Biosolids Stabilization & Safety: 503 Regulation Requirements and Upcoming Trends

IAWEA Biosolids Conference

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Biosolids Stabilization: Clarifying the 503 Regulation Requirements

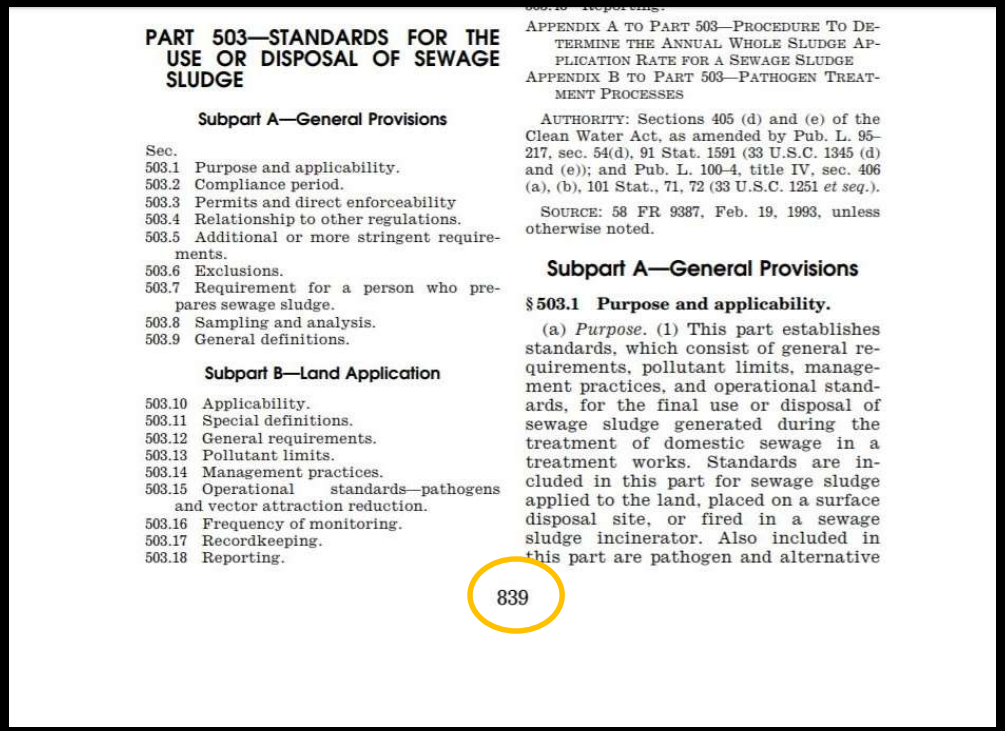
Agenda

AGENDA
1. 503 Regulations Background
2. Biosolids Classes & Restrictions
3. Class B & PSRP
4. Class A & PFRP
5. Vector Attraction Reduction
6. Case Studies
7. Upcoming Trends
8. Conclusions and Take-Away

BACKGROUND

TITLE 40 CODE OF FEDERAL REGULATIONS (CFR) PART 503 STANDARDS FOR THE USE OR DISPOSAL OF SEWAGE SLUDGE

- 50 Federal Regulation Titles, i.e. Books of Rules
- Title 40 – Protection of the Environment
- Title 40 has Hundreds of "Parts"
- "Part 503" - Standards for the Use or Disposal of Sewage Sludge
- Regulates Treatment, Use, and Disposal of Biosolids for Protection of Environment and Public Health



PART 503—STANDARDS FOR THE USE OR DISPOSAL OF SEWAGE SLUDGE

Subpart A—General Provisions

Sec.
503.1 Purpose and applicability.
503.2 Compliance period.
503.3 Permits and direct enforceability
503.4 Relationship to other regulations.
503.5 Additional or more stringent requirements.
503.6 Exclusions.
503.7 Requirement for a person who prepares sewage sludge.
503.8 Sampling and analysis.
503.9 General definitions.

Subpart B—Land Application

503.10 Applicability.
503.11 Special definitions.
503.12 General requirements.
503.13 Pollutant limits.
503.14 Management practices.
503.15 Operational standards—pathogens and vector attraction reduction.
503.16 Frequency of monitoring.
503.17 Recordkeeping.
503.18 Reporting.

APPENDIX A TO PART 503—PROCEDURE TO DETERMINE THE ANNUAL WHOLE SLUDGE APPLICATION RATE FOR A SEWAGE SLUDGE
APPENDIX B TO PART 503—PATHOGEN TREATMENT PROCESSES

AUTHORITY: Sections 405 (d) and (e) of the Clean Water Act, as amended by Pub. L. 95–217, sec. 54(d), 91 Stat. 1591 (33 U.S.C. 1345 (d) and (e)); and Pub. L. 100–4, title IV, sec. 406 (a), (b), 101 Stat., 71, 72 (33 U.S.C. 1251 *et seq.*).

SOURCE: 58 FR 9387, Feb. 19, 1993, unless otherwise noted.

Subpart A—General Provisions

§ 503.1 Purpose and applicability.

(a) *Purpose.* (1) This part establishes standards, which consist of general requirements, pollutant limits, management practices, and operational standards, for the final use or disposal of sewage sludge generated during the treatment of domestic sewage in a treatment works. Standards are included in this part for sewage sludge applied to the land, placed on a surface disposal site, or fired in a sewage sludge incinerator. Also included in this part are pathogen and alternative

