

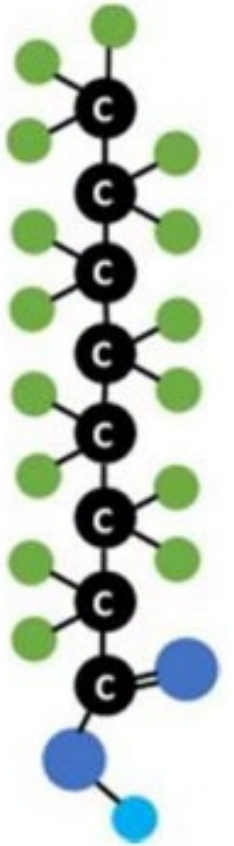
Draft Sewage Sludge Risk Assessment for PFOA and PFOS

Public Webinar
January 15, 2025

Image source: Appalachianviews/Dreamstime

Background: PFOA and PFOS

- PFOA and PFOS are two chemicals in a large class of synthetic organic chemicals called PFAS.
- PFOA and PFOS do not break down in the environment and can build up in people, animals, and the environment over time – and thus are sometimes referred to as “forever chemicals.”
- In 2024, the EPA classified both PFOA and PFOS as *likely to be carcinogenic to humans* and concluded that the chemicals are also likely to cause hepatic (liver), immunological, cardiovascular, and developmental effects, depending on exposure conditions.

