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CANADA-WIDE APPROACH FOR THE MANAGEMENT OF WASTEWATER BIOSOLIDS

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1. Context

Wastewater from households, industrial, commercial and institutional sources typically contains a broad range of substances that may pose risks to human and environmental health. In some cases, urban runoff or storm water is collected with sanitary waste in combined sewers, adding different pollutants to wastewater and increasing the volume of water to be treated. Treating wastewater before it is discharged to the environment reduces the risks posed to human and environmental health. Simply stated, the wastewater treatment facility separates the liquids from the solids. Depending on the level of treatment at the facility, the solids may be considered to be sludge or biosolids.

In many rural areas, residences are not serviced by wastewater treatment facilities. Their wastewater is treated by an on-site system such as a septic tank and treatment trench system. The semi-solid material that accumulates in septic tanks is called septage.

For the purposes of this document municipal biosolids are defined as organic-based products which may be solids, semi-solid or liquid, and which are produced from the treatment of municipal sludge. Municipal biosolids are municipal sludge which has been treated to meet jurisdictional standards, requirements or guidelines including the reduction of pathogens and vector attraction.

In 2009 CCME endorsed *The Canada-wide Strategy for the Management of Municipal Wastewater Effluent* (the Strategy). The Strategy sets out a harmonized framework to manage discharges from more than 3,500 wastewater facilities in Canada. The Strategy provides a path forward for achieving regulatory clarity in managing municipal wastewater effluent across the country. Performance standards contained in the Strategy are intended to increase protection for human health and the environment across Canada.

The quantity of municipal biosolids produced is expected to increase as new and upgraded wastewater facilities are constructed as a result of implementation of the Strategy. Anticipating this, the Canadian Council of Ministers of the Environment (CCME), in consultation with interested and affected parties, developed the Canada-wide Approach for the Management of Wastewater Biosolids (the Approach). The goal of the Approach is to be a framework which instils public confidence and protects the environment and human health. Supported by a technical guidance document, the Approach outlines the beneficial use and sound management of municipal biosolids, municipal sludge and treated septage as valuable sources of nutrients, organic matter and energy.

The Approach and the supporting *Guidance Document for the Beneficial Use of Municipal Biosolids, Municipal Sludge and Treated Septage* present best management practices, and encourage the beneficial use and sound management of municipal biosolids across Canada. The centrepiece of the Approach is a policy statement and four supporting principles.

Municipal biosolids, municipal sludge and treated septage can be beneficially managed in a number of ways including composting, agricultural land application and combustion for energy

production. However, in Canada some municipal biosolids are still disposed of rather than being used in a beneficial manner. Disposal options include combustion without energy capture and burial in landfills, both of which are not considered to be beneficial uses. The Approach does not promote disposal; it encourages the beneficial use of municipal biosolids, municipal sludge and treated septage, while maintaining protection of the environment and human health.

2. Policy Statement and Supporting Principles

The policy statement and supporting principles define and promote the sound management and the beneficial use of valuable resources in municipal biosolids, municipal sludge and treated septage.

Policy Statement

The Approach 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 principles that include:

- consideration of the utility and resource value (product performance)
- strategies to minimize potential risks to the environment and human health
- strategies to minimize greenhouse gas (GHG) emissions
- adherence to federal, provincial, territorial and municipal standards, requirements or guidelines.

Supporting Principles

Principle 1: Municipal biosolids, municipal sludge and treated septage contain valuable nutrients and organic matter that can be recycled or recovered as energy.

Land application of municipal biosolids can be considered a beneficial use when properly managed to enhance soil fertility, soil structure and plant growth (LeBlanc *et al.*, 2008; SYLVIS, 2009). Municipal biosolids and treated septage applied to land can also 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).

Principle 2: Adequate source reduction and treatment of municipal sludge and septage should effectively reduce pathogens, trace metals, vector attraction, odours and other substances of concern.

Applicable safety, quality and management standards, requirements or guidelines for municipal biosolids must be met. All jurisdictions should encourage and support the continuous

improvement of the quality of municipal biosolids through source control initiatives and the implementation of best management practices in order to limit any potential adverse impacts associated with their use.

Principle 3: The beneficial use of municipal biosolids, municipal sludge and treated septage should minimize the net GHG emissions.

Land application of municipal biosolids can supplement and may reduce fertilizer use. Land application results in the storage of carbon in the soil, thereby minimizing greenhouse gas (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 for use as energy (SYLVIS, 2009). However, the use of municipal biosolids as an amendment to final cover at landfills is considered as a beneficial use since it may act as a biofilter and reduce GHG emissions.

