

# Letter Health Consultation

## Per- and Poly-fluoroalkyl Substances (PFAS) in Soil at Five Areas of Interest, Lower Issaquah Valley, Issaquah, King County, WA

October 9, 2024

Prepared by

The Washington State Department of Health  
Under a Cooperative Agreement with the  
Agency for Toxic Substances and Disease Registry



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## **Foreword**

### Letter Preparation

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Kim Wooten  
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Re: Letter Health Consultation: PFAS in soil at five areas of interest located in the Lower Issaquah Valley (LIV). Issaquah, King County, Washington  
Evaluation of PFAS soil data results

Dear Kim Wooten:

The Washington State Department of Health (DOH) Site Assessment and Toxicology (SAT) Section conducted this letter health consultation (LHC) in response to a request received by your agency surrounding the potential for per- and poly-fluoroalkyl substances (PFAS) in five areas of interest located in the Lower Issaquah Valley (LIV):

- West Playfield at Issaquah Valley Elementary (West Playfield),
- Issaquah Valley Elementary East Ballfields (Dodd Fields Park),
- North of 190 East Sunset Way (Memorial Field),
- West of 135 East Sunset Way on the former rail grade (Rainier Trail) and,
- 175 Newport Way Northwest, Issaquah, Washington (Figure 1).

These sites were selected due to identified releases of PFAS to soil and groundwater due to historical firefighting training exercises conducted on these properties [1]. The purpose of this LHC is to review and evaluate the information for potential risks to human health and provide recommendations based on the available data and current science.

**Background**

PFAS aqueous firefighting foam (AFFF) was used at training exercises for 10 or more years at the current location of the Eastside Fire and Rescue Headquarters (EFRHQ, Figure 1). In addition, training exercises associated with the EFRHQ were conducted at the properties listed above and included use of AFFF. These training exercises are believed to be the source for PFAS release into the soil and groundwater at the locations within the LIV. These sites within the LIV are all Washington State Department of Ecology (Ecology) cleanup sites, or immediately adjacent to one (Figure 1). In 2013, the

city of Issaquah detected Perfluorooctane sulfonic acid (PFOS) in a groundwater well [1]. Additional groundwater samples were collected in 2014 through 2018 by the City of Issaquah [1]. In 2015 and 2018, the City of Issaquah collected more groundwater samples from a production well [1]. The PFAS levels in this well were less than Ecology's Investigatory Levels (ILs)<sup>1</sup> [1, 2] that were in use at the time.

In 2016 and 2018, Farallon Consulting, representing EFR, collected multi incremental (MI) soil samples in the LIV [1]. MI sampling in the LIV involved collecting soil samples from 30 locations at a specified depth from a total of 8 decision units. Two decision units were sampled at West Playfield, Dodd Fields, and 175 Newport Way, and one each at Memorial Field and Rainier Trail. The 30 samples from each decision unit were then homogenized together to provide an average concentration across each decision unit. MI sampling occurred in each decision unit at a depth interval 0 to 6 inches below ground surface (bgs). Discrete soil samples were also collected at depths from 2 to 25 feet bgs in the LIV [1], but these samples were not screened for this LHC due to their depth below what would be feasible for direct contact under typical conditions.

During this effort, groundwater and soil samples were analyzed for 13 PFAS chemicals: (Perfluorooctanoic Acid (PFOA), Perfluorooctane Sulfonate (PFOS), Perfluorononanoic Acid (PFNA), Perfluorodecanoic Acid (PFDA), Perfluorodecane Sulfonic Acid (PFDS), Perfluoroundecanoic Acid (PFUnDA), Perfluorododecanoic Acid (PFDoDA), Perfluorobutanoic Acid (PFBA), Perfluorobutane Sulfonic Acid (PFBS), Perfluorohexanoic Acid (PFHxA), Perfluorohexane Sulfonic Acid (PFHxS), Perfluoroheptanoic Acid (PFHpA), and Perfluoroheptane Sulfonic Acid (PFHpS)). Some PFAS analyzed for in groundwater and soils were not detected in any samples. The data used to screen contaminants for this LHC included only MI soil samples and zero to six inches were chosen to represent child playing in soil.

