

REGION 5 PERSPECTIVE: THE BIOSOLIDS PROGRAM

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PERSPECTIVE

- ▶ "The grass is always greener on the other side of the fence."

Unknown

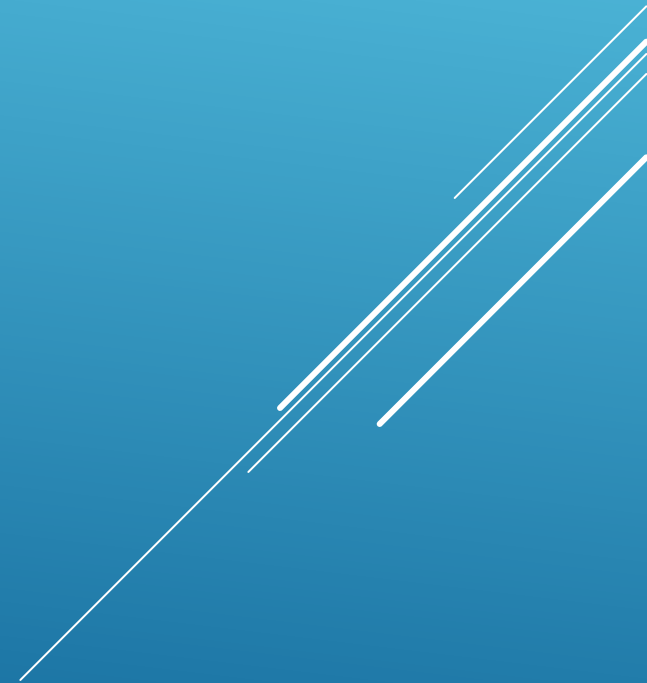
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REALITY



PERSPECTIVE

- ▶ The Biosolids and Septage Program in the Region run like a well oiled machine



REALITY

- ▶ The Biosolids and Septage Program are basically nonexistent in the Regional office
 - ▶ 1 staff person (<10%)
 - ▶ No dedicated enforcement staff
- 
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WHY DOES IT RUN SO SMOOTH?

- ▶ States had existing land application programs before 503
 - ▶ States updated (updating) their regs to be consistent with 503
 - ▶ Some states received program approval to implement the federal program
- 
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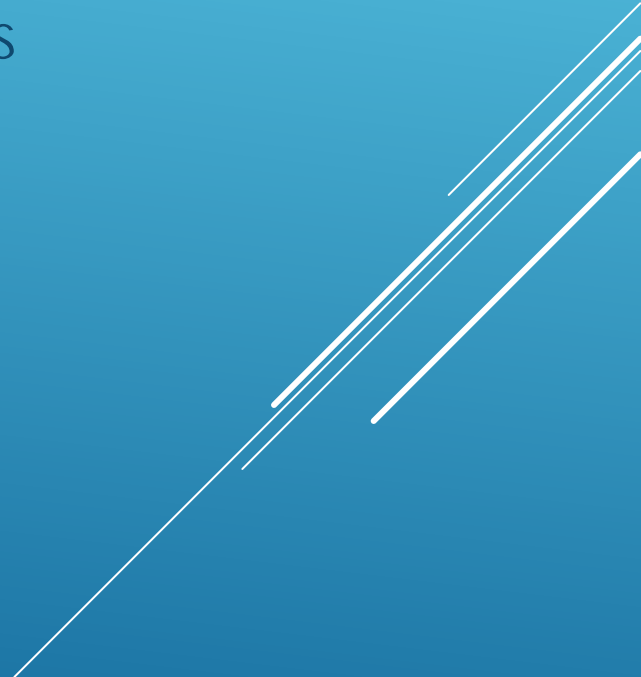
BIOSOLIDS PROGRAM APPROVAL

- ▶ State rules have to be consistent with federal rules
- 


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 - ▶ State Attorney General has to certify that the state has the authority to implement and enforce the program
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BIOSOLIDS PROGRAM APPROVAL

- ▶ State rules have to be consistent with federal rules
 - ▶ State Attorney General has to certify that the state has the authority to implement and enforce the program
 - ▶ State and EPA have to sign a Memorandum of Agreement on how the state will implement the program
- 

BIOSOLIDS PROGRAM APPROVAL

- ▶ State rules have to be consistent with federal rules
 - ▶ State Attorney General has to certify that the state has the authority to implement and enforce the program
 - ▶ State and EPA have to sign a Memorandum of Agreement on how the state will implement the program
 - ▶ No additional funding from EPA to implement the program
- 
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REGION 5 STATE PROGRAMS

- ▶ Illinois
 - ▶ State sludge regs are not consistent with 503
 - ▶ NPDES permits contain some sludge language
 - ▶ Issue Land Application permits to some facilities
 - ▶ No specific sludge fees
 - ▶ Septage regulated by the Department of Public Health and County Health Departments
 - ▶ Septage regs are consistent with 503

REGION 5 STATE PROGRAMS

- ▶ Indiana
 - ▶ State regs consistent with 503
 - ▶ No desire for program approval
 - ▶ Regulated by Office of Land Quality
 - ▶ No specific sludge fees
 - ▶ Septage regs consistent with 503
 - ▶ Requires Lime stabilization
 - ▶ Fee for land application site permit

REGION 5 STATE PROGRAMS

- ▶ Michigan

- ▶ Received program approval in 2006 for land application of biosolids
- ▶ Water Program regulates through NPDES
 - ▶ Requires a Residuals Management Plan
 - ▶ Fee based on amount land applied
- ▶ Septage regs are consistent with 503 but not part of approval
 - ▶ Regulated by the Water Program
 - ▶ One time per site approval fee

