Managing Wastewater Facilities Under Conflicting Regulatory Objectives

Kathryn Gies, P.E.

May 22, 2024

WEST YOST
Water. Engineered.

POTWs are Facing Pressures from All Directions

New Regulations

Efficient Operations

Aging Infrastructure

Aging Workforce

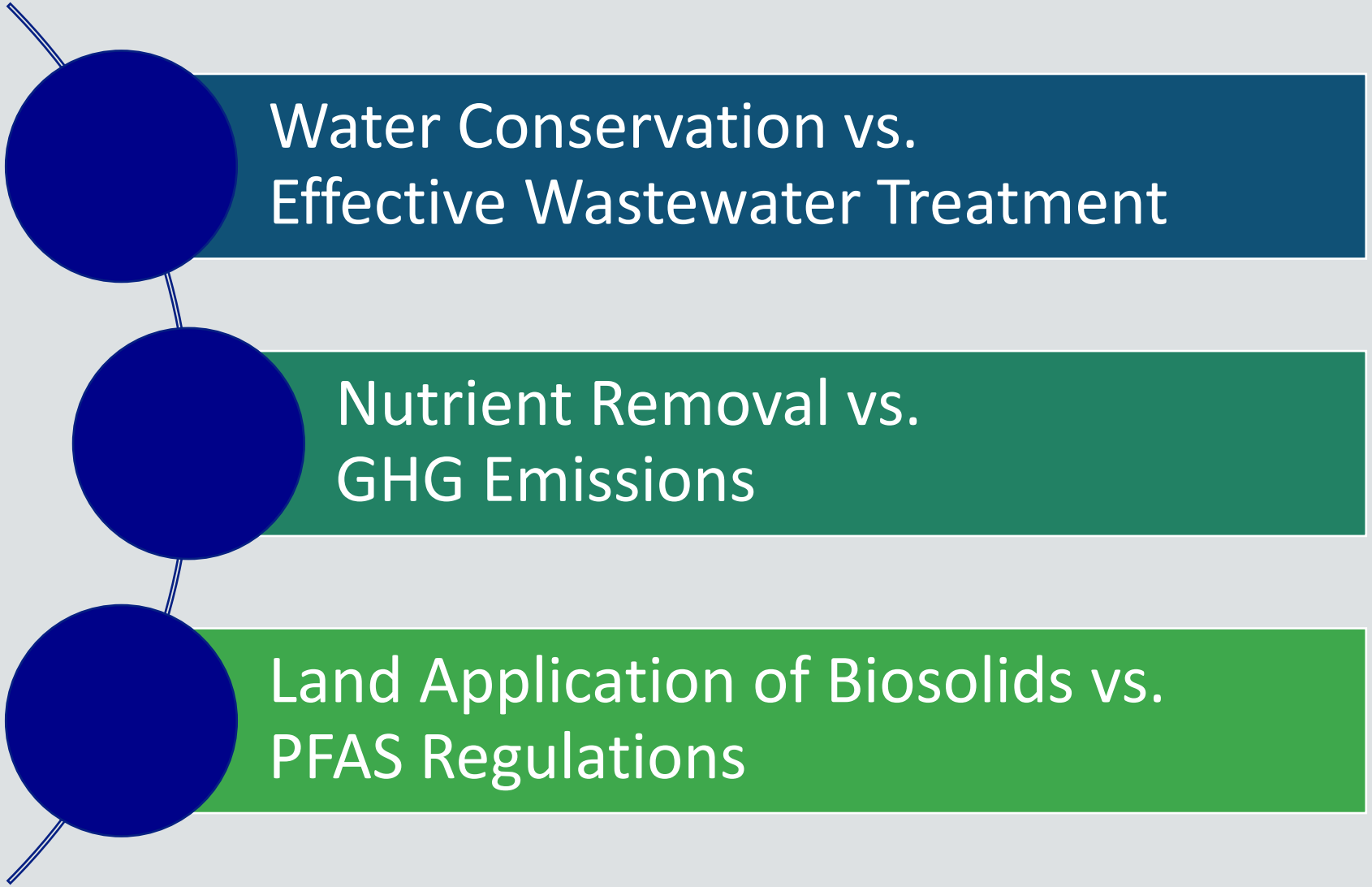
POTWs are Facing Pressures from All Directions

~~New~~ Conflicting Regulations

Efficient Operations

Aging Infrastructure

Aging Workforce


Water Conservation vs.
Effective Wastewater Treatment
Nutrient Removal vs.
GHG Emissions
Land Application of Biosolids vs.
PFAS Regulations