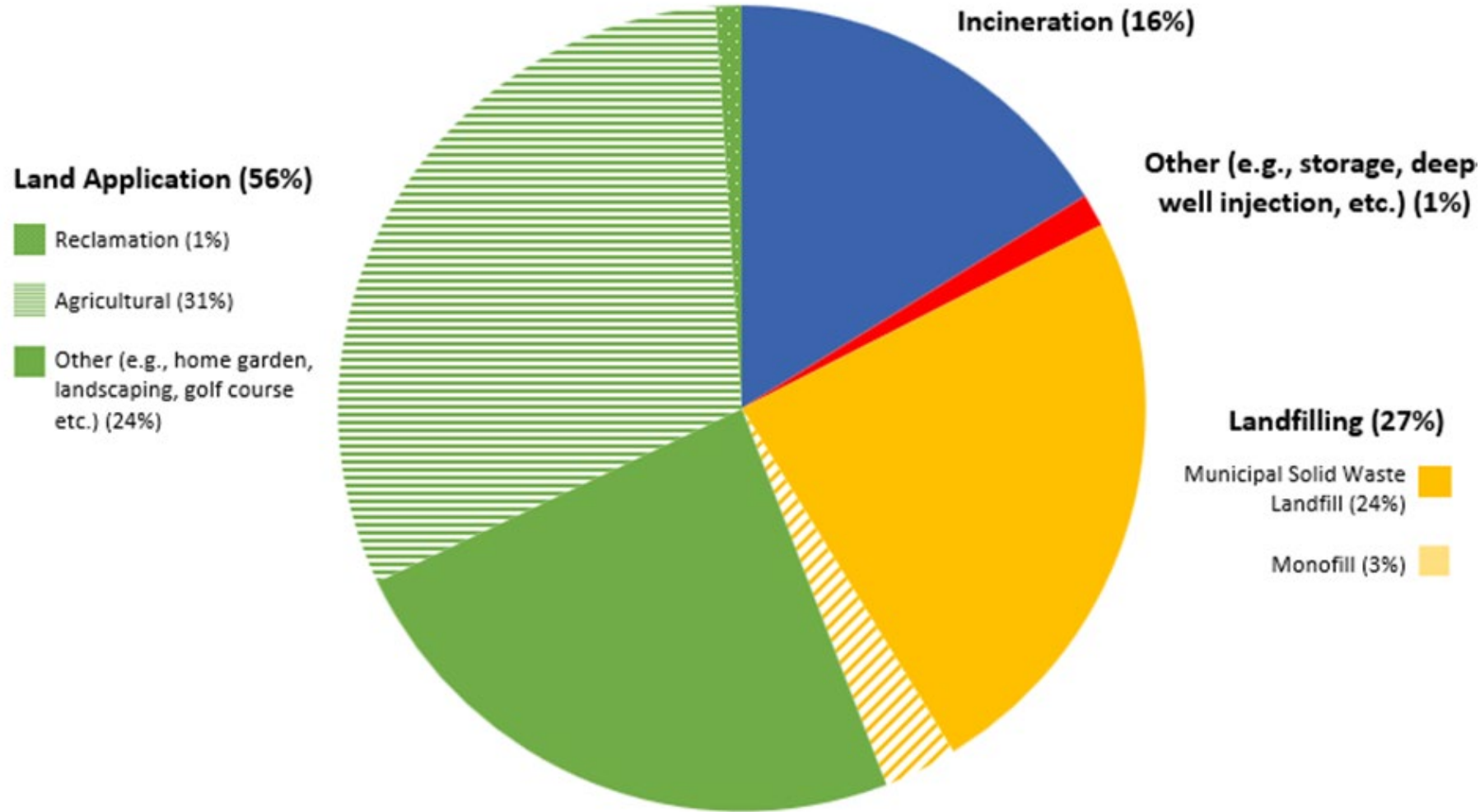


Background: Sewage Sludge

- Sewage produced by households and businesses, and sometimes wastewater from industrial dischargers, is conveyed to a wastewater treatment plant (WWTP), and ultimately treated to produce a semi-solid, nutrient-rich product known as “sewage sludge” or “biosolids.”
- Section 405(d) of the Clean Water Act requires EPA to:
 - Establish numeric limits and management practices that protect public health and the environment from the reasonably anticipated adverse effects of pollutants in sewage sludge.
 - Review existing regulations for the purpose of identifying additional toxic pollutants that may be present in sewage sludge and assess whether those pollutants may adversely affect public health or the environment.

Background: Sewage Sludge Use and Disposal Trends

Biosolids Use & Disposal from 2022 Biosolids Annual Reports



PFOA and PFOS in Sewage Sludge

- Although domestic manufacturing of PFOA and PFOS have been phased out and their uses restricted, multiple historic and ongoing activities still result in PFOA, PFOS, and their precursors being released to wastewater treatment plants (WWTPs).
 - Industrial releases (*e.g.*, aqueous film-forming foam, pulp and paper plants)
 - Commercial releases (*e.g.*, floor finishes, industrial launderers, ski wax)
 - Down-the-drain releases from homes (*e.g.*, use of consumer products like after-market water resistant sprays, and laundering of stain or water-resistant textiles with PFOA or PFOS coatings)
 - Landfill leachate (transferred to a WWTP)

PFOA and PFOS in Sewage Sludge

- Statewide surveys have found PFOA and PFOS in sewage sludge originating from industrial and non-industrial sources discharging to WWTPs.
- Traditional wastewater treatment technology does not remove or destroy PFOA or PFOS, and these chemicals accumulate in the sewage sludge.
- Appropriate pretreatment solutions at industrial dischargers exist, are cost-effective, and have been shown to be effective in reducing high concentrations of PFOA and PFOS.
 - However, studies have found that PFOA and PFOS are consistently detected in sewage sludge even at WWTPs that only receive wastewater from residential and commercial users.

What is a Risk Assessment?

- EPA risk assessments follow a scientific process to characterize the nature and magnitude of health risks to children, adults, and the environment from pollutants.
- An environmental risk assessment considers three primary factors:
 1. **Presence** (how much of a pollutant is present in the environment)
 2. **Exposure** (how much contact a human or wildlife has with the pollutant)
 3. **Toxicity** (the health effects the pollutant causes in humans or wildlife)

The EPA uses sewage sludge risk assessments to help evaluate whether risk reduction actions, including regulation, are warranted to protect those who may experience elevated risks from sewage sludge use or disposal.

EPA Modeling Approach for PFOA and PFOS

- **Central Tendency Risk Assessment:** EPA estimated risks assuming median (50th percentile) exposure conditions to better understand the potential scope and magnitude of risks under different use and disposal scenarios.
- EPA selected best available fate and transport models for PFOA and PFOS, parameterized with inputs and exposure factors to reflect median U.S. conditions and consumption behaviors.
- A central tendency approach was selected because a prior risk screening (high-end, 95th percentile) deterministic modeling approach indicated there could be elevated risks for multiple human exposure pathways.

