U.S. EPA Biosolids Program

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BIOSOLIDS PROGRAM
HEALTH AND ECOLOGICAL CRITERIA DIVISION
OFFICE OF SCIENCE AND TECHNOLOGY | OFFICE OF WATER

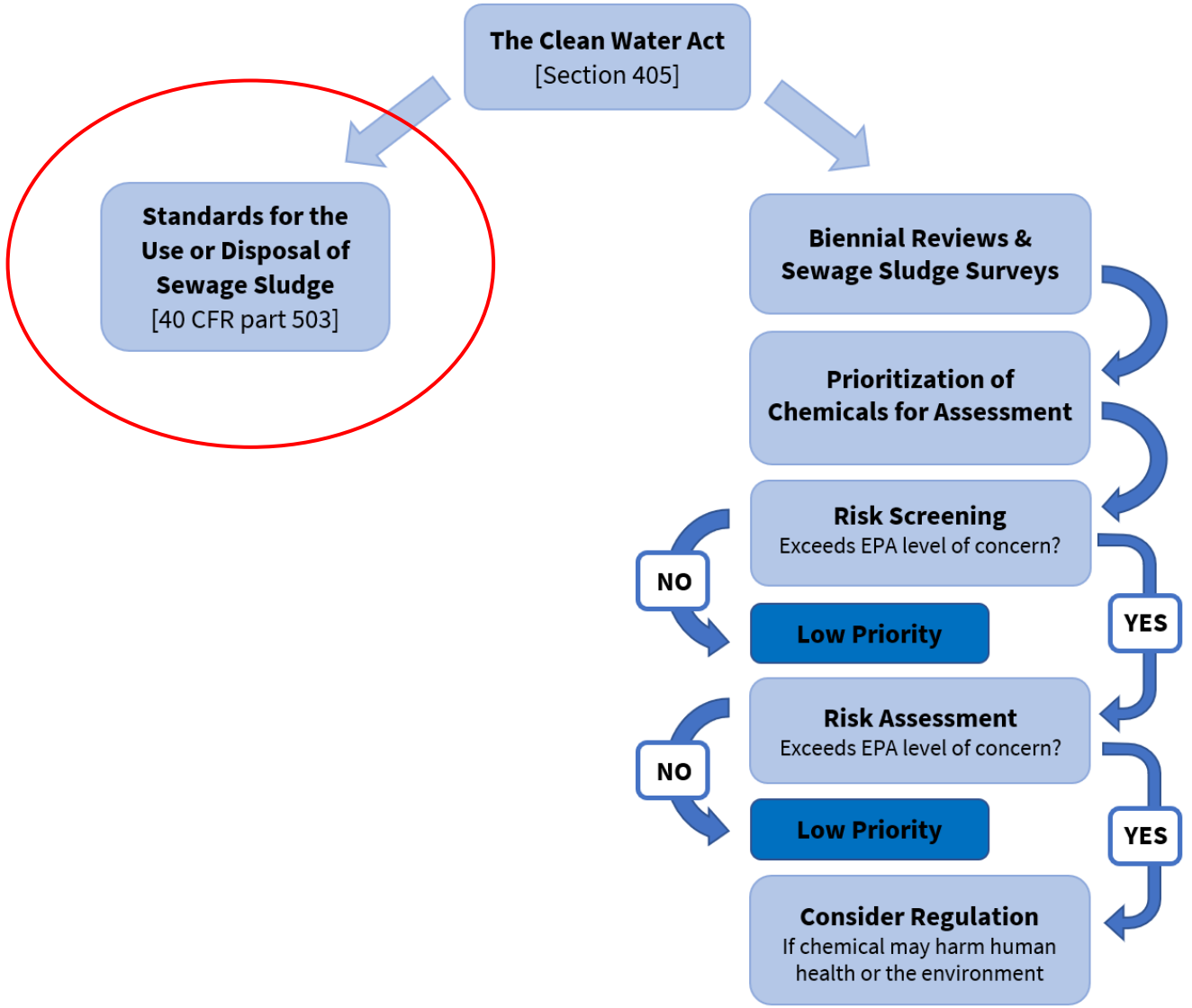
Disclaimer

The views expressed in this presentation are those of the author and do not necessarily represent the views or policies of the U.S. Environmental Protection Agency.

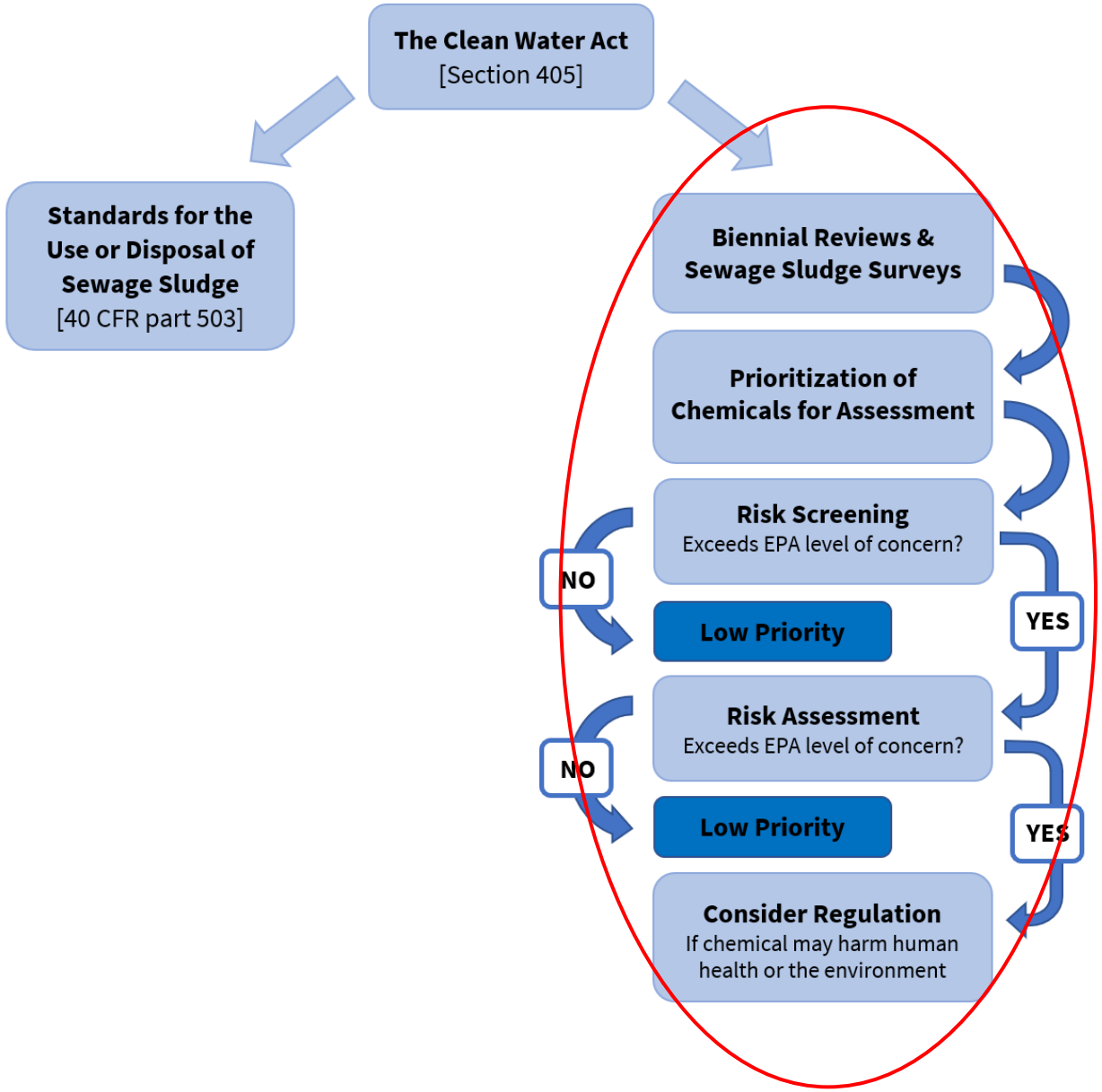
Outline

1) Part 503
2) Assessing risk from pollutants found in biosolids
    1) Science Advisory Board
    2) PFOA & PFOS Risk Assessment
3) Biosolids Annual Reporting – Using a Third Party to Manage Biosolids
4) Stakeholder Engagement
5) Research