REGION 5 STATE PROGRAMS

- ▶ Minnesota
 - ▶ State regs consistent with 503
 - ▶ No desire for program approval
 - ▶ Water Program regulates through NPDES – permitting fees
 - ▶ Septage regs are consistent with 503 – no permitting fees
- 

REGION 5 STATE PROGRAMS

- ▶ Ohio
 - ▶ Received program approval in 2005 for land application, surface disposal and landfilling of sewage sludge
 - ▶ Water Program regulates through NPDES
 - ▶ Requires a Sludge Management Plan
 - ▶ Permitting fee and a sludge fee based on tonnage
 - ▶ Septage regs are consistent with 503 but not part of approval
 - ▶ Regulated by the Ohio Department of Health and local County Department of Health
 - ▶ No fee

REGION 5 STATE PROGRAMS

▶ Wisconsin


- ▶ Received program approval in 2000 for land application, surface disposal and landfilling of sewage sludge
- ▶ Water Program regulates through NPDES
 - ▶ Nutrient Management Plan may be required
 - ▶ Site approval required
 - ▶ No fee
- ▶ Septage
 - ▶ Regulated by State or county
 - ▶ Site approval required
 - ▶ No fee

BIOSOLIDS CENTER OF EXCELLENCE

- ▶ Office of Enforcement and Compliance Assurance disinvests in 2012
 - ▶ Most Regional Enforcement Offices disinvested
- ▶ Region 7 offers to be the Biosolids Center of Excellence
 - ▶ Receive and review annual reports
 - ▶ 2308 received (2014)
 - ▶ 677 reviewed (2014)

| Region | State | Received | Reviewed |
|--------|-------|----------|----------|
| 5 | IL | 200 | 45 |
| | IN | 109 | 23 |
| | OH | 13 | 8 |
| | MI | 5 | 0 |
| | WI | 5 | 2 |
| | MN | 2 | 0 |
| | | | |

Reports Flagged For Further Action

- ▶ Marketing Class A or Class B biosolids without demonstrating the biosolids meet one of the pathogen reduction methods;
 - ▶ Grossly inadequate report;
 - ▶ Failure to meet Pollutant Limits or Other Pollutant Loading;
 - ▶ Failure to meet one of the Vector Attraction Reduction Methods (VAR);
 - ▶ Failure to monitor at the required frequency;
 - ▶ Cases not identified above that may pose significant public health risks or undermine the effectiveness of the Program;
 - ▶ No certifications.
- 

BIOSOLIDS CENTER OF EXCELLENCE

- ▶ Enforcement actions to be initiated by Region 7
- ▶ Complaints go to Region 7
 - ▶ Region 5 forwarded 4 septage complaints
 - ▶ 3 in Illinois
 - ▶ 1 in Ohio
 - ▶ CWA Section 308 letters being sent to those facilities
- ▶ eReporting will be coming soon



Key Issues and Challenges



...applying
science &
technology
to protect
water quality

On the one hand ...

2.3 billion acres of land in the USA

- ✓ 314,964,600 harvested (2012 Ag Census)

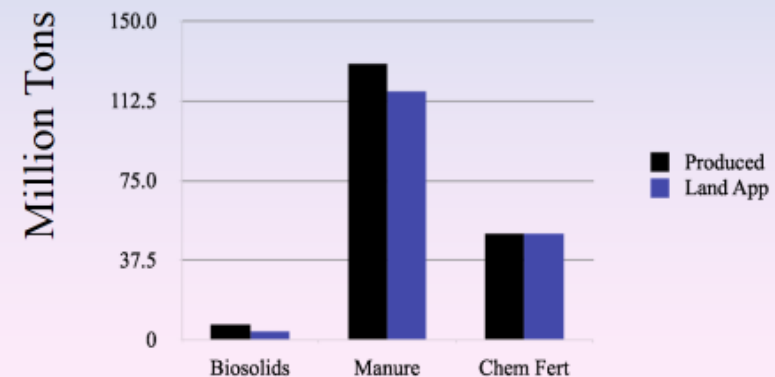
7 M dry tons of sewage sludge generated annually

- ✓ 3.5×10^6 tons @ 5 tons/acre = 700,000 acres applied
- ✓ Applied is 0.2% of harvested (99.8% receive no biosolids)

~140 M tons manure

- ✓ 22,072,968 acres of manure applied (2012 Ag Census)
- ✓ Applied is 7.0% of harvested

Materials Applied to Land in the US



NEBRA 2007; WERF 99PUM-1

On the other ...



Estimating the universe of chemicals is important

CAS Registry* is an authoritative collection of disclosed chemical substance information

- ▶ ~88 million organic and inorganic substances
- ▶ 65 million sequences
- ▶ ~15,000 new substances are added each day
- ▶ ~90,000 chemicals in commerce

Up to tens of thousands of chemicals require evaluation

*American Chemical Society's Chemical Abstracts Service: <http://www.cas.org/expertise/cascontent/registry/regsys.html> (accessed June 2014)

Estimating the Universe 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* O157:H7 [enterohemorrhagic / Shigella-toxin; EHEC / STEC]
- Antibiotic-resistance / Horizontal Gene Transfer
- **Ebola?**

Agency Drivers

Public Concerns / Uncertainty

Lacking Data /
Low Priority

Aesthetics

Some Environmental
Impacts Not Regulated
- Odor

Public
Confidence
and
Acceptance

Biosolids
Controversies

Q: What Chemicals do we find in the Environment / Biosolids?

A: All the ones we are using (i.e., assuming we are looking for them)

Mostly those that are:

- Mass-produced
- Discharged into wastewater and the environment
- Feature foreign chemical structures (i.e., PBDEs / PFCs)

Detection does not automatically imply a problem



Microconstituents / PPCPs / TOrCs / ECs / COECs / EDCs...

