Review on the Use of Sewage Sludge as Fertilizer

The Toronto Main Treatment Plant is planning on implementing a program to use biosolids beneficially. Two uses are being considered: spreading treated sewage sludge on farmlands, and marketing sewage sludge pellets as fertilizers. Concerns associated with these two uses are the level of pathogens and chemical contaminants present in the sludge. The present review focuses on whether the controls put in place are sufficient to ensure that human health concerns are addressed.

1. Spreading of Sewage Sludge on Farmlands

   The spreading of sewage sludge on farmlands is regulated at the provincial level in Ontario based on the Ministry of Environment (MOE) Guidelines for the Utilization of Biosolids and other Wastes on Agricultural Land. Sludge can only be used for this purpose if it has been stabilized (i.e. undergone a process to reduce pathogens, odour and to inhibit putrefaction), and is beneficial to crop production and soil health. The Guidelines lay out very specific conditions, which have to be met before sewage sludge can be applied to farmland. These conditions include the following.

   - general restrictions on the quality of sewage sludge, such as concentration of the nutrients and certain metals;
   - criteria relating to the sites where the sludge would be spread, such as separation distances from residences, groundwater and bedrock, water wells and surface water;
   - spreading rates and the manner in which the sludge is applied;
   - soil criteria including concentrations of metals, soil conditions, suitable crops;
   - restrictions on crop production for sites receiving the sludge, by instituting different waiting periods for different crops after sludge application before the soil can be used;
   - handling and storage; and
   - continuous monitoring, analysis and record keeping.

   These restrictions are designed to ensure that utilization of sewage sludge on farmland is successfully carried out in an environmentally friendly manner with beneficial effects for the agricultural soil.

   In addition to the Guidelines, MOE has control mechanisms at the implementation level. At present, a Certificate of Approval is required before application of sewage sludge is allowed on a particular piece of farmland. The application has to include information on the level of fecal coliforms, the quality of sewage sludge and conditions of the soil proposed to receive the sludge. The Ministry is planning to simplify the approval process, without relaxing the basic requirements. Although approval may not be required on a site-specific basis, the Ministry will set up a soil registry, and farmers are expected

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to follow the guidelines and maintain a good record. The Ministry’s proposed plan would
be revised to address concerns raised during public consultations.

1.1 Pathogens

The current process in place at the Main Treatment Plant involves anaerobic digestion of
sewage sludge followed by dewatering. During anaerobic digestion, aerobic pathogens
are killed and organic materials are utilized by the micro-organisms. The anaerobic
pathogens are expected to be reduced after being removed from the anaerobic digester.
Dewatering further renders the conditions unfavourable for the pathogens to thrive. It is
the dewatered sludge that is proposed to be spread on farmland.

To control pathogenic risk, the guidelines require that the sewage sludge be stabilized
beforehand in accordance with MOE criteria set for different stabilization procedures.
Fecal coliform is an indicator of the level of pathogens present in the sewage sludge. In
order to meet the fecal coliform level, the Ministry regulates the residence time that the
sewage sludge has to be in the anaerobic digester. At present, the Main Treatment plant
has some problem with meeting the Ministry’s criteria for prescribed residence time.
Work is under way to ensure this criterion is met before sewage sludge will be spread on
farmland. While the level of pathogen is minimal in the sludge to be applied, the
institution of a waiting period after the application of biosolids before people or animals
are allowed to access the land further prevents contact of pathogens with animals and
humans. For farmland designated for growing crops, sludge can only be applied on bare
soil and the soil tilled. The waiting period allows the sludge to be incorporated further
into the soil. For pastures, it would be spread on low cut grass. During the waiting
period before animals can be allowed on the pastures, the grass would have grown and
sludge that might have been deposited on the grass would have a chance to be washed
and incorporated into the soil.

At the Main Treatment Plant, after the sewage sludge passes through the anaerobic
digester, it goes through a dewatering process during which the sludge becomes roughly
30% solid. These conditions are not favourable for pathogens to thrive, particularly those
that are of most concern. The use of stabilized biosolids as fertilizers does not provide
the necessary conditions for the transmission of diseases such as necrotizing fasciitis,
HIV and BSE. The utilization of stabilized sewage sludge has been practised for over 25
years in Canada and the United States. Toronto Public Health is not aware of any
evidence of outbreaks of infectious disease directly linked to the practice.

