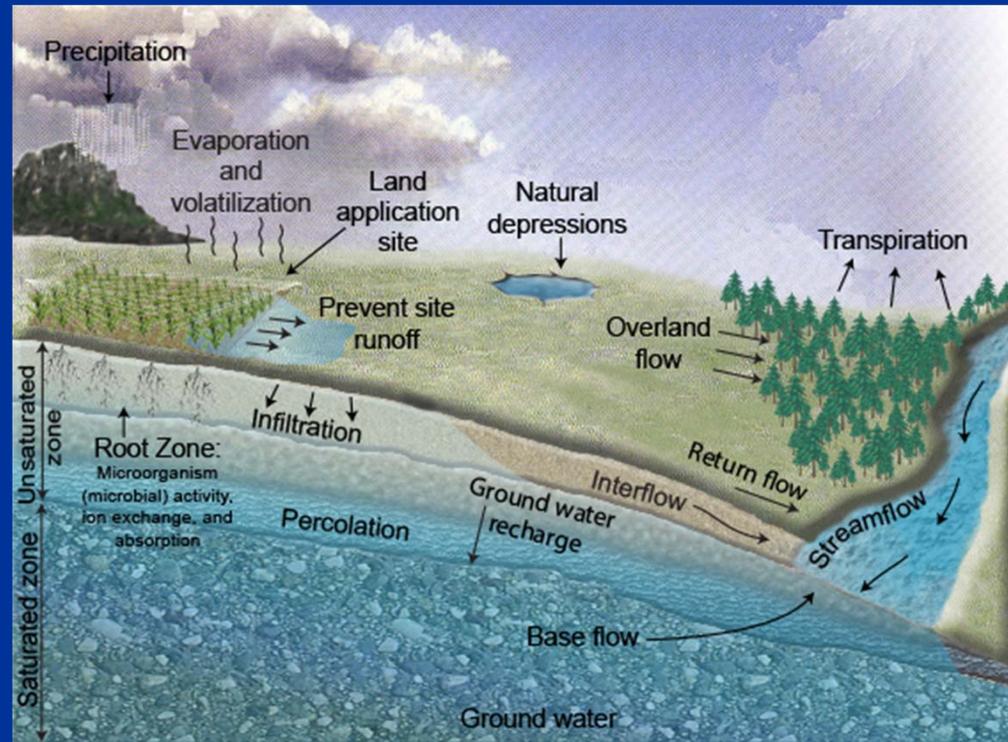




# Welcome to the Basics of Biosolids Management Workshop



# Housekeeping

- Sign in today
- Grab handouts
- Lunch for an hour on your own



# Welcome our panel of presenters

- Dr. Craig Cogger
- Dr. Sally Brown
- Maile Lono-Batura
- Dave Ruud



# Overview of Sludge and Biosolids



Tressa Nicholas, MSCE

IDEQ Water Quality Division

State Biosolids Coordinator

July 2014

# Overview

- Sludge vs Biosolids
  - From sewer circle to sludge alley
- Sludge Disposal
- Biosolids Beneficial Use
- Treatment
- State and Federal Rules
- Biosolids Management Plan



<http://www.loopforyoursoil.com/commercial-growers/>

# Wastewater Treatment

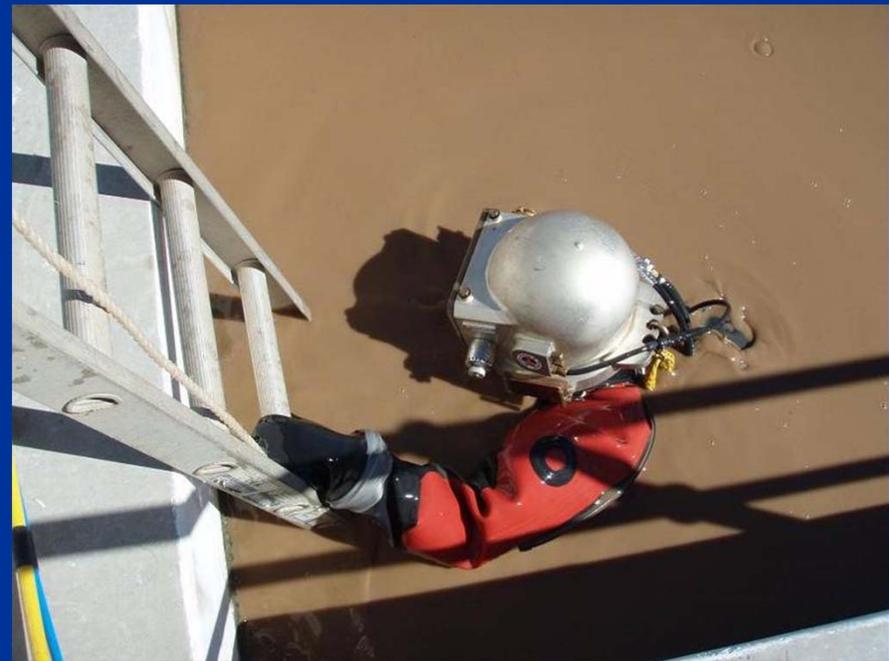
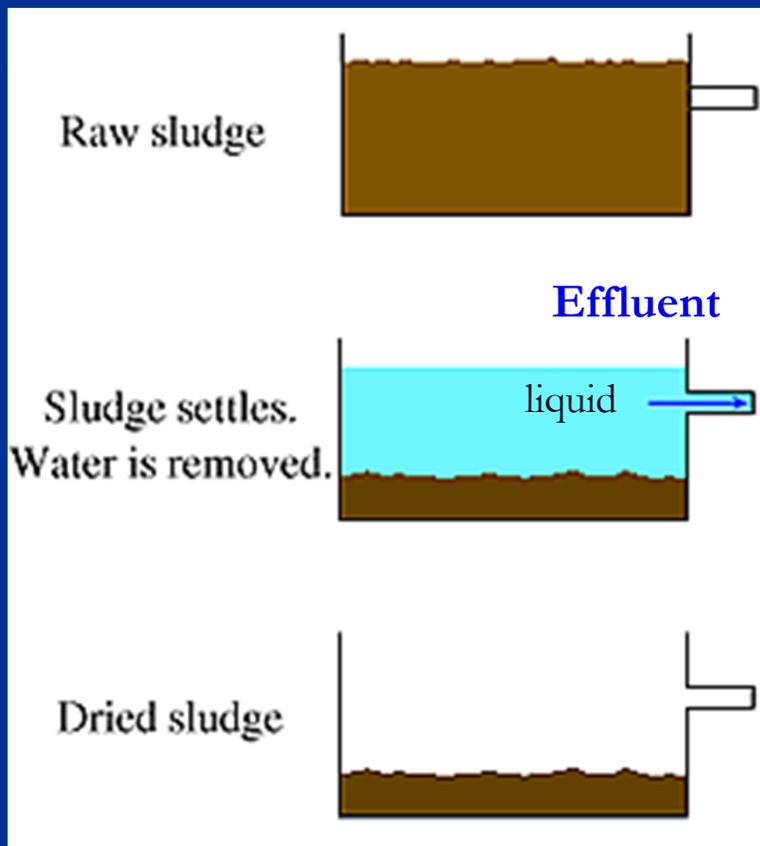
**Dive in a wastewater treatment basin**



<http://www.seaviewdiving.com/wastewater.html>

# Sludge and Wastewater Treatment

- The wastewater treatment process creates two products: a liquid stream and sludge

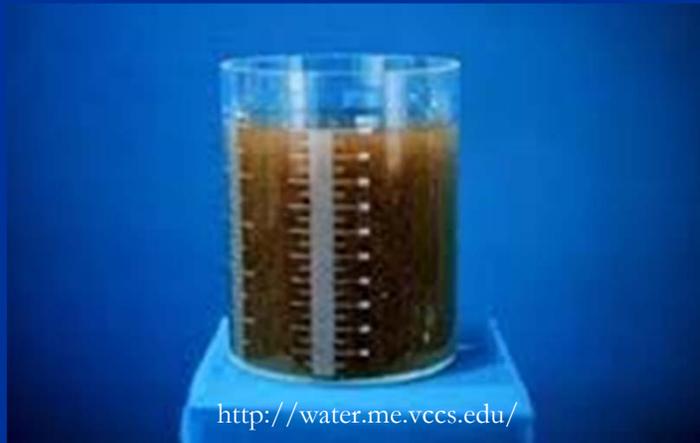


[http://www.descocorp.com/gallery\\_2.htm](http://www.descocorp.com/gallery_2.htm)

<http://www.petrotechservices.co.uk/gallery/index.phtml>

# Sludge

- **Sludge** is the solid, semisolid or liquid untreated residue generated during wastewater treatment.



# Sludge or Biosolids

- When treated, sludge becomes biosolids
- Biosolids are the stabilized residuals -what is stabilization?