839

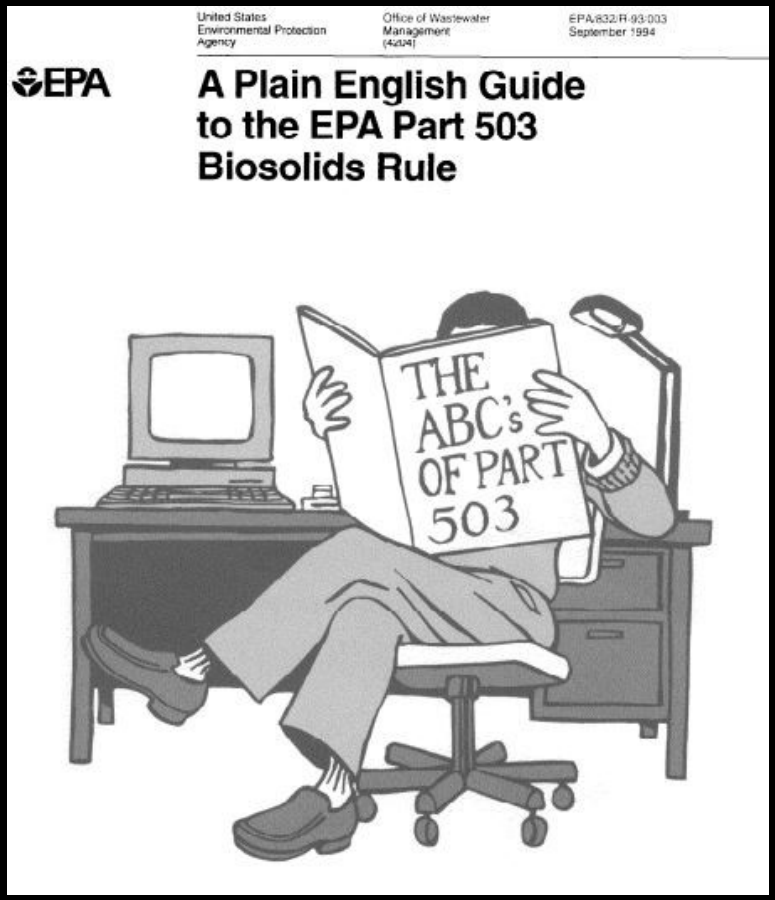
Facts:

1. EPA Established in 1970
2. 503 Regulations Adopted in 1993

A Plain English Guide to the EPA Part 503 Biosolids Rule

Six Chapters

1. Use or Disposal of Biosolids
2. Land Application of Biosolids
3. Surface Disposal of Biosolids
4. Incineration of Biosolids
5. **Pathogen and Vector Attraction Reduction Requirements**
6. Sampling and Analysis



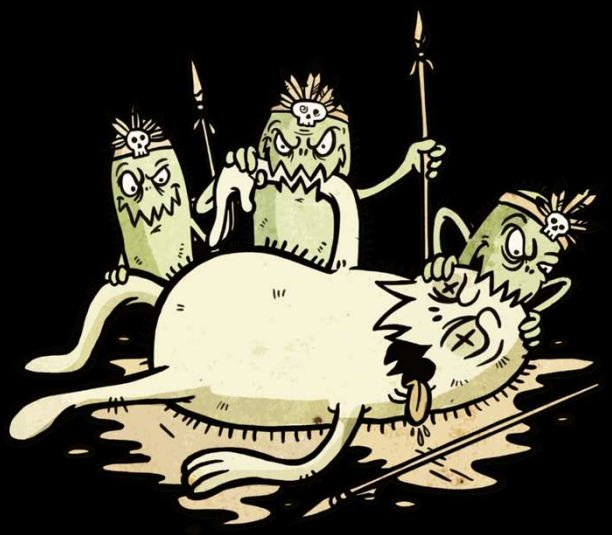
Still 183 Pages Long!

Two Classes of Biosolids

- Class A
  - Use Without Restriction (Use on Lawns & Gardens)
- Class B
  - Use With Restrictions
    - Food crops,
      - » No harvest for 14-months to 38-months after applying
    - Animal grazing
      - » No grazing until 30-days after applying
    - Turf Growing
      - » No harvesting for 1-year after applying
    - Public Land
      - » Restricted access for up to 1-year

Class A and Class B – Two Requirements

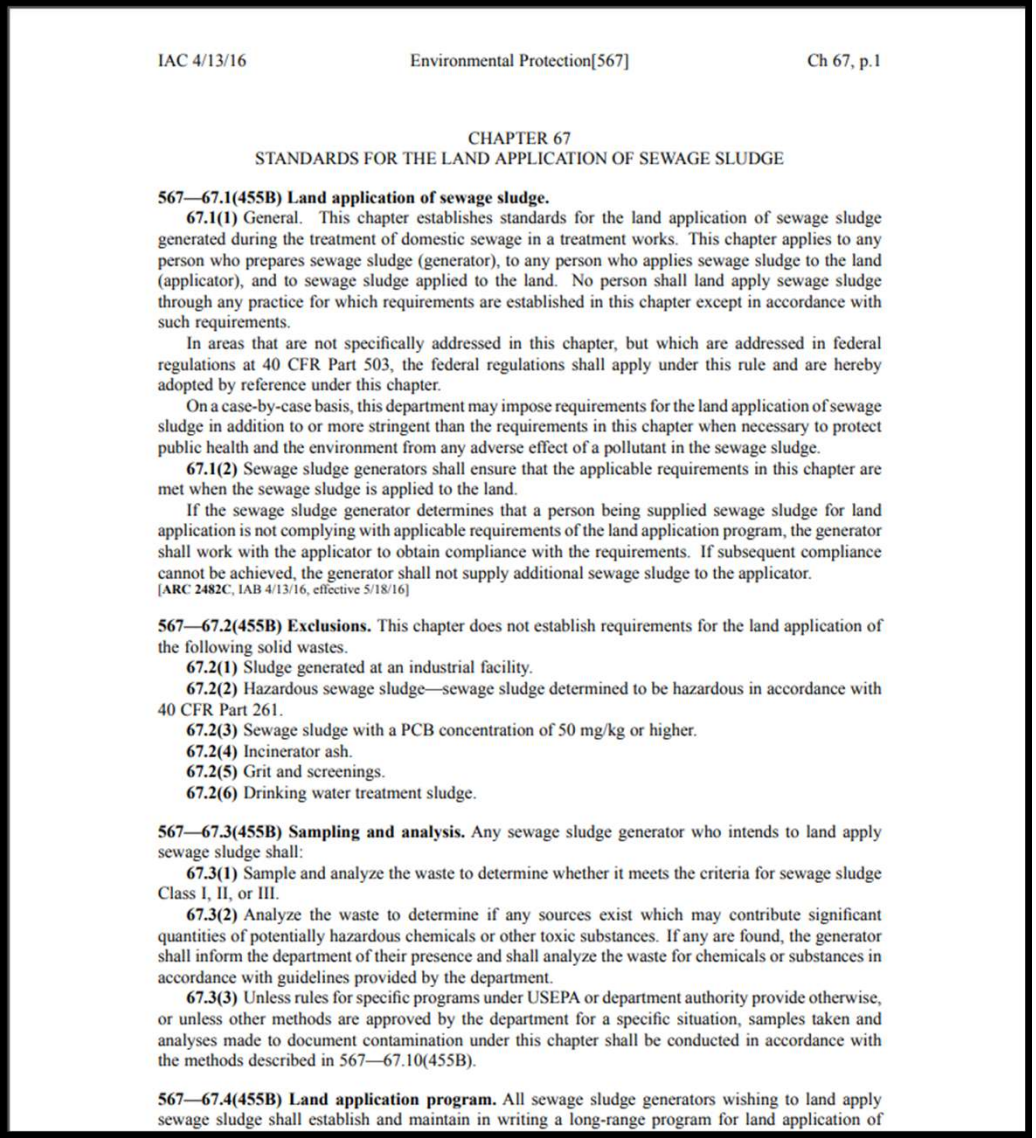
1. Pathogen Reduction
   - Test for Pathogen Reduction
   - Proven Processes
     - Class B
       - » Process to Significantly Reduce Pathogens (PSRP)
     - Class A
       - » Process to Further Reduce Pathogens (PFRP)
2. Vector Attraction Reduction
   - Reduce attractiveness of biosolids to vectors
   - Vectors are animals that can transmit disease from one animal to another (flies, fleas, mice, pigeons, etc…)



