

RESIDUALS AND BIOSOLIDS

Requirements for Class A, AA, B Sludge Treatment Processes and the Associated Reporting Requirements

Laura A. Boczek – Microbiologist US EPA, Office of Research and Development

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EPA Estimating the Universe of Pathogens

Known

- Viruses
 - Hepatitis
 - Adenovirus 12
 - Norovirus
- Bacteria
 - *Salmonella* spp. (to include *S. enterica*)
 - *Escherichia coli*
 - *Enterococcus* spp.
 - *Campylobacter* spp.
- Parasites
 - *Giardia*
 - *Cryptosporidium*

Emerging

- Bacteria strains:
 - *Escherichia coli* [enterohemorrhagic / shiga-toxin]
 - Antibiotic-resistance / Horizontal Gene Transfer
- Viruses
 - Ebola

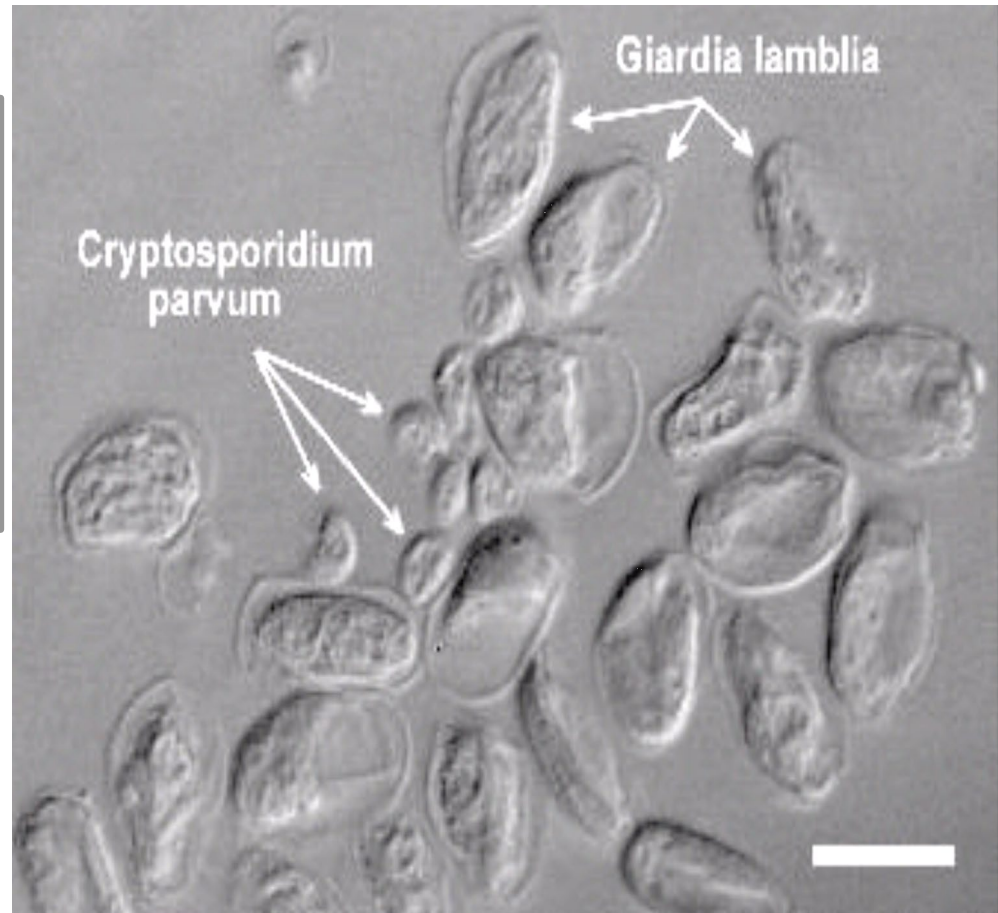


Size of Microbial Pathogens

- **Giardia** 12-15 μm
- **Crypto** 5-7 μm
- **Bacteria** 1-5 μm
- **Virus** 0.02 - 0.3 μm

Compare:

- **Human hair** 80 μm
- **Smallest visible** 40 μm
- **Red blood cell** 4 μm





Statute

Clean Water Act (CWA)

Enacted October 18, 1972 (PL 92-500)

Section 405 sets the framework for sewage sludge regulations (i.e., Part 503)