**Class A EQ Biosolids**

# Biosolids Stabilization

- **Stability** –the point at which food for rapid microbial activity is no longer available
- Relates to pathogens and processes that reduce
  - pathogen levels
  - odor
  - volatile solids content



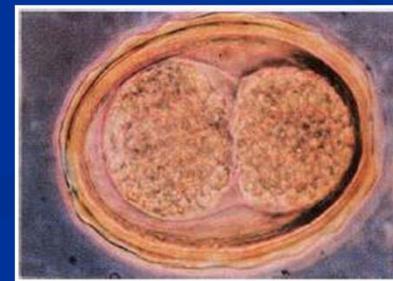
*Giardia lamblia* cysts. (Photo courtesy of Frank Schaefer, U.S. EPA, National Risk Management Research Laboratory, Cincinnati, Ohio)



*Hymenolepis* (tapeworm) ova. (Photo courtesy of Fox et al., 1981)



*Trichuris* sp. egg, 60  $\mu$ m from anaerobically digested sludge.



*Ascaris lumbricoides* (or var. *suum*) eggs, 66  $\mu$ m, from anaerobically digested sludge. Two-cell stage. (Photos on this page courtesy of Fox et al., 1981)

# Sludge (unstabilized) or Biosolids (stabilized)



Let's talk about sludge



**Class A Biosolids**



**Class B Biosolids**

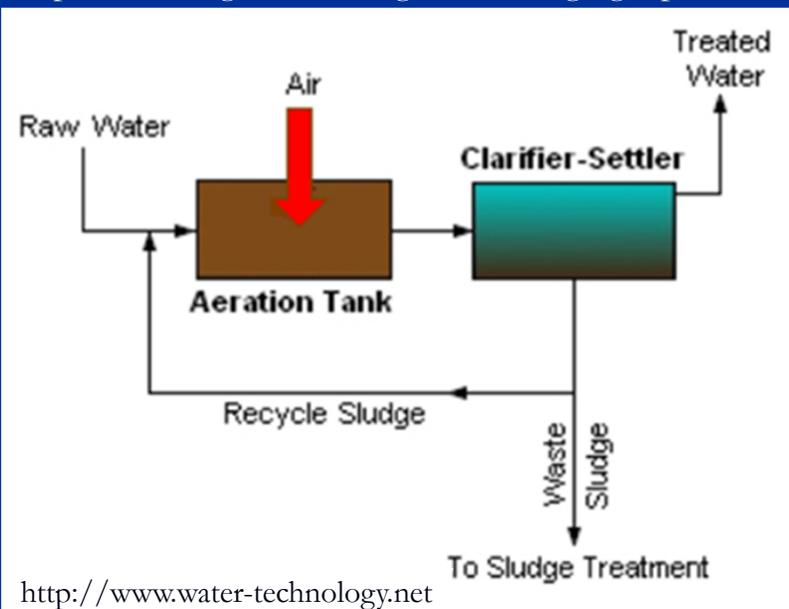
# Sludge Removal



<http://www.lagooncleaning.com/dredging.asp>



[http://www.projectnavigator.com/services\\_tech\\_sludges.htm](http://www.projectnavigator.com/services_tech_sludges.htm)



<http://www.water-technology.net>

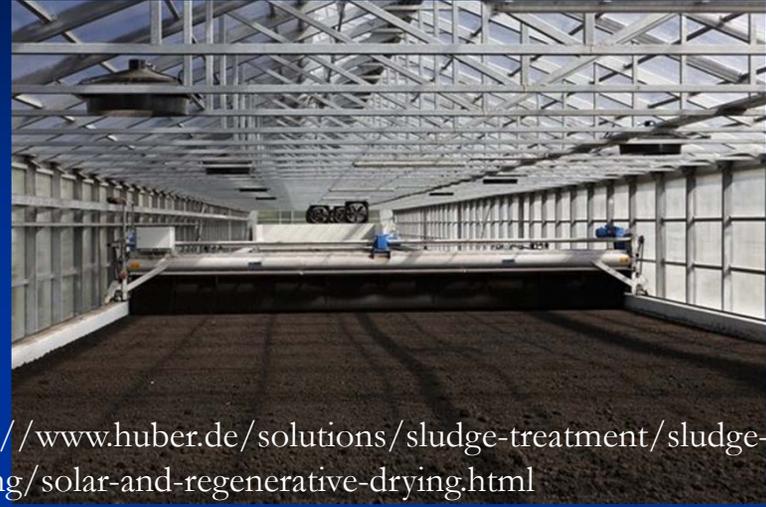


<http://www.dredgingtoday.com/2013/08/12/land-and-water-services-rapid-sludge-dewatering-uk/>

# Sludge – Drying and Dewatering



<http://www.jnseparation.dk/Dewatering.htm>



<http://www.huber.de/solutions/sludge-treatment/sludge-drying/solar-and-regenerative-drying.html>



[http://www.syskill.com.au/sludge\\_dewatering\\_equipment.html](http://www.syskill.com.au/sludge_dewatering_equipment.html)



Drying Beds

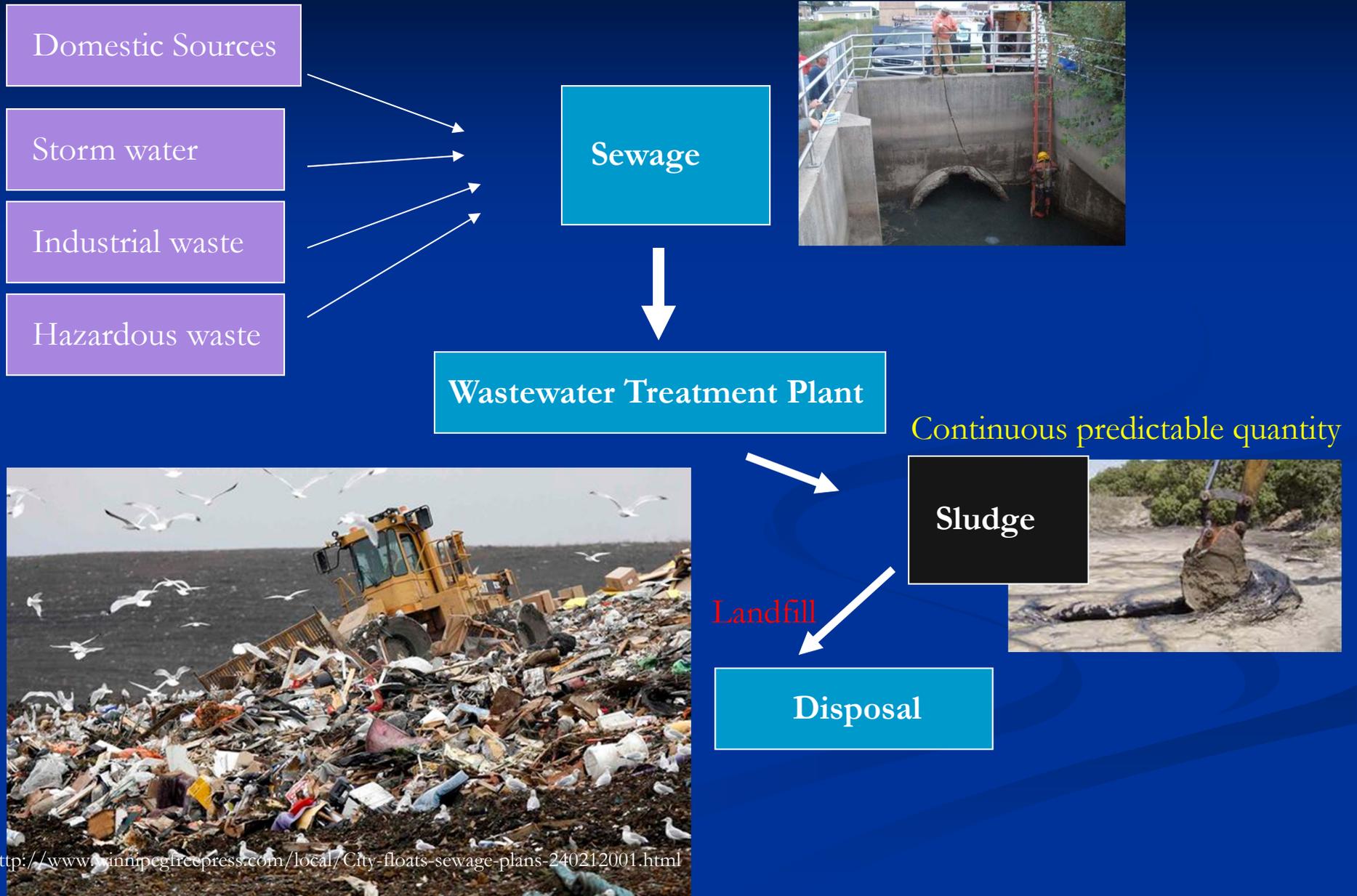
<http://www.fountainsanitation.com/Treatment/AerobicDigester.htm>

# Sludge Dewatering Bags



Sludge drying and dewatering may not equal stabilization per rules.

