December 2020)

Appendix F1 Hartland Monthly Gas Composition Data (March 2019-December 2020)

Parameter	Date	5-Apr-19	28-May-19	3-Jul-19	27-Jul-19	15-Aug-19	23-Oct-19	31-Oct-19	21-Nov-19	26-Nov-19	9-Dec-19	12-Dec-19	29-Jan-20	28-Feb-20	25-Mar-20	1-Dec-20	Maximum	Minimum	TWA (ppm)	STEL/Ceiling (ppm)	Notations
Sulfurous gases, VOC and ammonia	**CAS**	**ppm**	**ppm**	**ppm**	**ppm**	**ppm**	**ppm**	**ppm**	**ppm**	**ppm**	**ppm**	**ppm**	**ppm**	**ppm**	**ppm**	**ppm**	**ppm**	**ppm**			
Ammonia	7664-41-7	<2.6	<3.30	<2	1.1	4.30	<0.31	<0.46	---	<0.42	<0.48	---	<0.48	0.55	0.63	<0.35	4.30	0.55	25	35	
Acetone	67-64-1	---	---	---	---	---	---	---	---	---	---	---	---	---	---	0.94	0.00	0.00	250	500	
Benzene	71-43-2	---	**7.01**	0.485	**0.613**	**0.61**	**7.887**	---	---	0.275	0.3662	---	**0.642**	0.426	**0.582**	0.43	7.89	0.28	0.5	2.5	skin; A1, 1
Bromodichloromethane	75-27-4	---	0.33	<0.0403	<0.045	<0.039	<0.021	---	---	<0.0001	<0.0004	---	<0.001	<0.0012	<0.0045	<0.0024	0.33	0.33			2B
Bromoform	75-25-2	---	0.036	<0.0005	<0.001	<0.001	<0.0813	---	---	<0.0006	<0.0006	---	<0.001	<0.0006	<0.0174	<0.0048	0.04	0.04	0.5		
4-Bromofluorobenzene	460-004	---	1027000	964000	1041000	1028000	964000	1048000	---	959000	1046000	---	982000	961000	961000	1009000	1048000	959000			
Bromomethane (Methyl bromide)	74-83-9	---	---	---	---	---	---	---	---	---	---	---	---	---	---	<0.0048	0.00	0.00	1		skin
n-butane	106-97-8	---	---	---	---	---	---	---	---	---	---	---	---	---	---	14.00	0.00	0.00		1000	EX
2-Butanone	78-93-3	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	0.00	0.00	50	100	
n-Butyl mercaptan	109-79-5	<0.004	0.010	0.0091	< 0.004	<0.004	<0.004	<0.004	---	<0.004	<0.004	---	<0.025	<0.025	<0.058	<0.0064	0.0100	0.0091	0.5		
Butyl(t) mercaptan	75-66-1	0.0544	0.093	0.0306	< 0.004	0.0462	0.0449	0.0379	---	0.053	0.0466	---	0.055	0.055	0.110	0.03	0.1100	0.0306			
Carbon Disulfide	75-15-0	<0.0499	0.055	0.0248	0.0038	0.0264	0.0351	0.0345	---	0.031	0.0257	---	0.022	0.022	0.036	0.03	0.0550	0.0038	4	12	Skin
Carbonyl sulfide	463-58-1	<1.6	0.054	0.0181	0.0199	<0.004	0.0337	0.0383	---	<0.6	<1.3	---	<0.025	<0.025	0.065	0.04	0.1	0.0	5		
Carbon Tetrachloride	56-23-5	---	<0.0043	<0.0001	<0.0001	<0.0001	<1.558	---	---	<0.0381	<0.0366	---	<0.043	<0.0445	<0.0636	<0.00048	0.00	0.00	2		skin; A2, 2B
Chlorobenzene	108-90-7	---	0.371	0.0445	0.0528	0.04	0.606	---	---	0.002	0.0367	---	0.080	0.02	0.0348	0.00	0.61	0.00	10		
Chloroethane (Ethyl chloride)	75-00-3	---	<2.08	<0.163	<0.152	<0.197	<5.305	---	---	<0.1516	<0.1099	---	<0.182	<0.1516	<1.1369	0.09	0.00	0.00	100		skin
Chloroform	67-66-3	---	<0.084	<0.0016	<0.003	<0.002	<0.057	---	---	<0.0012	<0.0012	---	<0.002	<0.0018	<0.0037	0.00	0.00	0.00	2		2B; R
