# ATSDR

## Health Consultation

Exposure Investigation

**Supplemental Exposure Investigation at Select PFAS Exposure Assessment Sites**

December 10, 2024

Cost Recovery Number

MA: CR20220096

DE: CR20220097

U.S. Department of Health and Human Services
Agency for Toxic Substances and Disease Registry

**Health Consultation: A Note of Explanation**

An ATSDR health consultation is a verbal or written response from ATSDR to a specific request for information about health risks related to a specific site, a chemical release, or the presence of hazardous material. In order to prevent or mitigate exposures, a consultation may lead to specific actions, such as restricting use of or replacing water supplies; intensifying environmental sampling; restricting site access; or removing the contaminated material.

In addition, consultations may recommend additional public health actions, such as conducting health surveillance activities to evaluate exposure or trends in adverse health outcomes; conducting biological indicators of exposure studies to assess exposure; and providing health education for health care providers and community members. This concludes the health consultation process for this site, unless additional information is obtained by ATSDR which, in the Agency's opinion, indicates a need to revise or append the conclusions previously issued.

**About ATSDR**

The Agency for Toxic Substances and Disease Registry (ATSDR) is a federal public health agency of the U.S. Department of Health and Human Services (HHS). ATSDR works with other agencies and tribal, state, and local governments to study possible health risks in communities where people could come in contact with dangerous chemicals. For more information about ATSDR, visit the ATSDR website at www.atsdr.cdc.gov/.

**About US EPA**

The U.S. Environmental Protection Agency (EPA) mission is to protect human health and the environment. With laboratories located throughout the nation, EPA's Office of Research and Development (ORD) works to identify and solve environmental problems. Knowledge developed by ORD provides the foundation for Agency decisions and supports the needs of stakeholders, including state, tribal, and community partners. For more information about ORD visit www.epa.gov/research.

*This work was funded and sponsored by the U.S. Environmental Protection Agency under an Interagency Agreement with ATSDR (*IAA Number DW-075-95955001-0).

# Health Consultation

## Exposure Investigation

## Supplemental Exposure Investigation at Select PFAS

## Exposure Assessment Sites

Westfield, Massachusetts and New Castle, Delaware

Prepared By:

U.S. Department of Health and Human Services
Agency for Toxic Substances and Disease Registry (ATSDR)
Office of Community Health Hazard Assessment
Atlanta, Georgia 30333

# Contents

## List of Tables



## List of Figures

## List of Acronyms

| | |
|---|---|
| ANOSIM | Analysis of similarity |
| ATSDR | Agency for Toxic Substances and Disease Registry |
| B-H FDR | Benjamini-Hochberg false discovery rate correction |
| CDC | United States Centers for Disease Control and Prevention |
| CI | Chromatographic interference |
| CV | Comparison Value |
| DE | Delaware |
| DQOs | Data quality objectives |
| DiPAPs | Phosphate diesters |
| EA | Exposure Assessment |
| ECDF | Empirical cumulative distribution function |
| EI | Exposure Investigation |
| EJI | Environmental Justice Index |
| EOF | Extractable organic fluorine |
| EPA | United States Environmental Protection Agency |
| FOD | Frequency of detection |
| FTOHs | Fluorotelomer alcohols |
| GC-MS | Gas chromatography-mass spectrometry |
| IAA | Interagency Agreement |
| IQR | Interquartile range |
| ISM | Incremental Soil Methodology |
| LCS/LCSD | Lab control sample/lab control sample duplicate |
| MA | Massachusetts |
| MeFOSAA | N-Methyl perfluorooctanesulfonamidoacetic acid |
| MS/MSD | Matrix spike/matrix spike duplicate |
| MSC | Municipal Services Commission |
| ND | Non-detect(s) |
| $ng/cm^2$ | nanograms per centimeter squared |

| | |
|---|---|
| $ng/m^3$ | nanograms per cubic meter |
| NHANES | National Health and Nutritional Examination Survey |
| PFAS | Per-and polyfluoroalkyl substances |
| PFC | Perfluorochemical |
| PFDA | Perfluorodecanoic acid |
| PFHxS | Perfluorohexanesulfonic acid |
| PFNA | Perfluorononanoic acid |
| PFOS | Perfluorooctanesulfonic acid |
| PFOA | Perfluorooctanoic acid |
| PFUnA | Perfluoroundecanoic acid |
| ppt | parts per trillion |
| PUF/XAD/PUF | polyurethane foam/absorbent resins/polyurethane foam |
| QA | Quality assurance |
| QC | Quality control |
| RSD | Relative standard deviation |
| RT | Retention time |
| SAP | Sampling and Analysis Plan |
| SOP | Standard Operating Procedure |
| TOP | Total oxidizable precursor |
| TRI | Toxic Release Inventory |
| UPLC-MS/MS | Ultra-performance liquid chromatography-mass spectrometry/mass spectrometry |
| LC-MS/MS | Liquid chromatography-mass spectrometry/mass spectrometry |
| µg/kg | micrograms per kilogram |
| %RSD | Percent relative standard deviation |

# 1. Summary

Exposure to per-and polyfluoroalkyl substances (PFAS) can result from exposure to both drinking water and non-drinking water sources. PFAS have been used in stain-, water-, and grease-resistant materials including consumer products. While many of these materials and products are used in everyday life, information on the contribution of non-drinking water PFAS sources to exposure is sparse.

The Agency for Toxic Substances and Disease Registry (ATSDR) conducted eight exposure assessments (EAs) in 2019 and 2020 to evaluate whether a known drinking water source of certain PFAS may result in an increase in these PFAS in the body [ATSDR 2022a PFAS Exposure Assessments | PFAS and Your Health | ATSDR]. The intention of the EAs was to determine how exposure to PFAS in drinking water in communities near military installations may have impacted levels of PFAS in blood serum and urine. In addition to blood serum and urine testing, tap water and indoor settled dust were also sampled in a subset of homes during the EA. The results indicated that there was a significant increase in several PFAS in blood serum, primarily perfluorohexanesulfonic acid (PFHxS), perfluorooctanoic acid (PFOA) and perfluorooctanesulfonic acid (PFOS), at most of the eight PFAS locations tested.

In 2020, ATSDR entered into an Interagency Agreement (IAA) with the U.S. Environmental Protection Agency (EPA) to conduct an exposure investigation (EI) to collect additional environmental sampling at two of the EA sites, one in Westfield MA and one in New Castle DE, to identify potential non-drinking water contributors to PFAS body burdens.

The EI included collecting environmental samples at the homes of some participants from these two communities. At every home in the EI, a dust sample filtered through a small vacuum (settled dust) was collected and an exposure questionnaire was administered. In a subset of the EI homes, ATSDR and EPA performed more extensive environmental sampling. Additional samples were collected from indoor air, household vacuum dust collected from the resident's vacuum cleaner, surface dust collected by wet wipes, and soil. In addition, a silicone wristband worn by one participant per household was used to characterize PFAS exposure during daily activities. All environmental samples collected from EI homes were analyzed for a common set of PFAS and PFAS precursors. ATSDR and EPA also evaluated potential exposure to PFAS within the community by sampling outdoor air and locally-grown produce.

The objectives of this environmental sampling EI were to evaluate:

1. Whether PFAS were detectable in various non-drinking water environmental samples;
2. What the detectable levels of PFAS in environmental samples were; and
3. Whether any detectable levels of PFAS may be associated with the previously measured PFAS blood serum levels identified during the EA (i.e., the seven PFAS identified in blood serum).

The conclusions for the EI are provided below:

**Conclusion 1: Detectable levels of the seven PFAS species found in blood serum during the PFAS EAs were found in environmental samples at homes in Westfield, MA and New Castle, DE.**

**Basis for Conclusion:** Results of the environmental sampling conducted during the EI indicate that at least one PFAS was found in each medium sampled between the two sites: settled dust, household vacuum dust, soil, surface wipes, wristbands, produce and indoor/outdoor air.

**Conclusion 2: Of the seven PFAS evaluated in blood serum from the PFAS EAs, two PFAS in DE and one PFAS in MA were correlated with levels of PFAS in settled dust.**

**Basis for Conclusion:** For both DE and MA, there was a significant positive correlation between settled dust and blood serum levels for MeFOSAA, meaning that when settled dust levels of MeFOSAA were higher, levels in blood serum were also higher. In addition, there was a significant positive correlation between levels of PFOS in settled dust and blood serum for DE.

**Conclusion 3: PFAS species and precursors, in addition to the seven PFAS identified in blood serum during the PFAS EA, were detected in each type of environmental media sampled.**

**Basis for Conclusion:** Detectable levels of some PFAS species and some PFAS precursors were found in all types of environmental samples (air, settled dust, household vacuum dust, surface wipes, silicone wristbands, soil and produce) at both DE and MA. These PFAS were not further evaluated in the EI but were used to meet the project objective regarding whether PFAS were detected and, if so, which PFAS.

# 2. Background

## 2.1. Statement of Issue and Purpose

In 2018, ATSDR conducted statistically based biomonitoring exposure assessments (EAs) at eight locations that had documented exposures to per- and polyfluoroalkyl substances (PFAS) in drinking water.

The intention of the EAs was to determine how exposure to PFAS in drinking water in communities may have impacted levels of PFAS in blood serum and urine. In addition to blood serum and urine testing, tap water and indoor dust were also sampled in a subset of homes.

Exposure to PFAS can result from exposure to both drinking water and non-drinking water sources. PFAS have been used in many consumer products, including stain-, water- and grease-resistant products, which are used in everyday life.

**Body Burden**

The total amount of a substance in the body. Some substances build up in the body because they are stored in fat or bone or because they leave the body very slowly. The amount of PFAS in blood serum is part of body burden.

Although there is information indicating additional sources of exposure to PFAS (Holder et al, 2023, 2024; Deluca, 2024), studies reporting the contribution of these sources to PFAS body burden levels are limited (Hu et al., 2019; Deluca et al, 2022). In 2020, ATSDR entered into an IAA with EPA to conduct an exposure investigation (EI) to collect additional environmental samples at two of the EA sites to identify potential non-drinking water sources of PFAS exposure.

This environmental sampling EI included sampling environmental media and administering a household and personal exposure questionnaire at the homes of a subset of participants from two EA communities. ATSDR and EPA also evaluated potential exposure to PFAS within the community by sampling outdoor air and locally-grown produce.

**Environmental Media**

Soil, water, air, biota (plants and animals), or any other parts of the environment that can contain contaminants.

For this EI, we also sampled silicone wristbands. People wore the wristbands, which we used evaluate personal exposure by measuring the PFAS that would stick to the wristband.

The objectives of this environmental sampling EI were to evaluate:

- Whether PFAS are detectable in various non-drinking water environmental media;
- What the detectable levels of PFAS in environmental media are; and
- Whether these detectable levels of PFAS may be associated with the existing measured PFAS levels in blood serum identified during the EA.

The current report provides the results of the environmental sampling conducted in 2022. The report also provides the results of the analysis between levels of PFAS in blood serum collected during the 2020

EA and the PFAS in the environmental samples collected during this EI. Information on the analyses provided in this report are found in the Appendices:

- Appendix A: Sampling and Analysis Methodology
- Appendix B: Data Evaluation
- Appendix C: Detailed Results and Analysis of the 7 PFAS in Blood Serum for All Media Sampled
- Appendix D: Summary of Additional PFAS and PFAS Precursors in All Media Sampled

## 2.2. Site Description and Timeline

Two of the ten EA locations were chosen for inclusion in this investigation: Westfield, MA and New Castle, DE [Figure 1 (ATSDR 2022a)]. The locations were chosen based on the number of EA participants, the level of community involvement, PFAS levels in the water prior to remediation, and the industrial nature of the community.

The MA community was chosen because it had pre-remediation levels of PFAS in the drinking water at levels close to the EPA health advisory level [70 parts per trillion (ppt)] at the time the EA was conducted (PFOA at 43 ppt, PFOS at 160 ppt and PFHxS at 170 ppt) (ATSDR 2021), the largest number of participants in the EA (459 participants from 247 households), and active community involvement.

The DE community was chosen because it had higher levels of PFAS in pre-remediated drinking water than MA (PFOA at 440 ppt, PFOS at 2,300 ppt and 1,400 ppt for PFHxS) (ATSDR 2022b) and was located in a more industrial area than the MA site. The DE location had 214 participants from 134 households.

The environmental sampling was completed in May (DE) and June (MA) of 2022, with results of the sampling provided to participants in a letter in July (DE) and August (MA) 2023. The letters provided individual results to each participant, and ATSDR responded to calls from participants to discuss their results. A community meeting will be held upon the release of the EI report to provide the results to the DE and MA communities.

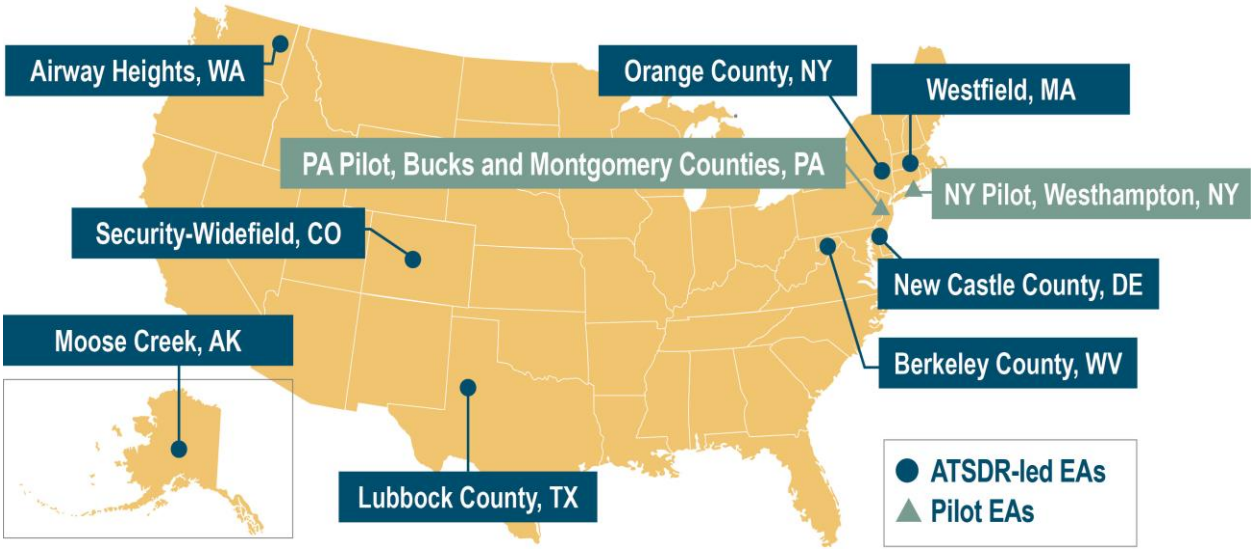


**Figure 1. PFAS Exposure Assessment Site Locations**

Source: ATSDR
EA = Exposure Assessment

## 2.3. Community Concerns, Community Demographics and Health Equity Considerations

### 2.3.1. Community Demographics and Health Equity Considerations

Population estimates from the 2020 census compiled for the DE and MA sampling frames, reflecting only those homes on a municipal water source, are provided by the U.S. Census Bureau (US Census Bureau 2022). The 2020 census data indicate that the MA sampling frame is predominantly White (85%) with 10% Hispanic Latino expected in the community. The ethnicity of participants tested in the EI in MA were consistent with the 2020 Census with 85% of those tested being White, although no participants were Hispanic Latino.

In DE, the 2020 census data incidicated that the sampling frame had a majority of White residents (51%) and a high percentage of both Black (30%) and Hispanic Latino (17%) residents. By contrast, 94% of EI participants in DE were White, 2% were African American and 0% were Hispanic Latino, which is markedly different from the 2020 census information.The demographic data from the 2020 census provided in Table 1 indicate that the EI participants tested included fewer Black participants and more White participants than expected from the census data (2020 census: 51% White and 30% Black; EI demographics: 94% White and 2% Black). The demographics for the DE community changed between the 2010 and 2020 census with a lower percentage of the community identifying as White (64% White in 2010 and 51% White in 2020).

The age profile was consistent between the two sites, with approximately 80% being adults aged 18 years and above, although the number of number of EI participants were generally older than 50 years of age, especially in DE.

**Table 1. Population Estimates of EI Sampling Frame from the 2020 Census and EI Participants***

| **Demographic** | DE: 2020 Census - number (percentage) | DE: EI participants - number (percentage) | MA: 2020 Census - number (percentage) | MA: EI participants - number (percentage) |
|---|---|---|---|---|
| **Total Population** | 12,899 | 48 | 14,578 | 88 |
| **Age (years)** | | (mean = 60.5) | | (mean = 55) |
| 18 | 2,785 (22%) | 3 (6%) | 3,024 (21%) | 7 (8%) |
| 18 to <50 | 5,074 (39%) | 11 (23%) | 5,545 (38%) | 23 (26%) |
| 50+ | 5,040 (39%) | 34 (71%) | 6,010 (41%) | 58 (66%) |
| **Ethnicity ₮** | | | | |
| White alone | 6,573 (51%) | 45 (94%) | 12,322 (85%) | 75 (85%) |
| African American alone | 3,864 (30%) | 2 (4%) | 239 (2%) | 4 (4%) |
| Asian alone | 149 (1%) | 0 (0%) | 298 (2%) | 1 (1%) |
| Native Hawaiian alone | 7 (<1%) | 0 (0%) | 5 (<1%) | 1 (1%) |
| Two+ races | 1,060 (8%) | 1 (2%) | 1,028 (7%) | 4 (4%) |
| Hispanic Latino | 2,210 (17%) | 0 (0%) | 1,499 (10%) | 0 (0%) |

* 2020 census information reflects homes that do not have private wells and are on municipal water.

₮ Three people in MA did not respond to the ethnicity questions.

ATSDR's Environmental Justice Index (EJI) (ATSDR 2022c) was used to evaluate the sampling frames for the two EI locations in DE and MA. The EJI measures the cumulative impacts of environmental injustice on health for census tracts in the United States along a 0 to 1 scale. Higher EJI ranks indicate more severe cumulative impacts of environmental burden. Tracts with EJI ranks of 0.75 or greater are often characterized as "high burden" tracts. The EJI ranks each census tract using 36 factors that include underlying 1) environmental burdens, 2) social vulnerabilities, and 3) pre-existing health conditions. EJI scores can be used to identify areas that may require special attention or additional action to improve health and health equity.

Table 2 shows the results of the EJI evaluation for New Castle County, DE and Westfield, MA. For the MA site, only 1.4% of the sampling frame population resides in high burden census tracts (EJI > 0.75).

A significant portion of residents in the DE sampling frame (more than 25%) live in areas that are highly impacted by a combination of environmental burdens, social factors, and pre-existing chronic health conditions according to the EJI. The DE site is located in a more highly industrial area than the MA site.

For DE, 27.3% of the sampling frame population resides in high burden census tracts (EJI > 0.75) and all ten census tracks within the sampling frame ranked higher than75% of tracts in the nation for environmental burden from ozone and for being in proximity to National Priority List, or Superfund, sites. Other indicators driving high EJI rankings for tracts near the DE site include being in close proximity to railroads, airports, and Toxic Release Inventory (TRI) sites, having housing built prior to 1980, and having elevated cancer risk associated with toxins in the air. Several census tracts were also identified through the EJI as having a high prevalence of chronic disease, including asthma, high blood pressure, poor mental health, diabetes, and all cancers (excluding skin cancer). This community is considered to

be of potential health equity concern due to the disproportionate percentage of the population living in high burden tracts.

**Table 2. Environmental Justice Index (EJI) Evaluation of Exposure Assessment Sampling Frames**

| **PFAS Exposure Assessment site** | Estimated population of EA sampling frame* | Estimated population of EA sampling frame living in highly impacted areas as identified by the EJI (≥0.75) (%) |
|---|---|---|
| | **Number** | **Number* (%†)** |
| **New Castle County, DE** | **11,076** | **3,031 (27.3%)** |
| **Westfield, MA** | 14,836 | 214 (1.4%) |

* Total and percent population estimated using an area proportion method that assumes equal distribution of populations throughout each census tract. Estimates based on 2015–2019 5-year American Community Survey data.

†Estimated percent among surveyed population
**Bold** numbers indicate locations with a relatively high (>25%) percentage of sample frame population living in high burden tracts (EJI ranks ≥0.75). We consider this community to be of health equity concern due to the disproportionate percentage of the population living in high burden tracts.

### 2.3.2. Community Demographics and Drinking Water Characteristics

Table 3 and Table 4 provide the demographic and household information for the two communities. The demographic information identified for the EI is consistent with that of the larger set of EA participants in both communities.

A supplement to the EA questionnaire was administered during the EI to clarify information collected during the EA. One of the limitations identified from the EA was that the questionnaire was not intended to evaluate exposure before or after PFAS was known to have impacted drinking water. Therefore, these questions were asked during the EI. In addition, the participants were asked whether they are currently employed in an occupation where PFAS exposure may occur since the questionnaire for the EA asked about employment for the 20 years prior to data collection in 2019.

For the MA community, there was a significant difference in water intake between pre- and post-PFAS mitigation results in MA for the following (results of the statistical analysis is found in Appendix B, Table B- 8 and Table B- 9:

- Median water intake reported by participants from their tap was greater before municipal water PFAS remediation (4 cups per day before vs 2 cups per day after),
- People reported their drinking water source as municipal more often before the PFAS remediation (97% used the municipal source before mitigation vs 79% after mitigation),
- People reported drinking more bottled water after remediation as compared to before (3% used bottled water before mitigation vs 21% after mitigation), and
- Use of water filtration system increased after municipal water PFAS remediation (56% had filtration systems before and 90% had filtration systems after).

These results indicate that awareness of the PFAS in the water in the MA community resulted in behavior changes with people drinking less water from their tap, installing filtration systems, and using more bottled water. There were no significant differences found in pre- and post-remediation in water intake, water sources, and water filtration use in the DE community. There were no significant differences in either community between the percentage of participants that were currently employed in an occupation where PFAS exposure may occur or those that were employed in the past (2019).

**Table 3. Demographic Information and Drinking Water Characteristics: Westfield, MA (51 Households, 88 Participants) (Adults and Children Combined)**

| **Characteristic** | Count of EI Participants (N) | Percentage of EI Participants (%) |
|---|---|---|
| **Sex** | | |
| Male | 39 | 44 |
| Female | 49 | 56 |
| **Years in current home** *,† | (mean = 26) | |
| <10 | 10 | 13 |
| 10 to <20 | 24 | 31 |
| 20 to <30 | 11 | 14 |
| 30+ | 32 | 42 |
| **Source of Drinking Water before PFAS removed from the water:** 2015 Westfield water system‡ | | |
| Municipal Source | **85** | **97** |
| Bottled Water | **3** | **3** |
| **Current Source of Drinking Water:** 2015 Westfield water system *,‡ | | |
| Municipal Source | **67** | **79** |
| Bottled Water | **18** | **21** |
| Average tap water consumption (8-ounce cups) before PFAS removed from the water: 2015 Westfield water system *,‡ | **(median = 4 cups)** | - |
| 0 | 7 | 10 |
| >0 to <2 | 3 | 4 |
| 2 to <4 | 20 | 28 |
| 4 to <6 | 17 | 24 |
| 6 to <8 | 8 | 11 |
| 8+ | 17 | 24 |
| Average tap water consumption (8-ounce cups) after PFAS | **(median = 2 cups)** | |

| **Characteristic** | Count of EI Participants (N) | Percentage of EI Participants (%) |
|---|---|---|
| removed from the water: 2015 Westfield water system *,‡ | | |
| 0 | 21 | 28 |
| >0 to <2 | 4 | 5 |
| 2 to <4 | 20 | 27 |
| 4 to <6 | 11 | 15 |
| 6 to <8 | 5 | 7 |
| 8+ | 14 | 19 |
| **Use of water filtration system before PFAS removed from the water** †,‡ | **-** | **-** |
| None | **38** | **43** |
| One or more treatment devices | **50** | **57** |
| **Use of water filtration system after PFAS removed from the water** †,‡ | **-** | **-** |
| None | **9** | **10** |
| One or more treatment devices | **79** | **90** |
| **Potential occupational exposure to PFAS in the 20 years prior to conducting the EA** *,† | - | - |
| None | 67 | 85 |
| One or more occupational exposures | 12 | 15 |
| **Potential occupational exposure to PFAS during the EI sampling period** *,† | - | - |
| None | 68 | 85 |
| One or more occupational exposures | 12 | 15 |

*Not all participants completed the questionnaire, therefore, the Count of EI Participants (N) does not always add to the total number of participants.

†These statistics are based on only adult participants aged 18 or over.

‡There was a statistical difference between theses parameters before and after PFAS was removed from the drinking water.

**Table 4. Demographic information and Drinking Water Characteristics: New Castle, DE (41 Households, 48 Participants) (Adults and Children Combined)**

| **Characteristic** | Count of EI Participants (N) | Percentage of EI Participants (%) |
|---|---|---|
| **Sex** | - | - |
| Male | 23 | 48 |
| Female | 25 | 52 |
| **Years in current home** *,† | (mean = 23) | - |
| <10 | 3 | 7 |
| 10 to <20 | 20 | 45 |
| 20 to <30 | 9 | 20 |
| 30+ | 12 | 27 |
| **Source of Drinking Water before municipal water PFAS remediation:** 2014 Municpal Services Commission (MSC) water system and 2016 Artesian water system | - | - |
| Municipal Source | 45 | 94 |
| Bottled Water | 3 | 6 |
| Average tap water consumption (8-ounce cups) before **municipal water PFAS remediation**: 2014 Municpal Services Commission (MSC) water system and 2016 Artesian water system † | (median = 4 cups) | - |
| 0 | 5 | 13 |
| >0 to <2 | 1 | 3 |
| 2 to <4 | 11 | 28 |
| 4 to <6 | 8 | 20 |
| 6 to <8 | 6 | 15 |
| 8+ | 9 | 23 |
| Average tap water consumption (8-ounce cups) after **municipal water PFAS remediation**: 2014 Municpal Services Commission (MSC) water system and 2016 Artesian water system † | (median = 4 cups) | - |
| 0 | 4 | 10 |
| >0 to <2 | 1 | 2 |
| 2 to <4 | 9 | 22 |
| 4 to <6 | 10 | 24 |
| 6 to <8 | 5 | 12 |
| 8+ | 12 | 29 |
| **Current Source of Drinking Water** † | | |

| | | |
|---|---|---|
| Municipal Source | 43 | 90 |
| Bottled Water | 2 | 10 |
| **Use of water filtration before municipal water PFAS remediation** | - | - |
| None | 17 | 35 |
| One or more treatment devices | 31 | 65 |
| **Use of water filtration after municipal water PFAS remediation** | - | - |
| None | 12 | 25 |
| One or more treatment devices | 36 | 75 |
| **Potential occupational exposure to PFAS in the 20 years prior to conducting the EA *,†** | - | - |
| None | 36 | 82 |
| One or more occupational exposures | 8 | 18 |
| **Potential occupational exposure to PFAS during the EI sampling period *,†** | - | - |
| None | 40 | 91 |
| One or more occupational exposures | 4 | 9 |

*These statistics are based on only adult participants aged 18 or over.
†All participants did not complete the questionnaire meaning the Count of EI Participants (N) does not always add to the total number of participants.

# 3. Methods and Sampling Data

## 3.1. Recruitment

All participants in the EAs in DE and MA communities were sent a letter of invitation to participate in the supplemental environmental sampling EI. Between the two locations, the goal was to collect only settled dust at 120 homes (40 in DE and 80 in MA) and to conduct the more robust sampling at 40 homes (20 at each site) for a total of 160 homes. ATSDR and EPA were able to sample half of our goal (79 homes). Table 5 provides the recruitment goal and the number of homes at each location that were actually sampled for the EI.

**Table 5. EI Participant Recruitment**

| **Location** | Settled Dust Sampling Goal | Settled Dust Sampling Households | Robust Sampling Goal* | Robust Sampling Households |
|---|---|---|---|---|
| **New Castle, DE** | 40 | 21 | 20 | 10 |
| **Westfield, MA** | 80 | 30 | 20 | 18 |

| | | | | |
|---|---|---|---|---|
| **TOTAL** | **120** | **51** | **40** | **28** |

* Robust sampling included the collection of settled dust, household vacuum dust, indoor air, surface wipes and silicone wristbands.

## 3.2. Environmental Sample Collection and Analysis

ATSDR and EPA collected environmental samples at homes located in Westfield, MA and New Castle, DE. Information regarding field collection methods is provided in Appendix A. All environmental samples collected from EI homes were analyzed for a common set of PFAS and PFAS precursors.

A consent form was completed by each person that previously provided a blood sample during the EA to allow ATSDR and EPA to collect the additional samples and questionnaire information. At every home participating in the EI, a dust sample filtered through a small vacuum (settled dust) was collected and household and exposure questionnaires were administered. The EI questionnaire was administered to all participants within the household that had previously provided a blood sample during the EA. Household questionnaires were completed by one person in each household and asked questions such age of home, length of residency, filter use and flooring types. Personal exposure questionnaires were administered to each participant and asked questions regarding water intake, time spent outdoors and use of household products that may contain PFAS, such as food containers and cosmetics. The results of the EI questionnaire were evaluated in conjunction with the EA questionnaire to interpret household and individual activity differences before and after PFAS mitigation from drinking water. The EI questionnaire was also used in conjunction with the environmental sampling to better interpret exposures.

Within the community, samples of both outdoor air and locally-grown produce were collected. For outdoor air, one central location was chosen in the community. Samples were taken using low flow pumps, identical to the pumps used to collect indoor air samples, and higher flow pumps taken to obtain samples with lower detection limits. Samples of locally-grown produce were collected with the goal of collecting samples of various types of produce in each community.

In a subset of the EI homes, ATSDR and EPA collected more extensive environmental sampling. Additional samples were collected of indoor air, household vacuum dust collected from the resident's vacuum cleaner, wet surface wipes, and soil. Wet wipes were used on surfaces to assess the presence of PFAS from nearby consumer product use (i.e. sampling in closets to evaluate effects from water-resistant clothing or on kitchen counter to evaluate effects from cleaning products or food containers). The locations varied based on household conditions as needed. In addition, a silicone wristband worn by one participant per household was used to characterize PFAS exposure during daily activities. During recruitment, participants were asked whether they were interested in the dust-only sampling or the more extensive sampling, and appointments were made on a first-come, first-serve basis.

### 3.2.1. Laboratory PFAS Analysis

PFAS were analyzed in all samples taken in each medium. The number of specific PFAS measured differed across media based on the capability of the laboratory analytical method for each medium. All PFAS species were analyzed by ultra-performance liquid chromatography-mass spectrometry/mass spectrometry (UPLC-MS/MS) or liquid chromatography-mass spectrometry/mass spectrometry (LC-MS/MS) by the Eurofins TestAmerica laboratory.

In addition to the seven PFAS measured in EA blood serum, several additional types of analyses were performed to broadly characterize PFAS and other fluorine containing PFAS precursors in each medium. The other fluorine containing chemicals include fluorotelomer alcohols (FTOHs), phosphate diesters (DiPAPs), and extractable organic fluorine (EOF). FTOHs were analyzed by gas chromatography-mass spectrometry (GC-MS), the DiPAPs by UPLC-MS/MS or LC-MS/MS and EOF by combustion ion chromatography. Appendix A provides information on the laboratory methods and specific PFAS measured in each medium.

An additional analysis, called total oxidizable precursor (TOP) assay, was completed for household vacuum dust. This specialized analysis method is used to better understand the potential for some PFAS precursors to be converted into more stable PFAS. This analysis provides information on the amounts and potentially types of known and unknown precursor PFAS present in the household vacuum dust. Precursors may transform into the more stable PFAS. The measurements are reported in Table D- 36 and are indicated as a checkmark on Table 6. Because this is a new approach for assessment of PFAS, detailed analyses are not presented in this report.

Table 6 provides the number of each PFAS and PFAS precursors that were analyzed in each medium. Appendix C provides the detailed results of the PFAS analysis for the seven PFAS analyzed during the PFAS EA and Appendix D provides the details for the remaining PFAS analyzed along with the PFAS precursors.

**Table 6. Number of PFAS and PFAS Precursor Analyses for Each Sample in Each Medium**

| Media | PFAS Species | FTOHs | diPAPs | EOF | TOP |
|---|---|---|---|---|---|
| **Filtered Dust** | 40 | 5 | 4 | 1 | -- |
| **Household Vacuum Dust** | 62 | 5 | 4 | 1 | ✓ |
| **Indoor Air** | 30 | 4 | 4 | -- | -- |
| **Soil** | 62 | 5 | 4 | 1 | -- |
| **Wipe** | 40 | 5 | 4 | 1 | -- |
| **Wristband** | 40 | 5 | 4 | 1 | -- |
| **Outdoor Air** | 30 | 4 | 4 (3 in MA) | -- | -- |
| **Produce** | 33* | 5† | -- | 1† | -- |

PFAS = per- and polyfluroalkyl substances; FTOHs = fluorotelomer alcohols; diPAPs = phosphate diesters; EOF = extractable organic fluorine; TOP = total oxidizable precursor

-- indicates that the contaminants were not analyzed in the medium.

✓indicates TOP analysis was performed for this medium

*This count includes the 15 PFAS included in the FDA PFAS list of analytes. The remaining 18 were additional PFAS analytes analyzed in produce.

†FTOHs and EOF were analyzed in produce but are not included in the FDA PFAS list of analytes.

# 4. Scientific Evaluations

## 4.1. Exposure Pathways

Figure 2 provides a conceptual exposure model indicating sources of PFAS to the environment that include industrial processes, use of firefighting foam, waste disposal, as well as the general use of PFAS-containing consumer products. As a result of these sources, PFAS may be found in water, food, soil, and outdoor air. In homes, PFAS may also be found in house dust, on surfaces, and indoor air. People may be exposed to PFAS in these media via ingestion, dermal contact, or inhalation.

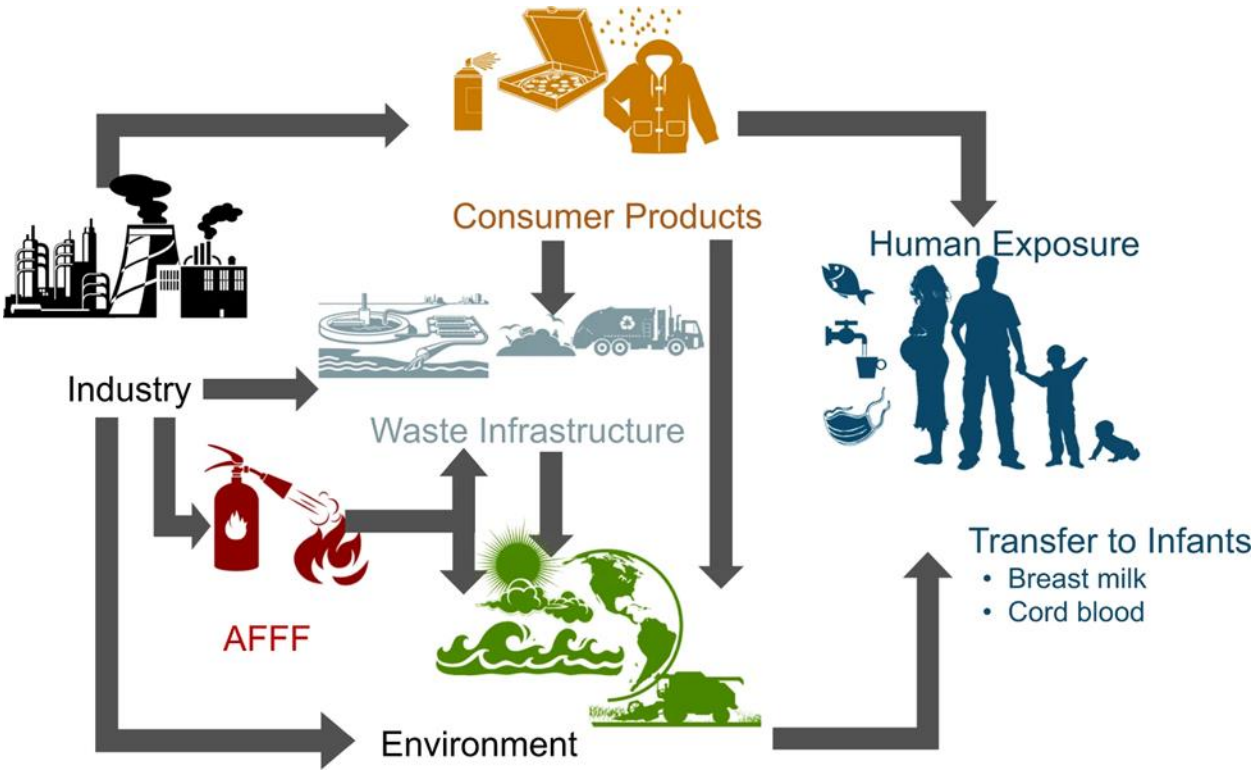


**Figure 2. PFAS Conceptual Exposure Model**

AFFF = Aqueous Film Forming Foam

Source: Sunderland et al. 2019

## 4.2. Results of the Settled Dust Sampling

A settled dust sample was collected in 78 households (a sample was unable to be collected in one household in MA). The results of the settled dust sampling are provided in Table 7 for the seven PFAS that were evaluated previously in blood serum during the PFAS EA. Table 7 provides the number of samples, percent detected, median, and range for all the settled dust samples collected in both DE and MA. The percent detected and maximum concentrations of each PFAS were generally higher in DE than in MA. Further details on the statistical analysis are provided in Appendices B and C.

**Table 7. Median and Range of Settled Dust (µg/kg) Results - DE and MA**

| Analyte | DE - # of Samples | DE - % Detected | DE - Median (Range) | MA - # of Samples | MA - % Detected | MA - Median (Range) |
|---|---|---|---|---|---|---|
| **PFHxS** | 31 | 52% | 2.4 (<1.5–76) | 47 | 49% | 2.7 (<0.75–700) |
| **PFOS** | 31 | 94% | 23 (<3.1–240) | 47 | 87% | 20 (<4.4–870) |
| **PFOA** | 31 | 90% | 17 (4–380) | 47 | 68% | 10 (1.8–250) |
| **PFNA** | 31 | 90% | 5.1 (1.7–41) | 47 | 60% | 2.1 (<0.85–170) |
| **PFDA** | 31 | 77% | 7.2 (<2.4–26) | 47 | 34% | 2 (<1.2–160) |
| **PFUnA** | 31 | 61% | 4.4 (<2.1–<21)* | 47 | 23% | NA (<1–40)† |
| **MeFOSAA** | 31 | 55% | 3 (<1.2–120) | 47 | 47% | 1.1 (0.6–370) |

*The method detection limit for the maximum in the data set was higher than all the detections in the data set. Refer to Appendix B, Treatment of Non-Detects (ND) in the Data Set.