# Sludge Disposal



# Sludge Disposal at Landfill



- All MSWLFs must comply with 40 CFR Part 258
  - Pass the paint-filter liquids test
    - (dewatering biosolids to about 20 percent solids or more will generally meet this goal)
  - Cannot contain  $> 50$  ppb of polychlorinated biphenyls (PCBs) (40 CFR Part 761)
  - Must not meet the definition of hazardous wastes

# Landfill Operators need to know



- Ask for documentation for
  - Hazardous waste characterization
  - Paint filter test results
- Procedures in land fill's operation plan for how they will manage sludge and biosolids



# Sludge Disposal at Landfill



- May not be long term environmentally sustainable
  - Biodegrade over time
  - Deplete the landfill capacity
  - Impact upon the landfill's structural stability
- Landfills, contamination and the environment

# Landfills may accept non-hazardous sludge



[http://www.epd.gov.hk/epd/english/environmentinhk/waste/prob\\_solutions/WFdev\\_TMSTF.html](http://www.epd.gov.hk/epd/english/environmentinhk/waste/prob_solutions/WFdev_TMSTF.html)

- All MSWLFs must comply with 40 CFR Part 258.

Federal MSWLF standards include:

- **Corrective action provisions**—control and clean up landfill releases and achieves groundwater protection standards
- **Financial assurance**—provides funding for environmental protection during and after landfill closure

Landfill's should know where the sludge comes from?

Generators may want to know where there sludge is going?

# Case Studies

- Lowry Landfill
- Davies Landfill
  
- Responsible Parties
- Disposal to
- Beneficial Use of Biosolids



<http://www2.epa.gov/region8/lowry-landfill>

## Lowry Landfill



# Lowry Landfill

Colorado

Operated during 1960s-1980s



- Industrial and municipal solid waste accepted.
- Liquids and solids were placed in unlined trenches over approximately 200 acres
- Waste included industrial degreasers, paint, pesticides, hospital and veterinary waste, metal-plating waste, petroleum products, sewage sludge, tires and household

# Lowry Landfill

EPA superfund site



Media Affected	Contaminants	Source of Contamination
liquid waste, soil, solid waste, debris, surface water, groundwater, sediment, leachate	chemicals, solvents (VOCs, SVOCs), sludge, landfill gas	landfill wastes

<http://www2.epa.gov/region8/lowry-landfill>

# Responsible Parties for Cleanup



- Hundreds of entities owned, operated and/or transported waste to Lowry Landfill
  - private businesses, municipalities, state/federal agencies
- Settlement: those entities paid
  - into a trust fund used to fund the work
  - or paid EPA to reimburse it for its work at the site

# Davie Landfill

Florida  
1971 - 1981



<http://www.epa.gov/region4/superfund/sites/npl/florida/davlfll.html>

- Sludge lagoon for the disposal of grease trap pump-out material, septic tank sludge and treated municipal sludge.
- 1981 county closed the lagoon -as disposal sludge contaminated ground water.
- 1983 EPA listed the site on the National Priorities List

# Davie Landfill Cleanup



- 2010, EPA awarded Broward County the “Excellence in Site Reuse” Award for turning most of the site into Vista View Park.
- EPA, the Florida Dept. of Environmental Protection and Broward County, the site’s potentially responsible party (PRP), assisted the cleanup and redevelopment
- Generators and landfills were responsible parties to cleanup

# Responsible Parties

- Generator
  - Disposal
  - Beneficial Use
- Preparer (i.e. composter)
- Landfills that accept waste
  - What you are collecting?
  - Where you are putting it?

Landfills may accept  
non-hazardous sludge



- All MSWLFs must comply with 40 CFR Part 258. Federal MSWLF standards include:
  - **Corrective action provisions**—control and clean up landfill releases and achieves groundwater protection standards.
  - **Financial assurance**—provides funding for environmental protection during and after landfill closure

[http://www.epd.gov.hk/epd/english/environment/ink/waste/prob\\_solutions/WFdev\\_TMSTF.html](http://www.epd.gov.hk/epd/english/environment/ink/waste/prob_solutions/WFdev_TMSTF.html)

“used to think that when you took something to the landfill you were done in the chain of responsibility”

# What you are receiving? Where you are putting it?



- Generators know what the receiving party is doing with the sludge
- What are you receiving?
  - Sludge or Biosolids
- Where are you putting it?
  - Lined
  - Not lined:
    - moisture in waste-leachate
  - Leachate collection system

## Landfills may accept non-hazardous sludge



- All MSWLFs must comply with 40 CFR Part 258. Federal MSWLF standards include:
  - **Corrective action provisions**—control and clean up landfill releases and achieves groundwater protection standards.
  - **Financial assurance**—provides funding for environmental protection during and after landfill closure

[http://www.epd.gov.hk/epd/english/environmentinkh/waste/prob\\_solutions/WFder\\_TMSTP.html](http://www.epd.gov.hk/epd/english/environmentinkh/waste/prob_solutions/WFder_TMSTP.html)

# Surface Disposal will have rule requirements

- General requirements
- Pollutant limits
- Management practices
- Operational standards for pathogen and VAR
- Monitoring and record keeping requirements
- Reporting Requirements

“Whether you are disposing at a landfill or beneficially using it, there are similar issues that need to be addressed.”



# Disposal or **Beneficial Use**

Where some see waste, **some see resources**

**Biosolids**



Sludge



# Biosolids Beneficial Use

Sewage

Wastewater Treatment Plant

Sludge

Biosolids

Beneficial Use

Disposal

treatment



*Where some see waste, some see resources*

# Biosolids Treatment

- Biosolids treatment is designed to kill pathogens and stabilize organic matter. This is also treatment to reduce odors and vector attraction.
- Biosolids can be safely used to sustainably improve and maintain productive soils and stimulate plant growth.



# Composition of Biosolids

- Water
- Nitrogen
- Phosphorus
- Other nutrients and organic matter
- Trace amounts of metals and organic compounds



Crop grown using biosolids

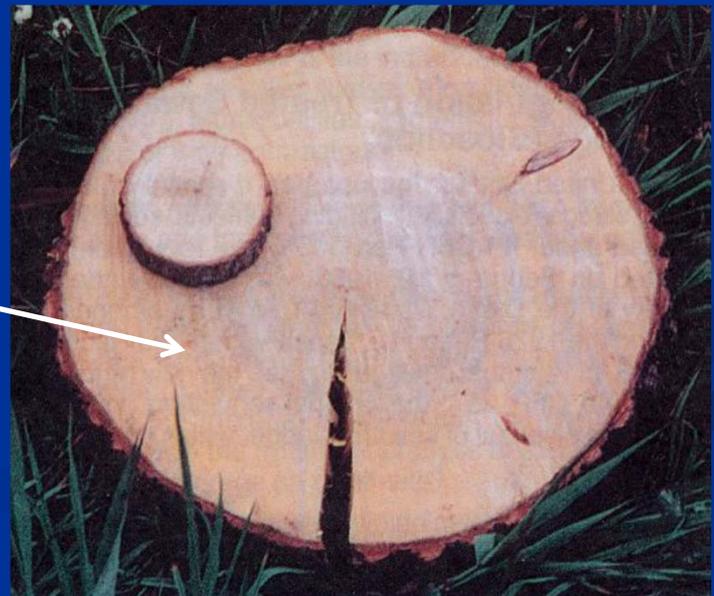
- Wisconsin.
- Injected into the soil.

# Biosolids Benefits

- EPA and State of Idaho considers biosolids a beneficial resource.
- Nutrients and organic matter in biosolids can be recycled as a fertilizer and used for soil augmentation.

Cross-section of poplar trees showing how sludge application increases tree growth.

Both cross sections are 8 years old.



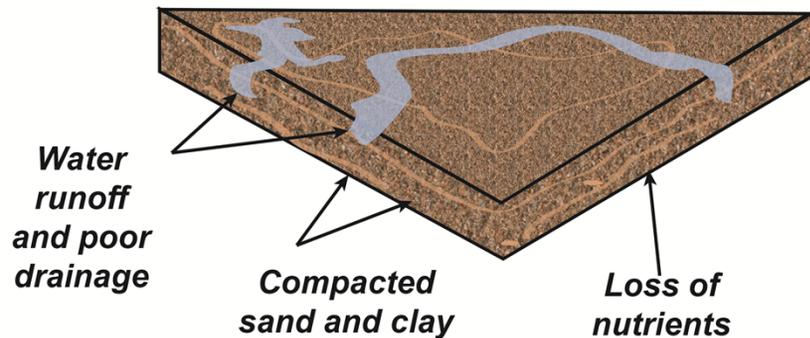
(Photo courtesy of Mike VanHam, British Columbia, Canada)