40 CFR Part 503 – Standards for the Use or Disposal of Sewage Sludge


The Clean Water Act
[Section 405]
Standards for the Use or Disposal of Sewage Sludge
[40 CFR part 503]
Biennial Reviews & Sewage Sludge Surveys
Prioritization of Chemicals for Assessment
Risk Screening
Exceeds EPA level of concern?
NO
Low Priority
YES
Risk Assessment
Exceeds EPA level of concern?
NO
Low Priority
YES
Consider Regulation
If chemical may harm human health or the environment

Assessing Risk from Pollutants Found in Biosolids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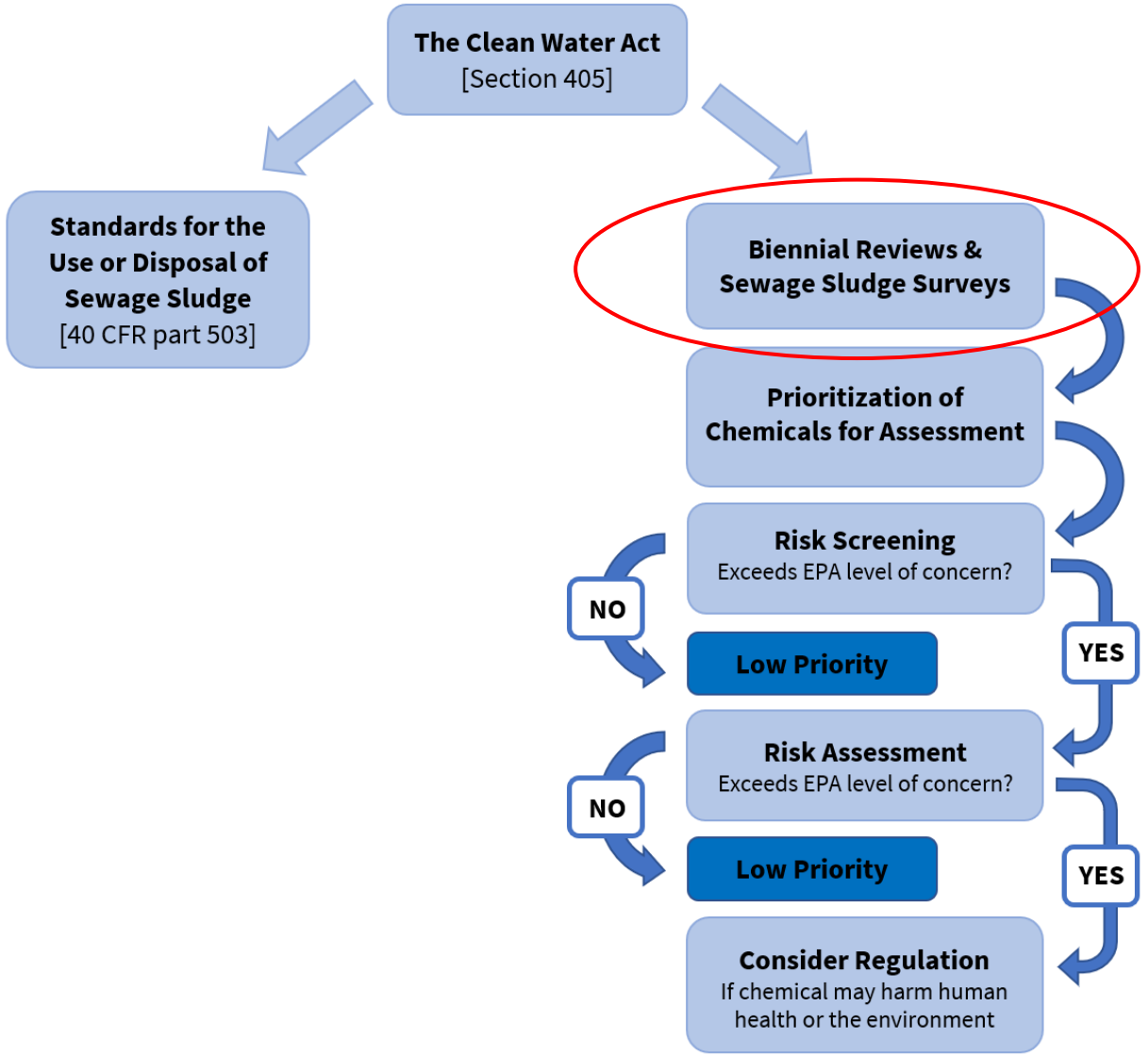
What is Risk Assessment?

Risk assessment is a scientific process. In general terms, risk depends on the following three factors:

1) **How much of a stressor is present** in an environmental medium (e.g., soil, water, air) over what geographic area,
2) **How much contact (exposure)** a person or ecological receptor has with the contaminated environmental medium, and
3) **How it affects** the health of humans or ecological receptors (i.e. toxicity).

Source: EPA Website: Risk Assessment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Biennial Reviews & Sewage Sludge Surveys

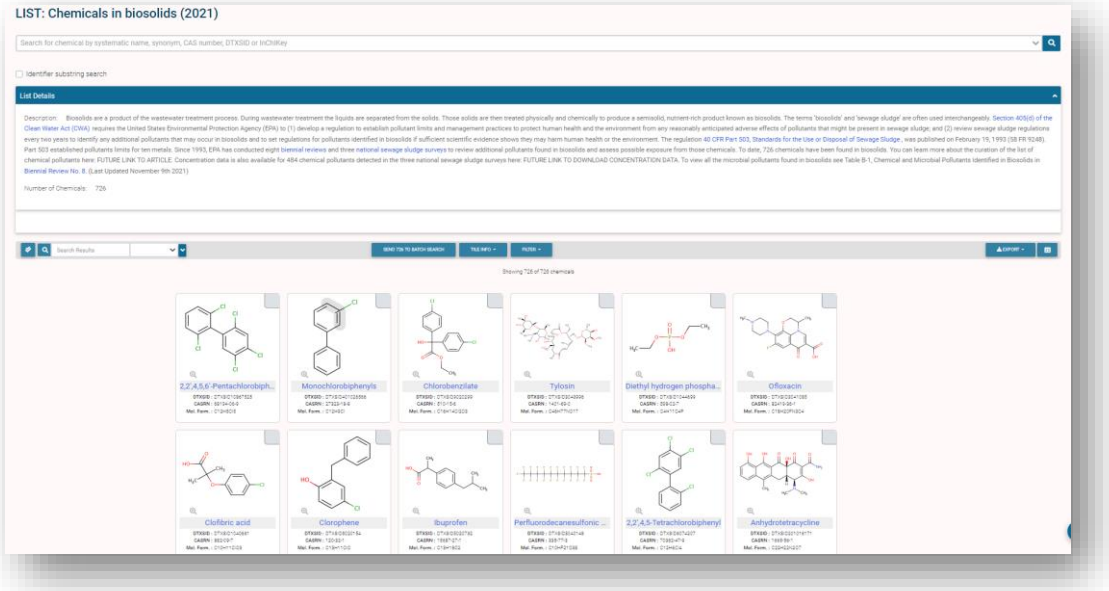
Biennial Reports
BR No.1 (2004-2005)
BR No.2 (2006-2007)
BR No.3 (2008-2009)
BR No.4 (2010-2011)
BR No.5 (2012-2013)
BR No.6 (2014-2015)
BR No.7 (2016-2017)
BR No.8 (2018-2019)
BR No.9 (2020-2021)

Sewage Sludge Surveys
1988 National Sewage Sludge Survey
2001 National Sewage Sludge Survey
2006 Targeted National Sewage Sludge Survey