## Results and Discussion

PFAS are a class of manufactured chemicals that have been used since the 1950s to make products resistant to heat, oil, stains, grease, and water. PFAS are a growing group of over 14,000 fluorinated man-made chemicals, that the health effects of only some PFAS compounds has been studied. They have been found in some fire-fighting foams and consumer products such as nonstick cookware, stain-resistant carpets, fabric coatings, food packaging, cosmetics, and personal care products [3]. People can be exposed to PFAS in the air, indoor dust, food, water, and consumer products. Because of their extensive use, PFAS are a common exposure for the general United States population [3-6].

PFAS persist in the environment. PFAS are water soluble and may be detected in the soil, sediment, water, or biota. Studies indicate that some PFAS move through the soil and easily enter groundwater where they may travel long distances [7]. On April 10, 2024, the EPA announced the first federal limits on PFAS in public drinking water, which would require water utilities to reduce PFAS concentrations to less than that allowed where the water supply is contaminated with those PFAS, as described in: [Per- and Polyfluoroalkyl Substances \(PFAS\) | US EPA](#) [8].

DOH reviewed soil data and compared the measured concentrations of PFAS to Health Based Comparison Values (HBCVs), or other screening levels (SLs), which are intended to protect the public from adverse health effects [9]. The maximum detected concentration was used, unless the compound was not detected. In that case, the value of the method detection limit was used in the process. For

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<sup>1</sup> Ecology's historical PFAS Investigatory Levels (ILs) are now superseded. Following the promulgation of the Department of Health's State Advisory Levels (SALs) Ecology no longer uses investigatory levels.

screening purposes, the ATSDR's Intermediate Environmental Media Evaluation Guide<sup>2</sup> (int EMEG) for non-cancer exposure was used in this LHC. Where there were no int EMEG available, we used the ATSDR Reference Dose Media Evaluation Guide (RMEG)<sup>3</sup> or other SLs (see Table 1).

During exposure pathway evaluation, a complete exposure pathway was identified when there was a reasonable likelihood that people would come into contact with contaminated soil. For this LHC, when a PFAS was present in soil, but did not exceed the HBCV/SL, no further evaluation of that PFAS was necessary. When a PFAS was found to be above a HBCV/SL, further evaluation of that PFAS was performed. It is important to note that a PFAS identified above the HBCV/SL does not necessarily mean that adverse health effects will occur if people are exposed. However, for the landscaped areas along the Rainier Trail, and grass median and stormwater retention basin along 175 Newport Way Northwest the adult RMEG was used as the SL because children are unlikely to have opportunities to dig or play in the soil in these areas. Groundwater was not evaluated in this LHC at the request of Ecology because direct exposure is not occurring to groundwater at these locations.

For the evaluation presented herein, PFAS exposure can occur to a child, a visitor, or a worker from accidentally eating, touching, or breathing in soil during recreational activities or to workers that dig in the soil. Therefore, DOH used standard risk assessment with default central tendency (CTE) values, a trespasser/recreational scenario, and a school scenario in this evaluation. Based on our evaluation, the trespasser/recreational scenarios were more protective of health than the school scenarios.

Table 1 in the appendix, summarizes the maximum PFAS concentrations that exceed HBCVs in soil for each area of interest evaluated. PFDA in surface soil exceeded HBCV at West Playfield, Dodds Field Park, and Memorial Field. PFDA was identified as the chemical of concern for present and current exposures, so PFDA was retained for further evaluation. However, it is important to note that just because a chemical was found above the HBCV does not necessarily mean that adverse health effects will occur if people are exposed.

### **Health effects from exposure to PFAS**

The primary non-cancer effects observed in laboratory animals exposed to PFAS include developmental toxicity, immune toxicity, and liver and kidney toxicity [10]. Numerous human epidemiology studies have examined associations between various harmful health effects and serum levels of PFAS in exposed workers, residents exposed to high levels of PFAS released by facilities, and people exposed to background levels of PFAS. The strongest evidence from epidemiological studies is for links between higher exposures to perfluoroalkyl acids (PFAAs) and reduced antibody response to childhood vaccines, increased serum cholesterol and liver enzymes, and slightly reduced birth weights. More limited evidence exists for links to thyroid disease, hormone disruption, and reduced resistance to infections, cardiovascular disease, and cancer. However, PFDA was the only PFAS retained for further evaluation based on a child exposure and only at West Playfield, Dodds Play Field Park, and Memorial Field Park.

