Reducing methane emissions from Canada's municipal solid waste landfills

WHAT WE HEARD REPORT

Environment and Climate Change Canada
Environnement et Changement climatique Canada

Canada

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Introduction

Methane is a powerful greenhouse gas that is generated when biodegradable waste (e.g. food, yard and paper) is disposed in landfills. In October 2021, Canada announced support for the Global Methane Pledge, which aims to reduce global methane emissions by 30% below 2020 levels by 2030. The Government of Canada has committed to taking comprehensive domestic actions to reduce methane, including in the waste sector. The Government of Canada's *Strengthened Climate Plan – A Healthy Economy and Healthy Environment* committed to developing new federal regulations that will reduce waste sector emissions by increasing the number of landfills that recover and flare or utilize landfill gas. On January 28, 2022, Environment and Climate Change Canada (ECCC) published a discussion paper titled *Reducing methane emissions from Canada's municipal solid waste landfills* to seek input on proposed objectives for regulations under the *Canadian Environmental Protection Act*, 1999 which aim to reduce methane emissions from municipal solid waste landfills. The discussion paper sought feedback on a number of key questions related to reducing landfill methane emissions. The purpose of this report is to present how the Government sought input, who provided input, what was said and the next steps moving forward.

How we consulted

The public consultation period on the discussion paper was held between January 28 and April 13, 2022. Consultations were held entirely online to facilitate national participation and due to restrictions caused by the COVID-19 pandemic. Consultation activities included:

- Written comment period: ECCC solicited written input by email and via an on-line form from all interested parties between January 28 and April 13;
- Webinar: ECCC hosted a webinar, open to all interested parties, that included an overview of the discussion paper and a question and answer session.
- Stakeholder and partner discussion sessions: Upon request, ECCC presented the discussion paper at various bilateral meetings during the consultation period.
- The consultation was also advertised using ECCC 's social media accounts.

Who participated

The government received 72 written comments and 208 people participated in the webinar. The charts in figures 1 and 2 provide a breakdown of who submitted comments and participated in the webinar. The "Landfill owners" category is made up primarily of municipalities and several private sector waste management companies. Written comments were received from interested parties in most provinces and territories.

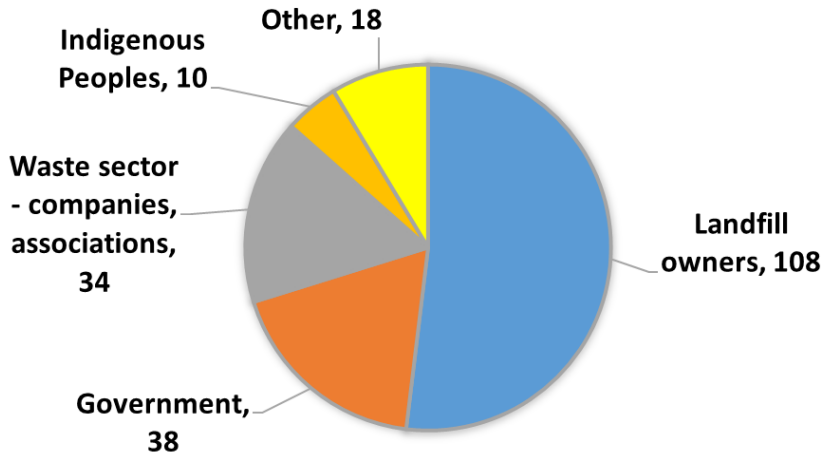

Figure 1. Breakdown of webinar participants by interested party type

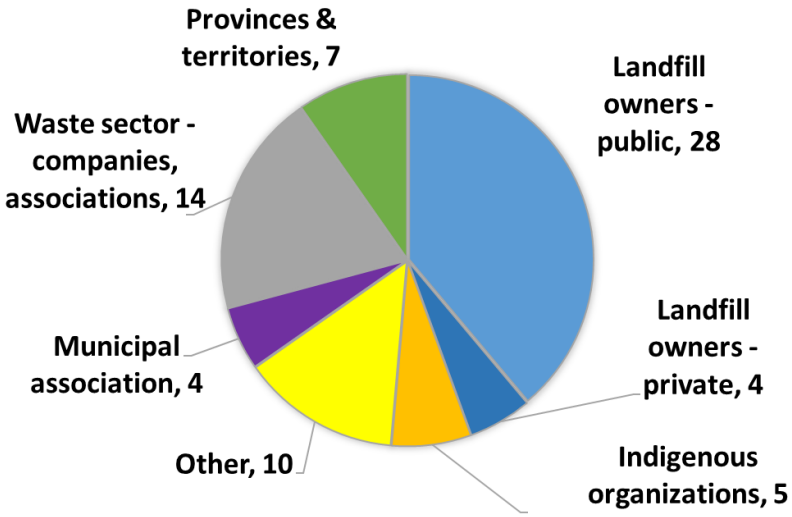

Figure 2. Breakdown of written comments on discussion paper by interested party type

