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EPA Tools and Resources Webinar: Chemical Risk Assessment for PFOA/PFOS in Biosolids

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Outline

- Statutory Requirement – Clean Water Act Section 405
- Biosolids Basics
- Proposed Risk Assessment Framework
- PFAS Risk Assessment Overview
- Summary

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Section 405(d) Clean Water Act (CWA)

…shall identify those toxic pollutants which, on the basis of available information on their toxicity, persistence, concentration, mobility, or potential for exposure, may be present in sewage sludge in concentrations which may adversely affect public health or the environment, and propose regulations specifying acceptable management practices for sewage sludge containing each such toxic pollutant and establishing numerical limitations for each such pollutant…

Background

- PFAS are widespread in wastewater influent and sewage sludge due to industrial, commercial, and domestic sources
- Within wastewater treatment plants some PFAS will associate mainly with the solids
- Disposal or use of sewage sludge/biosolids could lead to environmental exposures to PFAS

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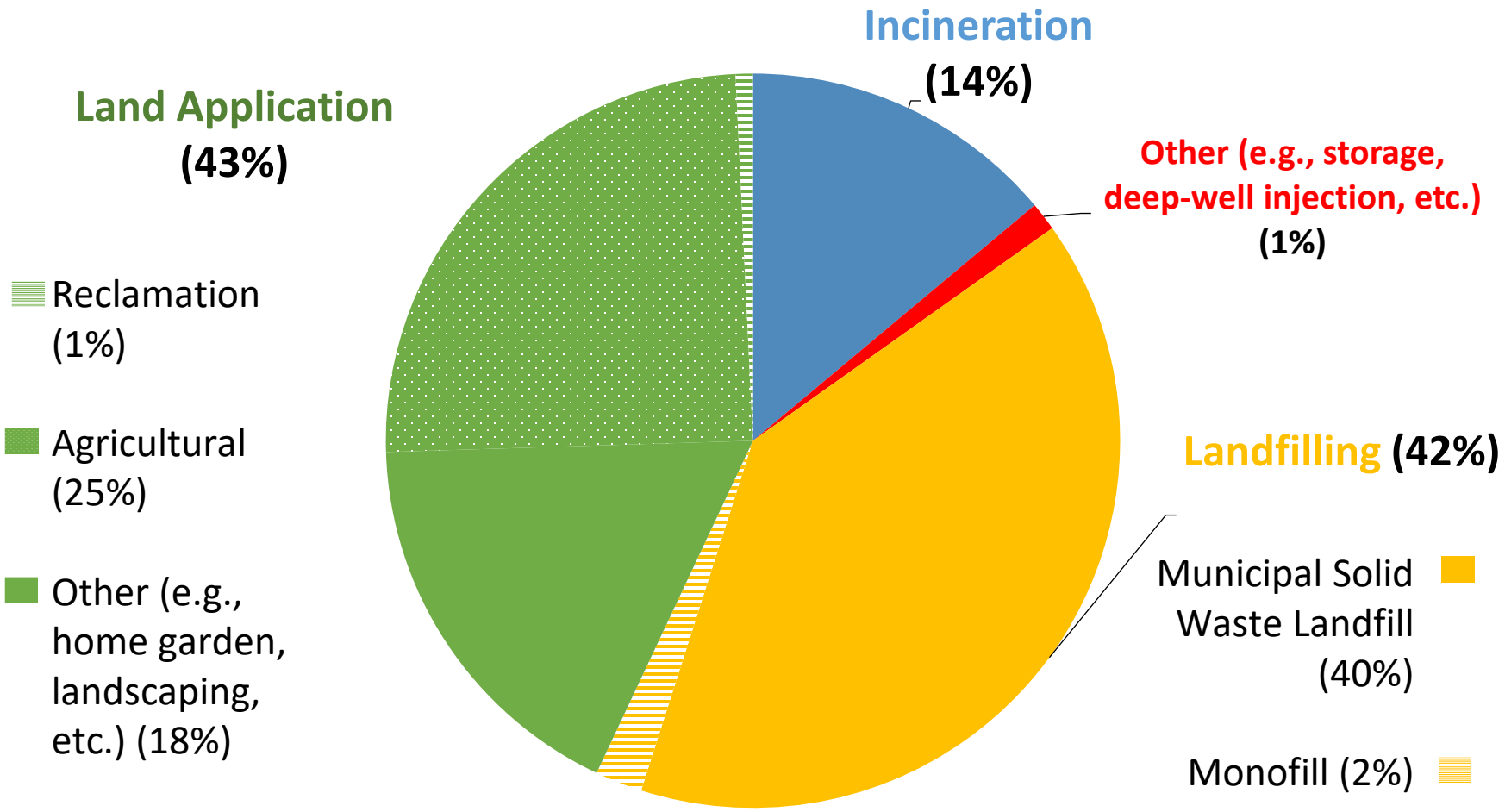
Biosolids Lifecycle