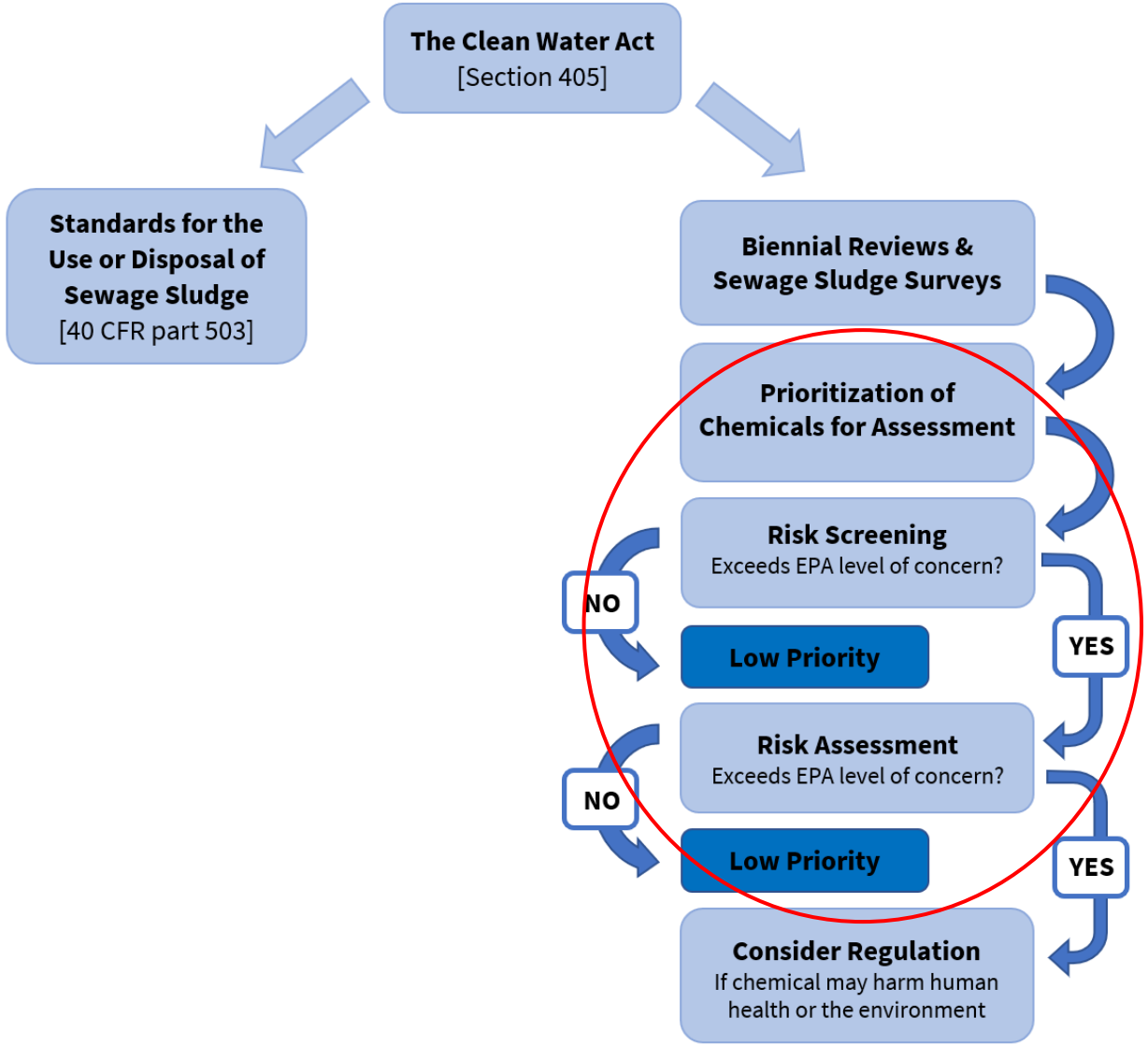
- Initiated planning for the next national sewage sludge survey

Biosolids List on EPA's CompTox Chemicals Dashboard

- Link: https://comptox.epa.gov/dashboard/chemical-lists/BIOSOLIDS



- Richman, T., Arnold, E. & Williams, A.J. Curation of a list of chemicals in biosolids from EPA National Sewage Sludge Surveys & Biennial Review Reports. *Sci Data* **9**, 180 (2022). https://doi.org/10.1038/s41597-022-01267-9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Science Advisory Board

Risk Assessment Framework

EPA is proposing a three-step approach to biosolids risk assessment:

- Step 1: Prioritization using the Public Information Curation and Synthesis (PICS) Approach
- Step 2: Screening-level Model
- Step 3: Framework for Refined Risk Assessment including Probabilistic Modeling

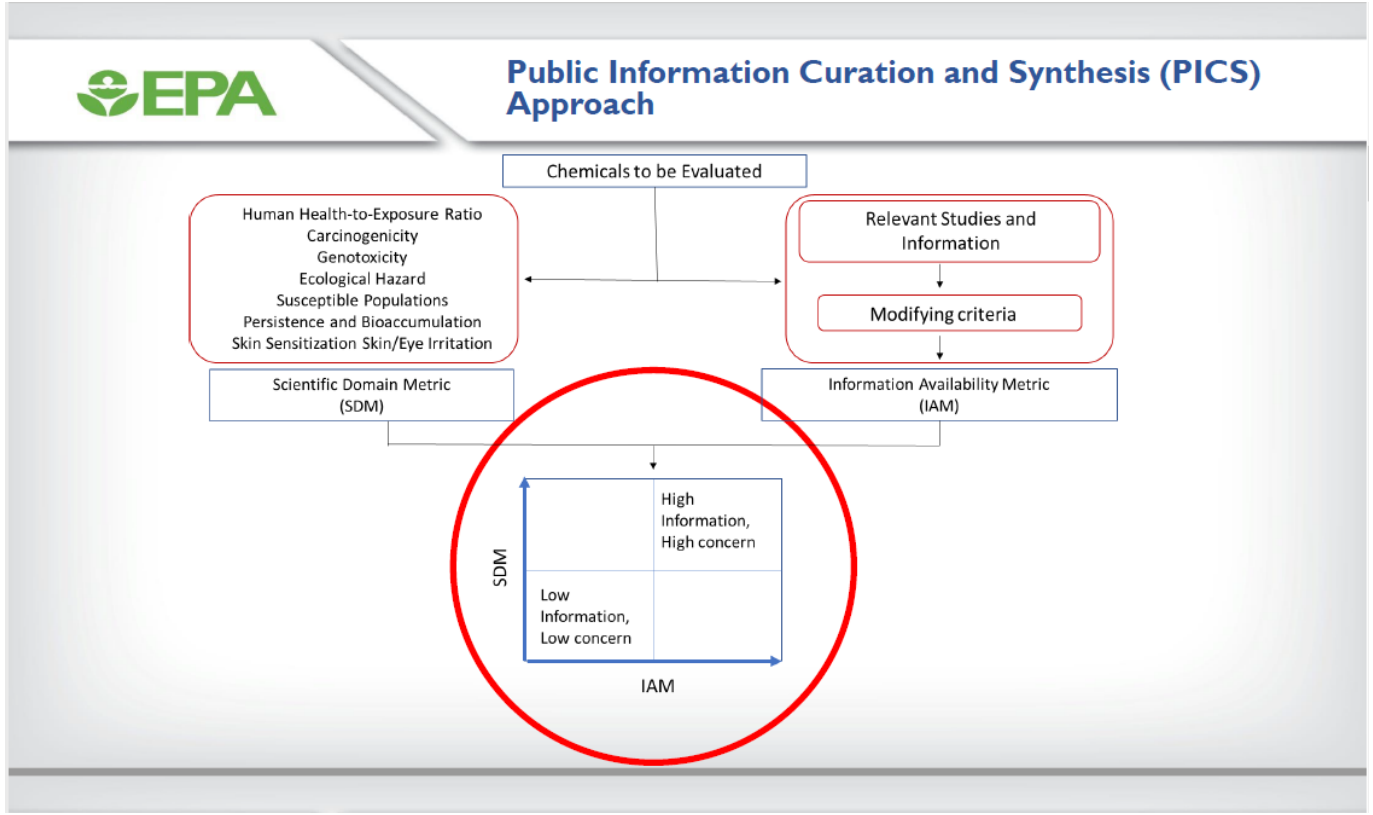
Science Advisory Board - "Approach to Biosolids Chemical Risk Assessment and Biosolids Screening Tool"

Link: https://sab.epa.gov/ords/sab/f?p=100:18:7435319323204:::RP,18:P18_ID:2610

Risk Assessment Framework: Prioritization

Link: EPA National Biosolids Meeting Summary 2021 (pdf)

Link: EPA National Biosolids Meeting 2021 (Session 3): EPA's Preliminary Biosolids Risk Assessment Approach – Biosolids Pollutant Prioritization