- Requires EPA to establish standards for proper treatment, use and disposal of sewage sludge
- Also requires EPA to conduct biennial reviews to determine if additional pollutants should be regulated





40 CFR Part 503

Self-implementing rule

- Federally enforceable without a permit
- Minimal standards for use or disposal

States have adopted Part 503 or something more restrictive

- Typically additional requirements address environmentally sensitive areas (e.g., shallow ground water)
- Eight states formally delegated (SD, UT, OK, WI, TX, AZ, OH, MI)

Choice of use or disposal practice is a local decision

Effective management practices help support the needs of local communities

- Renewable resource
- Too valuable to waste





Management Practices

Apply biosolids at or below the agronomic rate

No harm to endangered or listed species

Should not apply biosolids to
flooded, frozen, or snow-covered
land

10 meter (33 feet) buffer to U.S.
waters





40 CFR 503

Pathogens / Indicator Organisms

Microbial standards

- ✓ Technology based
- ✓ *Salmonella* sp., fecal coliforms, enteric viruses, viable helminth ova

Class A:

- ✓ Biosolids are treated to where they are considered to be pathogen free, and can be distributed to the public or land applied without restrictions

Class B:

- ✓ Biosolids are not treated to the same extent as Class A and some pathogens may be present
- ✓ Can only be land applied with site restrictions
- ✓ Can't be distributed to the public





Vector Attraction Reduction

Employ one of the following examples:

- Biological processes that break down volatile solids, reducing available nutrients for microbial activities and odor producing potential
 - 38 % VS reduction via treatment
- Chemical or physical conditions that stop microbial activity
 - Alkali to raise pH to at least 12
- Physical barriers between vectors and volatile solids in the sewage sludge
 - Soil barrier



Class A Materials

- 6 alternative treatment processes to achieve Class A for pathogens
- Specific requirements with respect to bacterial monitoring must be met for Class A material regardless of what alternative methods are employed
 - Fecal coliform density <1,000 mpn/g dry solids
 - Salmonella density <3 mpn/4g dry solids
- Additional pathogen requirements for alternatives 3, 4, and 6
 - Enteric Viruses <1 pfu/4g dry solids
 - Viable Helminth ova <1 ova/4g dry solids