- Water is supplied to domestic, commercial, and industrial sites
- Wastewater from these sources is sent to a wastewater treatment plant
- Sewage sludge originates from removal of organic solids from wastewater
- 3 main disposal methods
  1. Land application of treated sewage sludge (aka biosolids)
  2. Landfilled
  3. Incinerated

Biosolids Use and Disposal (2021 Data)



EPA National Biosolids Program

- The Biosolids program under the Clean Water Act (40 CFR 503) established requirements for the beneficial use or disposal of sewage sludge when:
  - Applied to land to fertilize soil
  - Placed in a sewage sludge only landfill
  - Disposed of in a sewage sludge incinerator
- 10 chemicals are regulated for disposal under 503
  - Regulatory values are based on protecting human health or preventing environmental harm

- Arsenic
- Cadmium
- *Chromium
- Copper
- Lead
- Mercury
- Molybdenum
- Nickel
- Selenium
- Zinc

*Chromium is not regulated for land application, but for other disposal pathways

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Background: Introduction to Risk

- Risk is the chance of harmful effects to human health or to ecological systems resulting from exposure to an environmental stressor
- Exposure assessment describes the amount of a chemical a receptor encounters due to the chemical's presence in environmental media
- Hazard (toxicity) is a measure of the dose of a chemical stressor that results in an adverse health outcome
- Chemical risk assessment commonly involves two parts:
  - Human health
  - Ecological (aquatic and terrestrial)

Biosolids SAB Review

- Biosolids Risk Assessment Framework

STEP 1. Prioritize the risk assessment of chemical pollutants found in biosolids using the EPA's Public Information Curation and Synthesis (PICS) process

STEP 2. Conduct screening-level risk assessments using the BioSolids Tool (BST)

STEP 3. Conduct refined risk assessments for chemicals that pose the greatest risk.

EPA Science Advisory Board (SAB) Approach to Biosolids Chemical Risk Assessment and Biosolids Tool webpage