There's Also An Exceptional Quality (EQ) and Pollutant Concentration (PC) Biosolids

State Regulations Also Apply

- States May Implement Additional Regulations on Biosolids
- https://www.legis.iowa.gov/docs/iac/chapter/05-10-2017.567.67.pdf



IAC 4/13/16 Environmental Protection[567] Ch 67, p.1

CHAPTER 67
STANDARDS FOR THE LAND APPLICATION OF SEWAGE SLUDGE

567—67.1(455B) Land application of sewage sludge.

67.1(1) General. This chapter establishes standards for the land application of sewage sludge generated during the treatment of domestic sewage in a treatment works. This chapter applies to any person who prepares sewage sludge (generator), to any person who applies sewage sludge to the land (applicator), and to sewage sludge applied to the land. No person shall land apply sewage sludge through any practice for which requirements are established in this chapter except in accordance with such requirements.

In areas that are not specifically addressed in this chapter, but which are addressed in federal regulations at 40 CFR Part 503, the federal regulations shall apply under this rule and are hereby adopted by reference under this chapter.

On a case-by-case basis, this department may impose requirements for the land application of sewage sludge in addition to or more stringent than the requirements in this chapter when necessary to protect public health and the environment from any adverse effect of a pollutant in the sewage sludge.

67.1(2) Sewage sludge generators shall ensure that the applicable requirements in this chapter are met when the sewage sludge is applied to the land.

If the sewage sludge generator determines that a person being supplied sewage sludge for land application is not complying with applicable requirements of the land application program, the generator shall work with the applicator to obtain compliance with the requirements. If subsequent compliance cannot be achieved, the generator shall not supply additional sewage sludge to the applicator.
[**ARC 2482C**, IAB 4/13/16, effective 5/18/16]

567—67.2(455B) Exclusions. This chapter does not establish requirements for the land application of the following solid wastes.

67.2(1) Sludge generated at an industrial facility.

67.2(2) Hazardous sewage sludge—sewage sludge determined to be hazardous in accordance with 40 CFR Part 261.

67.2(3) Sewage sludge with a PCB concentration of 50 mg/kg or higher.

67.2(4) Incinerator ash.

67.2(5) Grit and screenings.

67.2(6) Drinking water treatment sludge.

567—67.3(455B) Sampling and analysis. Any sewage sludge generator who intends to land apply sewage sludge shall:

67.3(1) Sample and analyze the waste to determine whether it meets the criteria for sewage sludge Class I, II, or III.

67.3(2) Analyze the waste to determine if any sources exist which may contribute significant quantities of potentially hazardous chemicals or other toxic substances. If any are found, the generator shall inform the department of their presence and shall analyze the waste for chemicals or substances in accordance with guidelines provided by the department.

67.3(3) Unless rules for specific programs under USEPA or department authority provide otherwise, or unless other methods are approved by the department for a specific situation, samples taken and analyses made to document contamination under this chapter shall be conducted in accordance with the methods described in 567—67.10(455B).

567—67.4(455B) Land application program. All sewage sludge generators wishing to land apply sewage sludge shall establish and maintain in writing a long-range program for land application of

Achieving Class B (PSRP)

- Pathogen Reduction Requirement through Testing
  - Fecal Coliform bacteria to less than 2,000,000 MPN per 1 gram of dried biosolids
- Untreated biosolids sludge typically contains 100,000,000 MPN per gram of dried solids (>2 log reduction)

Alternatives for Meeting Class B Pathogen Requirements

Alternative 1: Monitoring of Indicator Organisms

- Fecal Coliform geometric mean of seven samples <2,000,000 MPN per 1 gram

Alternative 2: Biosolids Treated in a PSRP

- Aerobic Digestion, Air Drying, Anaerobic Digestion, Composting, Lime Stabilization

