

Canada-Wide Approach for the Management of Biosolids

NOTE: The consultation document presented below was used to support public consultations by the CCME Biosolids Task Group in May of 2011. It must be noted that the consultation has been completed, and the Biosolids Task Group is currently finalizing the document; therefore, **no response to the “Canada-Wide Approach for the Management of Biosolids” document below is required.** It has, however, been attached herein to give context of the upcoming Draft CCME Canada-wide Approach for the Management of Wastewater Biosolids (which is one of the Matrix evaluation criteria).

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Canada-wide Approach for the Management of Wastewater Biosolids

CONSULTATION DOCUMENT

1. Introduction

CCME is developing a *Canada-wide Approach for the Management of Wastewater Biosolids*. The CCME objective for the initiative is that threats to ecosystems are minimized. The desired outcome of the *Canada-wide Approach for the Management of Wastewater Biosolids* is a harmonized policy and regulatory framework for municipalities and others who manage municipal biosolids that protects the environment and human health and instills public confidence.

Canadian wastewater treatment plants produce more than 660,000 dry tonnes of biosolids per year. Municipal biosolids contain valuable nutrients and organic matter, as well as some substances of concern. Currently, municipal biosolids are beneficially managed in a number of ways, including composting, use in fabricated growing media, land application in agriculture, forestry, silviculture, mines and other disturbed areas. Disposal options include combustion without energy capture and burial in landfills.

An ongoing challenge to managing municipal biosolids is that, irrespective of end use, there are benefits, risks, and specific considerations for every municipal biosolids management option.

Municipal biosolids are continually produced at wastewater treatment plants across the country and require ongoing management to ensure protection of human health and the environment. The Canadian Council of Ministers of the Environment (CCME), has established a Biosolids Task Group (BTG) composed of federal, provincial and territorial representatives. The role of BTG is to develop a *Canada-wide Approach for the Management of Wastewater Biosolids*. The development of the *Canada-wide Approach for the Management of Wastewater Biosolids* includes: legislative review, investigation of greenhouse gas (GHG) emissions related to municipal biosolids management and emerging substances of concern in municipal biosolids, and consultation with key stakeholders. This work guided the development of the draft policy statement and draft supporting principles and the draft Guidance Document. The work completed by BTG is summarized in Appendix 1.

1.1 Consultation Document Objectives

The purpose of this document is to provide background information to facilitate participation of interested parties in the consultation process. Information provided in this document includes:

- municipal biosolids use, management options and considerations
- benefits of developing a Canada-wide approach

- draft policy statement and draft supporting principles developed by BTG to facilitate a *Canada-wide Approach for the Management of Wastewater Biosolids*
- draft *Guidance Document for Beneficial Use of Municipal Biosolids, Municipal Sludge and Treated Septage*.

1.2 Document Organization

The subsequent Sections of this document are organized as follows:

- Section 2.0 Municipal biosolids Production, Management and Current Regulatory Framework
- Section 3.0 Opportunities for Developing a *Canada-wide Approach for the Management of Wastewater Biosolids*
- Section 4.0 Draft Policy Statement and Draft Supporting Principles
- Section 5.0 Consultation Questionnaire
- Appendix 1: Summary of Work Completed by the CCME Biosolids Task Group

1.3 Obtaining Additional Copies

Additional copies of this document may be obtained from Laura Manson, CCME Secretariat, lmanson@ccme.ca.

2.0 Consultation

The purpose of this consultation is to enable Canadians to have meaningful input into the development of a *Canada-wide Approach for the Management of Wastewater Biosolids*, which includes a policy statement and supporting principles, and the draft *Guidance Document for Beneficial Use of Municipal Biosolids, Municipal Sludge and Treated Septage*.

Through the consultation process, BTG will:

- provide interested Canadians with information on the activities and work completed by BTG
- build a shared understanding of the opportunity to develop a *Canada-wide Approach for the Management of Wastewater Biosolids*
- solicit input that will be used to inform and refine the draft policy statement and draft supporting principles and support development of a *Canada-wide Approach for the Management of Wastewater Biosolids*.

To promote participation and encourage feedback, BTG has developed a series of consultation questions in the attached comment form.

BTG will be accepting responses to the consultation questions until July 30, 2011. Your response to the consultation questions can be submitted to BTG using the attached form.