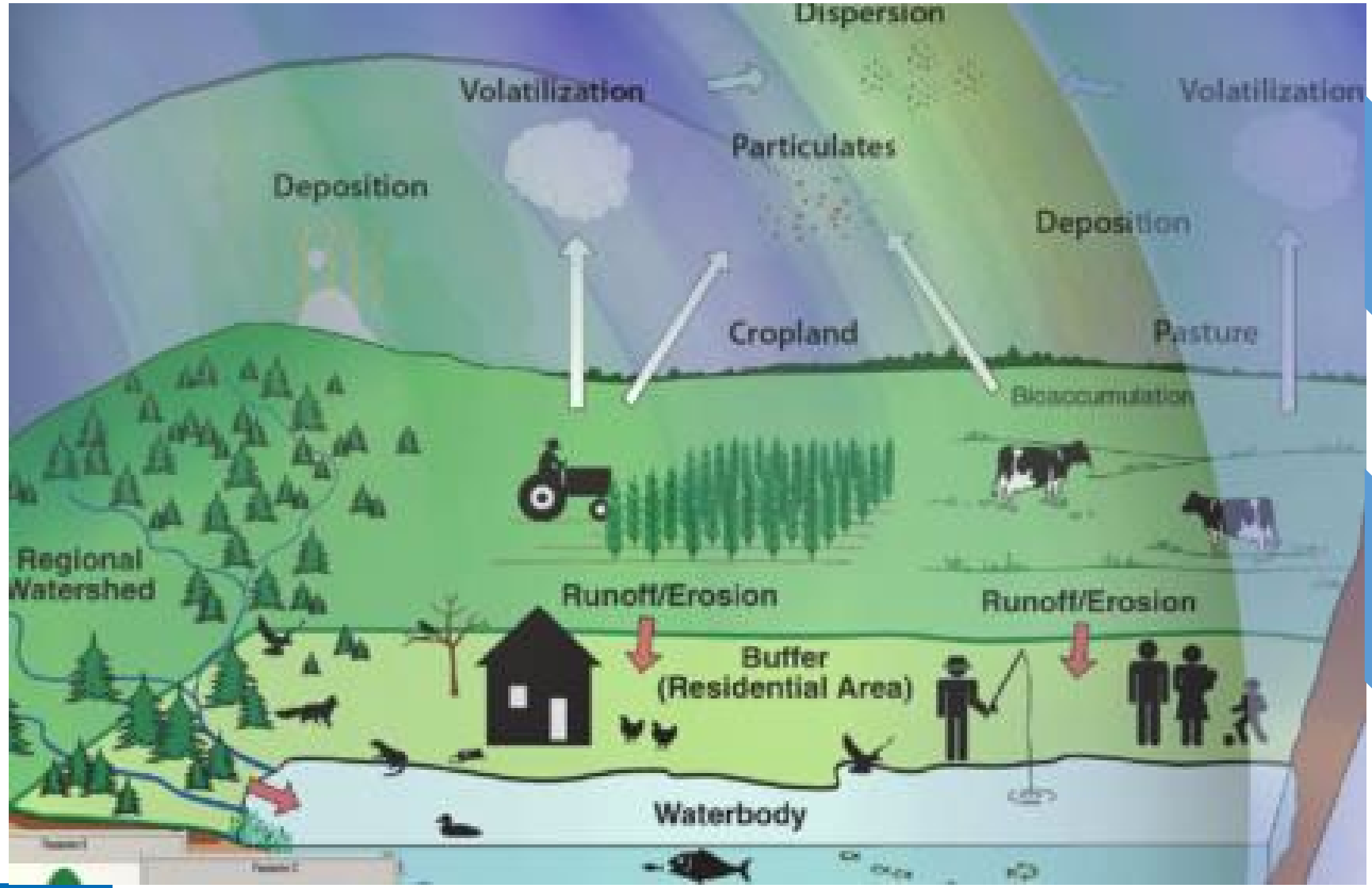
EPA Biosolids webpage

Background: Use and Disposal of Biosolids

Chemicals in sewage sludge can be released to the environment after surface disposal (i.e., sewage sludge monofill) and when biosolids are disposed of via land application

- Incineration and municipal solid waste landfill disposal are **not** part of the current biosolids risk tool