Draft Risk Assessment: Central Tendency Assumptions

- Assume median (50th percentile) exposure conditions rather than high-end (*e.g.*, 90th percentile) exposures.
- Does not add together exposures from multiple pathways (*e.g.*, egg consumption plus drinking water).
- Does not consider non-sewage sludge exposures to PFOA or PFOS (*e.g.*, consumer products, other dietary sources).
- Does not account for the combined risk of PFOA and PFOS together or PFAS of other chain lengths (*e.g.*, PFDA, PFNA, PFBS).
- Does not account for exposures from the transformation of PFOA or PFOS precursors.

Scope of Draft Risk Assessment for PFOA and PFOS

- Focused specifically on people living on or near impacted sites or those that rely primarily on their products (e.g., food crops, animal products, drinking water), not the general public.
- Modeled hypothetical scenarios:
 - Farm family – pasture-raised livestock
 - Farm family – food crops (fruits and vegetables)
 - Land reclamation sites
 - Sewage sludge surface disposal sites (monofills)
- Narrative discussion (not modeled):
 - Sewage sludge incinerators
 - Home or community gardens
- The draft risk assessment is *not* a rule and does *not* compel action by states or others (does not contain regulatory thresholds, standards, or screening values).

Application Rates for Exposure Scenarios

Scenario	Concentration of PFOA or PFOS	Application Rate	Number of Applications	Human Exposure Duration
Farm – pasture-raised livestock	1 part per billion (ppb)	10 dry metric tons (DMT) per hectare (ha)	Once annually for 40 years	10 years – cancer 1 year – noncancer
Farm – food crops (fruits and vegetables)	1 ppb	10 DMT/ha	Once annually for 40 years	10 years – cancer 1 year – noncancer
Land reclamation sites	1 ppb	50 DMT/ha	One application only	10 years – cancer 1 year – noncancer
Sewage sludge surface disposal sites (sewage monofills)	1 ppb	Flow rate 4×10^{-6} m ³ /sec	Disposal site operating for 50 years	10 years – cancer 1 year – noncancer

Estimated risks scale linearly with the starting concentration of PFOA or PFOS in sewage sludge, assuming all other factors are held constant. As such, sewage sludge containing ten times more PFOA or PFOS (i.e., 10 ppb) would yield risk estimates that are ten times greater than those presented in the draft risk assessment.

Draft Risk Assessment: Risk Estimates

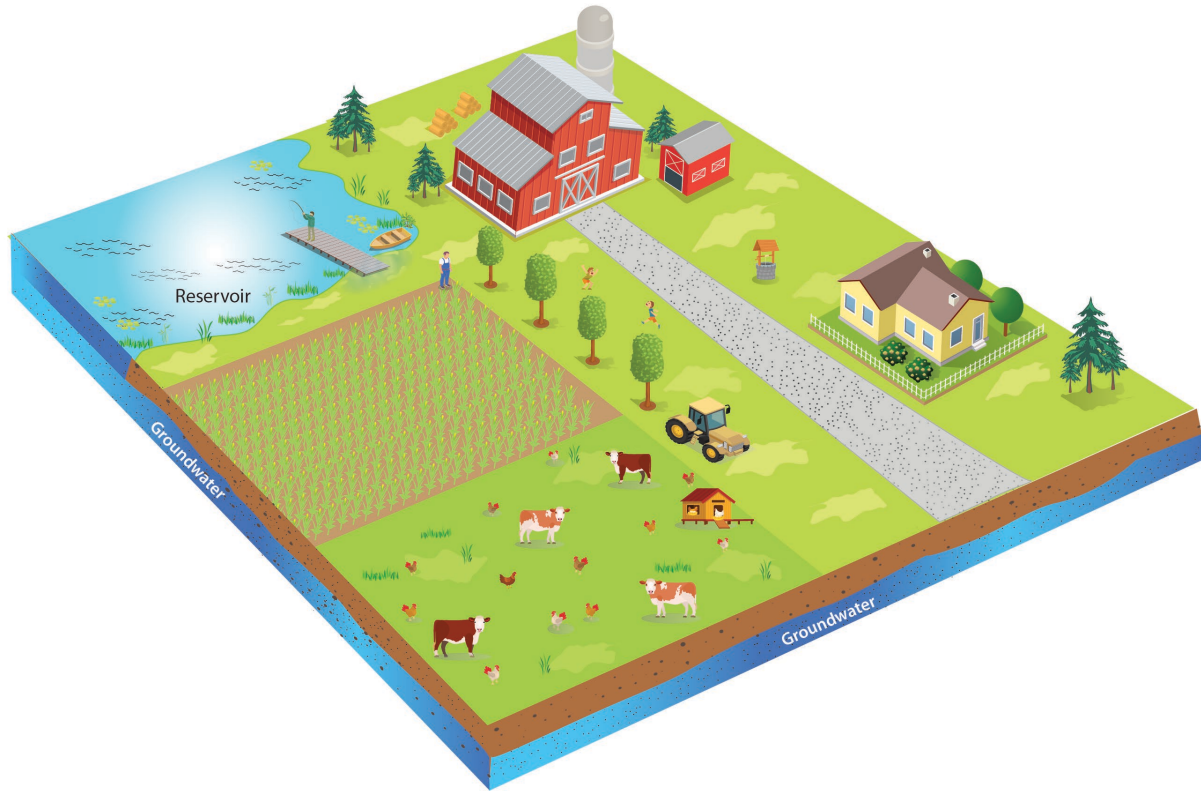
- Draft risk estimates for the modeled scenarios are presented in the risk assessment as cancer risk levels and hazard quotients (HQs).
- Cancer risk levels represent the number of expected excess lifetime cancer cases due to exposure to the carcinogenic pollutant in a given population size.
 - For example, a cancer risk level of 1×10^{-6} (1 in 1,000,000) indicates that lifetime exposure to the carcinogenic pollutant would be expected to cause one additional case of cancer for every one million people in the exposed population.
- Risk estimates for non-cancer effects are expressed as HQs that represent the ratio of the potential exposure to a pollutant to the level below which adverse non-cancer effects are not expected.
 - An $HQ < 1$ means adverse non-cancer health effects are unlikely, and thus risk can be considered negligible.
 - An $HQ > 1$ means adverse non-cancer effects are possible, and thus risk is indicated.

