PFAS Update

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Interim Soil and Soil Leachate Remediation Standards for PFAS

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Interim Soil and Soil Leachate Remediation Standards for PFAS

- Interim Remediation Standards for soil and soil leachate were developed for PFNA, PFOA, PFOS, and GenX
- Publication in New Jersey Register October 17, 2022
- Remediation Standards (N.J.A.C. 7:26D)
  - Ingestion-Dermal Exposure Pathway
  - Inhalation Exposure Pathway
  - Migration to Ground Water Exposure Pathway

Interim Soil Remediation Standards (SRS) Ingestion-Dermal Exposure Pathway

- SRS for PFNA, PFOA, PFOS, and GenX calculated using the procedures, risk-based equations, and default residential and nonresidential exposure parameters contained at N.J.A.C. 7:26D
- Oral toxicity information and risk assessment methods used to generate SRS are consistent with those used to develop the GWQS and MCLs for PFNA, PFOA, and PFOS. USEPA Office of Water Reference Dose used for GenX
- SRS are based on a Hazard Quotient of 1 for noncarcinogens and a 1 in one million lifetime cancer risk level, pursuant to the Brownfield and Contaminated Site Remediation Act (N.J.S.A. 58:10B-1 et seq.)

Interim Soil Remediation Standards Inhalation Exposure Pathway

- Interim SRS for the inhalation exposure pathway have not been developed
  - Limited inhalation toxicity information
  - Inadequate chemical properties information

Interim Soil Remediation Standards
Migration to Groundwater Exposure Pathway

- Generic SRS-MGW for PFNA, PFOA, and PFOS **cannot** presently be calculated
- The calculation relies on the soil-water partitioning coefficient (K_d)
  - Up to a five order of magnitude difference in reported K_d values
  - Complexity of PFAS-soil interactions
- SRS-MGW will be calculated on an AOC/site-specific basis using the Synthetic Precipitation Leaching Procedure (SPLP) as described in N.J.A.C. 7:26D

Interim Soil Leachate Remediation Standards Migration to Groundwater Exposure Pathway

- SLRS-MGW for PFNA, PFOA, and PFOS calculated using the procedures, equations, and parameters contained at N.J.A.C. 7:26D
  - GWRS multiplied by the default dilution-attenuation factor (DAF) of 20
- SLRS-MGW are compared to field leachate concentrations calculated using the Department's SPLP calculator

Interim Soil and Soil Leachate Remediation Standards for PFAS

Contaminant	CAS No.	Soil Remediation Standard: Ingestion-Dermal Residential (mg/kg)	Soil Remediation Standard: Ingestion-Dermal Nonresidential (mg/kg)	Soil Remediation Standard: Migration to Ground Water (mg/kg)	Soil Leachate Remediation Standard: Migration to Ground Water (ppt)
PFNA	375-95-1	0.047	0.67	AOC/Site-specific	260
PFOA	335-67-1	0.13	1.8	AOC/Site-specific	280
PFOS	1763-23-1	0.11	1.6	AOC/Site-specific	260
GenX	13252-13-6 & 6203780-3	0.23	3.9	NA	NA

Interim Soil and Soil Leachate Remediation Standards Website

- https://www.nj.gov/dep/srp/guidance/rs/interim_soil_ia_rl_rs.html

Table of Interim Soil Remediation Standards for the Ingestion-Dermal Exposure Pathway

Contaminant	CAS No.	Non-Carcinogenic Health-Based Criterion (mg/kg)		Carcinogenic Health-Based Criterion (mg/kg)		Reporting Limit (mg/kg)	Interim Soil Remediation Standard (mg/kg)		Effective Date	Fact Sheet
		Residential Criterion	Nonresidential Criterion	Residential Criterion	Nonresidential Criterion		Residential Standard	Nonresidential Standard		
There are currently no interim standards.										
Explanation of Terms: CAS No. = Chemical Abstracts System Registration Number										