Biosolids – Exposure Pathways



Human Health risk

- Inhalation
- Drinking water
- Diet
- Soil ingestion

Ecological risk

- Water
- Soil
- Terrestrial

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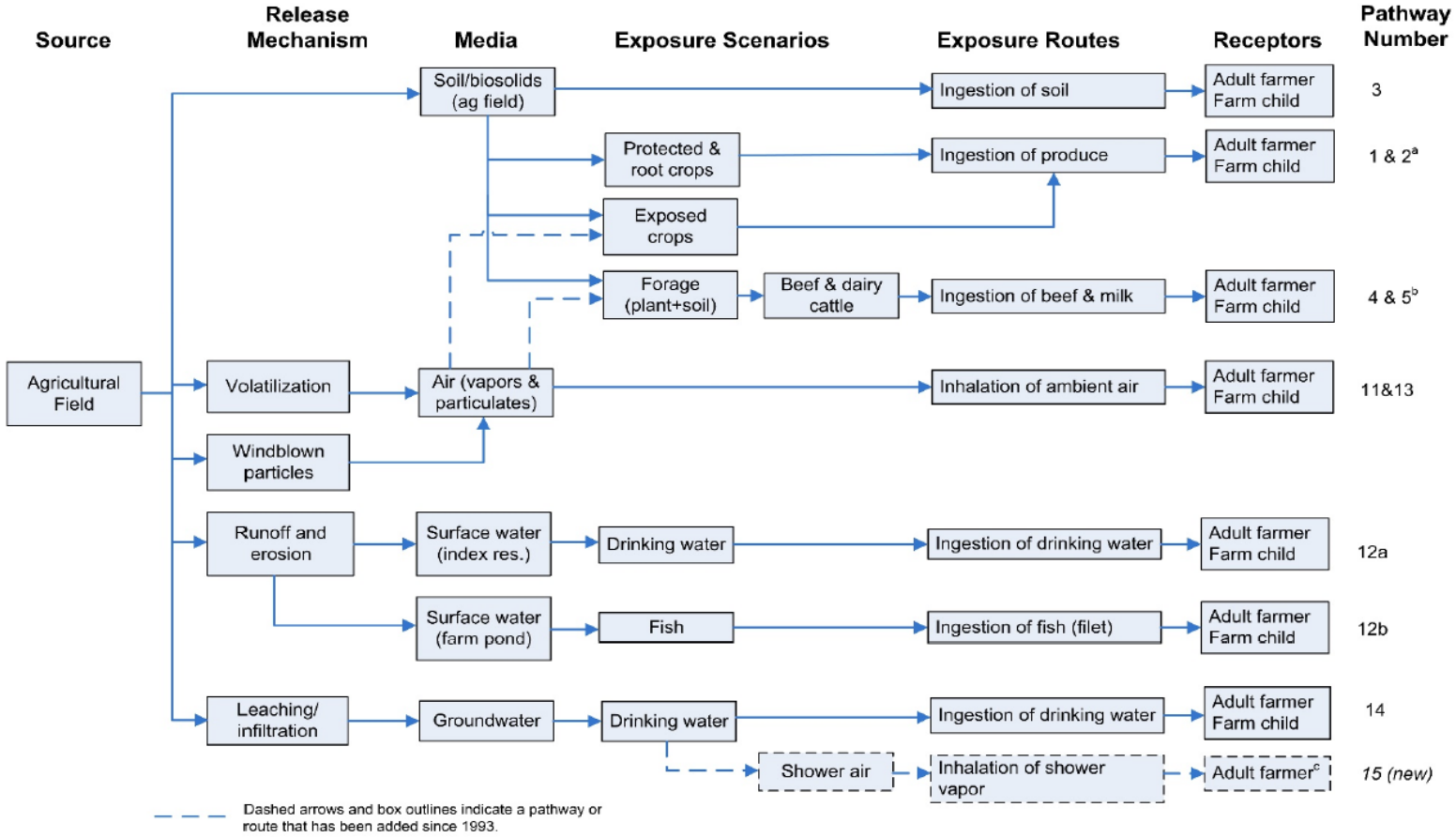
Human Exposure Pathways



[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).

