Frequently Asked Questions on Biosolids Management

What are biosolids?

Municipal biosolids are the treated, nutrient-rich and organic residual of municipal wastewater treatment. The wastewater treatment takes place at Water Pollution Control Plants, as they are called in Ontario, through processes and procedures approved and regulated by the Ministry of the Environment (MOE).

During this treatment, there are two main by-products: “effluent” or treated water which is discharged back into the local water source and “wastewater solids” which are further processed in digesters. When processing in the digester is complete and the material meets strict quality standards for recycling or beneficial use set by the MOE and the Ontario Ministry of Agriculture, Food and Rural Affairs (OMAFRA), it is called biosolids.

Biosolids contain nitrogen, phosphorous and organic matter as well as essential micro-nutrients such as copper, iron, molybdenum and zinc, all of which are important for plant growth and soil fertility. Beneficial use of biosolids as a fertilizer source on agricultural fields is an important means of recycling the nutrients in biosolids.

What is the difference between biosolids and sewage sludge?

The term sludge refers to the solids that are settled out at various points in the wastewater treatment process (e.g. primary sludge, waste activated sludge, secondary sludge, etc.). These solids cannot be removed from the Water Pollution Control Plants without further treatment.

The term biosolids is used to describe the material after it has been stabilized in the digestion process. Stabilization decomposes the solids, reduces odours and destroys most of the bacteria in the material. At the end of the digestion process, the biosolids meet safety and beneficial recycling criteria set by MOE and OMAFRA.

Why do we have biosolids?

We have biosolids as a result of treating wastewater. Wastewater treatment technology has made our water safer than ever as a drinking water source and

for recreation. In the past, cities and urban areas dumped their raw sewage directly into rivers, lakes and bays. Local governments are now required by regulations to treat sewage and the resulting solids before these products can be recycled.

Once treated to meet the regulatory requirements, the biosolids can be used as a valuable fertilizer or bio-fuel instead of taking up space in a landfill or other disposal facility.

How are biosolids generated and processed?

Biosolids are generated when solids resulting from the treatment of wastewater are treated further and tested to meet regulatory requirements. Biosolids quality control actually begins before the wastewater reaches the Water Pollution Control plant. In Ontario, pre-treatment regulations or sewer use by-laws require industrial and institutional facilities to pre-treat and test their wastewater to remove hazardous contaminants before it is discharged to the sanitary sewer system. As well, ongoing efforts to educate the public about household hazardous wastes and the establishment of local depots to receive these wastes reduce the discharge of contaminants to the sewer system and allow biosolids to meet quality standards.

The wastewater treatment facility monitors incoming wastewater streams to ensure their compatibility with the treatment process. The wastewater then goes through physical, chemical and biological processes that remove the solids and separate the water.

The solids are then heated in the digestion phase to control pathogens and other potentially harmful microorganisms. At this point, the biosolids can be disposed of at landfill sites, used as fertilizer on agricultural fields or further processed for other beneficial uses.

How are biosolids managed in Ontario?

The most common management options for Ontario biosolids are landfill disposal, incineration and beneficial use on agricultural land of liquid, dewatered or further processed forms of biosolids.

Agricultural land application is environmentally sustainable and the most cost effective biosolids management method. While landfilling and incineration waste the nutrient and soil conditioning value of biosolids, land application uses these

properties to enhance soil fertility and crop growth. Land application is the most preferred biosolids management option and is used by more than 80% of Ontario municipalities. Agricultural land application is also practiced by many municipalities in other provinces, the United States and European countries.

Do biosolids smell?

Biosolids may have their own distinctive odour depending on the type of treatment used. Some biosolids may have only a slight musty or ammonia odour. Others have a stronger odour that, may be offensive to some people. Much of the odour is caused by compounds containing sulphur and ammonia, both of which are plant nutrients. Odour can be effectively managed by incorporating the biosolids into the soil immediately after application.

Are biosolids good for the environment?

Recycling biosolids is good for the environment. Organic matter has been used for centuries to improve soil fertility and productivity. When properly applied and managed, biosolids can provide essential plant nutrients, improve soil structure and tilth, add organic matter, enhance moisture retention and reduce soil erosion.

The beneficial use of biosolids also reduces the need for commercial fertilizers which require significant resource inputs to manufacture and transport.

In Ontario, the main alternative to land application of biosolids is disposal in a landfill which uses up valuable space for a material that could have been recycled.

Carbon sequestration and reduction of greenhouse gases is another area where the beneficial uses for biosolids may have significant benefits for the environment.

Is land application of biosolids regulated in Ontario?