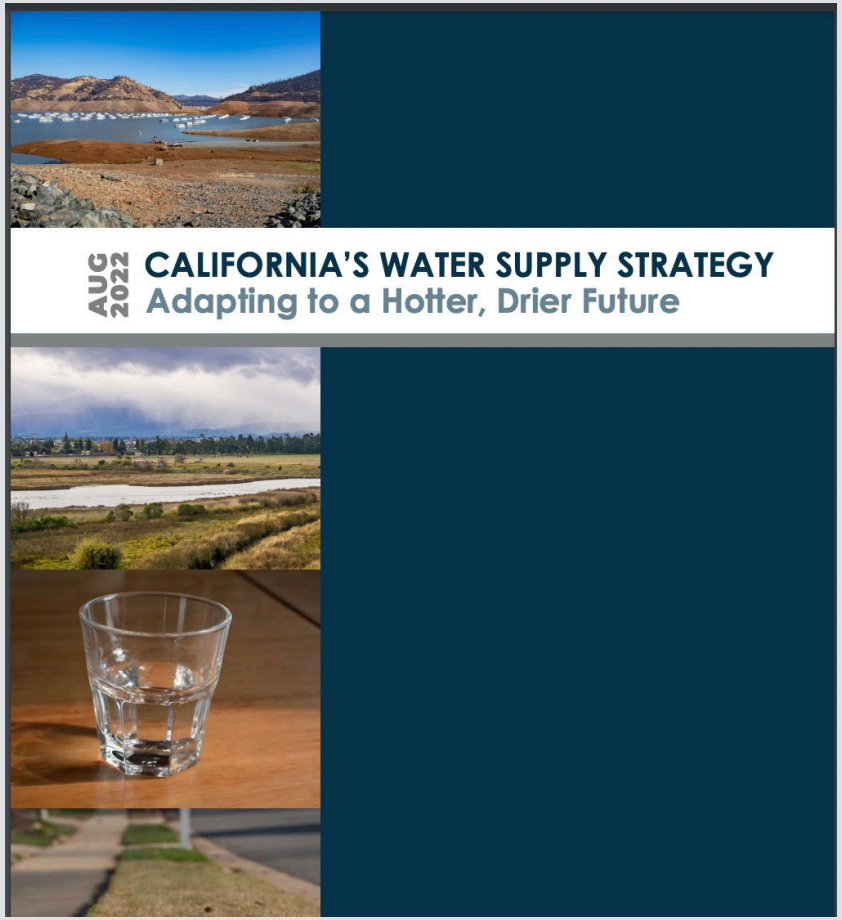
Water Conservation vs. Effective Wastewater Treatment

Nutrient Removal vs. GHG Emissions

Land Application of Biosolids vs. PFAS Regulations

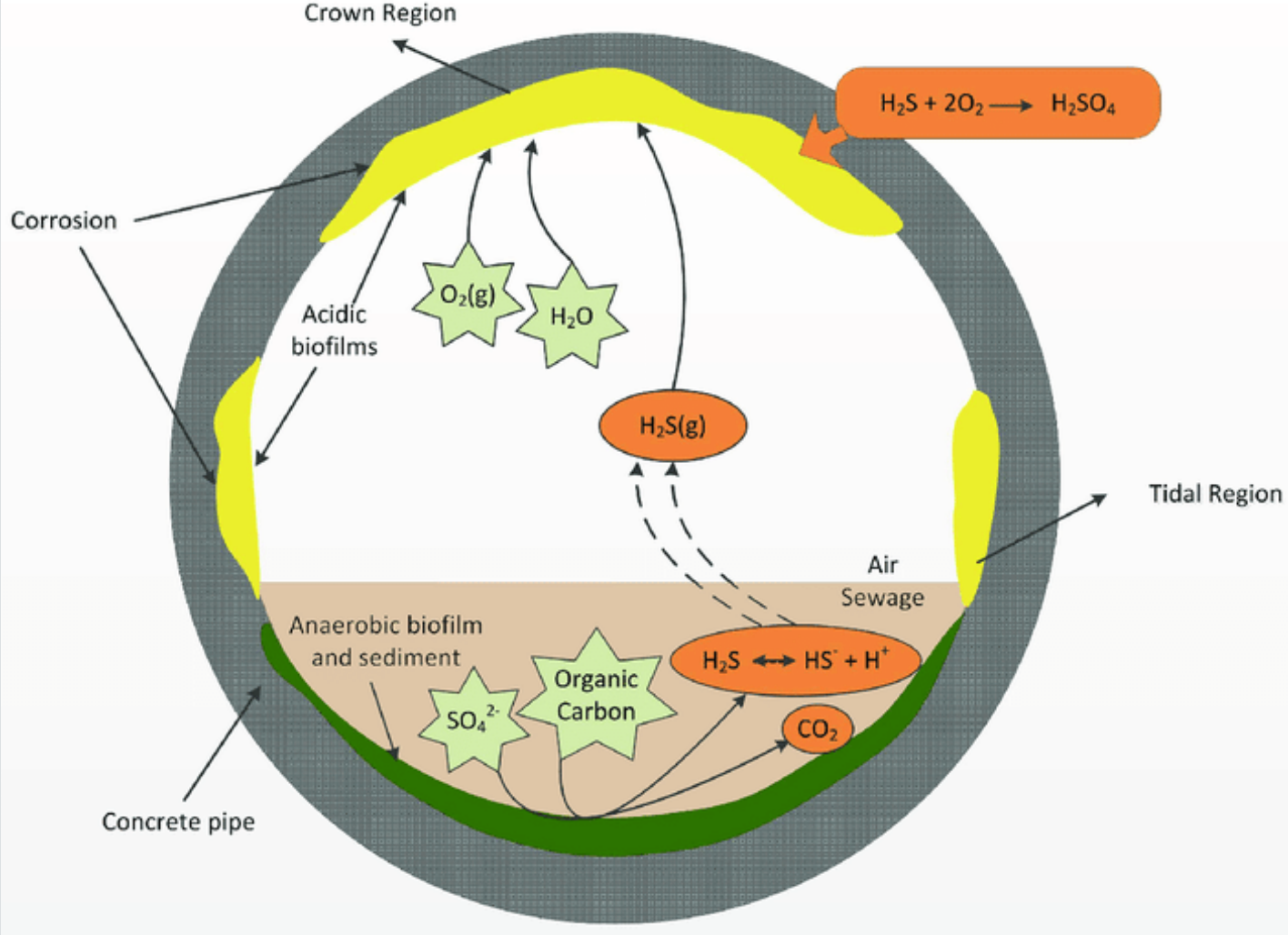
Impacts of Mandatory Water Use Efficiency Measures

