What are municipal biosolids?

Municipal biosolids are the treated, quality controlled by-products of municipal water treatment operations. Wastewater from residential and industrial sources is treated at municipal treatment plants that are approved by the Ministry of the Environment, Conservation and Parks (MECP).

During this treatment, there are two main by-products: “effluent” or treated water, which is discharged back into a local water source, and “wastewater solids” which are further processed in digesters to remove most bacteria and pathogens. When processing in the digester is complete and the material meets strict quality standards, it is called a biosolid.

Biosolids are organic in nature and contain nutrient constituents including nitrogen, phosphorus, micronutrients and metals, making them ideal for beneficial reuse on land.

How are municipal sewage biosolids treated?

Biosolids are biologically stabilized materials from an approved treatment process. In Ontario, stabilization is usually accomplished by subjecting wastewater solids to anaerobic and/or aerobic digestion. Stabilization decomposes the solids, reduces odours and destroys most of the bacteria and pathogens in the material. The stabilized solids are defined as biosolids when the material meets strict quality criteria as set out in provincial regulations and is of benefit to agriculture soils and field crop production. Biosolids consist mainly of organic matter that is rich in plant nutrients. Some biosolids are further processed through technologies such as dewatering, composting, lime stabilization and pelletizing.
What are the preferred biosolids management options in Ontario?

The management options for Ontario biosolids are landfilling (disposal), thermal pelletizing, incineration (burning) and land application (beneficial re-use). As much as possible, the province, municipalities and biosolids management service providers aim to divert biosolids from disposal and maximize their beneficial use through land application.

Landfilling of biosolids is not favoured because it is not environmentally sustainable – it uses up valuable nutrient resources while at the same time depleting increasingly scarce landfill space – and it is expensive. Further, there is proposed provincial legislation to exclude recyclable organics from Ontario landfills. Similarly, incineration is very expensive and raises public concern about air quality from emissions. In addition, residual incineration ash must be disposed of by landfilling. Pelletization of biosolids comes with a large GHG footprint as large volumes of natural gas are consumed to dry and pelletize biosolids. Pelletization is a very expensive process and is a costly option for municipalities.

Land application is the most environmentally sustainable and cost-effective management option. 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 preferred biosolids management option and is used by more than 80 percent of Ontario municipalities.

Is land application of biosolids regulated in Ontario?

Yes. Ontario’s biosolids management program is regulated under both Regulation 347 of the Environmental Protection Act and Ontario Regulation 267/03, also referred to as the Nutrient Management Regulation (NM Regs) of the Nutrient Management Act (NMA), 2002. The NMA defines biosolids as a Non-Agricultural Source Material (NASM) and must be land applied with an Ontario Ministry of Agriculture, Food and Rural Affairs (OMAFRA)-approved NASM Plan.

Who enforces the Nutrient Management Act 2002, Ontario Regulation 267/03?

The MECP enforces the NMA to ensure that land application practices comply with the requirements of the NASM Plan and the NM Regs. As part of their quality assurance program, land application sites are randomly inspected to ensure compliance with the NMA. This ensures that all nutrients continue to be managed in an environmentally responsible manner with an enhanced science-based approach to land applying nutrients.

What is a NASM and a NASM Plan?

A Non-Agricultural Source Material or NASM, as defined by OMAFRA, is any material containing nutrients that originate from non-farm sources that will be used on the farm to supply nutrients in field crop production. Examples would include food processing waste, fruit and vegetable peels, as well as paper fibre and biosolids. NASMs such as biosolids can contain high amounts of plant-available nitrogen and phosphorous as well as large amounts of organic matter and their usage and application rate are regulated through a NASM Plan.

Is land application of biosolids safe?

Yes. Over the past 40 years, no adverse effects on human or animal health, crop productivity or the environment have been documented in Ontario. The U.S. National Academy of Sciences, U.S. Environmental Protection Agency, European Union, Water Environment Federation, Canadian Federal and Provincial governments, the University of Guelph and numerous academic institutions worldwide have conducted extensive, long-term research and have concluded that land application of biosolids, when practiced in accordance with responsible regulations, is beneficial and poses minimal health or environmental risk.
A NASM plan, approved by OMAFRA, is required in order to demonstrate agronomic requirements of the crop, as well as the fertility benefit of the NASM in the farmer’s crop rotation. The NASM plan is a detailed summary of all the nutrients provided from all sources including commercial fertilizer, manure and NASM. The agronomic and crop removal balance are part of the NASM plan and account for crop removal as well as for some soil buildup, depending on the nutrient. This enhanced scientific approach to NASM application prevents the over application of nutrients while protecting the soil, ground and surface water.

Who can create a NASM Plan?

An OMAFRA-certified NASM Plan Developer is authorized to create a NASM plan. This individual must take a series of courses, pass an examination and prove competency by successfully completing two NASM plan scenarios. After this process, OMAFRA will grant certification that has a lifespan of 5 years, after which time the process must be repeated. The certified NASM Plan Developer is competent in using OMAFRA’s NMan computer program that calculates the required addition of biosolids to the farmer’s field based on the NASM plan and fertility and cropping program.