Chloromethane (methyl chloride)	74-87-3	---	<14.53	<0.286	<0.533	<0.412	<1.259	---	---	<0.2663	<0.0775	---	<0.281	<0.2615	<0.4261	0.02	0.00	0.00	50	100	skin; R
Decane (nC10)	124-18-5	---	<1.72	0.3420	0.6702	0.186	3.437	---	---	<0.0086	<0.1569	---	0.563	<0.0301	<0.2578	0.02	3.44	0.19			
Dibromochloromethane	124-48-1	---	<0.387	<0.0063	<0.024	<0.020	<0.329	---	---	<0.0023	<0.0023	---	<0.002	<0.0023	<0.0704	<0.0048	0.00	0.00			
1,2-Dibromoethane (Ethylene dibromide)	106-93-4	---	---	---	---	---	---	---	---	---	---	---	---	---		<0.00024	0.00	0.00	0.5		skin; 2A
Dibromomethane	74-95-3	---	---	---	---	---	---	---	---	---	---	---	---	---		---	0.00	0.00			
Dichlorodifluoromethane	75-71-8	---	---	---	---	---	---	---	---	---	---	---	---	---		0.22	0.00	0.00	1000		
1,2-dichlorobenzene	95-50-1	---	<0.20	<0.0027	<0.005	<0.004	<0.699	---	---	<0.0050	<0.0048	---	<0.004	<0.0045	<0.1497	<0.0048	0.00	0.00	25	50	
1,3-Dichlorobenzene (o-dichlorobenzene)	541-73-1	---	<0.068	<0.0009	<0.002	<0.001	<0.233	---	---	<0.0017	<0.0016	---	<0.001	<0.0001	<0.0499	<0.0048	0.00	0.00			
1,4-dichlorobenzene (p-dichlorobenzene)	106-46-7	---	0.103	0.0318	0.076	0.014	0.266	---	---	<0.0017	0.0098	---	0.036	<0.0016	<0.0499	<0.0048	0.27	0.01	10		2B
1-1,dichloroethane	75-34-3	---	0.550	<0.0519	0.097	0.045	0.600	---	---	0.034	<0.0272	---	0.040	0.031	0.04	0.03	0.60	0.03	100		
1-2,dichloroethane (ethylene dichloride)	107-06-2	---	<0.020	<0.0011	<0.007	0.105	<1.433	---	---	<0.0494	<0.0618	---	<0.047	<0.047	<0.0791	0.07	0.11	0.11	1	2	2B
1,1-Dichloroethene (1,1-dichloroethylene)	75-35-4	---	<0.139	0.0101	0.011	0.01	0.152	---	---	0.012	<0.0098	---	0.015	0.014	0.01	0.01	0.15	0.01	1		2B
1,2-dichloroethylene (1,2-dichloroethene)	156-59-2	---	11.20	0.852	0.714	1.009	12.535	---	---	0.618	0.6179	---	0.772	0.684	0.83		12.54	0.62	200		
trans-1,2-Dichloroethene	156-60-5	---	0.522	0.0547	0.046	0.053	0.656	---	---	0.035	0.0424	---	0.108	0.075	<0.0757	0.04	0.66	0.03	200		
1,2-Dichloropropane (propylene dichloride)	78-87-5	---	0.346	<0.0368	<0.028	<0.026	<0.757	---	---	<0.0162	<0.0260	---	<0.052	<0.043	<0.0476	0.02	0.35	0.35	75	110	1; S (D)
1,3-Dichloropropene (1,3-dichloropropylene cis and trans)	542-75-6	---	<0.200	<0.0117	<0.022	<0.022	<0.156	---	---	<0.0004	<0.0013	---	<0.002	<0.002	<0.0093	<0.0048	0.00	0.00	1		skin; 2B
cis-1,3-Dichloropropylene (1,3-dichloropropene)	542-75-6	---	<0.0757	<0.00584	<0.013	<0.015	<0.151	---	---	<0.0002	<0.0002	---	<0.001	<0.0002	<0.0065	<0.0048	0.00	0.00			
trans-1,3-Dichloropropylene (1,3-dichloropropene)	542-75-6	---	<0.180	<0.0132	<0.017	<0.015	<0.030	---	---	<0.0002	<0.0013	---	<0.002	<0.0017	<0.0065	<0.0048	0.00	0.00			