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

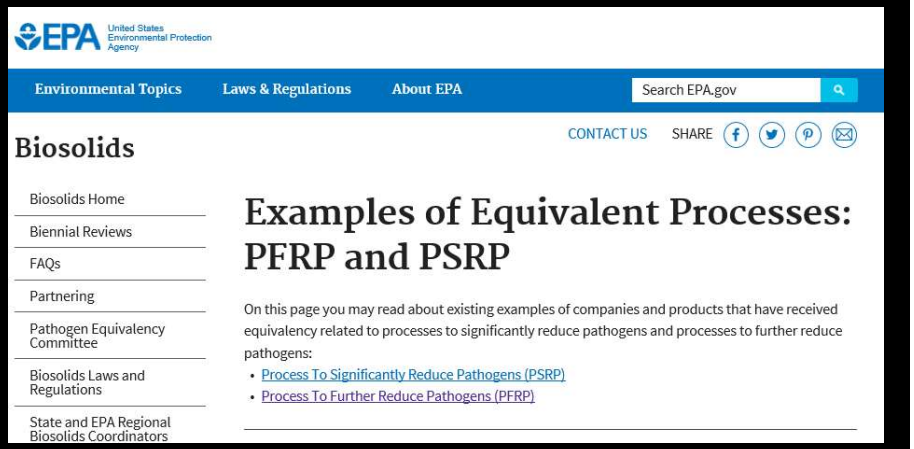
- Proving to a Permitting Authority
  - Purpose is for evolving technologies
  - Many examples: https://www.epa.gov/biosolids/examples-equivalent-processes-pfrp-and-psrp

Biosolids Treated in a PSRP (Class B)

1. Aerobic Digestion
   - Between 40-days at 20 degC (68 degF) to 60-days at 15 degC (59 degF)
2. Air Drying
   - Drying Beds for 3-months with 2 of those 3 months having ambient temperature >0 degC
3. Anaerobic Digestion
   - 15-days at 35 degC - 55 degC (95 degF - 131 degF)
4. Composting
   - 5-days with temperature above 40 degC (104 degF) and 4-hours with temperature above 55 degC (131 degF)
5. Lime Stabilization
   - pH above 12.0 after 2-hours

Biosolids Treated in a Process Equivalent to a PSRP (Class B)

- Examples of processes equivalent to PSRP: https://www.epa.gov/biosolids/examples-equivalent-processes-pfrp-and-psrp#PFRP
- National and Site Specific Equivalencies
- Includes:
  - BCR Environmental Clean B process
  - Synox Corp. OxyOzonation
  - Addition of cement kiln dust for lime stabilization
  - Variations from temperature/time requirements for PFRP



Achieving Class A (PFRP)

For all six alternatives:

- Pathogen Reduction Requirement through Testing
  - Test Salmonella bacteria to less than 3 MPN per 4 grams of dried biosolids

  OR
  - Fecal Coliform bacteria to less than 1,000 MPN per 1 gram of dried biosolids
- Untreated biosolids sludge typically contains 100,000,000 MPN per gram of dried solids (>5 log reduction)

Alternatives for Meeting Class A Pathogen Requirements

Alt 1: Thermally Treated Biosolids

- Time-Temperature Requirements

Alt 2: Biosolids Treated in High pH/High Temp. Process

Alt 3: Biosolids Treated in Other Processes

- Testing reduction of enteric virus and helminth ova

Alt 4: Biosolids Treated in Unknown Process

- Testing for Salmonella, Fecal Coliform, enteric virus and helmintha ova

Alt 5: Biosolids Treated in an Process to Further Reduce Pathogens (PFRP)

- **Composting, Heat Drying, ATAD, Beta Ray Irradiation, Gamma Ray Irradiation, Pasteurization**

Alt 6: Biosolids Treated in a Process Equivalent to a PFRP

- Prove equivalency to a permitting authority

ALL alternatives require fecal coliform or salmonella testing

Biosolids Treated in a PFRP (Class A)

1. Composting
   - Solids stored at 55 degC (131 degF) for 3 days in static aerated pile, or for 15 days in a windrow composting method
2. Heat Drying
   - Biosolids are dried to at least 90% total solids, and the temperature of the biosolids exceeds 80 degC (176 degF)
3. Heat Treatment
   - Liquid biosolids are heated to 180 degC (356 degF) or higher for 30 minutes
4. Thermophilic Aerobic Digestion
   - Liquid biosolids are aerated and heated to 55 – 60 degC (131 – 140 degF) for 10 days
5. Beta Ray Irradiation
   - Biosolids are irradiated with beta rays at dosages of at least 1.0 megarad at room temperature
6. Gamma Ray Irradiation
   - Biosolids are irradiated with gamma rays from certain isotopes at room temperature
7. Pasteurization
   - Temperature of the biosolids is maintained at 70 deg C (158 deg F) or higher for at least 30 minutes

Vector Attraction Reduction

Both Class A and Class B Biosolids Must Meet One of These Requirements

- Option 1: 38% Reduction in Volatile Solids
- Option 2: Additional Anaerobic Digestion on Bench Unit
- Option 3: Additional Aerobic Digestion on Bench Unit
- Option 4: Specific Oxygen Uptake Rate (SOUR) test
- Option 5: Aerobic Process at >40 degF for 14-days
- Option 6: Alkali addition under specific conditions
- Option 7: Dried Biosolids, stabilized, >75% solids
- Option 8: Dried Biosolids, unstabilized, >90% solids
- Option 9: Inject below the soil
- Option 10: Incorporate into soil <6 hours after application
- Option 11: Cover biosolids with soil at end of each day (surface disposal only)
- Option 12: Alkaline treatment to pH >12 for 30 minutes (domestic septage only)

Case Study #1 - Achieving Class B, Vector Attraction

Plant Info:

- Anaerobic Digester Meets PSRP Requirements
- WAS Only, No Primary Solids
- Vector Attraction Reduction Through 38% Volatile Destruction Not Achieved
  - Already Low Volatile Solids Into Digesters

Solution:

- Alternative to Proving Vector Attraction Reduction
  - Additional Anaerobic Digestion on Bench Unit (40-day w/ <17% additional reduction)

Take-Away:

- Room For Improvement Within the 503 Regulations Specific Sludge Type Requirements

Case Study #2 - Achieving Class A Vector Attraction

Plant Info:

- Anaerobic Digester Sludge Meets PSRP Requirements
- Digested Sludge Does Not Meet 38% VS Reduction
- Biosolids Sent to Thermal Dryer & Achieves 90% TS