3.0 Municipal biosolids Production, Management and Current Regulatory Framework

3.1 Municipal biosolids Production

Municipal biosolids are the treated and stabilized organic product of municipal wastewater treatment. Canadian wastewater treatment facilities currently generate greater than 660,000 dry tonnes of municipal biosolids per year. The amount of municipal biosolids generated in Canada is expected to increase in the future due to increasingly stringent requirements for wastewater treatment. Municipal biosolids are continually produced at wastewater treatment plants across the country and require ongoing management to ensure protection of human health and the environment.

3.2 Municipal biosolids Management

Municipal biosolids management options are dependent on the quality of the municipal biosolids, the level of treatment used to produce the municipal biosolids, and the regulatory framework of each province or territory. The regulatory framework will be discussed in greater detail in Section 3.3.

Municipal biosolids management options can be classified into two broad categories: disposal and beneficial use. Disposal options include burying of the municipal biosolids in a landfill or incinerating the municipal biosolids in a manner that does not result in energy recovery. In moving forward with development of the *Canada-wide Approach for the Management of Wastewater Biosolids*, BTG is focusing on beneficial use options for municipal biosolids.

Beneficial use options capitalize on the nutrient and organic matter value of the municipal biosolids for use in: agricultural land fertilization or soil amendment, forest fertilization, land reclamation, composting, development of soil products and energy production. The benefits of municipal biosolids use associated with each of the management options are summarized in Table 1.

There are several considerations in developing a beneficial municipal biosolids use option. Similar to the management options, the management considerations are dependent on the quality of the municipal biosolids, the treatment process, and the jurisdiction where the municipal biosolids are to be used. Factors that need to be considered in the effective management of municipal biosolids include:

- odour management
- municipal biosolids quality – trace elements, nutrients, pathogens, emerging substances of concern
- suitability of the land applications site (e.g., soil quality prior to municipal biosolids applications and proximity to sensitive water resources)
- transportation logistics – number of transport vehicles required, availability of access roads

- buffer distances (e.g., distance of the proposed land application of municipal biosolids from specified features such as water resources, roads and neighbouring landowners)
- social considerations (e.g. for example, proximity of proposed land applications to residences and community facilities, and marketability of some municipal biosolids products).

Table 1: Beneficial Management Options for Municipal Biosolids Use

Beneficial Municipal Biosolids Management Option	Opportunity for Municipal Biosolids Use
Compost and soil products (e.g. topsoil and growing media)	<ul style="list-style-type: none"> • Municipal biosolids, used as an ingredient in topsoil and compost, provide a source of nutrients and organic matter which supports plant establishment and growth. • Municipal biosolids can be used in development of biocover for placement on landfills to mitigate fugitive methane (CH₄) emissions.
Agricultural land fertilization	<ul style="list-style-type: none"> • Municipal biosolids provide macronutrients (e.g., nitrogen and phosphorus) and micronutrients (e.g., calcium, magnesium and sulphur).
Forest fertilization	<ul style="list-style-type: none"> • Municipal biosolids reduce the requirement for chemical fertilizer. • Municipal biosolids provide organic matter that improves soil physical properties including porosity, bulk density and water holding capacity.
Land reclamation	<ul style="list-style-type: none"> • Municipal biosolids provides a source of nutrients and organic matter to promote soil development and vegetation establishment on degraded sites. Municipal biosolids can be managed at mines to assist in achieving multiple reclamation objectives.
Energy capture	<ul style="list-style-type: none"> • Biogas generated during anaerobic digestion of municipal sludge can be captured and used for heating or to generate electricity. • Energy capture in the form of heat from combustion of municipal sludge can be used to generate electricity.

3.3 Current Canadian Regulatory Framework for Municipal Biosolids

In Canada, the framework for municipal biosolids management varies among the provinces and territories; however the Canadian Food Inspection Agency regulates municipal biosolids at the federal level if they are imported or sold as a fertilizer or soil supplement. In general, municipal

biosolids are managed similarly in that they are required to meet certain process and quality criteria in order to be used for specific purposes. Each of the provinces or territories is responsible for setting their own policy either through their own policy development or reference to policies created in other jurisdictions. The goal of developing a Canada-wide approach is to harmonize municipal biosolids management policies across jurisdictions. To aid in the development of the approach, BTG completed a review of the existing legislative framework for municipal biosolids. A Review of the Current Canadian Legislative Framework for Wastewater Biosolids is available on the CCME website at: http://www.ccme.ca/assets/pdf/pn_1446_biosolids_leg_review_eng.pdf.