Who can land apply biosolids with an approved NASM Plan?

A land application program can only operate with the cooperation of a number of parties in the business of protecting the environment: the generator (municipality, company), the contractor undertaking transportation and land application (service provider) and the farmer - who all work together to implement the NASM plan.

Material is only applied by individuals who have successfully passed the OMAFRA Nutrient Application Technician’s course to become licensed Nutrient Application Technicians. These licensed technicians apply biosolids at the specified application rate according to the farmer’s NASM plan and are familiar with all areas within the field that are environmentally sensitive and where biosolids can and cannot be land applied.

Are there different types of biosolids land application?

Land application can utilize a variety of forms of biosolids, such as liquid, cake, pellets and composted material. This material can be used in forestry or land reclamation, but is primarily used for agricultural applications in field crop production. The majority of liquid biosolids are injected into the soil, while a small amount may be top spread and not incorporated when applied to a hay field or when applied to a field that is in no-till crop production. All biosolids cake is incorporated into the soil within six hours of application as required by the Nutrient Management Regulation.

What other requirements are necessary prior to land application?

Before biosolids can be land applied for beneficial use, the following are required:

- Quality of biosolids analysis - the generator must test the biosolids at an accredited laboratory on a scheduled basis to ensure the material does not contain constituents that could harm public health, the soil, crops, livestock or the environment as specified in the NM Regulation Sampling and Analysis Protocols
- Site soil sampling and analysis - the soil must be sampled and analyzed at an accredited laboratory to ensure compliance with the NM Regulation specifically focusing on soil metals, pH and phosphorous levels
- An extensive site inspection must be completed by a certified NASM Plan Developer in order to create an accurate site map that is part of the NASM Plan. Site characteristics, such as soil type

...
and permeability, slope, depth to ground water and separation distances from watercourses, wells and residences, must be identified as well as other significant environmentally sensitive features

- Contractor Systems Certificate - must be provided by the MECP indicating that the contractor satisfies defined requirements and operates 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 recordkeeping requirements

**What happens to metals that are added to the soil from biosolids application?**

Many of the metals (e.g., zinc, copper and molybdenum) are micronutrients required for crop development. These metals are natural and necessary components of healthy plant growth and are absorbed by the plants. Copper, zinc, selenium and cobalt are important for animal health, including humans, and aid in the adsorption of vitamins.

Other metals (e.g., arsenic, cadmium and chromium) serve no known biological function. They form insoluble precipitates on the biosolids and soil materials. There is very little tendency for them to be taken up by plants or to migrate to surface or groundwater.

The metal additions and loading limits in Ontario soils as regulated by the NM Regulation are very conservative. Experiments conducted by the University of Guelph, OMAFRA and the Federal Wastewater Technology Centre show no detrimental crop or environmental effects, even where metal loadings were several times the Ontario Regulation limits for biosolids. These findings are consistent with the results of numerous international studies and it has been concluded that the Ontario limits are protective of public health, soil quality, livestock and the environment.

**What is the agricultural value of biosolids?**

Biosolids contain a wide range of materials that are of agricultural value for beneficial use. As a fertilizer equivalent, the nitrogen and phosphorus in biosolids have a value of approximately $400-1,000/hectare. Biosolids also add micronutrients, important for crop growth. The high organic matter levels in biosolids also improve soil structure, moisture retention and permeability, while reducing the potential for wind and water erosion. The present Ontario biosolids program saves farmers approximately $8 million annually in fertilizer costs. This is a significant contribution to the agriculture sector of the Ontario economy.

**When are biosolids land applied?**

Biosolids are land applied during the spring, summer and fall, depending on weather and cropping schedules. In Ontario, biosolids are not permitted to be applied during the winter and must be applied between April 1 and November 31, as outlined in the NM Regulation. During the winter, biosolids are usually stored by municipalities either at a wastewater treatment facility or in a specially designed storage facility.

**What crops are suitable for biosolids land application?**

Biosolids are well suited for field crops, such as corn, cereals, canola, soybeans, hay, pasture and sod, as they all require specific amounts of nitrogen and phosphorous for healthy growth and optimum yield.
What are the requirements for recordkeeping?

Accurate computerized records must be kept of exact application site locations; rates of biosolids application; soil pH and phosphorus levels; farmers’ names and addresses; sources and quality of biosolids. OMAFRA’s NMan computer program tracks the nutrient and metal additions to the soil and determines when biosolids can be land applied, again to a farm with an existing registered NASM plan. These records are maintained by the contractor, municipality, MECP and the farmer.

For more information on municipal biosolids please visit the following websites:

- Water Environment Association of Ontario
  www.weao.org

- Ministry of Agriculture, Food and Rural Affairs
  http://www.omafra.gov.on.ca/english/

- Ministry of the Environment, Conservation and Parks
  www.ontario.ca/page/ministry-environment-conservation-parks

- Terrapure Environmental
  www.terrapureenv.com

- Ministry of Agriculture, Food and Rural Affairs, BIOSOLIDS Factsheet
  http://www.omafra.gov.on.ca/english/nm/nasm/info/brochure.htm

- Water Environment Association of Ontario, Video
  https://www.weao.org/biosolids-video