Interest remains high

- What is their fate
- Do they have any impact
- Illustrates the connection of individuals' activities with their environment

What does it mean for biosolids management?

- Similar reactions / processes for all chemicals
- PBT chemicals present highest level of concern

Biosolids land application as a tool for managing microconstituents

- Assimilative capacities of soils
- Best management practices

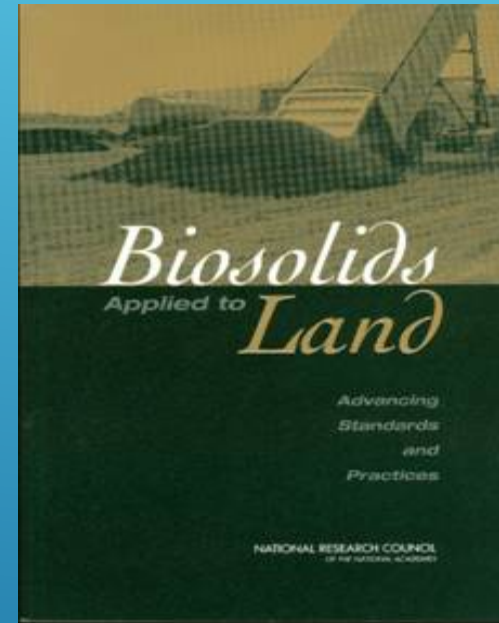
Is the Current Framework Protective?

We believe Part 503 is protective

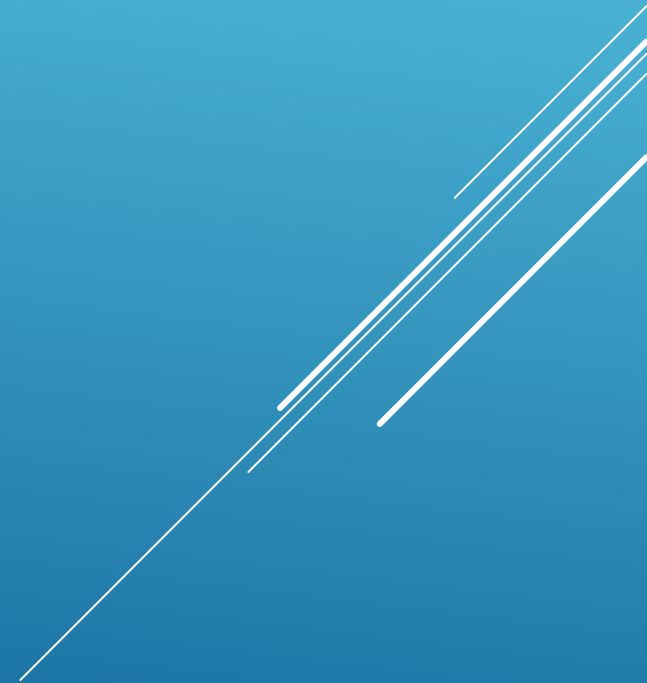
“No documented evidence to indicate that Part 503 has failed to protect public health”
(NAS Report , 2002)

Much we don't know

“However, additional scientific work is needed to reduce persistent uncertainty about the potential for adverse health effects from exposure to biosolids” (NAS Report, 2002)



WHAT HAS EPA BEEN DOING TO ADDRESS CHALLENGES



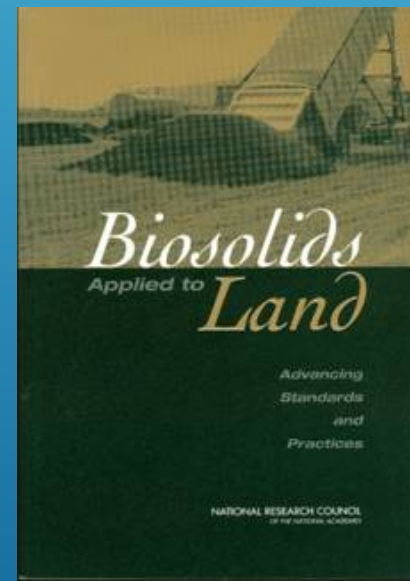
EPA'S 2003 ACTION PLAN

NAS Report (2002)

- 53+ recommendations
- Address public health concerns / scientific uncertainties