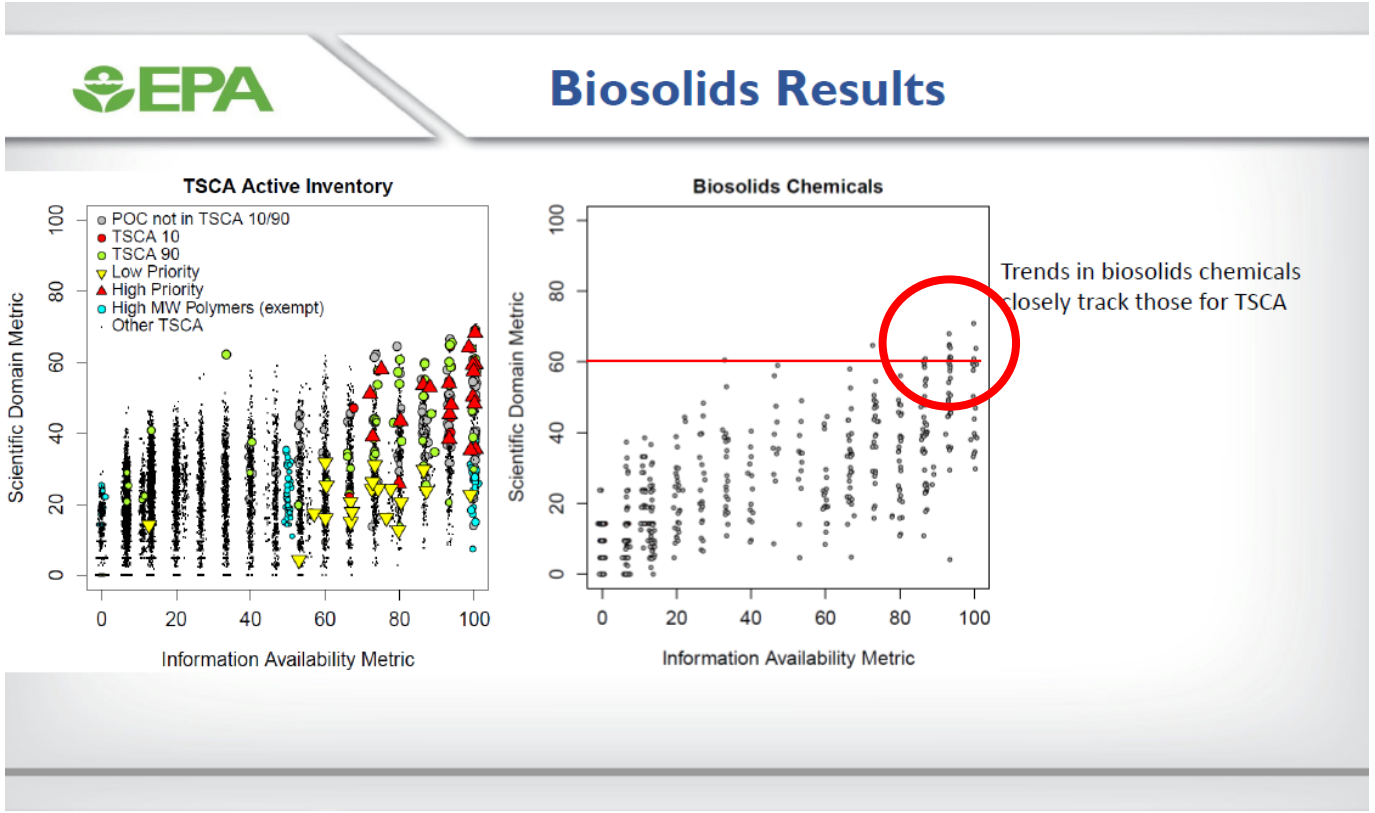


Source: EPA National Biosolids Meeting 2021 (Session 3): EPA's Preliminary Biosolids Risk Assessment Approach – Biosolids Pollutant Prioritization, Dr. Richard Judson. November 2, 2022.

Risk Assessment Framework: Prioritization (cont.)

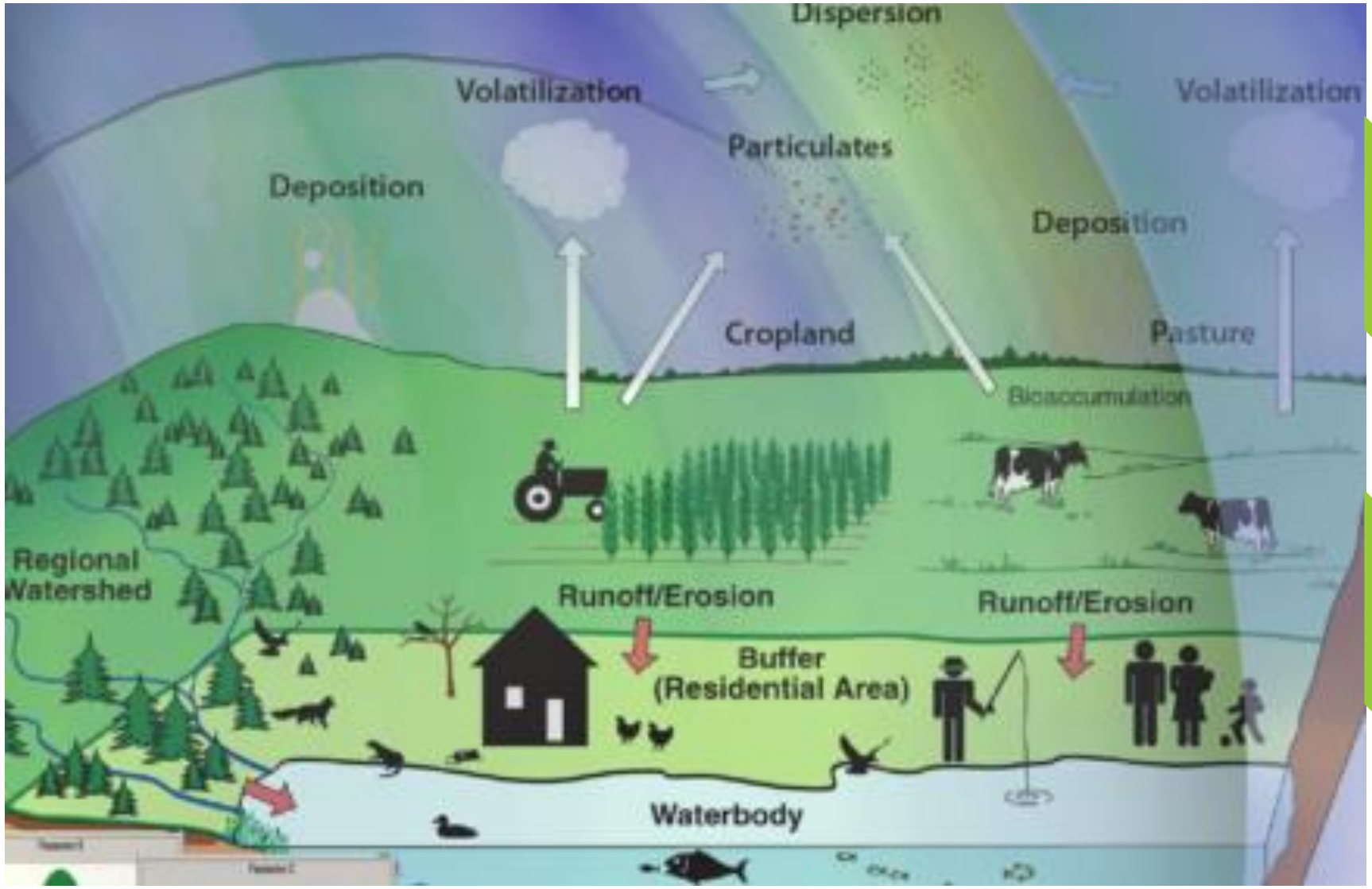
Link: EPA National Biosolids Meeting Summary 2021 (pdf)

Link: EPA National Biosolids Meeting 2021 (Session 3): EPA's Preliminary Biosolids Risk Assessment Approach – Biosolids Pollutant Prioritization



Source: EPA National Biosolids Meeting 2021 (Session 3): EPA's Preliminary Biosolids Risk Assessment Approach – Biosolids Pollutant Prioritization, Dr. Richard Judson. November 2, 2022.