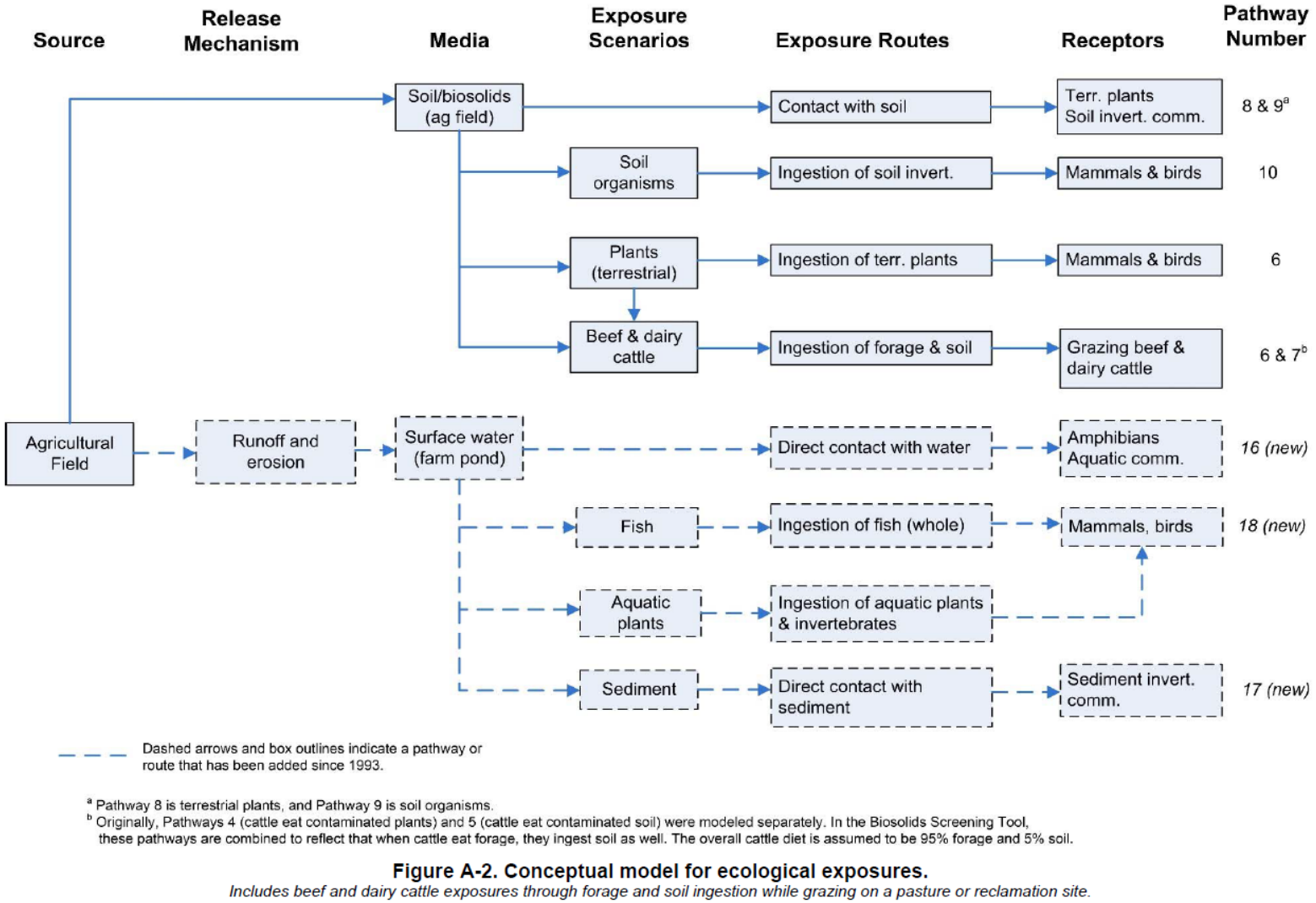
[b] Originally, Pathways 4 (cattle eat contaminated plants) and 5 (cattle eat contaminated soil) were modeled separately. In the Biosolids Screening Tool, these pathways are combined to reflect that when cattle eat forage, they ingest soil as well. The overall cattle diet is assumed to be 95% forage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

Figure from - **A Standardized Framework for Sewage Sludge Chemical Risk Assessment, EPA Document No. 822D23001**

