Information About Biosolids

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Jason H Carter
Agriculture Extension Agent

Virginia Cooperative Extension
VSU Virginia State
VirginiaTech Invent the Future
www.ext.vt.edu

Agricultural Land Application of Biosolids

The purpose of the following package of information is to describe:

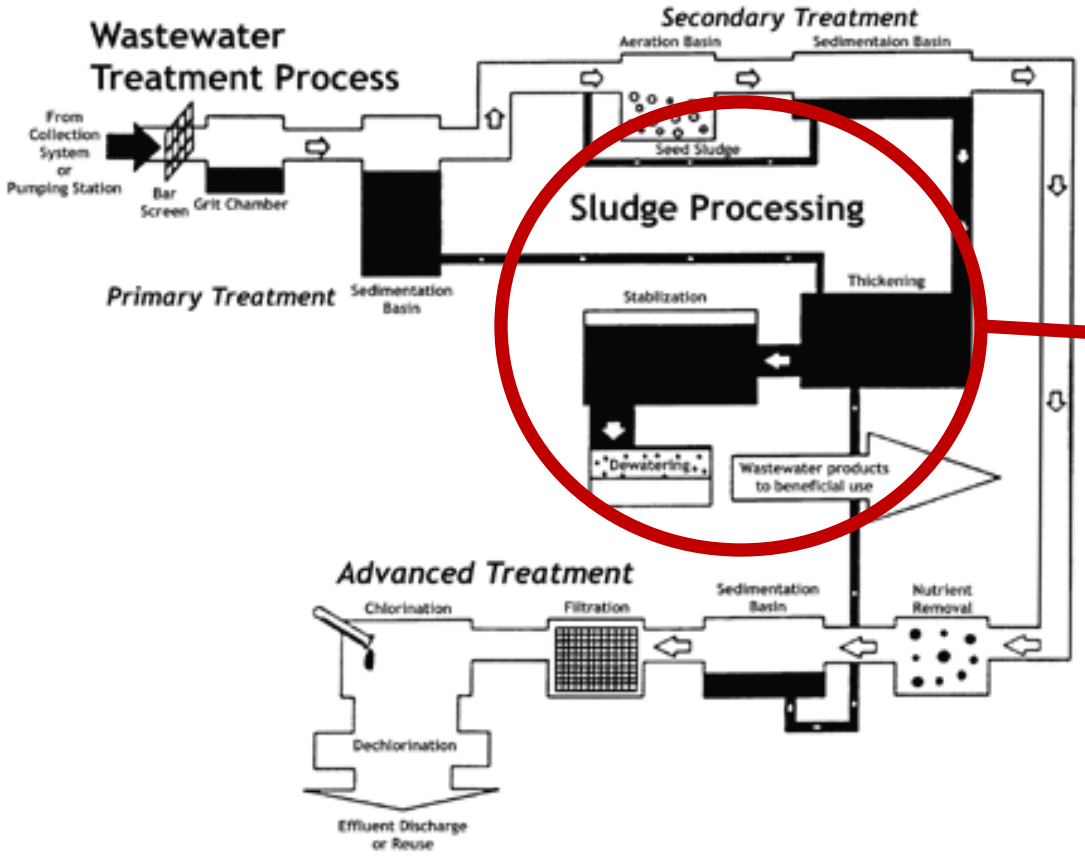
- Production and Characteristics of Biosolids
- Biosolids Regulations in Virginia
- Managing Biosolids for Agricultural Use
- Risks and Concerns of Biosolids Land Application in Augusta

Biosolids vs. Sewage Sludge

- Biosolids are solid, semi-solid or liquid materials, resulting from treatment of domestic sewage, that have been sufficiently processed to permit these materials to be safely land applied.
- The term “Biosolids” was created by the EPA to differentiate treated, high quality sewage sludge from the raw and polluted original product.

Biosolids Production

Biosolids are produced primarily through biological treatment of wastewater



The Sludge Processing phase defines the handling, economy, environmental health, public health and pathogenic characteristics of the biosolids.