Class A Materials

Summary of the 6 alternatives for Class A Pathogen Requirements

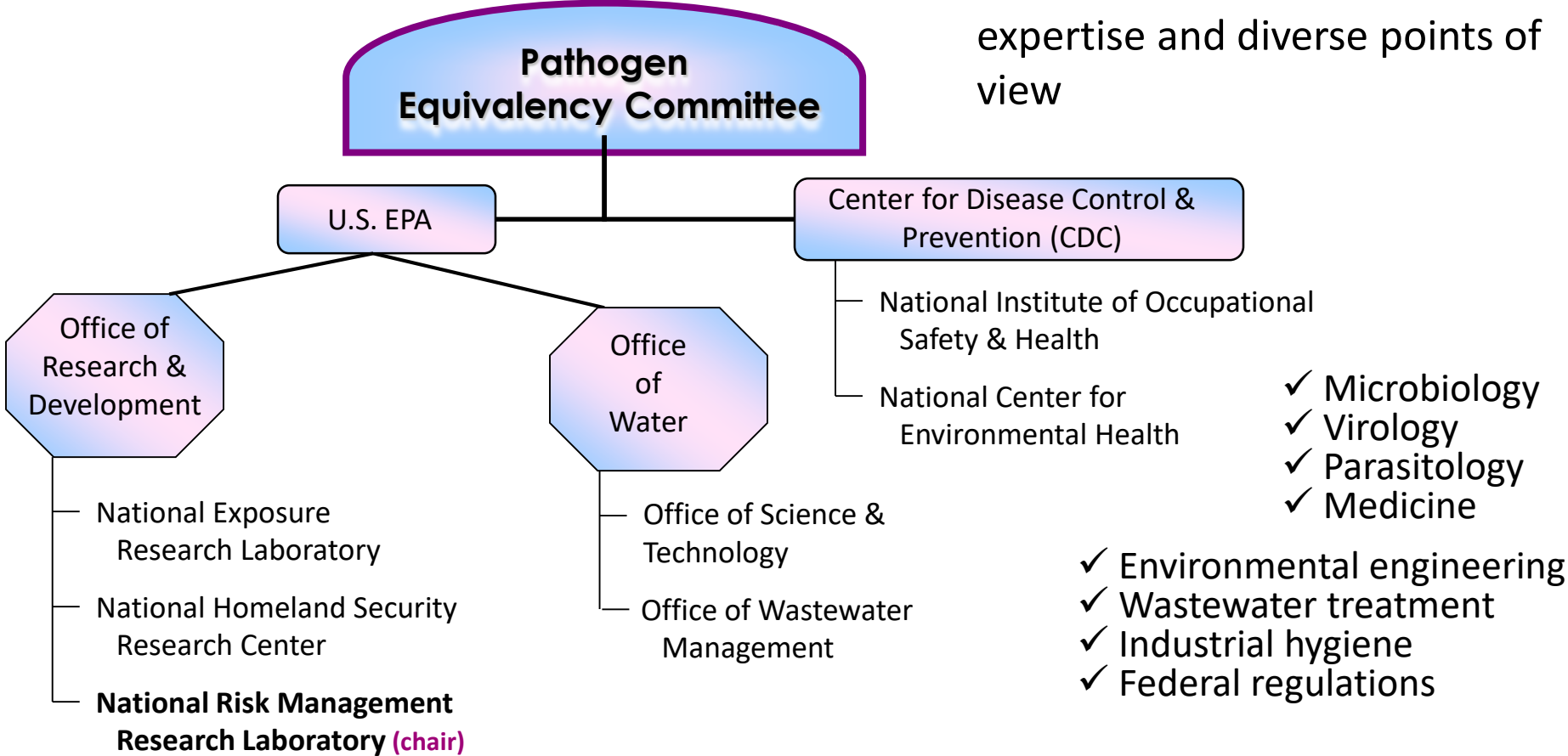
Alternative 1: Thermally Treated Biosolids	Biosolids must be subjected to 1 of 4 time and temperature regimes
Alternative 2: Biosolids Treated in a High pH – High Temperature Process	Biosolids must meet specific criteria with respect to pH, temperature, and air-drying
Alternative 3: Biosolids treated in other processes	Process must show ability to reduce enteric viruses, viable Helminth ova, along with maintenance of operating conditions
Alternative 4: Biosolids treated in unknown processes	Biosolids are tested for all pathogens and meet fecal coliform or <i>Salmonella</i> requirements at the time of use or disposal
Alternative 5: Biosolids treated in a PFRP	Biosolids must be treated in one of the processes to further reduce pathogens(PFRP) (composting, heat drying, heat treatment, thermophilic aerobic digesting, beta ray, gamma ray irradiation and pasteurization)
Alternative 6: Biosolids treated in a Process Equivalent to a PFRP	Biosolids must be equivalent to one of the PFRPs as determined by the permitting authority



Pathogen Equivalency Committee (PEC)