Draft Risk Estimates: Pasture Farm Scenario

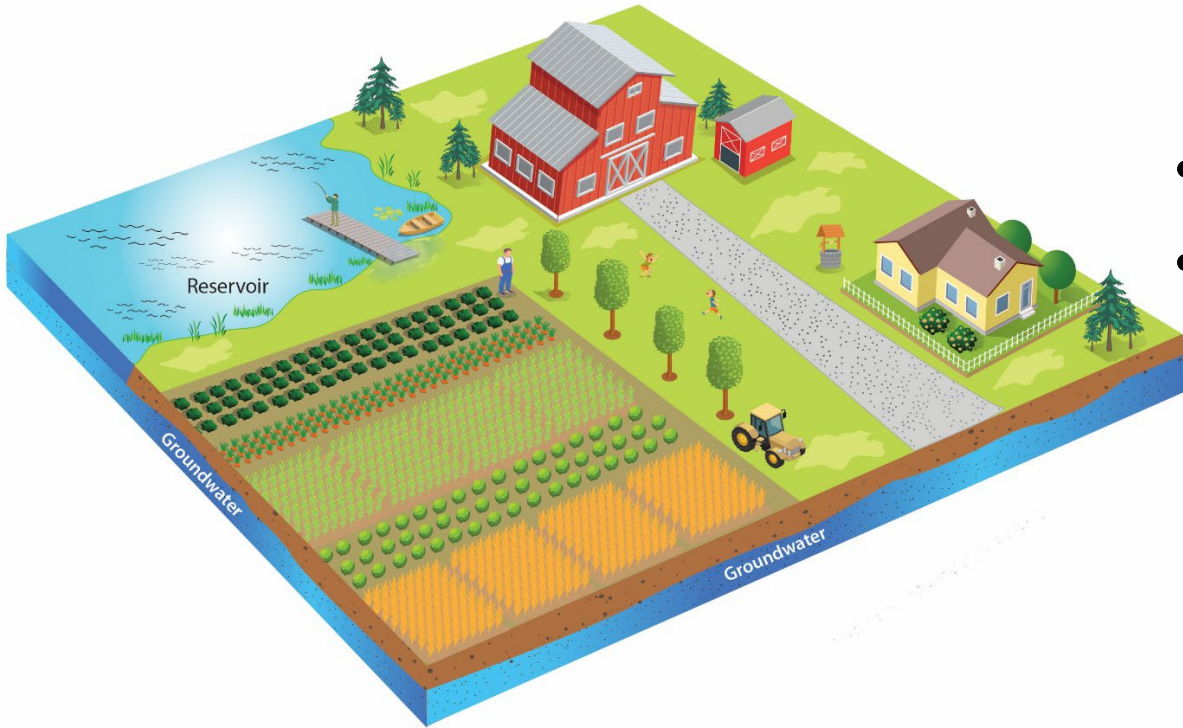
- Annual applications of 10 DMT/ha (median rate) for 40 years containing 1 ppb PFOA or PFOS. No tilling.
- Farm family lives on site for 10 years.
- In some scenarios, there may be risks associated with **drinking water**, consuming **fish**, pasture-raised **beef**, chicken, **eggs**, or **milk**

