

Selected Bibliography of Sewage Sludge Resources:

Legislation:

British Columbia. Ministry of Environment, Lands and Parks, Organic Matter Recycling Regulation (OMRR), <http://wlapwww.gov.bc.ca/epd/epdpa/mpp/omrreg.html>

Ontario. Ministry of the Environment. Guidelines for the Utilization of Biosolids and Other Wastes on Agricultural Land, March 1996.

<http://www.ene.gov.on.ca/envision/gp/3681e.pdf>

Ontario. *Nutrient Management Act, Bill 81*

<http://www.ontla.on.ca/library/bills/81372.htm>

City of Toronto. Sewer Use By-law. Municipal Code Chapter 681 and By-law amendment 01-0081.

<http://www.city.toronto.on.ca/involved/wpc/nbylaw.htm>

United States. Environmental Protection Agency. Proposed Rule Revising the Standards for Use and Disposal of Biosolids. [40 CFR Part 503].

<http://www.epa.gov/ost/biosolids/rule.pdf>

European Commission. Council Directive 86/278/EEC of 12 June 1986 on the protection of the environment, and in particular of the soil, when sewage sludge is used in agriculture.

http://europa.eu.int/eur-lex/en/lif/dat/1986/en_386L0278.html

European Commission. DG Environment; prepared by Arthur Andersen. Disposal and recycling routes for sewage sludge. Part 2 - Regulatory report. [Contains summaries of the sewage sludge regulatory framework in each EU country]. October 2001.

http://europa.eu.int/comm/environment/sludge/sludge_disposal.htm

Reports:

Cornell Waste Management Institute, Cornell University Center for the Environment. Ellen Z. Harrison, Murray B. McBride and David R. Bouldin. The Case for Caution: Recommendations for Land Application of Sewage Sludges and an Appraisal of the US EPA's Part 503 Sludge Rules: Working Paper, revised 1999 ed.

<http://www.cfe.cornell.edu/wmi/PDFS/LandApp.pdf>

European Commission. DG Environment; prepared by Arthur Andersen. Disposal and recycling routes for sewage sludge. Part 1 - Sludge use acceptance report. [Contains an analysis of attitudes to sludge in each EU country]. October 2001.

http://europa.eu.int/comm/environment/sludge/sludge_disposal.htm

U.S. EPA. Office of Water. Technical Support Documents and External Peer Review Comments to support the development of a final EPA action on the land application of sewage sludge regarding dioxins.

All are at <http://www.epa.gov/waterscience/biosolids/support.html>:

Exposure Analysis for Dioxins, Dibenzofurans, and Coplanar Polychlorinated Biphenyls in Sewage Sludge- Technical Background Document Including Appendices. External Peer Review Draft.

Appendices. November 30, 2001

Risk Characterization of "Exposure Analysis for Dioxins, Dibenzofurans, and Coplanar Polychlorinated Biphenyls in Sewage Sludge- Technical Background Document Including Appendices". External Peer Review Draft. December, 2001.

"Estimate of Population Exposed to Dioxins from the Land Application of Sewage Sludge and Corresponding Number of Annual Cancer Cases from this Exposure". External Peer Review Draft.

PART 5: INVENTORY OF POLLUTION PREVENTION OPTIONS FOR SEWAGE SLUDGE INCINERATION

Method / Technique II: Waste Segregation

The intractable nature of the problem of what to do with sewage sludge centres on the fact that an organic and recyclable waste stream is being combined with industrial and other hazardous waste streams. In the long run, therefore, in addition to source reduction, pollution prevention would be best undertaken by segregating these waste streams. There are no jurisdictions that currently manage to entirely separate the two waste streams, but it should still be stated because the existing ways of dealing with sewage sludge in the absence of complete segregation - basically incineration, landfill, and land application - all have serious shortcomings from an environmental standpoint.

Alternative technologies for treating sewage as a separate waste stream currently do exist, such as through wetlands management or the use of composting toilets, but the use of these measures to date has been on a relatively small scale. (e.g., Body Shop in Toronto & UBC Asian Studies building)

Sewer use legislation is the primary means of regulation to keep toxics from polluting wastewater.

As with Method I above, waste segregation measures will reduce the quantities of contaminants entering wastewater:

For additional initiatives and provisions related to this method, see measures listed under "waste segregation" in the other three incineration tables.

Jurisdiction	Initiative	Description
Toronto	Toronto Municipal Code Chapter 681 and by-law amendment 01-0081: http://www.city.toronto.on.ca/involved/wpc/nbylaw.htm	- limits on substances discharged into sewers - requirement for pollution prevention by industries discharging subject pollutants
Massachusetts	The Massachusetts Water Resources Authority (MWRA): http://www.mwra.state.ma.us/	- prohibits the discharge of mercury by industrial facilities to its sewer system and imposes an effective discharge limitation for mercury of 1.0 part per billion (ppb) from its regulated sources, including hospitals and institutions
Massachusetts	Municipal Waste Combustor Rule, 310 CMR 7.08 (1999): http://www.state.ma.us/dep/bwp/hgres.htm	- currently working on regulations requiring separation plans for the removal of mercury from medical waste incinerators and sewage sludge incinerators.