†NA: Not Applicable: Median could not be calculated due to the ranks of the method detection limits. Refer to Appendix B, Treatment of Non-Detects (ND) in the Data Set.

Blood serum was collected and analyzed for PFAS during the EA process in 2019. Table 8 provides the frequency of detection for the seven PFAS evaluated in blood serum during the EA and settled dust collected during the EI. The frequency of detections (% detected) in DE was 60 to 100% for blood serum and 52 to 94% for settled dust. In MA, the frequency of detections was 57 to 100% in blood serum and 23 to 87% in settled dust (Table 8).

**Table 8. Blood Serum and Settled Dust Frequency of Detection (FOD) - DE and MA**

| Analyte | Serum from 2019 EA FOD – DE (%) | Settled Dust from the EI FOD – DE (%) | Serum from 2019 EA FOD – MA (%) | Settled Dust from the EI FOD – MA (%) |
|---|---|---|---|---|
| **PFHxS** | 100 | 52 | 100 | 49 |
| **PFOS** | 100 | 94 | 100 | 87 |
| **PFOA** | 100 | 90 | 100 | 68 |
| **PFNA** | 100 | 90 | 97 | 60 |
| **PFDA** | 94 | 77 | 85 | 34 |
| **PFUnA** | 92 | 61 | 57 | 23 |
| **MeFOSAA** | 60 | 55 | 58 | 47 |

One of the objectives of this EI was to evaluate any relationships between the settled dust results collected for the EI and the blood serum levels measured in 2019. Table 9 provides an analysis for a potential correlation between the blood serum results from the EA and the settled dust results from the EI.

Kendall's Tau tests for correlation between blood serum and settled dust PFAS levels were performed using methods to accommodate for having multiple participants per a household. Details on how these tests were performed can be found in Appendix C1; Analysis of the Relationship between EA Blood Serum and EI Settled Dust.

A checkmark and plus sign (✓+) on the table indicates a statistically significant positive correlation. For both DE and MA, there was a significant positive correlation between blood serum and settled dust levels for MeFOSAA, meaning that when levels of MeFOSAA in blood serum were higher, levels were also higher in settled dust. In addition, there was a significant positive correlation between blood serum and settled dust levels for PFOS in DE. The detailed results for this analysis can be found in Appendix C (

Table C- 2 and Table C- 3).

**Table 9. Settled Dust Levels From the EI Associated With Blood Serum Levels From the EA: DE and MA**

| PFAS | DE Serum vs. Settled Dust | MA Serum vs. Settled Dust |
|---|---|---|
| PFHxS | — | — |
| PFOS | ✓+ | — |
| PFOA | — | — |
| PFNA | — | — |
| PFDA | — | NA |
| PFUnA | — | NA |
| MeFOSAA | ✓+ | ✓+ |

A checkmark/plus sign (✓+) means that there is a positive correlation between blood serum results and the medium results was significant (Benjamini-Hochberg false discovery rate adjusted p-value < 0.05).
A dash (—) means that the test was not statistically significant. Details for these tests are in Appendix C.
NA – Not applicable; Kendall's Tau correlation test was not performed for PFDA and PFUnA results from MA because the detection rates in settled dust were too low (see Table 7).

### 4.2.1. Comparison of Settled Dust in the EA and the EI

Given that settled dust samples were collected during both the EA and the EI, the results were compared. There were 9 total households that had settled dust data collected in both the EA and the EI: 6 in DE and 3 in MA. A two-sided Wilcoxon Signed Rank test for repeated measures was performed to evaluate the results of the filtered dust samples in these households (Appendix C, Table C- 4). There was no significant difference between the levels of the seven PFAS found during the EA and the EI, meaning the levels likely remained consistent in the media in the three years between data collection. However, given the small number of samples available for analysis, the results should be interpreted with caution.

A comparison of the settled dust results for the seven PFAS was also completed for the entire EA and EI data set, and not just the 9 homes that were sampled during both efforts. An HF-1 version of the generalized Wilcoxon test was used for this comparison. As with the direct comparison of the 9 homes, levels of PFAS in settled dust from DE and MA were similar for both the EA and the EI data sets (Appendix C, Table C- 5).

### 4.2.2. Questionnaire Analysis

The questionnaire data from both the EA and the EI were analyzed to evaluate demographic and drinking water characteristics as well as potential relationships between settled dust levels and activities within the home. The questionnaire results were evaluated by compiling the responses to determine whether an analysis could be completed based on the answers to the questions asked. For example, for

the question regarding whether participants used the municipal source of water or bottled water, there needed to be enough responses for each answer to allow for analysis. The strategy for evaluating the questionnaire results and the parameters that were able to be evaluated are provided in a flowchart in Appendix B, Figure B- 1.

The results of the demographic and drinking water characteristics analysis are provided in Table 3 and Table 4. A comprehensive analysis of potential associations between PFAS in settled dust and household activities was not performed, but preliminary analyses show that correlations may be present (Appendix C, Table C- 6). For example, higher levels of PFAS in settled dust were found when carpet cleaning services were used (DE) and when homes had carpet in their living room (MA).

## 4.3. Analysis of PFAS for Robust Sampling Households

Table 10 (DE) and Table 11 (MA) provide an overview of the frequency of detection for each medium sampled during the robust sampling efforts. Generally, a higher frequency of detection of PFAS were found in DE as compared to MA. These tables provide the results for the 7 PFAS that were found in the serum during the EA.

Additional PFAS and PFAS precursors were analyzed in the environmental samples. Detectable levels of these analytes were found in all sampled media in both DE and MA. For outdoor air in MA, complete analysis of the PFAS was not possible given that PFAS were identified in blank samples of outdoor air. Results for the full set of PFAS measured in the EI are presented in Appendix D.

**Table 10. PFAS Sampling Frequency of Detection (%) in Households with Robust Sampling - DE**

| PFAS | Serum from 2019 EA | Settled Dust | Household vacuum Dust | Indoor Air | Wipe 1: Typically Kitchen Counter | Wipe 2: Typically Closet Floor | Soil | Wrist-band |
|---|---|---|---|---|---|---|---|---|
| **PFHxS** | 100 | 60 | 57 | 0 | 30 | 100 | 70 | 10 |
| **PFOS** | 100 | 100 | 86 | 0 | 30 | 70 | 100 | 20 |
| **PFOA** | 100 | 100 | 100 | 40 | 60 | 90 | 100 | 0 |
| **PFNA** | 100 | 100 | 100 | 0 | 60 | 100 | 100 | 10 |
| **PFDA** | 94 | 80 | 100 | 30 | 30 | 40 | 100 | 0 |
| **PFUnA** | 92 | 70 | 100 | 0 | 20 | 50 | 100 | 0 |
| **MeFOSAA** | 60 | 90 | 100 | 0 | 20 | 50 | 50 | 10 |

**Table 11. PFAS Sampling Frequency of Detection (%) in Households with Robust Sampling - MA**

| PFAS | Serum from 2019 EA | Settled Dust | Household vacuum Dust | Indoor Air | Wipe 1: Typically Kitchen Counter | Wipe 2: Typically Closet Floor | Soil | Wrist-band |
|---|---|---|---|---|---|---|---|---|
| **PFHxS** | 100 | 33 | 69 | 0 | 22 | 56 | 22 | 11 |
| **PFOS** | 100 | 78 | 94 | 0 | 17 | 56 | 100 | 17 |
| **PFOA** | 100 | 61 | 88 | 0 | 50 | 56 | 83 | 17 |
| **PFNA** | 97 | 67 | 75 | 0 | 33 | 17 | 100 | 11 |
| **PFDA** | 85 | 39 | 69 | 0 | 22 | 11 | 100 | 6 |
| **PFUnA** | 57 | 22 | 56 | 0 | 11 | 0 | 100 | 6 |
| **MeFOSAA** | 58 | 50 | 81 | 0 | 11 | 17 | 6 | 22 |

Table 12 through Table 18 provide a summary of levels of certain PFAS measured in the different media for the homes that consented to the more robust sampling during the EI for DE and MA. The highlighted results are for the seven PFAS evaluated in blood serum during the EA. Table 19 (low-flow pump) and Table 20 (higher-flow pump) present the results of outdoor air samples taken in a central location within each community and Table 21 presents the results of locally-grown product samples. Additional details on the derivation of medians and ranges for each medium are provided in Appendix C for the seven PFAS (Table C- 8 to Table C- 16). Results for the full set of PFAS and PFAS precursors measured in the EI are presented in Appendix D.

For settled dust, Table 12 provides the results for the samples collected in the homes that consented to the more robust sampling. The settled dust results for the entire data set are provided above in Table 7. The results for these two settled dust data sets are comparable for most of the PFAS samples.

The results for all sampled media indicate that at least one PFAS was detected in every medium tested, except for outside air in MA. Results for this medium were not available due to issues associated with blank contamination.

**Table 12. Median and Range of Settled Dust (µg/kg) Results from Robust Sampling - DE and MA**

| Analyte | DE - # of Samples | DE - % Detected | DE - Median (Range) (µg/kg) | MA - # of Samples | MA - % Detected | MA - Median (Range) (µg/kg) |
|---|---|---|---|---|---|---|
| **PFHxS** | 10 | 60% | 2.1 (<1.5–76) | 18 | 33% | 1.1 (<0.75–94) |
| **PFOS** | 10 | 100% | 23 (12–200) | 18 | 78% | 9.4 (5.3–200) |
| **PFOA** | 10 | 100% | 23 (6.5–160) | 18 | 61% | 8.5 (1.8–250) |
| **PFNA** | 10 | 100% | 8.8 (1.9–41) | 18 | 67% | 2.2 (1–82) |
| **PFDA** | 10 | 80% | 7.2 (<2.4–26) | 18 | 39% | 2 (<1.2–160) |
| **PFUnA** | 10 | 70% | 6.6 (<2.1–18) | 18 | 22% | NA (<1–38)* |
| **MeFOSAA** | 10 | 90% | 4.1 (2.5–120) | 18 | 50% | 2.9 (0.6–92) |

*NA: Not Applicable: Median could not be calculated due to the ranks of the method detection limits. Refer to Appendix B, Treatment of Non-Detects (ND) in the Data Set.

**Table 13. Median and Range of Household Vacuum Dust (µg/kg) Results - DE and MA**

| Analyte | DE - # of Samples | DE - % Detected | DE - Median (Range) (µg/kg) | MA - # of Samples | MA - % Detected | MA - Median (Range) (µg/kg) |
|---|---|---|---|---|---|---|
| **PFHxS** | 7 | 57% | 2.8 (<0.63–640) | 16 | 69% | 5.3 (<0.25–1500) |
| **PFOS** | 7 | 86% | 33 (<1.1–950) | 16 | 94% | 15 (<4.3–2200) |
| **PFOA** | 7 | 100% | 56 (24–300) | 16 | 88% | 14 (1.5–830) |
| **PFNA** | 7 | 100% | 14 (1.8–71) | 16 | 75% | 2.2 (0.55–20) |
| **PFDA** | 7 | 100% | 11 (2.8–84) | 16 | 69% | 2.6 (0.8–34) |
| **PFUnA** | 7 | 100% | 12 (2–50) | 16 | 56% | 0.81 (<0.42–29) |
| **MeFOSAA** | 7 | 100% | 6.2 (2.8–160) | 16 | 81% | 4.3 (<0.2–540) |

**Table 14. Median and Range of Surface Wipe 1: Typically Kitchen Counter (ng/cm$^2$) Results - DE and MA**

| Analyte | DE - # of Samples | DE - % Detected | DE - Median (Range) (ng/cm$^2$) | MA - # of Samples | MA - % Detected | MA - Median (Range) (ng/cm$^2$) |
|---|---|---|---|---|---|---|
| **PFHxS** | 10 | 30% | NA (<0.0015–0.0027)* | 18 | 22% | NA (<0.0015–<0.015)*† |
| **PFOS** | 10 | 30% | NA (<0.0021–0.044)* | 18 | 17% | NA (<0.0021–0.069)* |
| **PFOA** | 10 | 60% | 0.0028 (<0.0026–0.034) | 18 | 50% | NA (<0.0026–0.17)* |
| **PFNA** | 10 | 60% | 0.0013 (<0.0011–0.017) | 18 | 33% | NA (<0.0011–0.57)* |
| **PFDA** | 10 | 30% | NA (<0.0023–0.024)* | 18 | 22% | NA (<0.0023–0.27)* |
| **PFUnA** | 10 | 20% | NA (<0.002–0.019)* | 18 | 11% | NA (<0.002–0.36)* |
| **MeFOSAA** | 10 | 20% | NA (<0.0012–0.0083)* | 18 | 11% | NA (<0.0012–0.02)* |

*NA: Not Applicable: Median could not be calculated due to the ranks of the method detection limits. Refer to Appendix B, Treatment of Non-Detects (ND) in the Data Set.

†The method detection limit for the maximum in the data set was higher than all the detections in the data set. Refer to Appendix B, Treatment of Non-Detects (ND) in the Data Set.

**Table 15. Median and Range of Surface Wipe 2: Typically Closet Floor (ng/cm$^2$) Results - DE and MA**

| Analyte | DE - # of Samples | DE - % Detected | DE - Median (Range) (ng/cm$^2$) | MA - # of Samples | MA - % Detected | MA - Median (Range) (ng/cm$^2$) |
|---|---|---|---|---|---|---|
| **PFHxS** | 10 | 100% | 0.0036 (0.0015–0.016) | 18 | 56% | 0.0017 (<0.0015–0.048) |
| **PFOS** | 10 | 70% | 0.021 (<0.0021–0.082) | 18 | 56% | 0.013 (<0.0021–0.89) |
| **PFOA** | 10 | 90% | 0.0091 (<0.0026–0.087) | 18 | 56% | 0.0028 (<0.0026–0.073) |
| **PFNA** | 10 | 100% | 0.0021 (0.0014–0.11) | 18 | 17% | NA (<0.0011–<0.011)[*†] |
| **PFDA** | 10 | 40% | NA (<0.0023–0.05)[*] | 18 | 11% | NA (<0.0023–0.023)[*] |
| **PFUnA** | 10 | 50% | NA (<0.002–0.06)[*] | 18 | 0% | <0.002 (<0.002–<0.02)[†] |
| **MeFOSAA** | 10 | 50% | NA (<0.0012–0.012)[*] | 18 | 17% | NA (<0.0012–<0.012)[*†] |

[*]NA: Not Applicable: Median could not be calculated due to the ranks of the method detection limits. Refer to Appendix B, Treatment of Non-Detects (ND) in the Data Set.

[†]The method detection limit for the maximum in the data set was higher than all the detections in the data set. Refer to Appendix B, Treatment of Non-Detects (ND) in the Data Set.

**Table 16. Median and Range of Indoor Air (ng/m$^3$) Results - DE and MA**

| Analyte | DE - # of Samples | DE - % Detected | DE - Median (Range) (ng/cm$^2$) | MA - # of Samples | MA - % Detected | MA - Median (Range) (ng/cm$^2$) |
|---|---|---|---|---|---|---|
| **PFHxS** | 6[*] | 0% | NC[†] | 11[*] | 0% | NC[†] |
| **PFOS** | 6[*] | 0% | NC[†] | 11[*] | 0% | NC[†] |
| **PFOA** | 10 | 40% | NA (<0.04–0.065)[‡] | 7[*] | 0% | NC[†] |
| **PFNA** | 10 | 0% | NC[†] | 16[*] | 0% | NC[†] |
| **PFDA** | 10 | 30% | NA (<0.0091–0.011)[‡] | 6[*] | 0% | NC[†] |
| **PFUnA** | 10 | 0% | NC[†] | 17 | 0% | NC[†] |
| **MeFOSAA** | 10 | 0% | NC[†] | 17 | 0% | NC[†] |

[*]Some samples were invalidated due to blank contamination results.

[†]NC: Not Calculated: Summary statistics (median and range) could not be calculated due to no detected samples available.

[‡]NA: Not Applicable: Median could not be calculated due to the ranks of the method detection limits. Refer to Appendix B, Treatment of Non-Detects (ND) in the Data Set.

**Table 17. Median and Range of Wristband (µg/kg) Results - DE and MA**

| Analyte | DE - # of Samples | DE - % Detected | DE - Median (Range) (µg/kg) | MA - # of Samples | MA - % Detected | MA - Median (Range) (µg/kg) |
|---|---|---|---|---|---|---|
| **PFHxS** | 10 | 10% | NA (<0.03–0.1)* | 18 | 11% | NA (<0.031–0.32)* |
| **PFOS** | 10 | 20% | NA (<0.045–0.17)* | 18 | 17% | NA (<0.045–0.59)* |
| **PFOA** | 10 | 0% | NC† | 18 | 17% | NA (<0.056–0.4)* |
| **PFNA** | 10 | 10% | NA (<0.023–0.056)* | 18 | 11% | NA (<0.023–0.14)* |
| **PFDA** | 10 | 0% | NC† | 18 | 5.6% | NA (<0.051–0.44)* |
| **PFUnA** | 10 | 0% | NC† | 18 | 5.6% | NA (<0.044–0.12)* |
| **MeFOSAA** | 10 | 10% | NA (<0.024–0.056)* | 18 | 22% | NA (<0.024–0.068)* |

*NA: Not Applicable: Median could not be calculated due to the ranks of the method detection limits. Refer to Appendix B, Treatment of Non-Detects (ND) in the Data Set.

†NC: Not Calculated: Summary statistics (median and range) could not be calculated due to no detected samples available.

**Table 18. Median and Range of Residential Soil (µg/kg) results - DE and MA**

| Analyte | DE - # of Samples | DE - % Detected | DE - Median (Range) (µg/kg) | MA - # of Samples | MA - % Detected | MA - Median (Range) (µg/kg) |
|---|---|---|---|---|---|---|
| **PFHxS** | 10 | 70% | 0.033 (<0.028–0.066) | 18 | 22% | NA (<0.026–0.072)* |
| **PFOS** | 10 | 100% | 1.3 (0.84–3.2) | 18 | 100% | 0.75 (0.26–3.8) |
| **PFOA** | 10 | 100% | 0.46 (0.25–1.1) | 18 | 83% | 0.065 (<0.048–0.47) |
| **PFNA** | 10 | 100% | 0.97 (0.66–2.1) | 18 | 100% | 0.077 (0.031–0.19) |
| **PFDA** | 10 | 100% | 1.9 (1.1–5.9) | 18 | 100% | 0.13 (0.055–0.42) |
| **PFUnA** | 10 | 100% | 2.1 (1–7.9) | 18 | 100% | 0.11 (0.053–0.22) |
| **MeFOSAA** | 10 | 50% | NA (<0.021–0.077)* | 18 | 5.6% | NA (<0.021–0.087)* |

*NA: Not Applicable: Median could not be calculated due to the ranks of the method detection limits. Refer to Appendix B, Treatment of Non-Detects (ND) in the Data Set.

**Table 19. Community Outdoor Air: Low Flow (ng/m$^3$) Results - DE and MA**

| Analyte | DE - # of Samples | DE - % Detected | DE - Result (ng/m$^3$) | MA - # of Samples | MA - % Detected | MA – Result (ng/m$^3$) |
|---|---|---|---|---|---|---|
| **PFHxS** | 1 | 0% | NC* | | | |
| **PFOS** | 1 | 0% | NC* | | | |
| **PFOA** | 1 | 100% | 0.08† | 1 | 0% | NC* |
| **PFNA** | 1 | 0% | NC* | 1 | 0% | NC* |
| **PFDA** | 1 | 0% | NC* | 1 | 0% | NC* |
| **PFUnA** | 1 | 0% | NC* | 1 | 0% | NC* |
| **MeFOSAA** | 1 | 0% | NC* | 1 | 0% | NC* |

Grayed out cells indicate that the summary statistics could not be calculated because the sample was invalidated during data analysis.

*NC: Not Calculated: Summary statistics could not be calculated due to no detected samples available.

†A single sample was collected and was detected. The result is stated as a single value.

**Table 20. Outdoor Air: Higher Flow (ng/m$^3$) Results - DE and MA**

| Analyte | DE - # of Samples | DE - % Detected | DE - Result (ng/m$^3$) | MA - # of Samples | MA - % Detected | MA – Result (ng/m$^3$) |
|---|---|---|---|---|---|---|
| **PFHxS** | 1 | 0% | NC* | 1 | 0% | NC* |
| **PFOS** | | | | 1 | 0% | NC* |
| **PFOA** | 1 | 100% | 0.013† | | | |
| **PFNA** | 1 | 0% | NC* | 1 | 0% | NC* |
| **PFDA** | 1 | 0% | NC* | 1 | 0% | NC* |
| **PFUnA** | 1 | 0% | NC* | 1 | 0% | NC* |
| **MeFOSAA** | 1 | 0% | NC* | 1 | 0% | NC* |

Grayed out cells indicate that the summary statistics could not be calculated because the sample was invalidated during data analysis.

*NC: Not Calculated: Summary statistics could not be calculated due to no detected samples available.

†A single sample was collected and was detected. The result is stated as a single value.

**Table 21. Median and Range of Community Produce (µg/kg) Results - DE and MA**

| Analyte | DE - # of Samples | DE - % Detected | DE - Median (Range) (µg/kg) | MA - # of Samples | MA - % Detected | MA - Median (Range) (µg/kg) |
|---|---|---|---|---|---|---|
| **PFHxS** | 6 | 0% | NC* | 7 | 0% | NC* |
| **PFOS** | 6 | 0% | NC* | 7 | 0% | NC* |
| **PFOA** | 6 | 17% | NA (<0.02–0.066)† | 7 | 57% | 0.026 (<0.02–0.032) |
| **PFNA** | 6 | 0% | NC* | 7 | 0% | NC* |
| **PFDA** | 6 | 0% | NC* | 7 | 0% | NC* |
| **PFUnA‡** | 6 | 0% | NC* | 7 | 0% | NC* |
| **MeFOSAA‡** | 6 | 0% | NC* | 7 | 0% | NC* |

*NC: Not Calculated: Summary statistics (median and range) could not be calculated due to no detected samples available.

†NA: Not Applicable: Median could not be calculated due to the ranks of the method detection limits. Refer to Appendix B, Treatment of Non-Detects (ND) in the Data Set.

‡Additional PFAS Analytes in produce – refer to Appendix A, Analytes and Method Selection.

# 5. Comparison Between the Delaware and Massachusetts Communities

To compare DE and MA, ATSDR used an analysis of similarity (ANOSIM) test that could test for differences between the sites, handle the non-detect data and multiple detection limits, and evaluate patterns in the 7 PFAS measured in these environmental media instead of looking at each PFAS species individually. ANOSIM considers all 7 PFAS at the same time and identifies significant differences between DE and MA in the patterns of those PFAS results.

The results of the ANOSIM test showed a significant difference between DE and MA in the PFAS concentration rank patterns for settled dust ($R$ = 0.110, p = 0.003), home vacuum dust ($R$ = 0.214, p = 0.022), soil ($R$ = 0.756, p = 0.001) and surface wipes taken from a closet area ($R$ = 0.258, p = 0.004) (Table C- 17). Plotting the data showed the direction of these differences (Figure C- 3 to Figure C- 6 in Appendix C). For all significant differences, DE PFAS levels were higher than levels in MA.

As indicated in the PFAS EA report for DE and MA, levels of PFAS in drinking water in the DE area were found to be considerably higher than those detected in the MA community based on the UCMR3 (the Third Unregulated Contaminant Monitoring Rule) program results (U.S. EPA 2015). In addition, New Castle DE is considered to be an industrial area, as indicated by its identification as a community with higher environmental burden than the MA community. The criteria are described in more detail in section 2.3.1.

# 6. Limitations of the EI

Federal and state regulations or guidelines are not available for PFAS in any of the media that were sampled except for soil. Therefore, the results of the sampling were only intended to be used to evaluate the presence or absence, and if detected, to identify the amount of PFAS that may be present in each of the sampled media. Quality control data were used to evaluate data representativeness, completeness, and comparability, including precision and accuracy, as appropriate.

For the DE site, an additional limitation was that the ethnicity of the EI participants did not correspond to the ethnicity of the sampling frame identified from 2020 census data. According to the census data, only 51% of the sampling frame was White, while 94% of EI participants were White, indicating that we did not test a representative sample of the population at the site. The ethnicity of the EI participants in MA were consistent with the 2020 Census with 85% of those tested being White, although no participants identified as Hispanic Latino.

The environmental PFAS sampling may assist participants in better understanding their PFAS exposure. The results provide discrete information about sources of exposure within the household, such as PFAS-contaminated dust. Additionally, it was not possible to identify every potential confounding exposure. The results of this investigation may generate new hypotheses about which potential PFAS exposure pathways may exist in these communities.

The results are not generalizable to either EA participants in the community that were not included in the environmental sampling EI, to non-EA residents within the sampling frame, or to communities across the United States. The EI was intended to allow a better understanding of potential sources of PFAS exposure within each household tested.

# 7. Conclusions

The results of the blood serum testing available from the EAs were evaluated using the results of the environmental sampling EI and the questionnaire results from the EAs along with this EI.

Given the lack of regulatory guidelines for PFAS, the results of the sampling could only be used to evaluate the presence or absence, and if detected, to identify the amount of PFAS that may be present in each of the sampled media.

The conclusions for the EI are provided below:

The conclusions for the EI are provided below:

**Conclusion 1: Detectable levels of the seven PFAS species found in blood serum during the PFAS EAs were found in environmental samples at homes in Westfield, MA and New Castle, DE.**

**Basis for Conclusion:** Results of the environmental sampling conducted during the EI indicate that at least one PFAS was found in each medium sampled between the two sites: settled dust, household vacuum dust, soil, surface wipes, wristbands, produce and indoor/outdoor air.

**Conclusion 2: Of the seven PFAS evaluated in blood serum from the PFAS EAs, two PFAS in DE and one PFAS in MA were correlated with levels of PFAS in settled dust.**

**Basis for Conclusion:** For both DE and MA, there was a significant positive correlation between settled dust and blood serum levels for MeFOSAA, meaning that when settled dust levels of MeFOSAA were higher, levels in blood serum were also higher. In addition, there was a significant positive correlation between levels of PFOS in settled dust and blood serum for DE.

**Conclusion 3: PFAS species and precursors, in addition to the seven PFAS identified in blood serum during the PFAS EA, were detected in each type of environmental media sampled.**

**Basis for Conclusion:** Detectable levels of some PFAS species and some PFAS precursors were found in all types of environmental samples (air, settled dust, household vacuum dust, surface wipes, silicone wristbands, soil and produce) at both DE and MA. These PFAS were not further evaluated in the EI but were used to meet the project objective regarding whether PFAS were detected and, if so, which PFAS.

# 8. Recommendations for Community Members

1. PFAS are found in many different consumer products in the home. You can lower your exposure to PFAS by being aware of consumer items in your home that may contain PFAS and reducing your use of these products. For example, you could reduce your use of coated fast-food containers or decline use of stain-resistant treatments during carpet cleanings. To learn more visit: Questions and Answers on PFAS in Food | FDA.

2. Even though recent efforts to remove PFAS from consumer products could reduce exposure, some products may still contain them. If you have questions or concerns about products you use in your home, contact the Consumer Product Safety Commission at (800) 638-2772.

3. Discuss any health concerns or symptoms with your health care provider. In addition, share results of PFAS blood testing with your health care provider and make them aware ATSDR's resources for clinicians PFAS Information for Clinicians – 2024 | PFAS and Your Health | ATSDR

4. Follow the advice of your health care provider and the recommendations for checkups, vaccinations, prenatal care, and health screening tests.

4. Follow the advice of your health care provider and the recommendations for checkups, vaccinations, prenatal care, and health screening tests.

5. Follow the advice of your child's health care provider and the recommendations for well child checkups, vaccinations, and recommended health screening tests. Consult https://health.gov/myhealthfinder to help identify those vaccinations and tests.

6. For additional information about environmental exposures and children's health, contact the Pediatric Environmental Health Specialty Units, a nationwide network of experts in reproductive and children's environmental health (https://www.pehsu.net/).

**Resources:**

- For additional information about PFAS from ATSDR, please visit: Per- and Polyfluoroalkyl Substances (PFAS) and Your Health | PFAS and Your Health | ATSDR.
- To learn about steps you may take to reduce your risk of exposure to PFAS, please visit: Meaningful and Achievable Steps You Can Take to Reduce Your Risk | US EPA.
- For more information about remediation technologies and methods for PFAS: Treatment Technologies and Methods for Per- and Polyfluoroalkyl Substances (PFAS) | ITRC.
- For information for clinicians on potential health effects associated with PFAS, please visit: PFAS Information for Clinicians – 2024 | PFAS and Your Health | ATSDR.
- For additional information about PFAS from the U.S. Environmental Protection Agency, please visit: Per- and Polyfluoroalkyl Substances (PFAS) | US EPA.
- Our Current Understanding of the Human Health and Environmental Risks of PFAS: Our Current Understanding of the Human Health and Environmental Risks of PFAS | US EPA.

# 8. Authors, Site Team, and Contributors

ATSDR Authors:

Karen Scruton, MS
Section Chief, Exposure Investigation Section
Office of Community Health Hazard Assessment
Agency for Toxic Substances and Disease Registry

CAPT Peter Kowalski, MPH CIH (retired)
United States Public Health Service
Team Lead, Exposure Investigation Section
Office of Community Health Hazard Assessment
Agency for Toxic Substances and Disease Registry

Rachel Tchen, MPH
Environmental Health Scientist, Exposure Investigation Section
Office of Community Health Hazard Assessment
Agency for Toxic Substances and Disease Registry

James Pyon, MS
Associate Service Fellow, Exposure Investigation Section
Office of Community Health Hazard Assessment
Agency for Toxic Substances and Disease Registry

James Durant, MSPH CIH
Environmental Health Scientist, Exposure Investigation Section
Office of Community Health Hazard Assessment
Agency for Toxic Substances and Disease Registry

EPA Authors:

Elaine Cohen Hubal, PhD
Senior Science Advisor, Center for Public Health and Environmental Assessment
Office of Research and Development
U.S. Environmental Protection Agency

Kent Thomas, BSPH
Research Physical Scientist, Center for Public Health and Environmental Assessment
Office of Research and Development
U.S. Environmental Protection Agency

Jeffrey Minucci, PhD
Physical Scientist, Center for Public Health and Environmental Assessment
Office of Research and Development
U.S. Environmental Protection Agency

EPA Contributors:

Nicole M. DeLuca, PhD (formerly affiliated)
Postdoctoral Physical Scientist, Center for Public Health and Environmental Assessment
Office of Research and Development
U.S. Environmental Protection Agency

Nicolle Tulve, PhD
Research Physical Scientist, Center for Public Health and Environmental Assessment
Office of Research and Development
U.S. Environmental Protection AgencyJason Boettger, PhD
ORISE Fellow, Center for Public Health and Environmental Assessment
Office of Research and Development
U.S. Environmental Protection Agency

Dylan Wallis, PhD
ORISE Fellow, Center for Public Health and Environmental Assessment
Office of Research and Development
U.S. Environmental Protection Agency

Contractors and Partners:

Eurofins TestAmerica Laboratory
Eurofins Sacramento
880 Riverside Parkway
West Sacramento, CA 95605

Eastern Research Group – Air Support Contractor
561 Virginia Rd Suite 300 Building 4
Concord, MA 01742

# References

[ATSDR] Agency for Toxic Substances and Disease Registry. 2021. PFAS Exposure Assessment: Hampden County, Massachusetts, Final Report. Atlanta, GA: Agency of Toxic Substances and Disease Registry; 2021. Hampden County, MA PFAS Exposure Assessment Report (cdc.gov)

[ATSDR] Agency for Toxic Substances and Disease Registry. 2022a. PFAS Exposure Assessments: Collective Findings Across Ten PFAS Exposure Assessment Sites, Final Report. 2022. Per- and Polyfuoroalkyl Substances (PFAS) Exposure Assessment (cdc.gov)

[ATSDR] Agency for Toxic Substances and Disease Registry. 2022b. PFAS Exposure Assessment: New Castle County, Delaware, Final Report. Atlanta, GA: Agency of Toxic Substances and Disease Registry; 2022. Per- and Polyfuoroalkyl Substances (PFAS) Exposure Assessment (cdc.gov)

[ATSDR] Agency for Toxic Substances and Disease Registry. 2022c. Environmental Justice Index. Atlanta, GA: Agency of Toxic Substances and Disease Registry; 2022. Environmental Justice Index | Place and Health - Geospatial Research, Analysis, and Services Program (GRASP) | ATSDR

[ATSDR] Agency for Toxic Substances and Disease Registry. 2022d. Protocol: Supplemental Exposure Investigation (EI) at Select PFAS Exposure Assessment Sites. Located online at PFAS Environmental Sampling | PFAS and Your Health | ATSDR

[ATSDR] Agency for Toxic Substances and Disease Registry. 2022e. Exposure Point Concentration Guidance for Non-Discrete Sampling. Atlanta, GA: U.S. Department of Health and Human Services, Public Health Service. April 14

Bizkarguenaga E. Zabeleta I, Mijangos L, Iparraguirre A, Ferdandez LA, Prieto A, Zuloaga O. 2016. Uptake of perfluorooctanoic acid, perfluorooctane sulfonate and perfluorooctane sulfonamide by carrot and lettuce from compost amended soil. Science of the Total Environment. 571: 444–451.

Blaine AC, Rich CD, Sedlacko EM, Hundal LS, Kumar K, Lau C, Mills MA, Harris KM, Higgins CP. 2014. Perfluoroalkyl acid distribution in various plant compartments of edible crops grown in biosolids-amended soils. Environmental Science and Technology. 48(14): 7858–7865.

DeLuca et al. 2022. Nicole M. DeLuca, Jeffrey M. Minucci, Ashley Mullikin, Rachel Slover, Elaine A. Cohen Hubal. 2022. Human exposure pathways to poly- and perfluoroalkyl substances (PFAS) from indoor media: A systematic review. Environment International. Volume 162, April 2022, 107149. https://doi.org/10.1016/j.envint.2022.107149

DeLuca, NM, J Boettger, KE Miller, C Fuller, J Minucci, P Ashley, W Friedman, E Pinzer, K Bradham, J McCord, EA Cohen Hubal. 2024. Per- and Polyfluoroalkyl Substances (PFAS) in Paired House Dust and Tap Water from United States Homes. Indoor Environments, (2024) https://doi.org/10.1016/j.indenv.2024.100033

[EPA] U.S. Environmental Protection Agency. 2015. Third Unregulated Contaminant Monitoring Rule. https://www.epa.gov/dwucmr/third-unregulated-contaminant-monitoring-rule

[EPA] U.S. Environmental Protection Agency. 2017. Field Collection Standard Operating Procedures (SOPs) for an EPA Pilot Study Evaluating Personal, Housing, and Community Factors Influencing Children's Potential Exposures to Indoor Contaminants at Various Lifestages (EPA Pilot Study Add-On to the Green Housing Study). [SOP for Collection of Indoor Air Samples using Active Samplers]. Office of Research and Development. https://cfpub.epa.gov/si/si_public_record_report.cfm?dirEntryId=335764&Lab=NERL

Felizeter S, McLachlan MS, deVoogt P. 2012. Uptake of perfluorinated alkyl acids by hydroponically grown lettuce (Lactuca sativa). Environmental Science and Technology. 46(21): 11735–11743
Ghisi R, Vamerali T, Manzetti S. 2019. Accumulation of perfluorinated alkyl substances (PFAS) in agricultural plants: A review. Environ Res. 169: 326–341

Hawaii Department of Health. 2016. Use of Multi Incremental Samples to Characterize DU's. https://health.hawaii.gov/heer/tgm/section-04/

Helsel, DR. 2011. Statistics for censored environmental data using Minitab and R. 2nd ed. John Wiley & Sons, USA, NJ.

Holder C, DeLuca N, Luh J, Alexander P, Minucci JM, Vallero DA, Thomas K, Cohen Hubal EA. 2023. Systematic Evidence Mapping of Potential Exposure Pathways for Per- and Polyfluoroalkyl Substances Based on Measured Occurrence in Multiple Media. Environ Sci Technol. 2023 Apr 4;57(13):5107-5116. doi: 10.1021/acs.est.2c07185.

Holder C, Cohen Hubal EA, Luh J, Lee MG, Melnyk LJ, Thomas K. 2024. Systematic evidence mapping of potential correlates of exposure for per- and poly-fluoroalkyl substances (PFAS) based on measured occurrence in biomatrices and surveys of dietary consumption and product use. Int J Hyg Environ Health. 2024 May 11;259:114384. doi: 10.1016/j.ijheh.2024.114384.

Hu et al. 2019. Xindi C. Hu, Andrea Tokranov, Jahred Liddie, Xianming Zhang, Philippe Grandjean, Jaime E. Hart, Francine Laden, Qi Sun, Leo W. Y. Yeung, and Elsie M. Sunderland. 2019. Tap Water

Contributions to Plasma Concentrations of Poly- and Perfluoroalkyl Substances (PFAS) in a Nationwide Prospective Cohort of U.S. Women**.** Environmental Health Perspectives. Volume 127, Issue 6, CID: 067006, https://doi.org/10.1289/EHP4093

[HUD] Housing and Urban Development. n.d. Wipe Sample of Settled Dust for Lead Determination. https://www.hud.gov/sites/documents/LBPH-40.PDF

[ITRC] Interstate Technology Regulatory Council. 2018. Site Characterization Considerations, Sampling Precautions, and Laboratory Analytical Methods for Per- and Polyfluoroalkyl Substances (PFAS).

[ITRC] Interstate Technology Regulatory Council. 2020. Incremental Sampling Methodology Update. https://ism-2.itrcweb.org/

Lechner M, Knapp H. 2011. Carryover of Perfluorooctanoic Acid (PFOA) and Perfluorooctane Sulfonate (PFOS) from soil to plant and distribution to the different plant compartments studied in cultures of carrots (Daucus carota ssp. Sativus), potatoes (Solanum tuberosum), and cucumbers (Cucumis Sativus). Journal of Agricultural and Food Chemistry. 59(20): 11011–11018.