Solution:

- Vector Attraction Reduction Met by Achieving >75% TS (Option 7 of Vector Attraction Reduction)

Take-Away:

- There May Be More Than One Method to Achieve Class A or Class B Solids.
- Know the 503 Regulations

Case Study #3 - Achieving Class A, Pathogen Reduction

Plant Info:

- ATAD Reactors – Approved PFRP Process
- Fecal Coliform Count After ATAD is Above 1,000 MPN

Solution:

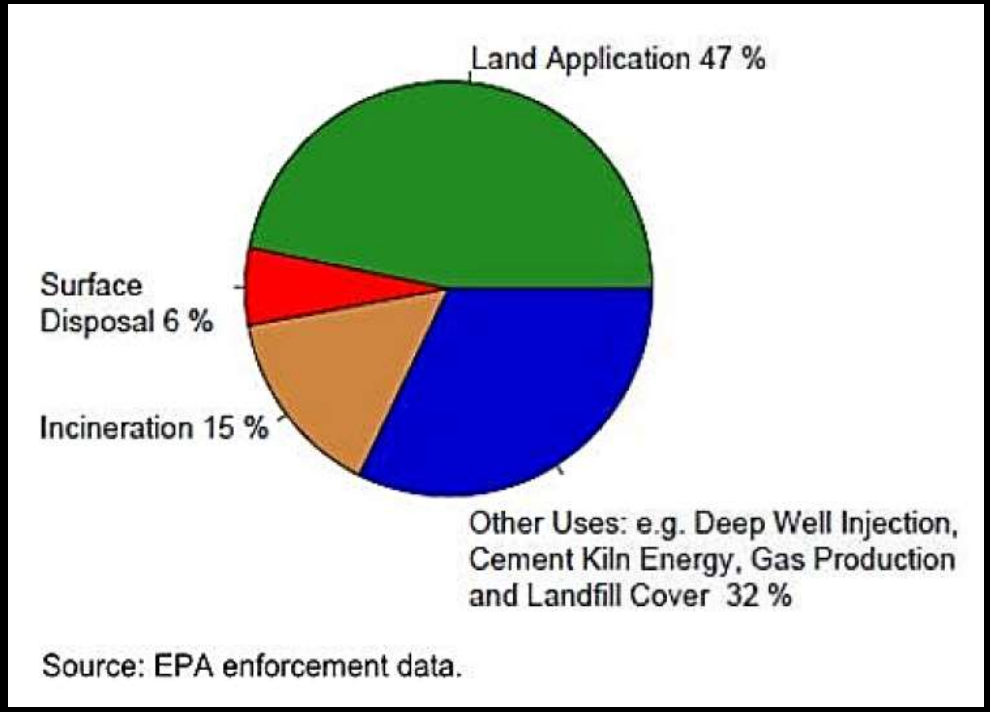
- Prove Pathogen Reduction Through Salmonella Testing Rather Than Fecal Coliform

Take-Away:

- There are Two Pathogen Reduction Tests Available for Class A
- Know the 503 Regulations

Current Trends Impacting the 503 Regulations

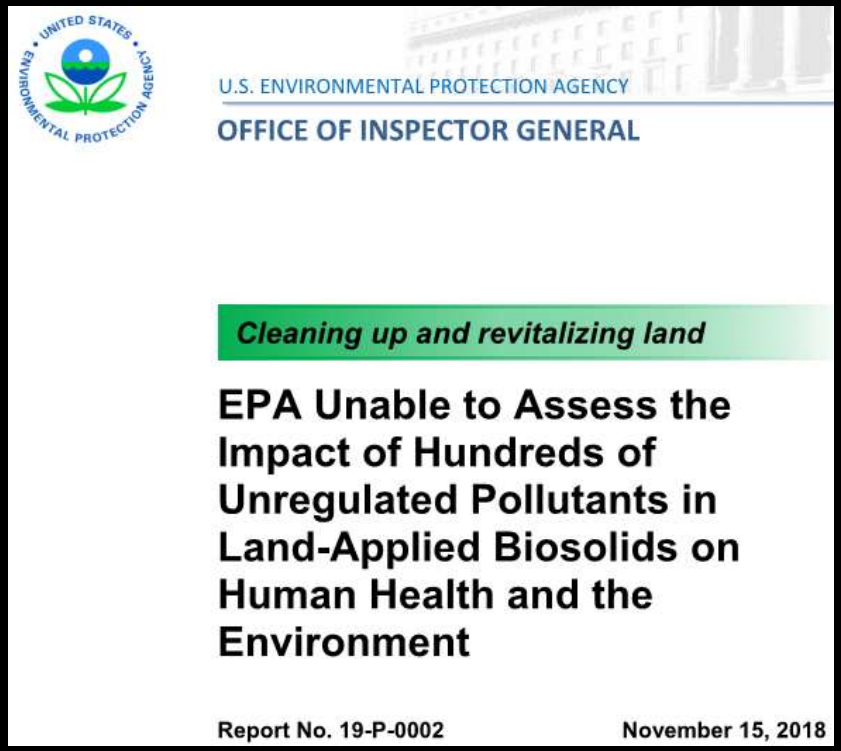
- High usage of biosolids for land application
- Public perception of land application and emerging contaminants



Current Trends Impacting the 503 Regulations

Office Of Inspector General Report:

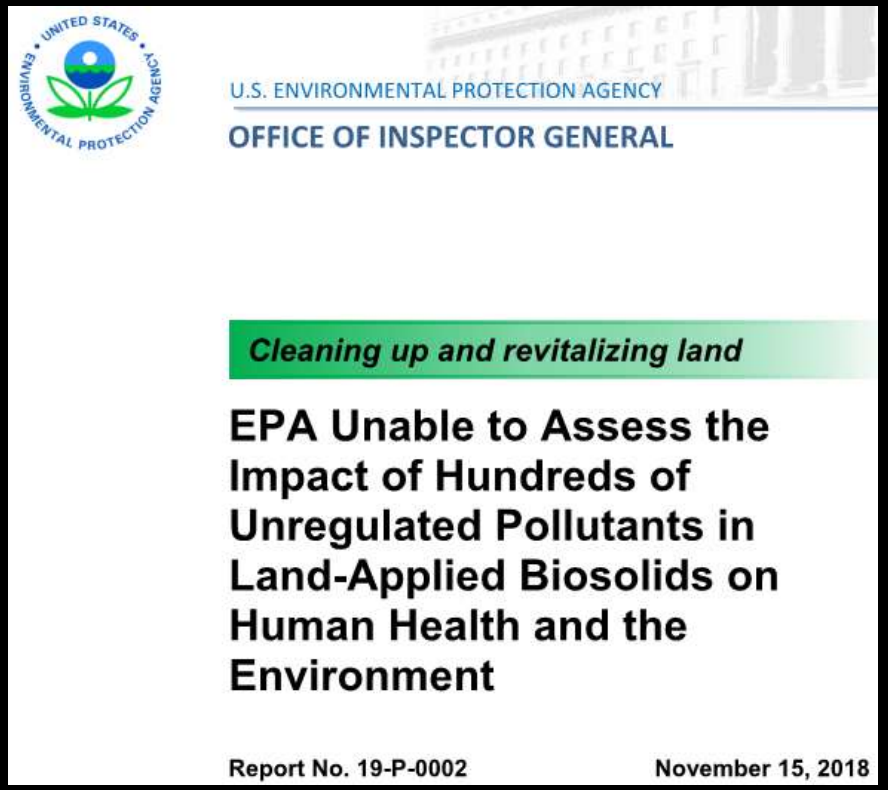
- Insufficient data for 352 unregulated pollutants
- No newly identified pollutants in 20 years
- Lack of transparency for public
- Need more data for potential risks to handlers
- Pollutant distribution via runoff not well regulated
- Limited staff/resources to address weaknesses



Current Trends Impacting the 503 Regulations

OIG Report Recommendations:

- 503 Update Needed
- Guidance on new technologies for biosolids pathogen reduction.
- Updated biosolids fecal coliform sampling practices
  - Will likely require more monitoring
- **Modify EPA's website to say that until the required research concerning unregulated pollutants found in biosolids is complete, the safety of biosolids cannot be guaranteed.**


U.S. ENVIRONMENTAL PROTECTION AGENCY

OFFICE OF INSPECTOR GENERAL

Cleaning up and revitalizing land

EPA Unable to Assess the Impact of Hundreds of Unregulated Pollutants in Land-Applied Biosolids on Human Health and the Environment

Report No. 19-P-0002 November 15, 2018

Current Trends Impacting the 503 Regulations

Since the OIG Report…

ENVIRONMENT MARCH 19, 2019 / 6:11 AM / UPDATED 4 YEARS AGO

The curious case of tainted milk from a Maine dairy farm

By Richard Valdmanis, Joshua Schneyer 6 MIN READ

ARUNDEL, Maine (Reuters) - For Maine dairy farmer Fred Stone, the discovery in 2016 that his cows were producing tainted milk has since brought financial ruin and threatened to shut down a century-old family business.

Current Trends Impacting the 503 Regulations

Since the OIG Report…

Maine Legislature Passes Bill Prohibiting Land Application of Biosolids, Governor Expected to Sign

Apr 20, 2022

Current Trends Impacting the 503 Regulations

Since the OIG Report…

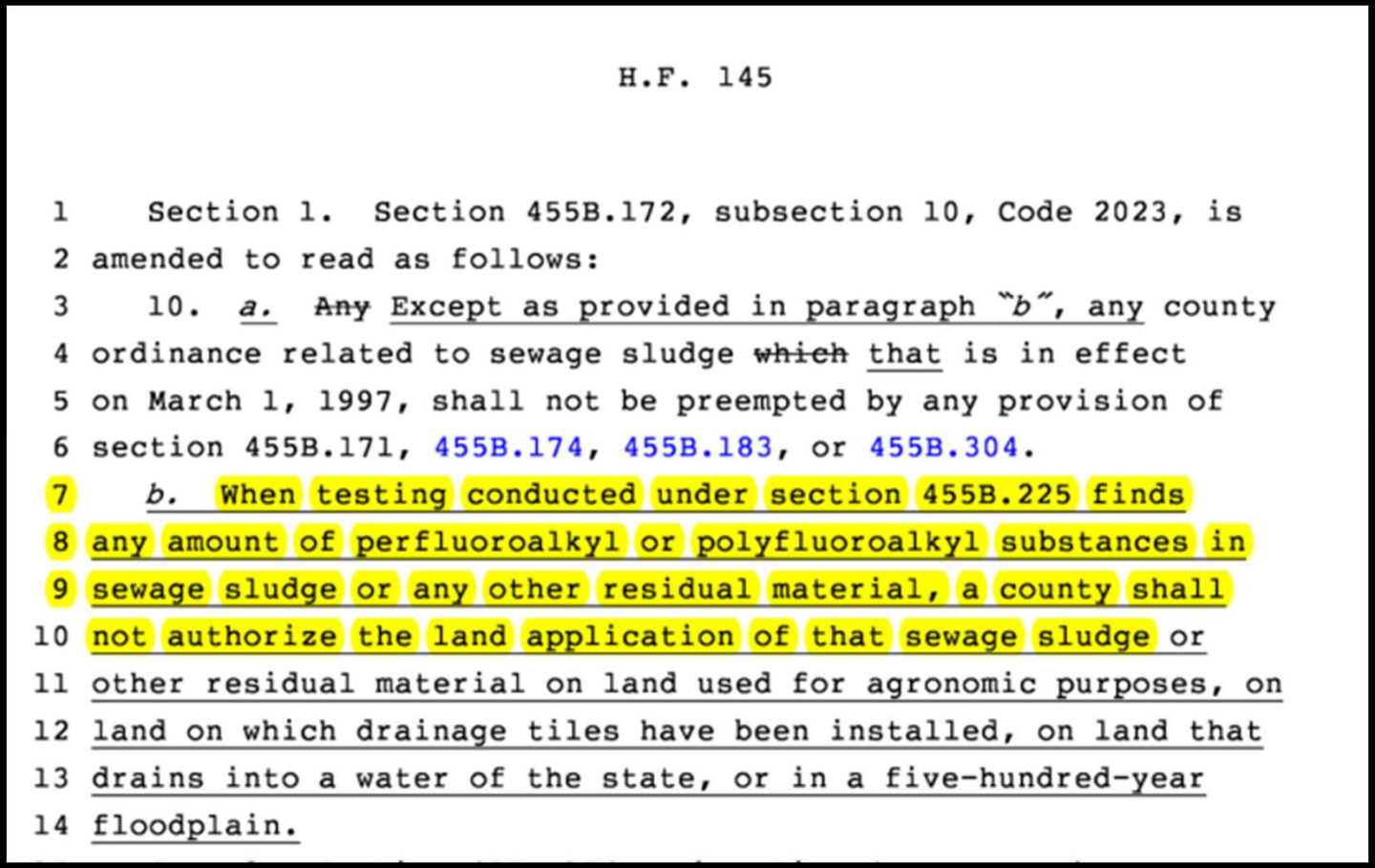
States With Biosolids Land Application Testing, Reporting, and/or Monitoring Requirements:

1. Colorado (coming in 2023)
2. Maryland
3. Massachusetts
4. Michigan
4. New Hampshire
5. Oklahoma
6. Oregon
7. Vermont
8. Washington

Several Individual Counties have Implemented Specific Rules in Their Jurisdictions

Current Trends Impacting the 503 Regulations

Since the OIG Report…



H.F. 145

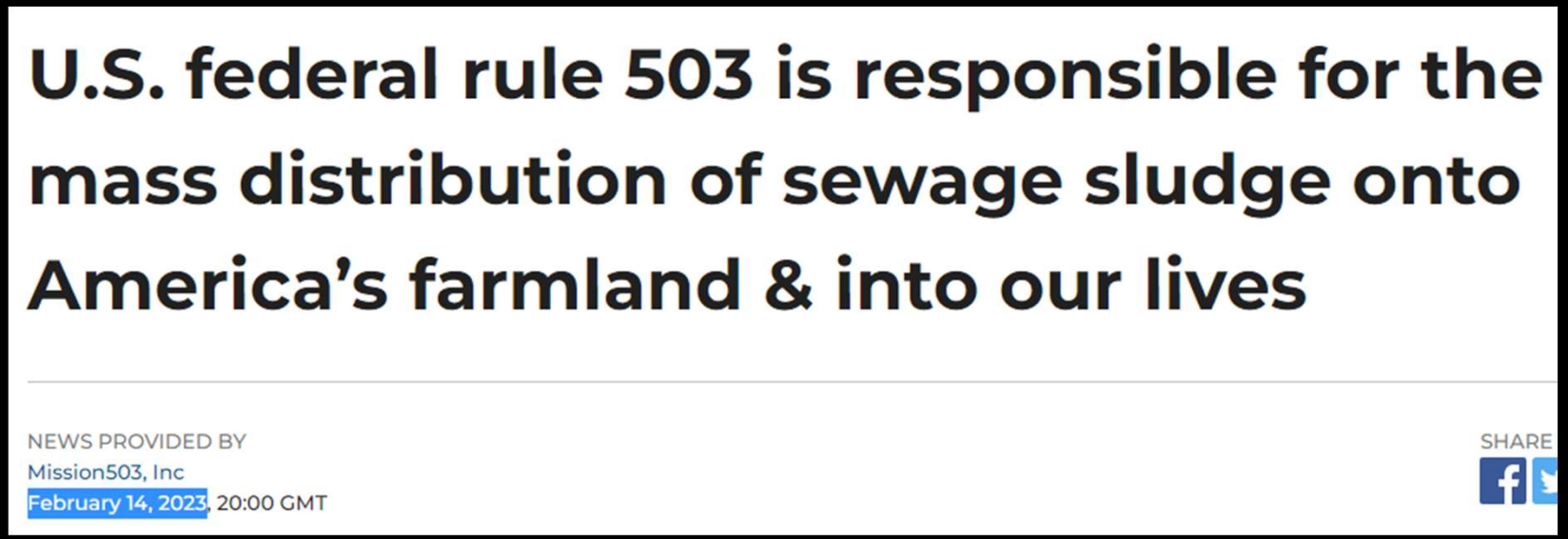
Section 1. Section 455B.172, subsection 10, Code 2023, is amended to read as follows:

10. *a.* ~~Any~~ Except as provided in paragraph "*b*", any county ordinance related to sewage sludge ~~which~~ that is in effect on March 1, 1997, shall not be preempted by any provision of section 455B.171, 455B.174, 455B.183, or 455B.304.

b. When testing conducted under section 455B.225 finds any amount of perfluoroalkyl or polyfluoroalkyl substances in sewage sludge or any other residual material, a county shall not authorize the land application of that sewage sludge or other residual material on land used for agronomic purposes, on land on which drainage tiles have been installed, on land that drains into a water of the state, or in a five-hundred-year floodplain.

Current Trends Impacting the 503 Regulations

Since the OIG Report…



U.S. federal rule 503 is responsible for the mass distribution of sewage sludge onto America's farmland & into our lives

