Applying knowledge to improve water quality
Mid-Atlantic
Regional Water Program
A Partnership of USDA CSREES
& Land Grant Colleges and Universities

March 01, 2005

MAWQP# 05-03

Land Application of Biosolids to Provide Plant Nutrients, Enhance Soil Properties, and Prevent Water Quality Impairment

Beshr Sukkariyah, Post-doctoral Associate;
Kathryn Haering, Research Support Specialist;
Gregory Evanylo, Professor and Extension Specialist,
Dept. of Crop & Soil Environmental Sciences, Virginia Tech, Blacksburg, VA.

Biosolids are the solid, semisolid, and liquid residues generated during the treatment of sanitary sewage by wastewater treatment works. The term was introduced by the wastewater treatment industry in 1991 to describe the residuals, or solids, created during the biological treatment of wastewater (hence, bio-solids). The U.S. Environmental Protection Agency (USEPA) recently adopted the name "biosolids" to distinguish this high quality sewage sludge from sludges that are untreated or that contain excessive concentrations of potential pollutants and pathogens; therefore, sewage sludges must be processed to meet USEPA standards for beneficial reuse before they can be called biosolids.

Photo by Tom Simpson

Biosolids contain partially decomposed organic matter, some amount of all plant essential elements, and (in some cases) liming agents. The application of these residuals to agricultural, forest, or disturbed lands can solely or partially provide plant nutrient needs and can improve soil physical and chemical attributes. Lime-stabilized biosolids can be used to increase soil pH, if necessary.

Water quality impairment can result from improper storage and/or application of biosolids. Nitrogen contamination of groundwater may occur if biosolids are not stored correctly or are applied at rates exceeding plant N demand or at the wrong time of the year. Phosphorus contamination of surface water may occur if biosolids are repeatedly applied at rates based on N availability and plant uptake, which may elevate soil P levels beyond the binding capacity of the biosolids-amended surface soil.

Certain biosolids (i.e., Class B, or those subject to Processes to Significantly Reduce Pathogens during treatment) contain detectable levels of microbial pathogens, whose further destruction by desiccation, heat, and competition with background microbes following land application and regulatory-prescribed buffers are necessary to ensure protection of ground and surface water.

The following links are to web sites that describe biosolids use, management recommendations, and federal and state regulation controlling biosolids application. We have included both general links and those which specifically pertain to biosolids use in EPA Region III. We hope these links will be useful in promoting the environmentally sound use of these potentially valuable residuals.

Federal Agency Resources

Environmental Protection Agency

Main Biosolids Page
http://www.epa.gov/owm/mtb/biosolids/index.htm
Introduction and links to the following pages and documents, plus other information on recycling and disposal of biosolids.

EPA Biosolids FAQ
http://www.epa.gov/owm/mtb/biosolids/genqa.htm
Biosolids questions and answers

Guide to Field Storage of Biosolids and Other Organic By-Products Used in Agriculture and for Soil Resource Management (2000)
http://www.epa.gov/owm/mtb/biosolids/fsguide/index.htm
Document describing management practices for field storage of biosolids prior to land application.

A Plain English Guide to the EPA Part 503 Biosolids Rule (1994)
http://www.epa.gov/owm/mtb/biosolids/503pe/503pe_toc.pdf
Document which assists in interpretation and application of the 40 CFR Part 503 rule, which governs biosolids management, use, and disposal.

A Guide to the Biosolids Risk Assessments for the EPA Part 503 Rule (1995)
http://www.epa.gov/owm/mtb/biosolids/503rule/index.htm
Document which explains the risk assessment process conducted as a basis for the part 503 rule, including procedures, assumptions, policy, issues, and frequently asked questions about the risk assessments.

Land Application of Sewage Sludge - A Guide for Land Appliers on the requirements of the Federal Standards for the Use or Disposal of Sewage Sludge, 40 CFR Part 503 (1994)
http://www.epa.gov/owmitnet/mtb/biosolids/sludge.pdf
Document describing requirements for land application of sewage sludge in accordance with 40 CFR Part 503.

Biosolids Applied to Land: Advancing Standards and Practices (2002)
http://www.epa.gov/waterscience/biosolids/nas/complete.pdf
The National Research Council's evaluation of the technical methods and approaches used to establish EPA's chemical and pathogen standards for biosolids.

Biosolids Generation, Use and Disposal in the USA (1999)
http://www.epa.gov/epaoswer/non-hw/compost/biosolid.pdf
Document describing current and possible future trends in the generation, use, recycling, and disposal of biosolids produced by publically owned treatment works.

Department of Agriculture
USDA Agricultural Research Service (ARS)
http://www.ars.usda.gov/main/main.htm
Enter “biosolids” or “sewage sludge” into keyword search to find relevant research projects.

Agricultural Uses of Municipal, Animal, and Industrial Byproducts: Current and Potential Agricultural Uses for Biosolids and Other Recyclable Municipal Residues http://www.ars.usda.gov/is/np/agbyproducts/agbyintro.htm
Book viewable on-line.

National Institute of Health
The Beauty of Biosolids
http://ehp.niehs.nih.gov/qa/105-1focus/focusbeauty.html
Article from Environmental Health Perspectives (1997) on biosolids origin, disposal, public health issues, and EPA regulations.