- **Milk**: cancer risks can exceed 1×10^{-3} ; HQ up to 34 for children, 18 for adults
- **Drinking water, fish, beef**, and **eggs**: cancer risk can exceed 1×10^{-4} ; **fish** HQ up to 45 for children and 39 for adults

(**Bold** indicates highest risk pathways)



Draft Risk Estimates: Crop Farm Scenario

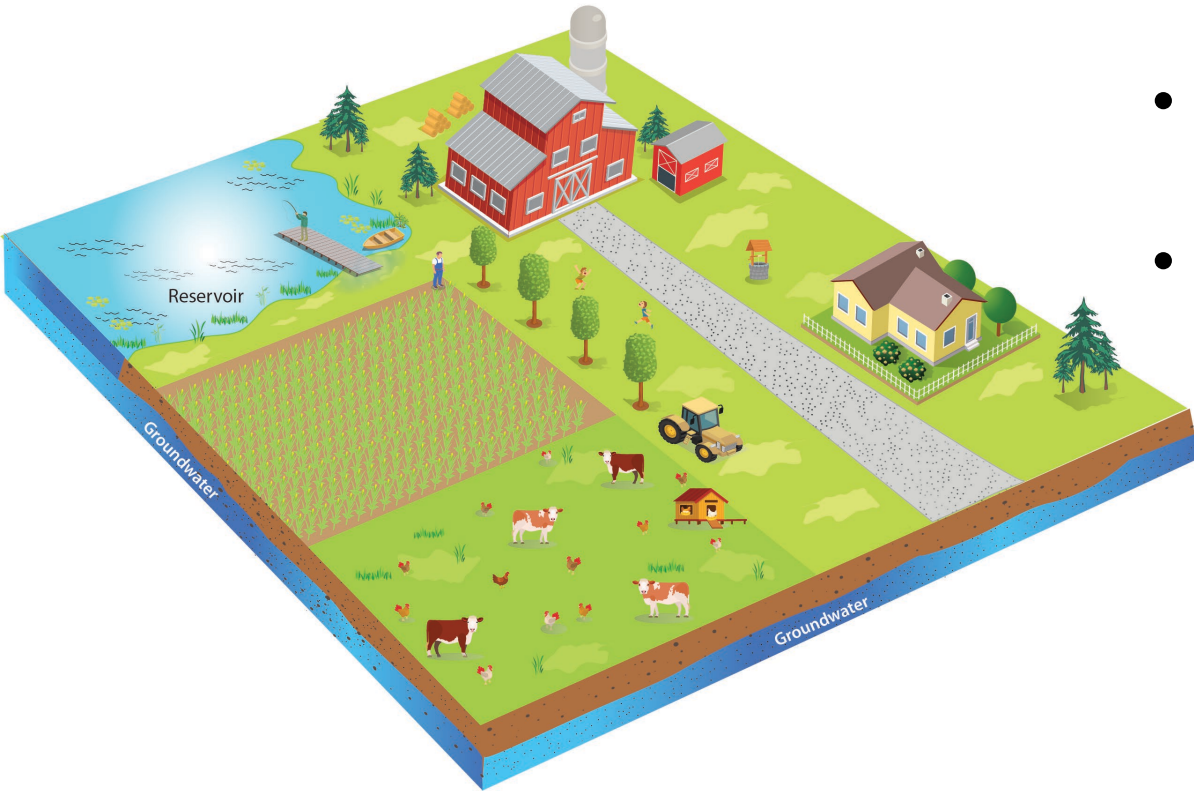


(**Bold** indicates highest risk pathways)