Levasseur JL, Hammel SC, Hoffman K, Phillips AL, Zhang S, Ye X, Calafat AC, Webster TF, Stapleton HM. 2021. Young children's exposure to phenols in the home: Associations between house dust, hand wipes, silicone wristbands, and urinary biomarkers. Environment International (147). https://doi.org/10.1016/j.envint.2020.106317

Liu Z, Lu Y, Song X, Jones K, Sweetman AJ. Johnson AC, Zhang M, Lu X, Su C. 2019. Multiple crop bioaccumulation and human exposure of perfluoroalkyl substances around a mega fluorochemical industrial park, China: Implication for planting optimization and food safety. Environ Int. 127: 671–684

[MDH] Minnesota Department of Health. 2010. House Dust Field Sampling Protocol for Perfluorochemical (PFC) Analysis.

National Children's Study. n.d. Environmental Vacuum Bag Dust Technician Collect SOP V1.0.

National Institute of Environmental Health Sciences. 2016. Perfluorinated Chemicals (PFCs). National Institutes of Health, Research Triangle Park, NC.

Navarro I, de la Torre A, Sanz P, Porcel MÁ, Pro J, Carbonell G, de los Angeles Martínez M. 2017. Uptake of perfluoroalkyl substances and halogenated flame retardants by crop plants grown in biosolids-amended soils. Environmental Research. 152: 199–206.

Roth J, Abusallout I, Hill T, Holton C, Thapa U, Hanigan D. 2020. Release of volatile per- and polyfluoroalkyl substances from aqueous film-forming foam. Environ. Sci. Technol. Lett. 7:164−170. https://pubs.acs.org/doi/suppl/10.1021/acs.estlett.0c00052/suppl_file/ez0c00052_si_001.pdf

Scher, D.P., Kelly, J.E., Huset, C.A., Barry, K.M., Hoffbeck, R.W., Yingling, V.L., and Messing, R.B. (2018) Occurrence of perfluoroalkyl substances (PFAS) in garden produce at homes with a history of PFAS-contaminated drinking water. Chemosphere. 196: 548–555

Sunderland et al. 2019. Sunderland EM, Hu XC, Dassuncao C, Tokranov AK, Wagner CC, Allen JG. A review of the pathways of human exposure to poly- and perfluoroalkyl substances (PFASs) and present

understanding of health effects. J Expo Sci Environ Epidemiol. 2019 Mar;29(2):131–147. doi: 10.1038/s41370-018-0094-1. Epub 2018 Nov 23. PMID: 30470793; PMCID: PMC6380916.

[US Census Bureau] United States Census Bureau. 2020. Online. https://www.census.gov/programs-surveys/decennial-census/decade/2020/2020-census-main.html

Wen, B., Wu, Y., Zhang, H., Liu, Y., Hu, X., Huang, H., and Zhang, S. (2016) The roles of protein and lipid in the accumulation and distribution of perfluorooctane sulfonate (PFOS) and perfluorooctanoate (PFOA) in plants grown in biosolids-amended soils. Environmental Pollution. 216: 682–688

# Appendices

# Appendix A: Sampling and Analysis Methodology

## Contents



### List of Tables



This appendix provides information regarding the methods used to collect and analyze PFAS and its precursors in the environmental media collected as part of the EI. The appendix sections are: an EI Overview, Project Data Quality Objectives, Field Methods and Procedures, and Analytes and Method Selection.

The following sections are excerpts from the Sampling and Analysis Plan (SAP) provided in the Supplemental Sampling for PFAS EI protocol (ATSDR 2022d).

It should be noted that the analysis of polyfluoroalkyl phosphate diesters (diPAPs) in each media were added to the analysis plan after the SAP was completed. The ester structure is formed when FTOH reacts with phosphate.

# EI Overview

ATSDR and EPA collected environmental samples from a subset of participating households at two of CDC/ATSDR's PFAS EA locations (Hampden County, MA, and New Castle County, DE). Households were identified and scheduled by recruiting strategies outlined in the EI Protocol (ATSDR 2022d). Data were collected in May of 2022 in DE and June of 2022 in MA. Data collection teams included personnel from both ATSDR and EPA.

Dust (settled and household vacuum), indoor and outdoor air, surface wipes, soil, silicone wristbands and produce samples were collected from identified households in both communities. In addition, community samples, including outdoor air and locally-grown produce, were collected. All samples were analyzed for PFAS and PFAS precursors in accordance with prescribed methods described in the protocol. The EI also included the administration of a questionnaire focused on better defining exposure to PFAS in the drinking water and obtaining additional information on non-drinking water exposure to PFAS sources, including the use of consumer products and potential dietary exposure.

The targeted and actual number of households/sampling locations by sample type are provided in Table A- 1. Number of sample types targeted and collected in each community PFAS samples were collected at each location. In addition, either FTOHs or EOF samples, but not both, were collected at each location. Appropriate quality control samples (e.g., blank samples, duplicates, triplicates) were also collected per the protocol.

**Table A- 1. Number of sample types targeted and collected in each community**

| Sample Type | Targeted Number | Actual Number |
|---|---|---|
| **Household Samples** | | |
| **Settled Indoor Dust** | 40 (DE)/80 (MA) | 31 (DE)/48 (MA) |
| **Indoor Dust (household vacuum)** | 20 | 7 (DE)/16 (MA) |
| **Indoor Air** | 20 | 10 (DE)/18 (MA) |
| **Surface Wipes** | 40 (two per household) | 20 (DE)/36 (MA) |
| **Soil** | 20 | 10 (DE)/18 (MA) |
| **Wristbands** | 20 | 10 (DE)/18 (MA) |
| **Community Samples** | | |
| **Ambient Air** | 2 (one low flow and one higher flow) | 2 (low and higher flow) |
| **Produce** | 21 per location* | 6 (DE)/9 (MA) |

* The goal was to collect 3 samples of 7 different types of produce

# Project Data Quality Objectives

## Project Objectives

The primary objective of the sampling plan was to ensure that the samples were collected in a consistent manner in order to be of the quality necessary to support the ATSDR and EPA evaluation of

PFAS exposure in the selected communities. ATSDR and EPA's overall goal in this EI was to determine the presence or absence of PFAS in selected media and the concentration of those found to be present. In addition, it was to evaluate whether detectable levels of PFAS may be associated with blood serum PFAS levels identified in the PFAS EA.

## Data Quality Objectives

The project Data Quality Objectives (DQOs) helped determine how to achieve the best data needed to meet the project's specific technical goals and objectives. This EI used DQOs to develop the criteria that the data collection design should satisfy, including where to conduct sampling, the number of samples to collect, and the overall representativeness, completeness, and comparability of data.

- Data representativeness: To help ensure that environmental samples collected were representative of the household that was being sampled, the sampling team (1) collected dust and wipe samples from the primary living spaces as identified by the homeowner (e.g., living room, family room, television room, kitchen, bedroom) in which participants spend the most time; (2) located indoor air sampling devices in one of the primary living spaces; and (3) implemented soil sampling using incremental sampling approaches in areas of the yard accessed by children and other family members (the decision or exposure unit). For produce, sample selection and representativeness were dictated by availability and variety of local produce.

- Data completeness: The sampling team did our best to ensure that complete samples sufficient to run the requested analyses were collected, and that the necessary quality control samples were collected. Laboratory calibration records were provided with the sampling report to determine the reliability of the sample data. Every effort was made to reschedule sampling times when homeowners were not available for the scheduled data collection time to help ensure that as many of the selected households as possible were sampled.

- Data comparability: Data sets were checked for comparability. Comparability is a qualitative measure of the confidence with which data sets can be compared. All analytical data received from the contract laboratories was reviewed to ensure analyses were completed in accordance with documented analytical procedures and by reporting the results in the standard units of measure as required in the methods.

# Field Methods and Procedures

The household sampling locations were a subset of PFAS EA participating households. Summary tables with community-specific locations, house identification numbers, contact numbers, and the household-specific sampling plan were provided to the environmental sampling team ahead of scheduled appointments. The exact sampling locations within each household were identified at the time of field sampling and recorded in the project-specific environmental sample collection form. Any deviations to the sampling plan were documented on the form.

## Household Samples

### *Indoor Dust (Settled Composite Samples)*

Settled dust samples were collected as part of the PFAS EAs as well as part of this EI. Settled dust was collected at each household in the EI.

### Sampling Point Selection

A composite dust sample was collected from up to six locations on the floor inside each selected home – the primary living space as identified by the homeowner (e.g., living room, family room, television room), the kitchen, and the bedroom in which EI participants spent the most time. Participants were instructed by the scheduler to not vacuum carpeting or sweep floors for at least 5 days prior to the scheduled visit to enable the sampling team to collect enough dust for analysis.

### Analyte and Method Selection

All settled composite dust samples were analyzed for PFAS via UPLC-MS/MS. FTOHs analysis (by LC-MS/MS) was conducted on samples collected in 50 percent of the selected households, and EOF analysis (by combustion ion chromatography) was conducted on samples collected in the other 50 percent of the selected households. When participants signed up for the sampling, they were asked whether they would prefer to have the settled-dust only sampling or the robust sampling completed at their homes. The robust sampling appointments were taken on a first-come first-serve basis.

### Sample Collection

The collection method was consistent with the Minnesota Department of Health's House Dust Field Sampling Protocol for Perfluorochemical (PFC) Analysis for the collection of vacuum filter samples, adapting the elements specific to collecting composite dust samples. Household dust samples were collected using a high-volume air sampler (Gast RotaryVane Pump Model 1532 or similar) with a flow rate of 15 L/min. The sampler was calibrated against a bubble meter (Gilian Bubble FlowMeter model 800285, Gilian Instrument Corp.). Dust was collected on 0.8 µm pore size polycarbonate filters (model 738 PC, Zefon Analytical Accessories, St. Petersburg, Fla.) placed in open-face 37-mm filter cassettes. PFAS contamination was not found in field blanks submitted to the laboratory during the EI, indicating that the cassettes and the bags used for shipping were considered to be PFAS free.

Samples were taken from both hard and soft surfaces, with mats, carpets, and area rugs being the preferred sampling surfaces. Samples were taken from easily accessible floor surfaces, but sampling staff asked permission of the homeowner to temporarily move small items to gain access to more floor space, as appropriate.

Field staff used a metal 2 $ft^2$ sampling template and had PFAS-free masking tape on hand to mark off the sampling area as needed. The total surface area, as well as the surface types on which the sample was taken, were recorded on the environmental sample collection form. Field staff attempted to collect samples with a minimum of 1-gram of total dust each in the open-faced cassettes from each home, vacuuming the same 2 $ft^2$ of carpet or other surface at least three times (vertically, horizontally, circles with the cassette) with slightly overlapping passes.

The initial weight of each filter cassettes was recorded in the field using an electronic Tesso TPS-100 scale. The initial recorded weight was compared to the post-sampling weight of the filter cassette to determine when enough sample has been collected at each household. The change in sample weight was recorded. Once sufficient sample mass was collected, the filter cassette was capped and placed in a plastic bag that zipped closed that was labeled with the appropriate sample identification number prior to shipping. Plastic shipping bags were considered to be PFAS free based on the absence of PFAS contamination in field blanks.

Sampling teams conducted all sampling activities in a manner to minimize potential contamination and cross-contamination of samples. Sampling staff wore new nitrile gloves at each household to avoid exposure to pollutants and other chemical, physical, and biological hazards, and to prevent cross-contamination of samples. Sampling staff took care not to touch the insides of filter cassettes and caps during sampling. Sampling staff ensured that the silicon tubing used to collect the sample was cleaned between households.

Any deviations to the sampling plan were documented on the environmental sample collection form. Conditions at the sampling locations, such as unusual operating conditions and odors or visual appearance, were also be recorded on the environmental sample collection form.

All samples were packed according to the laboratory guidelines and then shipped priority overnight via FedEx to the contract laboratory for analysis.

The laboratory provided settled dust results with the units as ng/sample. As stated above, the sample weight was recorded during sample collection. To obtain the concentration of PFAS in settled dust samples, the ng/sample results were divided by the sample weight (g/sample) which resulted in the concentration (ng/g, equivalent to µg/kg) which are the values used in the report.

## *Indoor Air*

### Sampling Point Selection

An active air sampler was placed in the home based on the following considerations:

- The first priority was selecting the room of primary occupancy by the participant (the room where the participant spends most of his/her time throughout the day other than a bedroom). The room of primary occupancy was often a living room or dining room and the apparatus was set up in an area of the room that was out of the traffic pattern of the home. The room identity was recorded on the field form.
- Sorbent tubes/cartridges were positioned at breathing zone height (~5 feet).
- For field duplicate samples, the sampling pumps were collocated within their boxes by placing each in adjacent positions at the base of the ring stand. Both sampling cartridges were located on the same horizontal support.
- The sampler location was recorded on the field form.
- The air sampler was calibrated, as appropriate, and personnel were available to troubleshoot the collection apparatus when notified of an issue by the homeowner.

### Analyte and Method Selection

Indoor air samples were analyzed for a targeted list of 30 semi-volatile PFAS and fluorotelomer alcohols (FTOHs). Samples were collected for the semi-volatile PFAS analytes using polyurethane foam/absorbent resins/polyurethane foam (PUF/XAD/PUF) cartridges while a separate sample, more appropriate for the volatile FTOHs, were collected using thermal desorption cartridges with appropriate sorbents. Preliminary testing was performed for both methods to optimize flow rates, sampling durations, and sample volumes to achieve the best detection limits possible for residential sample collection without analyte breakthrough.

Air samples were analyzed for PFAS by Liquid Chromatography/Tandem Mass Spectrometry (LC-MS/MS) (semi-volatiles) and thermal desorption Gas Chromatography/Tandem Mass Spectrometry (GC-MS/MS) (for volatile FTOHS).

Any deviations to the sampling plan were documented on the environmental sample collection form. Conditions at the sampling locations, such as unusual operating conditions and odors or visual appearance, were also be recorded on the environmental sample collection form.

#### Sample Collection

The sampling and analysis approach, modified for PFAS, was based on methods described in EPA 2017 (https://cfpub.epa.gov/si/si_public_record_report.cfm?dirEntryId=335764&Lab=NERL) and Roth et al. 2020 (https://pubs.acs.org/doi/suppl/10.1021/acs.estlett.0c00052/suppl_file/ez0c00052_si_001.pdf; https://pubs.acs.org/doi/suppl/10.1021/acs.estlett.0c00052/suppl_file/ez0c00052_si_001.pdf). Indoor air samples were collected over a period of 144-hours in each home.

A discussion of the air collection apparatus and calibration using an Air Check Touch is provided in the PFAS EI Protocol (ATSDR 2022d)

Any deviations to the sampling plan were documented on the environmental sample collection form. Conditions at the sampling locations, such as unusual operating conditions and odors or visual appearance, were also recorded on the environmental sample collection form.

### *Household vacuum dust*

#### Sampling Point Selection

A household vacuum dust sample was collected from the participant's vacuum cleaner, whether it was a bagged or bagless machine. During scheduling participants were instructed not to empty/dispose of dust in their vacuum, and not to vacuum at least five days prior to the appointment.

#### Analyte and Method Selection

All household vacuum dust samples were analyzed when sufficient sample mass was available for targeted PFAS (by UPLC-MS/MS), FTOHs analysis (by LC-MS/MS), EOF analysis (by combustion ion chromatography), and supplemented by total oxidizable precursor (TOP) assay.

Any deviations to the sampling plan were documented on the environmental sample collection form and communicated to ATSDR. Conditions at the sampling locations, such as unusual operating conditions and odors or visual appearance, were recorded on the environmental sample collection form.

#### Sample Collection

Procedures are adapted from the National Children's Study Environmental Vacuum Bag Dust Technician Collect SOP (National Children's Study, n.d.) and EPA's Field Collection Standard Operating Procedures for an EPA Pilot Study Evaluating Personal, Housing, and Community Factors Influencing Children's Potential Exposures to Indoor Contaminants at Various Lifestages (EPA Pilot Study Add-On to the Green Housing Study) (U.S. EPA 2017). The household vacuum samples were sieved (150 microns) in the laboratory prior to analysis.

## *Soil*

### Sampling Point Selection

Incremental Soil Methodology (ISM) increments were collected throughout the identified exposure unit (i.e., the area that people could come into contact with contaminants in soil on a regular basis) at each property. For some properties, it included the front, side, and back areas of the properties, if individuals are expected to access all areas of the properties equally. For others, this may have encompassed a more limited space (e.g., only the backyard if there was no access to the front yard).

Many possible sampling designs can be applied for ISM sample collection, each with the goal of yielding unbiased estimates of average concentrations. Systematic random grid sampling, a common and reliable method, was used for this program. Under this design, the position of the first increment sample was randomly selected and the remaining ISM increment collection points were determined by a sampling grid based off that first point. When field duplicates or triplicates were collected, the same grid pattern was used, but based on a new randomly selected starting point.

### Analyte and Method Selection

ISM soil samples were analyzed for PFAS via UPLC-MS/MS. FTOHs analysis (by LC-MS/MS) was conducted on samples collected in 50 percent of the selected households, and EOF analysis (by combustion ion chromatography) was conducted on the remaining 50% of the selected households. When participants signed up for the sampling, they were asked whether they would prefer to have the settled-dust only sampling or the robust sampling completed at their homes. The robust sampling appointments were taken on a first-come first-serve basis.

ISM soil samples were subsampled and processed in the laboratory following standard ISM protocols (HDOH 2016; ISM 2020). This involved sieving the samples to a particle size of less than two millimeters, and then drying and grinding the samples prior to subsampling (e.g., using a two-dimensional Japanese slab cake) and then extracting material for laboratory analysis.

### Sample Collection

ATSDR collected surface soil samples at 10 properties in DE and 18 properties in MA using an incremental sampling methodology (ISM) approach. This sampling method involves collecting and combining many equal mass increments of soil (i.e., increment samples) across a specific area or volume of soil (e.g., an exposure unit) into a single representative sampled for laboratory analysis (i.e., household vacuum ISM sample). The combined sample is sieved and ground to obtain a consistent particle size and then subsampled and processed by the laboratory following specific protocols. Due to the sampling density afforded by collecting many increments, ISM samples can provide more precise and representative estimates of an exposure unit's average contaminant concentrations than other sampling approaches.

For this program, each ISM sample was comprised of 80 increments collected in an unbiased manner and at a depth of two centimeters throughout the identified exposure unit for a given property. At a subset of properties, ISM field replicates were collected. Field replicates consisted of separate ISM samples collected and processed from the same exposure unit. For this program, triplicate ISM field samples were collected at approximately 20% of participating properties in each community.

The approach described below is based on ATSDR's Exposure Point Concentration Guidance for Non-discrete Sampling (ATSDR 2022e) and guidance developed by the following entities:

- Interstate Technology Regulatory Council (ITRC), 2020: https://ism-2.itrcweb.org/
- Hawaii Department of Health, 2016: https://health.hawaii.gov/heer/tgm/section-04/

## *Surface Wipes*

### Sampling Point Selection

Wipes were taken at two locations within the home, along with appropriate QC samples. Samples were taken in areas that may have residue from the use of PFAS-containing products or areas where dust may accumulate, such as kitchen counters or shelves in a high-traffic area that may accumulate dust. The scheduler instructed the participant to not dust, vacuum or sweep floors for at least 5 days prior to the scheduled visit.

The sampling teams collected the first wipe sample on the kitchen counter, preferably in a corner of the counter that may not be cleaned daily, and the second wipe sample was preferably taken on an uncarpeted floor of a closet that may contain outerwear. In cases where a suitable closet floor was not available, samples were collected from the floor in another location in the home and noted on the sample collection form. Sampling staff asked permission of the homeowner to temporarily move small items to gain access to more space.

### Analyte and Method Selection

Wipe samples were analyzed for PFAS via UPLC-MS/MS. FTOHs analysis (by LC-MS/MS) was conducted on samples collected in 50 percent of the selected households, and EOF analysis (by combustion ion chromatography) was conducted on samples collected in the remaining 50 percent of the selected households.

### Sample Collection

Field staff followed the Department of Housing and Urban Development (HUD) protocol for Wipe Sampling of Settled Dust for Lead Determination (https://www.hud.gov/sites/documents/LBPH-40.PDF), adapting the elements specific to collecting samples for PFAS analysis. The wipes and solvents used to collect the PFAS samples were different from those used to collect lead samples, but the technique for sample collection was based on the method provided in the HUD protocol.

## *Silicone Wristbands*

### Sampling Point Selection

One adult per household was requested to wear two to three wristbands for a period of six days. The designated person was the one that signed the consent form for sample collection.

### Analyte and Method Selection

Silicone wristbands were analyzed for targeted PFAS via LC-MS/MS. FTOHs analysis (by GC-MS/MS) was conducted on samples collected in 50 percent of the selected households, and EOF analysis was conducted on samples collected in the remaining 50 percent of the selected households.

### Sample Collection

A sample was collected using silicone wristbands as a passive sampler. Participants were instructed to wear wristbands continuously for six days, but to remove the wristband during showering, bathing, or swimming. The wristbands were collected from the participants after seven days.

## *Ambient Air*

### Sampling Point Selection

Sampling apparatus for ambient data collection were situated in a centralized location within the EA sampling frame within the community. Location selection was based on considerations such as power source, security, and minimizing noise disturbances, which ATSDR evaluated during pre-sampling reconnaissance. In DE, the ambient air apparatus was located in a central area owned by the local utility company and in MA it was located at a middle school.

Field staff recorded the ambient sampling equipment location (lat/long) on the field form and took pictures, if possible, in a 360-degree arc to record sampling location.

Fencing and signage was available or temporarily installed to ensure the equipment was secured, and there was no potential for tampering with samples as appropriate.

### Analyte and Method Selection

Outdoor air samples were analyzed for a targeted list of 30 semi-volatile PFAS and five FTOHs. Samples were collected for the semi-volatile PFAS analytes using PUF/XAD/PUF cartridges while a separate sample, more appropriate for the volatile FTOHs, was collected using thermal desorption cartridges with appropriate sorbents. Preliminary testing was performed for both methods to optimize flow rates, sampling durations, and sample volumes to achieve the best detection limits possible for residential sample collection without analyte breakthrough.

Air samples were analyzed for PFAS by Liquid Chromatography/Tandem Mass Spectrometry https://www.epa.gov/sites/production/files/2020-01/documents/pfas_methods-sampling_tech_brief_7jan2020-update.pdf (LC-MS/MS) (semi-volatiles) and thermal desorption Gas Chromatography/Tandem Mass Spectrometry (GC-MS/MS) (volatiles).

### Sample Collection

*Higher-volume samples*: Air samples were collected at 20 L/min for approximately 144 hours using AirChek 30 sampling pumps using the same PUF/XAD/PUF filters as used for the indoor sampling. Preliminary testing showed little to no significant losses of spiked analytes for this flow/duration condition.

*Low-volume samples*: The calibration, installation, and breakdown procedures were the same as those described for indoor air sampling.

## *Produce*

### Sample Selection Point

Produce samples were collected from markets throughout the EA sampling frame. Venues selling locally grown produce were identified before the sampling campaign began. The sampling team identified "local" produce based on labeling in the markets or knowledge of suppliers to community-based farmers' markets. To the extent possible, sampling targeted produce grown in the community itself.

### Analyte and Method Selection

Produce samples were tested for multiple PFAS by UPLC-MS/MS. The laboratory processed (homogenized) the sample.

### Sample Collection

Available data suggest that PFAS accumulation varies by plant part. The shorter chain length PFAS tend to accumulate in the shoots (leaves and fruits), whereas the longer chain length PFAS tend to accumulate in the roots (Blaine et al. 2014; Felizeter et al. 2012; Ghisi et al. 2019; Navarro et al. 2017). Uptake also appears to vary depending on vegetative structure (e.g. presence/absence of barriers) (Blaine et al. 2014; Liu et al. 2019) and protein content (Wen et al. 2016). In some cases, higher concentrations are found in the leaves/foliage than the edible parts of plants (e.g., potatoes, carrots, and cucumbers) (Lechner and Knapp 2011); higher concentrations have been reported in the lettuce heart versus the leaves (Bizkarguenaga et al. 2016). Acknowledging this expected variance, the EI sampling goal was goal to collect a cross-section of edible portions of leafy greens, root/shoot vegetables, and fruit vegetables. The following produce serves as a guide for sampling based on several considerations, including documented PFAS accumulation in the edible portion of the plant and likelihood of being grown locally.

In each community, the goal was to collect 21 samples—ideally, three samples of seven different types of produce. The seven types of produce may vary depending on sampling location and season. However, an effort was made to select a variety of produce types and within each produce type, the specific produce that was expected to have the highest PFAS levels, broadly ranked in the list above.

## Analytes and Method Selection

For this EI, samples were analyzed by methods that were being developed and refined for the measurement of multiple PFAS and PFAS precursors in non-aqueous matrices by the selected laboratory. Table A- 2 summarizes the analyses to be performed in air, dust, soil, wipes, and produce, and the PFAS and PFAS precursors associated with each analytical method.

The FDA established verified LC-MS/MS methods to identify 16 PFAS in foods (FDA 2021). PFAS in produce that were not among the 16 FDA-verified compounds in foods are indicated in Table A- 2 with a dagger (†) symbol as additional PFAS analytes.

**Table A- 2. List of PFAS and PFAS precursors measured in EI samples**

| Abbreviation | Chemical Name | Indoor Air | Outdoor Air | Soil | Settled Dust | Household Vacuum Dust | Produce | Wipes | Wristband |
|---|---|---|---|---|---|---|---|---|---|
| PFAS Species (*by UPLC-MS/MS or LC-MS/MS*) | | | | | | | | | |
| PFHxS | Perfluorohexanesulfonic acid | ✓ | ✓ | ✓ | ✓ | ✓* | ✓ | ✓ | ✓ |
| PFOS | Perfluorooctanesulfonic acid | ✓ | ✓ | ✓ | ✓ | ✓* | ✓ | ✓ | ✓ |

| Abbreviation | Chemical Name | Indoor Air | Outdoor Air | Soil | Settled Dust | Household Vacuum Dust | Produce | Wipes | Wristband |
|---|---|---|---|---|---|---|---|---|---|
| PFAS Species (*by UPLC-MS/MS or LC-MS/MS*) | | | | | | | | | |
| PFOA | Perfluorooctanoic acid | ✓ | ✓ | ✓ | ✓ | ✓* | ✓ | ✓ | ✓ |
| PFNA | Perfluorononanoic acid | ✓ | ✓ | ✓ | ✓ | ✓* | ✓ | ✓ | ✓ |
| PFDA | Perfluorodecanoic acid | ✓ | ✓ | ✓ | ✓ | ✓* | ✓ | ✓ | ✓ |
| PFUnA | Perfluoroundecanoic acid | ✓ | ✓ | ✓ | ✓ | ✓* | ✓[†] | ✓ | ✓ |
| MeFOSAA | N-Methyl perfluorooctanesulfonamidoacetic acid | ✓ | ✓ | ✓ | ✓ | ✓* | ✓[†] | ✓ | ✓ |
| PFPrA | Perfluoropropanoic acid | | | ✓ | | ✓* | | | |
| PFBA | Perfluorobutanoic acid | ✓ | ✓ | ✓ | ✓ | ✓* | ✓ | ✓ | ✓ |
| PFPeA | Perfluoropentanoic acid | ✓ | ✓ | ✓ | ✓ | ✓* | ✓ | ✓ | ✓ |
| PFHxA | Perfluorohexanoic acid | ✓ | ✓ | ✓ | ✓ | ✓* | ✓ | ✓ | ✓ |
| PFHpA | Perfluoroheptanoic acid | ✓ | ✓ | ✓ | ✓ | ✓* | ✓ | ✓ | ✓ |
| PFDoA | Perfluorododecanoic acid | ✓ | ✓ | ✓ | ✓ | ✓* | ✓[†] | ✓ | ✓ |
| PFTrA | Perfluorotridecanoic acid | ✓ | ✓ | ✓ | ✓ | ✓* | ✓[†] | ✓ | ✓ |
| PFTA | Perfluorotetradecanoic acid | ✓ | ✓ | ✓ | ✓ | ✓* | ✓[†] | ✓ | ✓ |
| PFHxDA | Perfluorohexadecanoic acid | | | ✓ | | ✓* | | | |
| PFODA | Perfluorooctadecanoic acid | | | ✓ | | ✓* | | | |
| PFPrS | Perfluoropropanesulfonic acid | | | ✓ | | ✓* | | | |

| Abbreviation | Chemical Name | Indoor Air | Outdoor Air | Soil | Settled Dust | Household Vacuum Dust | Produce | Wipes | Wristband |
|---|---|---|---|---|---|---|---|---|---|
| PFAS Species (*by UPLC-MS/MS or LC-MS/MS*) | | | | | | | | | |
| PFBS | Perfluorobutanesulfonic acid | ✓ | ✓ | ✓ | ✓ | ✓* | ✓ | ✓ | ✓ |
| PFPeS | Perfluoropentanesulfonic acid | ✓ | ✓ | ✓ | ✓ | ✓* | ✓ | ✓ | ✓ |
| PFHpS | Perfluoroheptanesulfonic acid | ✓ | ✓ | ✓ | ✓ | ✓* | ✓ | ✓ | ✓ |
| PFNS | Perfluorononanesulfonic acid | ✓ | ✓ | ✓ | ✓ | ✓* | ✓† | ✓ | ✓ |
| PFDS | Perfluorodecanesulfonic acid | ✓ | ✓ | ✓ | ✓ | ✓* | ✓† | ✓ | ✓ |
| PFDoS | Perfluorododecanesulfonic acid | ✓ | ✓ | ✓ | ✓ | ✓* | ✓† | ✓ | ✓ |
| 3:3 FTCA | 3:3 Fluorotelomer carboxylic acid | | | ✓ | ✓ | ✓* | | ✓ | ✓ |
| 5:3 FTCA | 5:3 Fluorotelomer carboxylic acid | | | ✓ | ✓ | ✓* | | ✓ | ✓ |
| 6:2 FTCA | 6:2 Fluorotelomer carboxylic acid | | | ✓ | | ✓* | | | |
| 7:3 FTCA | 7:3-Fluorotelomer carboxylic acid | | | ✓ | ✓ | ✓* | | ✓ | ✓ |
| 8:2 FTCA | 8:2 Fluorotelomer carboxylic acid | | | ✓ | | ✓* | | | |
| 10:2 FTCA | 10:2 Fluorotelomer carboxylic acid | | | ✓ | | ✓* | | | |
| FtS 4:2 | 4:2 Fluorotelomer sulfonic acid | ✓ | ✓ | ✓ | ✓ | ✓* | ✓† | ✓ | ✓ |

| Abbreviation | Chemical Name | Indoor Air | Outdoor Air | Soil | Settled Dust | Household Vacuum Dust | Produce | Wipes | Wristband |
|---|---|---|---|---|---|---|---|---|---|
| PFAS Species (*by UPLC-MS/MS or LC-MS/MS*) | | | | | | | | | |
| FtS 6:2 | 6:2 Fluorotelomer sulfonic acid | ✓ | ✓ | ✓ | ✓ | ✓* | ✓† | ✓ | ✓ |
| FtS 8:2 | 8:2 Fluorotelomer sulfonic acid | ✓ | ✓ | ✓ | ✓ | ✓* | ✓† | ✓ | ✓ |
| FtS 10:2 | 10:2 Fluorotelomer sulfonic acid | | | ✓ | | ✓* | | | |
| PFOSA | Perfluorooctanesulfonamide | ✓ | ✓ | ✓ | ✓ | ✓* | ✓† | ✓ | ✓ |
| N-MeFOSA | N-Methylperfluorooctanesulfonamide | ✓ | ✓ | ✓ | ✓ | ✓* | ✓† | ✓ | ✓ |
| N-EtFOSA | N-Ethylperfluorooctanesulfonamide | ✓ | ✓ | ✓ | ✓ | ✓* | ✓† | ✓ | ✓ |
| EtFOSAA | N-Ethyl perfluorooctanesulfonamidoacetic acid | ✓ | ✓ | ✓ | ✓ | ✓* | ✓† | ✓ | ✓ |
| N-MeFOSE | N-Methyl-N-(2-hydroxyethyl)perfluorooctanesulfonamide | ✓ | ✓ | ✓ | ✓ | ✓* | ✓† | ✓ | ✓ |
| N-EtFOSE | N-Ethyl-N-(2-hydroxyethyl)perfluorooctanesulfonamide | ✓ | ✓ | ✓ | ✓ | ✓* | ✓† | ✓ | ✓ |
| PFMOAA | Perfluoro-2-methoxyacetic acid | | | ✓ | | ✓* | | | |
| PFMPA | Perfluoro-3-methoxypropanoic acid | | | ✓ | ✓ | ✓* | | ✓ | ✓ |
| PMPA | Perfluoromethoxypropionic acid | | | ✓ | | ✓* | | | |

| Abbreviation | Chemical Name | Indoor Air | Outdoor Air | Soil | Settled Dust | Household Vacuum Dust | Produce | Wipes | Wristband |
|---|---|---|---|---|---|---|---|---|---|
| PFAS Species (*by UPLC-MS/MS or LC-MS/MS*) | | | | | | | | | |
| PFMBA | Perfluoro(4-methoxybutanoic) acid | | | ✓ | ✓ | ✓* | | ✓ | ✓ |
| PEPA | Perfluoro-2-ethoxypropanoic acid | | | ✓ | | ✓* | | | |
| HFPO-DA | Hexafluoropropylene oxide dimer acid | ✓ | ✓ | ✓ | ✓ | ✓* | ✓ | ✓ | ✓ |
| PFPE-1 | Perfluoro-6-methyl-5-oxaheptanoic acid | | | ✓ | | ✓* | | | |
| R-EVE | 4-(2-Carboxy-1,1,2,2-tetrafluoroethoxy)-perfluoropentanoic acid | | | ✓ | | ✓* | | | |
| NFDHA | Perfluoro-3,6-dioxaheptanoic acid | | | ✓ | ✓ | ✓* | | ✓ | ✓ |
| PFO2HxA | Perfluoro-3,5-dioxahexanoic acid | | | ✓ | | ✓* | | | |
| PFO3OA | Perfluoro-3,5,7-trioxaoctanoic acid | | | ✓ | | ✓* | | | |
| PFO4DA | Perfluoro-3,5,7,9-butaoxadecanoic acid | | | ✓ | | ✓* | | | |
| PFO5DA | Perfluoro-3,5,7,9,11-pentaoxadodecanoic acid | | | ✓ | | ✓* | | | |
| Byproduct 4 | R-PSDA | | | ✓ | | ✓* | | | |
| PFEESA | Perfluoro(2-ethoxyethane)sulfonic acid | | | ✓ | ✓ | ✓* | | ✓ | ✓ |
| 9Cl-PF3ONS | Perfluoro(2-((6-chlorohexyl)oxy)ethanesulfonic acid) | | | ✓ | ✓ | ✓* | ✓ | ✓ | ✓ |

| Abbreviation | Chemical Name | Indoor Air | Outdoor Air | Soil | Settled Dust | Household Vacuum Dust | Produce | Wipes | Wristband |
|---|---|---|---|---|---|---|---|---|---|
| PFAS Species (*by UPLC-MS/MS or LC-MS/MS*) | | | | | | | | | |
| 11Cl-PF3OUdS | 11-chloroeicosafluoro-3-oxaundecane-1-sulfonic acid | | | ✓ | ✓ | ✓* | ✓ | ✓ | ✓ |
| NVHOS | (1,1,2,2-Tetrafluoro-2-(1,2,2,2-tetrafluoroethoxy)ethane-1-sulfonic acid) | | | ✓ | | ✓* | | | |
| ADONA | 4,8-Dioxa-3H-perfluorononanoic acid | | | ✓ | ✓ | ✓* | ✓† | ✓ | ✓ |
| Hydro-EVE | Hydro-EVE acid | | | ✓ | | ✓* | | | |
| Byproduct 5 | Hydrolyzed PSDA | | | ✓ | | ✓* | | | |
| PFecHS | Perfluoro(perfluoroethyl)cyclohexanesulfonic acid | | | ✓ | | ✓* | | | |
| diPAPs (*by UPLC-MS/MS or LC-MS/MS*) | | | | | | | | | |
| 6:2 diPAP | 6:2 Fluorotelomer phosphate diester | ✓ | ✓ | ✓ | ✓ | ✓* | | ✓ | ✓ |
| 6:2/8:2 diPAP | 6:2/8:2 Fluorotelomer phosphate diester | ✓ | ✓ | ✓ | ✓ | ✓* | | ✓ | ✓ |
| 8:2 diPAP | 8:2 Fluorotelomer phosphate diester | ✓ | ✓ | ✓ | ✓ | ✓* | | ✓ | ✓ |
| 10:2 diPAP | 10:2 Fluorotelomer phosphate diester | ✓ | ✓ | ✓ | ✓ | ✓* | | ✓ | ✓ |
| Fluorotelomer Alcohols (FTOHs) (*by GC-MS/MS*) | | | | | | | | | |
| 4:2 FTOH | 4:2 Fluorotelomer alcohol | ✓ | ✓ | ✓ | ✓ | ✓ | ✓† | ✓ | ✓ |
| 6:2 FTOH | 6:2 Fluorotelomer alcohol | ✓ | ✓ | ✓ | ✓ | ✓ | ✓† | ✓ | ✓ |

| Abbreviation | Chemical Name | Indoor Air | Outdoor Air | Soil | Settled Dust | Household Vacuum Dust | Produce | Wipes | Wristband |
|---|---|---|---|---|---|---|---|---|---|
| PFAS Species (*by UPLC-MS/MS or LC-MS/MS*) | | | | | | | | | |
| 7:2 sFTOH | 7:2 sFluorotelomer alcohol | | | ✓ | ✓ | ✓ | ✓[†] | ✓ | ✓ |
| 8:2 FTOH | 8:2 Fluorotelomer alcohol | ✓ | ✓ | ✓ | ✓ | ✓ | ✓[†] | ✓ | ✓ |
| 10:2 FTOH | 10:2 Fluorotelomer alcohol | ✓ | ✓ | ✓ | ✓ | ✓ | ✓[†] | ✓ | ✓ |
| EOF (*by combustion ion chromatography*) | | | | | | | | | |
| EOF | Extractable organic fluorine | | | ✓ | ✓ | ✓ | ✓[†] | ✓ | ✓ |

*For dust, a total oxidizable precursor (TOP) assay was run for samples with sufficient collected amounts. The assay oxidation step and subsequent analysis helps identify the potential for non-target polyfluorinated precursors to form terminal perfluorinated target analytes. An increase in concentration of the terminal carboxylic acids following oxidation represents the precursor potential of the sample.