Key themes

The discussion paper solicited feedback on four objectives that were under consideration to inform a federal regulatory approach that would achieve significant reductions in emissions of methane from landfills. These included:

- Objective 1 - Increase the number of landfills that take action to reduce methane emissions
- Objective 2 - Ensure that regulated landfills maximize methane recovery

- Objective 3 - Achieve long-term emissions reductions through increased diversion of biodegradable waste
- Objective 4 - Increase utilization of landfill methane to create low-carbon energy and fuels

Overall, stakeholder input supported the idea that further efforts can be made to reduce landfill methane emissions. Stakeholders were most concerned with requiring action at the right place (e.g. where emissions are highest, where approaches are cost-effective, at the point where management decisions are made) and in a manner that is fair, consistent and economically feasible. Stakeholders expressed concern that the federal government should assess and consider the impact on smaller, rural and First Nations communities in particular, noting that the challenges faced in these locations are not the same as those in larger, urban settings. In addition to providing information that will help scope regulatory approaches, stakeholders offered ideas for alternative technologies and policy approaches that the federal government should consider to support and encourage all Canadians to take action to improve the management of biodegradable waste and reduce methane emissions.

The report summarizes a large number of comments within each of the proposed objectives, and does not attribute comments to any specific organizations or individuals. The specific questions on the objectives included in the discussion paper are located in the Appendix to this report.

What we heard

Objective 1 - Increase the number of landfills that take action to reduce methane emissions

Identification of which landfills should be regulated
Overall, stakeholders supported taking action to reduce methane emissions from landfills by increasing the number of landfills regulated, but identified a number of key issues and challenges that should be considered as regulations are developed.

Stakeholders provided views on which landfills should be regulated and how these might be identified in a regulation:

- Many landfill owners proposed that ECCC should first focus on regulating landfills that emit the most methane.
- Some stakeholders indicated that all landfills, including small landfills, should be regulated since they do contribute to methane emissions.
- Stakeholders identified many criteria which could be used to identify which landfills should be regulated, including:
    - Quantity of waste: the tonnage of waste in place and/or annual waste acceptance, design capacity
    - Age of landfill, status of current land use
    - Quantity of methane generated, surface methane concentrations
    - Waste characteristics, organics diversion programs

Many stakeholders highlighted considerations for setting regulatory thresholds, including:

- The cost of installation of a system and potential for revenue should be considered, especially for communities not served by large landfills.
- Federal regulations should be aligned with provincial and territorial regulatory requirements to avoid duplication and reduce burden; requirements should be developed so there can be equivalency agreements and federal requirements can act as a minimum backstop.
- Regulatory timeframes should be flexible to account for the time needed to have sufficient landfill gas quality, for landfilling to have progressed above the installed infrastructure and delays for regulatory approvals and commissioning of systems.
- The regulations should be applied fairly across municipal and private landfills to avoid a scenario where it is cost effective for waste to flow to an unregulated landfill or to landfills outside of Canada.
- Provisions would be needed to accommodate the remoteness and challenges affecting First Nations solid waste operations.

Economic impacts

Many stakeholders highlighted economic challenges that landfill owners would face if required to meet the federal regulation's objectives and proposed solutions to these challenges.

Stakeholders identified the following challenges:

- The main challenge highlighted is the anticipated cost associated with new federal regulations such as those for capital and operating costs especially for small and rural communities.
- The cost to install landfill gas utilization infrastructure is high at large landfills who may need to use multiple technologies or have higher costs due to distance from utilities.
- Some stakeholders were concerned that landfills would no longer have access to federal offset credits and credits under the *Clean Fuel Regulations* when they become subject to federal regulations to reduce methane emissions.