Biosolids – Conceptual Model



Human Health risk

- Inhalation
- Drinking water
- Diet
- Soil ingestion

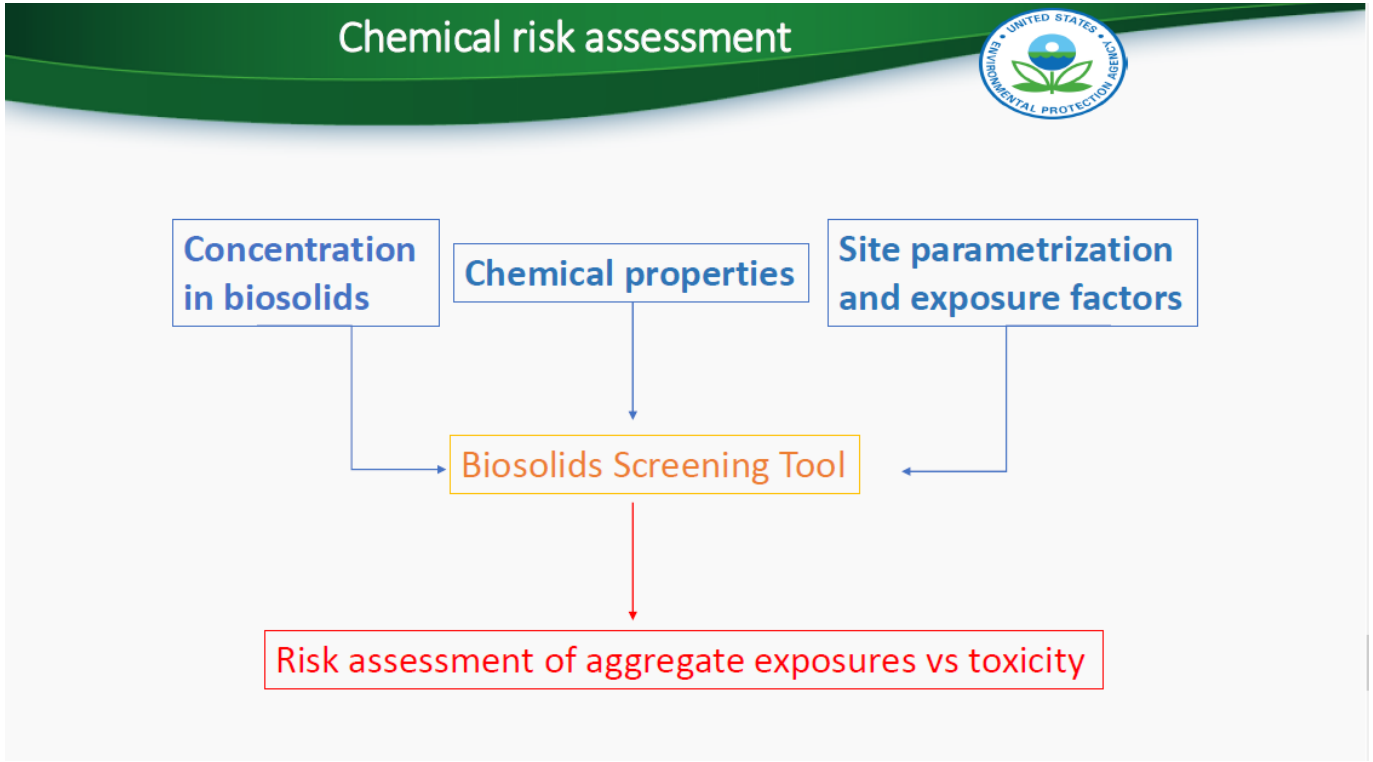
Ecological risk

- Water
- Soil
- Terrestrial

Risk Assessment Framework: Screening-level Model

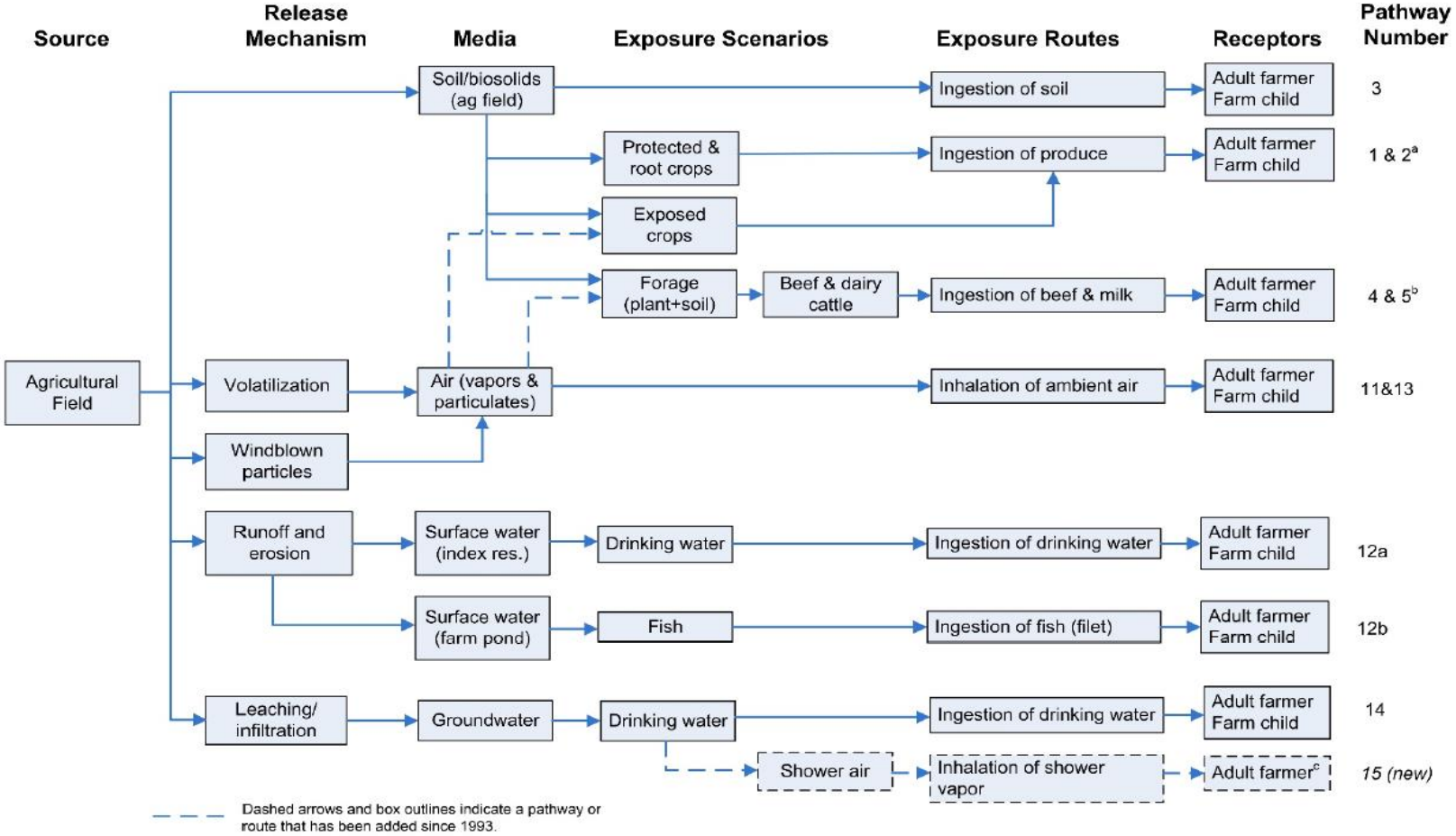
Link: EPA National Biosolids Meeting Summary 2021 (pdf)

Link: EPA National Biosolids Meeting 2021 (Session 5): EPA's Preliminary Biosolids Risk Assessment



Source: EPA National Biosolids Meeting 2021 (Session 5): EPA's Preliminary Biosolids Risk Assessment, Dr. David Tobias. November 2, 2022.

Risk Assessment Framework: Framework for Screening and Refined Risk Assessment including Probabilistic Modeling



[a] Originally, Pathways 1 and 2 differed only in that they were modeled for two different scenarios (1, general population and 2, home gardener). In the Biosolids Screening Tool, this pathway is modeled for only one scenario, a farm family (adult farmer and farm child).

