



UNITED STATES ENVIRONMENTAL PROTECTION AGENCY

Region 1

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To: Richard Hull

From: Courtney Carroll

Date: September 4, 2024

RE: Risk screening and evaluation of PFAS concentrations in surface water for the recreational pathway at the Coakley Landfill NPL Site

The purpose of this memorandum is to provide a screening and risk evaluation for the most recent available surface water data for Perfluorooctanoic acid (PFOA), Perfluorooctane sulfonate (PFOS), Perfluorobutane sulfonate (PFBS), Perfluorononanoic acid (PFNA), Perfluorohexanesulfonic acid (PFHxS), and Perfluorodecanoic acid (PFDA) for the recreational exposure pathway at the Coakley Landfill NPL Site. This screening and risk evaluation was performed using analytical data for surface water samples collected during 2023 and 2024. Surface water samples were collected by the Coakley Landfill Group from wetland areas that form the headwaters for Berrys Brook and Little River, from within Berrys Brook and Little River, and from the leachate seep located at the north-west corner of the landfill. A child recreator was selected as the receptor for this risk screening and evaluation. The recreator is an exposure scenario for a person who spends time wading in surface water and may be exposed through incidental ingestion and dermal contact.

Screening of PFAS data:

For the screening step, the maximum concentrations of PFOA, PFOS, PFBS, PFNA, PFHxS, and PFDA were selected from the surface water analytical data for June 2023, January 2024, and June 2024 sampling events. The maximum surface water detections for each PFAS compound and each sampling event were compared to the corresponding surface water screening level. The EPA Regional Screening Level (RSL) Calculator was used in a site-specific mode to obtain the screening levels for PFOA, PFOS, PFBS, PFNA, PFHxS, and PFDA. The maximum concentrations in bold represent concentrations that exceed the surface water screening level. Tables 1, 2, and 3 below present the maximum concentrations of PFAS in surface water for June 2023, January 2024, and June 2024, compared to the site-specific screening levels. Results of the screening show that maximum concentrations of PFOA, PFOS, PFNA, and PFDA exceeded the site-specific surface water screening levels in one or more of the 2023 and 2024 sampling rounds. Therefore, PFOA, PFOS, PFNA, and PFDA will be carried forward for risk evaluation.

**Table 1 – Screening of June 2023 Surface Water Data**

<b>PFAS compound</b>	<b>Maximum Concentration (ng/L)</b>	<b>Surface Water Site-Specific Screening Level (ng/L)</b>
PFOA	<b>569</b>	0.25
PFOS	<b>1100</b>	10.1
PFBS	6.54	30,200
PFNA	<b>360</b>	256
PFHxS	18.8	1,750
PFDA	<b>193</b>	0.203

**Table 2 – Screening of January 2024 Surface Water Data**

<b>PFAS compound</b>	<b>Maximum Concentration (ng/L)</b>	<b>Surface Water Site-Specific Screening Level (ng/L)</b>
PFOA	<b>459</b>	0.25
PFOS	<b>744</b>	10.1
PFBS	5.22	30,200
PFNA	243	256
PFHxS	19.6	1,750
PFDA	<b>126</b>	0.203

**Table 3 – Screening of June 2024 Surface Water Data**

<b>PFAS compound</b>	<b>Maximum Concentration (ng/L)</b>	<b>Surface Water Site-Specific Screening Level (ng/L)</b>
PFOA	<b>318</b>	0.25
PFOS	<b>795</b>	10.1
PFBS	6.48	30,200
PFNA	210	256
PFHxS	19.1	1,750
PFDA	<b>222</b>	0.203

Estimation of Exposure

In risk assessment, to evaluate the magnitude of potential human exposures, the concentrations of PFOA, PFOS, PFNA, and PFDA must be estimated. An estimate of this concentration is referred to as an Exposure Point Concentration (EPC). EPA recommends calculation of the 95% Upper Confidence Level (UCL) on the arithmetic mean concentration for estimation of risk. The 95% UCLs for PFOA, PFOS, PFNA, and PFDA were calculated using ProUCL (version 5.2) and are displayed in Table 4 below. The combined surface water data set for June 2023, January 2024, and June 2024 was used in the calculation of the EPCs which included three sampling rounds and 30 data points for each PFAS compound.

**Table 4 – Exposure Point Concentrations (EPCs) for PFOA, PFOS, PFNA, and PFDA**

<b>PFOA</b>	<b>PFOS</b>	<b>PFNA</b>	<b>PFDA</b>
243 ng/L	356 ng/L	123 ng/L	63.5 ng/L

Calculation of Risk

The EPCs obtained for PFOA, PFOS, PFNA, and PFDA representing the 95% UCLs were used in the EPA RSL calculator to generate estimates of risk for the child recreator. The exposure parameters used for the child recreator assumed default inputs, except for exposure frequency, exposure time, and exposure events per day. The RSL calculator requires site-specific values be entered for these parameters. Exposure frequency was assumed to be 45 days per year and an exposure duration of 6 years. Exposure time was assumed to be one hour per event and assumed to occur once per day.