Stakeholders proposed the following solutions:

- The federal government should provide financial assistance for capital investments (infrastructure) and ongoing funding for operating and maintenance costs. The federal government should also provide funding for research to develop new technologies to reduce methane emissions.
- Federal government should create financial incentives to reduce methane emissions such as carbon offset credits or other market based mechanisms and ensure landfills are eligible.
- A transition period to comply with new requirements should be considered, to provide time to pursue funds to commission or expand infrastructure.
- The methane reduction regulation should apply to waste landfilled after the regulation's effective date. For historical waste, an incentive mechanism (e.g. carbon credits, or federal/provincial greenhouse gas (GHG) financial support, or market mechanism) should be established to encourage methane reduction.

Alternative approaches for reducing landfill methane emissions
Many stakeholders noted that the most effective way to reduce landfill methane emissions in the long term is by diverting biodegradable waste from landfill – towards composting or waste to energy processes.

Additional and alternative technologies and technical approaches to the more typical active landfill gas recovery system approach were also suggested, including:

- Passive landfill gas mitigation systems (e.g. biocovers, biofilters) to reduce methane emissions – noting that these will require methodologies to characterize and measure emission reductions.
- Proper design and operation of a landfill site could result in lower methane emissions including: minimizing the size of the active face of the landfill, proper waste cell construction and developing closure plans.

Stakeholders highlighted several technical and capacity gaps that could impact the ability of landfills of all sizes to take action to reduce methane emissions:

- Many landfill owners indicated that one challenge to comply with new federal regulations would be a lack of capacity such as in-house administrative, technical expertise and human resources.
- The federal government should create tools and support for capacity building such as experts for technical advice and establish peer networks.

Regulating closed landfills
Stakeholders provided various views on whether closed landfill should be regulated or not.

Some stakeholders indicated that some or all closed landfills should be regulated, noting:

- Closed landfills have the potential to emit large amounts of methane which should be controlled.
- Closed landfills that still have significant methane generation, an active landfill gas collection system may still be appropriate if the generation is expected to be significant for 20 years or more.

Some stakeholders indicated that closed landfills should be excluded from the regulations, noting:

- Gas quantity and quality significantly decrease after landfill capping and closure and there is far less potential for achieving emissions reductions and potentially insufficient methane for landfill gas utilization.
- Challenges with funding landfill gas infrastructure given the lack of tipping fee revenue and noting that closed landfills may have not allocated additional funds for landfill gas recovery in their post-closure plans.
- Landfills that have been closed for a certain period of time (e.g. 5 years or more) should not be regulated as methane generation is past its peak.

Stakeholders identified technical limitations and alternative approaches to reduce emissions at closed landfills:

- Conventional methane recovery systems may not operate efficiently at older, smaller, closed landfill sites with lower methane generation. These landfills were typically constructed before

modern landfill engineering standards were established and do not have geomembrane liners that contain landfill gas.
- Best practices at existing closed landfills to capture emissions should be reviewed to set baseline standards and criteria for closed landfills in Canada; requiring and enforcing proper post-closure management techniques, including application of engineered covers or barrier systems to seal off waste; routine monitoring and reapplication of landfill covers as required to ensure effectiveness.
- Passive methane oxidative systems (such as biocovers), hybrid thermal oxidizer flares or low calorie flares could be used to reduce methane emissions where levels may be significant but declining.

Regulating landfills that serve small communities
Although it was noted that large landfills may have technical challenges due the large scale of a project involving installation of a landfill gas recovery system, many stakeholder comments noted challenges with implementing smaller sized projects. Recommendations on methane mitigation were also provided.

Stakeholders highlighted various challenges for small landfills:

- There may not be enough methane to warrant installation of landfill gas collection infrastructure or its utilization.
- Landfills serving remote communities may lack the service and support to manage landfill gas infrastructure.
- There are fewer financial resources for small landfills due to economies of scale compared to larger landfills.
- Many landfill owners are concerned with the additional regulatory burden imposed by new federal regulations especially for small and rural municipalities.

Stakeholders provided recommendations to address methane mitigation at small landfills included:

- Incentivizing small and medium landfills, through use of carbon credits or development of innovative technology, can reduce methane at these locations rather than a requirement.
- Funding should be provided with a streamlined application process.
- Government should provide resources, tools and training for any required testing and feasibility studies and to develop and implement project plans.
- Biocovers or biovents could be used to reduce methane but would require development of standards for performance.

Landfills that serve First Nations communities
Indigenous organizations highlighted challenges for solid waste management practices on reserves and in the North.

- The inadequacy of current waste management infrastructure serving First Nations and Inuit communities should be addressed prior to any new regulations or actions to address methane emissions.
- Smaller landfills used or owned by First Nations or Inuit communities would have significant challenges to meet federal requirements given their limited financial resources, limited access to

technical staff, limited to no access to services such as waste sorting and current infrastructure deficiencies.
- Measures and programs put in place within the framework of the application of federal regulations should be adapted to the needs, capacities and realities of each First Nation.