State Agencies

Delaware
Delaware Department of Natural Resources and Environmental Control solid waste page http://www.dnrec.state.de.us/DNREC2000/SolidWaste.asp

District of Columbia

DC Water and Sewer Authority biosolids page
http://www.dcwasa.com/education/biosolids.cfm
Links to DC's biosolids management brochures, information on biosolids recycling, biosolids environmental management, and FAQ's.

Maryland

Maryland Department of the Environment solid waste page
http://www.mde.state.md.us/Programs/LandPrograms/Solid_Waste/index.asp
Includes a link to a fact sheet on sewage sludge utilization in Maryland.

Regulations governing sewage sludge management in Maryland
http://www.dsd.state.md.us/comar/subtitle_chapters/26_Chapters.htm
Click on link for **MDE Title 26** Subtitle 4, then Chapter 6.

Maryland Department of Agriculture
http://www.mda.state.md.us
MDA oversees the nutrient management program and biosolids use is a component of this program. Enter "biosolids" into site search engine to find relevant pdf files, documents, and web pages.

Pennsylvania

Pennsylvania Department of Environmental Protection biosolids page
http://www.dep.state.pa.us/dep/biosolids/biosolids.htm
Many useful links to basic information about biosolids, Pennsylvania regulations governing biosolids use, downloadable permits and forms, technical information, training information, software tools, and more.

Virginia

Virginia State Department of Health: The Biosolids Lifecycle
http://www.biosolids.state.va.us
Information on benefits of using biosolids, concern about their use, Virginia regulations governing biosolids use, a glossary, and many useful links.

Virginia Department of Environmental Quality sewage sludge page
http://www.deq.virginia.gov/vpdes/sewage.html

West Virginia

West Virginia Division of Environmental Protection, Division of Waste Management, sewage sludge management rule
http://www.dep.state.wv.us/Docs/357_33csr02.pdf

University and Extension Links

Maryland Cooperative Extension

Application of Biosolids to Forests
http://www.naturalresources.umd.edu/biosolids.cfm

Using Composted Sewage Sludge in the Production and Maintenance of Ornamental Plants
http://www.agnr.umd.edu/MCE/Publications/Publication.cfm?ID=192&cat=N

Guidelines for Application of Digested Sewage Sludge and Composted Sewage Sludge to Agricultural Land
http://www.agnr.umd.edu/MCE/Publications/Publication.cfm?ID=505&cat=N

Pennsylvania State University Cooperative Extension

Agronomy Factsheets on Land Application of Sewage Sludge in Pennsylvania
http://cropsoil.psu.edu/extension/esi.cfm

- A Plain English Tour of the Regulations
- Biosolids Quality
- Use of Biosolids in Crop Production
- What is Sewage Sludge and What Can Be Done with It?
- Effect of Biosolids on Soil and Crop Quality

Virginia Cooperative Extension

VCE On-line Publications about Biosolids
http://www.ext.vt.edu/cgi-bin/WebObjects/Docs.woa/wa/getcat?cat=ir-nrem-bs

- Agricultural Land Application of Biosolids in Virginia: Managing Biosolids for Agricultural Use
- Agricultural Land Application of Biosolids in Virginia: Production and Characteristics of Biosolids
- Land Application of Biosolids in Virginia: Regulations
- Land Application of Biosolids in Virginia: Risks and Concerns
- Biosolids Land Use Ordinances Gaining Favor
- Runoff from Pasture and Cultivated Land Amended with Biosolids and Fertilizer

West Virginia Extension Service

Considerations for Organic Waste Utilization in Agriculture
http://www.caf.wvu.edu/~forage/organicwaste/orgwast.htm

Sewage Sludge Land Application Program in West Virginia
http://www.wvu.edu/~exten/infores/pubs/other/sludrecl.pdf
Includes information on use of biosolids in mined land reclamation.

Organizations and Associations

National Biosolids Partnership (NBP) web site
http://www.biosolids.org
This site contains basic information on biosolids for the public and the media, technical information for managers and researchers, a complete listing of biosolids contacts, and useful links. The NPB is a non-profit alliance between the Association of Metropolitan Sewerage Agencies (AMSA), Water Environment Federation (WEF), and the U.S. EPA.

A complete listing of federal and state biosolids pretreatment coordinators for EPA region 3
http://www.biosolids.org/region3_.asp

Mid-Atlantic Biosolids Association
http://www.mabiosolids.org/index.asp
Biosolids management information for the Mid-Atlantic Region, including recent news and research, biosolids contacts, and a very good links page. MABA is an association of environmental professionals in the water pollution control field.

Water Environment Federation
http://www.wef.org/ScienceTechnologyResources/Biosolids/

Basic information on biosolids from a not-for-profit technical and educational organization of environmental professionals.

This material is based upon work supported by the Cooperative State Research, Education, and Extension Service, U.S. Department of Agriculture, under Agreement No. 2002-51130-01522. Any opinions, findings, conclusions, or recommendations expressed in this publication are those of the author(s) and do not necessarily reflect the view of the U.S. Department of Agriculture

Be sure to check out the

Mid-Atlantic Regional Water Program

website for updates and additional information.

http://www.mawaterquality.org

Land Grant Universities and USDA's Cooperative State Research, Education and Extension System (CSREES), working with EPA Region 3, have formed a partnership to advance water quality protection and restoration efforts in the Mid-Atlantic by providing water quality science support, training and education.