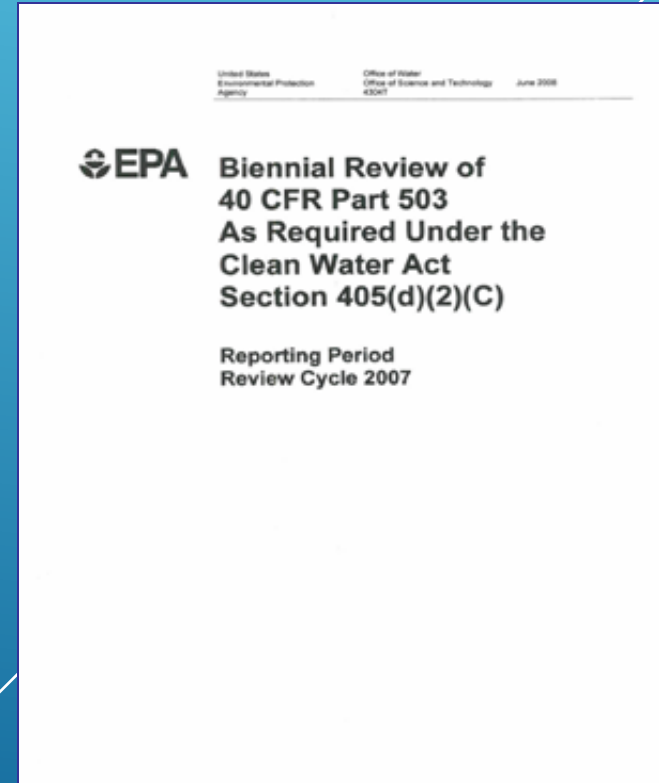
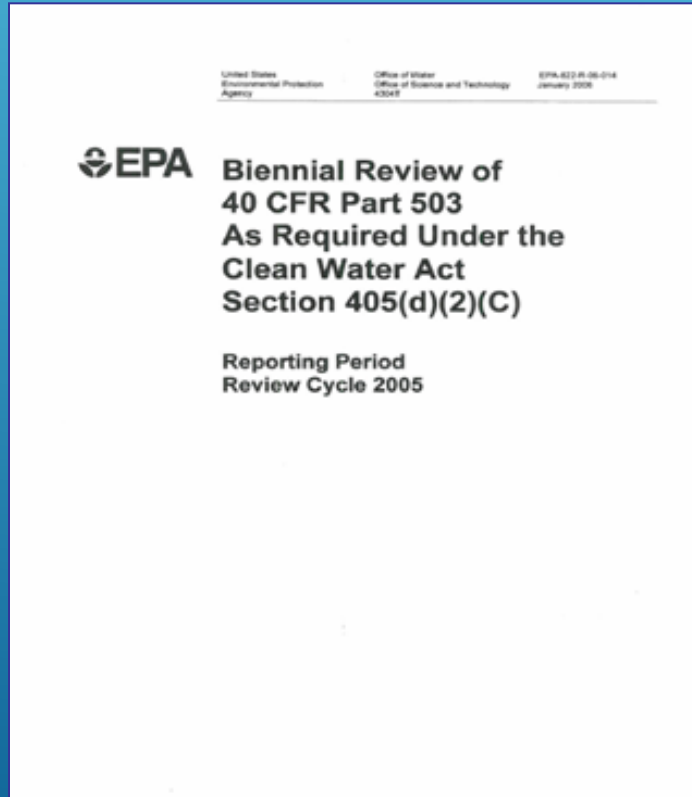
EPA response

- ✓ 14-point action plan
- ✓ Significant progress



NAS / NRC Report, July 2002

| Project Title | Status |
|---|-----------|
| Biennial review pursuant to the CWA Section 405(d)2)(C) | Completed |



Review Part 503 every 2 years to identify additional toxic pollutants for regulation

- Round One (final rule 2/93): screened 350+ pollutants
- Round Two (2001 & 2003): screened 32 pollutants
 - ✓ Dioxin and Dioxin-like chemicals
 - ✓ Final Action to not regulate
- Round Three (Biennial Review 2003): screened 803 pollutants
 - ✓ 9 pollutants (four metals, a pesticide, volatile and semi-volatile compounds, and nitrate / nitrite)
 - ✓ Molybdenum
 - ✓ Evaluating to determine if compounds should be regulated
- Biennial Reviews (2005 / 2007 / 2009 / 2011 / 2013 ...)

| Project Title | Status |
|---|-----------|
| Compliance Assistance and Enforcement Actions | Completed |

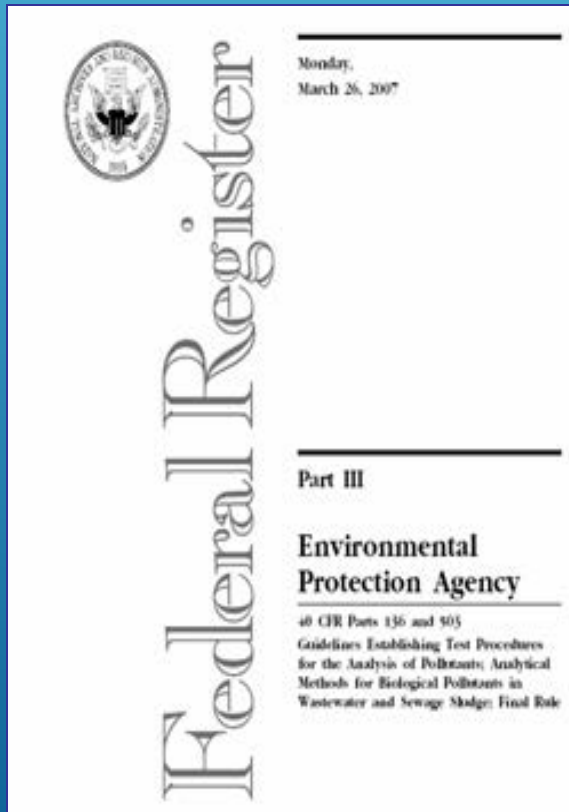
- Actively address biosolids violations
- Require the proper land-application of biosolids to prevent risk to human health or the environment
- OECA has developed a new look for its home page, where a 'new badge button' on their website invites the public to be a part of EPA's work and report possible environmental violations or crimes

www.epa.gov/compliance/index.html


- EPA Region 7 handles enforcement / compliance




| Project Title | Status |
|---|-----------|
| Methods development, optimization, and validation for microbial pollutants in sewage sludge | Completed |




| Project Title | Status |
|--|-----------|
| Development and application of analytical methods for detecting PPCPs in sewage sludge | Completed |


Method 1694: Pharmaceuticals and Personal Care Products in Water, Soil, Sediment, and Biosolids by HPLC/MS/MS

December 2007


Method 1698: Steroids and Hormones in Water, Soil, Sediment, and Biosolids by HRGC/HRMS

December 2007


Method 1699: Pesticides in Water, Soil, Sediment, Biosolids, and Tissue by HRGC/HRMS