Diethyl disulfide	110-81-6	<0.002	<0.0025	<0.002	<0.002	<0.002	<0.002	<0.002	---	<0.002	<0.002	---	<0.013	<0.013	<0.029	<0.0032	0.000	0.000			
Diethyl Sulfide	352-93-2	<0.004	<0.005	<0.004	<0.004	<0.004	<0.004	<0.004	---	<0.004	<0.004	---	<0.025	<0.025	<0.058	<0.0064	0.000	0.000			
Dimethyl disulfide	624-92-0	<0.002	0.0053	0.0474	<0.002	<0.002	0.0042	<0.002	---	<0.002	<0.002	---	0.04	<0.013	<0.029	<0.0032	0.0474	0.0042	0.5		skin
Dimethyl sulfide	75-18-3	0.0799	0.110	0.0023	0.0334	0.0478	0.0827	0.0703	---	0.073	0.0501	---	<0.013	0.040	0.075	0.08	0.1100	0.0023	10		
2,5-Dimethylthiophene	638-02-8	<0.004	<0.005	<0.004	<0.004	<0.004	<0.004	<0.004	---	<0.004	<0.004	---	<0.025	<0.025	<0.058	<0.0064	0.000	0.000			
Ethylbenzene	100-41-4	---	17.27	2.11	2.441	1.808	29.014	---	---	0.085	1.2757	---	2.786	0.652	1.695	0.24	29.01	0.09	20		2B
Ethyl mercaptan	75-08-1	0.0747	0.088	0.0302	<0.004	0.046	0.0494	0.0316	---	0.060	0.0605	---	0.066	0.066	0.090	0.02	0.0900	0.0302	0.5		
Ethyl Methyl Sulfide	624-89-5	<0.004	<0.002	0.0055	<0.004	<0.004	0.0053	<0.004	---	<0.004	<0.004	---	<0.025	<0.025	<0.058	<0.0064	0.006	0.005	100		skin
2-Ethylthiophene	872-55-9	<0.004	<0.005	<0.004	<0.004	<0.004	<0.004	<0.004	---	<0.004	<0.004	---	<0.025	<0.025	<0.058	<0.0064	0.000	0.000			
n-heptane	142-82-5	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	0.00	0.00	400	500	
n-hexane	110-54-3	---	**28.94**	1.756	1.5888	2.043	**24.456**	---	---	1.387	1.1632	---	1.646	1.4186	1.419	1.34	28.94	1.16	20		skin
2-Hexanone (methyl butyl ketone)	591-78-6	---	---	---	---	---	---	---	---	---	---	---	---	---	---	<0.024	0.00	0.00	5	10	skin; R

Appendix F1, continued

Parameter	Date	5-Apr-19	28-May-19	3-Jul-19	27-Jul-19	15-Aug-19	23-Oct-19	31-Oct-19	21-Nov-19	26-Nov-19	9-Dec-19	12-Dec-19	29-Jan-20	28-Feb-20	25-Mar-20	1-Dec-20	Maximum	Minimum	TWA (ppm)	STEL/Ceiling (ppm)	Notations
Isobutyl Mercaptan	513-53-1	0.0644	0.130	0.0589	<0.004	<0.004	<0.004	0.0112	---	<0.004	<0.004	---	0.054	0.054	0.12	0.06	0.1300	0.0112			
Isopropyl Mercaptan	75-33-2	0.489	0.570	0.182	<0.004	0.261	0.301	0.205	---	0.346	0.35	---	0.38	0.38	0.67	0.15	0.670	0.182			
Isopropanol	67-63-0	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	0.00	0.00	200	400	
Isopropylbenzene (cumene)	98-82-8	---	---	---	---	---	---	---	---	---	---	---	---	---	---	0.01	0.00	0.00	25	75	2B
4-Methyl-2-pentanone (methyl isobutyl ketone)	108-10-1	---	---	---	---	---	---	---	---	---	---	---	---	---	---	0.03	0.00	0.00	20	75	2B
Methyl acetate	79-20-9	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	0.00	0.00	200	250	