- Wastewater flows in California have generally declined 20 to 30 percent over the past 10 to 15 years
- Flows are expected to decline another 20 to 40 percent over the coming 10 to 20 years
- These continuing water use efficiency standards are challenging infrastructure integrity



Collection Systems Impacts

- Reduced flow rates result increased sulfide generation: odors, toxicity and corrosion
- Pumps may be oversized, resulting in increased cycling
- New SSMP strategies, design approaches, and technologies are needed



Treatment Plant Impacts

- Increased odor generation
- Increased energy demand due to more soluble carbon and ammonia entering the plant
- Nitrogen removal failures and breakthrough
- Increased salinity (CV-SALTS connection)
- Recycled water demands can’t be met

Permitting Considerations

- Permitted discharge capacity and treatment plant capacity do not match up for most plants
- Realignment can help eliminate confusion and erroneous assumptions regarding expansion needs
- Realignment of treatment capacity with does not mean giving up disposal capacity – discharge capacities are justified through antidegradation studies
- Provisions are applied to maintain disposal capacity once treatment capacity is increased

Parameter of Interest	Value
Permitted Discharge Capacity	Design Average Dry Weather Flow
Treatment Capacity	Design BOD and Ammonia Loads
Current Conditions	• Flows much lower than design values • Loads at or above design values

Strategies

- Understand the true facility capacities and limitations (do not only consider flow)
- Identify low flow areas in the collection systems that are susceptible to increased corrosion
  - Modeling and monitoring data is helpful
  - Consider enhanced control strategies that do not just suppress SO2, but instead change the reducing conditions
- Become aware of plant impacts due to low flows and look for mitigation strategies upstream in the collection system

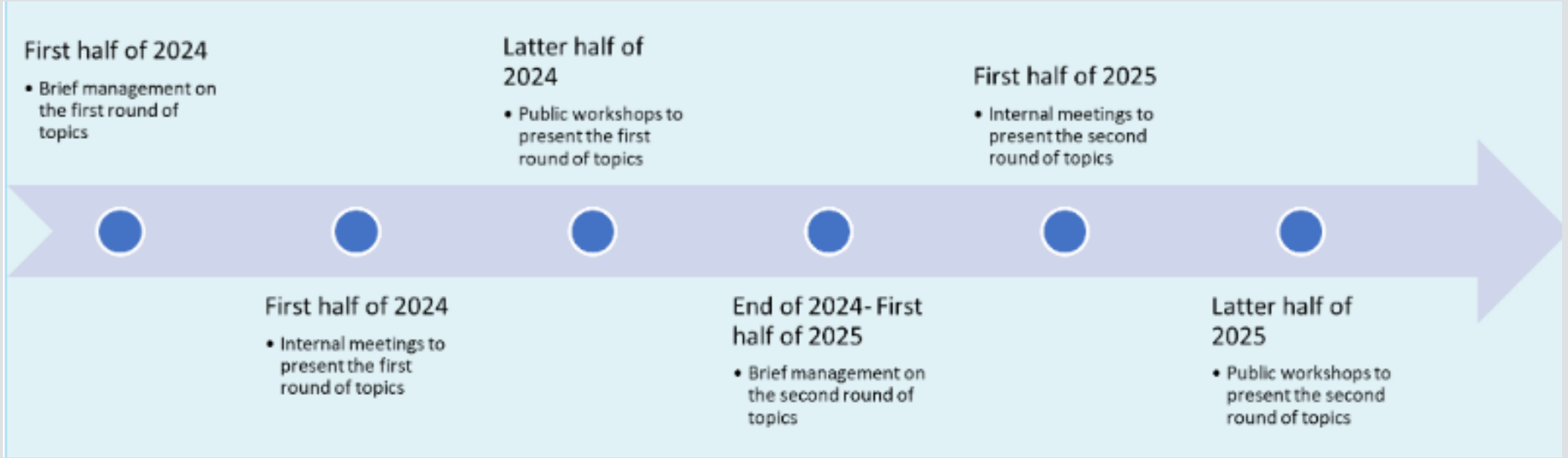
Water Conservation vs.
Effective Wastewater Treatment

**Nutrient Removal vs.
GHG Emissions**

Land Application of Biosolids vs.
PFAS Regulations

Emerging Regulatory Issue: Nutrients in Inland Waterways

The SWB is working to develop a statewide policy for water quality control to reduce nutrient impacts, biostimulation, and harmful algal blooms in surface waters.