Table of Interim Soil Remediation Standards for the Inhalation Exposure Pathway

Contaminant	CAS No.	Non-Carcinogenic Health-Based Criterion (mg/kg)		Carcinogenic Health-Based Criterion (mg/kg)		Soil Saturation Limit (mg/kg)	Reporting Limit (mg/kg)	Interim Soil Remediation Standard (mg/kg)		Effective Date	Fact Sheet
		Residential Criterion	Nonresidential Criterion	Residential Criterion	Nonresidential Criterion			Residential Standard	Nonresidential Standard		
There are currently no interim standards.											
Explanation of Terms: CAS No. = Chemical Abstracts System Registration Number											

Table of Interim Soil Remediation Standards for the Migration to Ground Water Exposure Pathway

Contaminant	CAS No.	Ground Water Remediation Standard (µg/L)	Migration to Ground Water Soil Criterion (mg/kg)	Soil Saturation Limit (mg/kg)	Reporting Limit (mg/kg)	Interim Soil Remediation Standard (mg/kg)	Effective Date	Fact Sheet
Methanol	67-56-1	4,000	12	160,000	5	12	11/17/2021	April 2022
Explanation of Terms: CAS No. = Chemical Abstracts System Registration Number								

Synthetic Precipitation Leaching Procedure (SPLP) and Soil Remediation Standards for the Migration to Ground Water Exposure Pathway

May 25, 2022

Greg Toffoli, Section Chief
CSRRP, Bureau of Environmental Evaluation & Risk Assessment

Interim Soil Remediation Standards
Migration to Groundwater Exposure Pathway

- Generic SRS-MGW for PFNA, PFOA, and PFOS **cannot** presently be calculated
- The calculation relies on the soil-water partitioning coefficient (K_d)
  - Up to a five order of magnitude difference in reported K_d values
  - Complexity of PFAS-soil interactions
- SRS-MGW will be calculated on an AOC/site-specific basis using the Synthetic Precipitation Leaching Procedure (SPLP) as described in N.J.A.C. 7:26D

Synthetic Precipitation Leaching Procedure (SPLP) and Soil Remediation Standards for the Migration to Ground Water Exposure Pathway

- National concern that PFAS adsorbs onto SPLP apparatus
- No empirical data existed to demonstrate efficacy of PFAS extraction using SPLP
- Lack of data makes using SPLP to develop SRS-MGW questionable

SPLP and Soil Remediation Standards for the Migration to Ground Water Exposure Pathway Research

- CSRRP to determine if SPLP is a viable approach
- Design and coordinate a multi-laboratory research experiment
- Perform full validation and data review
- Conclude if SPLP could be used to establish site-specific SRS-MGW

SPLP Research Design
Laboratory Criteria

- Laboratories were chosen based on certification status
  - Certified for SPLP
  - Certified for user-defined non-potable water method
- Laboratories used their own methods for the study
- Methods were similar among the laboratories
  - SPLP
  - Analytical – 537.1 analyte list with isotope dilution

SPLP PFAS Research Design Fortification Levels

- 5 different fortified/spiked leachate concentrations (containing PFOA, PFNA, PFOS, GenX and 14 additional PFAS), 3 duplicate analyses
- 10 ng/L (n = 2)
- 50 ng/L (n = 1)
- 250 ng/L (n = 2)
- 500 ng/L (n = 1)
- 1000 ng/L (n = 2)
- Sample blank (0 ng/L)

SPLP Research Design Methodology Overview

Sample Preparation

Leachate Fluid tumbled (16 – 20 hours)