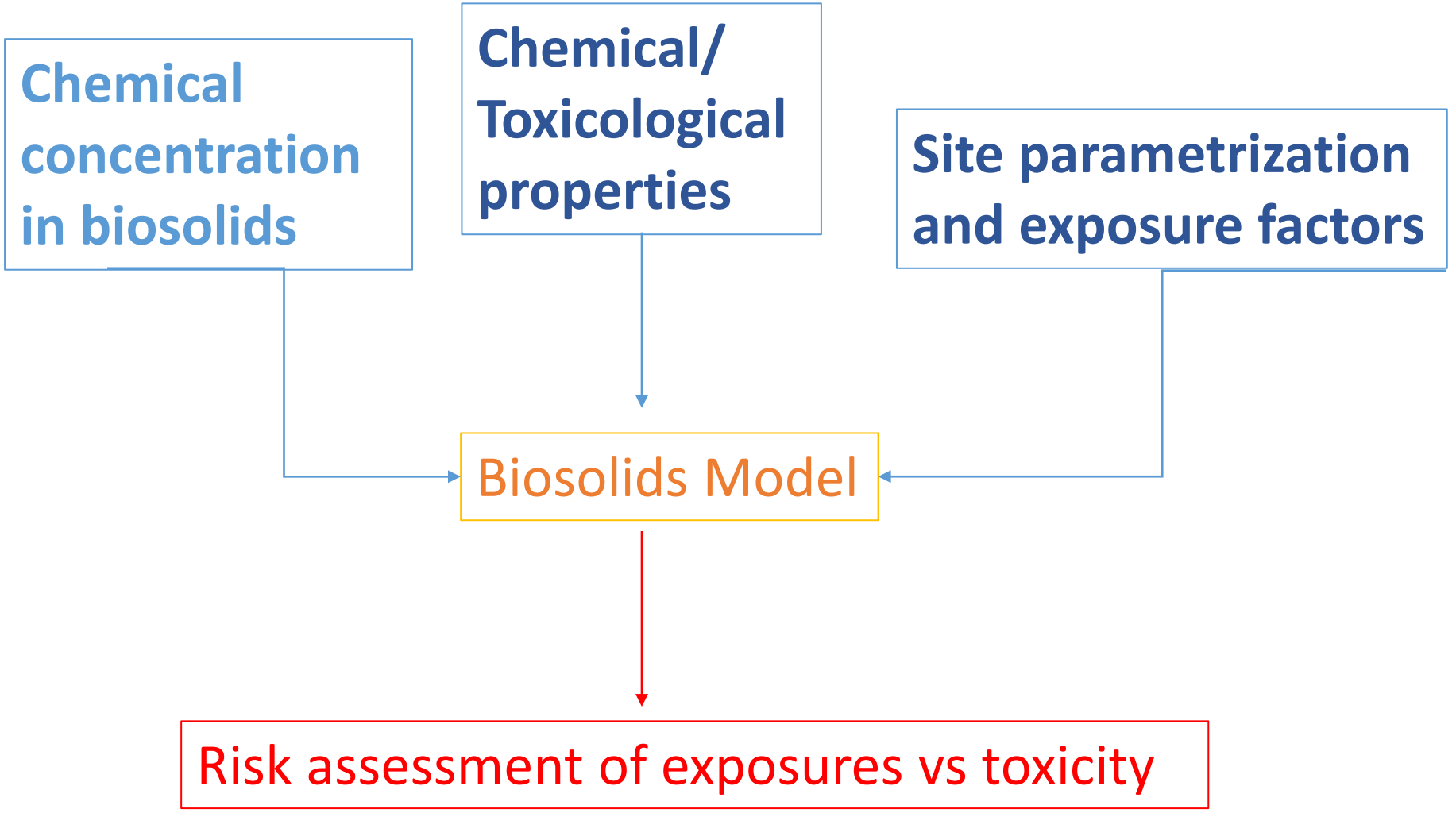
Ecological Exposure Pathways



[a] Pathway 8 is terrestrial plants, and Pathway 9 is soil organisms.
[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.

Figure A-2. Conceptual model for ecological exposures.
Includes beef and dairy cattle exposures through forage and soil ingestion while grazing on a pasture or reclamation site.

Figure from - **A Standardized Framework for Sewage Sludge Chemical Risk Assessment, EPA Document No. 822D23001**