Energy Impacts of Nutrient Removal

Level	Effluent N, mg/L	Effluent P, mg/L	Notes
1	None Specified		Typical secondary
2	8	1	
3	4-8	0.1-0.3	
4	3	0.1	
5	<2	<0.2	RO

Electricity per unit of total N and P equivalents removed remains relatively consistent from Level 2 through Level 4 but was 2-3 times higher for Level 5 configurations

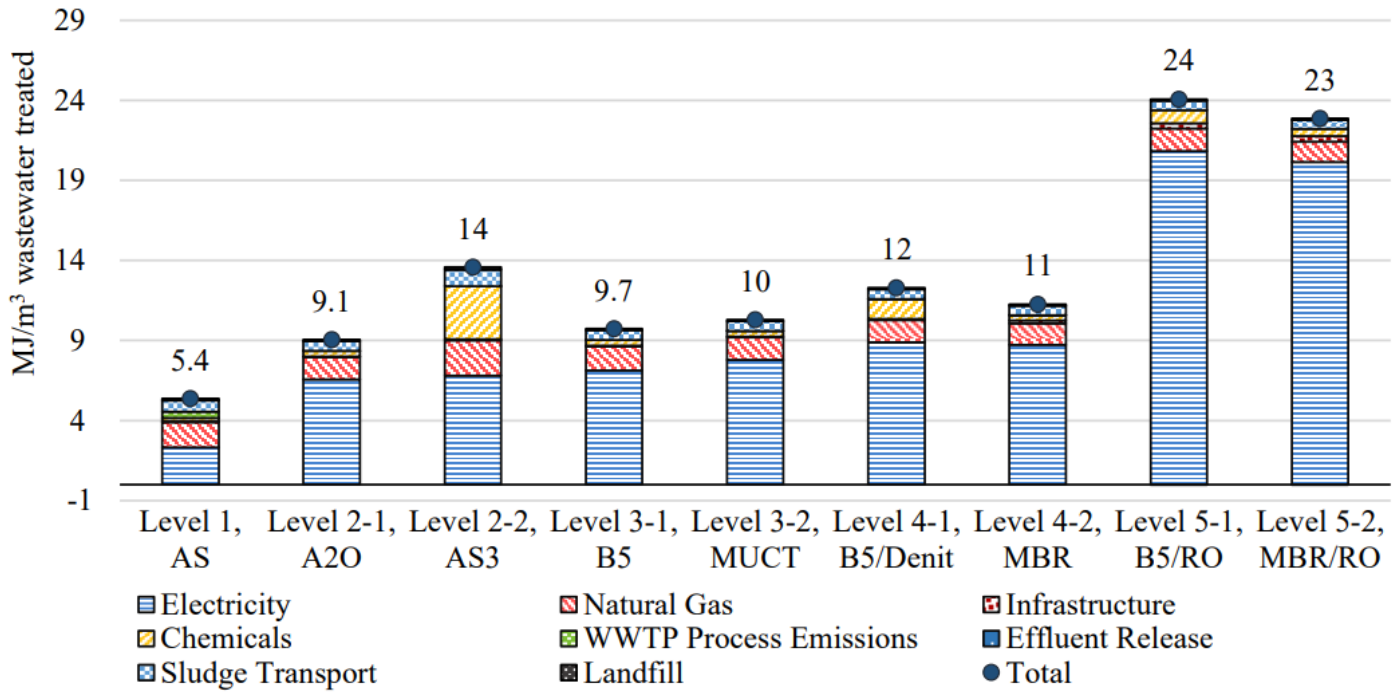


Figure 6-4. Cumulative Energy Demand Results by Process Contribution

Life Cycle and Cost Assessments of Nutrient Removal Technologies in Wastewater Treatment Plants, EPA 2021

Emerging Emissions Requirements

- CARB is taking a first step to possible regulation of emissions from WWTPs
- Starting in 2024, WWTPs will need to determine which air toxics are released and must continue to be monitored and reported beginning with calendar year 2028
- CASA is organizing a statewide study

Global Warming Potential (GWP)

- GWP increases are due both to the increasing energy demand as well as the increased production of process GHG emissions.
- Advanced biological treatment units contain a combination of aerobic, anoxic, and anaerobic stages, in which both CH4 and N2O emissions may be generated and emitted.

Level	Effluent N, mg/L	Effluent P, mg/L	Notes
1	None Specified		Typical secondary
2	8	1	
3	4-8	0.1-0.3	
4	3	0.1	
5	<2	<0.2	RO