Methyl t-butyl ether (MTBE)	1634-04-4	---	<0.582	0.00999	<0.014	<0.012	<1.942	---	---	<0.0139	<0.0136	---	<0.013	<0.0136	<0.4161	0.01	0.01	0.01	50		
Methylene Chloride (syn: Dichloromethane)	75-09-2	---	<0.806	<0.0605	<0.052	<0.049	<0.950	---	---	<0.0576	<0.0403	---	<0.060	<0.0576	<0.0864	0.03	0.00	0.00	25		2A
Methyl mercaptan	74-93-1	0.0258	0.040	0.0108	<0.004	0.006	0.0194	0.0074	---	0.023	0.0146	---	0.047	0.047	0.06	0.02	0.0640	0.0060	0.5		
2-Methylthiophene	554-14-3	<0.004	---	0.0236	<0.004	0.0165	0.0053	<0.004	---	<0.004	<0.004	---	---	---	---	<0.0064	0.024	0.005			
3-Methylthiophene	616-44-4	<0.004	0.037	0.0283	<0.004	0.0181	0.0088	<0.004	---	<0.004	<0.004	---	<0.025	<0.025	<0.058	<0.0064	0.037	0.009			
n-nonane	111-84-2	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	0.00	0.00	200		
n-octane	111-65-9	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	0.00	0.00	300		
n-pentane	109-66-0	---	---	---	---	---	---	---	---	---	---	---	---	---	---	<5.5	0.00	0.00	1000		
phenol	108-95-2	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	0.00	0.00	5		skin
n-Propyl Mercaptan (propanethiol)	107-03-9	0.072	0.069	0.0231	<0.004	0.04	0.0368	0.021	---	0.039	0.0496	---	0.044	0.044	0.052	0.01	0.072	0.021			
sec-Butyl Mercaptan + Thiophene	513-53-1	0.362	---	0.163	<0.006	0.22	0.17	0.11	---	0.163	0.207	---	---	---	---	0.08	0.362	0.110			
Styrene	100-42-5	---	<1.62	<0.158	0.256	<0.153	1.697	---	---	0.003	0.0901	---	0.219	0.0279	0.0657	0.02	1.70	0.00	20	40	2B
Thiophene	110-02-1	---	0.410	---	---	---	---	---	---	---	---	---	0.200	0.200	0.34	---	0.41	0.20			
1,1,1,2-Tetrachloroethane	630-20-6	---	<0.00903	<0.000117	<0.0002	<0.0002	<0.020	---	---	<0.0001	<0.0001	---	<0.0001	<0.0001	<0.0044	<0.00048	0.00	0.00			2B
1,1,2,2-Tetrachloroethane	79-34-5	---	<0.204	<0.0306	<0.061	<0.010	<0.041	---	---	<0.0004	<0.0022	---	<0.019	<0.0001	<0.0035	<0.00065	0.00	0.00	1		skin; 2B
Tetrachloroethene (tetrachloroethylene)	127-18-4	---	0.7962	0.104	<0.265	0.081	0.973	---	---	0.006	0.0548	---	0.107	0.038	<0.0885	0.01	0.97	0.01	25	100	2A
Tetrahydrothiophene	110-01-0	<0.004	<0.005	<0.004	<0.004	<0.004	<0.004	<0.004	---	<0.004	<0.004	---	<0.025	<0.025	<0.058	<0.0064	0.00	0.00			
Toluene	108-88-3	---	**100.30**	6.820	6.501	7.165	**100.305**	---	---	1.056	5.1214	---	8.518	4.591	7.2973	1.78	100.30	1.06	20		R
1,1,1-Trichloroethane (methyl chloroform)	71-55-6	---	<0.075	<0.0099	<0.014	<0.008	<0.128	---	---	0.004	0.0020	---	0.005	0.002	<0.0275	<0.0048	0.01	0.00	350	450	
1,1,2-Trichloroethane	79-00-5	---	<0.220	<0.00178	<0.003	<0.002	<0.068	---	---	<0.0007	<0.0072	---	<0.008	<0.0044	<0.0044	<0.00024	0.00	0.00	10		skin