Treatment Process	Definition	Effect on Biosolids	Effect on Land Application Practices
Thickening	Separation of solids by gravity, flotation or centrifugation	Removes water	Lowers transportation costs
Digestion: anaerobic or aerobic	Converts organic matter to gas	Reduces pathogen and odor levels	Reduces quantity of biosolids
Alkaline Stabilization	Addition of alkaline materials (ex: lime)	Raises pH to reduce pathogen activity and control odor	Raises soil pH, immobilizes metals
Conditioning	Coagulating solids with added polymers	Improves dewatering	Reduces ease of spreading
Dewatering	High force separation of solids	Lowers N & K, improves handling	Reduces land requirements and transportation cost
Composting	Stabilization of sludge similar to stacking litter	Lowers biological activity, destroys pathogens and converts sludge to humus like material	Improves soil conditioning properties, lowers agronomic N availability
Heat Drying	Heat kills pathogens and removes water	Disinfects, lowers odor	Greatly reduces sludge volume

Biosolids Characteristics

The suitability of biosolids for land application can be determined in part by the following measurable's

- **Total Solids (TS)** – typically range from 2-12% (liquid), 12-30% (dewatered) and 50% (dried or composted
- **Volatile Solids (%VS)** – estimate amount of decomposable organic matter -> odor potential
- **pH** – normally raised to ≥ 11, lime also increases ammonia loss -> reduced N value
- **Pathogens present**
- **Nutrients** – N,P,K,Ca,Mg,Na,S,B,Cu,Fe,Mn,Mo & Zn. Vary with actual material.
- **Trace Elements and Organic Chemicals** – man made compounds such as pesticides, cleaners, heavy metals

Agronomic Benefit of Land Application of Biosolids

- Increased soil water permeability and moisture retention
- Increased nutrient holding capacity
- Aids to maintain healthy pH
- Provides carbon source for microorganism growth

Biosolids Regulations in VA

- Clean Water Act
  - U.S. EPA Standards for the Use or Disposal of Sewage Sludge (Title 40, Part 503)
    - Establishes minimum requirements for agronomic use of biosolids in keeping with protecting human and environmental health
- The Biosolids Use Regulations in VA Code
  - Enforced by DEQ & DCR, local governments may add regulations
- The underlying premise of any regulation is to protect human and environmental health

Regulation of Pollutants in Biosolids

There are 9 trace elements federally regulated as pollutants in biosolids. These include:

- Arsenic
- Cadmium
- Copper
- Lead
- Mercury
- Molybdenum
- Nickel
- Selenium
- Zinc

There are limitations of acceptable amounts for each of these pollutants within biosolids that dictate how much may be land applied or if at all.

Pollutant Limitations

- **Ceiling Concentration Limits**: maximum concentrations of 9 trace elements allowed in biosolids to be land applied.
- **Pollutant Concentration Limits**: maximum concentrations of 9 trace elements that don't require tracking in the environment
- **Cumulative Pollutant Load Rate**: maximum amount of pollutants that can be applied to a site in its lifetime by all biosolids meeting Ceiling Concentration Limits.

Organic Chemical Regulations in Biosolids

Currently the EPA does not regulate organic chemicals in biosolids.

Primarily this is due to any organic chemical of concern for public and environmental health has been banned for use. Continuous testing of biosolids has demonstrated their presence to be virtually zero.

If they are found, then restrictions are imposed for their use similar to pollutant elements.