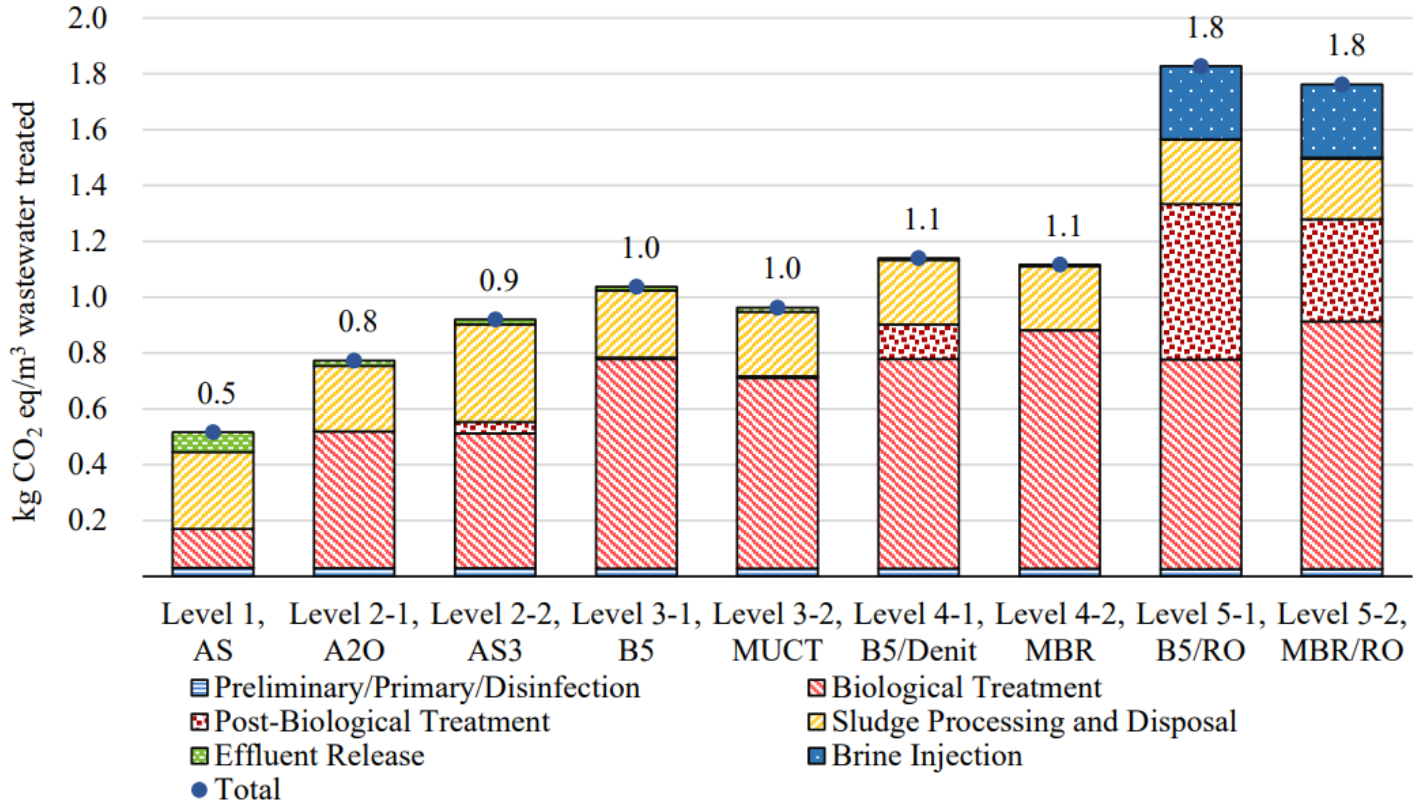
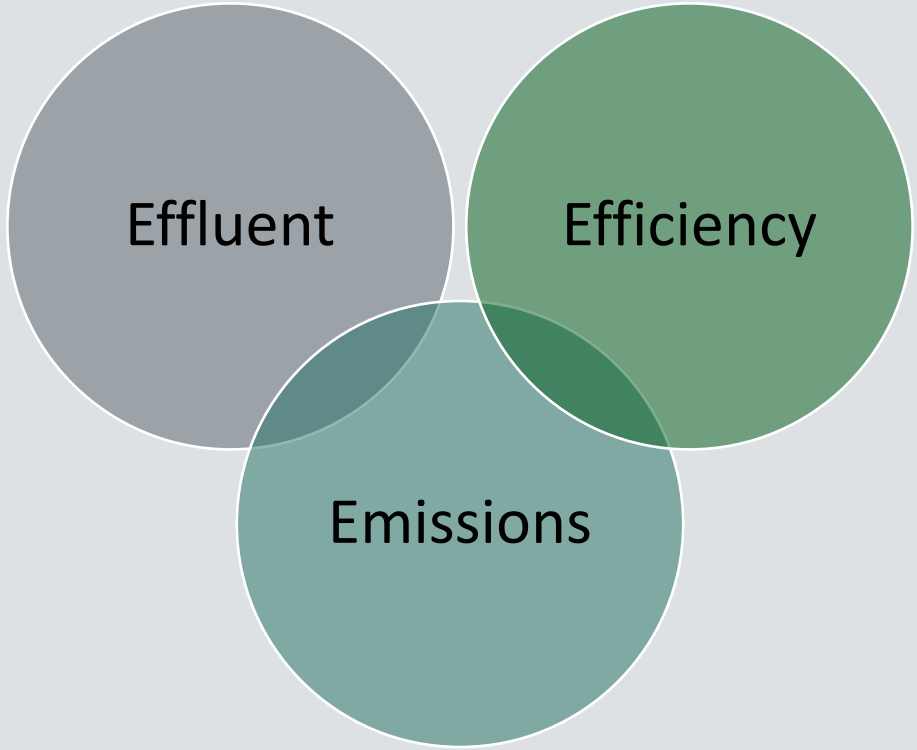