- Annual applications of 10 DMT/ha (median rate) for 40 years containing 1 ppb PFOA or PFOS. Assume annual tilling.
- Farm family lives on site for 10 years.
- In some scenarios, there may be risks associated with **drinking water**, consuming above ground fruits and vegetables, root vegetables, and **fish**
 - **Drinking water**: cancer risks can exceed 1×10^{-4} ; HQ up to 2.6
 - **Fish**: cancer risk can exceed 1×10^{-4} ; HQ up to 25 for children and 21 for adults
 - Fruits and vegetables: cancer risks exceeding 1×10^{-5} ; HQ up to 1.1

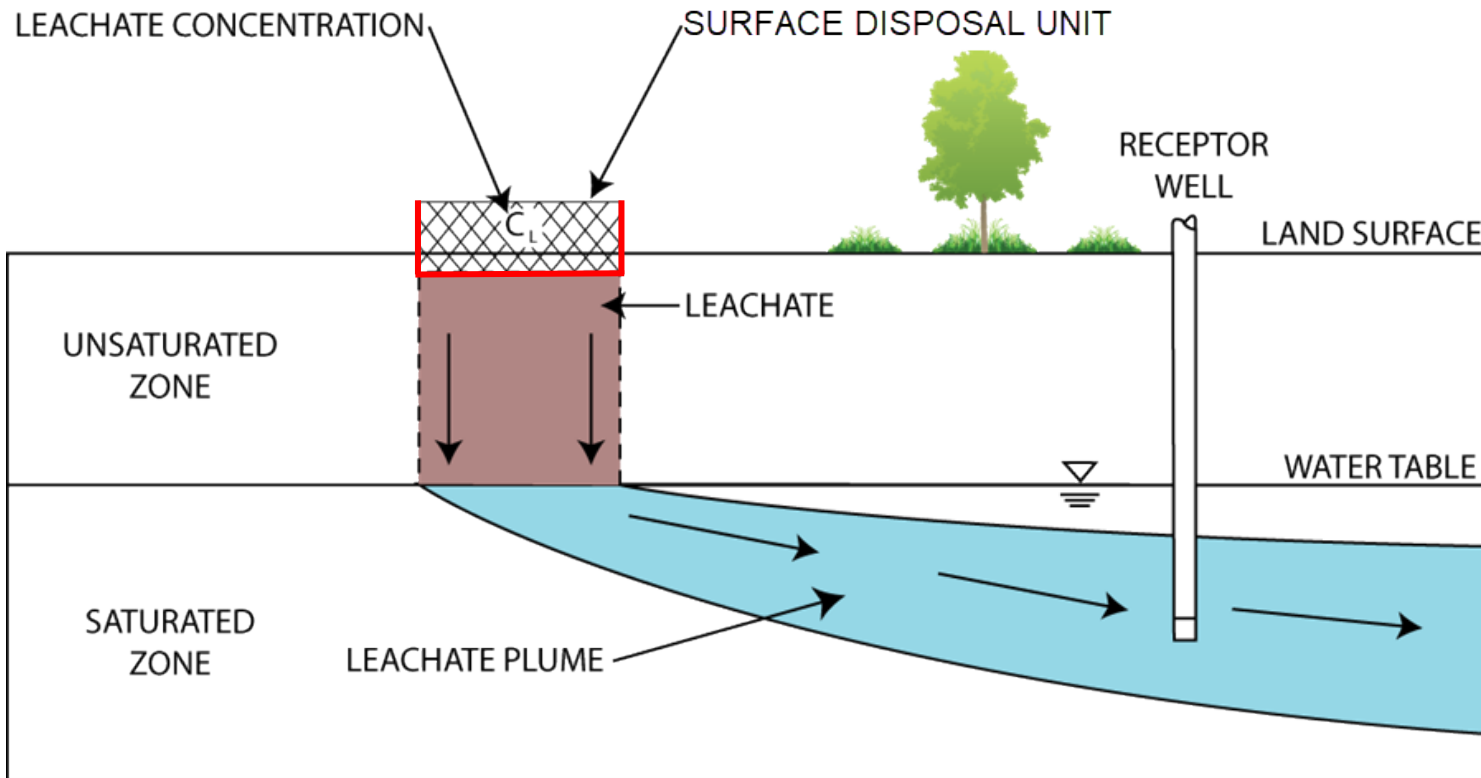
Draft Risk Estimates: Reclamation Scenario