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Method / Technique III: Land application of Sewage Sludge

As jurisdictions move away from incinerating sewage sludge, the most frequently adopted alternative is land application, which has become a major alternative to incineration throughout North America and Europe. However, there is increasing uncertainty about the environmental and health effects of heavy metals, pathogens, and organic compounds on agricultural and other lands. There is also concern about the environmental impacts of sludge runoff into waterways.

Jurisdiction	Initiative	Description						
European Commission	Process to tighten the standards for sewage sludge in the current Directive on the protection of the environment, and in particular of the soil, when sewage sludge is used in agriculture (86/278/EEC) For more information, see "Disposal and recycling routes for sewage sludge. Part 2 - Regulatory report" (October 2001) at: http://europa.eu.int/comm/environment/sludge/sludge_disposal.htm	European measures for controlling sewage sludge: - Limit values for heavy metals in sludge - Limit values for pathogens in sludge - Limit values for organic compounds in sludge - Limit values for soil for application - Obligations for treatment - Surfaces on which use of sludge is prohibited - Frequency of sampling analysis - Further quality related restrictions such as certification and information requirements, codes of practice and guides, voluntary agreements on disposal and recycling of sewage sludge - Labelling distinguish treated, higher-quality sludge - Specific requirements for use of sludge in silviculture, forest, and reclamation and green areas						
Denmark: - one of the more stringent European countries in terms of the regulatory framework for land application of sewage sludge Other countries with stringent regulations include Finland, Sweden, and the Netherlands	Three Statutory Orders govern sludge: • SO 2000/49 on Application of Waste Products for Agricultural Purposes (2000) • SO 590 of 27.6.94 on the Protection of the Environment • SO/2000/56 on describing control of sewage sludge for agricultural use http://europa.eu.int/comm/environment/waste/landspreading_annexes1.pdf	1. SO 2000/49 (and SO 1996/823): - determines the limit values for heavy metals in sludge. For example, compared to Directive 86/278/EEC, Denmark's limits are up to 25 x lower: <table> <tr> <th>Substance</th><th>EU Directive mg/kg DM (dry matter)</th><th>Denmark mg/kg DM (dry matter)</th></tr> <tr> <td>Cadmium</td><td>20-40</td><td>0.8</td></tr> </table>	Substance	EU Directive mg/kg DM (dry matter)	Denmark mg/kg DM (dry matter)	Cadmium	20-40	0.8
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Mercury	16-25	0.8
Nickel	300-400	30
Lead	750-1200	120 (60 for private gardens)
Zinc	2500-4000	4000
Chromium	-	100
Copper	1000-1750	1000
Arsenic	-	25 (for private gardens)

Source: EC. Disposal and recycling routes for sewage sludge, part 2, p. 14

http://europa.eu.int/comm/environment/sludge/sludge_disposal.htm

- sets the maximum quantity of sludge to be spread on land at 10 tonnes of dry matter per hectare per year

- for advanced treated sludge, there must be no salmonella and faecal streptococci must be below 100 per g.

- Limit values for organic compounds in sludge for agricultural use including limits on DEHP, PAHs (8 elements), NPE (Nonylphenole (+ Ethoxylates)) and LAS (Linear alkylbenzene sulphonates)

- Prohibits the agricultural use of untreated sewage sludge and requires different levels of treatment for different sludge sources, and for different agricultural uses.

- Prohibits application of sludge to surfaces where it is likely to run off into lakes, watercourses or drains; surfaces where it is likely to pollute groundwater; and surfaces where it is likely to cause significant nuisances or unsanitary conditions.

- Heavy metal concentrations in sludge must be analysed by wastewater treatment plants every 3 months; and organic compounds must be analysed every 12 months.

- Wastewater treatments must provide information and an annual report to regional councils every year

- Sludge can be applied in forests under certain conditions; and sludge used in green areas must be pasteurised.

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Sweden, Denmark, Netherlands	- Policies of no net degradation	- limiting inputs to the soil so they do not exceed outputs in order to prevent the accumulation of pollutants in the soil. This approach strives to limit the addition of contaminants to the levels that are present in uncontaminated soils.
British Columbia	<i>Organic Matter Recycling Regulation (OMRR):</i> http://wlapwww.gov.bc.ca/epd/epdpa/mpp/omrreg.html	- comparably high limits for toxics - no limits on frequency of application - limited monitoring
Ontario	Guidelines for the Utilization of Biosolids and Other Wastes on Agricultural Lands (March 1996) http://www.ene.gov.on.ca/envision/gp/3681e.pdf <i>Nutrient Management Act</i> (Bill 81): http://www.ontla.on.ca/library/bills/81372.htm	- not enforceable - recommendations, no measurable conditions - use of terms like "acceptable level" and "high concentrations" without quantification of these terms - 2000/2001 ECO report found "significant weaknesses in the current legislation and practices governing the land spreading of sludges and septage". - the effectiveness of the recent <i>Nutrient Management Act</i> proposed as a solution to this will depend on the regulations developed under the Act
Ontario	Internal review of policies regarding the land application of sewage sludge via a formal <i>EBR</i> consultation by MOE in conjunction with MMAH and OMAFRA.	
United States	EPA s reviewing the consequences of land application, and the National Academy of Science is undertaking a study of the risks involved	
United States	EPA Proposed Rule Revising the Standards for Use and Disposal of Biosolids (40 CFR part 503): http://www.epa.gov/ost/biosolids/rule.pdf	- Limit values for heavy metals are generally considerably higher than in Europe.