# Biosolids Benefits

- Improve Soil Texture
- Stimulate Root Growth
- Increase Water Holding Capacity

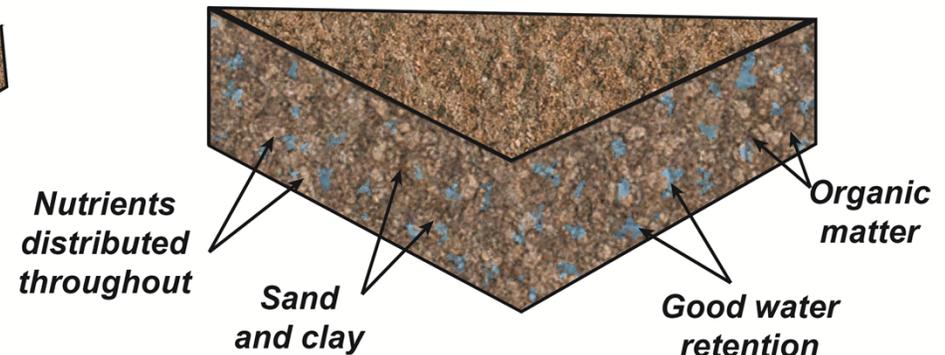


**Marginal Soil**



**This soil has insufficient soil structure for plant growth and is prone to erosion.**

**Soil with Biosolids**



**Soil particles form separate clumps and tiny pockets of air, like a sponge, allowing water to be absorbed and held in the soil.**

# Constituents of Concern

- Nutrients
- Pathogens
- Odors and bio-aerosols
- Pollutants
  - Trace elements
  - Organic Toxins



# Biosolids are Regulated

- Biosolids are subject to federal, state, and local regulations
- Biosolids must be treated to meet standards for:
  - Pathogens
  - Vectors
  - Pollutants



Land application at the Whitehouse

# Biosolids Regulations



- **Federal Regulations (40 CFR Part 503)**
  - Anyone who the law applies to, has to follow it whether or not they have a permit
  - Self-implementing rule



- **State of Idaho (IDAPA 58.01.16)**
  - “Wastewater Rules”
  - Section 650
  - Requires a Biosolids (or Sludge Management) Plan - approved by DEQ

**Separate enforcement authority in Idaho**

# Biosolids and Responsible Party

- *This applies to anyone who:*
  - **Generates** treated sewage sludge (biosolids)
  - **Derives** a material from treated sewage sludge (biosolids)
  - **Applies** biosolids to the land
  - Owns or operates a surface **disposal site**



<http://lancaster.unl.edu/enviro/biosolids/overview.shtml>

# Rules relate to Biosolids Uses

- Biosolids Uses

- Ocean Disposal

- Banned in 1988

- Disposal

- Surface Disposal or Land Fill

- Incineration

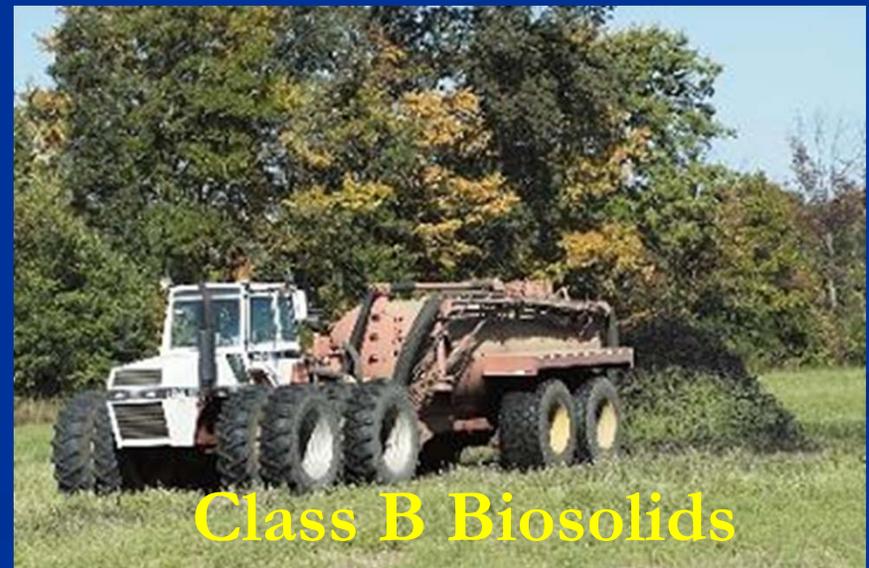
- Beneficial

- Land Application



# Biosolids Treatment

- Pathogen Reduction
  - Class A
  - Class B
- VAR: *Vector Attraction Reduction*
- Pollution Limits
- Other requirements

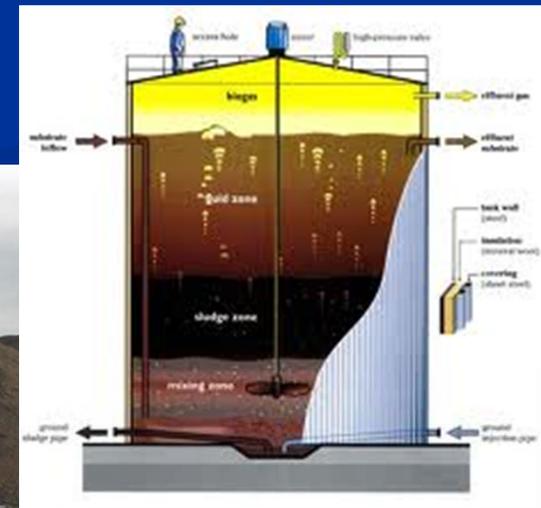


# Biosolids Treatment

- Biosolids treatment processes involve
  - Dewatering

And

  - Stabilization



# Dewatering

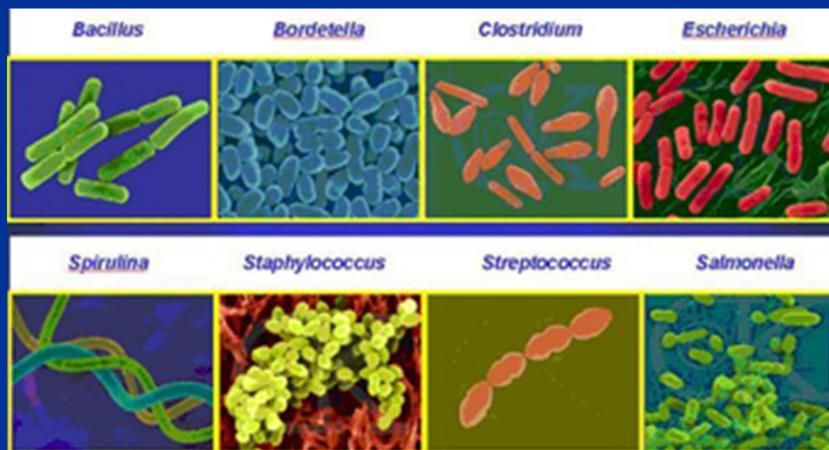


- Process that removes excess water
- Generally done before use: composted, land filled, dried (e.g., pelletized or heat dried), or incinerated.

“Get rid of the food source and then you get rid of the organisms that feed off food.”

# Biosolids Stabilization

- **Stability** –the point at which food for rapid microbial activity is no longer available
- Relates to processes that reduce pathogens:
  - disease causing organisms
    - Municipal wastewater contains many organisms,
    - Pathogens include bacteria, viruses, protozoa and helminths (parasitic worms).



<http://hsc.sca.nsw.gov.au/biology/water-pathogens>

# Pathogens

- For a pathogen to cause disease it must have:

- Susceptible host
- Pathway of exposure
- An Infective Dose

Without these three elements, disease cannot occur.

Biosolids treatment and management practices are looked at to address one or more of these elements.

## BACTERIA

*Salmonella* sp.  
*Shigella* sp.  
*Yersinia*  
*Vibrio cholerae*  
*Campylobacter jejuni*  
*Escherichia coli*

## ENTERIC VIRUSES

Hepatitis A virus  
Adenovirus  
Norovirus  
Sapporovirus  
Rotavirus  
Enteroviruses  
-Polioviruses  
-Coxsackieviruses  
-Echoviruses  
-Enteroviruses 68-91  
Reoviruses  
Astroviruses  
Hepatitis E virus  
Picobirnavirus

## PROTOZOA

*Cryptosporidium*  
*Entamoeba histolytica*  
*Giardia lamblia*  
*Balantidium coli*  
*Toxoplasma gondii*

## HELMINTH

*Ascaris lumbricoides*  
*Ascaris suum*  
*Trichuris trichirua*  
*Toxocara canis*  
*Taenia saginata*  
*Taenia solium*  
*Necator americanus*  
*Hymenolepis nana*

# Pathogen Reduction

Biosolids treatment and management practices are looked at to address one or more of elements that cause disease.

- High Temperatures
- Chemical disinfectants  
(i.e. lime, chlorine)
- Desiccation (drying processes)
- Predation and competition  
(from other microorganisms)
- Destruction of microbial food source  
(volatile solids reduction)



*Hymenolepis* (tapeworm) ova. (Photo courtesy of Fox et al., 1998)



*Giardia lamblia* cysts. (Photo courtesy of Frank Schaefer, U.S. EPA, National Risk Management Research Laboratory, Cincinnati, Ohio)

# Class A Biosolids

- Pathogen destruction must be complete before the biosolids are applied to land

Indicator	Density Limit (dry wt. Basis)
<i>Salmonella</i>	<3 MPN/4 g
Fecal coliforms	<1000 MPN/g
Enteric viruses	<1 PFU/4g
Viable helminth ova	<1 ova/4g

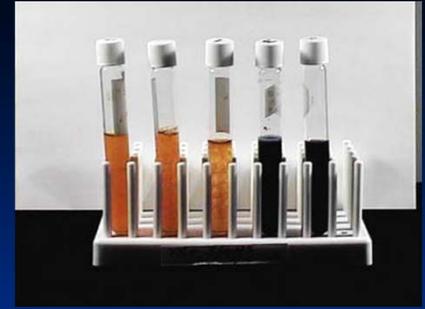


[http://filebox.vt.edu/users/chagedor/biol\\_4684/Microbes/Ecoli.html](http://filebox.vt.edu/users/chagedor/biol_4684/Microbes/Ecoli.html)

- Fecal < 1000 MPN/g or *Salmonella* s.p. < 3 MPN/4g

The MPN method involves taking the original solution or sample, and subdividing it by orders of magnitude (frequently 10× or 2×), and assessing presence/absence in multiple subdivisions.