Other municipal biosolids treatment processes may also produce methane, including anaerobic digestion. To minimize GHG emissions, methane should be captured to generate heat and/or energy to be considered a beneficial use. Another option would be to neutralize the methane to carbon dioxide (CO₂) by flaring.

Principle 4: Beneficial uses and sound management practices of municipal biosolids, municipal sludge and treated septage must adhere to all applicable safety, quality and management standards, requirements and guidelines.

Sound management of municipal biosolids and treated septage includes the best management practices outlined in the Guidance Document for the Beneficial Use of Municipal Biosolids, Municipal Sludge and Treated Septage.

The manufacture, transport and use of municipal biosolids are regulated at the federal, provincial, territorial and/or municipal levels. Municipal biosolids to be used as fertilizers or soil supplements, when imported or sold in Canada, are also regulated under the federal *Fertilizers Act* and *Regulations* which are administered by the *Canadian Food Inspection Agency* (CFIA).

3. Production of Municipal Biosolids, Municipal Sludge and Treated Septage

Municipal biosolids are defined as organic-based products which may be solids, semi-solid or liquid, and which are produced from the treatment of municipal sludge. Municipal biosolids are municipal sludge which has been treated to meet jurisdictional standards, guidelines or requirements including the reduction of pathogens and vector attraction. Municipal sludge is a mixture of water and non-stabilized solids separated from various types of wastewater as a result of natural or artificial processes (CAN/BNQ 0413-400/2009). Septage is the biodegradable waste pumped directly from domestic septic tanks and other types of on-site units, and includes

sediment, water, grease and scum. Treated septage refers to septage which has been treated to meet jurisdictional standards, requirements or guidelines for parameters such as pathogens (e.g., bacteria, viruses, fungi) and vector (e.g., rodents, insects) attraction.

Canadian wastewater treatment facilities produce more than 660,000 dry tonnes (2.5 million wet tonnes¹) of biosolids and sludge 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 and sludge are continually produced at wastewater treatment facilities across the country and require ongoing management to ensure protection of human health and the environment.

4. Management Options for Municipal Biosolids, Municipal Sludge and Treated Septage

Municipal Biosolids

An on-going challenge to managing municipal biosolids is that there are benefits, risks and specific considerations for every management option. Municipal biosolids management options depend on the characteristics and quality of the municipal biosolids, the treatment process used to produce the municipal biosolids and the legislative framework of the province or territory where the municipal biosolids are used. An overview of the current legislative framework for biosolids in Canada is provided in Section 6.

Municipal biosolids management options can be classified into two broad categories - beneficial use options and disposal options. Beneficial use options fulfill the policy statement and principles as detailed in Section 2 of this document, while disposal options do not.

Beneficial use options capitalize on the nutrient and organic matter value and energy content of the municipal biosolids for use in:

- energy production (e.g. combustion)
- compost and soil products
- agricultural land application as a fertilizer or soil conditioner
- forestry application as a fertilizer or soil conditioner
- land reclamation.

When combustion is used for municipal sludge or municipal biosolids management, it may be considered a disposal option or a beneficial use option. To qualify as a beneficial use option, combustion must meet the following three criteria:

- result in a positive energy balance
- emit low levels of nitrous oxides
- recover a significant portion of ash or phosphorus.

¹ assuming 25% total solids content

Disposal options include those that do not meet the beneficial use criteria listed above; for example, burying municipal biosolids in a landfill or combustion without the demonstration of beneficial use.

Municipal Sludge

If municipal sludge is not used to produce biosolids, its management can also be classified into two broad categories – disposal options and beneficial use options. The disposal options for municipal sludge and municipal biosolids are generally the same.

Beneficial use options for municipal sludge primarily capitalize on the energy content of the material and its use for energy production.

Treated Septage

Typically, septage can be treated either at a wastewater or septage treatment facility. When septage is added at the headworks of a wastewater treatment facility, the septage becomes part of the municipal sludge and resultant municipal biosolids, where generated. When septage is treated at a dedicated septage treatment facility, the result is treated septage. Treated septage can be beneficially used in the same manner as municipal biosolids, if it meets jurisdictional standards, requirements or guidelines.

The Approach does not support the land application of untreated septage.

Beneficial Use Options

Table 1: Potential Beneficial Use Options for Municipal Biosolids and Municipal Sludge

Potential Beneficial Use Option	Examples
Energy Production	<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 and steam.
Compost and Soil Products (e.g., topsoil and compost)	<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 the development of a final cover for placement on landfills to mitigate fugitive methane (CH₄) emissions.