Yes. OMAFRA works closely with the MOE to administer Ontario's successful biosolids land application program. The practice is governed by provisions and regulations set out under the *Ontario Water Resources Act,* the *Environmental Protection Act,* and the *Nutrient Management Act.*

The regulations under these Acts and supporting publications (e.g. guidelines, protocols, etc.) define requirements and standards to ensure that biosolids are used properly and their use is protective of food quality, human and animal health and the environment.
Key requirements under the regulations include:

- Government approval of the treatment processes;
- Strict quality standards for biosolids beneficial reuse
- Laboratory analysis of the biosolids and receiving soils to ensure they meet quality standards;
- Government approval of the fields that receive biosolids, and the application methods;
- Government certification and licensing of persons involved in transport and land application;
- Detailed recordkeeping, reporting to government and MOE site inspections.

Are biosolids good for the farming community?

Biosolids are a valuable nutrient source for growing field crops such as corn, soybeans, canola and cereals. They are also highly suitable for growing forage crops and for improving pasture. Using biosolids:

- Reduces the need for commercial fertilizers;
- Reduces production costs;
- Improves soil fertility;
- Enhances soil structure, moisture retention and soil permeability;
- Adds organic matter that helps to maintain good soil tilth and reduce the potential for soil erosion.

The recycling of this valuable resource benefits farmers and society. Farmers receive a substantial economic benefit because the biosolids provide nitrogen, phosphorous and other micro-nutrients that would otherwise have to be purchased to grow crops. Also, recycling biosolids is an environmentally desirable alternative to taking up valuable landfill space and reduces greenhouse gas emissions thus providing a benefit to society as a whole.

What is the agricultural value of biosolids?

Biosolids contain a wide range of materials that are of agricultural value. As a fertilizer equivalent, the nitrogen and phosphorous in biosolids has a value of

approximately $250/hectare. Biosolids also add micronutrients and organic materials, important for crop growth and soil fertility. The present Ontario biosolids program saves farmers approximately $5 million annually in fertilizer cost. This is a significant economic contribution to the agricultural industry.

Who monitors Ontario's land application programs?

The MOE conducts about 200 inspections a year of sites that receive biosolids. Municipalities also visit the sites associated with their individual programs, on a regular basis, to ensure that contracted services are being delivered properly. These ongoing checks confirm that the rules are being followed.

Reports received by a Municipality, OMAFRA or the MOE about possible infractions are promptly investigated. If a problem is found, the appropriate action to correct any deficiencies or undesirable outcomes can be undertaken as quickly as possible. This may range from simple actions like requiring the applicator to adjust how they apply the biosolids or reinforcing program procedures, to more serious actions like fines.

Can anyone apply biosolids to land?

Currently, in Ontario, a contractor or broker must have a Systems Certificate, provided by the MOE, indicating that they have satisfied defined requirements and operate in a safe manner. The Systems Certificate is a comprehensive document that also includes vehicle registration, insurance coverage, pollution clauses, training requirements, reporting procedures and day-to-day record keeping requirements.

If the generator is required to have a Nutrient Management Strategy under the Nutrient Management Act, annual Broker Agreements are required confirming the arrangement to haul and land apply a proposed volume of biosolids for the year. Also, a Broker providing service to a generator who has a Nutrient Management Strategy must hold a Broker Certificate. Completion of a technical training course and passing an examination are required to obtain a Broker Certificate.

Are biosolids safe?

Government scientists, health experts and agronomists continually review the regulatory requirements and standards for applying biosolids to land to make

sure they protect food safety, human health and the environment. Requirements are revised as needed, based on new science or technology.

The standards include:

- Strict quality requirements
- Approval of receiving sites
- Maximum quantity that can be applied
- Requirements for spreading to take place at specified minimum distance away from homes, wells and watercourses, and
- Mandatory waiting periods after application before crops can be harvested or livestock allowed to graze.

It should be noted that there are no documented cases of adverse effects where biosolids have been applied to agricultural land in accordance with regulations or to anyone living nearby. Furthermore, there are no documented cases where workers involved in the wastewater treatment process or the land application of biosolids have experienced adverse effects due to the biosolids.

What tests are conducted?

Before they can spread on agricultural land, biosolids must be tested for total solids, nitrogen, and phosphorous concentrations, as well as concentrations of 11 regulated metals. Biosolids produced by wastewater treatment plants that have been phased in under the Nutrient Management Act must also be analyzed for their E.coli concentration. If any of the levels is above the regulated level, the biosolids must be disposed of, rather than beneficially utilized on agricultural land.

Municipalities are responsible for the testing of biosolids. The testing must be completed by certified laboratories, in accordance with the Nutrient Management regulations.