December 2007

| Project Title | Status |
|-----------------|-----------|
| Support the PEC | Completed |

Pathogen Equivalency Committee (PEC)

Contact Us Search: All EPA This Area

You are here: EPA Home > Research & Development > Risk Management Research > LMS > PEC

Pathogen Equivalency Committee Home

Basic Information

- Equivalency Criteria
- Principal Biosolids Guidance

Equivalent Processes

- State & Regional Biosolids Coordinator
- How to Apply
- Quality Assurance Project Plan

Related Links

- Risk Management Research Home

This Web site provides guidance for demonstrating the effectiveness of innovative and/or alternative sewage sludge disinfection processes for the purposes of receiving a recommendation of equivalency to a process that significantly or further reduces pathogens. Biosolids are sewage sludges that have been treated and managed to meet state and federal standards. [40 CFR Part 503](#) regulates sewage sludge use and disposal.

Coordinator Locator

[Find a permitted authority](#)

Helpful Information

- [What are Processes to Further Reduce Pathogens \(PFRPs\) and Processes to Significantly Reduce Pathogens \(PSRPs\)?](#)
- [What are the criteria for demonstrating equivalency to a PFRP or PSRP?](#)
- [How do I get started?](#)
- [How do I apply?](#)
- [Why do fecal coliform, Salmonella spp., enteric viruses, and helminth ova demonstrate equivalency?](#)
- [Design elements and resources for quality assurance project plan development](#)
- [Examples of equivalent processes to significantly or further reduce pathogens](#)

Biosolids Guidance

[Control of Pathogens and Vector Attraction in Sewage Sludge \(EPA/625/R-92/013\)](#)

Disclaimer

A new process to significantly or further reduce pathogens can only be granted equivalency by the permitting authority. The Pathogen Equivalency Committee (PEC) advises permitting authorities on equivalency recommendations.

- Applicants can now easily submit requests online
- More formal approach for evaluating equivalency
- Numerous technologies are in different stages of receiving a recommendation of equivalency
- OST signature
- EPA support is ongoing

<http://water.epa.gov/scitech/wastetech/biosolids/pathogen.cfm>

| Project Title | Status |
|--|-------------|
| Review criteria for molybdenum in land applied biosolids | In progress |

- Assess the need and appropriate level for a numerical standard for molybdenum
- Completed assessment in 2014
- Peer reviewed / regulatory decision soon

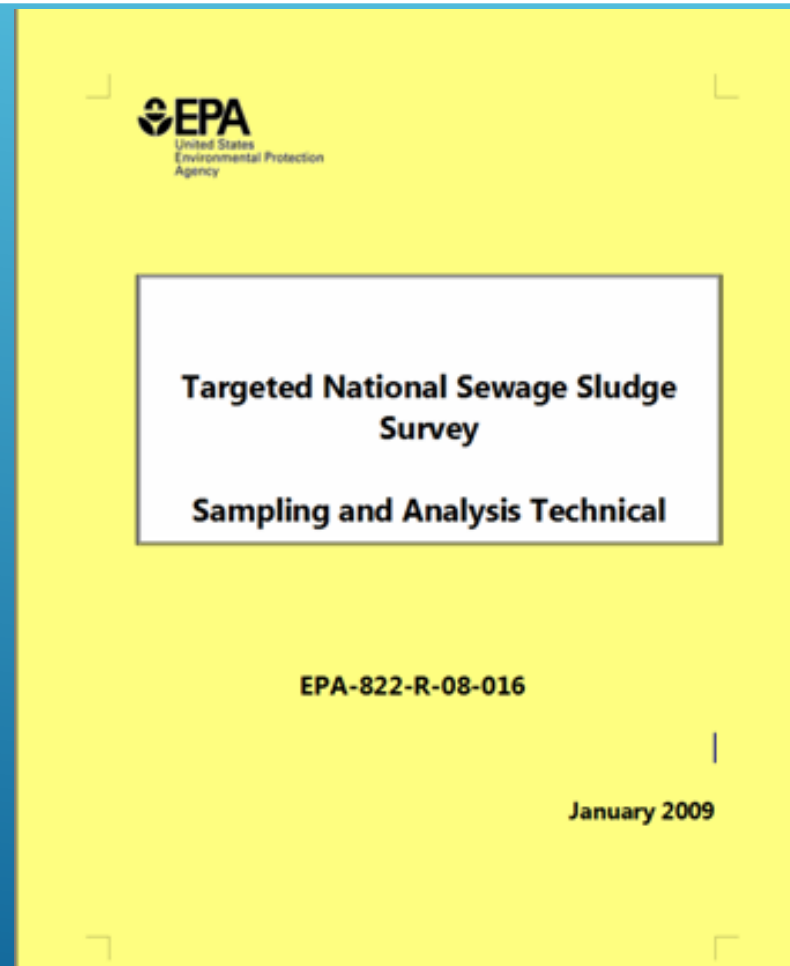
Molybdenum Estimates from Table 16 of 9/6/07 draft report

| Analyte | % Det. | n | Est. N | Lognormal-Based Estimates | | Observed Minimum | Observed Maximum | Lognormal-Based Percentiles | | | | |
|------------|--------|----|--------|---------------------------|--------|------------------|------------------|-----------------------------|------------------|------------------|------------------|------------------|
| | | | | Mean | S.D. | | | 99 th | 98 th | 95 th | 90 th | 50 th |
| Molybdenum | 100.0 | 74 | 3,337 | 15.328 | 13.841 | 2.510 | 86.400 | 68.664 | 55.570 | 40.521 | 30.615 | 11.377 |

"n" denotes total sample size in the survey. "Est N" is the total of the survey weights, or the total number of POTWs in the target population which these results represent.