1.2 Chemical Contaminants

Metals

As stipulated by the MOE Guidelines, the maximum permissible levels of metals in soils
are close to the provincial ‘background’ levels (i.e. levels that each metal occurs naturally
in the soil). Maximum permissible levels are determined by taking into account the
uptake rates of the metals into plants and their possible effects on vegetation, animals and humans. For most metals, vegetation is more sensitive to their toxic effect than humans.

At present, the Certificate of Approval application also has to provide information on the proposed application rate, frequency and minimum years of application, calculated based on the maximum permissible metal content in soils, the soil conditions of the farm and the metal contents in the sewage sludge to be applied. A Certificate of Approval would not be issued unless the Ministry is satisfied that the practice would not lead to a built-up of metals in the soil that would be a health hazard to both humans and the environment. Farmers would still be required to conduct the same type of analysis and calculations for their operation under the simplified approval process.

**Persistent Organics**

Although the *Biosolids Utilization Guidelines* do not set limits on persistent organics such as polychlorinated dioxins and PCBs, existing research suggests that they are unlikely to be a concern in Ontario treated sludge. The Ministry of the Environment and Ministry of Agriculture and Food have conducted studies on the digested sewage sludge in Ontario and concluded that the levels of these compounds in the Ontario treated sewage sludge are generally so low that they would not constitute a health risk after it is mixed in with the soil. With the trend towards decreasing production of these compounds in industrial operations, their levels are expected to decrease further.

The Sewer Use By-law is currently undergoing review to further control the level of chemical contaminants in the sewage going into the Sewage Treatment Plants. The by-law will include parameters that will support the City’s Beneficial Use of Biosolids program. The by-law will also include a provision for a Pollution Prevention Program as a first option for industries to implement.

2. **Marketing Sewage Sludge Pellets as Fertilizers**

The second beneficial use that is considered for the sewage sludge from the Toronto Main Treatment Plant is converting sewage sludge into pellets and marketing them as fertilizers. The process involves passing the dewatered sewage sludge through a pelletizer. The Main Treatment Plant will be using a thermal heating process by which the sludge would be pelleted by heated plates at 280°C. The biosolids would be dried from 30% solid to 92-95% solid during which pathogens would be virtually eliminated.

Sewage sludge pellets are classified by the United States Environmental Protection Agency as class A products under their Part 503 regulations. Class A products are considered to be pathogen free and are treated as unrestricted products in the United States. In Canada, sewage sludge pellets are regulated under the Federal Fertilizer Act, which puts a limit on the level of metals in the product.

The anticipated target market for the sludge pellets from the Main Treatment Plant is the bulk agricultural market. In other words, the intent is not to include retail sale to
consumers for use in home gardens. Furthermore, the Main Treatment Plant is developing plans to provide specific instructions on how the products should be used, such as application rate, application frequency, etc. to minimize the so that build-up of metals or other chemicals that could pose a risk to the environment, human or animal health. The content of the pellets and the associated benefits and risks will be identified on the product. The product will be sold to informed farm operators who are expected to use the product in the way it is intended.

Marketing sewage sludge pellets has been practised in Smith Falls, Ontario. Toronto Public Health is not aware of any reported problems with respect to human, animal or environmental health when proper procedures have been followed. Further strengthening source control through the Sewer Use By-law, along with controls on the marketing and sale of the product, ensures that human health will be safeguarded.

Conclusion

Only the stabilized sewage sludge from the Toronto Main Treatment Plant is intended for its biosolid beneficial use program. The sludge has undergone a process to reduce its level of pathogens, odour and to inhibit decay. Sufficient control is in place to ensure that the level of pathogens and chemical contaminants in the sewage sludge would not result in health hazard to human and environmental health. Application of treated sewage sludge on farmland and marketing sewage sludge pellets have been practised in North America for sometime now, we are not aware of any evidence of outbreaks of infectious disease, or reported health problems when proper procedures have been followed.