Pathogens in Biosolids

Biosolids for land application are generally treated by chemical or biological processes to eliminate pathogenic organisms and odor potential. There are two levels of pathogen reduction in biosolids:

- Class A
- Class B

Class A Biosolids

- Pathogens threatening to human health are reduced to below detectable levels
- Treatments to achieve Class A status include high temperature, very high pH, drying and composting

Class B Biosolids

- Pathogens are reduced to levels not likely to cause a threat to public health or the environment
- Treatments for Class B status include digestion, drying, heating and high pH
- Certain site restrictions are required to reasonably protect public health to a Class A status

Overall Biosolids Quality

- **Exceptional (EQ)** – meet or exceed federal standards for pollutant concentration limits, Class A pathogenicity and provide vector deterrence, no site restrictions
- **Pollutant Concentration (PC)** – meet or exceed federal standards for pollutant concentration limits, Class B pathogenicity and vector deterrence
- **Cumulative Pollutant Loading Rate Biosolids (CPLR)** – require tracking of metal loadings

Biosolids Nutrients

- Biosolids may be applied only at or below the required agronomic rate for Nitrogen.
- Application rate may be limited to Phosphorus requirements in water quality threatened areas.
- Agricultural producers must sign an agreement stipulating they will maintain the crop which the biosolids were applied accordingly for.

Biosolid Site Suitability

Federal, state and local ordinances may limit areas as unsuitable for biosolids application

- Unbuffered surface water
- Wetlands
- Steep areas
- Uncovered karst or bedrock
- Unproductive soil classes
- Historically significant areas
- Floodplains

Buffers & Biosolids Application

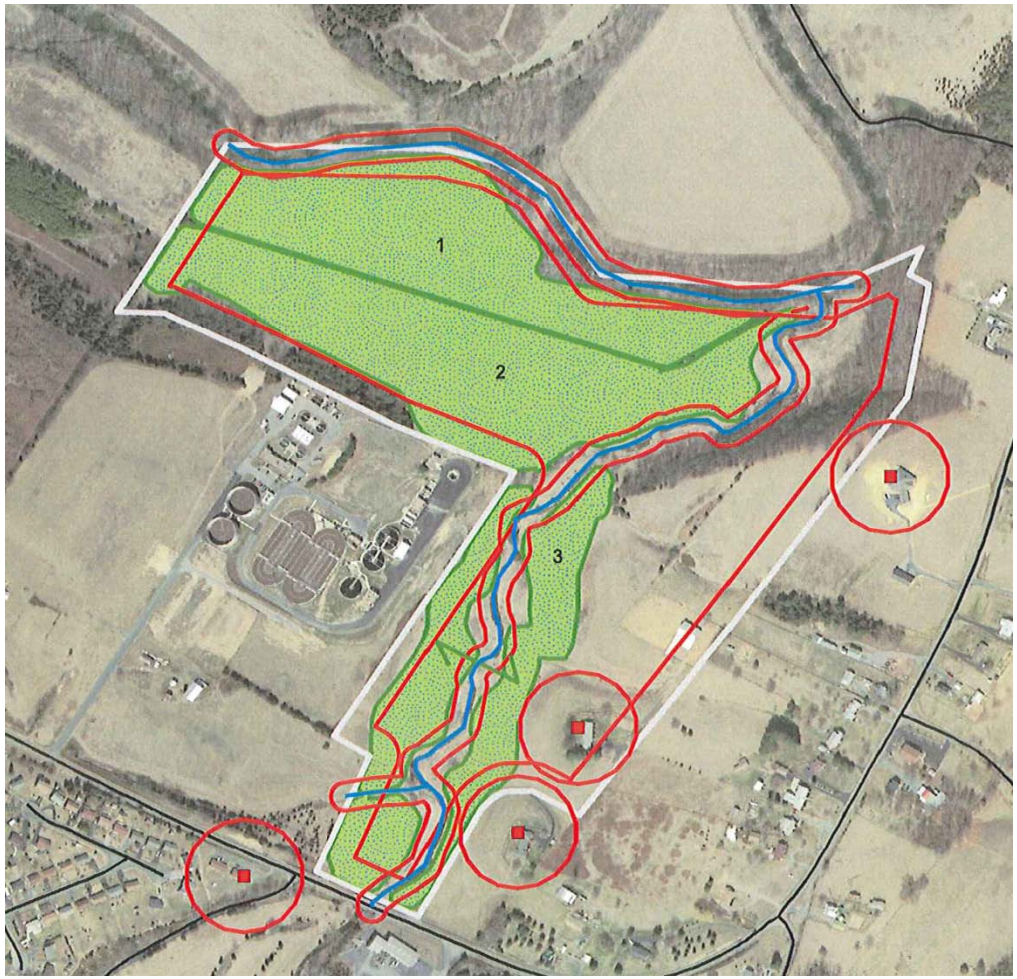
Minimum Distances (feet) to land application area