# Class A Biosolids



- Fecal < 1000 MPN/g or *Salmonella* s.p. < 3 MPN/4g (based on at least seven samples per batch)
- Either must be met at one of the following times:
  - When biosolids are used or disposed
  - When the biosolids are prepared for sale/give away in a container or bag for land application
  - When the biosolids or derived materials are prepared to meet the requirements for EQ – Exceptional Quality
- **AND**

Relates to pollutant levels

# Class A also must meet one of six treatment criteria

## ***Alternative 1: Thermally Treated Biosolids***

Biosolids must be subjected to one of four time-temperature regimes.

## ***Alternative 2: Biosolids Treated in a High pH-High Temperature Process***

Biosolids must meet specific pH, temperature, and air-drying requirements.

## ***Alternative 3: Biosolids Treated in Other Processes***

Demonstrate that the process can reduce enteric viruses and viable helminth ova. Maintain operating conditions used in the demonstration after pathogen reduction demonstration is completed.

## ***Alternative 4: Biosolids Treated in Unknown Processes***

Biosolids must be tested for pathogens—*Salmonella* sp. or fecal coliform bacteria, enteric viruses, and viable helminth ova—at the time the biosolids are used or disposed, or, in certain situations, prepared for use or disposal.

## ***Alternative 5: Biosolids Treated in a PFRP***

Biosolids must be treated in one of the Processes to Further Reduce Pathogens (PFRP) (see Table 5-4).

## ***Alternative 6: Biosolids Treated in a Process Equivalent to a PFRP***

Biosolids must be treated in a process equivalent to one of the PFRPs, as determined by the permitting authority.

Next slide



# Class A: Alternative 5



## Processes to Further Reduce Pathogens (PFRPs) Listed in Appendix B of 40 CFR Part 503

### 1. Composting

Using either the within-vessel composting method or the static aerated pile composting method, the temperature of the biosolids is maintained at 55<sup>o</sup>C or higher for 3 days.

Using the windrow composting method, the temperature of the biosolids is maintained at 55<sup>o</sup>C or higher for 15 days or longer. During the period when the compost is maintained at 55<sup>o</sup>C or higher, the windrow is turned a minimum of five times.

### 2. Heat Drying

Biosolids are dried by direct or indirect contact with hot gases to reduce the moisture content of the biosolids to 10 percent or lower. Either the temperature of the biosolids particles exceeds 80<sup>o</sup>C or the wet bulb temperature of the gas in contact with the biosolids as the biosolids leave the dryer exceeds 80<sup>o</sup>C.

### 3. Heat Treatment

Liquid biosolids are heated to a temperature of 180<sup>o</sup>C or higher for 30 minutes.

### 4. Thermophilic Aerobic Digestion

Liquid biosolids are agitated with air or oxygen to maintain aerobic conditions, and the mean cell residence time of the biosolids is 10 days at 55<sup>o</sup> to 60<sup>o</sup>C.

### 5. Beta Ray Irradiation

Biosolids are irradiated with beta rays from an accelerator at dosages of at least 1.0 megarad at room temperature (ca. 20<sup>o</sup>C).

### 6. Gamma Ray Irradiation

Biosolids are irradiated with gamma rays from certain isotopes, such as Cobalt 60 and Cesium 137, at room temperature (ca. 20<sup>o</sup>C).

### 7. Pasteurization

The temperature of the biosolids is maintained at 70<sup>o</sup>C or higher for 30 minutes or longer.

# Class A (EQ) Biosolids

- No use restrictions
- Pathogen free



GroCo compost provides organic matter to soils and improves the physical properties of both sandy and clayey soils. GroCo is appreciated by gardeners and commercial landscapers for its ability to aerate soil, retain moisture, and produce beautiful blooms.

# Class B

- Class B Biosolids contain pathogens
- Must meet one of three alternative treatments
- Combined treatment with site restrictions

## *Alternative 1: The Monitoring of Indicator Organisms*

Test for fecal coliform density as an indicator for all pathogens. The geometric mean of seven samples shall be less than 2 million MPNs per gram per total solids or less than 2 million CFUs per gram of total solids at the time of use or disposal.

## *Alternative 2: Biosolids Treated in a PSRP* Next slide

Biosolids must be treated in one of the Processes to Significantly Reduce Pathogens (PSRP) (see Table 5-7).

## *Alternative 3: Biosolids Treated in a Process Equivalent to a PSRP*

Biosolids must be treated in a process equivalent to one of the PSRPs, as determined by the permitting authority.

# Class B Process to Significantly Reduce Pathogens

## **1. Aerobic Digestion**

Biosolids are agitated with air or oxygen to maintain aerobic conditions for a specific mean cell residence time at a specific temperature. Values for the mean cell residence time and temperature shall be between 40 days at 20<sup>o</sup>C and 60 days at 15<sup>o</sup>C.

## **2. Air Drying**

Biosolids are dried on sand beds or on paved or unpaved basins. The biosolids dry for a minimum of 3 months. During 2 of the 3 months, the ambient average daily temperature is above 0<sup>o</sup>C.

## **3. Anaerobic Digestion**

Biosolids are treated in the absence of air for a specific mean cell residence time at a specific temperature. Values for the mean cell residence time and temperature shall be between 15 days at 35<sup>o</sup>C to 55<sup>o</sup>C and 60 days at 20<sup>o</sup>C.

## **4. Composting**

Using either the within-vessel, static aerated pile, or windrow composting methods, the temperature of the biosolids is raised to 40<sup>o</sup>C or higher and maintained for 5 days. For 4 hours during the 5-day period, the temperature in the compost pile exceeds 55<sup>o</sup>C.

## **5. Lime Stabilization**

Sufficient lime is added to the biosolids to raise the pH of the biosolids to 12 after 2 hours of contact.

# Class B Land Application is Treatment

- Pathogens are reduced by
  - Heat
  - Sunlight
  - Drying
  - Unfavorable pH
  - Other microorganisms



# Class B Restrictions at the Land Application Site:



[cvilletomorrow.typepad.com](http://cvilletomorrow.typepad.com)

## ***Restrictions for the harvesting of crops\* and turf:***

1. Food crops, feed crops, and fiber crops, whose edible parts do not touch the surface of the soil, shall not be harvested until *30 days* after biosolids application.
2. Food crops with harvested parts that touch the biosolids/soil mixture and are totally above ground shall not be harvested until *14 months* after application of biosolids.
3. Food crops with harvested parts below the land surface where biosolids remain on the land surface for 4 months or longer prior to incorporation into the soil shall not be harvested until *20 months* after biosolids application.
4. Food crops with harvested parts below the land surface where biosolids remain on the land surface for less than 4 months prior to incorporation shall not be harvested until *38 months* after biosolids application.
5. Turf grown on land where biosolids are applied shall not be harvested until *1 year* after application of the biosolids when the harvested turf is placed on either land with a high potential for public exposure or a lawn, unless otherwise specified by the permitting authority.

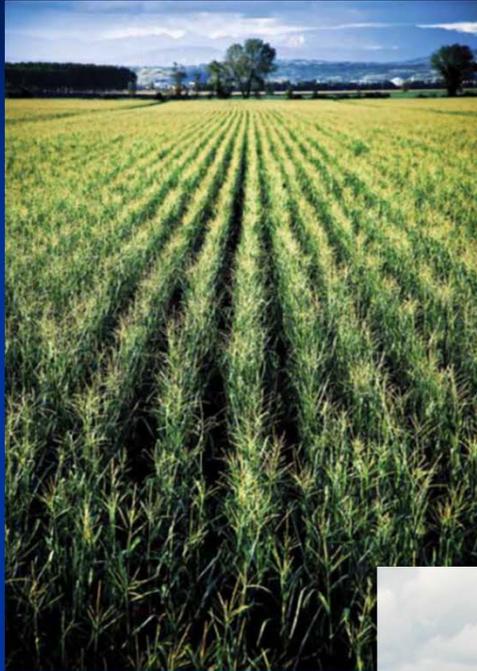
## ***Restriction for the grazing of animals:***

1. Animals shall not be grazed on land until *30 days* after application of biosolids to the land.

## ***Restrictions for public contact:***

1. Access to land with a high potential for public exposure, such as a park or ballfield, is restricted for *1 year* after biosolids application. Examples of restricted access include posting with no trespassing signs, and fencing.
2. Access to land with a low potential for public exposure (e.g., private farmland) is restricted for *30 days* after biosolids application. An example of restricted access is remoteness.