Additional policy actions suggested
Stakeholders suggested alternative policy approaches that could be considered by the federal government to reduce landfill methane emissions including:

- Consider the regulations within a broader policy framework, pursue goals to reduce waste, improve recycling, divert organics, and support for circular economy initiatives.
- Establish an outreach program to coordinate efforts of landfills operators, academia, consultants, regulatory bodies and to share knowledge.
- Develop financial incentives for landfill owners to implement methane mitigation such as organic waste diversion programs and efficient landfill gas capture systems such as: renewable gas blending mandates, credits under the *Clean Fuel Regulations* or federal GHG offset credits
- Provide financial incentives or funding opportunities for projects to reduce methane emissions and to support research and innovation.

Stakeholders highlighted information needs that will support the development of federal regulations:

- The federal government should release the inventory of landfills that are under consideration for regulations for stakeholders to have a common understanding of the opportunities and the challenges, the cost and greenhouse gas assumptions.
- The federal government should create an inventory of landfill sites on reserve lands and the quantities of methane produced by each site.

Objective 2 - Ensure that landfills maximize methane recovery

Ensuring landfills maximize methane recovery
Some stakeholders indicated that requirements should be flexible with a clear goal of reducing emissions, while others provided specific ideas on the kinds of actions that could be taken to ensure maximum methane recovery. One stakeholder suggested that this objective be reworded as “encourage landfills to maximize methane emission reductions” and several proposed technical approaches, such as biocovers, that align with this suggestion.

Stakeholders recommended technical approaches that are described below.

<u>Landfill and landfill gas collection design</u>

- Several stakeholders suggested there would be a benefit of updating or developing new standards for landfill gas collection system design.
- Mandating the installation of landfill gas recovery infrastructure within certain timeframes following waste disposal; progressive closure and installation of landfill gas collection infrastructure as soon as possible, particularly in wet climates, e.g. horizontal collectors as filling progresses, temporary vertical gas extraction wells on completed banks in advance of closure and potentially within a certain time frame; capping/liners.

- Use of interim covers to maximize gas collection, rather than waiting until closure when optimal gas recovery window may have passed; opening and closing active landfill areas in tandem with temporary and permanent landfill gas collection and flaring system.
- Split systems that collect and flare lower quality landfill gas while also collecting and converting methane-rich gas into energy could increase methane recovery.

Operational approaches

- Protocols for monitoring to adjust extraction - negative pressure at wells should be required since insufficient vacuum results in inefficient landfill gas capture; new technologies that automate and optimize the gas flow in well heads based on the environmental conditions (barometric pressure, temperature, etc.).
- Improvements to leachate management can improve efficiency of landfill gas capture.

Monitoring to identify design and operational effectiveness

- Several stakeholders noted challenges in quantifying the "collection efficiency" of a landfill gas recovery system and that a collection efficiency of 75% may not be achievable at all landfills.
- Surface emission monitoring - Leak detection could be used to determine efficiency rather than using the methane model; conducting surface measurements can provide good qualitative information about where methane could be escaping from a landfill site and may be considered a best management practice.

Additional actions to maximize methane recovery

Stakeholders proposed various actions that could encourage landfills to maximize methane recovery, noting:

- Rather than requiring landfills to maximize methane recovery, several stakeholders suggested this could be accomplished through financial incentives such as ones supporting renewable natural gas, carbon credits and credits under the *Clean Fuel Regulations* to encourage efficient landfill gas capture. Those incentives should be technology agnostic and entirely outcome focused (i.e. achieving methane emissions reduction from landfill).
- Federal policy actions should be identified that can support and improve the business case for increasing landfill gas recovery.
- There should be funding for research and innovation which would support projects to maximize methane recovery or other methane mitigation measures.
- Many stakeholders indicated that training of staff, availability of services or expert consultants and access to skilled operators could be challenges to maximizing methane recovery; other stakeholders noted that guidance could be developed to address technical and operational issues.

Stakeholders highlighted other considerations:

- Competing priorities could be an issue when generating energy and reducing methane, including the need to reduce odours and nuisances and the need to remove biodegradable waste from landfills, both of which could affect landfill gas quality.