- 1 application of 50 DMT/ha containing 1 ppb PFOA or PFOS. No tilling.
- Humans exposed to contaminated site for 10 years.
- In some scenarios, there may be risks associated with drinking water, consuming **fish**, pasture-raised beef, chicken, **milk**, and **eggs**
 - **Milk**: cancer risks can exceed 1×10^{-4} ; HQ up to 7.9 for children, 4.3 for adults
 - **Fish**: cancer risk can exceed 1×10^{-4} ; HQ up to 6.9 for children and 5.9 for adults
 - **Eggs**: cancer risk can exceed 1×10^{-4} ; HQ up to 1.3 for children and adults



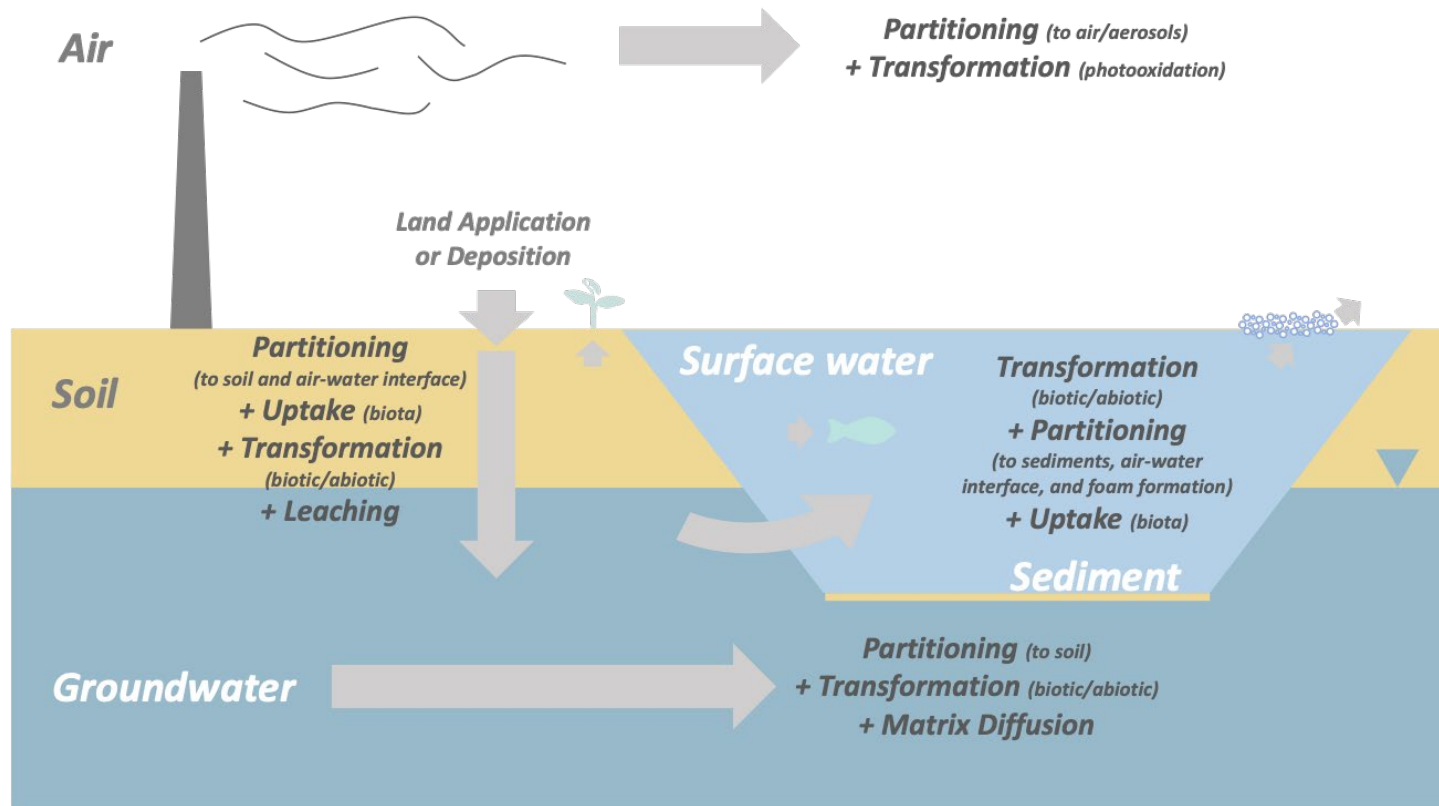
(**Bold** indicates highest risk pathways)