[b] Originally, Pathways 4 (cattle eat contaminated plants) and 5 (cattle eat contaminated soil) were modeled separately. In the Biosolids Screening Tool, these pathways are combined to reflect that when cattle eat forage, they ingest soil as well. The overall cattle diet is assumed to be 95% forage and 5% soil.

[c] The farm child is omitted because inhalation risks for children are always equal to or lower than those for adults, and young children are less likely to shower.

Figure A-1. Conceptual model for human exposures.

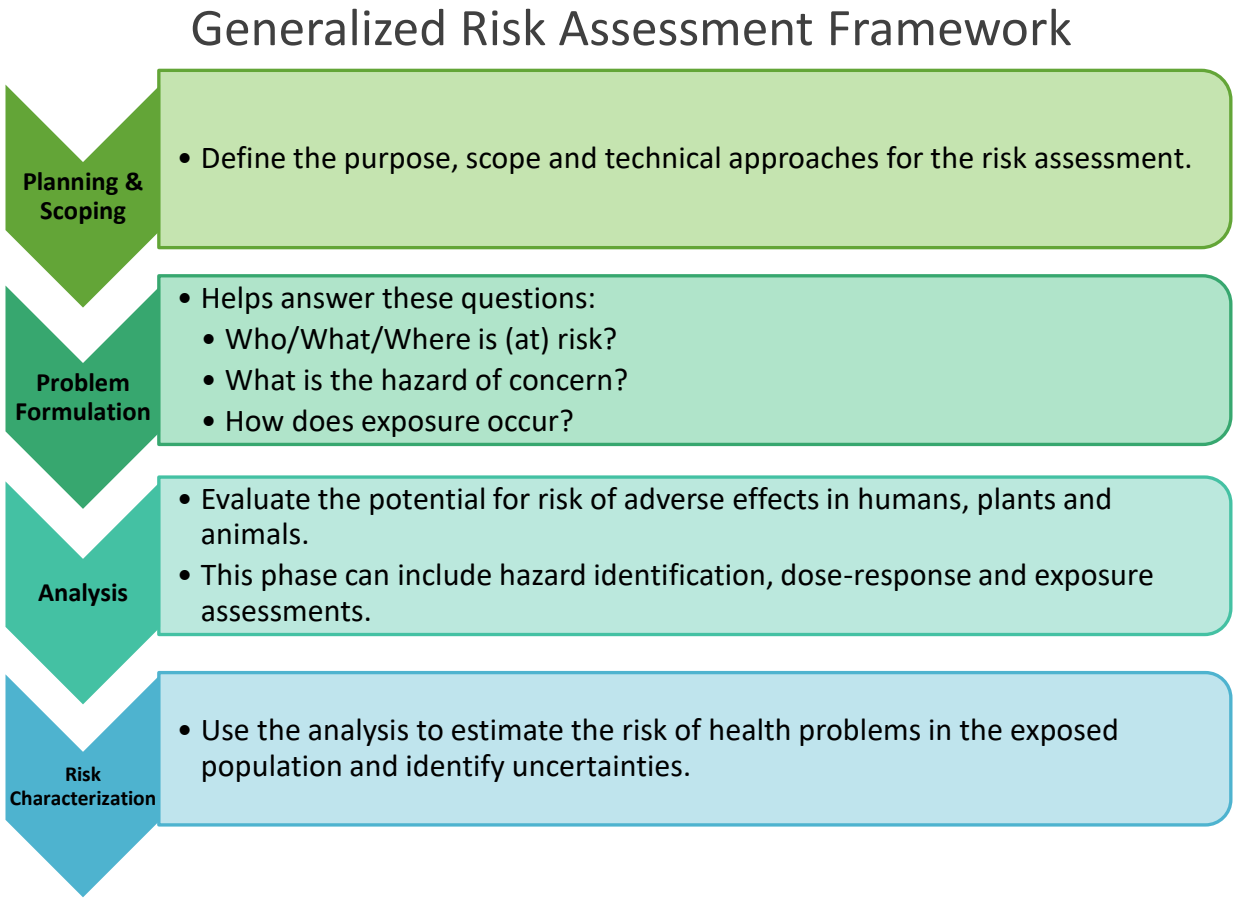
Source: [EPA National Biosolids Meeting 2021 (Session 5): EPA's Preliminary Biosolids Risk Assessment, Dr. David Tobias. November 2, 2022.]

PFOA and PFOS Risk Assessment in Biosolids

PFOA and PFOS Risk Assessment

- EPA PFAS Strategic Roadmap: EPA's Commitments to Action 2021-2024 – "Finalize risk assessment for PFOA and PFOS in biosolids that will serve as the basis for determining whether regulation of PFOA and PFOS in biosolids is appropriate."
  - Link: https://www.epa.gov/pfas/pfas-strategic-roadmap-epas-commitments-action-2021-2024

PFOA and PFOS Risk Assessment (cont.)



→ Link: EPA Biosolids PFOA & PFOS Problem Formulation Meeting Summary

Ongoing

PFOA and PFOS Hazard Assessment

- Hazard values for cancer and non-cancer effects (RfDs and CSFs) will come from the analyses done to support the drinking water regulations.
- Reference doses (RfDs) will be compared to daily exposures averaged over a year and Cancer Slope Factors (CSFs) will be compared to lifetime exposures for the farm family.
- The Maximum Contaminant Levels (MCLs) and MCL Goals (MCLGs) are not directly applicable to the biosolids risk assessment.
- "Per- and Polyfluoroalkyl Substances (PFAS) Proposed PFAS National Primary Drinking Water Regulation" (March 2023)
  - Toxicity Assessment and Contaminant Level Goal for Perfluorooctanoic Acid (PFOA) in Drinking Water
  - Toxicity Assessment and Contaminant Level Goal for Perfluorooctane Sulfonic Acid (PFOS) in Drinking Water
- Link: https://www.epa.gov/sdwa/and-polyfluoroalkyl-substances-pfas

“What happens after the PFOA/PFOS risk assessment is complete in 2024?”

Risk Management

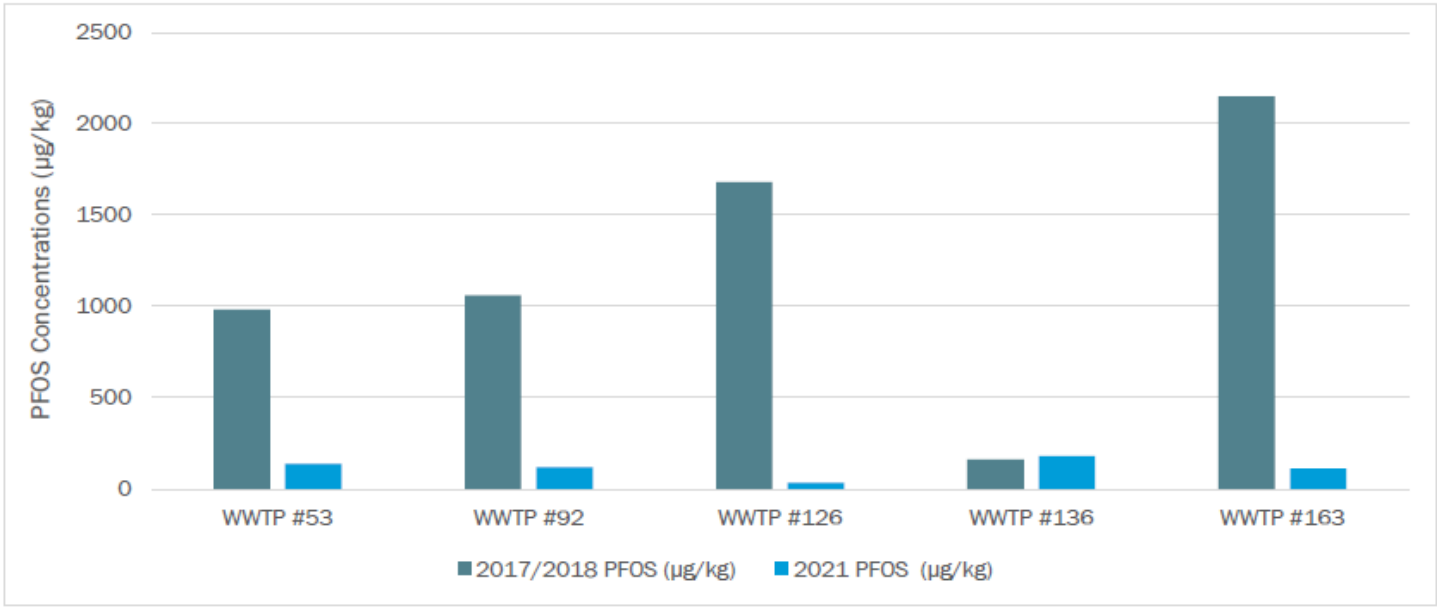
Risk Management is a distinctly different process from risk assessment. Risk assessment establishes whether a risk is present and, if so, the range or magnitude of that risk. In the risk management process, the results of the risk assessment are integrated with other considerations, such as economic or legal concerns, to reach decisions regarding the need for and practicability of implementing various risk reduction activities. Risk managers also use risk assessment results as a basis for communicating risks to interested parties and the general public.