[†]Additional PFAS analytes in produce that are in addition to the list of PFAS in produce provided by the FDA – refer to Appendix A, Analytes and Method Selection.

UPLC-MS/MS = Ultra-Performance Liquid Chromatography-Mass Spectrometry/Mass Spectrometry

LC-MS/MS = Liquid Chromatography-Mass Spectrometry/Mass-Spectrometry

GC-MS/MS = Gas chromatography-Mass Spectrometry/Mass-Spectrometry

# References


Bizkarguenaga E. Zabeleta I, Mijangos L, Iparraguirre A, Ferdandez LA, Prieto A, Zuloaga O. 2016. Uptake of perfluorooctanoic acid, perfluorooctane sulfonate and perfluorooctane sulfonamide by carrot and lettuce from compost amended soil. Science of the Total Environment. 571: 444–451.

Blaine AC, Rich CD, Sedlacko EM, Hundal LS, Kumar K, Lau C, Mills MA, Harris KM, Higgins CP. 2014. Perfluoroalkyl acid distribution in various plant compartments of edible crops grown in biosolids-amended soils. Environmental Science and Technology. 48(14): 7858–7865.

[FDA] Food and Drug Administration. 2021. FDA Food Program Compendium of Analytical Laboratory Methods: Chemical Analytical Manual (CAM).

Felizeter S, McLachlan MS, deVoogt P. 2012. Uptake of perfluorinated alkyl acids by hydroponically grown lettuce (Lactuca sativa). Environmental Science and Technology. 46(21): 11735–11743

Ghisi R, Vamerali T, Manzetti S. 2019. Accumulation of perfluorinated alkyl substances (PFAS) in agricultural plants: A review. Environ Res. 169: 326–341

Hawaii Department of Health. 2016. Use of Multi Incremental Samples to Characterize DU's. https://health.hawaii.gov/heer/tgm/section-04/

Helsel, DR. 2011. Statistics for censored environmental data using Minitab and R. 2nd ed. John Wiley & Sons, USA, NJ.

HUD n.d. Wipe Sample of Settled Dust for Lead Determination. https://www.hud.gov/sites/documents/LBPH-40.PDF

Interstate Technology Regulatory Council [ITRC]. 2018. Site Characterization Considerations, Sampling Precautions, and Laboratory Analytical Methods for Per- and Polyfluoroalkyl Substances (PFAS).

Interstate Technology Regulatory Council [ITRC]. 2020. Incremental Sampling Methodology Update. https://ism-2.itrcweb.org/

Lechner M, Knapp H. 2011. Carryover of Perfluorooctanoic Acid (PFOA) and Perfluorooctane Sulfonate (PFOS) from soil to plant and distribution to the different plant compartments studied in cultures of carrots (Daucus carota ssp. Sativus), potatoes (Solanum tuberosum), and cucumbers (Cucumis Sativus). Journal of Agricultural and Food Chemistry. 59(20): 11011–11018.

Levasseur JL, Hammel SC, Hoffman K, Phillips AL, Zhang S, Ye X, Calafat AC, Webster TF, Stapleton HM. 2021. Young children's exposure to phenols in the home: Associations between house dust, hand wipes, silicone wristbands, and urinary biomarkers. Environment International (147). https://doi.org/10.1016/j.envint.2020.106317

Liu Z, Lu Y, Song X, Jones K, Sweetman AJ. Johnson AC, Zhang M, Lu X, Su C. 2019. Multiple crop bioaccumulation and human exposure of perfluoroalkyl substances around a mega fluorochemical industrial park, China: Implication for planting optimization and food safety. Environ Int. 127: 671–684

Minnesota Department of Health [MDH]. 2010. House Dust Field Sampling Protocol for Perfluorochemical (PFC) Analysis.

National Children's Study. n.d. Environmental Vacuum Bag Dust Technician Collect SOP V1.0.

National Institute of Environmental Health Sciences. 2016. Perfluorinated Chemicals (PFCs). National Institutes of Health, Research Triangle Park, NC.

Navarro I, de la Torre A, Sanz P, Porcel MÁ, Pro J, Carbonell G, de los Angeles Martínez M. 2017. Uptake of perfluoroalkyl substances and halogenated flame retardants by crop plants grown in biosolids-amended soils. Environmental Research. 152: 199–206.

Roth J, Abusallout I, Hill T, Holton C, Thapa U, Hanigan D. 2020. Release of volatile per- and polyfluoroalkyl substances from aqueous film-forming foam. Environ. Sci. Technol. Lett. 7:164−170. https://pubs.acs.org/doi/suppl/10.1021/acs.estlett.0c00052/suppl_file/ez0c00052_si_001.pdf

Scher, D.P., Kelly, J.E., Huset, C.A., Barry, K.M., Hoffbeck, R.W., Yingling, V.L., and Messing, R.B. (2018) Occurrence of perfluoroalkyl substances (PFAS) in garden produce at homes with a history of PFAS-contaminated drinking water. Chemosphere. 196: 548–555

U.S. Environmental Protection Agency [EPA]. 2017. Field Collection Standard Operating Procedures (SOPs) for an EPA Pilot Study Evaluating Personal, Housing, and Community Factors Influencing Children's Potential Exposures to Indoor Contaminants at Various Lifestages (EPA Pilot Study Add-On to the Green Housing Study). [SOP for Collection of Indoor Air Samples using Active Samplers]. Office of Research and Development.
https://cfpub.epa.gov/si/si_public_record_report.cfm?dirEntryId=335764&Lab=NERL

Wen, B., Wu, Y., Zhang, H., Liu, Y., Hu, X., Huang, H., and Zhang, S. (2016) The roles of protein and lipid in the accumulation and distribution of perfluorooctane sulfonate (PFOS) and perfluorooctanoate (PFOA) in plants grown in biosolids-amended soils. Environmental Pollution. 216: 682–688

# Appendix B: Data Evaluation

## Contents

## List of Tables



## List of Figures



There are four sub-appendices within Appendix B:

- Appendix B1: Data Quality — This covers quality control sample types plus data quality objective evaluations which includes precision and accuracy analysis.
- Appendix B2: Invalidation of Results — This includes criteria for data invalidation and summaries of invalidated results.
- Appendix B3: Statistical Concepts and Procedures — This covers explanations of statistical concepts used throughout this report, treatment of non-detects (NDs) in all analyses, and procedures for the evaluation of questionnaire data.
- Appendix B4: Questionnaire Data Analysis — This includes results from the evaluation of the questionnaire data.

# Appendix B1: Data Quality

## Quality Control (QC) Types

Table B- 1 provides information on the types of Quality Control (QC) samples evaluated with some being collected in, or transported to and from, the field and some being generated in the laboratory. Analysis of the results of the QC samples was used to determine whether some results should not be included in the data analysis and reporting. Table B- 6 and Table B- 7 provide a listing of those samples eliminated from the data set as a result of the QC analysis.

**Table B- 1. Quality Control Samples**

| Quality Control Sample | Description |
|---|---|
| **Field Quality Control Samples** | |
| **Field Blank** | A blank was collected in the field to evaluate the potential for contamination of the sampling media, including contamination that might occur during collection, storage, and transport. Field blanks were taken for air, settled dust, surface wipes and wristband samples. |
| **Duplicates/ Triplicates** | A second or third sample was collected in the same location and at the same time as the primary sample to evaluate the degree of measurement precision. Duplicates were collected for air, settled dust, surface wipes, wristbands, and produce. Triplicates were collected for soil. |
| **Field controls for surface wipes and air samples** | The laboratory added known amounts of target analytes to surface wipe and air media to evaluate the recovery of these analytes through storage, transport, and analysis. |
| **Laboratory Quality Control Samples** | |
| **Method Blanks** | Method blanks were used to evaluate possible contamination arising from laboratory equipment, containers, solvents, or processes used during the analysis of field samples. |
| **Matrix Spike/ Matrix Spike Duplicates** | Known quantities of target analytes were added to separate portions of several soil samples to evaluate analyte recoveries and effectiveness of the quantification of the result. |
| **Laboratory Duplicates** | The laboratory performed second analyses of selected samples and quality control samples to evaluate the replication of results from an instrument. |
| **Laboratory Control Sample** | Known amounts of target analytes were added to solvents and carried through processing and analysis procedures to evaluate analyte recoveries and method performance. |
| **SRM (Standard Reference Material)** | For household vacuum dust, the laboratory analyzed ten samples of 10 g of the National Institute of Standards and Technology (NIST) Standard Reference Material 2585 to assess recovery of selected target analytes in house dust using a well-characterized reference material. |

## DQO Evaluation

The Data Quality Objectives for the EI are:

- Data representativeness: This objective was met by ensuring that the data collection teams collected samples using methodology outlined in the Sampling and Analysis Plan.
- Data completeness: This objective was met by ensuring that the data collection teams collected the appropriate number of site and quality control samples to allow the laboratory to perform the data analysis.
- Data comparability: Comparability is a qualitative measure of the confidence with which data sets can be compared using the following:
    - Precision: Precision was evaluated by determining the percent relative standard deviations (RSDs) between the duplicates or triplicates (soil only) collected in the field. The analysis is provided below.
    - Accuracy: Accuracy of the results was evaluated by assessing recoveries of laboratory controls and spiked samples. This analysis is provided below.

## Precision Analysis

A second (duplicate) or third (triplicate) field sample was collected in the same location as the primary sample to evaluate the precision of field sampling and laboratory analysis. Precision is a measure of mutual agreement among individual measurements of samples collected at the same time and location, usually under prescribed similar conditions.

The relative percent difference (RPD), the absolute value of the difference between duplicate results divided by the arithmetic mean multiplied by 100, of the duplicates was calculated for each site/household/media/PFAS combination when there was more than 1 detected result. For triplicates, the percent relative standard deviation (%RSD), the arithmetic standard deviation divided by the arithmetic mean multiplied by 100. Lower RPD/%RSD values indicate more precision in replicate samples. Higher RPD/%RSD values indicate less precision in replicate samples. RPD/%RSD values were not used to invalidate results. For ease of reading, RPD and %RSD values will be collectively referred to as “values” in this Precision Analysis section.

Values of zero mean that the duplicate or triplicate measurements were equivalent to each other. Cases where the mean, minimum, and maximum values are all the same indicate there was only one duplicate or triplicate sample collected.

As stated in the PFAS EI Supplemental QA Addendum, because laboratories have limited experience in analyzing these exposure sample media for PFAS chemicals, a value of plus or minus 25% was considered a goal. The actual performance was to be evaluated and described as an important outcome of the investigation.

Table B- 2 contains mean values and a range of values among households for each site/media/PFAS combination for the 7 PFAS from the EA. Values in field samples for the 7 PFAS ranged below and above the goal of 25% precision. Wipe samples tended to be the least precise (higher values) among the media but had a wide range of values for different PFAS. Settled dust and soil may result in higher values due

to differences in the sampling locations. MeFOSAA results from settled dust and soil samples were less precise than other PFAS results from both those media which tended to have values less than 25%. Produce and wristbands were precise with values at or below the 25% goal, but there were few detected results for these media. Precision seemed roughly comparable between sites, though more values are available for DE due to the higher detection rates in DE.

**Table B- 2. Relative Percent Difference (Mean and Range) for Field Samples — 7 PFAS**

| Site | PFAS | Settled Dust | Wipe 1 | Wipe 2 | Indoor Air | Wrist-band | Soil[†] | Outdoor Air | Produce |
|---|---|---|---|---|---|---|---|---|---|
| DE | PFHxS | 26.1 (12–50) | 58.3 (58.3–58.3) | 2.74 (2.74–2.74) | | 31.2 (31.2–31.2) | 1.64 (1.64–1.64) | | |
| DE | PFOS | 31.1 (14.3–46.2) | | 47.1 (47.1–47.1) | | 34.5 (34.5–34.5) | 1.34 (0–2.67) | | |
| DE | PFOA | 23.8 (5.24–53.7) | 93.8 (93.8–93.8) | | | | 4.96 (3.4–6.53) | | |
| DE | PFNA | 17.1 (10.3–22.2) | 86.7 (86.7–86.7) | 7.41 (7.41–7.41) | | | 2 (0.897–3.1) | | |
| DE | PFDA | 11.2 (5.41–17) | 79.2 (79.2–79.2) | | | | 0 (0–0) | | |
| DE | PFUnA* | 0 (0–0) | | | | | 2.32 (0–4.64) | | |
| DE | MeFOSAA* | 47.8 (26.4–85.7) | 68.8 (68.8–68.8) | | | 24 (24–24) | 14 (0–28) | | |
| MA | PFHxS | 29.3 (11.8–43.9) | | 140 (140–140) | | | | | |

| Site | PFAS | Settled Dust | Wipe 1 | Wipe 2 | Indoor Air | Wrist-band | Soil† | Outdoor Air | Produce |
|---|---|---|---|---|---|---|---|---|---|
| MA | PFOS | 31.9 (8.96–57.1) | | | | | 3.4 (0–6.8) | | |
| MA | PFOA | 24.6 (5.71–73.5) | 0 (0–0) | 98.2 (98.2–98.2) | | 31.3 (31.3–31.3) | 9.95 (6.1–13.8) | | 9.49 (3.08–15.9) |
| MA | PFNA | 12.2 (0–20.4) | | | | | 10.3 (6.77–13.8) | | |
| MA | PFDA | | | | | | 10.4 (7.61–13.2) | | |
| MA | PFUnA* | 26.1 (26.1–26.1) | | | | | 7.12 (5.41–8.84) | | |
| MA | MeFOSAA* | 28.5 (14.8–48.6) | | | | | | | |

Grayed out cells indicate the primary and/or replicate of all samples are not detected, and the mean of RPD/%RSD values and range of RPD/%RSD values could not be calculated.

*Additional PFAS Analytes in produce – refer to Appendix A, Analytes and Method Selection.

†For soil triplicates, there is a different precision calculation, because there are more than two replicate samples. It is called the percent relative standard deviation (%RSD) and used in place of the RPD.

Table B- 3 contains mean RPD/%RSD values and a range of RPD/%RSD values among households for each site/media/PFAS combination for other PFAS analyzed in field samples. Lower values indicate replicate field sample results were more similar. Higher values indicate replicate field sample results were more dissimilar. These precision values were not used to invalidate results.

Values of zero mean that the measurements of duplicate or triplicate samples were equivalent to each other. Cases where the mean, minimum, and maximum values are all the same indicate there was only one duplicate or triplicate sample collected.

For other PFAS, surface wipes tended to be the least precise, but again had a wide range of values. DiPAPs in soil had low precision in the 50-90 range. Other PFAS in soil were more precise and within the 25% goal for both sites. Most results for other PFAS in settled dust were within the 25% goal, with the exception of N-EtFOSE and N-MeFOSE at both DE and MA. PFHpA, PFHxA, and PFPeA were less precise

for MA settled dust than DE settled dust results. Indoor air fell within the 25% precision goal at both sites. Outdoor air and produce had very few detected results, but the calculable values for these media tended to be higher. Similarly, settled dust and soil may result in higher values due to differences in the sampling locations.

**Table B- 3. Relative Percent Difference (Mean and Range) for Field Samples — Other PFAS**

| Site | PFAS | Settled Dust | Wipe 1 | Wipe 2 | Indoor Air | Wrist-band | Soil[†] | Outdoor Air | Produce |
|---|---|---|---|---|---|---|---|---|---|
| DE | PFBA | | | 4.44 (4.44–4.44) | | | 4.52 (3.34–5.7) | | |
| DE | PFPeA | | 88.4 (88.4–88.4) | | | | 8.63 (7.32–9.94) | | |
| DE | PFHxA | 8.7 (8.7–8.7) | 45.8 (4.08–87.6) | | | | 5.28 (3.89–6.67) | | |
| DE | PFHpA | 14 (1.38–26.7) | 90.9 (90.9–90.9) | | 10.2 (10.2–10.2) | | 4.23 (3.33–5.14) | | |
| DE | PFDoA* | 12.8 (0–27.6) | 57.8 (57.8–57.8) | 35.3 (35.3–35.3) | | | 3.79 (3.42–4.16) | | |
| DE | PFTrA* | 8.16 (2.33–14) | | 28.6 (28.6–28.6) | | | 5.18 (4.56–5.81) | | |
| DE | PFTA* | 4.6 (2.3–6.9) | | | | | 8.17 (4.04–12.3) | | |
| DE | PFHxDA* | | | | | | 4.88 (3.31–6.45) | | |
| DE | PFBS | 0 (0–0) | | | | | | | |

| Site | PFAS | Settled Dust | Wipe 1 | Wipe 2 | Indoor Air | Wrist-band | Soil[†] | Outdoor Air | Produce |
|---|---|---|---|---|---|---|---|---|---|
| DE | 6:2 diPAP* | 17.7 (12.5–24) | 0 (0–0) | 22.2 (22.2–22.2) | 6.59 (6.59–6.59) | 9.52 (9.52–9.52) | 52.7 (52.7–52.7) | | |
| DE | 6:2/8:2 diPAP* | 26.1 (18.8–32.2) | 9.35 (9.35–9.35) | | | 3.51 (3.51–3.51) | 93 (93–93) | | |
| DE | 8:2 diPAP* | 25.8 (16.1–31.1) | 14.3 (14.3–14.3) | | | 23.6 (10.1–37) | 57.1 (57.1–57.1) | | |
| DE | 4:2 FTOH* | | | | 16.2 (16.2–16.2) | | | | |
| DE | 6:2 FTOH* | | | | 15.4 (15.4–15.4) | | | 97.8 (97.8–97.8) | |
| DE | 8:2 FTOH* | | | | 18.2 (18.2–18.2) | | | | |
| DE | 10:2 FTOH* | | | | 13.3 (13.3–13.3) | | | | |
| DE | 5:3 FTCA* | | | | | | 9.26 (7.61–10.9) | | |
| DE | FtS 6:2* | 31.8 (0–63.5) | | | | | | | |
| DE | FtS 8:2* | 23.1 (0–48.4) | 88.9 (88.9–88.9) | | | 40 (40–40) | | | |
| DE | PFOSA* | | | | 0 (0–0) | | | | |

| Site | PFAS | Settled Dust | Wipe 1 | Wipe 2 | Indoor Air | Wrist-band | Soil[†] | Outdoor Air | Produce |
|---|---|---|---|---|---|---|---|---|---|
| DE | N-MeFOSA* | | | | 10.4 (5.13–19.4) | 8 (8–8) | | | |
| DE | N-EtFOSA* | | | | 6.67 (0–10.5) | | | | |
| DE | EtFOSAA* | 27.1 (5.13–43) | 29.3 (29.3–29.3) | | | | | | |
| DE | N-MeFOSE* | 50.4 (25.5–85.7) | 132 (132–132) | | 2.64 (0–4.65) | 12.7 (4.2–21.2) | 26.1 (26.1–26.1) | | |
| DE | N-EtFOSE* | 25.1 (0–62.1) | 112 (112–112) | | 3.35 (0–8) | 26.9 (5.5–48.3) | 4.8 (4.16–5.43) | | |
| DE | PFMOAA* | | | | | | 14.9 (14.9–14.9) | | |
| DE | PFO2HxA* | | | | | | 7.19 (7.19–7.19) | | |
| DE | EOF* | 20.6 (20.6–20.6) | | 18.2 (18.2–18.2) | | | | | |
| MA | PFBA* | | | | | | 20.2 (17.1–23.2) | | |
| MA | PFPeA | 70.3 (70.3–70.3) | | | | | | | 54.6 (7.06–126) |
| MA | PFHxA | 44.9 (24.5–79.8) | | 145 (145–145) | | | 20.3 (20.3–20.3) | | |

| Site | PFAS | Settled Dust | Wipe 1 | Wipe 2 | Indoor Air | Wrist-band | Soil[†] | Outdoor Air | Produce |
|---|---|---|---|---|---|---|---|---|---|
| MA | PFHpA | 56.8 (33.1–80.6) | | | | | 7.6 (7.6–7.6) | | |
| MA | PFDoA* | | | | | | 14 (4.31–23.7) | | |
| MA | PFTrA* | 19 (19–19) | | | | | 5.08 (3.63–6.54) | | |
| MA | PFTA* | | | | | | 3.6 (3.6–3.6) | | |
| MA | PFBS* | 40 (40–40) | | | | | | | |
| MA | PFPeS* | 21.3 (21.3–21.3) | | | | | | | |
| MA | 6:2 diPAP* | 17.7 (8.22–35.3) | 82.8 (82.8–82.8) | 67.9 (67.9–67.9) | | 13.9 (10.7–17.1) | 30.7 (30.7–30.7) | | |
| MA | 6:2/8:2 diPAP* | 14 (5.33–28.6) | 0 (0–0) | | | 26.2 (22.2–30.3) | | | |
| MA | 8:2 diPAP* | 17.5 (6.9–25) | | | | 13.2 (9.64–16.7) | 2.35 (2.35–2.35) | | |
| MA | 6:2 FTOH* | | | | 3.82 (3.39–4.26) | | | 71.4 (71.4–71.4) | |
| MA | 8:2 FTOH* | | | | 19.8 (18.2–21.3) | | | | |

| Site | PFAS | Settled Dust | Wipe 1 | Wipe 2 | Indoor Air | Wrist-band | Soil[†] | Outdoor Air | Produce |
|---|---|---|---|---|---|---|---|---|---|
| MA | 10:2 FTOH* | | | | 13.8 (1.48–26.1) | | | | |
| MA | FtS 4:2* | | | | | | | | 23.5 (23.5–23.5) |
| MA | FtS 6:2* | 19.8 (7.41–32.3) | | | | | | | |
| MA | FtS 8:2* | 16.5 (10.5–22.5) | | | | | | | |
| MA | N-MeFOSA* | | | | 6.7 (4.44–8.96) | | | | |
| MA | N-EtFOSA* | | | | 19.6 (14.3–25) | | | | |
| MA | EtFOSAA* | 9.69 (4.65–16.2) | | 88.3 (88.3–88.3) | | | 11.9 (11.9–11.9) | | |
| MA | N-MeFOSE* | 43.8 (8.22–149) | | 75.2 (75.2–75.2) | 7.17 (0–12.8) | 15.4 (15.4–15.4) | | | |
| MA | N-EtFOSE* | 20 (0–40) | | | 11.3 (11.3–11.3) | 4.08 (4.08–4.08) | 6.24 (3.14–9.35) | | |
| MA | HFPO-DA | | | | | | | | 4.26 (4.26–4.26) |
| MA | EOF* | 32.3 (14.6–50) | | | | | | | |

Grayed out cells indicate the primary and/or replicate of all samples are not detected, and the mean of RPD/%RSD values and range of RPD/%RSD values could not be calculated.

*Additional PFAS Analytes in produce – refer to Appendix A, Analytes and Method Selection.

[†]For soil triplicates, there is a different precision calculation, because there are more than two replicate samples. It is called the percent relative standard deviation (%RSD) and used in place of the RPD.

## Accuracy Analysis

During the analysis of the field samples, the laboratory used matrix spike samples and the lab control samples to evaluate analyte recoveries (performance of lab methods) and accuracy of the environmental results (see Table B- 1 for definitions of matrix spike and lab control samples). Accuracy is the degree of agreement of measurements with an accepted reference or true value. The reference values here are the matrix spike and lab control sample results. These recovery results were provided by the laboratory and pertain to laboratory analysis batches where lab controls and matrix spikes were run together with field samples.

Table B- 4 contains the mean and range of recoveries among laboratory analysis group for each site/media/PFAS combination for the 7 PFAS from the EA. Field samples in media such as wipe 1 and wipe 2 or indoor air and outdoor air were run together in the same laboratory analysis batch with a single lab control and matrix spike, so these media are collapsed as wipe and air media samples. Because most of household vacuum dust samples in DE had only 1 recovery available (except for FTOHs and EOF samples, which had 2 recoveries), the mean and range of the recoveries have the same value. All other media and PFAS combinations have 2 or more recoveries.

**Table B- 4. Recovery summary table — 7 PFAS**

| Site | PFAS | Settled Dust | Household Vacuum Dust | Wipe | Air | Wrist-band | Soil | Produce |
|---|---|---|---|---|---|---|---|---|
| DE | PFHxS | 90.5 (87–94) | 89 (89–89) | 98 (95–100) | 100 (98–103) | 99.5 (98–101) | 93.7 (90–96) | 103 (101–105) |
| DE | PFOS | 106 (100–111) | 97 (97–97) | 110 (105–116) | 110 (103–127) | 114 (113–114) | 112 (104–125) | 104 (104–105) |
| DE | PFOA | 95.5 (92–99) | 105 (105–105) | 104 (93–112) | 102 (99–104) | 104 (100–107) | 92.7 (87–99) | 119 (119–119) |
| DE | PFNA | 104 (101–106) | 102 (102–102) | 104 (98–107) | 105 (101–109) | 106 (101–112) | 98.2 (93–101) | 106 (106–107) |
| DE | PFDA | 100 (97–104) | 98 (98–98) | 107 (97–112) | 106 (103–109) | 112 (111–112) | 112 (106–125) | 114 (110–119) |

| Site | PFAS | Settled Dust | Household Vacuum Dust | Wipe | Air | Wrist-band | Soil | Produce |
|---|---|---|---|---|---|---|---|---|
| DE | PFUnA | 104 (103–106) | 105 (105–105) | 109 (99–125) | 106 (102–111) | 112 (111–112) | 102 (95–110) | 110 (109–112) |
| DE | MeFOSAA | 96.5 (95–98) | 93 (93–93) | 100 (93–107) | 102 (97–109) | 96 (92–100) | 108 (104–117) | 113 (110–116) |
| MA | PFHxS | 102 (98–114) | 101 (98–103) | 106 (100–116) | 102 (99–106) | 99.8 (98–102) | 99.3 (94–102) | 97.2 (85–111) |
| MA | PFOS | 108 (103–128) | 107 (104–112) | 113 (103–124) | 108 (94–135) | 108 (103–113) | 99 (94–105) | 90.8 (77–103) |
| MA | PFOA | 104 (98–118) | 101 (97–107) | 108 (104–115) | 101 (97–106) | 98.8 (94–101) | 97.7 (93–101) | 94.8 (81–111) |
| MA | PFNA | 104 (98–122) | 103 (100–107) | 105 (100–110) | 105 (102–110) | 103 (99–106) | 99 (95–102) | 98.8 (88–112) |
| MA | PFDA | 105 (99–122) | 104 (98–114) | 106 (98–114) | 110 (102–122) | 109 (104–111) | 104 (100–110) | 99 (83–116) |
| MA | PFUnA | 102 (97–116) | 98.8 (95–106) | 102 (99–110) | 108 (101–119) | 95 (89–100) | 92.3 (90–96) | 96.5 (85–109) |
| MA | MeFOSAA | 104 (96–122) | 105 (96–113) | 108 (99–122) | 106 (97–118) | 113 (107–119) | 104 (98–107) | 97 (83–114) |

Recoveries are from lab control samples and matrix spike samples.

Table B- 5 contains the mean and range of recoveries among laboratory analysis batch for each site/media/PFAS combination for other PFAS analyzed in the field samples. A list of field samples invalidated for high recoveries can be found Table B- 7.

**Table B- 5. Recovery summary table — Other PFAS**

| Site | PFAS | Settled Dust | House-hold Vacuum Dust | Wipe | Air | Wristband | Soil | Produce |
|---|---|---|---|---|---|---|---|---|
| DE | PFPrA | | 37 (37–37) | | | | 19.5 (18–22) | |
| DE | PFBA | 98 (93–103) | 104 (104–104) | 104 (100–111) | 91.8 (88–96) | 104 (103–106) | 101 (95–105) | 108 (106–111) |
| DE | PFPeA | 106 (104–109) | 111 (111–111) | 108 (95–117) | 96 (94–97) | 114 (112–116) | 103 (90–132) | 108 (107–110) |
| DE | PFHxA | 95 (94–96) | 91 (91–91) | 102 (97–107) | 95.5 (91–107) | 97.5 (97–98) | 95.3 (89–100) | 114 (112–116) |
| DE | PFHpA | 98 (98–98) | 100 (100–100) | 105 (96–110) | 98.5 (96–101) | 104 (102–105) | 96.7 (94–103) | 110 (109–110) |
| DE | PFDoA * | 98.5 (98–99) | 100 (100–100) | 101 (91–110) | 104 (100–107) | 108 (105–110) | 98.2 (93–110) | 102 (102–103) |
| DE | PFTrA* | 98 (98–98) | 93 (93–93) | 103 (95–109) | 118 (115–121) | 110 (107–113) | 99.5 (97–106) | 78.5 (75–82) |
| DE | PFTA* | 99 (99–99) | 99 (99–99) | 101 (91–106) | 96.5 (96–97) | 104 (104–105) | 89.8 (86–93) | 108 (106–110) |
| DE | PFHxDA | | 107 (107–107) | | | | 108 (102–110) | |
| DE | PFODA | | 95 (95–95) | | | | 48.5 (21–101) | |

| Site | PFAS | Settled Dust | House-hold Vacuum Dust | Wipe | Air | Wristband | Soil | Produce |
|---|---|---|---|---|---|---|---|---|
| DE | PFPrS | | 101 (101–101) | | | | 90.8 (87–94) | |
| DE | PFBS | 103 (100–106) | 100 (100–100) | 103 (97–108) | 104 (101–106) | 110 (108–112) | 100 (97–103) | 110 (109–110) |
| DE | PFPeS | 104 (102–106) | 100 (100–100) | 101 (90–107) | 123 (115–126) | 111 (108–114) | 90.2 (88–93) | 108 (106–110) |
| DE | PFHpS | 106 (102–110) | 99 (99–99) | 108 (105–111) | 106 (103–110) | 111 (107–115) | 105 (103–109) | 95.5 (93–98) |
| DE | PFNS* | 106 (101–112) | 105 (105–105) | 113 (102–121) | 103 (98–107) | 116 (114–117) | 102 (95–107) | 87.5 (86–89) |
| DE | PFDS* | 102 (101–103) | 107 (107–107) | 109 (106–112) | 116 (107–121) | 104 (100–108) | 111 (109–115) | 59.5 (59–60) |
| DE | PFDoS* | 102 (98–107) | 97 (97–97) | 105 (78–118) | 130 (126–133) | 112 (107–118) | 83 (77–87) | 39 (39–39) |
| DE | 6:2 diPAP | 89.5 (88–91) | 105 (105–105) | 103 (94–108) | 101 (96–108) | 106 (101–111) | 115 (97–184) | |
| DE | 6:2/8:2 diPAP | 89.5 (89–90) | 105 (105–105) | 95 (88–98) | 72.2 (49–105) | 123 (118–128) | 114 (88–196) | |
| DE | 8:2 diPAP | 93.5 (93–94) | 104 (104–104) | 93.9 (86–101) | 109 (107–111) | 100 (100–101) | 95.5 (86–137) | |

| Site | PFAS | Settled Dust | House-hold Vacuum Dust | Wipe | Air | Wristband | Soil | Produce |
|---|---|---|---|---|---|---|---|---|
| DE | 10:2 diPAP | 101 (99–103) | 119 (119–119) | 76.5 (53–101) | 180 (100–309) | 69 (68–70) | 33.8 (9–80) | |
| DE | 4:2 FTOH* | 68.7 (63–73) | 77.5 (74–81) | 72.5 (58–85) | | 0 (0–0) | 67 (50–83) | 61 (54–68) |
| DE | 6:2 FTOH* | 62.2 (60–67) | 68 (65–71) | 69 (50–86) | | 20.5 (18–23) | 65.5 (39–86) | 63.5 (55–72) |
| DE | 7:2 sFTOH* | 62.2 (57–71) | 70.5 (70–71) | 70 (54–83) | | 30 (25–35) | 59.8 (44–74) | 69.5 (62–77) |
| DE | 8:2 FTOH* | 66.5 (64–71) | 70 (67–73) | 70.8 (55–89) | | 51.5 (47–56) | 66.2 (54–78) | 50 (44–56) |
| DE | 10:2 FTOH* | 64.2 (58–69) | 75.5 (74–77) | 75.8 (71–88) | | 52 (50–54) | 73 (61–82) | 71 (63–79) |
| DE | 3:3 FTCA | 32.5 (31–34) | 35 (35–35) | 59.6 (16–96) | | 110 (109–110) | 44.8 (37–52) | |
| DE | 5:3 FTCA | 548 (536–559) | 105 (105–105) | 225 (100–603) | | 126 (123–130) | 97.8 (85–111) | |
| DE | 6:2 FTCA | | 92 (92–92) | | | | 99.7 (92–106) | |
| DE | 7:3 FTCA | 445 (435–455) | 108 (108–108) | 190 (84–481) | | 116 (113–120) | 80.2 (72–83) | |
| DE | 8:2 FTCA | | 90 (90–90) | | | | 87.8 (81–100) | |

| Site | PFAS | Settled Dust | House-hold Vacuum Dust | Wipe | Air | Wristband | Soil | Produce |
|---|---|---|---|---|---|---|---|---|
| DE | 10:2 FTCA | | 92 (92–92) | | | | 104 (89–115) | |
| DE | FtS 4:2* | 95.5 (92–99) | 94 (94–94) | 96.6 (83–102) | 112 (107–115) | 97 (92–102) | 91.3 (83–96) | 102 (100–103) |
| DE | FtS 6:2* | 103 (101–105) | 93 (93–93) | 98.2 (81–110) | 113 (103–135) | 107 (103–111) | 77.5 (71–84) | 109 (104–114) |
| DE | FtS 8:2* | 106 (98–115) | 98 (98–98) | 107 (97–122) | 105 (96–111) | 116 (112–120) | 107 (102–109) | 105 (105–105) |
| DE | FtS 10:2 | | 112 (112–112) | | | | 106 (101–111) | |
| DE | PFOSA * | 99 (98–100) | 106 (106–106) | 105 (99–110) | 104 (100–108) | 114 (111–118) | 99.2 (95–101) | 103 (101–105) |
| DE | N-MeFOSA | 99.5 (98–101) | 98 (98–98) | 106 (97–110) | 104 (101–106) | 106 (103–109) | 93.8 (92–96) | 124 (122–127) |
| DE | N-EtFOSA * | 96.5 (95–98) | 99 (99–99) | 104 (96–110) | 100 (99–103) | 104 (102–105) | 95.3 (94–98) | 101 (101–101) |
| DE | EtFOSAA* | 100 (99–101) | 104 (104–104) | 104 (91–107) | 106 (102–112) | 103 (102–104) | 96.5 (94–100) | 118 (118–119) |
| DE | N-MeFOSE* | 100 (98–103) | 97 (97–97) | 104 (96–108) | 102 (98–105) | 108 (105–110) | 90.2 (80–98) | 111 (110–112) |
| DE | N-EtFOSE * | 96.5 (95–98) | 101 (101–101) | 100 (97–108) | 106 (99–108) | 101 (101–101) | 92 (88–97) | 108 (103–112) |

| Site | PFAS | Settled Dust | House-hold Vacuum Dust | Wipe | Air | Wristband | Soil | Produce |
|---|---|---|---|---|---|---|---|---|
| DE | PFMOAA | | 56 (56–56) | | | | 43 (39–46) | |
| DE | PFMPA | 76 (72–80) | 71 (71–71) | 82.9 (31–118) | | 112 (108–115) | 62.5 (56–67) | |
| DE | PMPA | | 101 (101–101) | | | | 113 (108–124) | |
| DE | PFMBA | 108 (105–111) | 107 (107–107) | 110 (102–123) | | 113 (108–118) | 85.3 (82–92) | |
| DE | PEPA | | 110 (110–110) | | | | 122 (116–133) | |
| DE | HFPO-DA | 102 (100–103) | 107 (107–107) | 106 (102–110) | 102 (101–104) | 104 (100–109) | 104 (99–108) | 124 (123–124) |
| DE | PFPE-1 | | 116 (116–116) | | | | 109 (99–116) | |
| DE | R-EVE | | 133 (133–133) | | | | 99.8 (52–157) | |
| DE | NFDHA | 112 (108–115) | 98 (98–98) | 119 (113–124) | | 117 (114–120) | 115 (107–120) | |
| DE | PFO2HxA | | 106 (106–106) | | | | 100 (88–119) | |

| Site | PFAS | Settled Dust | House-hold Vacuum Dust | Wipe | Air | Wristband | Soil | Produce |
|---|---|---|---|---|---|---|---|---|
| DE | PFO3OA | | 102 (102–102) | | | | 94.7 (86–100) | |
| DE | PFO4DA | | 91 (91–91) | | | | 108 (99–122) | |
| DE | PFO5DA | | 104 (104–104) | | | | 80.5 (72–86) | |
| DE | Byproduct 4 | | 158 (158–158) | | | | 80.5 (14–178) | |
| DE | PFEESA | 102 (100–105) | 95 (95–95) | 105 (97–115) | | 110 (108–112) | 110 (107–114) | |
| DE | 9Cl-PF3ONS | 100 (96–104) | 107 (107–107) | 105 (95–110) | | 112 (110–113) | 94 (92–96) | 102 (99–106) |
| DE | 11Cl-PF3OUdS | 96.5 (95–98) | 99 (99–99) | 98.4 (92–101) | | 102 (100–105) | 93 (91–97) | 65.5 (65–66) |
| DE | NVHOS | | 259 (259–259) | | | | 152 (134–178) | |
| DE | ADONA* | 106 (105–106) | 102 (102–102) | 103 (86–111) | | 118 (116–119) | 88.2 (85–91) | 104 (102–106) |
| DE | Hydro-EVE | | 101 (101–101) | | | | 118 (113–121) | |
| DE | Byproduct 5 | | 199 (199–199) | | | | 67.8 (14–155) | |