Adjacent Feature	Surface Application[a]	Incorporation	Winter[b]
Occupied Dwellings	200	200	200
Water supply wells or springs	100	100	100
Property lines	100	50	100
Perennial surface water	50	35	100
Seasonal surface water	25	25	50
All improved roadways	10	5	0
Rock outcrops and sinkholes	25	25	25

[a] Not incorporated within 48 hours

[b] Site greater than 7% slope between November 16 and March 15 of successive years

Example Biosolids Application Map



An example site specific application may utilizes aerial photography to illustrate locations of sensitive areas including homes, surface water and property boundaries along with appropriate buffers.

This aids to ensure proper application.

Managing Biosolids for Agricultural Use

The general approach for utilizing biosolids in agronomic situations can be summarized as follows:

1. Determine the nutrient needs for an expected crop yield and soil test requirements
2. Calculate biosolids rates based on crop N needs, soil test P or lime requirements
3. Calculate supplemental fertilizer needs by subtracting the plant available N, P & K supplied by biosolids from the crop needs

Biosolid Nitrogen Availability

- Nitrogen in biosolids is found as ammonium, nitrate or organically bound similar to animal waste.
- Most ammonium is lost to the atmosphere
- Organically bound N is the principal source. Typical plant available N may be up to 30% in Year 1, 15% in Year 2 and 8% in Year 3 of the total N.
- Lime stabilized biosolids have highest plant available N

Biosolids Phosphorus Availability

- P is a soil adsorb able nutrient, meaning it is not readily water soluble.
- Biosolid P is 50% agronomically available
- Poultry litter P is 60 – 75% agronomically available
- The water soluble fraction of biosolids P is lower than that of animal manure

Biosolids Concerns for Augusta

- Nutrient Management
  - Shenandoah Valley animal agriculture is targeted by the VA WIP and TMDL.
  - P based nutrient management will be increasingly important with large supplies of poultry litter and dairy manure along with vast grazing systems
  - Biosolids P has lower plant available P (PAP) but also lower water soluble P (WSP)
  - Will necessitate increased Nutrient Management Planning for utilization

Biosolids Concerns for Augusta

- Nutrient Management continued
  - Credit for 2025 WIP Nutrient Reductions will be gathered by increased nutrient management planning
  - Augusta is generally a high soil P area in the Bay watershed.
  - Biosolids are generally applied every three years on site. Lower WSP of biosolids may benefit certain soils while lowering P leaching.

Biosolids Concerns for Augusta

- Odor
  - Lime stabilizing of biosolids is economical and efficient way to control pathogenicity
  - Similar to animal manure, composting or aerobic digestion is most effective way to control odor
  - No treatment process will eliminate odor in biosolids or animal manure entirely

Biosolids Concerns for Augusta

- Designated Vulnerable Areas
  - In addition to future WIP expectations, biosolids application proximity to sensitive areas that may threaten human health or drinking water quality are a concern
  - Existing regulatory buffer zones are designed for adequate protection from pollutants and metals.
  - Surface applied biosolids are not N rich enough or applied often enough to specific sites to provide nitrate concerns in well water

Summary

- Biosolids are highly regulated but available in varying forms and qualities
- Biosolids are an economical soil nutrient amendment for N or P
- Biosolids will have odor issues temporarily for every application
- Use of biosolids will likely increase Nutrient Management Plan adoption as these are a requirement for acceptance