Potential Beneficial Use Option	Examples
Agricultural Land and Forestry Applications	<ul style="list-style-type: none"> • Municipal biosolids provide macronutrients (e.g., nitrogen and phosphorus) and micronutrients (e.g., copper, cobalt, chromium and zinc). • Land application of municipal biosolids can supplement and potentially reduce other fertilizer use. • Municipal biosolids contain 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 serve as a source of nutrients and organic matter to help promote soil development and the establishment of vegetation on degraded sites. • Municipal biosolids can be used at mine sites to assist in reclamation initiatives.

The Approach only supports the land application of materials that meet jurisdictional standards, requirements and guidelines.

Factors to be Considered for Sound Management

Factors that should be considered in the sound management of municipal biosolids, municipal sludge and treated septage include but are not limited to:

- characteristics (e.g., water content, nutrients, organic matter, trace metals and pathogens)
- utility and value of the residual (e.g., nutrient availability, soil amendment potential and energy value)
- air quality management (e.g., stack emissions from thermal treatment, odour)
- suitability of the site (e.g., soil quality prior to municipal biosolids application and proximity to sensitive water resources, local airshed issues)
- transportation logistics – number of transport vehicles required, availability of access roads
- buffer distances (e.g., distance of the proposed beneficial use site from features such as residences, water resources, roads)
- social considerations (e.g., community perception and level of acceptance of the beneficial use option, marketability of municipal biosolids or treated septage products).

The Approach supports ongoing science and research related to other substances of concern (e.g., pharmaceuticals and personal care products). Additional information on other substances of concern is available in the supporting *Guidance Document for the Beneficial Use of Municipal Biosolids, Municipal Sludge and Treated Septage*.

5. Current Canadian Legislative Framework for Municipal Biosolids, Municipal Sludge and Treated Septage

In Canada, the framework for municipal biosolids management varies among federal, provincial, territorial and municipal jurisdiction. Federal, provincial and/or territorial governments may have standards, requirements or guidelines to ensure that biosolids are managed in an appropriate and environmentally sound manner.

Generally, municipal biosolids are managed in a similar manner across Canada in that they are required to meet certain process and quality criteria in order to be used for specific purposes. For example, some jurisdictions have developed quality criteria for a range of parameters, including metals and pathogens.

Each province is responsible for setting its own policies for municipal biosolids. Each has done so either through its own policy development or by referring to policies created in other jurisdictions. In the territories, federal or territorial agencies may have jurisdiction of facilities that generate municipal biosolids. The federal or territorial agency responsible for facilities, and relevant standards, requirements or guidelines may cover one or more aspects of the lifecycle of biosolids, including production, handling, storage, transport, beneficial use and disposal methods.

The Canadian Food Inspection Agency (CFIA) regulates municipal biosolids if they are imported or sold in Canada as a fertilizer or soil supplement. The CFIA administers standards to ensure product safety and quality with respect to trace metal content, dioxin and furan contamination and pathogens. The CFIA currently uses fecal coliform and *Salmonella* as indicators of the effectiveness of treatment processes and potential pathogen loads in fertilizers and supplements, including biosolids.

Environment Canada has the authority under the *Canadian Environmental Protection Act, 1999* (CEPA 1999) to develop regulatory instruments to manage substances added to the list of toxic substances under the Act. In addition, Environment Canada's *Guidelines for Effluent Quality and Wastewater Treatment at Federal Establishments* recommend that processes involving the treatment and disposal of sludge produced at wastewater systems should reflect the best practicable technology available.

There are also CCME Canada-wide standards for emissions of mercury and of dioxins and furans from sewage sludge incinerators.

The standards, requirements and guidelines for the management of septage vary by province and territory.

In some provinces, septage is not treated prior to land application. In some provinces, septage management alternatives need to be identified and developed before the land application of untreated septage ceases.

Most provinces treat septage so it meets provincial standards, requirements or guidelines prior to land application. Others discharge and treat septage at wastewater treatment facilities.

6. Guidance Document

The *Guidance Document for the Beneficial Use of Municipal Biosolids, Municipal Sludge and Treated Septage* has been developed by CCME to provide more detailed information in support of the Approach. The Guidance Document contains information to assist Canadian regulators and generators in managing these three categories of wastewater residuals in an environmentally beneficial and sustainable manner. It outlines best management practices for the beneficial use of residuals, regardless of the jurisdiction under which they are regulated. It also provides details about management options that are currently practiced across Canada including composting, use in soil products, and land application in agriculture, forestry, silviculture, mines and other disturbed areas.

7. Opportunities for Continuous Improvement

Jurisdictions should consider adopting a continuous improvement philosophy and keep up to date with municipal biosolids research. The consideration of new information and emerging technologies should provide opportunities for continuous improvement in the selection and implementation of appropriate beneficial uses for municipal biosolids. Ongoing research and technology development may lead to changes in management practices, and can result in changes to the beneficial use choices available.