Trichloroethene (trichloroethylene)	79-01-6	---	0.983	<0.100	0.082	0.077	<1.042	---	---	<0.0223	<0.0428	---	<0.078	<0.0447	<0.0633	0.04	0.98	0.08	10	25	A2, 2A
Trichlorofluoromethane	75-69-4	---	3.328	0.388	0.262	<0.231	1.531	---	---	0.091	0.0587	---	0.056	0.046	<0.2670	0.06	3.33	0.05		C 1000	
1,2,4-trimethylbenzene	95-63-6	---	---	---	---	---	---	---	---	---	---	---	---	---	---	0.01	0.00	0.00	25		
Vinyl Chloride	75-01-4	---	**16.391**	**1.260**	**1.154**	**1.53**	**<8.998**	---	---	**<1.956**	0.8763	---	**<1.878**	**<1.9169**	**<1.7995**	1.08	16.39	0.88	1		A1, 1
ortho-Xylene	95-47-6	---	7.002	0.891	1.131	0.693	14.003	---	---	0.024	0.5343	---	1.207	0.27	0.6218	0.10	14.00	0.02			
meta-& para-Xylene	108-38-3 & 106-42-3	---	24.874	3.178	3.823	2.464	41.226	---	---	0.103	1.7849	---	4.169	0.70	2.2709	0.36	41.23	0.10			
Xylenes	1330-20-7	---	31.777	4.076	4.951	3.155	55.265	---	---	0.127	2.3257	---	5.388	0.97	2.9014	0.45	55.27	0.13	100	150	
Fixed Gases																					
Methane	74-82-8	439000	436000	454000	447000	437000	445000	399000	---	481000	429000	464000	427000	443000	447000	408000	481000	399000		simple asphixiant	EX
Carbon Monoxide	630-08-0	<2.5	**<500**	**<500**	**<500**	**<500**	**<500**	**<500**	---	**<500**	**<500**	**<500**	**<500**	**<500**	**<500**	<500	0.0	0.0	25	100	R
Carbon dioxide	124-38-9	**273000**	**327000**	**385000**	**368000**	**359000**	**340000**	**305000**	---	**381000**	**313000**	**380000**	**292000**	**356000**	**343000**	312000	385000	273000	5000	15000	
Nitrogen	7727-37-9	149000	188000	167000	181000	168000	169000	251000	---	136000	186000	165000	207000	208000	202000	228000				simple asphixiant	
Oxygen	7782-44-7	14000	14500	10100	10000	11800	11400	36900	---	9300	16600	13600	29700	19300	14100	24100					
Hydrogen sulfide	7783-06-4	**37.10**	0.60	5.20	<0.004	9.0	**14.5**	**16.9**	---	**27.8**	**30.9**	---	**51**	**89**	**27**	5.84	89.00	0.60		10	ceiling
Total Reduced Sulfur (22) as H2S	30-39-5	38.40	2.50	5.90	0.057	9.8	15.3	17.5	---	28.6	31.7	---	52	90	28	6.36					
Aggregate Organics																ppm					
D3(CVMS) Hexamethylcyclotrisiloxane	541-05-9	<0.0632	<0.0256	<0.0256	0.97	0.06	0.057	0.048	0.123	0.050	0.0753	---	<0.026	0.06	0.146	0.06	0.97	0.05			
D4 (CVMS) Octamethylcyclotetrasiloxane	556-67-2	<0.0140	<0.0140	0.18	0.10	0.41	0.772	0.472	1.179	0.325	0.7056	---	0.622	0.29	0.655	0.51	1.18	0.10			
D5 (CVMS) Decamethylcyclopentasiloxane	541-02-6	<0.0112	<0.0112	0.12	<0.016	0.15	0.298	0.166	0.857	0.066	0.2631	---	0.222	0.03	0.215	0.12	0.86	0.03			
D6 (CVMS) Dodecamethylcyclohexasiloxane	540-97-6	<0.0093	<0.0093	<0.00934	<0.092	0.01	<0.009	<0.009	<0.009	0.009	0.0099	---	<0.009	<0.0093	<0.0093	<0.009342	0.01	0.01			