| Site | PFAS | Settled Dust | House-hold Vacuum Dust | Wipe | Air | Wristband | Soil | Produce |
|---|---|---|---|---|---|---|---|---|
| DE | PFecHS | | 110 (110–110) | | | | 104 (92–122) | |
| DE | EOF* | 87.5 (85–93) | 86.5 (86–87) | 84.5 (83–86) | | 89 (85–93) | 95.8 (86–122) | 80 (80–80) |
| MA | PFPrA | | 34.8 (21–49) | | | | 27 (0–69) | |
| MA | PFBA | 109 (104–128) | 106 (96–114) | 114 (107–117) | 104 (97–110) | 110 (106–113) | 104 (100–108) | 91.8 (82–102) |
| MA | PFPeA | 105 (98–126) | 105 (100–111) | 107 (102–114) | 95.2 (92–97) | 100 (97–103) | 103 (98–108) | 90.5 (78–103) |
| MA | PFHxA | 97.4 (89–114) | 98.3 (91–106) | 103 (98–115) | 105 (100–112) | 100 (98–102) | 98.7 (92–102) | 97 (83–115) |
| MA | PFHpA | 102 (96–119) | 104 (98–111) | 107 (99–116) | 100 (97–107) | 102 (101–103) | 101 (99–102) | 100 (85–116) |
| MA | PFDoA* | 104 (98–125) | 104 (100–110) | 110 (106–116) | 108 (105–109) | 103 (99–104) | 101 (97–104) | 94 (78–109) |
| MA | PFTrA* | 102 (92–129) | 99.5 (92–109) | 105 (98–121) | 117 (110–130) | 108 (103–110) | 100 (92–110) | 69.8 (54–90) |
| MA | PFTA* | 104 (97–122) | 102 (96–106) | 106 (102–115) | 106 (102–109) | 98.7 (97–100) | 100 (97–104) | 99.2 (87–113) |

| Site | PFAS | Settled Dust | House-hold Vacuum Dust | Wipe | Air | Wristband | Soil | Produce |
|---|---|---|---|---|---|---|---|---|
| MA | PFHxDA | | 108 (101–113) | | | | 103 (101–105) | |
| MA | PFODA | | 108 (104–114) | | | | 68.8 (40–106) | |
| MA | PFPrS | | 100 (92–108) | | | | 102 (99–108) | |
| MA | PFBS | 103 (95–118) | 103 (95–110) | 109 (97–119) | 110 (103–114) | 105 (101–110) | 102 (99–106) | 96.8 (85–110) |
| MA | PFPeS | 103 (100–119) | 104 (99–114) | 105 (98–115) | 131 (126–140) | 104 (101–106) | 99.8 (95–107) | 97.2 (81–113) |
| MA | PFHpS | 106 (96–131) | 109 (98–116) | 113 (106–126) | 103 (95–113) | 114 (103–118) | 106 (102–113) | 87.2 (77–101) |
| MA | PFNS* | 113 (107–128) | 108 (101–115) | 115 (109–123) | 102 (97–109) | 105 (99–107) | 105 (99–114) | 88.5 (75–104) |
| MA | PFDS* | 108 (97–123) | 98.7 (91–107) | 108 (96–120) | 108 (92–128) | 93.2 (91–96) | 100 (91–111) | 78 (64–97) |
| MA | PFDoS* | 108 (91–136) | 93.3 (80–99) | 110 (99–117) | 117 (97–153) | 101 (97–106) | 101 (99–108) | 48 (39–64) |
| MA | 6:2 diPAP | 101 (90–125) | 100 (92–109) | 109 (104–116) | 98.2 (86–105) | 104 (99–108) | 100 (91–108) | |

| Site | PFAS | Settled Dust | House-hold Vacuum Dust | Wipe | Air | Wristband | Soil | Produce |
|---|---|---|---|---|---|---|---|---|
| MA | 6:2/8:2 diPAP | 108 (84–158) | 104 (75–123) | 116 (93–144) | 87.2 (83–95) | 112 (108–117) | 98 (65–124) | |
| MA | 8:2 diPAP | 126 (97–149) | 106 (90–128) | 133 (107–148) | 116 (113–120) | 89.2 (81–96) | 109 (77–135) | |
| MA | 10:2 diPAP | 164 (100–192) | 126 (82–185) | 181 (108–218) | 124 (111–148) | 88.8 (66–98) | 67.3 (20–181) | |
| MA | 4:2 FTOH* | 80.6 (53–96) | 75.1 (72–81) | 75.3 (69–78) | | 0 (0–0) | 73.8 (63–80) | 81.5 (79–84) |
| MA | 6:2 FTOH* | 72 (56–77) | 69 (65–71) | 73.2 (67–76) | | 29.2 (27–30) | 69.2 (63–74) | 79.5 (77–82) |
| MA | 7:2 sFTOH* | 73.1 (51–87) | 70.6 (68–73) | 71.7 (67–77) | | 40.8 (38–44) | 69.5 (65–73) | 76.5 (70–83) |
| MA | 8:2 FTOH* | 76.3 (61–96) | 77.6 (67–86) | 78.3 (71–82) | | 64.8 (55–72) | 73.8 (71–77) | 77.5 (76–79) |
| MA | 10:2 FTOH* | 85.3 (49–116) | 74.5 (71–81) | 74.5 (63–81) | | 79.2 (54–102) | 71.8 (62–81) | 75 (71–79) |
| MA | 3:3 FTCA | 65.6 (27–114) | 80.8 (53–100) | 99 (91–109) | | 89 (79–104) | 83.5 (45–104) | |
| MA | 5:3 FTCA | 601 (112–1380) | 124 (114–131) | 116 (111–124) | | 131 (126–138) | 109 (98–124) | |

| Site | PFAS | Settled Dust | House-hold Vacuum Dust | Wipe | Air | Wristband | Soil | Produce |
|---|---|---|---|---|---|---|---|---|
| MA | 6:2 FTCA | | 92.8 (80–100) | | | | 85.8 (81–89) | |
| MA | 7:3 FTCA | 514 (106–1120) | 110 (93–124) | 116 (112–121) | | 110 (98–126) | 109 (95–123) | |
| MA | 8:2 FTCA | | 99 (92–105) | | | | 91 (85–96) | |
| MA | 10:2 FTCA | | 97 (89–108) | | | | 97.8 (91–105) | |
| MA | FtS 4:2* | 105 (96–120) | 107 (100–115) | 112 (106–124) | 118 (110–127) | 101 (98–108) | 105 (96–113) | 87.8 (83–95) |
| MA | FtS 6:2* | 105 (89–127) | 101 (93–114) | 111 (103–120) | 362 (105–1120) | 92.2 (88–101) | 102 (93–109) | 106 (96–127) |
| MA | FtS 8:2* | 101 (97–115) | 101 (94–108) | 108 (97–121) | 114 (108–129) | 100 (94–104) | 101 (95–110) | 93.2 (82–104) |
| MA | FtS 10:2 | | 105 (100–110) | | | | 98.5 (94–104) | |
| MA | PFOSA* | 102 (93–125) | 103 (99–111) | 111 (99–118) | 107 (102–114) | 106 (102–111) | 101 (96–110) | 91 (76–107) |
| MA | N-MeFOSA* | 107 (101–128) | 107 (101–114) | 111 (106–115) | 111 (108–119) | 106 (102–110) | 105 (100–111) | 103 (95–112) |

| Site | PFAS | Settled Dust | House-hold Vacuum Dust | Wipe | Air | Wristband | Soil | Produce |
|---|---|---|---|---|---|---|---|---|
| MA | N-EtFOSA* | 102 (95–116) | 106 (101–113) | 105 (101–110) | 110 (106–115) | 102 (99–104) | 102 (97–105) | 88.2 (78–99) |
| MA | EtFOSAA* | 106 (100–123) | 107 (102–112) | 108 (105–112) | 116 (110–120) | 112 (108–119) | 106 (103–108) | 100 (90–111) |
| MA | N-MeFOSE* | 108 (101–122) | 105 (104–106) | 109 (103–113) | 108 (98–115) | 102 (98–104) | 101 (97–104) | 93.8 (83–105) |
| MA | N-EtFOSE* | 106 (101–124) | 104 (101–107) | 107 (103–117) | 109 (103–117) | 105 (102–108) | 100 (97–106) | 95.5 (85–107) |
| MA | PFMOAA | | 57.8 (49–69) | | | | 73.3 (40–94) | |
| MA | PFMPA | 91.5 (62–127) | 99.5 (90–115) | 108 (98–113) | | 97 (93–101) | 99.5 (72–108) | |
| MA | PMPA | | 102 (90–112) | | | | 100 (97–104) | |
| MA | PFMBA | 114 (104–131) | 109 (104–113) | 110 (106–114) | | 106 (103–110) | 104 (100–109) | |
| MA | PEPA | | 97.5 (83–104) | | | | 90.5 (86–99) | |
| MA | HFPO-DA | 100 (93–119) | 104 (98–114) | 106 (98–111) | 107 (102–112) | 100 (99–103) | 98.5 (94–103) | 100 (87–108) |

| Site | PFAS | Settled Dust | House-hold Vacuum Dust | Wipe | Air | Wristband | Soil | Produce |
|---|---|---|---|---|---|---|---|---|
| MA | PFPE-1 | | 118 (104–130) | | | | 99 (79–139) | |
| MA | R-EVE | | 131 (119–160) | | | | 407 (130–894) | |
| MA | NFDHA | 104 (90–130) | 106 (85–122) | 104 (95–116) | | 106 (102–110) | 100 (90–110) | |
| MA | PFO2HxA | | 104 (90–116) | | | | 98 (85–106) | |
| MA | PFO3OA | | 95.8 (72–111) | | | | 92.7 (77–113) | |
| MA | PFO4DA | | 94.5 (71–119) | | | | 80.3 (69–95) | |
| MA | PFO5DA | | 89.2 (80–101) | | | | 60.8 (46–82) | |
| MA | Byproduct 4 | | 88.2 (78–104) | | | | 306 (97–584) | |
| MA | PFEESA | 104 (97–118) | 102 (99–106) | 107 (100–117) | | 104 (100–107) | 100 (97–102) | |
| MA | 9Cl-PF3ONS | 113 (107–132) | 110 (106–115) | 116 (107–127) | | 101 (99–104) | 106 (97–112) | 100 (84–116) |

| Site | PFAS | Settled Dust | House-hold Vacuum Dust | Wipe | Air | Wristband | Soil | Produce |
|---|---|---|---|---|---|---|---|---|
| MA | 11Cl-PF3OUdS | 112 (95–128) | 96 (87–108) | 116 (109–124) | | 90.8 (89–92) | 99.3 (85–112) | 84 (69–101) |
| MA | NVHOS | | 130 (106–149) | | | | 119 (83–210) | |
| MA | ADONA* | 116 (108–132) | 113 (107–117) | 121 (112–134) | | 107 (102–113) | 113 (108–122) | 91.2 (79–106) |
| MA | Hydro-EVE | | 102 (95–117) | | | | 92.3 (85–101) | |
| MA | Byproduct 5 | | 110 (97–134) | | | | 190 (107–366) | |
| MA | PFecHS | | 102 (93–113) | | | | 94.8 (86–105) | |
| MA | EOF* | 88.2 (84–95) | 82 (73–94) | 77.5 (76–79) | | 75 (75–75) | 76 (73–79) | 86.5 (86–87) |

Recoveries are from lab control samples and matrix spike samples.
Grayed out cells indicate the PFAS analyte was not analyzed in the corresponding media field sample.
*Additional PFAS Analytes in produce – refer to Appendix A, Analytes and Method Selection.

# Appendix B2: Invalidation of Results

## Criteria for Invalidating Sampling Results

During the data quality assessment, some sample results were invalidated based on analysis of the Quality Control (QC) samples and therefore, were not included in the final data analysis. There were two reasons for data invalidation during this EI:

1. The associated blank(s) had a detection for the target PFAS, and the sample result was less than 3 times the maximum blank detection value.
2. There was evidence of chromatographic interference (CI) during the analysis. This means that there was uncertainty as to whether the correct chemical was being identified by the analytical instruments. The results flagged for CI by the lab that had both of the following highly technical attributes were not included in data analysis:
    - there was a poor match to the laboratory-expected chromatographic retention time (RT) and
    - the analysis was based on only a single mass transition instead of the preferred two transitions to help confirm chemical identities.

An evaluation of recoveries was also completed using an associated lab control sample (LCS) or matrix spike sample (MS), although data were not eliminated based on recovery results. When recoveries were low, it was assumed that the compound was detected but that the full signal was not being quantified and, therefore, the reported concentration may be lower than the actual concentration. In addition, most of the PFAS compounds were analyzed and quantified using isotope dilution methods, resulting in a more reliable quantification, even for recoveries below 100%. Compounds with low recoveries, therefore, were included to be conservative. For high recoveries, it was assumed that the instrument may be detecting either contamination or interference from another compound, resulting in identification of a compound that may not be present. There was only one compound in one medium in DE, 5:3 FTCA in settled dust, that was identified as having a high recovery above 200% and was not invalidated based on the two reasons explained above. This compound was not one of the seven PFAS found in serum that were analyzed, and while there is some uncertainty about the identification of this compound, it remains in the data set to be conservative.

Table B- 6 provides a list of the number of the samples that were invalidated based on QC analysis for the seven PFAS found in the blood serum during the PFAS EA. For these samples, the only media impacted were indoor and outdoor air that were invalidated due to issues with blank contamination, the results for all other media were retained for the seven PFAS species. Similarly, Table B- 7 provides a list of the samples invalidated based on the QC analysis (blank contamination and chromatographic interference) for the remaining PFAS and PFAS precursors in each medium.

**Table B- 6. Invalidated Results for the seven PFAS found in blood serum from the PFAS EA**

| Reason for Invalidation | Site | Medium | PFAS | Number Invalidated |
|---|---|---|---|---|
| Blank Contamination | DE | Indoor Air | PFHxS and PFOS | 4 |
| | DE | Outdoor Air | PFOS | 1 |
| | MA | Indoor Air | PFHxS and PFOS | 7 |
| | MA | Indoor Air | PFOA | 11 |
| | MA | Indoor Air | PFNA | 2 |
| | MA | Indoor Air | PFDA | 12 |
| | MA | Indoor Air | PFUnA and MeFOSAA | 1 |
| | MA | Outdoor Air | PFHxS, PFOS and PFOA | 1 |

Note that PFAS species and sample media that are not listed in the above table have no invalidated samples based on the 3 criteria for disqualifying data.

**Table B- 7. Invalidated Results for the Remaining PFAS and PFAS precursors**

| Reason for Invalidation | Site | Medium | PFAS | Number Invalidated |
|---|---|---|---|---|
| Blank Contamination | DE | Settled Dust | FtS 6:2 and EOF | 4–8 |
| | DE | Wipe 1 | 6:2 diPAP | 5 |
| | DE | Wipe 2 | 6:2 diPAP | 2 |
| | DE | Indoor Air | PFHxA | 2 |
| | MA | Settled Dust | PFBA | 8 |
| | MA | Wipe 1 | PFBA, 6:2 diPAP, 6:2/8:2 diPAP, 8:2 diPAP, and PFOSA | 1–10 |
| | MA | Wipe 2 | PFBA, 6:2 diPAP, 6:2/8:2 diPAP, 8:2 diPAP, and PFOSA | 1–7 |
| | MA | Indoor Air | PFHxA, PFHpA, PFBS, PFPeS, PFHpS, 6:2 diPAP, FtS 4:2, FtS 6:2, | 1–12 |

| Reason for Invalidation | Site | Medium | PFAS | Number Invalidated |
|---|---|---|---|---|
| | | | FtS 8:2, PFOSA, EtFOSAA, and HFPO-DA | |
| | MA | Wristband | EOF | 1 |
| | MA | Outdoor Air | 6:2 diPAP and FtS 6:2 | 1–2 |
| Chromatographic Interference | DE | Household vacuum Dust | NVHOS, PMPA, PEPA and R-EVE | 1–4 |
| | DE | Soil | PFPrA and PMPA | 2–3 |
| | MA | Household vacuum Dust | PFPrS, PMPA, PFO2HxA and Byproduct 4 | 1–3 |
| | MA | Soil | R-EVE | 1 |

Note that PFAS species and sample/media that are not listed in the above table have no invalidated samples based on the 2 reasons for invalidating data.

# Appendix B3: Statistical Concepts and Procedures

## Statistical Concepts Used in the EI Report

Throughout this report, there are repeated references to some statistical terms. Below are explanations of these terms and how ATSDR has determined significance:

- Tests and p-values — Two-sided hypothesis tests are used to look for relationships and differences among data. A hypothesis test will output a test statistic and a p-value associated with it. The p-value tells us the probability of getting a value equal to or greater than the test statistic if the relationship does not actually exist. Smaller p-values mean this probability is small. It is common practice to use a cutoff point of $p < 0.05$. P-values below 0.05 are "significant", meaning it is probable that the relationship exists. The meaning of the test statistic differs by the type of test.
- Benjamini-Hochberg false discovery rate (B-H FDR) correction — When many statistical tests are performed, the chance of producing a falsely significant result increases because each test has its own chance of a falsely significant result. The Benjamini-Hochberg false discovery rate correction adjusts for this increased chance of falsely significant results. The new corrected p-value is called the adjusted p-value and is the p-value used to observe significance in these analyses.

- When the Benjamini-Hochberg false discovery rate correction was performed, the adjusted p-values were used to determine significance of the analyses. This is because when both the unadjusted and the adjusted p-value are less than 0.05, it is more likely that the relationship truly exists and is not due to chance. When the unadjusted p-value is less than 0.05, but the adjusted p-value is not, it is less likely that the relationship truly exists. Like with all statistical tests, a degree of uncertainty is associated with the results. Therefore, it is important to also look at the test statistic in addition to the p-value. If the adjusted p-value is greater than 0.05, the unadjusted p-value is less than 0.05, and the test statistic is similar in magnitude to the significant test statistics (adjusted p-value is less than 0.05) then it still might be worth exploring that relationship in the future even though it is not statistically significant according to the adjusted p-value.

- Kendall's Tau ($\tau$): This is a nonparametric rank-based correlation coefficient which does not assume a specific distribution (Helsel 2011). It is looking for the relationship between two sets of data (x and y). This test evaluates: Does x tend to increase as y increases (positive tau values), or does x tend to increase as y decreases (negative tau values)? The closer to −1 or 1 the tau value is, the stronger the relationship. Tau values closer to 0 mean the relationship is weaker.

## Treatment of Non-Detects (ND) in the Data Set

Non-detected results were substituted with the corresponding detection limit and flagged as censored in a separate field. This treatment of the data allows for the use of left-censored statistical methods which incorporates the uncertainty from non-detections for our analyses. The following statistical methods implement non-detection with censored analysis:

- Estimates of an empirical cumulative distribution function (ECDF) for censored data using the Kaplan-Meier method (used in Table 7, Table 12 to Table 21, Table C- 1, Table C- 7 to Table C-16, and Table D- 1 to Table D- 35)

- Kendall's tau for doubly censored data (used in Table 9,

- Table C- 2, and Table C- 3)

- Two-sided nonparametric Wilcoxon signed-rank test of median difference of paired censored data (used in Table C- 4)

- Two-sided HF-1 version of the generalized Wilcoxon test for difference between two or more ECDF (used in Table C- 5 and Table C- 6)

- Calculation of u-scores before performing two-sided analysis of similarity (ANOSIM) (Table C-17)

Estimates for Table 7, Table 12 to Table 21, Table C- 1, Table C- 7 to Table C- 16, and Table D- 1 to Table D- 35 were made using an ECDF based on the Kaplan-Meier method of evaluating censored data. Through this method, data with low detection rates can have their summary statistics calculated even when the detection rate does not match the percentile calculated (i.e. median can be calculated with <50% detections). These calculations can be made because the ranks of the non-detects are distributed in between the ranks of detected results, where some detected results have lower values than non-detect results. This distribution is from the multiple detection limits occurring from the differences in masses obtained between individual samples.

Summary statistics that are similar to their respective detection rates (i.e. medians at 50% detection rate) cannot be calculated when the data have a single detection limit or multiple detection limits where all detection limits are less than all detected results. In these cases, the summary statistics need to be calculated using a mix of detected values and non-detected values (i.e. medians will be the average of the 5$^{th}$ highest result which is a detected value and the 6$^{th}$ highest result which is a non-detect when the number of samples is 10). Any calculation using any number of non-detected values will result in a non-detected value.

## Evaluation of Questionnaire Data

### *Linking environmental sampling data and questionnaire data:*

Before evaluating the questionnaire data, the data were joined to their related environmental field sample results to evaluate exposure media that were related to appropriate questions asked in the questionnaire (e.g., questions related to carpets were linked with settled dust and household vacuum dust samples).

### *Evaluating if there is sufficient questionnaire data and environmental sampling data to proceed:*

The data were evaluated by considering two criteria. The first criterium was to determine whether the response data from each question were sufficient for further analysis. The second criterium was to determine whether a sufficient number of results were in the environmental samples to allow for analysis with the questionnaire data.

The joined data were run through a series of hypothesis tests using the environmental sample results as the quantitative variable and the question results as the grouping or categorical variable. A decision was made whether to run the hypothesis test based on the completeness of the data: a check to see if the number of participant responses within each response group was greater than or equal to 5 and a check to see if the number of detected values in the PFAS environmental samples within each response group was greater than or equal to 2 (Figure B- 1).

### *Testing for relationships between environmental sampling results and questionnaire responses:*

If both conditions were met, the data were tested using the environmental sample results as the quantitative variable and the questionnaire results as the grouping or categorical variable, according to the number of detected values within the subset of the data:

- If there were any non-detected field results for any group, a test for the difference between the empirical cumulative distribution functions (ECDF) was performed to account for the censoring.
- If there were no non-detected field results for any group, either a Wilcoxon rank-sum test for two groups or a Kruskal-Wallis Rank Sum Test for three or more groups was performed.

To account for false discovery rate from multiple testing, a Benjamini-Hochberg false discovery rate correction was applied to the p-value. Figure B- 1 shows a flowchart of the decisions made during the multiple hypothesis testing of the questionnaire data with the field samples.

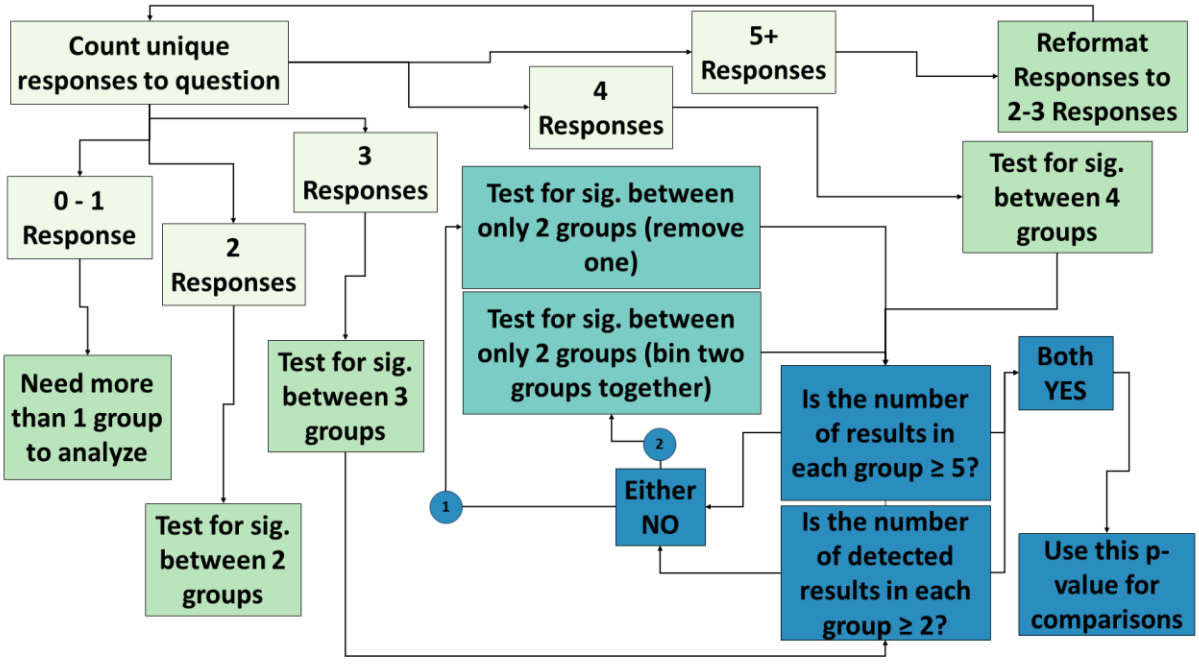


**Figure B- 1. Flowchart for Evaluating Questionnaire Data**

## Appendix B4: Questionnaire Data Analysis

Fisher's Exact tests for count data were used to test differences in questionnaire responses between before and after mitigation. Fisher's exact test is useful as an alternative to other tests between two categorical variables when dealing with small sample sizes and multiple levels in the variable. For multiple levels in a variable, p-values were calculated by Monte-Carlo simulation. A significant difference ($p < 0.05$) means that there was a change in the distribution of responses from the expected “before mitigation” question responses to the observed "after mitigation" question responses.

In DE, there were no differences in behaviors such as water intake, use of filtration systems and drinking water source identified in the questionnaire before and after mitigation.

In MA, participant's use of municipal water decreased after the water was mitigated compared to before ($p = 0.002$). Participant's reported use of a water filter or treatment device was increased after mitigation compared to before ($p = 0.0005$). As seen in Table 3 in the report (MA demographics table), before mitigation 43% of participants used no filter or treatment device and 57% used one or more filter or treatment device(s). After mitigation, 10% of participants used no filter or treatment device and 90% used one or more filter or treatment device(s). Bolding in the table indicates a significant difference between the appropriate questionnaire responses.

**Table B- 8. Differences in Water Source, Water Use and Filtration Use Before and After PFAS Mitigation: Fisher's Exact Test**

| Site | Question | Test | p-value |
|---|---|---|---|
| DE | How often did you water your lawn? | Fisher's Exact Test for Count Data with simulated p-value (based on 2000 replicates) | 1 |
| DE | What was the main source of drinking water in your home? | Fisher's Exact Test for Count Data with simulated p-value (based on 2000 replicates) | 0.75 |
| DE | Which, if any, water filter or treatment device did you use to filter or treat the tap water you drink? | Fisher's Exact Test for Count Data with simulated p-value (based on 2000 replicates) | 0.20 |
| DE | If you used a filter or treatment device, was it maintained and replaced according to manufacturer's recommendations? | Fisher's Exact Test for Count Data | 1 |
| MA | How often did you water your lawn? | Fisher's Exact Test for Count Data with simulated p-value (based on 2000 replicates) | 1 |
| **MA** | **What was the main source of drinking water in your home?** | **Fisher's Exact Test for Count Data with simulated p-value (based on 2000 replicates)** | **0.0020** |
| **MA** | **Which, if any, water filter or treatment device did you use to filter or treat the tap water you drink?** | **Fisher's Exact Test for Count Data with simulated p-value (based on 2000 replicates)** | **0.00050** |
| MA | If you used a filter or treatment device, was it maintained and replaced according to manufacturer's recommendations? | Fisher's Exact Test for Count Data | 0.70 |
| **Bolding indicates a significant difference — p value <0.05** | | | |

A paired Wilcoxon signed rank test was used to test for differences in drinking tap water before and after PFAS mitigation of tap water (Table B- 9). There was a significant difference (p-value = 0.0089) in tap water intake before and after mitigation in MA with intake being reduced after mitigation (4 cups vs

2 cups daily). The Hodges-Lehmann estimate of the pseudo-median of the differences in drinking tap water before and after PFAS mitigation from tap water ("before" minus "after") is also provided.

**Table B- 9. Differences in Tap Water Intake Before and After PFAS Mitigation**

| Site | Question | Test Statistic | Hodges-Lehmann Estimate | p-value |
|---|---|---|---|---|
| DE | How much water (in cups) did you drink before and after the PFAS was removed from your water? | 9 | -2 | 0.065 |
| **MA** | **How much water (in cups) did you drink before and after the PFAS was removed from your water?** | **318** | **3** | **0.0089** |
| Test used was a two-sided Wilcoxon signed rank test with continuity correction. **Bolding indicates a significant difference — p value <0.05** | | | | |

Figure B- 2 is a boxplot showing the differences in tap water intake between DE and MA. For MA, there is a decrease in tap water intake after PFAS mitigation was implemented. This difference is significant as seen in Table B- 9.

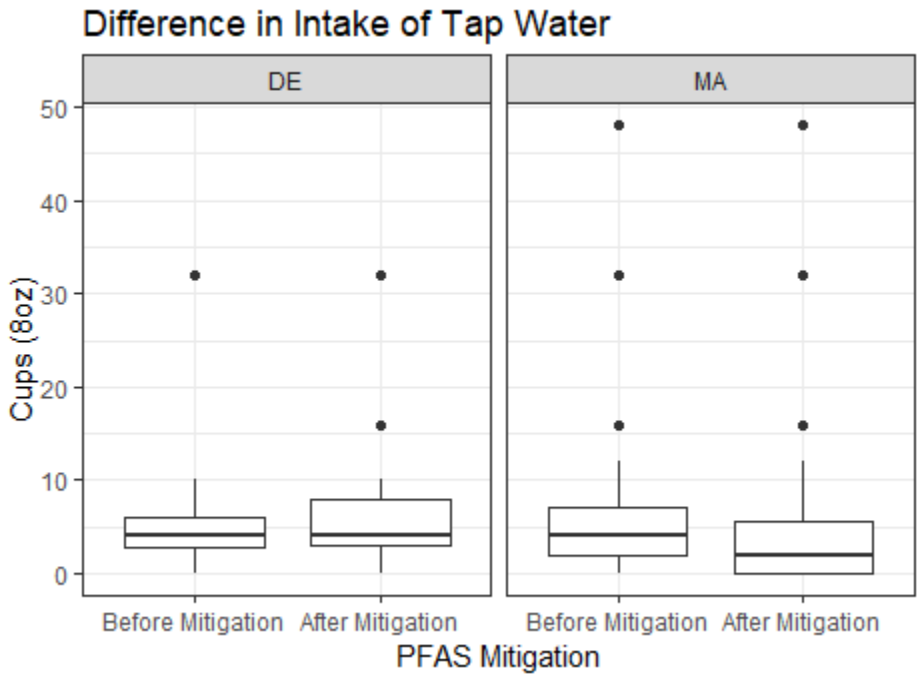


**Figure B- 2. Boxplot of Intake of Tap Water Grouped by PFAS Mitigation**

Table B- 10 provides an analysis using Fisher's Exact Test of the differences between people who were employed in industries associated with potential exposure to PFAS prior to the PFAS EA being conducted and those employed in those industries from 2019 to 2022 when the EI was conducted. There was no significant difference between participants' occupations between 2019 and 2022.

**Table B- 10. Differences between Previous and Current Occupation**

| Site | Question | Test | p-value |
|---|---|---|---|
| DE | Did you in the last 20 years work in any of the following industries? vs Since the exposure assessment, do you work in any of the following industries? | Fisher's Exact Test for Count Data with simulated p-value (based on 2000 replicates) | 0.31 |
| MA | Did you in the last 20 years work in any of the following industries? vs Since the exposure assessment, do you work in any of the following industries? | Fisher's Exact Test for Count Data with simulated p-value (based on 2000 replicates) | 0.12 |

# Appendix C: Detailed Results and Analysis of the 7 PFAS in Blood Serum for All Media Sampled

## Table of Contents



There are three sub-appendices within Appendix C:

- Appendix C1: Results and Analysis for the 7 PFAS in for Settled Dust — This includes a detailed summary of results for settled dust limited to the 7 PFAS measured in EA blood serum. This analysis was limited to these 7 PFAS so a comparison to serum from the EA could be conducted. Detailed results include: number of samples, detection rates, minimum, maximum, median, and interquartile range (IQR). C1 also includes results of analyses testing for consistency between EA and EI settled dust levels, associations between EA blood serum and EI settled dust, and associations between blood serum levels and household activities.
- Appendix C2: Results for PFAS in All Media for the 7 PFAS in Blood Serum — C2 includes detailed summaries of results of the 7 PFAS in blood serum for all other household environmental media (household vacuum dust, surface wipes, indoor air, wristbands, and soil). Detailed results include: number of samples, detection rates, minimum, maximum, median, and interquartile range (IQR). Additionally, there are detailed summaries of results of the 7 PFAS in blood serum for community media (outdoor air and produce).
- Appendix C3: Comparison of DE and MA

## List of Tables



## List of Figures

# Appendix C1: Settled Dust Results and Analysis for the 7 PFAS Detected in Blood Serum

## Settled Dust Results

**Table C- 1. Summary Statistics of Settled Dust (µg/kg) Results — DE and MA**

| Site | Analyte | # of Samples Collected (Invalid Samples) | Method Detection Limit Median (Range) (µg/kg) | % Detected from Valid Samples (Estimated Values)* | Minimum (µg/kg) | Median (25%–75%) (µg/kg) | Maximum (µg/kg) |
|---|---|---|---|---|---|---|---|
| **DE** | **PFHxS** | 31 (0) | 2.7 (0.38–15) | 52% (10) | <1.5 | 2.4 (1.5–7.2) | 76 |
| **DE** | **PFOS** | 31 (0) | 4 (0.55–22) | 94% (9) | <3.1 | 23 (13–60) | 240 |
| **DE** | **PFOA** | 31 (0) | 4.9 (0.68–27) | 90% (13) | 4 | 17 (9–29) | 380 |
| **DE** | **PFNA** | 31 (0) | 2 (0.28–11) | 90% (20) | 1.7 | 5.1 (3–9) | 41 |
| **DE** | **PFDA** | 31 (0) | 4.4 (0.6–24) | 77% (18) | <2.4 | 7.2 (5–11) | 26 |
| **DE** | **PFUnA** | 31 (0) | 3.8 (0.52–21) | 61% (13) | <2.1 | 4.4 (2.5–9.6) | <21† |
| **DE** | **MeFOSAA** | 31 (0) | 2.2 (0.3–12) | 55% (13) | <1.2 | 3 (NA–7.3)‡ | 120 |
| **MA** | **PFHxS** | 47 (0) | 2.1 (0.75–15) | 49% (16) | <0.75 | 2.7 (1.1–4.1) | 700 |
| **MA** | **PFOS** | 47 (0) | 3.1 (0.22–170) | 87% (13) | <4.4 | 20 (9.1–70) | 870 |
| **MA** | **PFOA** | 47 (0) | 3.9 (1.4–27) | 68% (14) | 1.8 | 10 (4.1–24) | 250 |
| **MA** | **PFNA** | 47 (0) | 1.6 (0.55–11) | 60% (24) | <0.85 | 2.1 (1.2–3.5) | 170 |
| **MA** | **PFDA** | 47 (0) | 3.4 (1.2–24) | 34% (13) | <1.2 | 2 (NA–4)‡ | 160 |

| Site | Analyte | # of Samples Collected (Invalid Samples) | Method Detection Limit Median (Range) (µg/kg) | % Detected from Valid Samples (Estimated Values)* | Minimum (µg/kg) | Median (25%–75%) (µg/kg) | Maximum (µg/kg) |
|---|---|---|---|---|---|---|---|
| **MA** | **PFUnA** | 47 (0) | 3 (1–21) | 23% (8) | <1 | NA (NA–2.6)‡ | 40 |
| **MA** | **MeFOSAA** | 47 (0) | 1.7 (0.6–12) | 47% (13) | 0.6 | 1.1 (0.6–7.2) | 370 |

*Estimated Values are the number of sample results flagged by the laboratory as less than the reporting limit but greater than or equal to the method detection limit and the concentration is an approximate value.

†The method detection limit for the maximum in the data set was higher than all the detections in the data set. Refer to Appendix B, Treatment of Non-Detects (ND) in the Data Set.

‡NA: Not Applicable: Summary statistics (median, 25% or 75%) could not be calculated due to the ranks of the method detection limits. Refer to Appendix B, Treatment of Non-Detects (ND) in the Data Set.

## Analysis of the Relationship between EA Blood Serum and EI Settled Dust

Kendall's Tau non-parametric correlation tests were used to test for potential relationships between EA blood serum levels and EI settled dust levels. More information about the Kendall's Tau test can be found in Appendix B3; Statistical Concepts Used in the EI Report.

To account for the clustering of participants within a household, ATSDR used a random sampling method to get a one-to-one match between participant blood serum data and household settled dust data. The term clustered data means that there were sometimes multiple participants within one household.

For the random sampling method, one participant from each household was randomly selected to represent the household serum PFAS level. The Kendall's Tau correlation between participant blood serum PFAS levels and household settled dust PFAS levels was then performed. Random sampling and a Kendall's Tau test were repeated 1000 times to get a more accurate estimation of the correlation. Correlations were determined to be significant if the median of adjusted p-values was less than 0.05. The results of the Kendall's Tau test are summarized in

Table C- 2 for DE and Table C- 3 for MA.

For DE, blood serum and settled dust had a significant positive correlation for PFOS and MeFOSAA. For MA, blood serum and settled dust had a significant positive correlation for MeFOSAA.

**Table C- 2. Blood Serum vs. Settled Dust Kendall's Tau Correlation Results – DE**

| PFAS | Tau ($\tau$) Median (Range) | Adjusted* p-value Median (Range) | Number of Random Samples |
|---|---|---|---|
| PFHxS | 0.12 (0.034–0.18) | 0.58 (0.27–1) | 1,000 |
| **PFOS** | **0.36 (0.29–0.45)** | **0.018 (0.0027–0.086)** | 1,000 |
| PFOA | 0.18 (0.084–0.27) | 0.38 (0.084–0.88) | 1,000 |
| PFNA | 0.0065 (−0.067–0.073) | 0.90 (0.60–1) | 1,000 |
| PFDA | −0.054 (−0.11–0.0022) | 0.77 (0.48–1) | 1,000 |
| PFUnA | −0.082 (−0.13–−0.030) | 0.68 (0.39–1) | 1,000 |
| **MeFOSAA** | **0.35 (0.31–0.39)** | **0.017 (0.0048–0.060)** | 1,000 |

Significant correlations are in **bold**.
*Multiple tests were performed increasing the chance of a falsely significant result. The Benjamini-Hochberg false discovery rate correction was applied to adjust for this increased chance. The p-values reported here are the adjusted p-values. Correlations were determined to be significant if the median adjusted p-value was less than 0.05.