4.0 Opportunities for Developing a *Canada-wide Approach for the Management of Wastewater Biosolids*

The desired outcome of the *Canada-wide Approach for the Management of Wastewater Biosolids* is a harmonized policy and regulatory framework for municipalities and others who manage municipal biosolids that protects the environment and human health and instills public confidence. BTG has identified opportunities for the development of a *Canada-wide Approach for the Management of Wastewater Biosolids* which will address the management options identified in Section 3. Opportunities include:

- harmonizing communication and policy among different governments within Canada
- establishing consistent terminology (e.g., the definition of municipal biosolids)
- facilitating identification and investigation of emerging issues.

5.0 Draft Policy Statement and Draft Supporting Principles

5.1 Draft Policy Statement

BTG has prepared a draft policy statement and draft supporting principles for consultation that defines and addresses the challenges surrounding beneficial municipal biosolids management.

Policy Objective:

The purpose of this draft policy is to define and promote a Canada-wide approach to beneficial use and sound management of valuable resources in municipal biosolids, municipal sludge and treated septage.

Draft Policy Statement:

The Canadian Council of Ministers of Environment (CCME) promotes the beneficial use of valuable resources such as nutrients, organic matter and energy contained within municipal biosolids, municipal sludge and treated septage.

Beneficial uses should be based on sound management that includes:

- Substantiation of the resource value (efficacy)
- Adherence to federal, provincial and municipal standards and regulations
- Strategies to minimize potential risks to the environment and human health and minimizing emissions of greenhouse gases.

Beneficial use includes land application of municipal biosolids and treated septage to grow vegetation when it is done according to applicable regulations and best management practices. Anaerobic digestion of municipal sludge where methane is recovered and used to generate energy and digestate is beneficially recovered, is also considered a beneficial use.

Combustion that does not result in a positive energy balance or that emits significant amounts of nitrous oxides (greenhouse gases) is not considered a beneficial use.

Landfilling is not considered a beneficial use, even if it meets provincial and territorial regulations or standards because of the loss of nutrients and the release of greenhouse gas (GHG) emissions.

Draft Supporting Principles

1. Municipal biosolids contain valuable nutrients and organic matter that can be recycled.

Land application of municipal biosolids that are adequately processed and treated can be considered a beneficial use when it is properly managed to enhance soil fertility, soil structure and plant growth (LeBlanc *et al.*, 2008; SYLVIS, 2009). These municipal biosolids, when used as directed, can be efficacious for their intended use. Municipal biosolids and treated septage applied to land can provide nutrients such as nitrogen and phosphorus and organic matter, which are wasted if the material is landfilled or combusted without energy and ash recovery. Phosphorus is a limited non-renewable resource that should be recycled from municipal biosolids (Institute for Sustainable development, 2010; Soil Association, 2010).

2. Adequate source reduction and treatment of municipal sludge, and treated septage should effectively reduce pathogens, vector attraction, odours and substances of concern in municipal biosolids.

Applicable safety, quality and management standards must be adhered to. All jurisdictions should encourage and support the continuous improvement of the quality of municipal biosolids through source control initiatives and implementation of best management practices in order to limit any potential adverse impacts associated with their use.

3. Beneficial use of municipal sludge and treated septage should minimize the net greenhouse gas emissions (GHG) resulting from treatment processes or municipal biosolids use.

Land application of municipal biosolids can supplement and may reduce fertilizer use and results in sequestration of carbon in the soil, thereby minimizing GHG emissions to the atmosphere (SYLVIS 2009).

Landfilling of municipal biosolids and municipal sludge is not considered a beneficial use because organic matter decomposition contributes to methane emissions, even if a landfill is equipped to collect a significant portion of the gas and its use for energy (SYLVIS, 2009). The use of municipal biosolids as an amendment to final cover at landfills provides some benefit in that it may act as a biofilter and reduce emissions of greenhouse gases.

Some other municipal sludge/biosolids treatment processes may also produce methane, including anaerobic digestion. To minimize GHG emissions, methane should be captured, treated or used to generate heat or energy.

Combustion of nitrogen rich municipal sludge/biosolids must emit low levels of nitrous oxides (a powerful GHG), result in a positive net energy balance, and recover a significant portion of ash or phosphorus in order to be considered a beneficial use.

