Improving PFAS Risk Assessments through Site-Specific Exposure Characterization

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GROUP 1

The Problem

Applying default exposure assumptions often overestimates risks when used to represent unique exposure settings. Risk assessments for per- and polyfluoroalkyl substances (PFAS) are especially sensitive to this bias due to the current toxicity factors that predict adverse health effects at extremely low exposure levels. Formulating representative exposure assumptions specific to each exposure scenario produces conclusions that are accurate, defensible, and protective of human health.

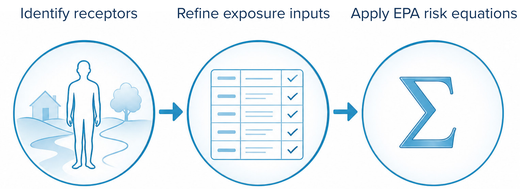
Approach

Site-specific exposure framework. Exposure assessments should be conducted in alignment with U.S. Environmental Protection Agency (EPA) guidance, using a tiered approach that integrates site data, land use records, and receptor activity patterns. This framework replaces generic national defaults with inputs grounded in the actual physical and demographic context of each site.

Human receptor identification. Potential receptors are identified through site visits, review of current and planned land uses, and evaluation of access conditions. Differentiating between residential, commercial, and recreational receptors is essential for selecting appropriate exposure parameters.

Refined exposure estimates. Site-, region-, and receptor-specific data are used to calibrate exposure frequency and duration. Key inputs include the EPA *Exposure Factors Handbook*, U.S. Bureau of Labor Statistics data, state residency tenure records, and outdoor recreation survey data. Each is applied to the specific activity type, age group, and access pattern observed at the site.

Risk estimation. Standard EPA risk equations ensure consistency with regulatory frameworks. The refinement occurs in the inputs, not in the equations themselves, preserving regulatory defensibility while improving accuracy.



Case Study A: Park Recreation Site

Receptor Selection

Default Options

Site-Specific Approach

Exposure Factors Selection

- **Activity:** Using playground equipment for recreation
- **Age**: Child to adolescent
- **Physical Setting:** Regional climate per season
- **Exposure Setting:** Outdoor only
- **Access:** Unrestricted, terrestrial land use only

Case Study B: Fenced Woodland Site

Receptor Selection

Default Options

Site-Specific Approach

Exposure Factors Selection

- **Activity:** Hiking on a wooded site
- **Age**: Adolescent
- **Physical Setting:** Regional climate per season
- **Exposure Setting:** Outdoor exposure to a mostly vegetated site
- **Access**: Restricted, terrestrial land use only

Exposure Assessment and Risk Characterization Results for Perfluorooctanoic Acid (PFOA) per Receptor

Parameter	Resident (default)	Park Recreator (site-specific)	Hiker (site-specific)
Age	Child and adult	Child	Adolescent
Exposure duration (yrs)	26	10	10
Exposure frequency (days/yrs)	350	72	30
Body weight (kg)	15 (child) / 80 (adult)	24	56
Ingestion rate of soil (mg/day)	200 (child) / 100 (adult)	35	16
Skin surface area exposed (cm^2)	2,373 (child) / 6,032 (adult)	1.773	3,106
Soil-to-skin-adherence factor (mg/cm^2 - event)	0.2 (child) / 0.07 (adult)	0.05	0.05
Soil Concentration (µg/kg)	15	15	15
Hazard Quotient	**8**	**0.2**	**0.02**
Cancer Risk	**8E-04**	**2E-05**	**2E-06**

Takeaway #1

Site-specific assumptions increase accuracy without sacrificing protection.

Applying site-specific exposure parameters typically produces risk estimates lower than the conservative default assumptions. The approach does not compromise protectiveness; it removes overestimation that distorts risk conclusions.

Takeaway #2

Defensible, site-specific data strengthens community and stakeholder engagement.

Accurate risk characterization improves the credibility of results with regulators, communities, and stakeholders. Risk conclusions derived from realistic inputs are easier to explain, easier to defend, and less likely to generate concern disproportionate to actual exposure.

Takeaway #3

Refined assumptions and improved communication lead to informed cleanup decisions.

Risk assessors have an obligation to characterize risk accurately—not just conservatively. Using site-specific data within the EPA framework produces results that are both regulatory-compliant and representative of how people interact with a site.

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