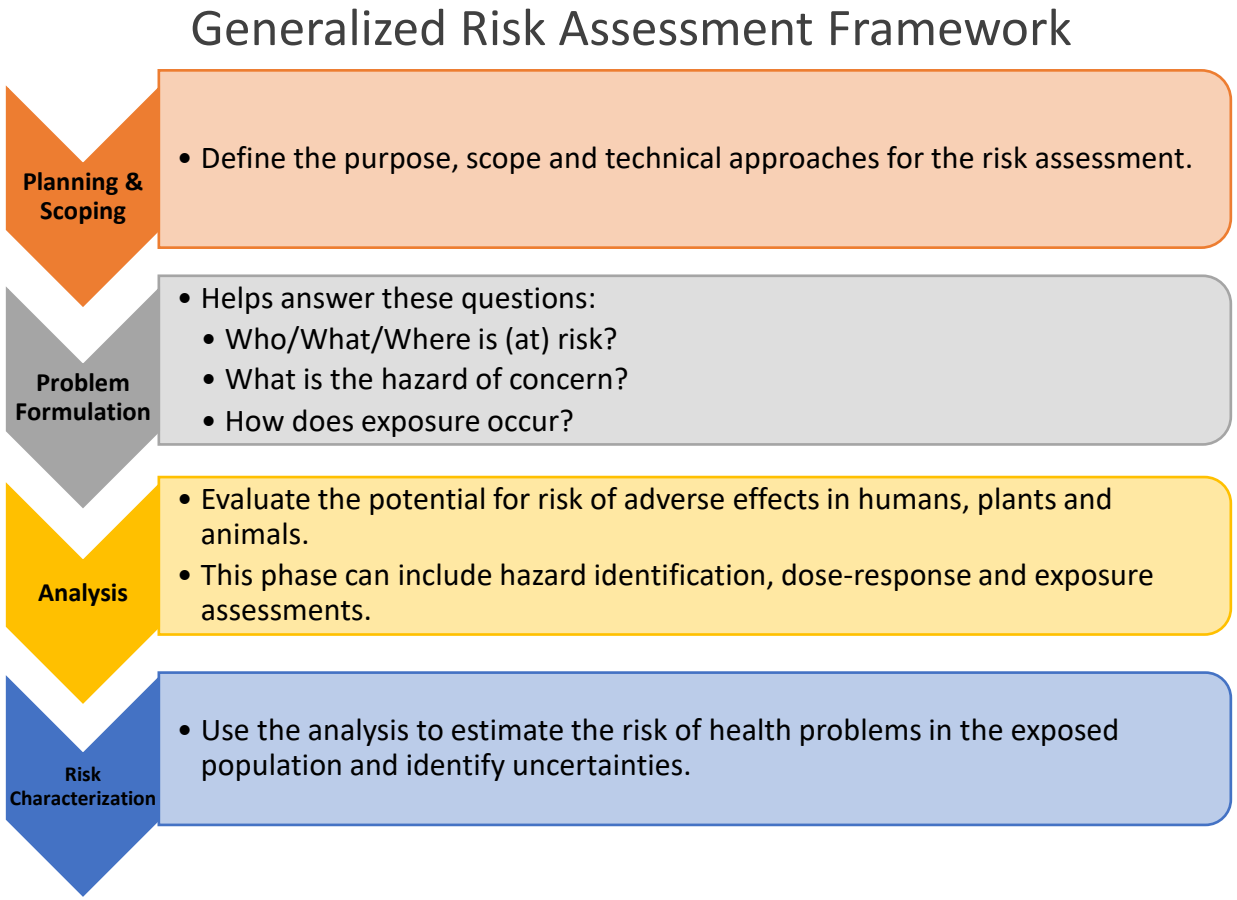

Chemical concentration in biosolids
Chemical/ Toxicological properties
Site parametrization and exposure factors
Biosolids Model
Risk assessment of exposures vs toxicity

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."

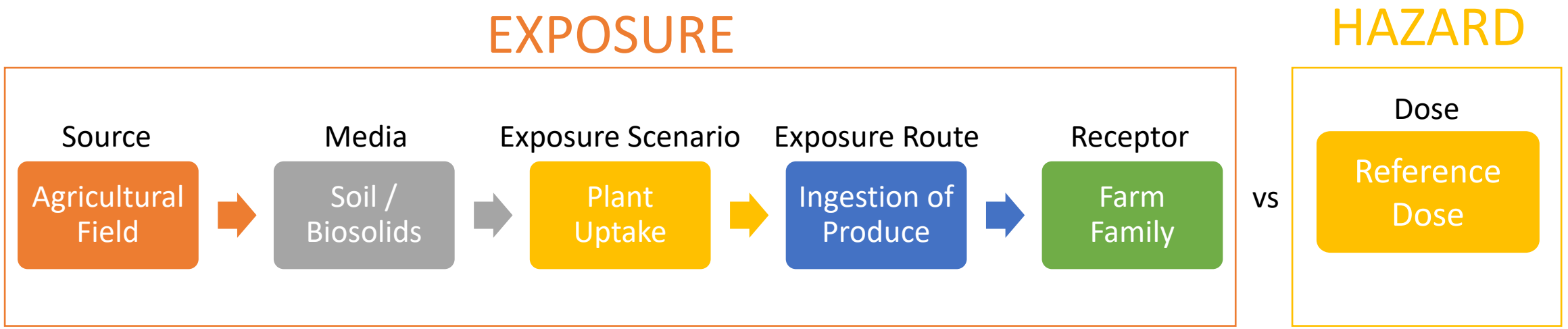
PFOA and PFOS Risk Assessment (cont.)