**Table C- 3. Blood Serum vs. Settled Dust Kendall's Tau Correlation Results – MA**

| PFAS | Tau ($\tau$) Median (Range) | Adjusted* p-value Median (Range) | Number of Random Samples |
|---|---|---|---|
| PFHxS | 0.098 (−0.0083–0.18) | 0.63 (0.19–1) | 1,000 |
| PFOS | 0.13 (−0.0065–0.22) | 0.53 (0.094–1) | 1,000 |
| PFOA | 0.064 (−0.063–0.16) | 0.76 (0.24–1) | 1,000 |
| PFNA | 0.098 (−0.0028–0.22) | 0.62 (0.080–1) | 1,000 |
| PFDA | NA | NA | NA |
| PFUnA | NA | NA | NA |
| **MeFOSAA** | **0.34 (0.28–0.41)** | **0.0022 (<0.001–0.023)** | 1,000 |

Significant correlations are in **bold**.
*Multiple tests were performed increasing the chance of a falsely significant result. The Benjamini-Hochberg false discovery rate correction was applied to adjust for this increased chance. The p-values reported here are the adjusted p-values. Correlations were determined to be significant if the median adjusted p-value was less than 0.05.
NA – Not applicable; Kendall's Tau correlation test was not performed for PFDA and PFUnA from MA, because the detection rates in settled dust were too low (see Table 7).

## Analysis of EA and EI Settled Dust Comparisons

A paired two-sided Wilcoxon Signed Rank test was performed to test for differences between the 9 households that had settled dust measurement from both the EA and EI. Because this test compares each household to itself, DE and MA results can be combined for this test. None of the settled dust PFAS levels were significantly different between the EA and EI, indicating that settled dust PFAS levels remained consistent between the 2019 EA and 2022 EI (Table C- 4).

**Table C- 4. Comparison of settled dust levels for the 9 households that participated in both the EA and EI**

| PFAS | Wilcoxon Sign Rank Z | p-value* |
|---|---|---|
| PFHxS | −1.43 | 0.27 |
| PFOS | −1.72 | 0.20 |
| PFOA | −0.831 | 0.43 |
| PFNA | 1.31 | 0.27 |
| PFDA | 2.14 | 0.11 |
| PFUnA | 2.51 | 0.08 |
| MeFOSAA | −0.791 | 0.43 |

*Multiple tests were performed increasing the chance of a falsely significant result. The Benjamini-Hochberg false discovery rate correction was applied to adjust for this increased chance. The p-values reported here are the adjusted p-values.

An HF-1 version of the generalized Wilcoxon test was used to test for differences between all EA and all EI settled dust results. Because this test is not household-specific, unlike the paired Wilcoxon Signed Rank test, the sites were analyzed separately to account for differences in settled dust levels between sites. This test did not find any significant differences between 2019 EA and 2022 EI settled dust PFAS levels (Table C- 5). This further indicates that settled dust PFAS levels remained consistent.

**Table C- 5. Comparison of EA and EI settled dust levels for all samples collected (DE and MA)**

| PFAS | DE Test Statistic | DE p-value* | MA Test Statistic | MA p-value* |
|---|---|---|---|---|
| PFHxS | 0.0685 | 0.794 | 1.49 | 0.504 |
| PFOS | 6.19 | 0.0901 | 4.10 | 0.270 |
| PFOA | 0.486 | 0.567 | 0.309 | 0.675 |
| PFNA | 0.545 | 0.567 | 1.13 | 0.504 |
| PFDA | 0.973 | 0.567 | 3.13 | 0.270 |

| PFAS | DE Test Statistic | DE p-value* | MA Test Statistic | MA p-value* |
|---|---|---|---|---|
| PFUnA | 2.62 | 0.369 | 0.430 | 0.675 |
| MeFOSAA | 1.88 | 0.398 | 0.0889 | 0.766 |

For DE, n=13 from the EA and n=31 from the EI. For MA, n=17 from the EA and n=31 from the EI.
*Multiple tests were performed increasing the chance of a falsely significant result. The Benjamini-Hochberg false discovery rate correction was applied to adjust for this increased chance. The p-values reported here are the adjusted p-values.

## Analysis of Questionnaire and Settled Dust Results

**Table C- 6. Settled Dust Sample and Questionnaire Results**

| Media | Questionnaire Analysis | PFAS | DE p-value | MA p-value |
|---|---|---|---|---|
| Settled Dust | In DE, if a carpet cleaning service was used in the home, homes had higher levels of PFHxS, PFNA, PFDA, PFUnA and MeFOSAA in settled dust (See Figure C- 1).<br>In MA, this relationship was not found to be significant. | PFHxS | **0.025** | 0.860 |
| | | PFNA | **0.019** | 0.860 |
| | | PFDA | **0.010** | 0.860 |
| | | PFUnA | **0.010** | 0.860 |
| | | MeFOSAA | **0.025** | 0.860 |
| | In MA, if people had carpet in their living room, they had higher levels of PFHxS, PFOS, PFOA, and MeFOSAA in settled dust (See Figure C- 2).<br>In DE, this relationship was not found to be significant. | PFHxS | 0.83 | **0.014** |
| | | PFOS | 0.71 | **0.014** |
| | | PFOA | 0.83 | **0.014** |
| | | MeFOSAA | 0.83 | **0.014** |

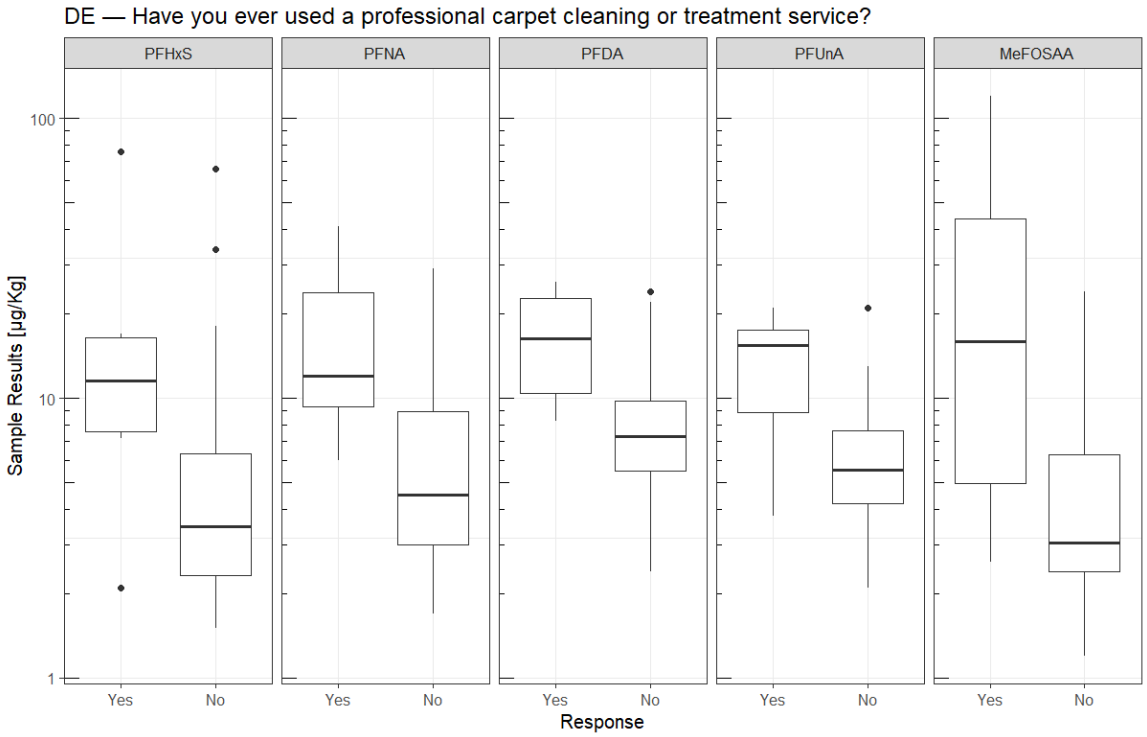


**Figure C- 1. Boxplot of Settled Dust Grouped by Carpet Cleaning Service**

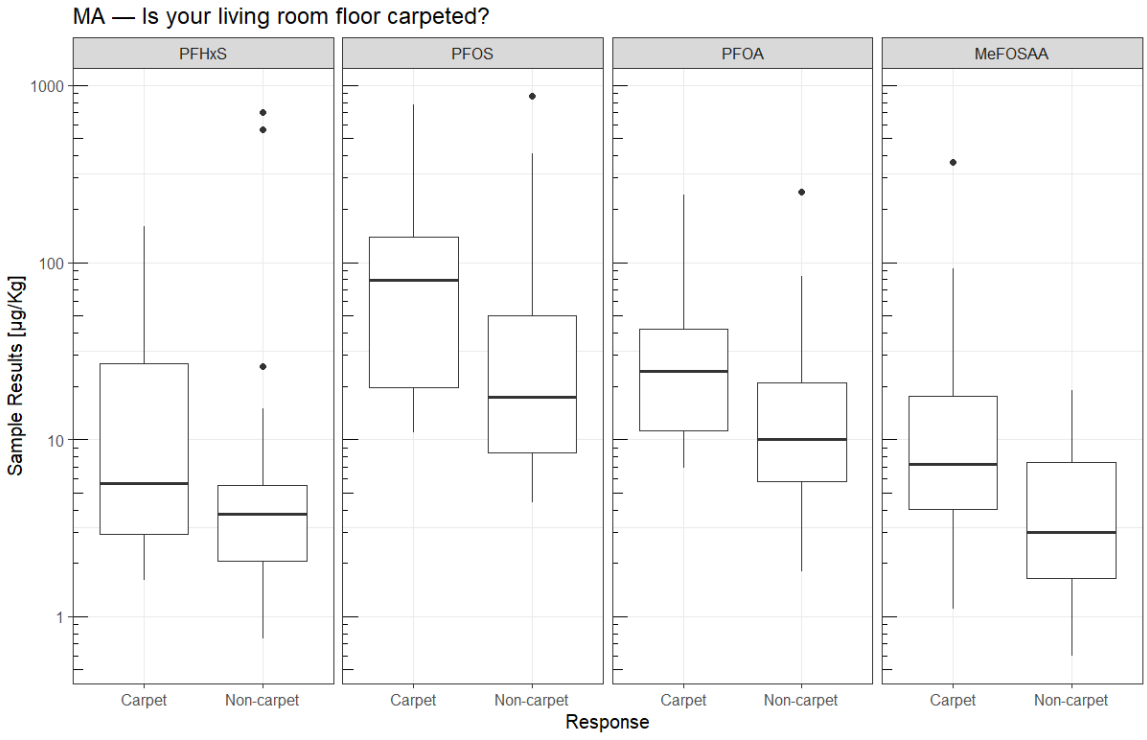


**Figure C- 2. Boxplot of Settled Dust Grouped by Living Room Carpeting**

# Appendix C2: All Media Results for the 7 PFAS Detected in Blood Serum

## Robust Settled Dust

**Table C- 7. Summary Statistics of Robust Settled Dust (µg/kg) Results — DE and MA**

| Site | Analyte | # of Samples Collected (Invalid Samples) | Method Detection Limit Median (Range) (µg/kg) | % Detected from Valid Samples (Estimated Values) | Minimum (µg/kg) | Median (25%–75%) (µg/kg) | Maximum (µg/kg) |
|---|---|---|---|---|---|---|---|
| **DE** | **PFHxS** | 10 (0) | 1.6 (0.39–6) | 60% (3) | <1.5 | 2.1 (1.5–17) | 76 |
| **DE** | **PFOS** | 10 (0) | 2.3 (0.58–8.8) | 100% (1) | 12 | 23 (21–130) | 200 |
| **DE** | **PFOA** | 10 (0) | 2.85 (0.71–11) | 100% (3) | 6.5 | 23 (14–49) | 160 |
| **DE** | **PFNA** | 10 (0) | 1.15 (0.29–4.4) | 100% (5) | 1.9 | 8.8 (3.9–29) | 41 |
| **DE** | **PFDA** | 10 (0) | 2.55 (0.63–9.6) | 80% (4) | <2.4 | 7.2 (5.8–13) | 26 |
| **DE** | **PFUnA** | 10 (0) | 2.2 (0.55–8.4) | 70% (3) | <2.1 | 6.6 (3.9–11) | 18 |
| **DE** | **MeFOSAA** | 10 (0) | 1.25 (0.32–4.8) | 90% (6) | 2.5 | 4.1 (2.6–14) | 120 |
| **MA** | **PFHxS** | 18 (0) | 1.9 (0.75–15) | 33% (3) | <0.75 | 1.1 (NA–3.6)* | 94 |
| **MA** | **PFOS** | 18 (0) | 3.6 (1.1–170) | 78% (7) | 5.3 | 9.4 (7.4–28) | 200 |
| **MA** | **PFOA** | 18 (0) | 3.4 (1.4–27) | 61% (3) | 1.8 | 8.5 (1.8–39) | 250 |
| **MA** | **PFNA** | 18 (0) | 1.4 (0.55–11) | 67% (11) | 1 | 2.2 (1.6–3.4) | 82 |
| **MA** | **PFDA** | 18 (0) | 3 (1.2–24) | 39% (5) | <1.2 | 2 (1.9–4.2) | 160 |

| Site | Analyte | # of Samples Collected (Invalid Samples) | Method Detection Limit Median (Range) (µg/kg) | % Detected from Valid Samples (Estimated Values) | Minimum (µg/kg) | Median (25%–75%) (µg/kg) | Maximum (µg/kg) |
|---|---|---|---|---|---|---|---|
| **MA** | **PFUnA** | 18 (0) | 2.6 (1–21) | 22% (3) | <1 | NA (NA–2.3)* | 38 |
| **MA** | **MeFOSAA** | 18 (0) | 1.5 (0.6–12) | 50% (5) | 0.6 | 2.9 (0.6–7.2) | 92 |

*NA: Not Applicable: Summary statistics (median, 25% or 75%) could not be calculated due to the ranks of the method detection limits. Refer to Appendix B, Treatment of Non-Detects (ND) in the Data Set.

## Household Vacuum Dust

**Table C- 8. Summary Statistics of Household Vacuum Dust (µg/kg) Results — DE and MA**

| Site | Analyte | # of Samples Collected (Invalid Samples) | Method Detection Limit Median (Range) (µg/kg) | % Detected from Valid Samples (Estimated Values)* | Minimum (µg/kg) | Median (25%–75%) (µg/kg) | Maximum (µg/kg) |
|---|---|---|---|---|---|---|---|
| **DE** | **PFHxS** | 7 (0) | 0.73 (0.63–7.6) | 57% (2) | <0.63 | 2.8 (NA–26)† | 640 |
| **DE** | **PFOS** | 7 (0) | 1.1 (0.93–11) | 86% (0) | <1.1 | 33 (14–200) | 950 |
| **DE** | **PFOA** | 7 (0) | 1.3 (1.2–1.4) | 100% (0) | 24 | 56 (25–260) | 300 |
| **DE** | **PFNA** | 7 (0) | 0.55 (0.48–0.58) | 100% (1) | 1.8 | 14 (7.7–68) | 71 |
| **DE** | **PFDA** | 7 (0) | 1.2 (1–1.3) | 100% (1) | 2.8 | 11 (9.9–28) | 84 |
| **DE** | **PFUnA** | 7 (0) | 1.1 (0.91–1.1) | 100% (1) | 2 | 12 (5.9–20) | 50 |
| **DE** | **MeFOSAA** | 7 (0) | 0.58 (0.5–0.61) | 100% (2) | 2.8 | 6.2 (4.6–14) | 160 |

| Site | Analyte | # of Samples Collected (Invalid Samples) | Method Detection Limit Median (Range) (µg/kg) | % Detected from Valid Samples (Estimated Values)* | Minimum (µg/kg) | Median (25%–75%) (µg/kg) | Maximum (µg/kg) |
|---|---|---|---|---|---|---|---|
| **MA** | **PFHxS** | 16 (0) | 0.29 (0.25–15) | 69% (3) | <0.25 | 5.3 (2.2–10) | 1500 |
| **MA** | **PFOS** | 16 (0) | 0.43 (0.38–22) | 94% (2) | <4.3 | 15 (7.3–41) | 2200 |
| **MA** | **PFOA** | 16 (0) | 0.53 (0.46–27) | 88% (2) | 1.5 | 14 (5.2–36) | 830 |
| **MA** | **PFNA** | 16 (0) | 0.22 (0.19–11) | 75% (6) | 0.55 | 2.2 (1.2–5.1) | 20 |
| **MA** | **PFDA** | 16 (0) | 0.48 (0.42–24) | 69% (3) | 0.8 | 2.6 (1.9–5.5) | 34 |
| **MA** | **PFUnA** | 16 (0) | 0.42 (0.37–21) | 56% (6) | <0.42 | 0.81 (0.55–1) | 29 |
| **MA** | **MeFOSAA** | 16 (0) | 0.23 (0.2–12) | 81% (5) | <0.2 | 4.3 (1.4–20) | 540 |

*Estimated Values are the number of sample results flagged by the laboratory as less than the reporting limit but greater than or equal to the method detection limit and the concentration is an approximate value.

†NA: Not Applicable: Summary statistics (median, 25% or 75%) could not be calculated due to the ranks of the method detection limits. Refer to Appendix B, Treatment of Non-Detects (ND) in the Data Set.

## Wipe 1: Kitchen Counter

**Table C- 9. Summary Statistics of Surface Wipe 1: Typically Kitchen Counter (ng/cm$^2$) Results — DE and MA**

| Site | Analyte | # of Samples Collected (Invalid Samples) | Method Detection Limit Median (Range) (ng/cm$^2$) | % Detected from Valid Samples (Estimated Values)* | Minimum (ng/cm$^2$) | Median (25%–75%) (ng/cm$^2$) | Maximum (ng/cm$^2$) |
|---|---|---|---|---|---|---|---|
| **DE** | **PFHxS** | 10 (0) | 0.0015 (0.0015–0.0015) | 30% (3) | <0.0015 | NA (NA–0.0017)‡ | 0.0027 |
| **DE** | **PFOS** | 10 (0) | 0.0021 (0.0021–0.0021) | 30% (0) | <0.0021 | NA (NA–0.029)† | 0.044 |
| **DE** | **PFOA** | 10 (0) | 0.0026 (0.0026–0.0026) | 60% (4) | <0.0026 | 0.0028 (NA–0.0082)† | 0.034 |
| **DE** | **PFNA** | 10 (0) | 0.0011 (0.0011–0.0011) | 60% (5) | <0.0011 | 0.0013 (NA–0.0025)† | 0.017 |
| **DE** | **PFDA** | 10 (0) | 0.0023 (0.0023–0.0023) | 30% (2) | <0.0023 | NA (NA–0.0029)† | 0.024 |
| **DE** | **PFUnA** | 10 (0) | 0.002 (0.002–0.002) | 20% (1) | <0.002 | NA (NA–NA)† | 0.019 |
| **DE** | **MeFOSAA** | 10 (0) | 0.0012 (0.0012–0.0012) | 20% (2) | <0.0012 | NA (NA–NA)† | 0.0083 |
| **MA** | **PFHxS** | 18 (0) | 0.0015 (0.0015–0.015) | 22% (4) | <0.0015 | NA (NA–NA)† | <0.015‡ |
| **MA** | **PFOS** | 18 (0) | 0.0021 (0.0021–0.048) | 17% (0) | <0.0021 | NA (NA–NA)† | 0.069 |

| Site | Analyte | # of Samples Collected (Invalid Samples) | Method Detection Limit Median (Range) ($ng/cm^2$) | % Detected from Valid Samples (Estimated Values)* | Minimum ($ng/cm^2$) | Median (25%–75%) ($ng/cm^2$) | Maximum ($ng/cm^2$) |
|---|---|---|---|---|---|---|---|
| **MA** | **PFOA** | 18 (0) | 0.0026 (0.0026–0.026) | 50% (5) | <0.0026 | NA (NA–0.0091)† | 0.17 |
| **MA** | **PFNA** | 18 (0) | 0.0011 (0.0011–0.011) | 33% (4) | <0.0011 | NA (NA–0.0011)† | 0.57 |
| **MA** | **PFDA** | 18 (0) | 0.0023 (0.0023–0.023) | 22% (2) | <0.0023 | NA (NA–NA)† | 0.27 |
| **MA** | **PFUnA** | 18 (0) | 0.002 (0.002–0.02) | 11% (1) | <0.002 | NA (NA–NA)† | 0.36 |
| **MA** | **MeFOSAA** | 18 (0) | 0.0012 (0.0012–0.012) | 11% (1) | <0.0012 | NA (NA–NA)† | 0.02 |

*Estimated Values are the number of sample results flagged by the laboratory as less than the reporting limit but greater than or equal to the method detection limit and the concentration is an approximate value.

†NA: Not Applicable: Summary statistics (median, 25% or 75%) could not be calculated due to the ranks of the method detection limits. Refer to Appendix B, Treatment of Non-Detects (ND) in the Data Set.

‡The method detection limit for the maximum in the data set was higher than all the detections in the data set. Refer to Appendix B, Treatment of Non-Detects (ND) in the Data Set.

## Wipe 2: Typically Closet Floor

**Table C- 10. Summary Statistics of Surface Wipe 2: Typically Closet Floor (ng/cm$^2$) Results — DE and MA**

| Site | Analyte | # of Samples Collected (Invalid Samples) | Method Detection Limit Median (Range) (ng/cm$^2$) | % Detected from Valid Samples (Estimated Values)* | Minimum (ng/cm$^2$) | Median (25%–75%) (ng/cm$^2$) | Maximum (ng/cm$^2$) |
|---|---|---|---|---|---|---|---|
| **DE** | **PFHxS** | 10 (0) | 0.0015 (0.0015–0.0015) | 100% (9) | 0.0015 | 0.0036 (0.0019–0.0057) | 0.016 |
| **DE** | **PFOS** | 10 (0) | 0.0021 (0.0021–0.0021) | 70% (0) | <0.0021 | 0.021 (NA–0.06)[†] | 0.082 |
| **DE** | **PFOA** | 10 (0) | 0.0026 (0.0026–0.0026) | 90% (4) | <0.0026 | 0.0091 (0.0049–0.017) | 0.087 |
| **DE** | **PFNA** | 10 (0) | 0.0011 (0.0011–0.0011) | 100% (8) | 0.0014 | 0.0021 (0.0016–0.0061) | 0.11 |
| **DE** | **PFDA** | 10 (0) | 0.0023 (0.0023–0.0023) | 40% (2) | <0.0023 | NA (NA–0.0041)[†] | 0.05 |
| **DE** | **PFUnA** | 10 (0) | 0.002 (0.002–0.002) | 50% (4) | <0.002 | NA (NA–0.0031)[†] | 0.06 |
| **DE** | **MeFOSAA** | 10 (0) | 0.0012 (0.0012–0.0012) | 50% (4) | <0.0012 | NA (NA–0.0046)[†] | 0.012 |
| **MA** | **PFHxS** | 18 (0) | 0.0015 (0.0015–0.015) | 56% (7) | <0.0015 | 0.0017 (NA–0.0037)[†] | 0.048 |
| **MA** | **PFOS** | 18 (0) | 0.0021 (0.0021–0.021) | 56% (0) | <0.0021 | 0.013 (NA–0.027)[†] | 0.89 |

| Site | Analyte | # of Samples Collected (Invalid Samples) | Method Detection Limit Median (Range) ($ng/cm^2$) | % Detected from Valid Samples (Estimated Values)* | Minimum ($ng/cm^2$) | Median (25%–75%) ($ng/cm^2$) | Maximum ($ng/cm^2$) |
|---|---|---|---|---|---|---|---|
| **MA** | **PFOA** | 18 (0) | 0.0026 (0.0026–0.026) | 56% (7) | <0.0026 | 0.0028 (NA–0.0079)† | 0.073 |
| **MA** | **PFNA** | 18 (0) | 0.0011 (0.0011–0.011) | 17% (3) | <0.0011 | NA (NA–NA)† | <0.011‡ |
| **MA** | **PFDA** | 18 (0) | 0.0023 (0.0023–0.023) | 11% (1) | <0.0023 | NA (NA–NA)† | 0.023 |
| **MA** | **PFUnA** | 18 (0) | 0.002 (0.002–0.02) | 0 | | NC§ | |
| **MA** | **MeFOSAA** | 18 (0) | 0.0012 (0.0012–0.012) | 17% (3) | <0.0012 | NA (NA–NA)† | <0.012‡ |

*Estimated Values are the number of sample results flagged by the laboratory as less than the reporting limit but greater than or equal to the method detection limit and the concentration is an approximate value.

†NA: Not Applicable: Summary statistics (median, 25% or 75%) could not be calculated due to the ranks of the method detection limits. Refer to Appendix B, Treatment of Non-Detects (ND) in the Data Set.

‡The method detection limit for the maximum in the data set was higher than all the detections in the data set. Refer to Appendix B, Treatment of Non-Detects (ND) in the Data Set.

§NC: Not Calculated: Summary statistics (median, 25%, 75%, and range) could not be calculated due to no detected samples available.

## Indoor Air

**Table C- 11. Summary Statistics of Indoor Air (ng/m³) Results — DE and MA**

| Site | Analyte | # of Samples Collected (Invalid Samples) | Method Detection Limit Median (Range) (ng/m³) | % Detected from Valid Samples (Estimated Values)* | Minimum (ng/m³) | Median (25%–75%) (ng/m³) | Maximum (ng/m³) |
|---|---|---|---|---|---|---|---|
| **DE** | **PFHxS** | 10 (4) | 0.012 (0.012–0.012) | 0 | | NC† | |
| **DE** | **PFOS** | 10 (4) | 0.033 (0.032–0.034) | 0 | | NC† | |
| **DE** | **PFOA** | 10 (0) | 0.04 (0.039–0.041) | 40% (4) | <0.04 | NA (NA–0.062)‡ | 0.065 |
| **DE** | **PFNA** | 10 (0) | 0.016 (0.016–0.016) | 0 | | NC† | |
| **DE** | **PFDA** | 10 (0) | 0.0092 (0.0091–0.0095) | 30% (3) | <0.0091 | NA (NA–0.0099)‡ | 0.011 |
| **DE** | **PFUnA** | 10 (0) | 0.017 (0.016–0.017) | 0 | | NC† | |
| **DE** | **MeFOSAA** | 10 (0) | 0.019 (0.019–0.02) | 0 | | NC† | |
| **MA** | **PFHxS** | 18 (7) | 0.012 (0.012–0.013) | 0 | | NC† | |
| **MA** | **PFOS** | 18 (7) | 0.033 (0.032–0.037) | 0 | | NC† | |
| **MA** | **PFOA** | 18 (11) | 0.04 (0.039–0.045) | 0 | | NC† | |

| Site | Analyte | # of Samples Collected (Invalid Samples) | Method Detection Limit Median (Range) ($ng/m^3$) | % Detected from Valid Samples (Estimated Values)* | Minimum ($ng/m^3$) | Median (25%–75%) ($ng/m^3$) | Maximum ($ng/m^3$) |
|---|---|---|---|---|---|---|---|
| **MA** | **PFNA** | 18 (2) | 0.016 (0.015–0.018) | 0 | | NC† | |
| **MA** | **PFDA** | 18 (12) | 0.0093 (0.009–0.0094) | 0 | | NC† | |
| **MA** | **PFUnA** | 18 (1) | 0.017 (0.016–0.018) | 0 | | NC† | |
| **MA** | **MeFOSAA** | 18 (1) | 0.02 (0.019–0.022) | 0 | | NC† | |

*Estimated Values are the number of sample results flagged by the laboratory as less than the reporting limit but greater than or equal to the method detection limit and the concentration is an approximate value.

†NC: Not Calculated: Summary statistics (median, 25%, 75%, and range) could not be calculated due to no detected samples available.

‡NA: Not Applicable: Summary statistics (median, 25% or 75%) could not be calculated due to the ranks of the method detection limits. Refer to Appendix B, Treatment of Non-Detects (ND) in the Data Set.

## Wristband

**Table C- 12. Summary Statistics of Wristband (µg/kg) Results — DE and MA**

| Site | Analyte | # of Samples Collected (Invalid Samples) | Method Detection Limit Median (Range) (µg/kg) | % Detected from Valid Samples (Estimated Values)* | Minimum (µg/kg) | Median (25%–75%) (µg/kg) | Maximum (µg/kg) |
|---|---|---|---|---|---|---|---|
| **DE** | **PFHxS** | 10 (0) | 0.031 (0.03–0.031) | 10% (1) | <0.03 | NA (NA–NA)‡ | 0.1 |
| **DE** | **PFOS** | 10 (0) | 0.046 (0.045–0.047) | 20% (2) | <0.045 | NA (NA–NA)† | 0.17 |
| **DE** | **PFOA** | 10 (0) | 0.0565 (0.056–0.057) | 0 | | NC‡ | |
| **DE** | **PFNA** | 10 (0) | 0.0235 (0.023–0.024) | 10% (1) | <0.023 | NA (NA–NA)† | 0.056 |
| **DE** | **PFDA** | 10 (0) | 0.051 (0.05–0.052) | 0 | | NC‡ | |
| **DE** | **PFUnA** | 10 (0) | 0.045 (0.044–0.046) | 0 | | NC‡ | |
| **DE** | **MeFOSAA** | 10 (0) | 0.0245 (0.024–0.025) | 10% (1) | <0.024 | NA (NA–NA)† | 0.056 |
| **MA** | **PFHxS** | 18 (0) | 0.031 (0.031–0.032) | 11% (1) | <0.031 | NA (NA–NA)† | 0.32 |
| **MA** | **PFOS** | 18 (0) | 0.046 (0.045–0.047) | 17% (2) | <0.045 | NA (NA–NA)† | 0.59 |
| **MA** | **PFOA** | 18 (0) | 0.057 (0.056–0.058) | 17% (2) | <0.056 | NA (NA–NA)† | 0.4 |

| Site | Analyte | # of Samples Collected (Invalid Samples) | Method Detection Limit Median (Range) (µg/kg) | % Detected from Valid Samples (Estimated Values)* | Minimum (µg/kg) | Median (25%–75%) (µg/kg) | Maximum (µg/kg) |
|---|---|---|---|---|---|---|---|
| **MA** | **PFNA** | 18 (0) | 0.024 (0.023–0.024) | 11% (2) | <0.023 | NA (NA–NA)† | 0.14 |
| **MA** | **PFDA** | 18 (0) | 0.052 (0.051–0.052) | 6% (0) | <0.051 | NA (NA–NA)† | 0.44 |
| **MA** | **PFUnA** | 18 (0) | 0.045 (0.044–0.046) | 6% (1) | <0.044 | NA (NA–NA)† | 0.12 |
| **MA** | **MeFOSAA** | 18 (0) | 0.025 (0.024–0.025) | 22% (4) | <0.024 | NA (NA–NA)† | 0.068 |

*Estimated Values are the number of sample results flagged by the laboratory as less than the reporting limit but greater than or equal to the method detection limit and the concentration is an approximate value.

†NA: Not Applicable: Summary statistics (median, 25% or 75%) could not be calculated due to the ranks of the method detection limits. Refer to Appendix B, Treatment of Non-Detects (ND) in the Data Set.

‡NC: Not Calculated: Summary statistics (median, 25%, 75%, and range) could not be calculated due to no detected samples available.

## Soil

**Table C- 13. Summary Statistics of Residential Soil (µg/kg) Results — DE and MA**

| Site | Analyte | # of Samples Collected (Invalid Samples) | Method Detection Limit Median (Range) (µg/kg) | % Detected from Valid Samples (Estimated Values)* | Minimum (µg/kg) | Median (25%–75%) (µg/kg) | Maximum (µg/kg) |
|---|---|---|---|---|---|---|---|
| **DE** | **PFHxS** | 10 (0) | 0.028 (0.027–0.029) | 70% (7) | <0.028 | 0.033 (NA–0.044)‡ | 0.066 |
| **DE** | **PFOS** | 10 (0) | 0.0415 (0.039–0.043) | 100% (0) | 0.84 | 1.3 (1.1–1.5) | 3.2 |
| **DE** | **PFOA** | 10 (0) | 0.051 (0.049–0.053) | 100% (0) | 0.25 | 0.46 (0.42–0.78) | 1.1 |
| **DE** | **PFNA** | 10 (0) | 0.021 (0.02–0.022) | 100% (0) | 0.66 | 0.97 (0.81–1.1) | 2.1 |
| **DE** | **PFDA** | 10 (0) | 0.046 (0.044–0.048) | 100% (0) | 1.1 | 1.9 (1.8–2.7) | 5.9 |
| **DE** | **PFUnA** | 10 (0) | 0.0405 (0.038–0.042) | 100% (0) | 1 | 2.1 (1.6–3.1) | 7.9 |
| **DE** | **MeFOSAA** | 10 (0) | 0.022 (0.021–0.023) | 50% (5) | <0.021 | NA (NA–0.047)† | 0.077 |
| **MA** | **PFHxS** | 18 (0) | 0.028 (0.026–0.029) | 22% (4) | <0.026 | NA (NA–NA)† | 0.072 |
| **MA** | **PFOS** | 18 (0) | 0.042 (0.039–0.043) | 100% (0) | 0.26 | 0.75 (0.64–0.99) | 3.8 |
| **MA** | **PFOA** | 18 (0) | 0.051 (0.048–0.053) | 83% (13) | <0.048 | 0.065 (0.055–0.11) | 0.47 |

| Site | Analyte | # of Samples Collected (Invalid Samples) | Method Detection Limit Median (Range) (µg/kg) | % Detected from Valid Samples (Estimated Values)* | Minimum (µg/kg) | Median (25%–75%) (µg/kg) | Maximum (µg/kg) |
|---|---|---|---|---|---|---|---|
| **MA** | **PFNA** | 18 (0) | 0.021 (0.02–0.022) | 100% (17) | 0.031 | 0.077 (0.066–0.11) | 0.19 |
| **MA** | **PFDA** | 18 (0) | 0.046 (0.044–0.048) | 100% (13) | 0.055 | 0.13 (0.11–0.19) | 0.42 |
| **MA** | **PFUnA** | 18 (0) | 0.041 (0.038–0.042) | 100% (16) | 0.053 | 0.11 (0.09–0.14) | 0.22 |
| **MA** | **MeFOSAA** | 18 (0) | 0.022 (0.021–0.023) | 6% (1) | <0.021 | NA (NA–NA)† | 0.087 |

*Estimated Values are the number of sample results flagged by the laboratory as less than the reporting limit but greater than or equal to the method detection limit and the concentration is an approximate value.

†NA: Not Applicable: Summary statistics (median, 25% or 75%) could not be calculated due to the ranks of the method detection limits. Refer to Appendix B, Treatment of Non-Detects (ND) in the Data Set.

## Outdoor Air: Low Flow

**Table C- 14. Summary Statistics of Community Outdoor Air: Low Flow (ng/m³) Results — DE and MA**

| Site | Analyte | # of Samples Collected (Invalid Samples) | Method Detection Limit Median (Range) (ng/m³) | % Detected from Valid Samples (Estimated Values)* | Minimum (ng/m³) | Median (25%–75%) (ng/m³) | Maximum (ng/m³) |
|---|---|---|---|---|---|---|---|
| **DE** | **PFHxS** | 1 (0) | 0.024 (0.024–0.024) | 0 | | NC† | |
| **DE** | **PFOS** | 1 (0) | 0.066 (0.066–0.066) | 0 | | NC† | |
| **DE** | **PFOA** | 1 (0) | 0.08 (0.08–0.08) | 100% (1) | | | 0.08‡ |
| **DE** | **PFNA** | 1 (0) | 0.032 (0.032–0.032) | 0 | | NC† | |
| **DE** | **PFDA** | 1 (0) | 0.018 (0.018–0.018) | 0 | | NC† | |
| **DE** | **PFUnA** | 1 (0) | 0.033 (0.033–0.033) | 0 | | NC† | |
| **DE** | **MeFOSAA** | 1 (0) | 0.039 (0.039–0.039) | 0 | | NC† | |
| **MA** | **PFHxS** | 1 (1) | | | | § | |
| **MA** | **PFOS** | 1 (1) | | | | § | |
| **MA** | **PFOA** | 1 (0) | 0.041 (0.041–0.041) | 0 | | NC† | |
| **MA** | **PFNA** | 1 (0) | 0.016 (0.016–0.016) | 0 | | NC† | |

| Site | Analyte | # of Samples Collected (Invalid Samples) | Method Detection Limit Median (Range) ($ng/m^3$) | % Detected from Valid Samples (Estimated Values)* | Minimum ($ng/m^3$) | Median (25%–75%) ($ng/m^3$) | Maximum ($ng/m^3$) |
|---|---|---|---|---|---|---|---|
| **MA** | **PFDA** | 1 (0) | 0.0095 (0.0095–0.0095) | 0 | | NC† | |
| **MA** | **PFUnA** | 1 (0) | 0.017 (0.017–0.017) | 0 | | NC† | |
| **MA** | **MeFOSAA** | 1 (0) | 0.02 (0.02–0.02) | 0 | | NC† | |

*Estimated Values are the number of sample results flagged by the laboratory as less than the reporting limit but greater than or equal to the method detection limit and the concentration is an approximate value.

†NC: Not Calculated: Summary statistics (median, 25%, 75%, and range) could not be calculated due to no detected samples available.

‡A single sample was collected and was detected. The result is stated as a maximum.

§Summary statistics (median, 25%, 75%, and range) could not be calculated because the sample was invalidated during data analysis.