NEWS PROVIDED BY
Mission503, Inc
February 14, 2023, 20:00 GMT

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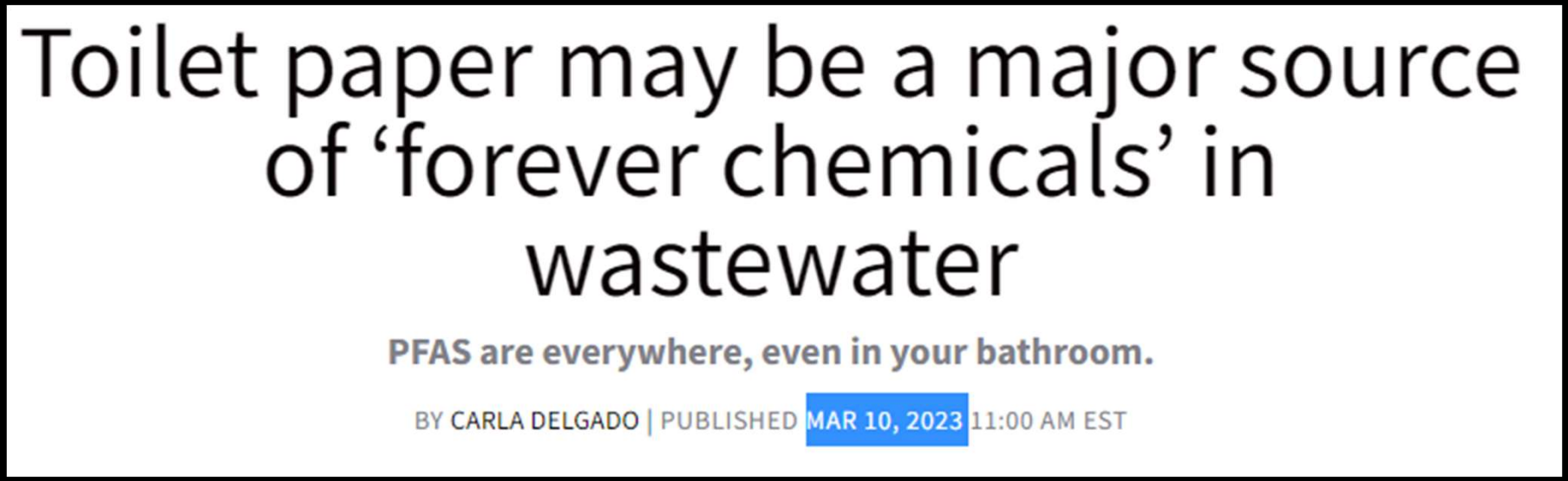
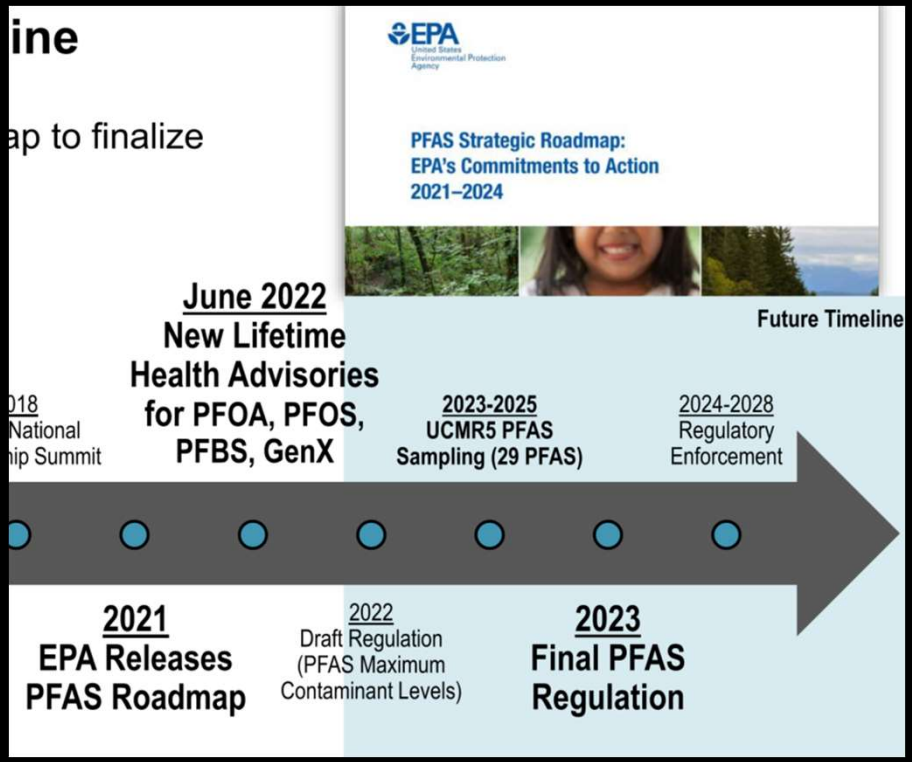
Current Trends Impacting the 503 Regulations

Since the OIG Report…



Current Trends Impacting the 503 Regulations

EPA Status Update:



- **Address PFAS in Biosolids.** EPA is working to complete a full risk assessment on PFOA and PFOS in biosolids for release in 2024. The Agency is set to reach a milestone in its biosolids efforts in late 2022 by releasing a draft biosolids risk-assessment screening framework for scientific peer review, which will estimate high end exposures for a wide range of chemical contaminants due to use and disposal of biosolids. PFAS in biosolids is an issue that requires enhanced coordination, and the Agency commits to working with key partners across the federal government, states, and the water, solid waste, and agricultural sectors.

3/14/2023 Update: EPA listed Six (6) PFAS MCL concentrations for National Drinking Water Standards. PFOA & PFOS @ 4 ng/L and PFNA, PFHxS, PFBS, GenX @ Non-Detect

Current Trends Impacting the 503 Regulations

Implications:

- Individual State PFAS Actions Creating Public Outreach Issues with Land Application of Biosolids
- EPA's Responses to OIG Report with Updated 503 Regulation Recommendations Will Be Heavily Scrutinized by the Public and Utilities
- Pathogen reduction/VAR monitoring requirements and fecal sampling practices are likely to change.
- Processes Not Already Established as PFRPs To Undergo Evaluation to Pass Class A&B standards.
- Costs of Disposal for Class A and Class B Biosolids Will Rise Based on Testing and Possible Treatment/Disposal Changes.

Conclusions

- 503 Regulations Designate
  - Class A and Class B Biosolids
  - PSRP (Class B) Process Requirements
  - PFRP (Class A) Process Requirements
  - Vector Attraction Requirements for Both
- The 503 Regulations Updates Are In Progress. 352 Unregulated Pollutants…
- State Rules Addressing Emerging Contaminants Becoming Common
- Future is Uncertain for Biosolids, Especially Land Application