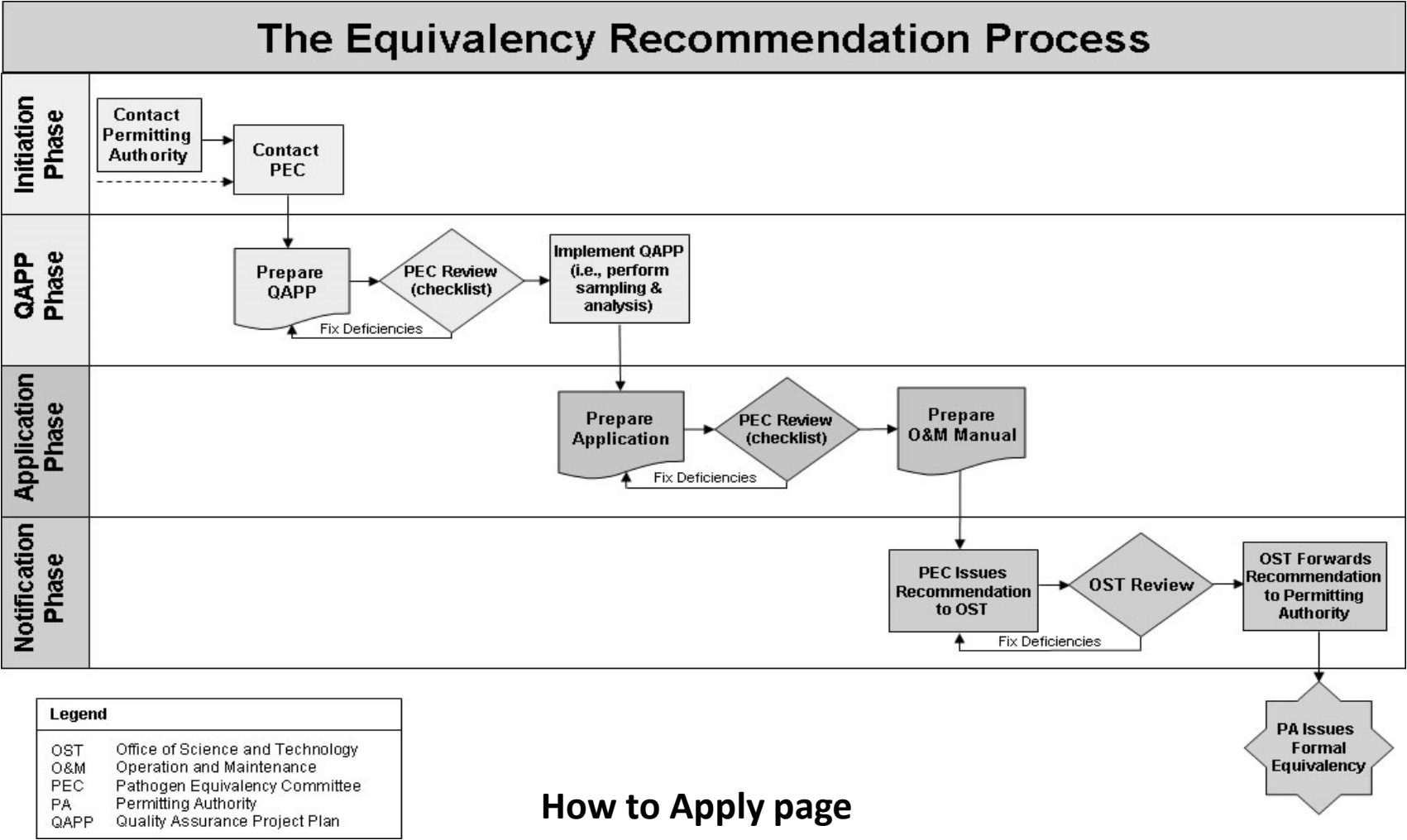
- Created in 1985 to provide technical expertise to permitting authorities on PFRP/PSRP Equivalencies

- 8 members with direct or related expertise and diverse points of view





Website Resources





Class B Materials

- Pathogens such as Helminths may survive Class B treatments and as such these materials are restricted with land application
- Class B materials have site restrictions that restrict crop harvest, animal grazing, and public access
- These restrictions are in place to ensure public and environmental health
- Class B materials cannot be sold or given away in bags or other containers, due to the possibility of public health risks, it would be impossible to monitor the site restrictions on these materials in these instances
- Class B requirements apply to bulk biosolids, as well as material that is placed on a surface disposal site, unless they are covered



Class B Biosolids Land Applied B + Management = A



Public access:

- 30 days – public access when there is a low potential for exposure
- 1 year – public access restriction when there is a high potential for exposure (e.g., turf)

Harvest:

- 30 days – food, feed, fiber crops harvest
- 14 to 38 months – depending on type of food crop and likelihood of touching amended soil

Grazing:

- 30 days – animals not allowed to graze



Class B Materials

Summary of the 3 alternatives for Class B biosolids with respect to pathogens

Alternative 1: The monitoring of Indicator Organisms	Fecal coliform densities must be less than 2 million MPN or CFU/ g total solids at the time of disposal
Alternative 2: Biosolids treated in a process to significantly reduce pathogens(PSRP)	One of the following treatments must be used on biosolid material: Aerobic digestion, Air drying, Anaerobic digestion, Composting, and Lime Stabilization
Alternative 3: Biosolids treated in a process equivalent to a PSRP	Biosolids must be treated in a manner that is equivalent to one of the PSRP's in Alt 2 as deemed by the permitting authority



Site Restrictions for Land Application of Class B Biosolids

FOOD CROPS WHERE HARVEST PARTS TOUCH BIOSOLID MATERIAL

Food crops with harvested parts below the land surface

FOOD HARVEST CAN'T OCCUR UNTIL 14 MONTHS AFTER LAND APPLICATION (LA)

- Harvest can't occur until 20 months after LA in situations where the biosolids remain in contact with the soil surface for 4 months or longer
- Harvest can't occur until 38 months after LA if biosolid material is incorporated into soil

