



**REPORT TO ENVIRONMENTAL SERVICES COMMITTEE  
MEETING OF WEDNESDAY, APRIL 21, 2021**

---

**SUBJECT**     **Landfill Gas Emissions Quantification at Hartland Landfill**

**ISSUE SUMMARY**

To provide the results of a recent study on landfill gas generation, collection and emissions at Hartland Landfill (Hartland) and how the results will support additional landfill gas mitigation projects across the site.

**BACKGROUND**

In a solid waste landfill, the decomposition of refuse produces landfill gas, consisting primarily of methane and carbon dioxide. Even with an extensive landfill gas collection network, a portion of emissions will escape to the atmosphere. These fugitive emissions contribute to climate change, as methane is a powerful greenhouse gas (GHG).

In 2020, to better understand and mitigate fugitive emissions at Hartland, 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 mitigation strategies.

Under the BC Landfill Gas Management Regulation, the Ministry of Environment and Climate Change Strategy (ENV) requires all BC landfills to use the same theoretical model and ENV Annual Reporting Tool (ENV AR tool) to predict gas generation and collection efficiency on an annual basis. Under the regulation, landfills are expected to meet a performance objective of 75% collection efficiency (i.e. of the total gas generation estimated by the model, 75% must be collected for destruction/beneficial reuse).

In order to better understand model accuracy and actual collection efficiency, fugitive emissions at Hartland were empirically measured during two field events in 2020 (Appendix A). The data was used to complete a comprehensive landfill gas mass balance for the site using three different landfill gas generation models. Report findings confirm that the ENV AR tool overestimates landfill gas generation and fugitive emissions at Hartland, while the more advanced landfill gas generation model (UBCiModel©) more accurately estimates these parameters due to its capacity for tailor model parameters to reflect Hartland's site specific conditions. Consequently, Hartland is collecting a higher proportion of total landfill gas than previously reported; approximately 76%-81% over the last three years compared to 64%-67% for the same period using the required ENV AR tool. According to the report, the Hartland gas collection efficiency may be the highest the consultant has observed in BC, and it exceeds the target of 75% under the Landfill Gas Management Regulation.

The analysis also found that current landfill cover systems are estimated to biologically oxidize 29% of the total fugitive emissions. Biological oxidation converts methane into carbon dioxide (CO<sub>2</sub>) making the gas much more inert from a climate change perspective (methane is 25 times more potent as a GHG than CO<sub>2</sub>).

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 to increase methane collection efficiency and biological oxidization, including enhancements to the existing landfill gas collection system and targeted application of an engineered biocover system on both closed portions and operational phases of the landfill. The report concludes that implementing the recommendations could result in Hartland fugitive methane emissions approaching zero.

## **IMPLICATIONS**

### *Regulatory Implications*

Results of the study indicate that measured fugitive emissions for Hartland are significantly lower than those calculated using the ENV AR tool, and that Hartland currently meets the 75% collection efficiency target. These findings will provide a basis for the CRD to discuss using the UBCiModel© in annual reporting with the regulator.

### *Environmental & Climate Implications*

Implementing recommendations from the study has environmental and climate benefits across multiple programs/initiatives:

- Areas identified as having high fugitive emissions can be targeted for additional landfill gas mitigation, either through additional infrastructure installation, or application of biocover.
  - Design/installation of a specialized gas collector is already underway to address an area contributing approximately 15% of the overall fugitive emissions.
  - In areas where gas collection is not feasible, the data will provide a baseline to support short-term biosolids planning and biocover application. Effective engineered biocover systems typically include a combination of biosolids, wood chips and sand. Emissions can be quantified before and after biocover application to quantify the GHG emissions reductions benefits as a result of biocover placement.
  - Beginning in 2023, landfill gas will be upgraded to Renewable Natural Gas (RNG) and used to displace conventional natural gas, replacing an estimated 264,000 tonnes CO<sub>2</sub>e (Carbon dioxide equivalent) over a 25-year period. Optimizing landfill gas management through enhancing collection systems could increase landfill gas collection efficiency, which would increase the benefit of the RNG initiative.
- Any emission reductions beyond the 75% collection efficiency may be used to offset corporate GHG emissions, or could be sold as offset units to the Province (contingent on ENV approval). Follow-up emissions quantification studies are planned to support this effort.

## **CONCLUSION**

In 2020, to better understand the performance of the landfill gas collection system and fugitive GHG emissions at Hartland, staff commissioned a field-level study to quantify fugitive landfill gas emissions across the site. The results of this study confirm a higher landfill gas capture rate (76%-81%), and lower fugitive GHG emissions than previously modelled. Including biological oxidation in cover soils, it is estimated that approximately 86% of the total methane from Hartland is beneficially being utilized or destroyed. The information will enable staff to implement focused landfill gas infrastructure improvements/mitigations to further increase landfill gas collection and reduce GHG emissions.

**RECOMMENDATION**

The Environmental Services Committee recommends to the Capital Regional District Board:

That this report be received for information.

Submitted by:	Glenn Harris, Ph.D., R.P.Bio., Senior Manager, Environmental Protection
Concurrence:	Larisa Hutcheson, P.Eng., General Manager, Parks & Environmental Services
Concurrence:	Robert Lapham, MCIP, RPP, Chief Administrative Officer

**ATTACHMENT**

Appendix A: January 2021 Hartland Landfill Greenhouse Gas Emissions Quantification (Final Report)