Toxicity values used in the risk calculations for PFOA and PFOS were based on values from EPA Office of Water which were released in April 2024. The non-cancer reference dose for PFOA is  $3.0 \times 10^{-8}$  (mg/kg/day) and for PFOS is  $1.0 \times 10^{-7}$  (mg/kg/day). The oral cancer slope factors are  $2.93 \times 10^4$  [mg/kg/day]<sup>-1</sup> for PFOA and  $3.95 \times 10^1$  [mg/kg/day]<sup>-1</sup> for PFOS. For PFNA, the non-cancer reference dose is  $3.0 \times 10^{-6}$  (mg/kg/day) based on toxicity information from ATSDR. The non-cancer reference dose for

PFDA is  $2.0 \times 10^{-9}$  (mg/kg/day) based on toxicity information from EPA IRIS. No cancer toxicity values are currently available for PFNA or PFDA.

Estimates of ILCR represent the lifetime incremental risk of cancer from the Site. Hazard quotient (HQ) estimates represent the risk of health effects other than cancer from exposure to contaminants. A hazard index (HI) is obtained by summing HQs for individual contaminants. Table 5 presents the estimated results for ILCR, while Table 6 presents the results for estimated non-cancer hazards. It is noted that for both cancer and non-cancer risk PFOA includes both ingestion and dermal exposure routes. For PFNA, estimation of non-cancer hazard includes both ingestion and dermal routes; however, ILCR cannot currently be estimated for PFNA due to lack of cancer toxicity values and therefore it was not included in the cancer risk calculation. Risks from PFOS and PFDA are based on ingestion only due to lack of dermal toxicity information. PFDA does not currently have cancer toxicity values available and therefore was not included in the cancer risk calculation. There is currently insufficient toxicity data to estimate risk from inhalation exposure to PFAS.

**Table 5 – ILCR Estimates for PFOA and PFOS**

Chemical	Ingestion	Dermal	Incremental Lifetime Cancer Risk (ILCR)
PFOA	9.47E-04	2.62E-05	9.73E-04
PFOS	1.87E-06	-	1.87E-06
<b>Total Risk</b>	<b>9.49E-04</b>	2.62E-05	<b>9.75E-04</b>

**Table 6 – Non-cancer Hazard Estimates for PFOA, PFOS, PFNA, and PFDA**

Chemical	Ingestion	Dermal	Non-cancer hazard quotient (HQ)
PFOA	7.99	0.119	8.11
PFOS	3.51	-	3.51
PFNA	0.04	0.00762	0.0481
PFDA	31.3	-	31.3
<b>Hazard Index (HI)</b>	<b>42.9</b>	0.126	<b>43.0</b>

Risk results shown in Table 5 indicate that the total ILCR exceeds the EPA target cancer risk range of  $10^{-4}$  to  $10^{-6}$ . The results for non-cancer hazard shown in Table 6 indicate that the total non-cancer hazard index for PFOA, PFOS, PFNA, and PFDA exceeds a target limit of 1. Additionally, the target endpoint of developmental effects also exceeds the target limit of 1.

#### References

U.S. Environmental Protection Agency (EPA). 1989. *Risk Assessment Guidance for Superfund. Volume I: Human Health Evaluation Manual. Part A. Interim Final.* EPA/540/1-89/002. December 1989.

U.S. Environmental Protection Agency (EPA). 1992. *Supplemental Guidance to RAGS: Calculating the Concentration Term.* Office of Solid Waste and Emergency Response. Washington, D.C. Publication 9285.7-081. May 1992.

U.S. Environmental Protection Agency (EPA). 2002a. *Calculating Upper Confidence Limits for Exposure Point Concentrations at Hazardous Waste Sites*. OSWER 9285.6-10 Office of Emergency and Remedial Response, Washington, DC. December 2002.

U.S. Environmental Protection Agency (EPA). 2021. Provisional Peer-Reviewed Toxicity Values for Perfluorobutane Sulfonic Acid (PFBS) and Related Compound Potassium Perfluorobutane Sulfonate. Office of Research and Development, Center for Public Health and Environmental Assessment, EPA/690/R-21/001F, 2021.

U.S. Environmental Protection Agency (EPA). 2022. *ProUCL Version 5.2 for Environmental Applications for Data Sets with and without Nondetect Observations*. Prepared for EPA by Lockheed Martin Environmental Services. 2022.

U.S. Environmental Protection Agency (EPA). 2024a. Final Human Health Toxicity Assessment for Perfluorooctanoic Acid (PFOA) and Related Salts. USEPA Office of Water, Health and Ecological Criteria Division, 815R24006, 2024. <https://www.epa.gov/system/files/documents/2024-05/final-human-health-toxicity-assessment-pfoa.pdf>

U.S. Environmental Protection Agency (EPA). 2024b. Final Human Health Toxicity Assessment for Perfluorooctane Sulfonic Acid and Related Salts. USEPA Office of Water, Health and Ecological Criteria Division, 815R24007, 2024. <https://www.epa.gov/system/files/documents/2024-05/final-human-health-toxicity-assessment-pfos.pdf>

U.S. EPA. 2024c. Toxicological Review of Perfluorodecanoic Acid (PFDA) and Related Salts (Final Report, 2024). U.S. Environmental Protection Agency, Washington, DC, EPA/635/R-24/172Fa, 2024.