Food crops that do not touch the biosolid surface, feed crops, and fiber crops

Harvest can't occur for 30 days after LA

Animal Grazing

Grazing can't occur for 30 days after LA

Turf Growing

Turf can't be harvested until 1yr after LA, unless otherwise deemed by permit authority

Public Access

Public access is restricted for 1 yr following LA where the site has a high potential for public use, and 30 days for LA with a low public use potential

Sampling

- Important to choose an analytical laboratory that is familiar with biosolid testing, and familiar with the methods outlined by the EPA
 - Enteric Viruses
 - Viable Helminth Ova

- It is not possible to analyze every load of biosolids, nor is it necessary
 - Sampling should be performed in a manner to take into account the variability in the biosolids produced
 - Sampling protocols should include frequency, sample number, sample volume, and most appropriate sampling times



Sample Frequency - Materials to be Land Applied, Surface Disposed, or Incinerated

AMOUNTS OF BIOSOLIDS* (METRIC TONS PER YEAR)	FREQUENCY
Greater than 0 but less than 290	Once per year
Equal to or greater than 290 but less than 1,500	Once per quarter (4 times a year)
Equal to or greater than 1,500 but less than 15,000	Once per 60 days (6 times a year)
Equal to or greater than 15,000	Once per month (12 times a year)



Sampling Guidelines

- Class A Materials

- No set guidelines for number of samples required
- Sampling should be sufficient in order to adequately represent the biosolids that are produced
- The sampling results for Class A are not averaged, therefore every sample must meet Class A requirements
- Sampling should occur at a time that is close to disposal due to the potential of bacterial pathogen regrowth

- Class A Materials

- **Alternative 1** – Sample data are valid as long as biosolid material remains dry prior to use, and time and temperature are continuously monitored
- **Alternative 2** – Monitor for pH value of 12 for more than 72 hours at 25°C
- **Alternative 3** – Sampling should be done in a manner that determines the process is able to achieve pathogen reduction status, and then take into account frequency of monitoring to ensure the results are valid
- **Alternative 4** – Don't know if Helminths, or viruses were present in sludges prior to treatment therefore not sure if the process eliminates them
 - Sampling should be done just prior to usage or disposal
 - Just before prepared for sale or distributions in containers
 - Just before prepared for EQ requirements
- **Alternative 5** – Monitor at a frequency to show compliance with time and temperature or irradiation requirements
- **Alternative 6** – Monitor at a frequency to show compliance with PFRP or equivalent process



Sampling Guidelines

■ Class B Materials

- Sampling should be conducted in a manner that ensures that the biosolid materials are adequately tested
- Unlike Class A, Class B alternative 1 materials do have sample number requirements
- The geometric mean of 7 samples over a 2 week period, close to the time of disposal or use such that fecal coliform densities are less than the 2 million mpn or cfu/ g dry solids
 - 7 samples are used to reduce the standard error to a reasonable value
 - A high standard deviation for fecal coliforms suggests a wide range of population densities in the individual samples
 - High standard deviations could be due to lab analysis, variations in sampling, or indicate a treatment process problem
- Alternative 2 and 3 – monitoring frequency to ensure PSRP requirements are met.



Sampling Guidelines

- Class A and Class B Materials
 - Analytical methods used to measure pathogen densities should be approved by the EPA
 - Bacterial analysis
 - Methods 1680, 1681, 1682 or methods outlined in Standard Methods for the Analysis of Water and Wastewater 22nd ed.
 - Enteric Viruses Methods
 - Methods as outlined in Appendix H of Environmental
 - Regulations and Technology Control of Pathogens and Vector Attraction in Sewage Sludge (White House Document)
 - Viable Helminth Ova Methods
 - Methods as outlined in Appendix I of Environmental
 - Regulations and Technology Control of Pathogens and Vector Attraction in Sewage Sludge (White House Document)



Sampling Guidelines

- Class A and Class B Materials

- Samples should be taken in proper sterile containers and proper preservation as well as maximum storage conditions must be met:
- Standard QA/QC checks, including the use of duplicates to ensure proper laboratory protocols are being used
- Generally a log standard deviation between duplicate samples of $<.3$ are considered acceptable

QUESTIONS?



Laura Boczek
Microbiologist
boczek.laura@epa.gov
513-569-7282

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