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

Ongoing

Ongoing Work: PFOA and PFOS Risk Assessment



PFOA and PFOS Hazard Assessment

- Proposed PFAS National Primary Drinking Water Regulation (March 2023)
- Link: https://www.epa.gov/sdwa/and-polyfluoroalkyl-substances-pfas
- Hazard values, reference doses and cancer slope factors will be used in the PFOA/PFOS biosolids risk assessment

PFOA and PFOS Aquatic Life Criteria

- Draft Aquatic Life Criteria for PFOA & PFOS
- Links:
  - https://www.epa.gov/wqc/aquatic-life-criteria-perfluorooctanoic-acid-pfoa
  - https://www.epa.gov/wqc/aquatic-life-criteria-perfluorooctane-sulfonate-pfos
- Provide aquatic hazard values for the farm pond in biosolids assessment

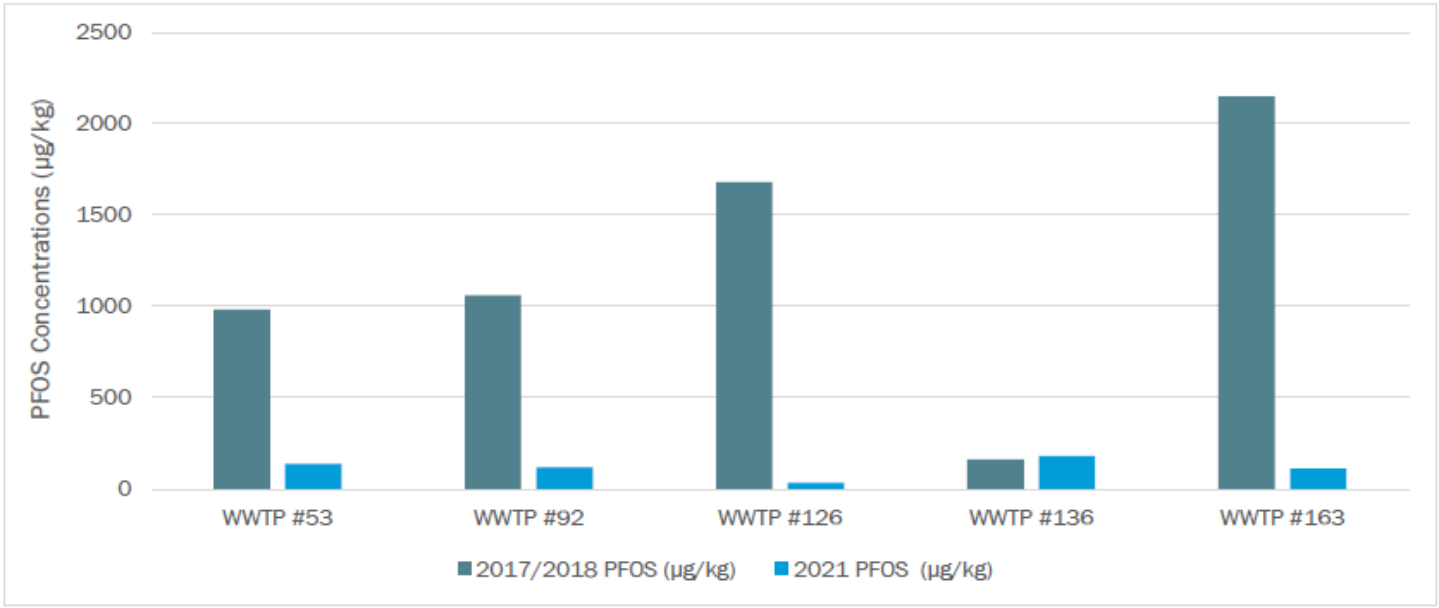
State Activities

- States (including CA, CO, ME, MI, MN, NH, VT) have initiated programs to monitor for PFAS in sewage sludge
- Regulatory/Statutory actions
  - Maine banned land application of biosolids, resulting in a sharp increase in landfilling
    - Maine CDC/DEP researching soil, groundwater, cattle and plant uptake
  - Michigan restricted land application or required POTW pretreatment programs based on level of PFOS in biosolids
    - Colorado has initiated a program similar to Michigan's
  - Connecticut Agriculture and Environment departments recommended that farmers only apply biosolids if the levels of PFAS are measured to be at very low levels
  - California phasing out landfilling of biosolids, leading to increased land application
- ECOS report entitled PFAS in Biosolids: A Review of State Efforts & Opportunities for Action (January 2023)

Michigan EGLE

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.

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Conclusion

- Biosolids Risk Assessment Framework
- PFOA/PFOS Biosolids Risk Assessment
  - Biosolids Risk Assessment completed in 2024
- Exposure Mitigation

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