Note: This analysis excludes data for sample #68357 collected at Plant #19.

| Project Title | Status |
|--|-----------|
| Targeted National Sewage Sludge Survey | Completed |



<http://water.epa.gov/scitech/wastetech/biosolids/>

TNSSS DESIGN

Designed to provide nationally representative results

Statistically selected 74 POTWs to represent 3,337 POTWs that met the following criteria:

- Flow greater than 1 MGD
- Secondary treatment or better
- Located in the contiguous United States

Peer-reviewed both survey design and analytical methods

Sampled treated sewage sludge

TNSSS DESIGN (CONT)

Collected 84 samples at 74 POTWs in 35 states August 2006 – March 2007

Measured 145 analytes, including:

- 97 pharmaceuticals, steroids and hormones
 - ✓ 72 antibiotics and drugs (Rx and OTC)
 - ✓ 25 steroids and hormones
- 28 metals
- 11 polybrominated diphenyl ethers (PBDEs)
- 4 polycyclic aromatic hydrocarbons (PAHs)
- 3 inorganic ions
- 2 semivolatile organics

TNSSS FINDINGS – OCCURRENCE

Wide variation in minimum and maximum levels

Wide variation in detection frequency:

- 16 analytes (11%) not detected
- 129 analytes (89%) detected in at least one sample
- Most non-pharmaceuticals were detected in more than 50 of 84 samples
- Pharmaceuticals/steroids/hormones ranged from 0 to all 84 samples
- 42 analytes detected in 100% of samples (3 pharmaceuticals; 3 steroids & hormones; 36 metals, inorganic ions, organics)

TNSSS NEXT STEPS

Characterizing risk where data are sufficient

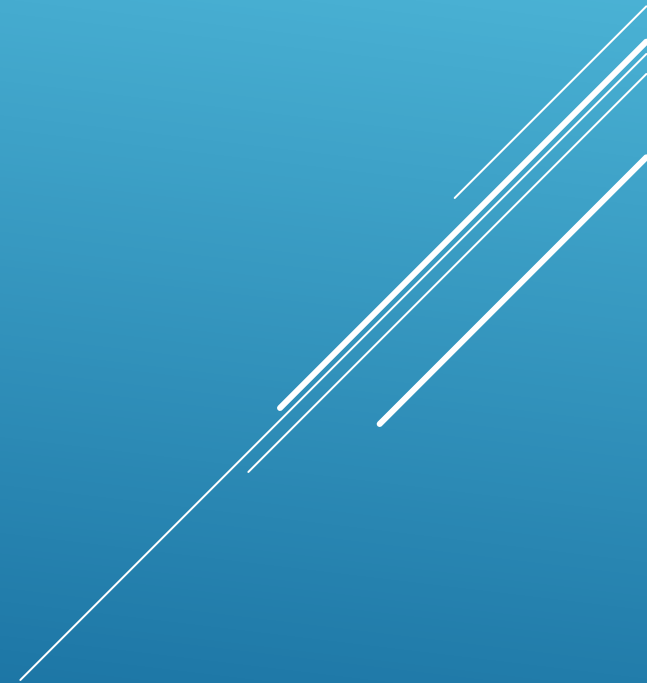
- ▶ Evaluate exposure and effects to human and ecological receptors
 - ▶ 10 pollutants (barium, beryllium, manganese, molybdenum, silver, 4-chloroaniline, fluoranthene, pyrene, nitrate, nitrite)
 - ▶ 135 pollutants
- ▶ Biosolids Core Risk Assessment Model



OTHER KEY CONSIDERATIONS



...applying
science &
technology
to protect
water quality



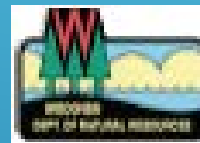
**A National Biosolids
Regulation, Quality, End
Use & Disposal Survey**



FINAL REPORT

July 20, 2007

North East Biosolids and Residuals Association (NEBRA)
P. O. Box 422, Tarrytown, NY 10594
phone 903-323-7434, email info@nabiosolids.org
www.nabiosolids.org