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<sup>2</sup> Environmental Media Evaluation Guides (EMEGs) are ATSDR comparison values that are based on ATSDR's minimal risk levels for non-cancer health effects. They represent estimated contaminant concentrations below which humans exposed during a specific timeframe (acute, intermediate, or chronic) are not expected to experience noncarcinogenic health effects. Intermediate exposure means contact with a substance that occurs for more than 14 days and less than a year (15-364 days) [compare with acute exposure and chronic exposure].

<sup>3</sup> RMEG is an ATSDR-derived comparison value based on non-cancer health effects for chronic exposure duration only. RMEGs represent the concentration in a specific medium (e.g., water or soil) at which daily human exposure is unlikely to result in adverse noncarcinogenic effects. ATSDR derives RMEGs from EPA's reference doses (RfDs) and reference concentrations (RfCs).

### **Exposure assessment: Dose Calculations (non-Cancer)**

DOH used the MI soil maximum concentration for PFDA detected at West Playfield, Dodds Play Field Park, and Memorial Field Park to calculate non-cancer doses. We used the ATSDR Public Health Assessment Site Tool (PHAST) along with default central tendency (CTE) trespassers/recreational scenario assumptions to calculate doses for soil exposure. Calculated exposure doses along with oral reference dose (RfD) was used to calculate a hazard quotient (HQ), which is the ratio of the exposure doses divided by the appropriate PFAS RfD.

Table 2 shows trespassers/recreational scenario calculated doses for a child exposure at West Playfield, with the highest at the one-to two-year age group. This dose of 1.8E-08 mg/kg/day is above the RfD of 2.0E-09 mg/kg/day. The concentration of PFDA in soil exceeded the HQ of one (HQ >1) and the HQs ranged from 1.6 to 8.9 for children's exposures at West Playfield.

Similarly, Table 3 shows a school scenario calculated doses for a child exposure at West Playfield, with the highest at the Pre-Kindergarten age group. This dose of 5.4E-09 mg/kg/day is above the RfD of 2.0E-09 mg/kg/day. The concentration of PFDA in soil exceeded the HQ of one (HQ >1) and the HQs from Pre-Kindergarten to Middle School ranged from 1.0 to 2.7 for children's exposures at West Playfield.

Based on our evaluations, the trespasser/recreational scenarios were more protective of health than the school scenario. Therefore, only trespasser/recreational scenarios are summarized here. PFDA in soil at Dodds Field Park exceeds HQ >1 and ranged from 1.0 to 4.9 for age groups birth through 16 years. Similarly, PFDA in soil at Memorial Field exceeds HQ >1 and ranged from 1.7 to 4.7 for age groups birth through 11 years. Tables that summarize this are available on request.

### **Exposure to PFDA and other PFAS**

Very little scientific information is available from either human or animal studies about the health effects from exposure to other PFAS including PFDA. There are insufficient data for derivation of a chronic, intermediate and acute-duration oral ATSDR Minimal Risk Levels (MRL)<sup>4</sup> for PFDA [11]. However, during pregnancy when PFDA was measured in humans, decreased birth weight developmental effects were seen [12]. PFDA also shows decreased antibody immune responses [12]. The health effects of many short-chained PFAS and new PFAS alternatives have not been fully researched or not researched at all.

### **Summary of Limitations and Uncertainties**

Assessment of risks attributable to environmental exposures is complicated due to a lot of uncertainty. Uncertainty regarding the health assessment process refers to the lack of knowledge about factors such as chemical toxicity, human variability, human behavior patterns, and chemical concentrations in the environment. Uncertainty can be reduced through further study.

This LHC has used data from one or two decision units at each area of interest in the LIV using a multi-incremental soil sampling effort. Soil samples were collected from eight decision units at a depth interval of 0 to 6 inches bgs, as described above. The maximum concentration was used to calculate an exposure dose value. Other limitations and uncertainties were considered including multiple exposure

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<sup>4</sup> Minimal Risk Level (MRL) – It is an estimate of daily human exposure to a hazardous substance that is likely to be without an appreciable risk of adverse noncancer health effects over a specified route and duration of exposure.

sources, lack of historical exposure data, incomplete information on AFFF and specific PFAS formulations used and lack of health guidelines for some PFAS.