Source: EPA Website – Risk Management

“WWTPs do not generate PFAS, they just receive them. What are we supposed to do?”

MICHIGAN STRATEGY FOR LAND APPLICATION OF BIOSOLIDS CONTAINING PFAS (UPDATED 2022)

Figure 1. PFOS Concentration Reductions in Industrially Impacted Biosolids: 2017 to 2021



Source: Land Application of Biosolids Containing PFAS: Interim Strategy, Updated April 2022. Michigan Department of Environment, Great Lakes, and Energy.

“What should I do in the meanwhile?”

MEMORANDUM

SUBJECT: Addressing PFAS Discharges in NPDES Permits and Through the Pretreatment Program and Monitoring Programs

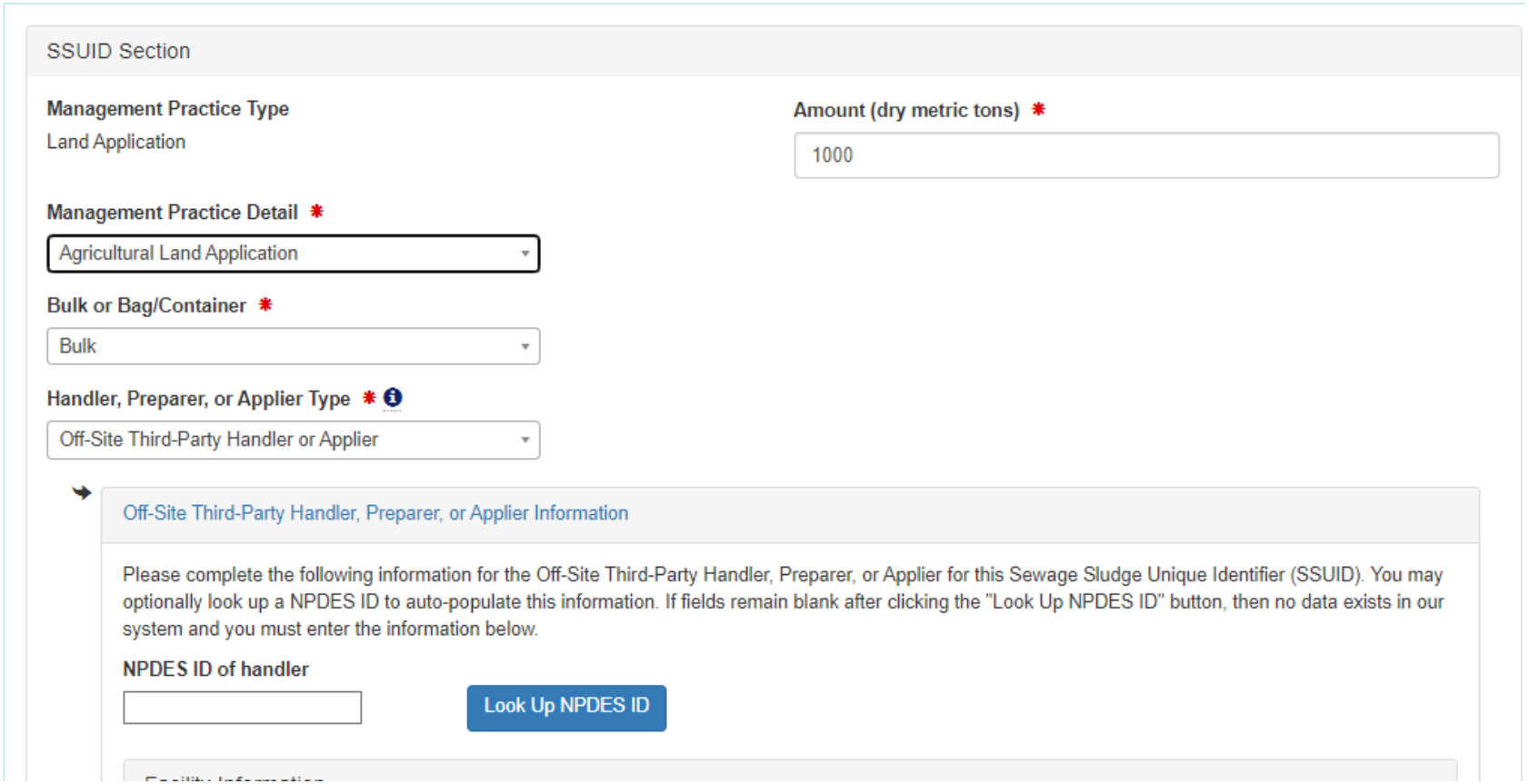
C. Recommended Biosolids Assessment

1. **Where appropriate, states may work with their POTWs to reduce the amount of PFAS chemicals in biosolids, in addition to the NPDES recommendations in Section B above, following these general steps:**[7]
   a. EPA recommends using draft method 1633 to analyze biosolids at POTWs for the presence of 40 PFAS chemicals.[8]
   b. Where monitoring and IU inventory per section B.2 and B.3.a above indicate the presence of PFAS in biosolids from industrial sources, EPA recommends actions in B.3.b to reduce PFAS discharges from IUs.
   c. EPA recommends validating PFAS reductions with regular monitoring of biosolids. States may also use their available authorities to conduct quarterly monitoring of the POTWs (*see* 40 CFR 403.10(f)(2)).

Source: Memorandum: Addressing PFAS Discharges in NPDES Permits and Through the Pretreatment Program and Monitoring Programs (December 5, 2022)

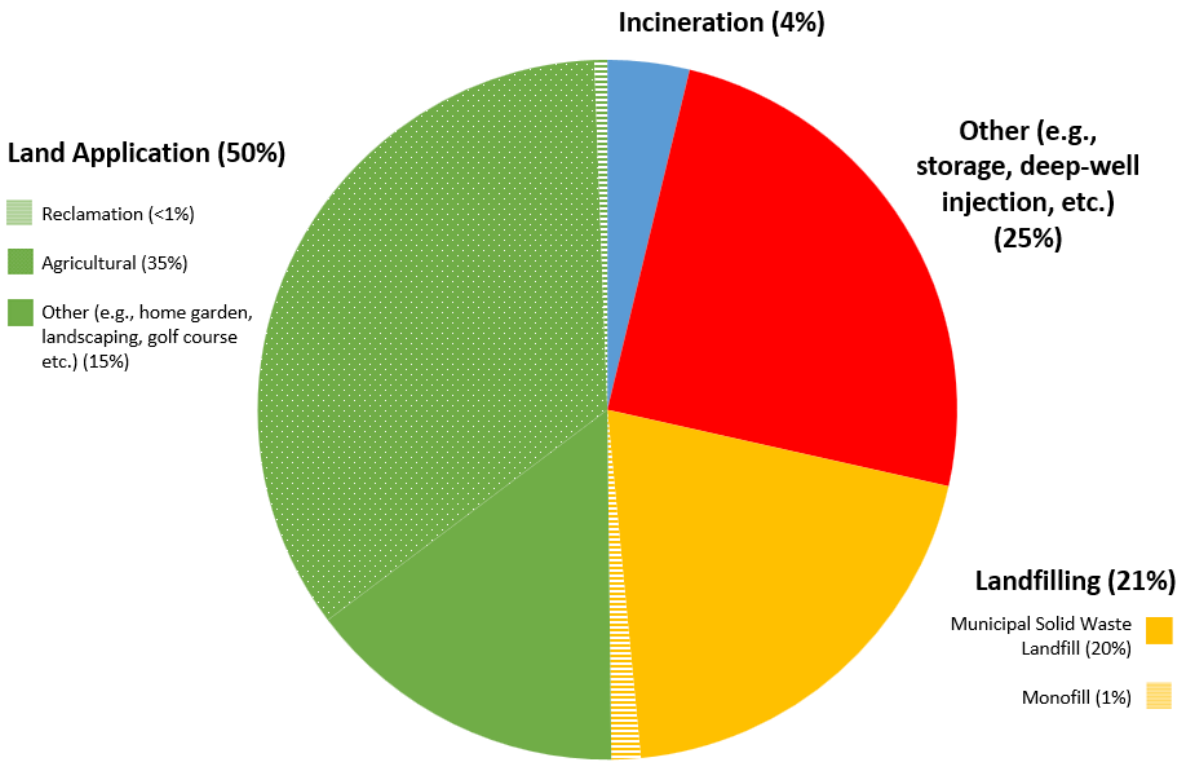
Biosolids Annual Reporting – Using a Third Party to Manage Biosolids