# Biosolids Beneficial Use



EPA, WERF, NACWA have demonstrated that the beneficial land application of biosolids poses a negligible risk to human health (National Academy of Sciences, 2002 Study)



Local farmer/landowners began applying King County biosolids to their wheat

# Class A = Class B + Site Restrictions + Site Management

- Class A or B status are protective of human health and the environment:
  - Because of the added site restrictions and management practices.
  - All Biosolids applied to the land must meet Pathogen and VAR and Pollutant limits



# Pathogen Treatment

## ■ Sludge

- untreated (sometimes dewatered)
- contains pathogens
- for disposal or further treatment



## ■ Class A Biosolids

- treated - no pathogens



## ■ Class B Biosolids

- treated- some pathogens remain
- further treatment via land application
- Site restrictions during treatment time





# VAR and Pathogen Reduction

- Pathogen reduction must take place before or at the same time as Vector Attraction Reduction (VAR)

- Option 1:** Meet 38 percent reduction in volatile solids content.
- Option 2:** Demonstrate vector attraction reduction with additional anaerobic digestion in a bench-scale unit.
- Option 3:** Demonstrate vector attraction reduction with additional aerobic digestion in a bench-scale unit.
- Option 4:** Meet a specific oxygen uptake rate for aerobically digested biosolids.
- Option 5:** Use aerobic processes at greater than 40°C for 14 days or longer.
- Option 6:** Alkali addition under specified conditions.
- Option 7:** Dry biosolids with no unstabilized solids to at least 75 percent solids.
- Option 8:** Dry biosolids with unstabilized solids to at least 90 percent solids.
- Option 9:** Inject biosolids beneath the soil surface.
- Option 10:** Incorporate biosolids into the soil within 6 hours of application to or placement on the land.
- Option 11:** Cover biosolids placed on a surface disposal site with soil or other material at the end of each operating day. (Note: Only for surface disposal.)
- Option 12:** Alkaline treatment of domestic septage to pH 12 or above for 30 minutes without adding more alkaline material.

- Except when pH adjustment, percent solids VAR, injection or incorporation options are met

# Vector Attraction Reduction (VAR)

- Insects, birds, rodents, and domestic animals may transport from biosolids to humans
- Vectors are attracted to biosolids as a food source
- VAR can be accomplished by:
  - Treating to the point at which vectors will no longer be attracted
  - Placing a barrier between the sludge and vectors



Sludge Storage



[santafenm.gov](http://santafenm.gov)

# Pollutants

- All Biosolids applied to the land must meet Ceiling Concentration Limits (CCL) for pollutants
  - Arsenic
  - Cadmium
  - Copper
  - Lead
  - Mercury
  - Molybdenum
  - Nickel
  - Selenium
  - Zinc

## Heavy metal limits

Maximum concentration limits

Cumulative loading limits

High quality concentration limits

<b>Pollutant</b>	<b>Ceiling Concentration Limits for All Biosolids Applied to Land (milligrams per kilogram)<sup>a</sup></b>	<b>Pollutant Concentration Limits for EQ and PC Biosolids (milligrams per kilogram)<sup>a</sup></b>	<b>Cumulative Pollutant Loading Rate Limits for CPLR Biosolids (kilograms per hectare)</b>	<b>Annual Pollutant Loading Rate Limits for APLR Biosolids (kilograms per hectare per 365-day period)</b>
<b>Arsenic</b>	75	41	41	2.0
<b>Cadmium</b>	85	39	39	1.9
<b>Chromium</b>	3,000	1,200	3,000	150
<b>Copper</b>	4,300	1,500	1,500	75
<b>Lead</b>	840	300	300	15
<b>Mercury</b>	57	17	17	0.85
<b>Molybdenum<sup>b</sup></b>	75	—	—	—
<b>Nickel</b>	420	420	420	21
<b>Selenium</b>	100	36	100	5.0
<b>Zinc</b>	7,500	2,800	2,800	140
<b>Applies to:</b>	All biosolids that are land applied	Bulk biosolids and bagged biosolids <sup>c</sup>	Bulk biosolids	Bagged biosolids <sup>c</sup>
<b>From Part 503</b>	Table 1, Section 503.13	Table 3, Section 503.13	Table 2, Section 503.13	Table 4, Section 503.13

<sup>a</sup> Dry-weight basis

<sup>b</sup> As a result of the February 25, 1994, Amendment to the rule, the limits for molybdenum were deleted from the Part 503 rule pending EPA reconsideration.

<sup>c</sup> Bagged biosolids are sold or given away in a bag or other container.

# Pollution Limits

- **Class A:** Different kinds of Class A, with limited requirements.

- EQ (Exceptional Quality)
- PC (Pollutant Concentration)
- CPLR (Cumulative Pollutant Loading Rate)
- APLR (Annual Pollutant Loading Rate)

No Use Restrictions



- **Class B:** Site restrictions are often required in order to protect public health and the environment.
- PC (Pollutant Concentration)
- CPLR (Cumulative Pollutant Loading Rate)

Option*	Pollutant Limits	Pathogen Requirements	Vector Attraction Reduction Requirements
"Exceptional Quality" (EQ) Biosolids	Bulk or bagged biosolids meet pollutant concentration limits in Table 2-1	Any 1 of the Class A requirements in Table 2-5	Any 1 of the requirements in options 1 through 8 in Table 2-6
"Pollutant Concentration" (PC) Biosolids	Bulk biosolids meet pollutant concentration limits in Table 2-1	Any 1 of the Class B requirements in Table 2-5 and Figure 2-4	Any 1 of the 10 requirements in Table 2-6
		Any 1 of the Class A requirements in Table 2-5	Requirements 9 or 10 in Table 2-6
"Cumulative Pollutant Loading Rate" (CPLR) Biosolids	Bulk biosolids applied subject to cumulative pollutant loading rate (CPLR) limits in Table 2-1	Any 1 of the Class A or Class B requirements in Table 2-5 and Figure 2-4	Any 1 of the 10 requirements in Table 2-6
"Annual Pollutant Loading Rate" (APLR) Biosolids	Bagged biosolids applied subject to annual pollutant loading rate (APLR) limits in Table 2-1	Any 1 of the Class A requirements in Table 2-5	Any 1 of the first 8 requirements in Table 2-6

\* Each of these options also requires that the biosolids meet the ceiling concentrations for pollutants listed in Table 2-1, and that the frequency of monitoring requirements in Table 2-7 and recordkeeping and reporting requirements in Table 2-8 be met. In addition, the general requirements in Figure 2-8 and the management practices in Figure 2-9 have to be met when biosolids are land applied (except for EQ biosolids).

# Site requirements

- Requirements or restrictions
  - minimum distances to surface waters

## Buffer Requirements:

50' from surface water

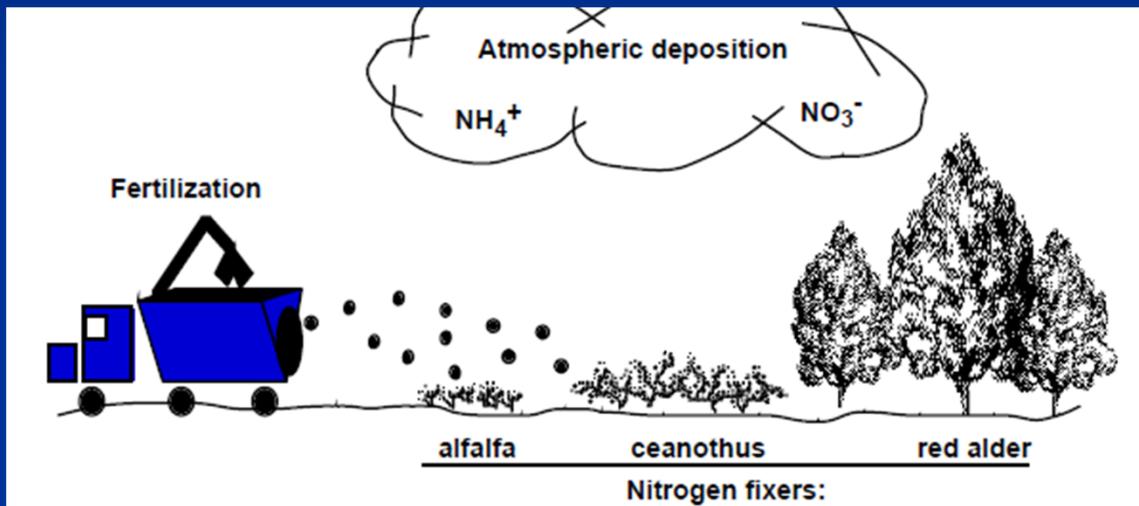
No application to slopes > 20%



- Fencing and Signs

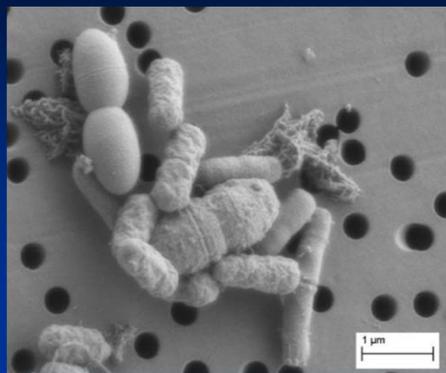
# Other requirements

- Monitoring, record keeping and reporting



# Representative Sampling

A subset of a statistical population that accurately reflects the members of the entire population.