## Outdoor Air: Higher Flow

**Table C- 15. Summary Statistics of Community Outdoor Air: Higher Flow (ng/m$^3$) Results — DE and MA**

| Site | Analyte | # of Samples Collected (Invalid Samples) | Method Detection Limit Median (Range) (ng/m$^3$) | % Detected from Valid Samples (Estimated Values)* | Minimum (ng/m$^3$) | Median (25%–75%) (ng/m$^3$) | Maximum (ng/m$^3$) |
|---|---|---|---|---|---|---|---|
| **DE** | **PFHxS** | 1 (0) | 0.0027 (0.0027–0.0027) | 0 | | NC† | |
| **DE** | **PFOS** | 1 (1) | | | | ‡ | |
| **DE** | **PFOA** | 1 (0) | 0.009 (0.009–0.009) | 100% (1) | | | 0.013§ |
| **DE** | **PFNA** | 1 (0) | 0.0036 (0.0036–0.0036) | 0 | | NC† | |
| **DE** | **PFDA** | 1 (0) | 0.0021 (0.0021–0.0021) | 0 | | NC† | |
| **DE** | **PFUnA** | 1 (0) | 0.0037 (0.0037–0.0037) | 0 | | NC† | |
| **DE** | **MeFOSAA** | 1 (0) | 0.0044 (0.0044–0.0044) | 0 | | NC† | |
| **MA** | **PFHxS** | 1 (0) | 0.0036 (0.0036–0.0036) | 0 | | NC† | |
| **MA** | **PFOS** | 1 (0) | 0.0098 (0.0098–0.0098) | 0 | | NC† | |
| **MA** | **PFOA** | 1 (1) | | | | ‡ | |

| Site | Analyte | # of Samples Collected (Invalid Samples) | Method Detection Limit Median (Range) ($ng/m^3$) | % Detected from Valid Samples (Estimated Values)* | Minimum ($ng/m^3$) | Median (25%–75%) ($ng/m^3$) | Maximum ($ng/m^3$) |
|---|---|---|---|---|---|---|---|
| **MA** | **PFNA** | 1 (0) | 0.0047 (0.0047–0.0047) | 0 | | NC† | |
| **MA** | **PFDA** | 1 (0) | 0.0027 (0.0027–0.0027) | 0 | | NC† | |
| **MA** | **PFUnA** | 1 (0) | 0.0049 (0.0049–0.0049) | 0 | | NC† | |
| **MA** | **MeFOSAA** | 1 (0) | 0.0058 (0.0058–0.0058) | 0 | | NC† | |

*Estimated Values are the number of sample results flagged by the laboratory as less than the reporting limit but greater than or equal to the method detection limit and the concentration is an approximate value.

†NC: Not Calculated: Summary statistics (median, 25%, 75%, and range) could not be calculated due to no detected samples available.

‡Summary statistics (median, 25%, 75%, and range) could not be calculated because the sample was invalidated during data analysis.

§A single sample was collected and was detected. The result is stated as a maximum.

## Produce

**Table C- 16. Summary Statistics of Community Produce (µg/kg) Results — DE and MA**

| Site | Analyte | # of Samples Collected (Invalid Samples) | Method Detection Limit Median (Range) (µg/kg) | % Detected from Valid Samples (Estimated Values)* | Minimum (µg/kg) | Median (25%–75%) (µg/kg) | Maximum (µg/kg) |
|---|---|---|---|---|---|---|---|
| **DE** | **PFHxS** | 6 (0) | 0.02 (0.02–0.02) | 0 | | NC† | |
| **DE** | **PFOS** | 6 (0) | 0.02 (0.02–0.02) | 0 | | NC† | |
| **DE** | **PFOA** | 6 (0) | 0.02 (0.02–0.02) | 17% (0) | <0.02 | NA (NA–NA)‡ | 0.066 |
| **DE** | **PFNA** | 6 (0) | 0.02 (0.02–0.02) | 0 | | NC† | |
| **DE** | **PFDA** | 6 (0) | 0.02 (0.02–0.02) | 0 | | NC† | |
| **DE** | **PFUnA§** | 6 (0) | 0.02 (0.02–0.02) | 0 | | NC† | |
| **DE** | **MeFOSAA§** | 6 (0) | 0.02 (0.02–0.02) | 0 | | NC† | |
| **MA** | **PFHxS** | 9 (2) | 0.02 (0.02–0.02) | 0 | | NC† | |
| **MA** | **PFOS** | 9 (2) | 0.02 (0.02–0.02) | 0 | | NC† | |
| **MA** | **PFOA** | 9 (2) | 0.02 (0.02–0.02) | 57% (4) | <0.02 | 0.026 (NA–0.029)‡ | 0.032 |
| **MA** | **PFNA** | 9 (2) | 0.02 (0.02–0.02) | 0 | | NC† | |
| **MA** | **PFDA** | 9 (2) | 0.02 (0.02–0.02) | 0 | | NC† | |
| **MA** | **PFUnA§** | 9 (2) | 0.02 (0.02–0.02) | 0 | | NC† | |

| Site | Analyte | # of Samples Collected (Invalid Samples) | Method Detection Limit Median (Range) (µg/kg) | % Detected from Valid Samples (Estimated Values)* | Minimum (µg/kg) | Median (25%–75%) (µg/kg) | Maximum (µg/kg) |
|---|---|---|---|---|---|---|---|
| **MA** | **MeFOSAA**§ | 9 (2) | 0.02 (0.02–0.02) | 0 | | NC† | |

*Estimated Values are the number of sample results flagged by the laboratory as less than the reporting limit but greater than or equal to the method detection limit and the concentration is an approximate value.

†NC: Not Calculated: Summary statistics (median, 25%, 75%, and range) could not be calculated due to no detected samples available.

‡NA: Not Applicable: Summary statistics (median, 25% or 75%) could not be calculated due to the ranks of the method detection limits. Refer to Appendix B, Treatment of Non-Detects (ND) in the Data Set.

§Additional PFAS Analytes in produce – refer to Appendix A, Analytes and Method Selection.

# Appendix C3: Comparison of DE and MA Results

An analysis of similarity (ANOSIM) is a multivariate approach that allows us to look at explanatory variables (site) and response variables (the 7 different PFAS species). Ranks of u-scores were calculated to address the multiple detection limits in the results (Helsel 2011). The ANOSIM on ranks of u-scores uses nonparametric methods to analyze the data based on relative ranks rather than levels of PFAS. ANOSIM tests if there are significantly higher similarities among ranks in the same explanatory variable groups than in the ranks of different groups (Helsel 2011). In summary, the ANOSIM considers all 7 PFAS at the same time and tells us if there are significant differences between DE and MA.

The results of the ANOSIM test showed a significant difference between DE and MA for settled dust ($R$ = 0.110, p = 0.003), home vacuum dust ($R$ = 0.214, p = 0.022), soil ($R$ = 0.756, p = 0.001) and surface wipes taken from a closet area ($R$ = 0.258, p = 0.004) (Table C- 17). ANOSIM comparing DE and MA for indoor air was not performed due to insufficient valid results. Plotting the data showed the direction of this differences (Figure C- 3 to Figure C- 6). For all significantly different media, DE PFAS levels were higher than levels in MA.

**Table C- 17. ANOSIM test results for the comparison of DE and MA 7 PFAS levels**

| Environmental Medium | ANOSIM Test Statistic ($R$) | p-value |
|---|---|---|
| **Settled Dust** | **0.110** | **0.003** |
| **Household Vacuum Dust** | **0.214** | **0.022** |
| **Soil** | **0.756** | **0.001** |
| Wipe 1 | 0.00121 | 0.367 |
| **Wipe 2** | **0.258** | **0.004** |
| Wristband | -0.0485 | 0.751 |

Significant test results are in **bold**.

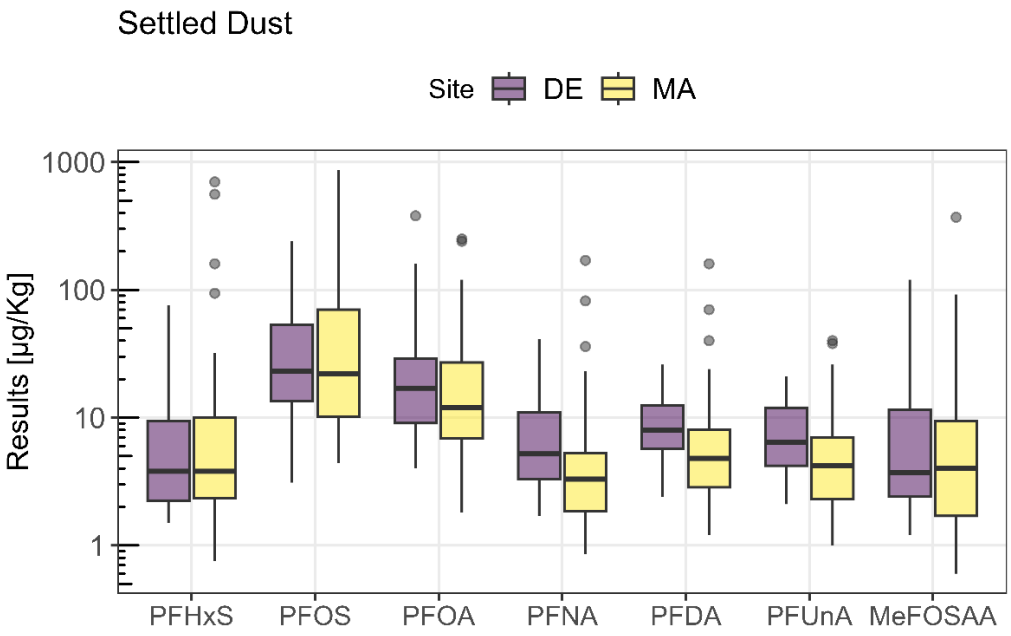


**Figure C- 3. Settled dust results of 7 PFAS comparing DE and MA**

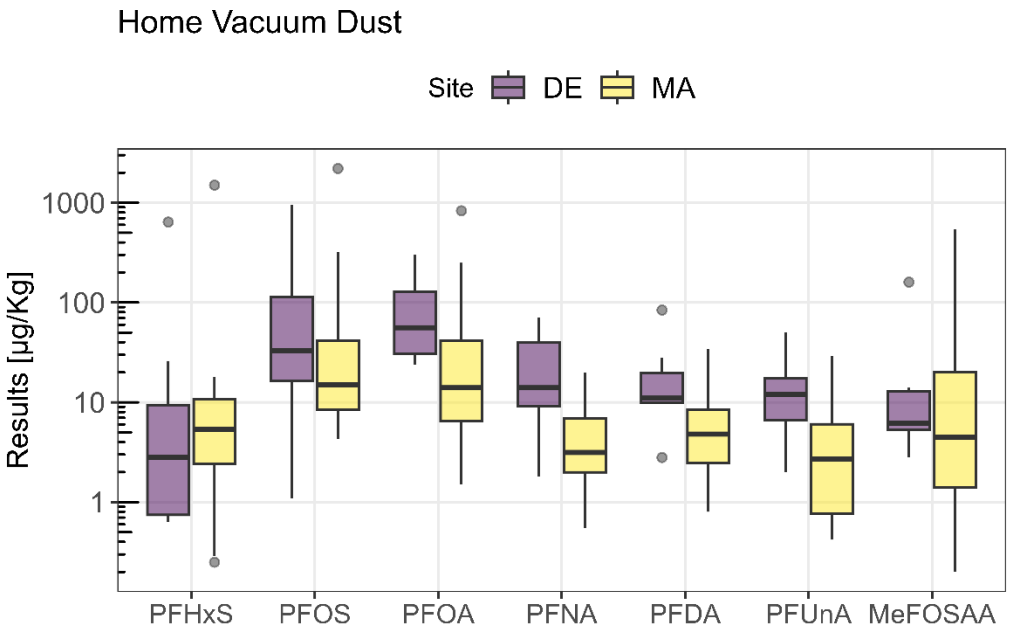


**Figure C- 4. Household vacuum dust results of 7 PFAS comparing DE and MA**

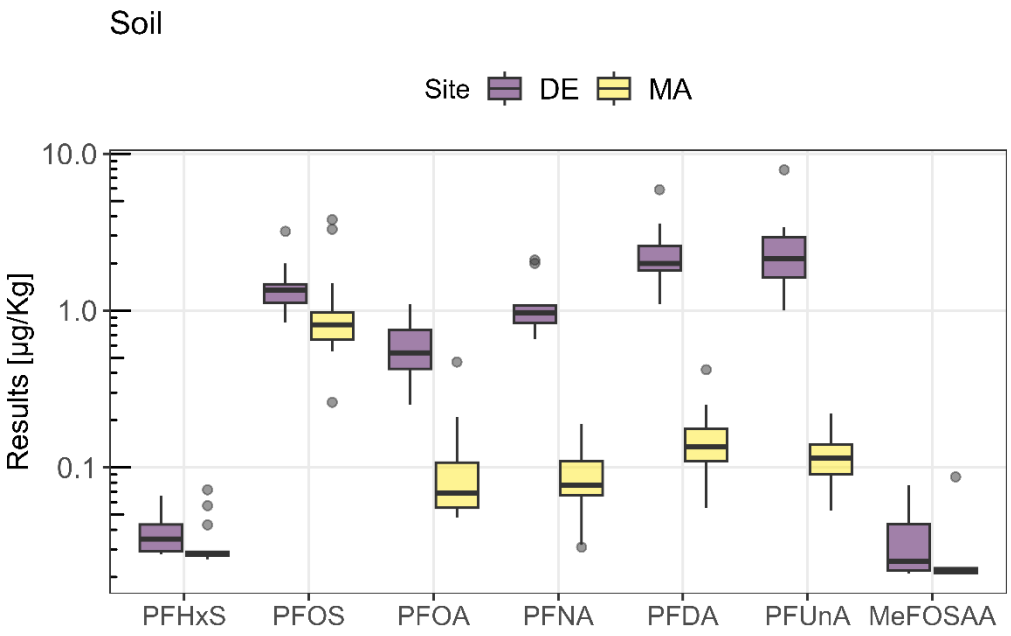


**Figure C- 5. Soil results of 7 PFAS comparing DE and MA**

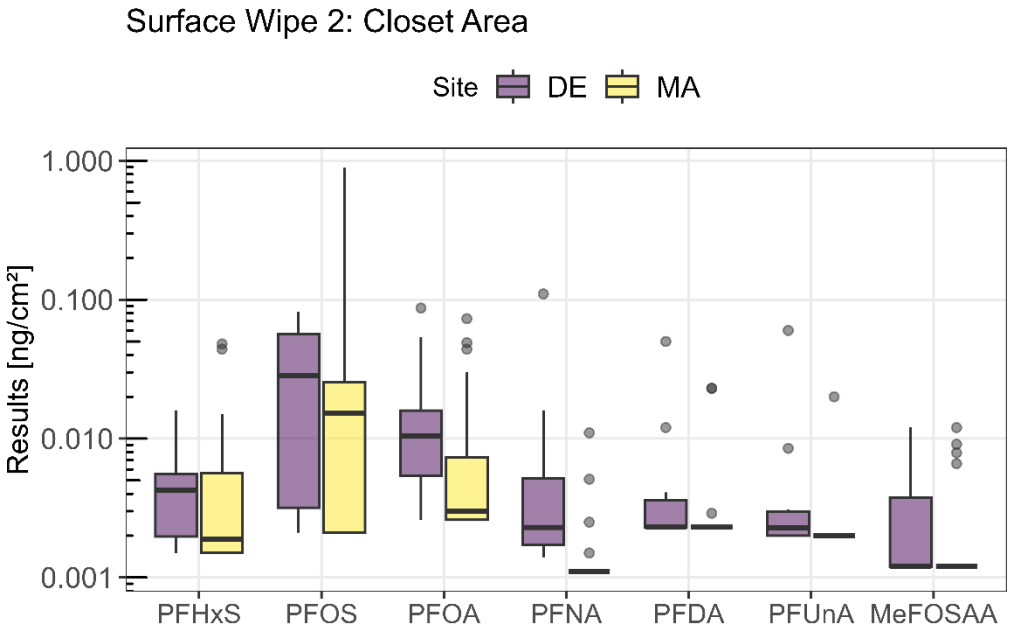


**Figure C- 6. Surface Wipe 2: Closet Area results of 7 PFAS comparing DE and MA**

# Appendix D: Summary of Additional PFAS and PFAS Precursors in All Media Sampled

CONTENTS



## List of Tables

Separate samples were collected to measure a type of PFAS called fluorotelomer alcohols (FTOHs). Different analysis procedures were required for the FTOH chemicals because they are more volatile than the chemicals included in the 'PFAS' analyses. In addition, a different sample collection material and method was used to collect FTOHs in indoor and outdoor air.

Separate samples were also collected for a measurement called extractable organic fluorine (EOF). While the PFAS and FTOH analyses measured specific chemicals, the EOF analysis was used to assess the total amount of fluorine-containing organic chemicals that could be extracted from each medium. The EOF measurement is used to assess whether PFAS other than those in the targeted analyses may be present in an environmental medium. It can also provide information about the proportion of PFAS in a medium that is being captured by the targeted analysis. However, the method may also measure fluorine containing organic chemicals that are not PFAS, so careful interpretation of measurement results is needed.

Targeted PFAS measurements were made for all household vacuum dust samples collected from the homes. When enough material was available from the collected household vacuum dust, an additional analysis was performed called the total oxidizable precursor (TOP) assay. This specialized analysis method is used to better understand the potential for some PFAS chemicals known as 'precursors' to be converted into other, more stable PFAS. This analysis provides information on the amounts, and potentially types of known and unknown precursor PFAS present in the dust. Because these precursors may transform into the more stable PFAS measured in the blood serum of EA participants, total precursor amount may help to explain PFAS body burden levels observed in the EA.

## Settled Dust

**Table D- 1. Summary Statistics of Settled Dust (µg/kg) Results for PFAS — DE and MA**

| Site | Analyte | # of Samples Collected (Invalid Samples) | Method Detection Limit Median (Range) (µg/kg) | % Detected from Valid Samples (Estimated Values)* | Minimum (µg/kg) | Median (25%–75%) (µg/kg) | Maximum (µg/kg) |
|---|---|---|---|---|---|---|---|
| **DE** | **PFBA** | 31 (0) | 550 (75–3000) | 0% (0) | | NC† | |
| **DE** | **PFPeA** | 31 (0) | 45 (16–250) | 0% (0) | | NC† | |
| **DE** | **PFHxA** | 31 (0) | 3.2 (1–30) | 42% (9) | <1.6 | NA (NA–11)‡ | 52 |
| **DE** | **PFHpA** | 31 (0) | 3.5 (0.48–19) | 77% (15) | 2.4 | 6.8 (3.8–11) | 120 |

| Site | Analyte | # of Samples Collected (Invalid Samples) | Method Detection Limit Median (Range) (µg/kg) | % Detected from Valid Samples (Estimated Values)* | Minimum (µg/kg) | Median (25%–75%) (µg/kg) | Maximum (µg/kg) |
|---|---|---|---|---|---|---|---|
| **DE** | **PFDoA** | 31 (0) | 2.7 (0.38–15) | 87% (22) | 2 | 5.9 (4.4–9) | 20 |
| **DE** | **PFTrA** | 31 (0) | 2 (0.28–11) | 81% (23) | 1.1 | 3 (2.3–4.6) | 15 |
| **DE** | **PFTA** | 31 (0) | 3.5 (0.48–19) | 45% (10) | <1.9 | 2.8 (NA–6.2)‡ | 20 |
| **DE** | **PFBS** | 31 (0) | 3.8 (0.48–19) | 42% (10) | <0.5 | 2.7 (NA–5)‡ | 92 |
| **DE** | **PFPeS** | 31 (0) | 3.5 (0.48–19) | 10% (2) | <0.5 | NA (NA–NA)‡ | <19§ |
| **DE** | **PFHpS** | 31 (0) | 4.5 (0.62–25) | 3% (1) | <0.66 | NA (NA–0.68)‡ | <25§ |
| **DE** | **PFNS** | 31 (0) | 2.7 (0.38–15) | 3% (1) | <0.39 | NA (NA–NA)‡ | <15§ |
| **DE** | **PFDS** | 31 (0) | 4.7 (0.65–26) | 16% (2) | <1.6 | NA (NA–2.7)‡ | <26§ |
| **DE** | **PFDoS** | 31 (0) | 4.4 (0.6–24) | 0% (0) | | NC† | |
| **DE** | **3:3 FTCA** | 31 (0) | 3.8 (0.52–21) | 0% (0) | | NC† | |
| **DE** | **5:3 FTCA** | 31 (0) | 3.5 (0.48–19) | 3% (1) | <0.48 | NA (NA–1.6)‡ | <19§ |
| **DE** | **7:3 FTCA** | 31 (0) | 3.8 (0.52–21) | 0% (0) | | NC† | |
| **DE** | **FtS 4:2** | 31 (0) | 5.2 (0.65–26) | 10% (0) | <0.65 | NA (NA–1.8)‡ | <26§ |
| **DE** | **FtS 6:2** | 31 (8) | 1.6 (0.35–14) | 83% (1) | <0.87 | 50 (9.4–100) | 2300 |

| Site | Analyte | # of Samples Collected (Invalid Samples) | Method Detection Limit Median (Range) (µg/kg) | % Detected from Valid Samples (Estimated Values)* | Minimum (µg/kg) | Median (25%–75%) (µg/kg) | Maximum (µg/kg) |
|---|---|---|---|---|---|---|---|
| **DE** | **FtS 8:2** | 31 (0) | 3.3 (0.45–18) | 68% (17) | <1.1 | 5.6 (3–9.2) | 35 |
| **DE** | **PFOSA** | 31 (0) | 3.1 (0.42–17) | 6% (2) | <0.45 | NA (NA–NA)‡ | <17§ |
| **DE** | **N-MeFOSA** | 31 (0) | 4.5 (0.62–25) | 0% (0) | | NC† | |
| **DE** | **N-EtFOSA** | 31 (0) | 4.4 (0.6–24) | 3% (1) | <0.6 | NA (NA–NA)‡ | <24§ |
| **DE** | **EtFOSAA** | 31 (0) | 4.4 (0.6–24) | 65% (11) | <2.4 | 6.2 (NA–14)‡ | 220 |
| **DE** | **N-MeFOSE** | 31 (0) | 4.4 (0.6–24) | 87% (10) | 4.6 | 17 (8.4–100) | 880 |
| **DE** | **N-EtFOSE** | 31 (0) | 2.5 (0.35–14) | 55% (8) | <1.4 | 2.2 (1.4–19) | 5200 |
| **DE** | **PFMPA** | 31 (0) | 2.2 (0.3–12) | 3% (1) | <0.3 | NA (NA–NA)‡ | <12§ |
| **DE** | **PFMBA** | 31 (0) | 4.2 (0.57–23) | 0% (0) | | NC† | |
| **DE** | **HFPO-DA** | 31 (0) | 3.8 (0.52–21) | 0% (0) | | NC† | |
| **DE** | **NFDHA** | 31 (0) | 3.6 (0.5–20) | 0% (0) | | NC† | |
| **DE** | **PFEESA** | 31 (0) | 2.9 (0.4–16) | 0% (0) | | NC† | |
| **DE** | **9Cl-PF3ONS** | 31 (0) | 3.3 (0.45–18) | 0% (0) | | NC† | |
| **DE** | **11Cl-PF3OUdS** | 31 (0) | 2.9 (0.4–16) | 0% (0) | | NC† | |

| Site | Analyte | # of Samples Collected (Invalid Samples) | Method Detection Limit Median (Range) (µg/kg) | % Detected from Valid Samples (Estimated Values)* | Minimum (µg/kg) | Median (25%–75%) (µg/kg) | Maximum (µg/kg) |
|---|---|---|---|---|---|---|---|
| **DE** | **ADONA** | 31 (0) | 3.6 (0.5–20) | 0% (0) | | NC† | |
| **MA** | **PFBA** | 47 (8) | 150 (1.3–4200) | 3% (0) | <1.3 | NA (NA–NA)‡ | <4200§ |
| **MA** | **PFPeA** | 47 (0) | 4.2 (1–82) | 19% (9) | <1 | 1.2 (NA–2)‡ | <82§ |
| **MA** | **PFHxA** | 47 (0) | 2.3 (0.8–16) | 68% (25) | <0.8 | 6.2 (2.7–13) | 74 |
| **MA** | **PFHpA** | 47 (0) | 2.7 (0.95–19) | 53% (23) | <0.95 | 3.5 (NA–5.6)‡ | 120 |
| **MA** | **PFDoA** | 47 (0) | 2.1 (0.75–15) | 36% (14) | <0.75 | 1 (0.94–2.6) | 100 |
| **MA** | **PFTrA** | 47 (0) | 1.6 (0.55–11) | 21% (7) | <0.55 | NA (NA–1.3)‡ | 22 |
| **MA** | **PFTA** | 47 (0) | 2.7 (0.95–19) | 17% (5) | <0.95 | NA (NA–1.8)‡ | 58 |
| **MA** | **PFBS** | 47 (0) | 2.7 (0.95–19) | 26% (9) | <0.95 | 1.5 (NA–2.4)‡ | 56 |
| **MA** | **PFPeS** | 47 (0) | 2.7 (0.95–19) | 6% (3) | <0.95 | NA (NA–NA)‡ | <19§ |
| **MA** | **PFHpS** | 47 (0) | 3.6 (1.2–25) | 0% (0) | | NC† | |
| **MA** | **PFNS** | 47 (0) | 2.1 (0.75–15) | 0% (0) | | NC† | |
| **MA** | **PFDS** | 47 (0) | 3.7 (1.3–26) | 11% (4) | <1.3 | NA (NA–1.9)‡ | <26§ |
| **MA** | **PFDoS** | 47 (0) | 3.4 (1.2–24) | 0% (0) | | NC† | |

| Site | Analyte | # of Samples Collected (Invalid Samples) | Method Detection Limit Median (Range) (µg/kg) | % Detected from Valid Samples (Estimated Values)* | Minimum (µg/kg) | Median (25%–75%) (µg/kg) | Maximum (µg/kg) |
|---|---|---|---|---|---|---|---|
| **MA** | **3:3 FTCA** | 47 (0) | 3 (1–21) | 0% (0) | | NC† | |
| **MA** | **5:3 FTCA** | 47 (0) | 2.7 (0.95–19) | 0% (0) | | NC† | |
| **MA** | **7:3 FTCA** | 47 (0) | 3 (1–21) | 0% (0) | | NC† | |
| **MA** | **FtS 4:2** | 47 (0) | 3.7 (1.3–26) | 0% (0) | | NC† | |
| **MA** | **FtS 6:2** | 47 (0) | 2 (0.7–14) | 45% (14) | 1.2 | 1.3 (1.2–4.4) | 160 |
| **MA** | **FtS 8:2** | 47 (0) | 2.6 (0.9–18) | 30% (9) | <0.9 | NA (NA–4.4)‡ | 57 |
| **MA** | **PFOSA** | 47 (0) | 2.4 (0.85–17) | 2% (1) | <0.85 | NA (NA–NA)‡ | <17§ |
| **MA** | **N-MeFOSA** | 47 (0) | 3.6 (1.2–25) | 0% (0) | | NC† | |
| **MA** | **N-EtFOSA** | 47 (0) | 3.4 (1.2–24) | 0% (0) | | NC† | |
| **MA** | **EtFOSAA** | 47 (0) | 3.4 (1.2–24) | 47% (11) | 2.4 | 3.7 (2.5–13) | 180 |
| **MA** | **N-MeFOSE** | 47 (0) | 3.4 (1.2–24) | 79% (17) | <2.5 | 13 (3.7–58) | 3800 |
| **MA** | **N-EtFOSE** | 47 (0) | 2 (0.7–14) | 40% (12) | 0.85 | 1.2 (0.85–6.7) | 150 |
| **MA** | **PFMPA** | 47 (0) | 1.7 (0.6–12) | 0% (0) | | NC† | |
| **MA** | **PFMBA** | 47 (0) | 3.3 (1.2–23) | 0% (0) | | NC† | |

| Site | Analyte | # of Samples Collected (Invalid Samples) | Method Detection Limit Median (Range) (µg/kg) | % Detected from Valid Samples (Estimated Values)* | Minimum (µg/kg) | Median (25%–75%) (µg/kg) | Maximum (µg/kg) |
|---|---|---|---|---|---|---|---|
| **MA** | **HFPO-DA** | 47 (0) | 3 (1–21) | 0% (0) | | NC† | |
| **MA** | **NFDHA** | 47 (0) | 2.9 (1–20) | 0% (0) | | NC† | |
| **MA** | **PFEESA** | 47 (0) | 2.3 (0.8–16) | 0% (0) | | NC† | |
| **MA** | **9Cl-PF3ONS** | 47 (0) | 2.6 (0.9–18) | 0% (0) | | NC† | |
| **MA** | **11Cl-PF3OUdS** | 47 (0) | 2.3 (0.8–16) | 0% (0) | | NC† | |
| **MA** | **ADONA** | 47 (0) | 2.9 (1–20) | 0% (0) | | NC† | |

*Estimated Values are the number of sample results flagged by the laboratory as less than the reporting limit but greater than or equal to the method detection limit and the concentration is an approximate value.

†NC: Not Calculated: Summary statistics (median, 25%, 75%, and range) could not be calculated due to no detected samples available.

‡NA: Not Applicable: Summary statistics (median, 25% or 75%) could not be calculated due to the ranks of the method detection limits. Refer to Appendix B, Treatment of Non-Detects (ND) in the Data Set.

§The method detection limit for the maximum in the data set was higher than all the detections in the data set. Refer to Appendix B, Treatment of Non-Detects (ND) in the Data Set.

**Table D- 2. Summary Statistics of Settled Dust (µg/kg) Results for diPAPs — DE and MA**

| Site | Analyte | # of Samples Collected (Invalid Samples) | Method Detection Limit Median (Range) (µg/kg) | % Detected from Valid Samples (Estimated Values)* | Minimum (µg/kg) | Median (25%–75%) (µg/kg) | Maximum (µg/kg) |
|---|---|---|---|---|---|---|---|
| **DE** | **6:2 diPAP** | 31 (0) | 3.1 (0.42–17) | 100% (1) | 33 | 200 (85–370) | 860 |
| **DE** | **6:2/8:2 diPAP** | 31 (0) | 6.7 (0.92–37) | 94% (17) | 6.1 | 39 (18–61) | 170 |
| **DE** | **8:2 diPAP** | 31 (0) | 1.7 (0.23–9.3) | 97% (6) | 6.2 | 32 (14–58) | 140 |
| **DE** | **10:2 diPAP** | 31 (0) | 10 (1.4–55) | 6% (2) | <3.4 | 3.9 (NA–3.9)† | <55‡ |
| **MA** | **6:2 diPAP** | 47 (0) | 2.4 (0.85–17) | 100% (0) | 25 | 290 (140–560) | 3300 |
| **MA** | **6:2/8:2 diPAP** | 47 (0) | 5.3 (1.8–37) | 89% (27) | 4.2 | 24 (13–50) | 870 |
| **MA** | **8:2 diPAP** | 47 (0) | 1.3 (0.46–9.3) | 89% (14) | <1 | 18 (11–40) | 780 |
| **MA** | **10:2 diPAP** | 47 (0) | 7.9 (2.8–55) | 11% (5) | <2.8 | NA (NA–NA)† | <55‡ |

*Estimated Values are the number of sample results flagged by the laboratory as less than the reporting limit but greater than or equal to the method detection limit and the concentration is an approximate value.

†NA: Not Applicable: Summary statistics (median, 25% or 75%) could not be calculated due to the ranks of the method detection limits. Refer to Appendix B, Treatment of Non-Detects (ND) in the Data Set.

‡The method detection limit for the maximum in the data set was higher than all the detections in the data set. Refer to Appendix B, Treatment of Non-Detects (ND) in the Data Set.

**Table D- 3. Summary Statistics of Settled Dust (µg/kg) Results for FTOHs — DE and MA**

| Site | Analyte | # of Samples Collected (Invalid Samples) | Method Detection Limit Median (Range) (µg/kg) | % Detected from Valid Samples (Estimated Values)* | Minimum (µg/kg) | Median (25%–75%) (µg/kg) | Maximum (µg/kg) |
|---|---|---|---|---|---|---|---|
| **DE** | **4:2 FTOH** | 15 (0) | 0.33 (0.05–1) | 0% (0) | | NC† | |
| **DE** | **6:2 FTOH** | 15 (0) | 0.33 (0.05–1) | 27% (0) | <0.05 | NA (NA–110)‡ | 640 |
| **DE** | **7:2 sFTOH** | 15 (0) | 0.33 (0.05–1) | 0% (0) | | NC† | |
| **DE** | **8:2 FTOH** | 15 (0) | 0.33 (0.05–1) | 20% (0) | <0.05 | NA (NA–NA)‡ | 470 |
| **DE** | **10:2 FTOH** | 15 (0) | 0.33 (0.05–1) | 7% (0) | <0.05 | NA (NA–NA)‡ | 320 |
| **MA** | **4:2 FTOH** | 24 (0) | 2.5 (0.25–17) | 0% (0) | | NC† | |
| **MA** | **6:2 FTOH** | 24 (0) | 1.75 (0.25–17) | 0% (0) | | NC† | |
| **MA** | **7:2 sFTOH** | 24 (0) | 1.75 (0.25–17) | 0% (0) | | NC† | |
| **MA** | **8:2 FTOH** | 24 (0) | 2.5 (0.25–17) | 0% (0) | | NC† | |
| **MA** | **10:2 FTOH** | 24 (0) | 1.75 (0.25–17) | 0% (0) | | NC† | |

*Estimated Values are the number of sample results flagged by the laboratory as less than the reporting limit but greater than or equal to the method detection limit and the concentration is an approximate value.

†NC: Not Calculated: Summary statistics (median, 25%, 75%, and range) could not be calculated due to no detected samples available.

‡NA: Not Applicable: Summary statistics (median, 25% or 75%) could not be calculated due to the ranks of the method detection limits. Refer to Appendix B, Treatment of Non-Detects (ND) in the Data Set.

**Table D- 4. Summary Statistics of Settled Dust (µg/kg) Results for EOF — DE and MA**

| Site | PFAS Species | Analyte | # of Samples Collected (Invalid Samples) | Method Detection Limit Median (Range)* (µg/kg) | % Detected from Valid Samples (Estimated Values) | Minimum (µg/kg) | Median (25%–75%) (µg/kg) | Maximum (µg/kg) |
|---|---|---|---|---|---|---|---|---|
| **DE** | **EOF** | EOF | 15 (4) | 350 (70–1400) | 64% (1) | <160† | 1300 (NA–3000) | 7000 |
| **MA** | **EOF** | EOF | 23 (0) | 560 (180–2800) | 48% (7) | <180 | 440 (290–1200) | 6500 |

*Estimated Values are the number of sample results flagged by the laboratory as less than the reporting limit but greater than or equal to the method detection limit and the concentration is an approximate value.

†NA: Not Applicable: Summary statistics (median, 25% or 75%) could not be calculated due to the ranks of the method detection limits. Refer to Appendix B, Treatment of Non-Detects (ND) in the Data Set.