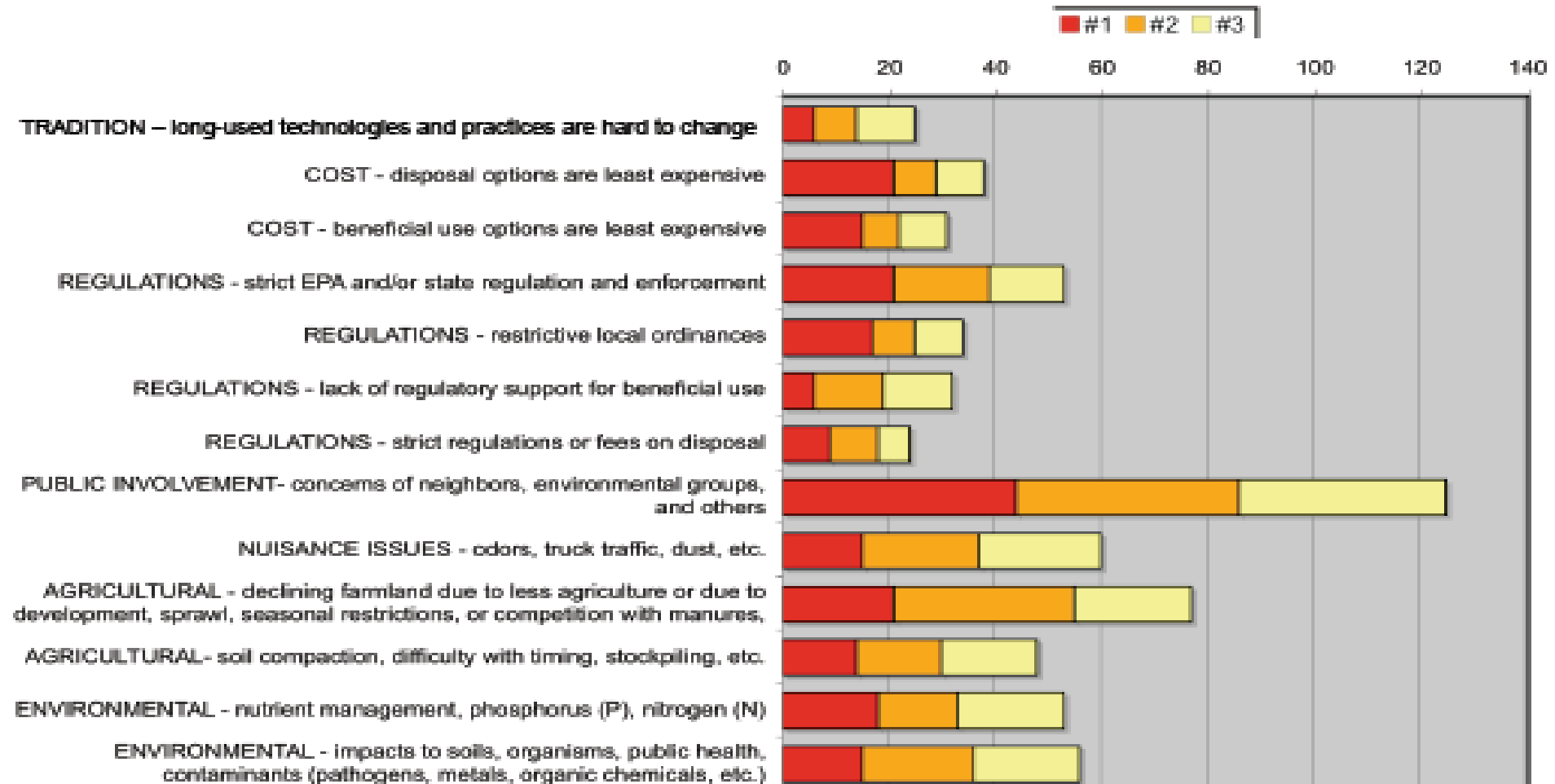


Pressures on biosolids recycling ...

Online survey of individual TWTDS asked respondents to identify the three most important pressures on biosolids recycling. Figure 12 is a compilation of the ~250 responses from around the nation. The #1 priority responses appear in the darkest color; the #3 priority responses appear in the lightest color.

Figure 12

Top pressures on biosolids recycling programs



Collectively Improve Communication and Public Perception



“Public Acceptance will be the main obstacle to biosolids disposal/use viability” – WEF

- Public concern is a key driver
- Systematic and proactive outreach

Constrained Federal and State resources

We know how to make good products

IMPROVING SCIENCE RESEARCH PRIORITIES

Continue evaluating pollutants

Conduct acceptable and informative research

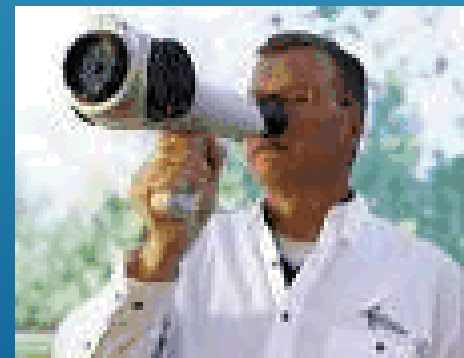
- ▶ Field validation of models
- ▶ Attenuation of pollutants in biosolids systems

Evaluate treatment effectiveness

Develop a bioassay

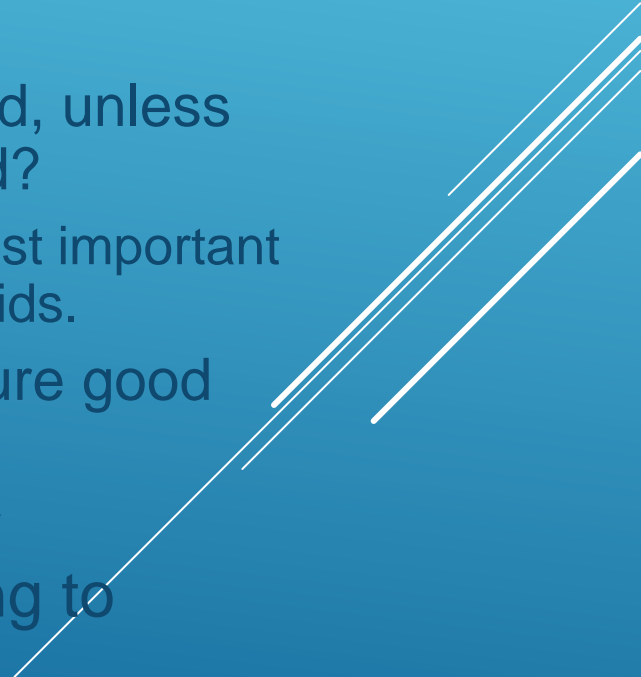
Define stability

- ▶ **ODOR TESTING ??**





STABILITY / ODORS

- As with any business biosolids managers should meet consumer demands with a “designed product” which
 - Meets time and temperature conditions for good disinfection
 - Is permanently or irreversibly stabilized, unless temporary stabilization can be justified?
 - ✓ A well stabilized sludge may be the most important characteristic of a well accepted biosolids.
 - Meets monitoring requirements to insure good disinfection
 - Consider requiring the use of an odor classification system and/or monitoring to insure public acceptance
- 

REBRANDING WASTEWATER AS A RESOURCE



Case Study 3: East Bay Municipal Utility District, Oakland, CA

Memorandum To: Bart Jones; From: Re-branding Task Force; Date: January 24, 2012

STRUVITE

Magnesium ammonium phosphate: $\text{NH}_4\text{MgPO}_4 \cdot 6\text{H}_2\text{O}$

Fig. 1 illustrates occasions where struvite was formed in the piping at treatment plants.