MM(LVMS) Hexamethyldisiloxane	107-46-0	<0.0256	<0.0256	0.15	0.22	0.19	0.294	0.271	0.388	0.468	0.3027	---	0.191	0.41	0.255	0.37	0.47	0.15			
MDM (LVMS) Octamethyltrisiloxane	556-67-2	<0.0140	<0.0140	<0.0140	0.02	0.02	0.027	0.022	0.017	0.017	0.0313	---	0.015	0.02	0.026	0.02	0.03	0.02			
MD2M (LVMS) Decamethyltetrasiloxane	141-62-8	<0.0134	<0.0134	<0.0134	<0.013	<0.013	<0.013	<0.013	<0.013	0.013	<0.0134	---	<0.013	<0.0134	<0.0134	<0.0133784	0.01	0.01			
MD3M (LVMS) Dodecamethylpentasiloxane	541-02-6	<0.0112	<0.0112	<0.0112	<0.011	<0.011	<0.011	<0.011	<0.011	0.011	0.0132	---	<0.011	<0.0112	<0.0112	<0.0112	0.01	0.01			

Appendix F1, continued

Parameter	Date	5-Apr-19	28-May-19	3-Jul-19	27-Jul-19	15-Aug-19	23-Oct-19	31-Oct-19	21-Nov-19	26-Nov-19	9-Dec-19	12-Dec-19	29-Jan-20	28-Feb-20	25-Mar-20	1-Dec-20	Maximum	Minimum	TWA (ppm)	STEL/Ceiling (ppm)	Notations
Aliphatic hydrocarbon gases																					
Ethane	78-84-0	---	---	---	---	---	---	---	---	---	---	---	---	---	---	<5.5	0.00	0.00		simple asphixiant	EX
Butane	106-97-8	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	0.00	0.00		1000	EX
Butene	9003-28-5	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	0.00	0.00			(I)
Pentene	646-04-08	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	0.00	0.00			
Propane	74-98-6	---	---	---	---	---	---	---	---	---	---	---	---	---	---	<5.5	0.00	0.00		simple asphixiant	EX
Ethene	74-85-1	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	0.00	0.00	200 ppm		
Propene	115-07-1	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	0.00	0.00	500 ppm		
Pentane	109-66-0	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	0.00	0.00	1000		
Hexene	592-41-6	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	0.00	0.00	50 ppm		R

Notes:
ACGIH notations A1 and A2 and IARC notations 1, 2A and 2B indicate substances designated as carcinogens under section 5.57(1) of the OHS Regulation. The different categories used by the two organizations indicate different levels of certainty of carcinogenic effect, e.g., from confirmed carcinogen to probable or possible. For more information, see OHS Guideline G5.57.
The term "Skin" identifies substances that contribute significantly to the overall exposure by the skin route. For more information, see OHS Guideline G5.52.
The term "R" identifies substances with an adverse reproductive effect under section 5.57(1) of the OHS Regulations
The term "EX" identifies substances that are flammable asphixiants or excursions above the exposure limit could approach 10% of the lower explosive limit
Red text in tables - laboratory detection limits greater than WorkSafeBC exposure limits