Agricultural soils that are going to have sewage biosolids applied must be tested for pH, phosphorous and regulated metal concentrations. Pre-approval inspections are carried out by MOE staff to make sure that the site conditions (e.g. surface slope, depth of soil, etc.) are suitable and that all required protective distances (e.g. setback distance from surface water) have been properly identified before biosolids can be applied.

What about other contaminants such as those found in organic compounds, pharmaceuticals, and personal care products in biosolids?

A wide variety of microconstituents, including pharmaceuticals, personal care products, antimicrobial additives, flame retardants, plasticizers, natural and synthetic hormones, surfactants, and perfluorinated compounds have been reported in municipal wastewater influents and effluents. Depending on their chemical characteristics, some of these compounds degrade during the treatment process, some remain in the liquid phase and some end up in the solids. The compounds that end up in the solids may in turn be degraded during solids treatment processes, or remain in the finished biosolids. North American and European researchers have reported that polybrominated diphenyl ethers (PBDEs, flame retardants), some classes of antibiotics, some anti-inflammatory, lipid regulating, anti-epileptic, and anti-depressant pharmaceuticals, the antimicrobial compounds triclosan and triclocarban, bisphenol A and other plasticizers, and musk fragrances are present in biosolids at parts-per-billion (ppb) to parts-per-million (ppm) concentrations. Perfluorinated compounds and the naturally occuring hormone estrone are found at ppb concentrations. Surfactants, including the nonylphenol class, are found at ppm to parts-per-thousand concentrations.

When discussing concentrations, it is important to understand the terminology. To keep perspective, consider that a typical planting rate for soybeans is 200,000 seeds per acre. Therefore, 1 ppm is equivalent to 1 seed in 5 acres. One ppb is equivalent to 1 seed in 5,000 acres and 1 ppt is equivalent to 1 seed in 5 million acres. The Province of Ontario is approximately 230 million acres.

It is also important to understand that the impact of contaminants on human health depends on how the person is exposed. People are more likely to be exposed to these contaminants through daily use or contact with household products such as soap, hair detergents, clothes, furniture, indoor air and dust.

To assure public safety, government and academic researchers continue to study the effects in terrestrial ecosystems to which biosolids have been applied, and in aquatic ecosystems which may receive sewage effluent and/or runoff from biosolids applications.

Are there other options for managing biosolids?

Yes, a list of the best available technologies is provided below:

- Anaerobic Digestion with energy recovery
- Autothermal Thermophilic Aerobic Digestion (ATAD)
- Thickening/dewatering
- Permanent secure storage
- Land application of liquid or cake
- Heat drying/pelletization (with product marketing)
- Alkaline Stabilization (w/product marketing)
- Thermal treatment with energy recovery (i.e. gasification)
- Composting/co-composting
- Reclamation uses
- Forestry/nursery applications

In Ontario, wastewater treatment and managing the residuals are a municipal responsibility that is approved by the Ministry of the Environment. Selecting a management method should be carefully considered and evaluated, starting at the inlet pipe to the wastewater treatment plant.

How do biosolids compare to livestock manure and commercial fertilizers?

Like livestock manure, biosolids are a good source of nitrogen, phosphorous and organic matter. Organic matter can only be found in natural materials, like biosolids, manure and crop residues, and is depleted in soil by cropping practices, tillage, weather conditions and erosion. Organic matter is essential in productive agricultural soils, playing an important role in improving soil structure, moisture retention, tilth and enhancing the uptake of plant nutrients.

Unlike livestock manure, biosolids are required to be sampled and analysed at least bi-weekly during the land application season. Required analyses include nitrogen and phosphorus, as well as the eleven heavy metals of concern to agriculture, and E.coli. Biosolids are also being closely monitored for other contaminants, such as those contained in pharmaceuticals and personal care products. The current science indicates seemingly low concentrations, and government and academia continue to study the effects in the environment.

Application of biosolids to agricultural land offsets the need for commercial fertilizer use, while providing a prime example of returning nutrients to land.

Biosolids are free to the farmer, while commercial fertilizers can be quite costly. Production of commercial fertilizers can also be resource-intensive and contribute to greenhouse gas emissions, so recycling of biosolids on agricultural land also provides a societal benefit.

Where can I get more information about biosolids and their uses?

To learn more about sewage biosolids visit these web sites:

Canadian Biosolids Partnership
http://www.cwwa.ca/cbp-pcb/home/home_e.asp

National Biosolids Partnership
http://www.biosolids.org

Water Environment Association of Ontario
http://www.weao.org/committees/biosolids/biosolids.html

Water Environment Federation (WEF)
http://www.wef.org

Ministry of Agriculture and Food
http://www.gov.on.ca/OMAF

Biosolids Utilization Committee
http://www.gov.on.ca/OMAF/english/environment/biosolids/contacts.htm

Ministry of the Environment
http://www.ene.gov.on.ca