DOH's evaluation for the LIV community is based primarily on soil sampling results of 13 analyzed PFAS. We did not assess the drinking water pathway because the city of Issaquah provides public water for residents living in the LIV. However, because the type of AFFF used at the LIV site and its specific PFAS formulation are unknown, the soil sampling for 13 PFAS may not capture the full spectrum of potential exposure. Identification of new and additional PFAS species in AFFF-impacted groundwater is ongoing in the LIV. Little is known about newly discovered PFAS, and additional, but not newly discovered PFAS have not been adequately studied. Therefore, risk estimate results are likely biased low or high due to uncertainties and data limitations.

### **Conclusions**

After reviewing the available information and considering the known factors that may contribute to the health effects of PFAS exposures, DOH herein provides the following conclusions regarding the five areas of interest studied in the LIV. Our conclusions are limited by several uncertainties relating to the human health risks associated with PFAS exposures, as noted above. Because of these uncertainties, DOH used a conservative approach, including several lines of evidence to evaluate the public health implications of exposures to PFAS at the LIV site.

**Conclusion 1.** Based on the available soil information and CTE exposures, DOH concludes that direct contact, accidentally ingesting, or inhaling dust/soil could increase harmful health effects from PFAS, particularly for young children and infants.

**Basis for Decision.** The estimated exposure doses for PFDA from soil were above the EPA's reference dose, indicating a potential for non-cancer health concerns.

Research in humans suggests that high levels of certain PFAS may lead to increased cholesterol levels, changes in liver enzymes, decreased vaccine response in children, increased risk of high blood pressure or pre-eclampsia in pregnant women, small decreases in infant birth weights, and increased risk of kidney or testicular cancer. Developmental (especially in animals) and immune effects are the most sensitive endpoint for multiple PFAS.

The combined exposures to a mixture of PFAS could have increased risk for developmental and immune effects above what might be expected from exposure to any of these PFAS alone. For other PFAS and other health endpoints, the scientific information is uncertain.

### **Recommendations**

It is important to note that this discussion and the following recommendations are specific to the LIV community. The community in this study may be directly exposed to some PFAS including being exposed from a variety of sources. As such, their exposure may not be reflective of the general population and these findings and recommendations do not represent DOH's general position on health risk from PFAS due to ingestion or dermal exposure.

To continue to protect public health of residents accidentally ingesting or inhaling soil at the areas of concern referred to herein in the LIV, DOH recommends:

- The parties responsible for the PFAS contamination, in coordination with Ecology, and the public drinking water authorities, should continue implementing a long-term remedy to permanently mitigate public exposures to contaminated soil sources in the LIV.
- The parties responsible for the PFAS contamination, in coordination with Ecology should continue to conduct investigative and confirmatory soil sampling to further understand PFAS concentrations in the area that people can be exposed to.

DOH encourages any resident with long-term exposures or elevated PFAS in their blood to reduce exposures from all sources of PFAS. Community members should take steps to reduce their potential background sources of PFAS exposure, including avoiding or limiting the use of products containing PFAS. Examples of products that may contain PFAS include non-stick cookware, stain resistant carpets, water repellent clothing, cleaning products, make-up and personal care products, See DOH ([PFAS Basics Series - YouTube](#)).

### **Public Health Action Plan**

In coordination with our agency partner at Ecology, local health districts, and the local water authorities, DOH is available to:

- Review data and update the recommendations of this health consultation.
- Provide outreach and education materials to parents and community members.

DOH appreciates the opportunity to assist Ecology with the five areas of concern in the LIV. Please contact me at 360-236-3192 if you have any questions.

Sincerely,

/s/Elmer Diaz

Elmer Diaz  
Health Assessor Toxicologist  
Site Assessments and Toxicology Section.

cc: Lenford O'Garro, Department of Health,  
Priscilla Thomson, Department of Ecology



## References

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Appendix

Figure 1. Map PFAS contamination in the Lower Issaquah Valley. Source: Ecology.