Draft Risk Estimates: Surface Disposal Scenario



- Humans exposed via contaminated drinking water for 10 years
- 1 ppb PFOA or PFOS associated with high risks for **drinking water**
 - For PFOA, drinking water can exceed 1×10^{-3} for unlined sites and 1×10^{-4} for clay-lined sites.
- No risks found for composite-lined sites

Draft Risk Description: Incineration



- Not able to model risks from deposition of PFOA or PFOS onto soils surrounding sewage sludge incinerators (SSI).
 - Lack of data regarding PFOA/PFOS destruction efficiency in a SSI
 - Lack of data on products of incomplete combustion
- Qualitatively conclude that there *may be* risks associated with soil deposition near SSIs, but more data needed.

Draft Risk Description: Home or Community Gardens



- Considered:
 - Home gardening with previously agriculture land application (*i.e.*, new development)
 - Community/home garden land application
- Lacking data on size of application area; application rates
- Qualitatively conclude that there *may be* risks associated with fruit and vegetable consumption, egg consumption from backyard flocks

Key Messages

- EPA is working to understand how people are exposed to PFAS, including through practices like use and disposal of sewage sludge, so that we can work to reduce PFAS exposure.
- EPA published a rigorous, data-driven draft risk assessment that, once finalized, can help the Agency determine whether regulating PFOA and PFOS in sewage sludge under the Clean Water Act is appropriate. The draft risk assessment is not a rule and does not compel any action.
- The draft risk assessment does not model risks for the general public. It is focused on risks to people who live on or near lands that use contaminated biosolids or to people who consume food produced on and water from those sites.
 - When sewage sludge containing low amounts of PFOA or PFOS is applied to agricultural or other lands or disposed of in an unlined or clay-lined surface disposal site, there may be risks to people living on or near those sites, or for people relying primarily on those sites' products. This exposure could significantly increase their risk to cancer or other illnesses.
 - Potential risks via incineration are possible but were not modeled due to data gaps.

Key Messages

- **Risk estimates were based on modeling hypothetical scenarios and do not apply to any specific site.**
 - Risk is expected to vary across regions and among properties depending on site-specific factors.
- **The models assume that exposure to PFOA and PFOS through sewage sludge is linear with the amount of these chemicals applied to land; if the concentration of PFOA or PFOS in sewage sludge or the amount of applied to a site is lowered, then risk is lowered by the same amount.**
- **The preliminary findings of the draft risk assessment underscore the importance of proactive federal and state policies to control and remove PFAS at their source.**
 - EPA encourages states to use their Clean Water Act permitting authorities and industrial pretreatment programs to require industrial dischargers of PFAS to remove them before sending their effluent to the environment or to wastewater treatment plants.
- **EPA is accepting public comments on the draft risk assessment for 60 days.**

Ongoing and Planned EPA Actions

- Planning a National Sewage Sludge Survey (NSSS) in collaboration with the publicly owned treatment works (POTW) Influent PFAS Study.
 - Obtain national occurrence and concentration data on PFAS in sewage sludge to inform future risk assessments and risk management actions.
- Effluent Limitations Guidelines: PFAS manufacturing facilities; electroplating facilities using PFAS-based fume suppressants and wetting agents; and landfills.
- PFAS research, especially agricultural uptake, fate, and transport
- PFAS destruction and disposal guidance

Resources

- Risk communication materials available on EPA's [website](#):
 - [Web FAQs](#)
 - Fact sheets
 - [General public](#)
 - [Wastewater treatment plants](#)
 - [Farmers](#)
 - [State water agencies](#)
- Technical documents available on EPA's [website](#) and in the [docket](#):
 - [Draft risk assessment](#)
 - [Response to external peer review comments](#)
 - [Response to select SAB comments](#)
- Infographic Fact Sheets for [PFOA](#) and [PFOS](#)