- Landfills producing renewable natural gas (RNG) already maximize methane recovery to maximize their return on investment on their RNG facility. One stakeholder provided information on a landfill gas upgrading system that can process a range of landfill gas quality, meaning that landfills might not need to limit recovery in order to maintain high methane concentrations.
- The time it takes to design, approve, construct new, or to expand existing infrastructure can often be longer than anticipated; there is a difference between installation and operation timelines.

Measuring methane emissions

With the potential for regulatory thresholds and other regulatory requirements to rely on estimating or measuring methane generation or emissions, stakeholders provided comments on the challenges that currently exist in undertaking these measurements and new approaches.

Limitations of current methane measurement approaches

- Stakeholders were concerned that the use of a methane model may not be an accurate method of determining whether a landfill should be regulated, as some models tend to over estimate methane emissions. Additionally, poor data on small and closed landfills, and limited waste characterization data can produce inaccurate modeling results.
- There are technical issues with determining landfill gas collection efficiency as the model used to calculate methane generation produces various results depending on the inputs, which can overestimate methane generated and underestimate collection efficiency.
- The use of surface emissions monitoring (SEM) alone can cause inaccuracies when considering the need to install landfill gas infrastructure. SEM results are dependent on conditions at the landfill and represent concentrations at one point rather than whole site emissions. This could flag a small methane leak while significant emissions could go undetected.
- Some stakeholders supported the use of SEM to detect methane leaks.

New approaches

- Use of satellites is an alternative method to identify sites with high emission rates for which the installation of gas recovery systems should be prioritized.
- Stakeholders support new approaches for measuring methane emissions at landfills but would like standardized protocols for these assessments.

Objective 3 - Achieve long-term emissions reductions through diversion of biodegradable waste

Banning disposal of organic waste

There was general agreement among stakeholders that action is needed to reduce landfilling of biodegradable waste and that the federal government has a role to play.

Some stakeholders supported the idea of a federal ban on disposal of organic waste indicating:

- Federal regulations would address current inconsistent regulations and policies within Canada and create a level playing field for municipalities.
- A ban could promote innovative treatment technologies, reduce the quantity of waste that must be landfilled (and exported for landfilling) and stimulate the economy.
- The mandate should include a progressive ban on disposal of organic waste in landfills with set targets and phasing in smaller waste generators over time.
- Proposed implementation timelines would be needed to allow sufficient time to expand existing facilities or build new ones to accommodate the increased quantity of organics that will require processing.

Some stakeholders provided viewpoints on why the federal government should not mandate an organics disposal ban at landfills, noting:

- Waste management is a provincial and municipal responsibility.
- Landfill owners are not in control of the organic content of waste that is disposed.
- Such a ban could incentivize the export of waste, which would lead to carbon leakage.
- Mandatory diversion would limit the ability to create renewable natural gas at landfills.
- A federal mandate should drive provinces/territories to write their own policy on food and organic waste, instead of the federal government regulating a specific framework.

Many stakeholders indicated that requirements to increase organic waste diversion should apply to waste generators and waste management programs and not to landfills, noting that:

- Organics should be separated at the source rather than at the landfill.
- Generators of waste should be targeted to take action, with an emphasis on the industrial, commercial, and institutional (ICI) sector.

Increasing organics diversion – alternative approaches
Stakeholders provided suggestions for alternative federal policy approaches to increase diversion, including:

- A coordinated federal plan/policy to address organic waste and a national vision to divert organics, including food waste, from landfill will provide the foundation for economies of scale and cost effectiveness at the generator level.
- Incentivize diversion through offset credits for organic waste processing facilities such as composting or anaerobic digestion.
- Provide federal funding to support increased diversion such as funding for collection and infrastructure to process organic waste.
- Establish a landfill levy for all waste disposed in and exported out of Canada to reflect the true cost of waste and greenhouse gas emissions and to fund waste reduction and diversion projects.
- Encourage/require measurement and reporting of organic waste disposal and diversion, including food waste; consider a voluntary program to reward the ICI sector for diversion actions.
- Strengthen producer responsibility approaches for printed paper and packaging materials.

- Support the use of compostable food packaging through clarified labeling requirements for “biodegradable” and “compostable” packaging while recognizing the challenge for some existing organics processing systems to properly process these materials.

Stakeholders voiced support for Circular Economy approaches rather than focusing on “end of life” management, such as:

- Reducing the generation of food waste through incentives; increasing public awareness; and encouraging food retailers to influence consumer behaviour and redistribute surplus food.
- Encouraging reuse of biodegradable construction materials.