Figure 6-5. Global Warming Potential Results by Treatment Group

Life Cycle and Cost Assessments of Nutrient Removal Technologies in Wastewater Treatment Plants, EPA 2021

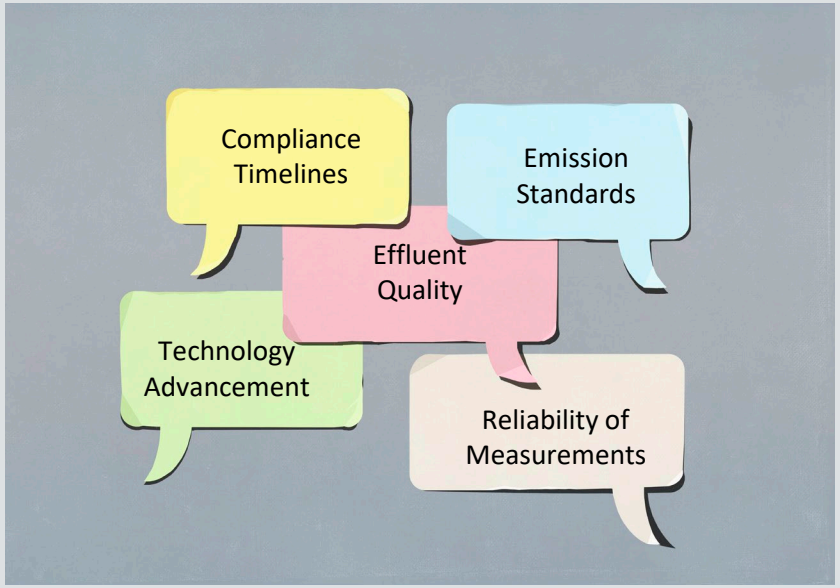
Emerging Area of Investigation

- Quantification methods for overall N2O emissions and pathway contributions need improvement.
- Analysis is required to quantify and compare the benefits of N2O control strategies.
- More long-term full-scale trials of N2O mitigation are needed to enable robust assessments of the resulting operational costs and impact on nutrient removal performance.



Strategy

- Regulators need help to understand impacts of increased nutrient removal requirements and weigh against benefits
- Emerging understanding of causes and mitigations for N2O emissions could result in different decisions regarding nitrogen control strategies
- Agencies need time to allow the science to catch up



Communication is key to developing a common understanding and a logical path forward

Water Conservation vs.
Effective Wastewater Treatment

Nutrient Removal vs.
GHG Emissions

Land Application of Biosolids vs. PFAS Regulations

SB1383 Organics Diversion Regulation

Final Regulations Adopted — **January 2020**

Regulations Effective — **2022**

Regulations Enforceable — **2024**

- Reduces GHG emissions by diverting organic waste from landfills
- Statewide target of 75% diversion by 2025 (2014 base)
- Biosolids included in organic waste definition if they are anaerobically digested and land applied

Benefits of Biosolids Land Application

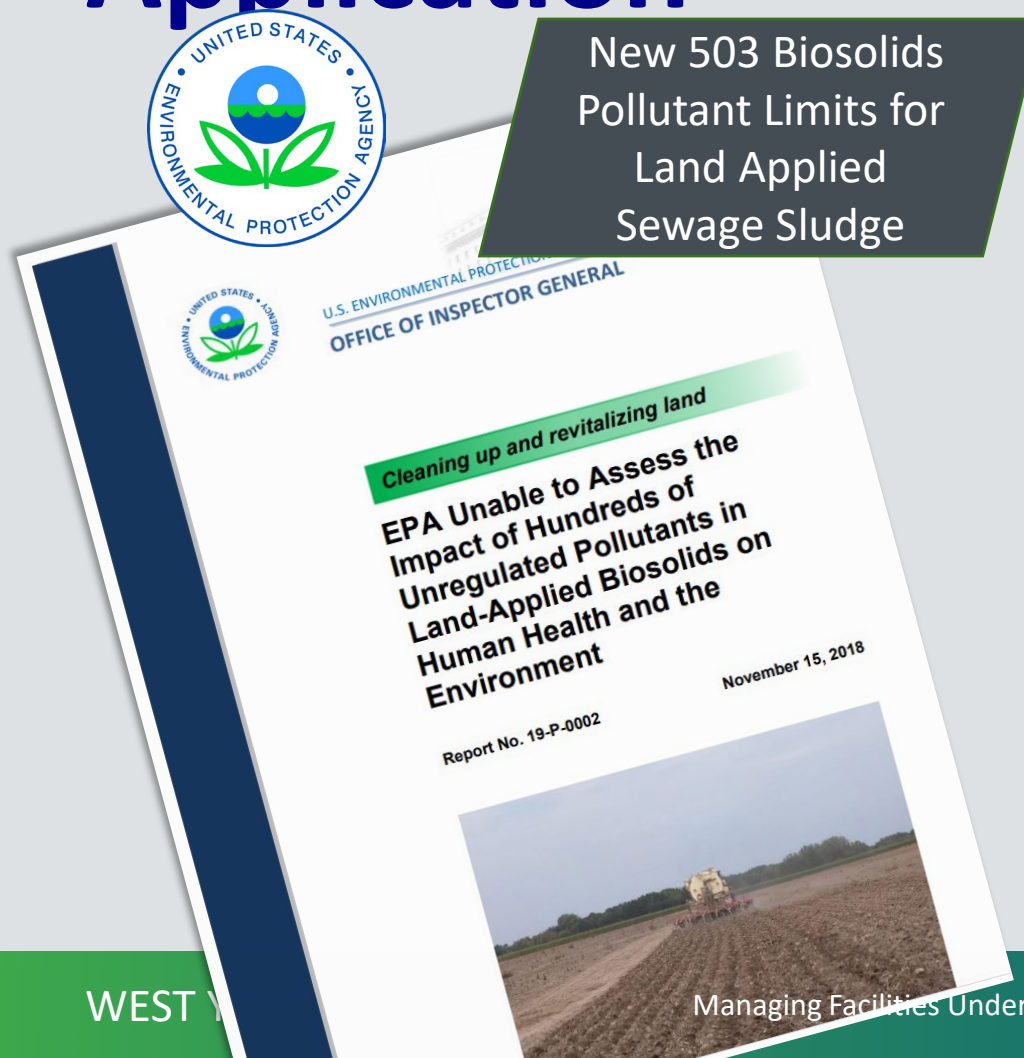
- Increased soil fertility and crop yield
- Slow release Nitrogen
- Increased water retention capacity
- Increased resistance to plant diseases
- Nitrogen, Phosphorous, and Potassium (NPK)
- Micronutrients and trace elements