4. Beneficial uses and sound management practices of municipal biosolids and treated septage must adhere to all applicable safety, quality and management standards and regulations.

The manufacture, transport, and beneficial uses of municipal biosolids are regulated at the provincial/territorial and/or municipal levels. Biosolids represented as fertilizers or soil supplements when imported or sold in Canada are also regulated under the federal *Fertilizers Act* and *Regulations* administered by the Canadian Food Inspection Agency.

The *Canada-wide Approach for the Management of Wastewater Biosolids* is applicable to all aspects of the life cycle from the moment municipal sludge is generated to its end-use.

BTG has developed a draft *Guidance Document for Beneficial Use of Municipal Biosolids, Municipal Sludge and Treated Septage* which provides technical information related to the draft policy and draft supporting principles.

5.2 Draft Guidance Document for Beneficial Use of Municipal Biosolids, Municipal Sludge and Treated Septage

BTG has prepared a draft *Guidance Document for Beneficial Use of Municipal Biosolids, Municipal Sludge and Treated Septage* which will assist jurisdictions in meeting the draft policy statement and draft supporting principles. Input on the draft Guidance Document is being sought as part of this consultation. Previous work completed by the BTG (summarized in Appendix 1 and the legislative review) was used to develop the draft Guidance Document along with input from stakeholders who participated in a consultation process on the draft table of contents for the Guidance Document. The draft Guidance Document is intended to provide harmonized, Canada-wide recommendations, best management practices and considerations for regulators regarding beneficial use of municipal biosolids, municipal sludge and treated septage. Recommendations are designed to assist regulators in managing municipal biosolids, municipal sludge and treated septage according to the beneficial use draft policy statement.

6.0 Public Consultation Questionnaire and Response Submission

BTG will be accepting responses to the consultation questions until July 30, 2011. Your response to the consultation questions can be submitted to BTG using the attached form.

6.1 Next Steps

BTG will be considering comments received during this consultation to refine the draft policy statement and draft supporting principles and the draft *Guidance Document for Beneficial Use of Municipal Biosolids, Municipal Sludge and Treated Septage* which will form elements of the *Canada-wide Approach for the Management of Wastewater Biosolids*.

Completion of the Approach is targeted for the winter of 2011.

Appendix 1: Summary of Work Completed by the CCME Biosolids Task Group

The draft policy statement and draft supporting principles were developed, in part, by reviewing work previously completed by BTG pertaining to GHG emissions and emerging substances of concern (ESOC). This work is summarized below. The final reports for these projects and the Biosolids Emissions Assessment Model are available on CCME's website at:

http://www.ccme.ca/ourwork/waste.html?category_id=137.

I. Emerging Substances of Concern

BTG identified emerging substances of concern (ESOC) in municipal biosolids as an area for further research. Specifically this research was designed to identify and inventory ESOC that may be present in Canadian municipal biosolids. ESOC are compounds such as pharmaceuticals and personal care products. Sound scientifically-based knowledge on the presence or absence of these compounds in Canadian municipal biosolids is important in evaluating risks and ensuring health and environmental protection in the beneficial use of municipal biosolids.

In 2008, BTG commissioned a project to:

- review the state of the knowledge with respect to municipal biosolids science and research
- complete a field sampling program to identify and quantify the presence/absence of ESOC in Canadian municipal biosolids
- determine the effect of wastewater treatment on ESOC
- identify those ESOC that may pose a risk to the environment if land applied
- recommend best management practices and research requirements for ESOC.

This project was completed by Hydromantis Inc., the University of Waterloo and Trent University under contract to CCME. In carrying out the ESOC study the following activities were completed:

- Literature Review and Survey:
 - The literature review and survey included a review of academic and government research and correspondence with experts in the field of ESOC. The literature review is available on CCME's website: http://www.ccme.ca/assets/pdf/pn_1440_contam_invt_rvw.pdf
- Selection of ESOC for Analysis:
 - The specific ESOC included in this study were selected based on potential importance with respect to the environment and human health, likelihood of finding detectable concentrations, the presence of good laboratory methods and the project budget. The list of ESOC selected for analysis included 57 pharmaceutical compounds, three alkylphenolic compounds (Bisphenol A for example) and 11 synthetic musk fragrances. In addition the municipal sludge/municipal biosolids were analyzed for nutrients and 11 trace elements which are commonly regulated in Canadian municipal biosolids.