Increasing organics diversion – considerations
Stakeholders provided suggestions for additional analysis or ideas that should be considered as federal policy approaches are further developed:

- The overall lifecycle GHG impact of diversion approaches should be investigated to inform policy decisions. Some comments emphasized the value of creating compost - a useable product which will sequester carbon and improve soil health. Others indicated concern for added collection, transportation and processing emissions.
- Analysis of the environmental and economic benefits of diversion should be undertaken to ensure that transportation and organic waste processing infrastructure costs do not increase the cost of waste management, which could impact a municipality’s ability to finance landfill methane recovery and utilization systems.
- Increasing diversion of biodegradable waste may be an efficient approach in urban areas where waste is collected at the curb; however, building similar systems in rural areas with low service levels may be more difficult and may require different types of solutions and partnerships.

Objective 4 - Increase utilization of landfill methane to create low-carbon energy and fuels

Stakeholders provided comments on options that should be considered within a federal regulatory framework to require or encourage the utilization of recovered methane to produce low-carbon energy.

There was general agreement among all stakeholders that federal regulations should encourage use of landfill gas by putting forward incentives rather than mandating its use, noting:

- Encouragement could be through either providing federal funding for investments in projects or access to carbon credits such as the federal offset credits or the proposed *Clean Fuel Regulations*.
- A mandatory requirement would not be feasible for all landfills as some would not generate sufficient methane for landfill gas utilization and others may be located too far from natural gas pipeline infrastructure or the electricity grid.
- The cost of infrastructure is high and may negatively impact landfill owners.

Many stakeholders indicated that the federal government should create a market for biogas through a renewable gas blending mandate with standards and content requirements or carbon credits. This would ensure the processing and upgrading of biogas is economically viable for landfill operators.

Stakeholders also noted that there should be linkages between the federal landfill methane regulatory framework and current (and proposed) market mechanisms such as the *Clean Fuel Regulation* or the federal offset credits.

Comments were received on how a regulatory approach on landfill methane will affect policy and other goals to increase the production of renewable natural gas, noting:

- Many stakeholders indicated that care should be taken so that landfills are able to monetize the utilization of landfill gas, for example through sale of renewable natural gas, and incentives are created to promote this activity.
- Some stakeholders were concerned that once landfills are regulated they would not have access to financial incentives such as offset credits.

Next steps

ECCC would like to thank stakeholders who took the time and effort to provide feedback on the discussion paper. Stakeholder feedback will be taken into consideration.

A Technical Working Group (TWG) process to support in-depth discussions on elements of federal regulations will be initiated in Fall 2022. A call-out for membership, including a description of the mandate of the TWG and its activities, and a nomination form is available at this link**.** Please submit your nomination by September 15, 2022.

The TWG findings and comments received during the consultation will be considered when drafting the proposed regulatory framework, which is expected to be published for comment in spring 2023.

The proposed regulations are expected to be published in *Canada Gazette*, Part I in 2024.

Appendix: key objectives and themes

The discussion paper sought feedback on four objectives to reduce methane emissions from landfills. The key objectives and underlying themes are summarized below.

1. **Increase the number of landfills that take action to reduce methane emissions**
    - Identification of the types of landfills that should be regulated
    - Other technical approaches that should be considered to reduce methane emissions
    - Options for reducing methane emissions at closed landfills in Canada
    - Challenges that landfill owners would face to meet the federal regulation's objective of reducing methane emissions and how existing provincial approaches can be leveraged
    - Differences of challenges between small and large landfills and opportunities to reduce methane emissions and incentives to encourage innovative technologies at smaller landfills in Canada
2. **Ensure that landfills maximize methane recovery**
    - Key opportunities and approaches for maximizing methane recovery at landfills with landfill gas recovery systems
    - Key technical challenges and limitations to implementing these approaches
    - Opportunities to enable a landfill to generate energy from landfill gas and to optimize methane recovery
    - Requirements to ensure methane recovery is optimized
3. **Achieve long-term emissions reductions through diversion of biodegradable waste**
    - The role of federal regulations to require landfill owners to reduce the landfilling of biodegradable waste
    - Opportunities exist to incorporate biodegradable waste diversion into a landfill methane emission reduction plan
4. **Increase utilization of landfill methane to create low-carbon energy and fuels**
    - Options that should be considered within a federal landfill methane regulatory framework to require or encourage the utilization of recovered methane to produce low-carbon energy
    - How a regulatory approach on landfill methane will affect policy and other goals to increase the production of renewable natural gas