**Table 1. Maximum MI Concentrations in milligrams per kilogram (mg/kg) of PFAS Detected in the LIV soils Compared to Health-Based Comparison Values.**

<b>Contaminant Name and location</b>	<b>Maximum MI soil Concentration (mg/kg)</b>	<b>Health-Based Comparison Value (mg/kg)</b>	<b>Further Evaluation</b>
Perfluorooctanesulfonic acid (PFOS), Dodd Field Park	0.085	0.10 Int EMEG Child	No
Perfluorooctanesulfonic acid (PFOS), Memorial Field	0.014	0.10 Int EMEG Child	No
Perfluorooctanesulfonic acid (PFOS), 175 Newport Way	0.026	0.10 Int EMEG Child	No
Perfluorodecanoic acid (PFDA), West Playfield	0.0015	0.00010 RMEG Child	Yes
Perfluorodecanoic acid (PFDA), Dodds Playfield Park	0.00082	0.00010 RMEG Child	Yes
Perfluorodecanoic acid (PFDA), Rainier Trail	0.00076	0.0016 RMEG Adult	No
Perfluorodecanoic acid (PFDA), Memorial Field	0.00079	0.00010 RMEG Child	Yes
Perfluorodecanoic acid (PFDA), 175 Newport NW	0.00093	0.0016 RMEG Adult	No

Int EMEG - Environmental Media Evaluation Guides (EMEGs) are ATSDR comparison values that are based on ATSDR's minimal risk levels for non-cancer health effects. They represent estimated contaminant concentrations below which humans exposed during a specific timeframe (acute, intermediate, or chronic) are not expected to experience noncarcinogenic health effects. Intermediate exposure means contact with a substance that occurs for more than 14 days and less than a year (15-364 days) [compare with acute exposure and chronic exposure].

RMEG – Reference Dose Media Evaluation Guide (RMEG) is an ATSDR-derived comparison value based on non-cancer health effects for chronic exposure duration only. RMEGs represent the concentration in a specific medium (e.g., water or soil) at which daily human exposure is unlikely to result in adverse noncarcinogenic effects. ATSDR derives RMEGs from EPA's reference doses (RfDs) and reference concentrations (RfCs).

**Table 2. Trespasser/Recreational: Site-specific combined ingestion and dermal exposure doses for chronic exposure to perfluorodecanoic acid in soil at 0.0015 mg/kg along with noncancer hazard quotients\* West Playfield, Issaquah (MI), Washington.**

	CTE Dose (mg/kg/day)	CTE Noncancer Hazard Quotient	CTE Cancer Risk
Exposure Group			
Birth to < 1 year	1.7E-08	8.7 †	-
1 to < 2 years	1.8E-08	8.9 †	-
2 to < 6 years	9.6E-09	4.8 †	-
6 to < 11 years	6.4E-09	3.2 †	-
11 to < 16 years	3.7E-09	1.8 †	-
16 to < 21 years	3.2E-09	1.6 †	-
Total Child	-	-	-

Source: [Environmental data, Farallon Consulting] [1].


Abbreviations: CTE = central tendency exposure (typical); mg/kg/day = milligram chemical per kilogram body weight per day; mg/kg = milligram chemical per kilogram soil; RME = reasonable maximum exposure (higher); yrs = years

MI – Multi-incremental

\* The calculations in this table were generated using ATSDR’s PHAST v2.4.2.0. The noncancer hazard quotients were calculated using the chronic (lifetime) reference dose of 2E-09 mg/kg/day.

† Indicates the hazard quotient is greater than 1, which ATSDR evaluates further.

**Table 3. School scenario: Site-specific combined ingestion and dermal exposure doses for chronic exposure to perfluorodecanoic acid in soil at 0.0015 mg/kg along with noncancer hazard quotients\* West Playfield (MI), Issaquah, Washington.**

	CTE Dose (mg/kg/day)	CTE Noncancer Hazard Quotient	CTE Cancer Risk	CTE Exposure Duration (yrs)
<b>Exposure Group</b>				
Pre-Kindergarten	5.4E-09	2.7 †	-	2
Kindergarten	4.8E-09	2.4 †	-	1
Elementary School 1st – 5th grades	2.7E-09	1.3 †	-	5
Middle School 6th – 8th grades	2.0E-09	1.0 †	-	3
High School 9th – 12th grades	1.8E-09	0.88	-	4
Total Child	-	-	-	15

Source: [Environmental data, Farallon Consulting] [1].

Abbreviations: CTE = central tendency exposure (typical); mg/kg/day = milligram chemical per kilogram body weight per day; mg/kg = milligram chemical per kilogram soil; RME = reasonable maximum exposure (higher); yrs = years

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† Indicates the hazard quotient is greater than 1, which ATSDR evaluates further.