Recycled Water and Class B Biosolids Reuse Nexus

- Recycled water serves as a water supply
- Fodder crops grown, does not require advanced treated water
- Must consider nitrogen loading from recycled water
- Land is leased to third party for operations (except semi-annual biosolids application)
- Farmers get: Free water and nutrients
- Agencies get: Low cost biosolids disposal, revenue from farming operations

Possible Pathways for PFAS-Related Restrictions on Biosolids Land Application

New 503 Biosolids Pollutant Limits for Land Applied Sewage Sludge



Potential impact depends on what standard is set:

- Ceiling Limits
- Cumulative Load Limits
- Annual Load Limits

Could limit or preclude land application

New 503 Regulations Require a Better Understanding of Biosolids Land Application Contaminants Exposure Pathways

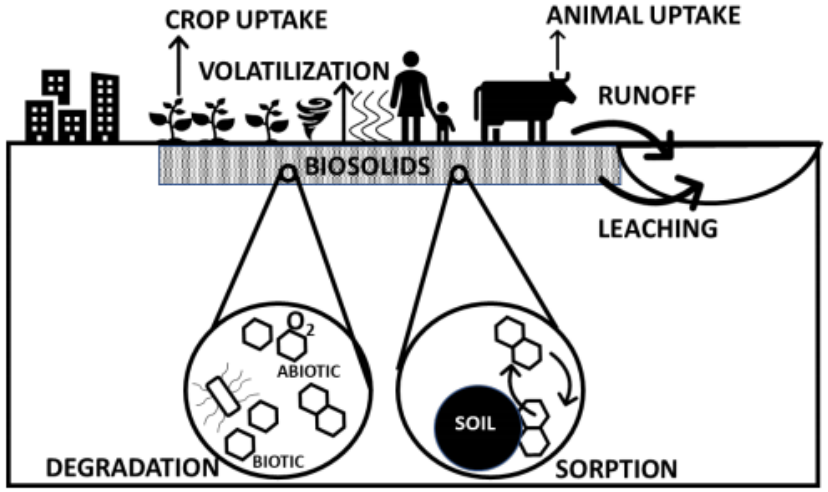


Fig. 1. Environmental fate and transport pathway for chemicals in biosolids.

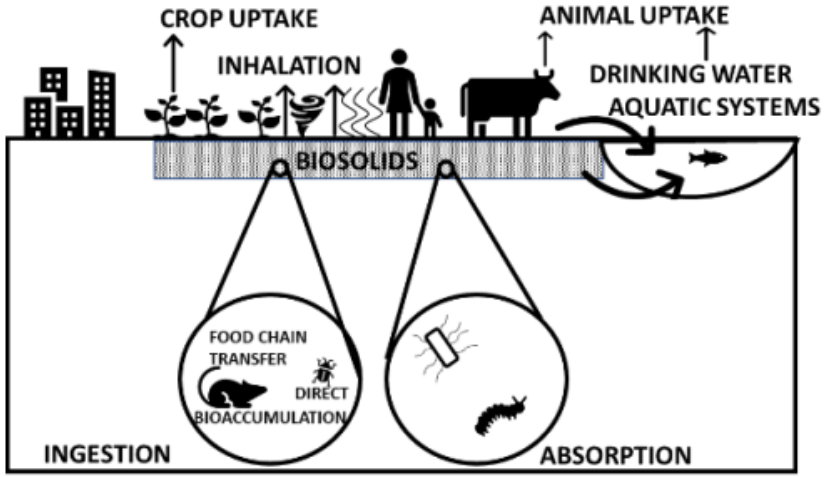


Fig. 2. Human and ecological exposure pathways for chemicals in biosolids.