- Sampling and Analysis:
 - Municipal sludge/municipal biosolids samples were collected from 11 municipalities across Canada representing seven different municipal biosolids and municipal sludge treatment processes. The samples were collected before and after the municipal sludge treatment process to determine the effect of the treatment process on the form and concentration of the ESOC.
- Effectiveness of Wastewater Treatment Methods, Identification of Alternatives and Recommendations for Best Management Practices:
 - From the data collected and literature reviewed, the study identifies knowledge gaps and research needs, makes conclusions regarding the presence of ESOC and effect of treatment processes on ESOC and provides recommendations for further investigation and research.

This study revealed that some ESOC were never detected in Canadian municipal biosolids, some detected ESOC showed a decrease in concentration after treatment to the extent they were no longer detectable, and a limited number increased after treatment possibly due to transformation from other compounds. Lab methods currently allow ESOC to be detected at concentrations in the range of nanograms per litre (10^{-9} g/L) or nanograms per gram (10^{-9} g/g). It is currently unknown what risk if any is posed by ESOC detected at these low levels; detection does not immediately imply a risk associated with proper municipal biosolids management. Of the treatment processes identified, composting was identified to efficiently remove a large number of pharmaceuticals and fragrances (*Hydromantis et al, 2010*).

The ESOC literature review and study were used to inform the draft policy statement and draft supporting principles. The report discussing the results of the sampling and analysis is available on the CCME website at http://www.ccme.ca/assets/pdf/pn_1445_biosolids_esoc_final_e.pdf.

II. Greenhouse Gas Emissions

Knowledge of GHG emissions is an important consideration in assessing the sustainability of a municipal biosolids management option. Although methodologies had been developed for other organic materials generated by municipalities, the methodologies and documentation for municipal biosolids were limited.

To address these issues, BTG initiated the development of a tool which allows for the calculation of GHG emissions from municipal biosolids management options currently in use in Canada. This tool was developed by SYLVIS Environmental with project partners at the University of Washington, the North East Biosolids and Residuals Association and Northern Tilth under contract to CCME.

Biosolids Emissions Assessment Model (BEAM) is the name of the tool developed for quantification of GHG emissions from Canadian municipal biosolids management options. The BEAM and supporting user guide are publicly available and can be accessed on CCME's website at http://www.ccme.ca/ourwork/waste.html?category_id=137

The BEAM model can be used to:

- estimate the GHG emissions from a municipal biosolids management program, including establishing a baseline
- compare emissions from different municipal biosolids management options
- estimate the impacts on GHG emissions resulting from changes in a municipal biosolids management program
- understand the factors that have the greatest impact on increasing or reducing GHG emissions associated with municipal biosolids management.

Development of the BEAM included:

- Background and Literature Review:
 - The background and literature review consisted of a review of the municipal biosolids management options used in Canada including land application and combustion and a review of current methods of quantifying GHG emissions. The type of municipal biosolids management options used in Canada was determined by surveying wastewater treatment plants across the country.
- Method Development:
 - The goal in developing the BEAM was to allow Canadians to easily calculate GHG emissions related to municipal biosolids management, to identify opportunities in the management process for GHG reduction, and to identify sustainable management options.
 - Considerations in method development included identification of the municipal biosolids management options in use in Canada and sources of GHG emissions and reductions associated with each option.
- Development of Examples:
 - The BEAM model was tested using real-world Canadian examples. GHG emissions were calculated for municipal biosolids management programs from nine Canadian municipalities. The municipalities were selected to ensure Canada-wide representation and variations in municipal biosolids management options. Data provided by the municipalities and literature-based emission factors were used in the BEAM to calculate the GHG emissions associated with the management options and to provide recommendations for reducing the emissions. Ideally the amount of GHG emitted would be less than the amount of GHG avoided or sequestered (i.e., in a form that is not available for release to the atmosphere).

The results of the BEAM and testing with Canadian municipalities demonstrated opportunities for carbon sequestration and reduction in the overall GHG emissions when municipal biosolids were land applied, even where land applications sites were far from the wastewater treatment plant. Scenarios involving landfilling or combustion at relatively low temperatures emitted significant amounts on CH₄ and N₂O respectively. The information obtained through this project was considered in the development of the draft policy statement and draft supporting principles.