Filtration of leachate fluid

Extraction of leachate fluid

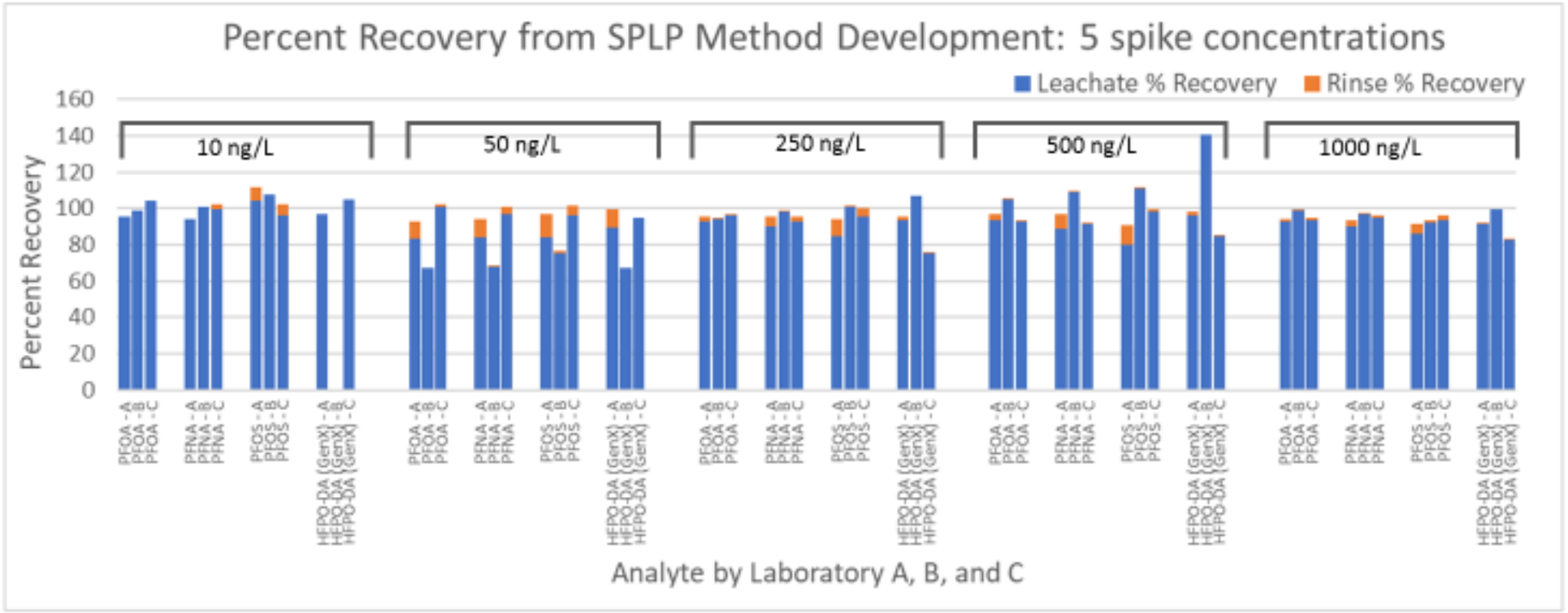
Concentration of extract

After leachate fluid processing, MeOH rinse of equipment

Concentration of MeOH rinse

Analysis

PFOA, PFNA, PFOS, and Gen X Percent Recoveries (across 5 spike conc.)



SPLP Percent Recoveries for PFAS Leachate

Contaminant	CAS No.	10.0 ng/L	50.0 ng/L	250 ng/L	500 ng/L	1000 ng/L	Averages
PFNA	375-95-1	98.2	82.9	93.6	96.3	94.0	93.0
PFOA	335-67-1	99.5	83.6	94.2	97.1	95.1	93.9
PFOS	1763-23-1	102.7	85.2	93.7	96.1	90.6	93.7
GenX	13252-13-6 & 6203780-3	100.7	83.9	91.9	107	91.2	94.9

SPLP Percent Recoveries for PFAS MeOH Rinsate

Contaminant	CAS No.	Range	Averages
PFNA	375-95-1	0 – 7.7	2.6
PFOA	335-67-1	0 – 9.6	1.4
PFOS	1763-23-1	0 – 13	4.4
GenX	13252-13-6 & 6203780-3	0 – 9.8	1.1

Synthetic Precipitation Leaching Procedure (SPLP) Research Conclusions

- Data indicate acceptable percent recoveries for PFOA, PFNA, and PFOS without having to modify the SPLP method
- Data indicate acceptable percent recoveries for GenX
- SPLP can be used to generate site-specific SRS-MGW using the ARS process
- Data and conclusions will be shared with other state agencies and EPA

Questions?