Possible PFAS Regulation Pathways for Biosolids Land Application

New 503 Biosolids Pollutant Limits for Land Applied Sewage Sludge

Potential impact depends on what standard is set:

- Ceiling Limits
- Cumulative Load Limits
- Annual Load Limits

Could limit or preclude land application

Possible PFAS Regulation Pathways for Biosolids Land Application

New 503 Biosolids Pollutant Limits for Land Applied Sewage Sludge

→ Potential impact depends on what standard is set:
- Ceiling Limits
- Cumulative Load Limits
- Annual Load Limits

Could limit or preclude land application

New Drinking Water Standards

→ Potential impact depends on movement of PFAS/PFOA contaminants to groundwater.
Could limit application in areas with shallow groundwater

Possible PFAS Regulation Pathways for Biosolids Land Application

New 503 Biosolids Pollutant Limits for Land Applied Sewage Sludge	Potential impact depends on what standard is set: • Ceiling Limits • Cumulative Load Limits • Annual Load Limits Could limit or preclude land application
New Drinking Water Standards	Potential impact depends on movement of PFAS/PFOA contaminants to groundwater. Could limit application in areas with shallow groundwater
New Hazardous Waste Level	Potential impact depends on what limits are established but could result in total ban on biosolids to land *and landfills*

Possible PFAS Regulation Pathways for Biosolids Land Application

New 503 Biosolids Pollutant Limits for Land Applied Sewage Sludge →

Potential impact depends on what standard is set:
- Ceiling Limits
- Cumulative Load Limits
- Annual Load Limits

Could limit or preclude land application

New Drinking Water Standards →

Potential impact depends on movement of PFAS/PFOA contaminants to groundwater.
Could limit application in areas with shallow groundwater

New Hazardous Waste Level →

Potential impact depends on what limits are established but could result in total ban on biosolids to land *and landfills*

Public Perception →

Could lead to effective bans on land application through local agencies/agency decisions

Possible PFAS Regulation Pathways for Biosolids Land Application

New 503 Biosolids Pollutant Limits for Land Applied Sewage Sludge	2-3 Years Out
New Drinking Water Standards	Regulations Adopted: wait and see!
New Hazardous Waste Level	Initial information released indicates hazardous levels will be much higher than typical biosolids levels
Public Perception	*Biggest unknown and limited control*

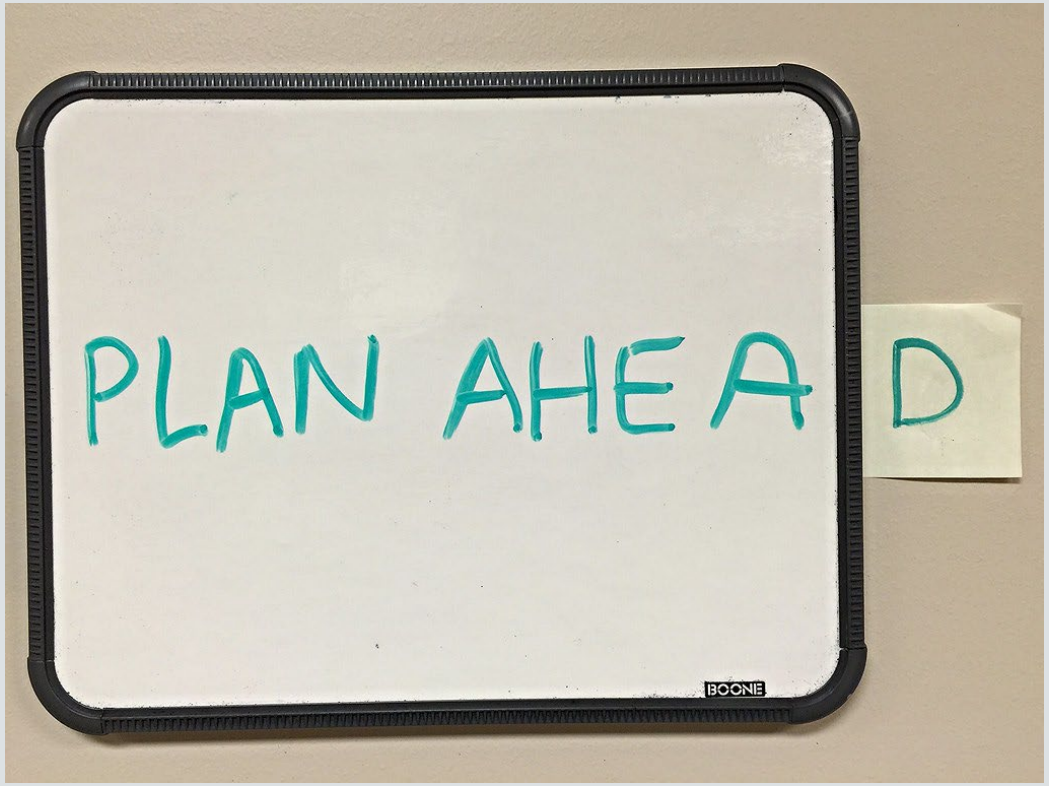
Strategies

Keep abreast of emerging regulations

- Drinking Water MCLs
- SB 1383 (organics diversion)
- 503 Regulations
- Hazardous Waste Regulations

Keep abreast of emerging technologies

Consider need for potential increased biosolids management costs



THANK YOU

WESTYOST.COM