Linking Third Party NPDES IDs

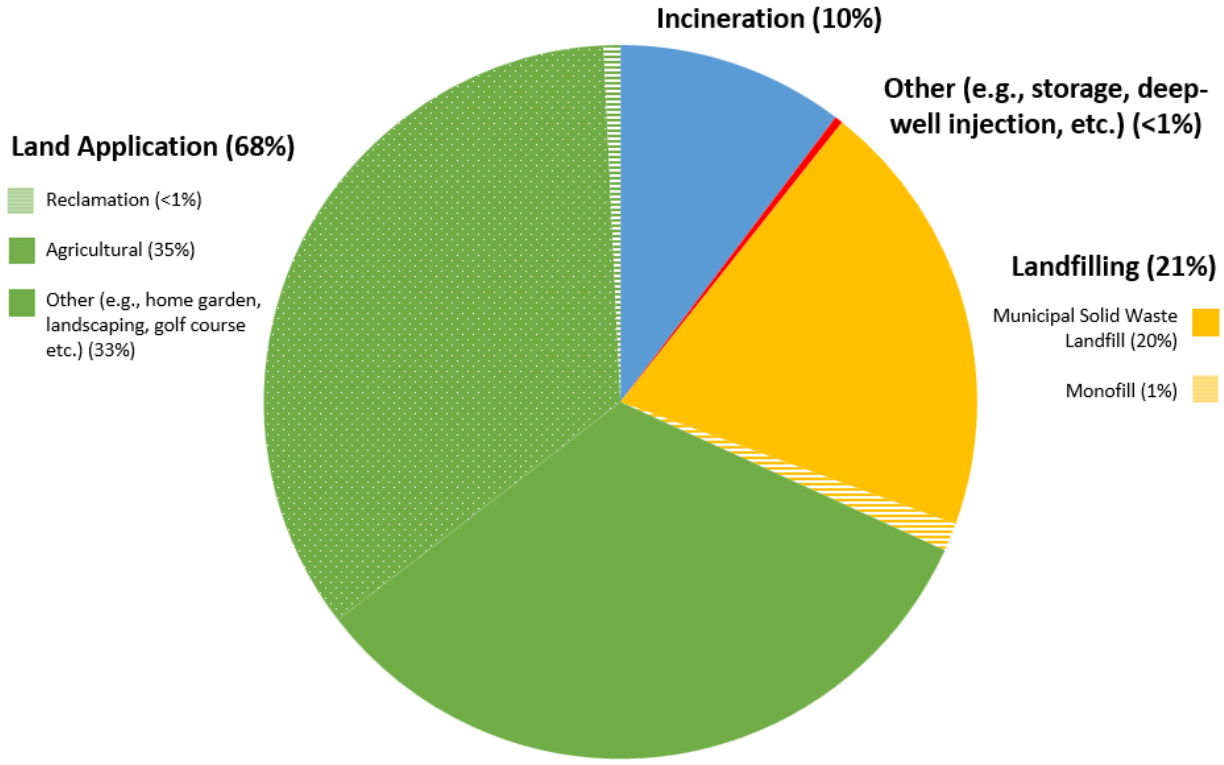


Data from POTWs using a Third-Party Facility to Manage Sewage Sludge

RAW DATA



AFTER OW-OST/OECA ANALYSIS



Stakeholder Engagement

Stakeholder Engagement

- Webinar Series: https://www.epa.gov/biosolids/epa-biosolids-webinar-series
- National Meetings: https://www.epa.gov/biosolids/epa-biosolids-national-meetings
- Website: https://www.epa.gov/biosolids

Research

Biosolids Research Updates from the Office of Research and Development (ORD)

Pathogen and Vector Attraction Reduction:

- Environmental Regulations and Technology: Control of Pathogens and Vector Attraction in Sewage Sludge" report (EPA/625/R-92/013)
  - Completed January 2023

Antibiotic Resistant Bacteria and Genes:

- Evaluate types and prevalence of antibiotic resistant bacteria (ARB) and antibiotic resistance genes (ARGs) in biosolids to inform management strategies.

Biosolids Research Updates from ORD (cont.)

PFAS Analytical Methods:

- Draft Method 1633
  - Multi-laboratory validation ongoing
- Non-targeted analyses

PFAS Prevalence and Pretreatment:

- Evaluate pretreatment strategies
  - PFAS Innovation Treatment Team Research Briefs

Thermal Treatment Strategies:

- Incineration and Pyrolysis/Gasification:
  - Sewage sludge incinerator products of incomplete combustion (PICS).
  - Pyrolysis field study with BioForceTech
    - https://doi.org/10.1080/10962247.2021.2009935
  - Co-incineration of spent drinking water residuals with limed sewage sludge

Biosolids Research Updates from ORD (cont.)

Contaminants and Land Application:

- Field Study 2: Application biosolids and evaluation of contaminant attenuation
  - Presentation: Land Application Field Study II
- Field Study 3: Long-term (20 years) land application and evaluation of contaminant transport and plant uptake.
- Modeling subsurface transport.
  - PFAS analyses in soil and GW.
  - Adapt current modeling approaches to more accurately describe fate/transport for application to land application sites.

Biosolids-Related Research Grants

- Practical Methods to Analyze and Treat Emerging Contaminants (PFAS) in Solid Waste, Landfills, Wastewater/Leachates, Soils, and Groundwater to Protect Human Health and the Environment
  - "Decreasing polyfluoroalkyl substances (PFASs) in municipal wastewater effluent and minimizing release from land-applied biosolids" (Grant ID RD839640 - Lee, Linda S., Chaplin, Brian, Judy, Jonathan)
- National Priorities: Research on PFAS Impacts in Rural Communities and Agricultural Operations
  - "Evaluating PFAS Occurrence and Fate in Rural Water Supplies and Agricultural Operations to Inform Management Strategies" (Grant ID R840082 - Lee, Linda S., Pennell, Kurt, Preisendanz, Heather)
- National Priorities: Evaluation of Pollutants in Biosolids
  - "Unregulated Organic Chemicals in Biosolids: Prioritization, Fate and Risk Evaluation for Land Applications" (Grant ID R840245 - Olabode, Lola, Gan, Jay, Lee, Linda S., McAvoy, Drew)
  - "Fate and Transport of Unregulated Organic Contaminants in Biosolids - Development of a Human and Environmental Exposure Risk Framework" (Grant ID R840247 - Prasse, Carsten, Burke, Thomas A., Nachman, Keeve)
  - "Elucidating the occurrence of known and emerging chemical contaminants in wastewater biosolids and the influence of treatment and management processes on their fate, mobility and bioavailability" (Grand ID R840248 - Hale, Robert C., Guardia, Mark La, Luellen, Drew, Song, Bongkeun)
  - "Assessing biosolid treatment processes on pollutant environmental fate and plant uptake following land application" (Grant ID R840252 - Li, Hui, Carignan, Courtney, Huang, Qingguo, Ippolito, James, Norton, John, Zhang, Wei)

Biosolids Team

Biosolids Program
Health & Ecological Criteria Division
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