Salmonella and faecal bacteria.

<http://blogs.ifr.ac.uk>

**Bob Brobst**

Biosolids Coordinator

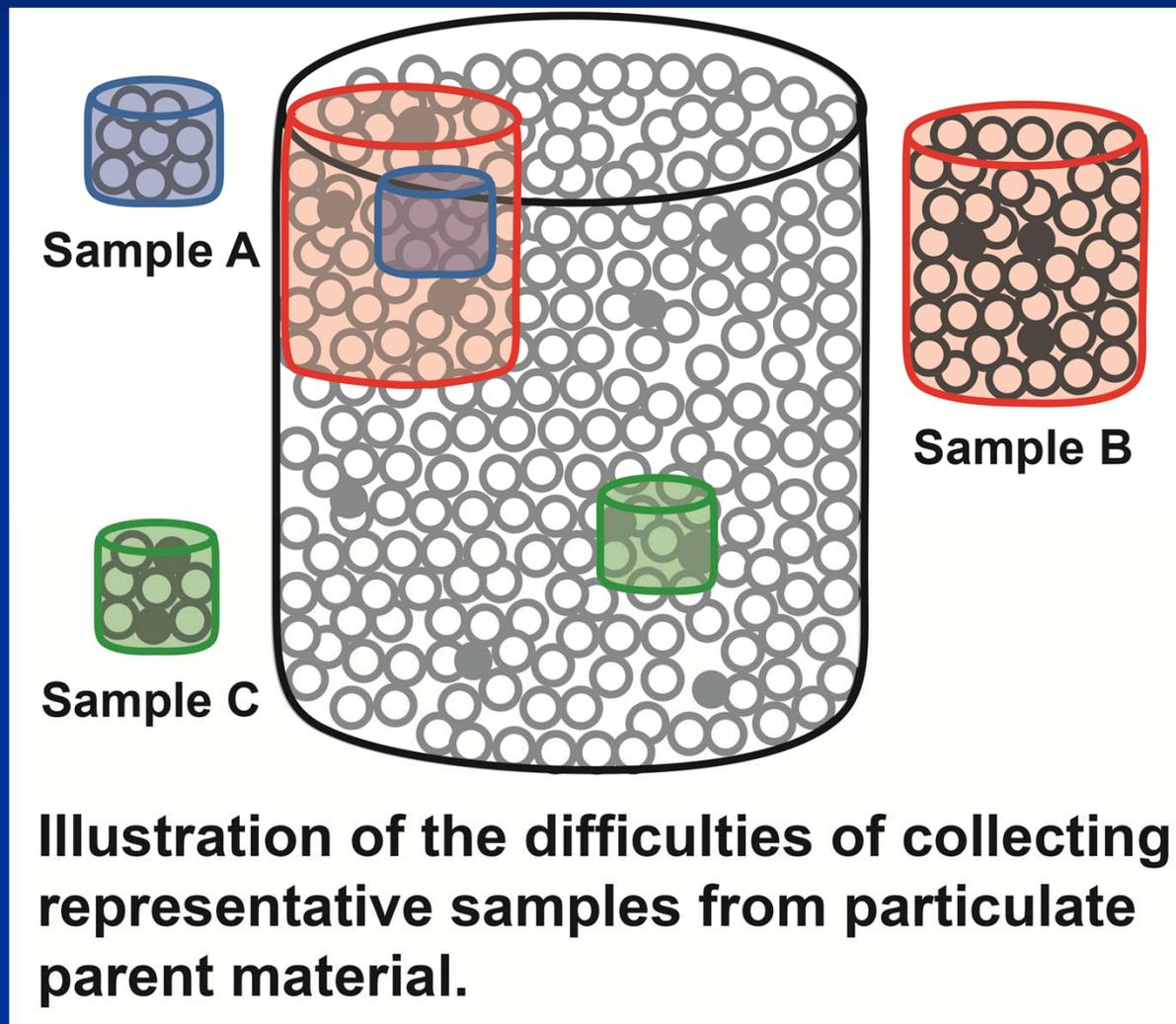
U.S. EPA, Region 8

1595 Wynkoop Street

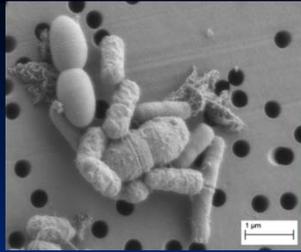
Denver, Colorado 80202-1129

Telephone: 303-312-6129

[brobst.bob@epa.gov](mailto:brobst.bob@epa.gov)



**Illustration of the difficulties of collecting representative samples from particulate parent material.**



# Sampling

- **Representative Samples**
  - are sufficiently accurate and precise to provide reliable estimates
- **Sample Accuracy**
  - usually achieved by some form of Random Sampling
- **Sample Precision**
  - taking an appropriate # of samples from the population
  - The 7 Sample listed in the Regulations is a minimum and does not guarantee a representative sample
- **A Sampling and Analysis Plan will contain more than 7 samples per event**

# Alternative Options

- Batches that do not meet requirements for
  - Pathogens
  - VAR
  - Pollutants



# The Basic Part 503 Standards

- General Requirements
- Pollutant Limits
- Management Practices
- Operational Standards
- Frequency of Monitoring
- Record Keeping
- Reporting
  - NPDES FORM 2S



Loading and transporting biosolids from a wastewater treatment plant to the farm

# Biosolids Management Plan

- IDAPA 58.01.16.650 requires approved Plans
- Plans should accurately reflect activities
- Requires DEQ approval and includes:
  - Biosolids characterization and stabilization
  - Site selection criteria, including soil types, geology, ground water characteristics, land use, topography, and climate
  - Management for application process, nutrient loading and public and environmental safety (buffer zones)



# Biosolids or Sludge Use

- As a generator or preparer you have to know what is in your waste.
- Responsibility to manage waste appropriately
  - With disposal or beneficial use



<http://www.ecy.wa.gov/programs/swfa/biosolids/faq.html>



<http://www.flickr.com/photos>



# City of Boise, Idaho



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« Idaho Gun Bills Zip Through Senate... Idaho Man Accused of Handing Out Me... »

SATURDAY, FEBRUARY 15, 2014

## BOISE CITY COUNCIL Farm to Market: Boise Reaping Millions From Commodities Grown at 4,000-Acre Farm

POSTED BY [GEORGE PRENTICE](#) ON SAT, FEB 15, 2014 AT 10:10 AM

### Farm to Market: Boise Officials To Consider Sale Prices for City-Grown Alfalfa, Corn

City of Boise Council members will be asked to approve a new pricing structure to sell the crops, based on United States Department of Agriculture market reports

By [George Prentice](#) [@georgepren](#)



## BIOSOLIDS/TWENTY MILE SOUTH FARM

The city of Boise owns a 4000-acre farm on South Cloverdale Road. Known as the "Twenty-Mile South Farm", the farm receives the "biosolids" from the City's two main wastewater treatment plants.

The treated biosolids are one of two end products of wastewater treatment that can be recycled as soil supplements. The other product is water. The water is treated and released into the Boise River.

The biosolids are trucked to the farm four times a day in trailers holding approximately 25 tons per load. The biosolids are applied to the fields for growing crops that are eventually sold to farmers for silage and food for livestock. The crops are primarily alfalfa, corn, and small grains. The farm is managed to comply with state and federal regulations governing the reuse of biosolids.

## Benefits flow from biosolids

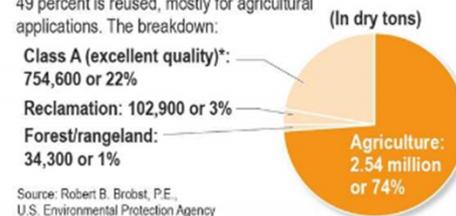


Published:  
June 1, 2012 3:01AM

Last changed:  
June 29, 2012 9:30AM

### U.S. biosolids use in agriculture

Of the 7 million dry tons of treated sewage sludge produced yearly, 49 percent is reused, mostly for agricultural applications. The breakdown:



Source: Robert B. Brobst, P.E., U.S. Environmental Protection Agency

\* Not subject to federal restrictions; commonly used as a soil additive.

Alan Kenaga/Capital Press

Treated sludge fertilizes crops; some public concerns remain

By JOHN O'CONNELL

Capital Press

The city of Boise once gave away the nutrient-rich sludge -- called biosolids -- left after treating its sewage.