Fig. 1. Clogging of a post digestion pipe by struvite at a treatment plant (location confidential)



Uncontrolled

Controlled

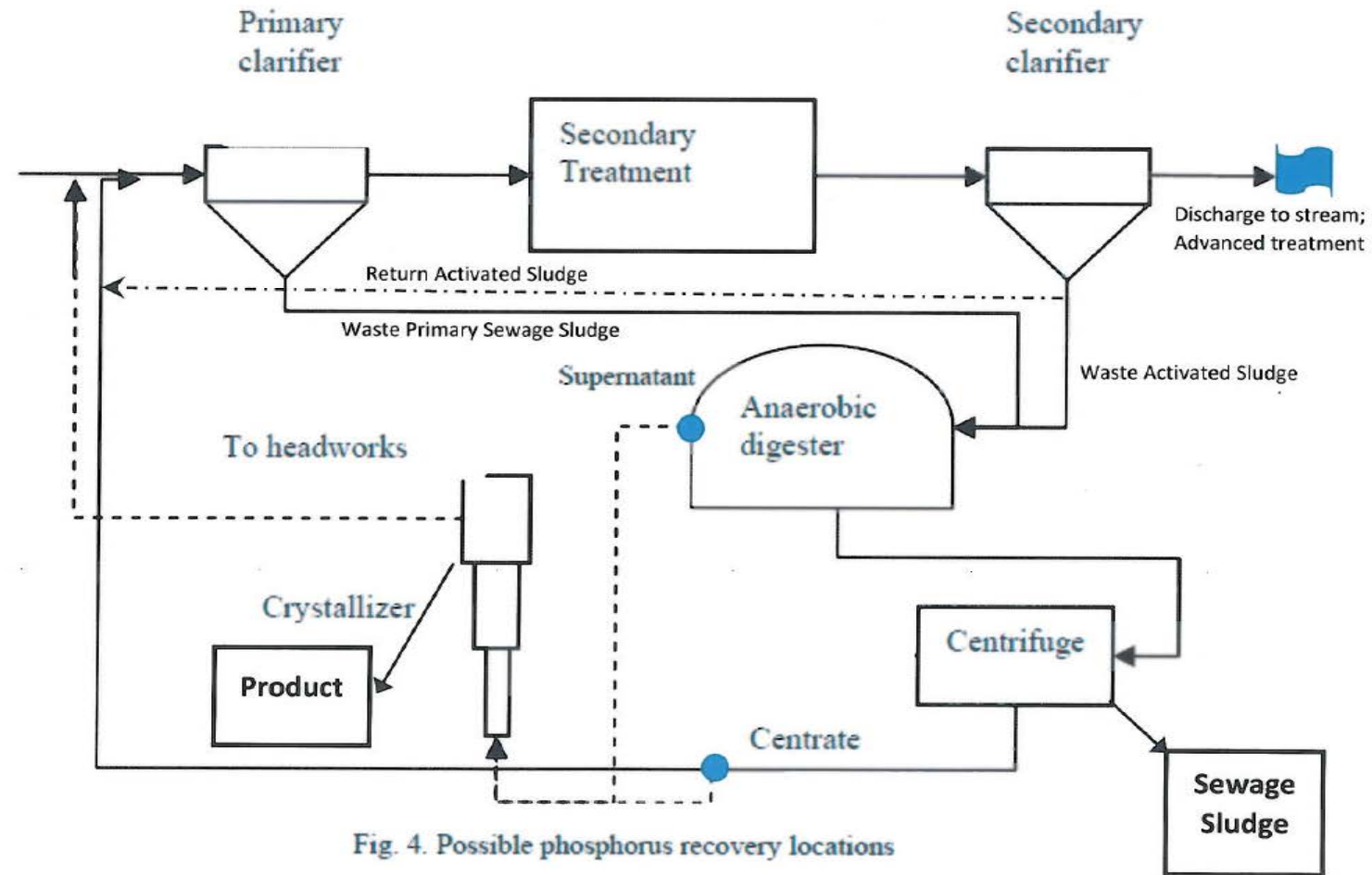


Fig. 4. Possible phosphorus recovery locations

★ Flow diagram modified from K. Fattah. 2012. *Assessing Struvite Formation Potential at Wastewater Treatment Plants*, showing relevant treatment processes and possible / likely phosphorous recovery locations ●

STRUVITE (CONTINUED)


Historically, products produced from sewage sludge meet EPA's Part 503 regulations

Consider struvite derived from sewage sludge

- ▶ Raw wastewater / sewage sludge is the starting material
- ▶ The liquid sidestreams resulting from treatment of sewage sludge is the source of struvite

Legally, there may be more than one possible interpretation of the sludge definition, with respect to struvite

TMDLs- Impacts to Biosolids Program?

- ▶ If water body is impaired
 - ▶ Total Maximum Daily Load developed for the pollutant causing impairment
 - ▶ Covers point and nonpoint sources
 - ▶ If impaired because of excessive nutrients (Phosphorus, Nitrogen)
 - ▶ Could require fields to be taken out of production
 - ▶ Could limit type of fertilizer application
 - ▶ TMDLs are usually not that specific related to biosolids
- 

THE IMPORTANCE OF CLARITY