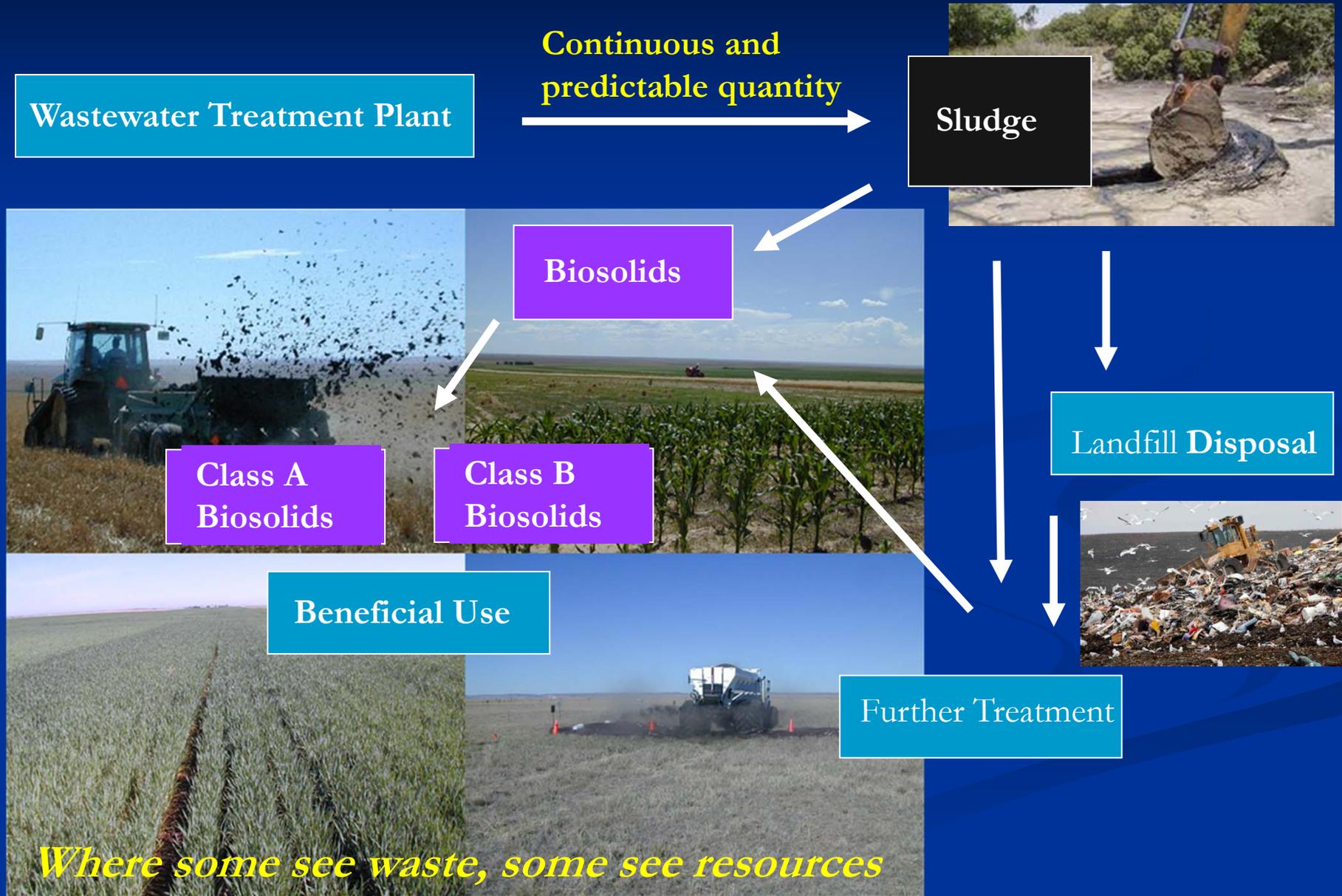
No IPTC Header found  
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◀ 1 of 3 ▶

turning what had been an expense into a revenue stream.

Now Boise is in the farming business,

# Biosolids and Sludge Flowchart



*Where some see waste, some see resources*

# What you are receiving? Where you are putting it?

- What are you receiving?
  - Sludge *further treat to Class A or B?*
  - Class B Biosolids →
  - Class A Biosolids →
- Where are you putting it?
  - Disposal
  - Beneficial Use



# Disposal or Biosolids Management Plans

“Whether you are disposing at a landfill or beneficially using it, there are similar issues that need to be addressed.”

- General requirements
- Pollutant limits
- Management practices
- Standards for pathogen and VAR
- Monitoring and record keeping
- Reporting Requirements



*Biosolids fertilization gives obvious increases in growth compared to crops fertilized with commercial fertilizers.*

<http://www.kingcounty.gov/>

# Beneficial Uses of Biosolids

## Examples

- Commercial Biosolids
- Agricultural land application for crops
- Non-agricultural land application
  - Forest Crops
  - Land reclamation
  - Landfill covers
  - Landscaping, recreational field
- Energy Recover
  - Heat generation, gasification



Cowlitz County WA  
Biosolids Cover



Sanford, Florida Biosolids  
Gasification System



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INL Oversight

Permitting

Home » Water Quality » Wastewater » Sludge & Biosolids

## Sludge & Biosolids

Sludge is the solid, semisolid or liquid untreated residue created during the wastewater treatment process. When treated and processed, sludge becomes biosolids, which are the stabilized residuals that settle from the water during the treatment process. Biosolids may be disposed of or beneficially used.

## Biosolids Beneficial Reuse/Disposal Options

### Beneficial Reuse

Because biosolids contain nutrients and organic matter, they are considered a beneficial resource by EPA and DEQ; therefore, the reuse of biosolids through land application is encouraged. When land-applied, biosolids can be used as fertilizer to help improve and maintain productive soils and stimulate plant growth.

Before biosolids may be land applied, they must be treated to meet standards for pathogens, vectors, and metals. Biosolids treatment is designed to kill pathogens, stabilize organic matter, reduce odors, and minimize vector attraction.

### Disposal

Biosolids may be disposed of by various means such as landfilling, incineration, or surface disposal.

» [Biosolids Beneficial Use and Disposal Flowchart](#)

## Staff Contact

### Wastewater Analyst

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DEQ State Office  
Water Quality Division  
1410 N. Hilton  
Boise, ID 83706  
(208) 373-0116  
[tressa.nicholas@deq.idaho.gov](mailto:tressa.nicholas@deq.idaho.gov)

## DEQ Resource

[Guidance for Land Application of Municipal Biosolids](#) (December 2011)

## More Information on EPA's Website

[Use and Disposal of Biosolids \(Sewage Sludge\)](#)

[A Plain English Guide to the EPA Part 503 Biosolids Rule](#)

[Technology Fact Sheet: Land Application of Biosolids](#)

[Technology Fact Sheet: Alkaline Stabilization of Biosolids](#)

Resources: <http://www.nwbiosolids.org/>



## Northwest Biosolids Management Association



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The mission of the Northwest Biosolids Management Association is to advance environmental sustainability through the beneficial use of biosolids.

Members of the Northwest Biosolids Management Association (NBMA) support the beneficial use of biosolids and have joined forces to meet the challenge of finding safe, economical ways to manage biosolids. The organization's purpose is to share knowledge about biosolids management between member agencies and companies; local, state and federal regulators; and the general public.

### Upcoming events

- Jul 30 - Basics of Biosolids Workshop [\[details\]](#)
- Sep 7 - NBMA's 27th Annual BioFest [\[details\]](#)

### New in the online library

- [Organic micropollutant degradation in sewage sludge during composting under thermophilic conditions](#)
- [On the fate of LAS, NPEOs and DEHP in municipal sewage sludge during composting](#)
- [Transformation of 4-nonylphenol isomers during biosolids composting](#)
- [Biodegradation of prions in compost](#)
- [Antibiotic degradation during manure composting](#)

[Search the library »](#)

*Advancing environmental sustainability through beneficial use of biosolids*

# Questions?



<http://aertec.com/installation/diver/>

# IPDES Primacy

- Direction to Seek Primacy --Statute HB176 – 2005

## Idaho Code § 39-175C.

### APPROVAL OF STATE NPDES PROGRAM

- Department Authorized to Explore NPDES Primacy. Prepare a report to the Legislature - **COMPLETED**
- Board is Authorized to proceed with Negotiated Rulemaking - **Not Implemented**
- Any Memorandum of Agreement executed by the Director to obtain approval to operate a state NPDES program shall not be binding on the state of Idaho unless **authorized by enactment of a statute -** **Not Implemented**

# IPDES

## Steps to Obtain Primacy

NPDES Primacy Schedule	Year 1	Year 2	Year 3	Year 4	Year 5
Develop Funding Strategy Municipal Sector Commercial/Industrial Sector	..... ✓ Fee ? Fee?				
Funding for Start Up (\$300K/yr)		.....			
Develop Rules and Guidance/Application Package		.....	.....	.....	
Present Rules/MOA/Statutes to Legislature			.....	.....	
Phase in Program (multiple years)					.....

Draft plan for IPDES phase-in  
includes Biosolids in the final year of the phase  
– final year has not been set

### IPDES Primacy – Phase In

---

- Municipal Permits
- Industrial Permits
- General Permits
  - Aquaculture
  - CAFO
  - Pesticide GP
- Stormwater/Biosolids