## Household Vacuum Dust

**Table D- 5. Summary Statistics of Household Vacuum Dust (µg/kg) Results for PFAS — DE and MA**

| Site | Analyte | # of Samples Collected (Invalid Samples) | Method Detection Limit Median (Range) (µg/kg) | % Detected from Valid Samples (Estimated Values)* | Minimum (µg/kg) | Median (25%–75%) (µg/kg) | Maximum (µg/kg) |
|---|---|---|---|---|---|---|---|
| **DE** | **PFPrA** | 7 (0) | 0.73 (0.63–0.76) | 0% (0) | | NC† | |
| **DE** | **PFBA** | 7 (0) | 1.2 (1–12) | 100% (0) | 14 | 17 (15–20) | 1800 |
| **DE** | **PFPeA** | 7 (0) | 1 (0.89–1.1) | 100% (0) | 7.2 | 12 (8.9–17) | 22 |
| **DE** | **PFHxA** | 7 (0) | 0.78 (0.67–0.82) | 100% (0) | 13 | 28 (13–42) | 57 |
| **DE** | **PFHpA** | 7 (0) | 0.95 (0.83–1) | 100% (0) | 6.8 | 15 (13–44) | 88 |
| **DE** | **PFDoA** | 7 (0) | 0.75 (0.65–0.79) | 100% (2) | 1.8 | 7.1 (4.1–15) | 52 |
| **DE** | **PFTrA** | 7 (0) | 0.53 (0.46–0.55) | 100% (3) | 0.84 | 5.9 (2.2–9.1) | 37 |
| **DE** | **PFTA** | 7 (0) | 0.93 (0.8–0.97) | 100% (4) | 1 | 3.9 (2.3–6.9) | 32 |
| **DE** | **PFHxDA** | 7 (0) | 0.95 (0.83–1) | 86% (5) | <0.95 | 2 (1.1–2.4) | 12 |
| **DE** | **PFODA** | 7 (0) | 1.7 (1.4–1.7) | 14% (1) | <1.4 | NA (NA–NA)‡ | 3.9 |
| **DE** | **PFPrS** | 7 (0) | 0.75 (0.65–0.79) | 29% (2) | <0.71 | NA (NA–2.1)‡ | 2.2 |

| Site | Analyte | # of Samples Collected (Invalid Samples) | Method Detection Limit Median (Range) (µg/kg) | % Detected from Valid Samples (Estimated Values)* | Minimum (µg/kg) | Median (25%–75%) (µg/kg) | Maximum (µg/kg) |
|---|---|---|---|---|---|---|---|
| **DE** | **PFBS** | 7 (0) | 0.95 (0.83–9.5) | 71% (3) | <0.83 | 3.5 (NA–8.4)‡ | 850 |
| **DE** | **PFPeS** | 7 (0) | 0.93 (0.8–0.97) | 29% (1) | <0.8 | NA (NA–0.96)‡ | 5.6 |
| **DE** | **PFHpS** | 7 (0) | 1.2 (1.1–1.3) | 29% (1) | <1.1 | NA (NA–2)‡ | 5.8 |
| **DE** | **PFNS** | 7 (0) | 0.73 (0.63–0.76) | 14% (1) | <0.63 | NA (NA–NA)‡ | 1 |
| **DE** | **PFDS** | 7 (0) | 1.3 (1.1–1.4) | 57% (3) | <1.1 | 1.8 (NA–2.7)‡ | 67 |
| **DE** | **PFDoS** | 7 (0) | 1.2 (1–1.2) | 0% (0) | | NC† | |
| **DE** | **3:3 FTCA** | 7 (0) | 1 (0.89–1.1) | 0% (0) | | NC† | |
| **DE** | **5:3 FTCA** | 7 (0) | 0.95 (0.83–1) | 0% (0) | | NC† | |
| **DE** | **6:2 FTCA** | 7 (0) | 2.5 (2.2–2.7) | 43% (2) | <2.4 | NA (NA–3.9)‡ | 18 |
| **DE** | **7:3 FTCA** | 7 (0) | 1 (0.89–1.1) | 0% (0) | | NC† | |
| **DE** | **8:2 FTCA** | 7 (0) | 1 (0.87–1.1) | 43% (3) | <1 | NA (NA–2.1)‡ | 4.9 |
| **DE** | **10:2 FTCA** | 7 (0) | 0.63 (0.54–0.66) | 43% (3) | <0.63 | NA (NA–1.1)‡ | 1.5 |

| Site | Analyte | # of Samples Collected (Invalid Samples) | Method Detection Limit Median (Range) (µg/kg) | % Detected from Valid Samples (Estimated Values)* | Minimum (µg/kg) | Median (25%–75%) (µg/kg) | Maximum (µg/kg) |
|---|---|---|---|---|---|---|---|
| **DE** | **FtS 4:2** | 7 (0) | 1.3 (1.1–1.3) | 0% (0) | | NC† | |
| **DE** | **FtS 6:2** | 7 (0) | 0.68 (0.59–0.71) | 71% (2) | <0.68 | 3.6 (NA–12)‡ | 20 |
| **DE** | **FtS 8:2** | 7 (0) | 0.88 (0.76–0.92) | 86% (3) | <0.88 | 4.3 (1.6–10) | 19 |
| **DE** | **FtS 10:2** | 7 (0) | 0.95 (0.83–1) | 100% (5) | 1.3 | 2.3 (1.4–4.8) | 11 |
| **DE** | **PFOSA** | 7 (0) | 0.83 (0.72–0.87) | 43% (2) | <0.83 | NA (NA–3.2)‡ | 19 |
| **DE** | **N-MeFOSA** | 7 (0) | 1.2 (1.1–1.3) | 0% (0) | | NC† | |
| **DE** | **N-EtFOSA** | 7 (0) | 1.2 (1–1.2) | 14% (1) | <1 | NA (NA–NA)‡ | 2 |
| **DE** | **EtFOSAA** | 7 (0) | 1.2 (1–1.3) | 100% (2) | 2.7 | 16 (2.8–30) | 290 |
| **DE** | **N-MeFOSE** | 7 (0) | 1.2 (1–11) | 100% (0) | 19 | 53 (25–93) | 680 |
| **DE** | **N-EtFOSE** | 7 (0) | 0.7 (0.61–6.7) | 100% (1) | 1.5 | 9.8 (5.3–180) | 650 |
| **DE** | **PFMOAA** | 7 (0) | 0.53 (0.46–0.55) | 71% (4) | <0.53 | 2.4 (NA–4.1)‡ | 9.4 |
| **DE** | **PFMPA** | 7 (0) | 0.6 (0.52–0.63) | 0% (0) | | NC† | |

| Site | Analyte | # of Samples Collected (Invalid Samples) | Method Detection Limit Median (Range) (µg/kg) | % Detected from Valid Samples (Estimated Values)* | Minimum (µg/kg) | Median (25%–75%) (µg/kg) | Maximum (µg/kg) |
|---|---|---|---|---|---|---|---|
| **DE** | **PMPA** | 7 (4) | 62 (23–110) | 0% (0) | | NC† | |
| **DE** | **PFMBA** | 7 (0) | 1.1 (0.98–1.2) | 0% (0) | | NC† | |
| **DE** | **PEPA** | 7 (1) | 1.3 (1.1–1.4) | 33% (2) | <1.1 | NA (NA–2.9)‡ | 4.4 |
| **DE** | **HFPO-DA** | 7 (0) | 1 (0.89–1.1) | 14% (1) | <0.89 | NA (NA–NA)‡ | 2.3 |
| **DE** | **PFPE-1** | 7 (0) | 0.88 (0.76–0.92) | 0% (0) | | NC† | |
| **DE** | **R-EVE** | 7 (3) | 1.1 (1–1.2) | 0% (0) | | NC† | |
| **DE** | **NFDHA** | 7 (0) | 1 (0.87–1.1) | 0% (0) | | NC† | |
| **DE** | **PFO2HxA** | 7 (0) | 1.5 (1.3–1.5) | 14% (1) | <1.3 | NA (NA–NA)‡ | 3 |
| **DE** | **PFO3OA** | 7 (0) | 1 (0.87–1.1) | 0% (0) | | NC† | |
| **DE** | **PFO4DA** | 7 (0) | 1.2 (1–1.2) | 0% (0) | | NC† | |
| **DE** | **PFO5DA** | 7 (0) | 1.7 (1.5–1.8) | 0% (0) | | NC† | |
| **DE** | **Byproduct 4** | 7 (0) | 1.3 (1.1–1.4) | 0% (0) | | NC† | |
| **DE** | **PFEESA** | 7 (0) | 0.8 (0.7–0.84) | 0% (0) | | NC† | |

| Site | Analyte | # of Samples Collected (Invalid Samples) | Method Detection Limit Median (Range) (µg/kg) | % Detected from Valid Samples (Estimated Values)* | Minimum (µg/kg) | Median (25%–75%) (µg/kg) | Maximum (µg/kg) |
|---|---|---|---|---|---|---|---|
| **DE** | **9Cl-PF3ONS** | 7 (0) | 0.88 (0.76–0.92) | 0% (0) | | NC† | |
| **DE** | **11Cl-PF3OUdS** | 7 (0) | 0.78 (0.67–0.82) | 0% (0) | | NC† | |
| **DE** | **NVHOS** | 7 (1) | 3.4 (3–3.6) | 0% (0) | | NC† | |
| **DE** | **ADONA** | 7 (0) | 0.98 (0.85–1) | 0% (0) | | NC† | |
| **DE** | **Hydro-EVE** | 7 (0) | 0.73 (0.63–0.76) | 0% (0) | | NC† | |
| **DE** | **Byproduct 5** | 7 (0) | 1.7 (1.5–1.8) | 0% (0) | | NC† | |
| **DE** | **PFecHS** | 7 (0) | 1.1 (0.96–1.2) | 14% (1) | <0.96 | NA (NA–NA)‡ | 3.1 |
| **MA** | **PFPrA** | 16 (0) | 10.95 (0.25–54) | 0% (0) | | NC† | |
| **MA** | **PFBA** | 16 (0) | 0.46 (0.4–23) | 62% (3) | 0.96 | 2.9 (2.1–8.2) | 110 |
| **MA** | **PFPeA** | 16 (0) | 0.41 (0.36–21) | 62% (5) | <0.41 | 1.8 (1.2–6.3) | <21§ |
| **MA** | **PFHxA** | 16 (0) | 0.31 (0.27–16) | 94% (5) | 0.64 | 6.8 (3.1–14) | 82 |
| **MA** | **PFHpA** | 16 (0) | 0.38 (0.33–19) | 81% (6) | <0.38 | 4.6 (1.9–11) | 110 |
| **MA** | **PFDoA** | 16 (0) | 0.3 (0.26–15) | 62% (5) | 0.4 | 1.1 (0.85–2.5) | 56 |

| Site | Analyte | # of Samples Collected (Invalid Samples) | Method Detection Limit Median (Range) (µg/kg) | % Detected from Valid Samples (Estimated Values)* | Minimum (µg/kg) | Median (25%–75%) (µg/kg) | Maximum (µg/kg) |
|---|---|---|---|---|---|---|---|
| **MA** | **PFTrA** | 16 (0) | 0.21 (0.18–11) | 50% (6) | <0.18 | 0.33 (0.29–0.51) | 24 |
| **MA** | **PFTA** | 16 (0) | 0.37 (0.32–19) | 50% (5) | <0.32 | 0.62 (0.47–1.4) | 52 |
| **MA** | **PFHxDA** | 16 (0) | 0.38 (0.33–19) | 31% (3) | <0.33 | NA (NA–0.77)‡ | <19§ |
| **MA** | **PFODA** | 16 (0) | 0.66 (0.58–33) | 12% (2) | <0.58 | NA (NA–NA)‡ | <33§ |
| **MA** | **PFPrS** | 16 (3) | 0.3 (0.26–15) | 15% (1) | <0.26 | NA (NA–NA)‡ | <15§ |
| **MA** | **PFBS** | 16 (0) | 0.38 (0.33–19) | 38% (4) | <0.35 | NA (NA–4.1)‡ | 63 |
| **MA** | **PFPeS** | 16 (0) | 0.37 (0.32–19) | 12% (1) | <0.32 | NA (NA–NA)‡ | <19§ |
| **MA** | **PFHpS** | 16 (0) | 0.49 (0.43–25) | 6% (0) | <0.43 | NA (NA–NA)‡ | <25§ |
| **MA** | **PFNS** | 16 (0) | 0.29 (0.25–15) | 0% (0) | | NC† | |
| **MA** | **PFDS** | 16 (0) | 0.52 (0.46–26) | 31% (3) | <0.52 | NA (NA–1.9)‡ | <26§ |
| **MA** | **PFDoS** | 16 (0) | 0.47 (0.41–24) | 0% (0) | | NC† | |

| Site | Analyte | # of Samples Collected (Invalid Samples) | Method Detection Limit Median (Range) (µg/kg) | % Detected from Valid Samples (Estimated Values)* | Minimum (µg/kg) | Median (25%–75%) (µg/kg) | Maximum (µg/kg) |
|---|---|---|---|---|---|---|---|
| **MA** | **3:3 FTCA** | 16 (0) | 0.41 (0.36–21) | 0% (0) | | NC† | |
| **MA** | **5:3 FTCA** | 16 (0) | 0.38 (0.33–19) | 25% (4) | <0.35 | NA (NA–0.43)‡ | <19§ |
| **MA** | **6:2 FTCA** | 16 (0) | 1 (0.89–51) | 50% (3) | <1 | 2.6 (1.8–3.9) | <51§ |
| **MA** | **7:3 FTCA** | 16 (0) | 0.41 (0.36–21) | 6% (1) | <0.36 | NA (NA–NA)‡ | <21§ |
| **MA** | **8:2 FTCA** | 16 (0) | 0.4 (0.35–20) | 44% (5) | <0.38 | 0.71 (NA–1.8)‡ | <20§ |
| **MA** | **10:2 FTCA** | 16 (0) | 0.25 (0.22–13) | 50% (6) | <0.24 | 0.43 (0.34–0.6) | <13§ |
| **MA** | **FtS 4:2** | 16 (0) | 0.51 (0.45–26) | 0% (0) | | NC† | |
| **MA** | **FtS 6:2** | 16 (0) | 0.27 (0.24–14) | 88% (10) | 0.63 | 1.4 (0.88–5.3) | 72 |
| **MA** | **FtS 8:2** | 16 (0) | 0.35 (0.31–18) | 69% (9) | 0.37 | 1.2 (0.77–3.4) | 58 |
| **MA** | **FtS 10:2** | 16 (0) | 0.38 (0.33–19) | 50% (7) | <0.38 | 0.65 (0.49–1.3) | <19§ |
| **MA** | **PFOSA** | 16 (0) | 0.33 (0.29–17) | 31% (4) | <0.32 | NA (NA–0.47)‡ | 51 |

| Site | Analyte | # of Samples Collected (Invalid Samples) | Method Detection Limit Median (Range) (µg/kg) | % Detected from Valid Samples (Estimated Values)* | Minimum (µg/kg) | Median (25%–75%) (µg/kg) | Maximum (µg/kg) |
|---|---|---|---|---|---|---|---|
| **MA** | **N-MeFOSA** | 16 (0) | 0.49 (0.43–25) | 12% (1) | <0.45 | NA (NA–NA)‡ | <25§ |
| **MA** | **N-EtFOSA** | 16 (0) | 0.47 (0.41–24) | 6% (0) | <0.44 | NA (NA–NA)‡ | <24§ |
| **MA** | **EtFOSAA** | 16 (0) | 0.48 (0.42–24) | 81% (3) | 1.7 | 3.4 (2.5–23) | 98 |
| **MA** | **N-MeFOSE** | 16 (0) | 0.47 (0.41–24) | 88% (0) | 2.6 | 17 (5.9–56) | 2100 |
| **MA** | **N-EtFOSE** | 16 (0) | 0.28 (0.25–14) | 88% (6) | 0.44 | 2.7 (0.9–21) | 480 |
| **MA** | **PFMOAA** | 16 (0) | 0.21 (0.18–11) | 6% (1) | <0.18 | NA (NA–NA)‡ | <11§ |
| **MA** | **PFMPA** | 16 (0) | 0.24 (0.21–12) | 0% (0) | | NC† | |
| **MA** | **PMPA** | 16 (1) | 0.3 (0.26–89) | 13% (0) | <0.29 | NA (NA–NA)‡ | 280 |
| **MA** | **PFMBA** | 16 (0) | 0.45 (0.39–23) | 0% (0) | | NC† | |
| **MA** | **PEPA** | 16 (0) | 0.52 (0.46–26) | 6% (1) | <0.5 | NA (NA–NA)‡ | <26§ |
| **MA** | **HFPO-DA** | 16 (0) | 0.41 (0.36–21) | 0% (0) | | NC† | |
| **MA** | **PFPE-1** | 16 (0) | 0.35 (0.31–18) | 0% (0) | | NC† | |

| Site | Analyte | # of Samples Collected (Invalid Samples) | Method Detection Limit Median (Range) (µg/kg) | % Detected from Valid Samples (Estimated Values)* | Minimum (µg/kg) | Median (25%–75%) (µg/kg) | Maximum (µg/kg) |
|---|---|---|---|---|---|---|---|
| **MA** | **R-EVE** | 16 (0) | 0.44 (0.39–56) | 56% (4) | 0.68 | 2.4 (1.2–3.9) | <56§ |
| **MA** | **NFDHA** | 16 (0) | 0.4 (0.35–20) | 0% (0) | | NC† | |
| **MA** | **PFO2HxA** | 16 (1) | 0.58 (0.51–29) | 7% (1) | <0.51 | NA (NA–NA)‡ | <29§ |
| **MA** | **PFO3OA** | 16 (0) | 0.4 (0.35–20) | 0% (0) | | NC† | |
| **MA** | **PFO4DA** | 16 (0) | 0.46 (0.4–23) | 0% (0) | | NC† | |
| **MA** | **PFO5DA** | 16 (0) | 0.68 (0.6–34) | 0% (0) | | NC† | |
| **MA** | **Byproduct 4** | 16 (2) | 0.52 (0.46–26) | 7% (1) | <0.46 | NA (NA–NA)‡ | <26§ |
| **MA** | **PFEESA** | 16 (0) | 0.32 (0.28–16) | 0% (0) | | NC† | |
| **MA** | **9Cl-PF3ONS** | 16 (0) | 0.35 (0.31–18) | 0% (0) | | NC† | |
| **MA** | **11Cl-PF3OUdS** | 16 (0) | 0.31 (0.27–16) | 0% (0) | | NC† | |
| **MA** | **NVHOS** | 16 (0) | 1.4 (1.2–68) | 0% (0) | | NC† | |
| **MA** | **ADONA** | 16 (0) | 0.39 (0.34–20) | 0% (0) | | NC† | |
| **MA** | **Hydro-EVE** | 16 (0) | 0.29 (0.25–15) | 0% (0) | | NC† | |
| **MA** | **Byproduct 5** | 16 (0) | 0.67 (0.59–34) | 0% (0) | | NC† | |

| Site | Analyte | # of Samples Collected (Invalid Samples) | Method Detection Limit Median (Range) (µg/kg) | % Detected from Valid Samples (Estimated Values)* | Minimum (µg/kg) | Median (25%–75%) (µg/kg) | Maximum (µg/kg) |
|---|---|---|---|---|---|---|---|
| **MA** | **PFecHS** | 16 (0) | 0.44 (0.39–22) | 0% (0) | | NC† | |

*Estimated Values are the number of sample results flagged by the laboratory as less than the reporting limit but greater than or equal to the method detection limit and the concentration is an approximate value.

†NC: Not Calculated: Summary statistics (median, 25%, 75%, and range) could not be calculated due to no detected samples available.

‡NA: Not Applicable: Summary statistics (median, 25% or 75%) could not be calculated due to the ranks of the method detection limits. Refer to Appendix B, Treatment of Non-Detects (ND) in the Data Set.

§The method detection limit for the maximum in the data set was higher than all the detections in the data set. Refer to Appendix B, Treatment of Non-Detects (ND) in the Data Set.

**Table D- 6. Summary Statistics of Household Vacuum Dust (µg/kg) Results for diPAPs — DE and MA**

| Site | Analyte | # of Samples Collected (Invalid Samples) | Method Detection Limit Median (Range) (µg/kg) | % Detected from Valid Samples (Estimated Values)* | Minimum (µg/kg) | Median (25%–75%) (µg/kg) | Maximum (µg/kg) |
|---|---|---|---|---|---|---|---|
| **DE** | **6:2 diPAP** | 7 (0) | 0.85 (0.74–8.9) | 100% (0) | 40 | 75 (43–250) | 650 |
| **DE** | **6:2/8:2 diPAP** | 7 (0) | 1.9 (1.6–1.9) | 100% (1) | 10 | 27 (15–40) | 110 |
| **DE** | **8:2 diPAP** | 7 (0) | 0.48 (0.41–0.5) | 100% (0) | 10 | 27 (25–53) | 130 |
| **DE** | **10:2 diPAP** | 7 (0) | 2.7 (2.4–2.9) | 29% (1) | <2.4 | NA (NA–4.8)† | 13 |
| **MA** | **6:2 diPAP** | 16 (0) | 0.34 (0.3–17) | 100% (1) | 19 | 290 (100–450) | 2000 |

| Site | Analyte | # of Samples Collected (Invalid Samples) | Method Detection Limit Median (Range) (µg/kg) | % Detected from Valid Samples (Estimated Values)* | Minimum (µg/kg) | Median (25%–75%) (µg/kg) | Maximum (µg/kg) |
|---|---|---|---|---|---|---|---|
| **MA** | **6:2/8:2 diPAP** | 16 (0) | 0.74 (0.65–37) | 94% (3) | 5.3 | 25 (17–63) | 410 |
| **MA** | **8:2 diPAP** | 16 (0) | 0.19 (0.17–9.5) | 88% (2) | 3.4 | 24 (7.9–44) | 410 |
| **MA** | **10:2 diPAP** | 16 (0) | 1.1 (0.96–55) | 69% (7) | <1.1 | 2.8 (1.3–23) | 130 |

*Estimated Values are the number of sample results flagged by the laboratory as less than the reporting limit but greater than or equal to the method detection limit and the concentration is an approximate value.

†NA: Not Applicable: Summary statistics (median, 25% or 75%) could not be calculated due to the ranks of the method detection limits. Refer to Appendix B, Treatment of Non-Detects (ND) in the Data Set.

**Table D- 7. Summary Statistics of Household Vacuum Dust (µg/kg) Results for FTOHs — DE and MA**

| Site | Analyte | # of Samples Collected (Invalid Samples) | Method Detection Limit Median (Range) (µg/kg) | % Detected from Valid Samples (Estimated Values)* | Minimum (µg/kg) | Median (25%–75%) (µg/kg) | Maximum (µg/kg) |
|---|---|---|---|---|---|---|---|
| **DE** | **4:2 FTOH** | 3 (0) | 410 (60–420) | 0% (0) | | NC† | |
| **DE** | **6:2 FTOH** | 3 (0) | 410 (60–420) | 33% (0) | <60 | NA (NA–NA)‡ | 1200 |
| **DE** | **7:2 sFTOH** | 3 (0) | 410 (60–420) | 0% (0) | | NC† | |
| **DE** | **8:2 FTOH** | 3 (0) | 410 (60–420) | 33% (0) | <60 | NA (NA–NA)‡ | 870 |

| Site | Analyte | # of Samples Collected (Invalid Samples) | Method Detection Limit Median (Range) (µg/kg) | % Detected from Valid Samples (Estimated Values)* | Minimum (µg/kg) | Median (25%–75%) (µg/kg) | Maximum (µg/kg) |
|---|---|---|---|---|---|---|---|
| **DE** | **10:2 FTOH** | 3 (0) | 410 (60–420) | 0% (0) | | NC† | |
| **MA** | **4:2 FTOH** | 11 (0) | 310 (70–1700) | 0% (0) | | NC† | |
| **MA** | **6:2 FTOH** | 11 (0) | 130 (28–660) | 9% (1) | <28 | NA (NA–NA)‡ | <660§ |
| **MA** | **7:2 sFTOH** | 11 (0) | 130 (28–660) | 0% (0) | | NC† | |
| **MA** | **8:2 FTOH** | 11 (0) | 310 (70–1700) | 0% (0) | | NC† | |
| **MA** | **10:2 FTOH** | 11 (0) | 130 (28–660) | 0% (0) | | NC† | |

*Estimated Values are the number of sample results flagged by the laboratory as less than the reporting limit but greater than or equal to the method detection limit and the concentration is an approximate value.

†NC: Not Calculated: Summary statistics (median, 25%, 75%, and range) could not be calculated due to no detected samples available.

‡NA: Not Applicable: Summary statistics (median, 25% or 75%) could not be calculated due to the ranks of the method detection limits. Refer to Appendix B, Treatment of Non-Detects (ND) in the Data Set.

§The method detection limit for the maximum in the data set was higher than all the detections in the data set. Refer to Appendix B, Treatment of Non-Detects (ND) in the Data Set.

**Table D- 8. Summary Statistics of Household Vacuum Dust (µg/kg) Results for EOF — DE and MA**

| Site | Analyte | # of Samples Collected (Invalid Samples) | Method Detection Limit Median (Range) (µg/kg) | % Detected from Valid Samples (Estimated Values)* | Minimum (µg/kg) | Median (25%–75%) (µg/kg) | Maximum (µg/kg) |
|---|---|---|---|---|---|---|---|
| **DE** | **EOF** | 2 (0) | 415 (140–690) | 100% (0) | 3900 | NA (3900–NA)† | 46000 |
| **MA** | **EOF** | 8 (0) | 140 (140–140) | 100% (0) | 500 | 1600 (630–6700) | 10000 |

*Estimated Values are the number of sample results flagged by the laboratory as less than the reporting limit but greater than or equal to the method detection limit and the concentration is an approximate value.

†NA: Not Applicable: Summary statistics (median, 25% or 75%) could not be calculated due to the ranks of the method detection limits. Refer to Appendix B, Treatment of Non-Detects (ND) in the Data Set.

## Wipe 1: Kitchen Counter

**Table D- 9. Summary Statistics of Surface Wipe 1: Typically Kitchen Counter (ng/cm$^2$) Results for PFAS — DE and MA**

| Site | Analyte | # of Samples Collected (Invalid Samples) | Method Detection Limit Median (Range) (ng/cm$^2$) | % Detected from Valid Samples (Estimated Values)* | Minimum (ng/cm$^2$) | Median (25%–75%) (ng/cm$^2$) | Maximum (ng/cm$^2$) |
|---|---|---|---|---|---|---|---|
| **DE** | **PFBA** | 10 (0) | 0.0022 (0.0022–0.0022) | 40% (4) | <0.0022 | NA (NA–0.0028)‡ | 0.0059 |
| **DE** | **PFPeA** | 10 (0) | 0.002 (0.002–0.002) | 50% (5) | <0.002 | NA (NA–NA)† | 0.0026 |
| **DE** | **PFHxA** | 10 (0) | 0.0016 (0.0016–0.0016) | 60% (6) | <0.0016 | 0.0024 (NA–0.005)† | 0.0086 |
| **DE** | **PFHpA** | 10 (0) | 0.0018 (0.0018–0.0018) | 50% (5) | <0.0018 | NA (NA–0.0024)† | 0.009 |
| **DE** | **PFDoA** | 10 (0) | 0.0015 (0.0015–0.0015) | 40% (3) | <0.0015 | NA (NA–0.0021)† | 0.026 |
| **DE** | **PFTrA** | 10 (0) | 0.0011 (0.0011–0.0011) | 30% (2) | <0.0011 | NA (NA–0.0015)† | 0.016 |
| **DE** | **PFTA** | 10 (0) | 0.0018 (0.0018–0.0018) | 20% (1) | <0.0018 | NA (NA–NA)† | 0.02 |
| **DE** | **PFBS** | 10 (0) | 0.0018 (0.0018–0.0018) | 0% (0) | | NC‡ | |
| **DE** | **PFPeS** | 10 (0) | 0.0018 (0.0018–0.0018) | 0% (0) | | NC‡ | |

| Site | Analyte | # of Samples Collected (Invalid Samples) | Method Detection Limit Median (Range) (ng/cm²) | % Detected from Valid Samples (Estimated Values)* | Minimum (ng/cm²) | Median (25%–75%) (ng/cm²) | Maximum (ng/cm²) |
|---|---|---|---|---|---|---|---|
| **DE** | **PFHpS** | 10 (0) | 0.0024 (0.0024–0.0024) | 0% (0) | | NC‡ | |
| **DE** | **PFNS** | 10 (0) | 0.0015 (0.0015–0.0015) | 0% (0) | | NC‡ | |
| **DE** | **PFDS** | 10 (0) | 0.0025 (0.0025–0.0025) | 0% (0) | | NC‡ | |
| **DE** | **PFDoS** | 10 (0) | 0.0023 (0.0023–0.0023) | 0% (0) | | NC‡ | |
| **DE** | **3:3 FTCA** | 10 (0) | 0.002 (0.002–0.002) | 0% (0) | | NC‡ | |
| **DE** | **5:3 FTCA** | 10 (0) | 0.0018 (0.0018–0.0018) | 0% (0) | | NC‡ | |
| **DE** | **7:3 FTCA** | 10 (0) | 0.002 (0.002–0.002) | 0% (0) | | NC‡ | |
| **DE** | **FtS 4:2** | 10 (0) | 0.0025 (0.0025–0.0025) | 0% (0) | | NC‡ | |
| **DE** | **FtS 6:2** | 10 (0) | 0.0014 (0.0014–0.0014) | 0% (0) | | NC‡ | |
| **DE** | **FtS 8:2** | 10 (0) | 0.0017 (0.0017–0.0017) | 10% (1) | <0.0017 | NA (NA–NA)† | 0.0025 |

| Site | Analyte | # of Samples Collected (Invalid Samples) | Method Detection Limit Median (Range) (ng/cm²) | % Detected from Valid Samples (Estimated Values)* | Minimum (ng/cm²) | Median (25%–75%) (ng/cm²) | Maximum (ng/cm²) |
|---|---|---|---|---|---|---|---|
| **DE** | **PFOSA** | 10 (0) | 0.0017 (0.0017–0.0017) | 0% (0) | | NC‡ | |
| **DE** | **N-MeFOSA** | 10 (0) | 0.0024 (0.0024–0.0024) | 0% (0) | | NC‡ | |
| **DE** | **N-EtFOSA** | 10 (0) | 0.0023 (0.0023–0.0023) | 0% (0) | | NC‡ | |
| **DE** | **EtFOSAA** | 10 (0) | 0.0023 (0.0023–0.0023) | 50% (4) | <0.0023 | NA (NA–0.0047)† | 0.12 |
| **DE** | **N-MeFOSE** | 10 (0) | 0.0023 (0.0023–0.0023) | 50% (5) | <0.0023 | NA (NA–0.0053)† | 0.0068 |
| **DE** | **N-EtFOSE** | 10 (0) | 0.0014 (0.0014–0.0014) | 40% (4) | <0.0014 | NA (NA–0.0023)† | 0.0048 |
| **DE** | **PFMPA** | 10 (0) | 0.0012 (0.0012–0.0012) | 0% (0) | | NC‡ | |
| **DE** | **PFMBA** | 10 (0) | 0.0022 (0.0022–0.0022) | 0% (0) | | NC‡ | |
| **DE** | **HFPO-DA** | 10 (0) | 0.002 (0.002–0.002) | 0% (0) | | NC‡ | |
| **DE** | **NFDHA** | 10 (0) | 0.0019 (0.0019–0.0019) | 0% (0) | | NC‡ | |

| Site | Analyte | # of Samples Collected (Invalid Samples) | Method Detection Limit Median (Range) ($ng/cm^2$) | % Detected from Valid Samples (Estimated Values)* | Minimum ($ng/cm^2$) | Median (25%–75%) ($ng/cm^2$) | Maximum ($ng/cm^2$) |
|---|---|---|---|---|---|---|---|
| **DE** | **PFEESA** | 10 (0) | 0.0016 (0.0016–0.0016) | 0% (0) | | NC‡ | |
| **DE** | **9Cl-PF3ONS** | 10 (0) | 0.0017 (0.0017–0.0017) | 0% (0) | | NC‡ | |
| **DE** | **11Cl-PF3OUdS** | 10 (0) | 0.0016 (0.0016–0.0016) | 0% (0) | | NC‡ | |
| **DE** | **ADONA** | 10 (0) | 0.0019 (0.0019–0.0019) | 0% (0) | | NC‡ | |
| **MA** | **PFBA** | 18 (10) | 0.0022 (0.0022–0.022) | 0% (0) | | NC‡ | |
| **MA** | **PFPeA** | 18 (0) | 0.002 (0.002–0.02) | 0% (0) | | NC‡ | |
| **MA** | **PFHxA** | 18 (0) | 0.0016 (0.0016–0.016) | 56% (7) | <0.0016 | 0.0016 (NA–0.0054)† | 0.097 |
| **MA** | **PFHpA** | 18 (0) | 0.0018 (0.0018–0.018) | 33% (5) | <0.0018 | NA (NA–0.0026)† | 0.4 |
| **MA** | **PFDoA** | 18 (0) | 0.0015 (0.0015–0.015) | 17% (1) | <0.0015 | NA (NA–NA)† | 0.17 |
| **MA** | **PFTrA** | 18 (0) | 0.0011 (0.0011–0.011) | 11% (1) | <0.0011 | NA (NA–NA)† | 0.17 |
| **MA** | **PFTA** | 18 (0) | 0.0018 (0.0018–0.018) | 17% (2) | <0.0018 | NA (NA–NA)† | 0.086 |

| Site | Analyte | # of Samples Collected (Invalid Samples) | Method Detection Limit Median (Range) (ng/cm²) | % Detected from Valid Samples (Estimated Values)* | Minimum (ng/cm²) | Median (25%–75%) (ng/cm²) | Maximum (ng/cm²) |
|---|---|---|---|---|---|---|---|
| **MA** | **PFBS** | 18 (0) | 0.0018 (0.0018–0.018) | 33% (6) | <0.0018 | NA (NA–0.0022)† | <0.018§ |
| **MA** | **PFPeS** | 18 (0) | 0.0018 (0.0018–0.018) | 0% (0) | | NC‡ | |
| **MA** | **PFHpS** | 18 (0) | 0.0024 (0.0024–0.024) | 0% (0) | | NC‡ | |
| **MA** | **PFNS** | 18 (0) | 0.0015 (0.0015–0.015) | 0% (0) | | NC‡ | |
| **MA** | **PFDS** | 18 (0) | 0.0025 (0.0025–0.025) | 6% (1) | <0.0025 | NA (NA–NA)† | <0.025§ |
| **MA** | **PFDoS** | 18 (0) | 0.0023 (0.0023–0.023) | 0% (0) | | NC‡ | |
| **MA** | **3:3 FTCA** | 18 (0) | 0.002 (0.002–0.02) | 0% (0) | | NC‡ | |
| **MA** | **5:3 FTCA** | 18 (0) | 0.0018 (0.0018–0.018) | 0% (0) | | NC‡ | |
| **MA** | **7:3 FTCA** | 18 (0) | 0.002 (0.002–0.02) | 0% (0) | | NC‡ | |
| **MA** | **FtS 4:2** | 18 (0) | 0.0025 (0.0025–0.025) | 0% (0) | | NC‡ | |
| **MA** | **FtS 6:2** | 18 (0) | 0.0014 (0.0014–0.014) | 0% (0) | | NC‡ | |

| Site | Analyte | # of Samples Collected (Invalid Samples) | Method Detection Limit Median (Range) (ng/cm²) | % Detected from Valid Samples (Estimated Values)* | Minimum (ng/cm²) | Median (25%–75%) (ng/cm²) | Maximum (ng/cm²) |
|---|---|---|---|---|---|---|---|
| **MA** | **FtS 8:2** | 18 (0) | 0.0017 (0.0017–0.017) | 0% (0) | | NC‡ | |
| **MA** | **PFOSA** | 18 (1) | 0.0017 (0.0017–0.017) | 6% (1) | <0.0017 | NA (NA–NA)† | <0.017§ |
| **MA** | **N-MeFOSA** | 18 (0) | 0.0024 (0.0024–0.024) | 0% (0) | | NC‡ | |
| **MA** | **N-EtFOSA** | 18 (0) | 0.0023 (0.0023–0.023) | 0% (0) | | NC‡ | |
| **MA** | **EtFOSAA** | 18 (0) | 0.0023 (0.0023–0.023) | 33% (3) | <0.0023 | NA (NA–0.0028)† | <0.023§ |
| **MA** | **N-MeFOSE** | 18 (0) | 0.0023 (0.0023–0.023) | 22% (2) | <0.0023 | NA (NA–NA)† | 0.17 |
| **MA** | **N-EtFOSE** | 18 (0) | 0.0014 (0.0014–0.014) | 17% (1) | <0.0014 | NA (NA–NA)† | 0.023 |
| **MA** | **PFMPA** | 18 (0) | 0.0012 (0.0012–0.012) | 0% (0) | | NC‡ | |
| **MA** | **PFMBA** | 18 (0) | 0.0022 (0.0022–0.022) | 0% (0) | | NC‡ | |
| **MA** | **HFPO-DA** | 18 (0) | 0.002 (0.002–0.02) | 0% (0) | | NC‡ | |
| **MA** | **NFDHA** | 18 (0) | 0.0019 (0.0019–0.019) | 0% (0) | | NC‡ | |

| Site | Analyte | # of Samples Collected (Invalid Samples) | Method Detection Limit Median (Range) ($ng/cm^2$) | % Detected from Valid Samples (Estimated Values)* | Minimum ($ng/cm^2$) | Median (25%–75%) ($ng/cm^2$) | Maximum ($ng/cm^2$) |
|---|---|---|---|---|---|---|---|
| **MA** | **PFEESA** | 18 (0) | 0.0016 (0.0016–0.016) | 0% (0) | | NC‡ | |
| **MA** | **9Cl-PF3ONS** | 18 (0) | 0.0017 (0.0017–0.017) | 0% (0) | | NC‡ | |
| **MA** | **11Cl-PF3OUdS** | 18 (0) | 0.0016 (0.0016–0.016) | 0% (0) | | NC‡ | |
| **MA** | **ADONA** | 18 (0) | 0.0019 (0.0019–0.019) | 0% (0) | | NC‡ | |

*Estimated Values are the number of sample results flagged by the laboratory as less than the reporting limit but greater than or equal to the method detection limit and the concentration is an approximate value.

†NA: Not Applicable: Summary statistics (median, 25% or 75%) could not be calculated due to the ranks of the method detection limits. Refer to Appendix B, Treatment of Non-Detects (ND) in the Data Set.

‡NC: Not Calculated: Summary statistics (median, 25%, 75%, and range) could not be calculated due to no detected samples available.

§The method detection limit for the maximum in the data set was higher than all the detections in the data set. Refer to Appendix B, Treatment of Non-Detects (ND) in the Data Set.

**Table D- 10. Summary Statistics of Surface Wipe 1: Typically Kitchen Counter (ng/cm$^2$) Results for diPAPs — DE and MA**

| Site | Analyte | # of Samples Collected (Invalid Samples) | Method Detection Limit Median (Range) (ng/cm$^2$) | % Detected from Valid Samples (Estimated Values)* | Minimum (ng/cm$^2$) | Median (25%–75%) (ng/cm$^2$) | Maximum (ng/cm$^2$) |
|---|---|---|---|---|---|---|---|
| **DE** | **6:2 diPAP** | 10 (5) | 0.0017 (0.0017–0.0017) | 100% (0) | 0.011 | 0.04 (0.03–0.064) | 0.09 |
| **DE** | **6:2/8:2 diPAP** | 10 (0) | 0.0036 (0.0036–0.0036) | 30% (1) | <0.0036 | NA (NA–0.0044)† | 0.056 |
| **DE** | **8:2 diPAP** | 10 (0) | 9e-04 (9e-04–9e-04) | 40% (2) | <9e-04 | NA (NA–0.005)† | 0.03 |
| **DE** | **10:2 diPAP** | 10 (0) | 0.0053 (0.0053–0.0053) | 0% (0) | | NC‡ | |
| **MA** | **6:2 diPAP** | 18 (2) | 0.0017 (0.0017–0.017) | 100% (0) | 0.011 | 0.073 (0.042–0.17) | 160 |
| **MA** | **6:2/8:2 diPAP** | 18 (4) | 0.0036 (0.0036–0.036) | 79% (3) | <0.0036 | 0.046 (0.014–5.3) | 180 |
| **MA** | **8:2 diPAP** | 18 (5) | 9e-04 (9e-04–0.009) | 69% (0) | <9e-04 | 0.034 (NA–8.1)† | 77 |
| **MA** | **10:2 diPAP** | 18 (0) | 0.0053 (0.0053–0.053) | 50% (5) | <0.0053 | NA (NA–0.017)† | 17 |

*Estimated Values are the number of sample results flagged by the laboratory as less than the reporting limit but greater than or equal to the method detection limit and the concentration is an approximate value.

†NA: Not Applicable: Summary statistics (median, 25% or 75%) could not be calculated due to the ranks of the method detection limits. Refer to Appendix B, Treatment of Non-Detects (ND) in the Data Set.

| Site | Analyte | # of Samples Collected (Invalid Samples) | Method Detection Limit Median (Range) (ng/cm²) | % Detected from Valid Samples (Estimated Values)* | Minimum (ng/cm²) | Median (25%–75%) (ng/cm²) | Maximum (ng/cm²) |
|---|---|---|---|---|---|---|---|

‡NC: Not Calculated: Summary statistics (median, 25%, 75%, and range) could not be calculated due to no detected samples available.

**Table D- 11. Summary Statistics of Surface Wipe 1: Typically Kitchen Counter (ng/cm²) Results for FTOHs — DE and MA**

| Site | Analyte | # of Samples Collected (Invalid Samples) | Method Detection Limit Median (Range) (ng/cm²) | % Detected from Valid Samples (Estimated Values)* | Minimum (ng/cm²) | Median (25%–75%) (ng/cm²) | Maximum (ng/cm²) |
|---|---|---|---|---|---|---|---|
| **DE** | **4:2 FTOH** | 6 (0) | 0.00097 (0.00097–0.0049) | 0% (0) | | NC‡ | |
| **DE** | **6:2 FTOH** | 6 (0) | 0.00097 (0.00097–0.0049) | 0% (0) | | NC† | |
| **DE** | **7:2 sFTOH** | 6 (0) | 0.00097 (0.00097–0.0049) | 0% (0) | | NC† | |
| **DE** | **8:2 FTOH** | 6 (0) | 0.00097 (0.00097–0.0049) | 0% (0) | | NC† | |
| **DE** | **10:2 FTOH** | 6 (0) | 0.00097 (0.00097–0.0049) | 0% (0) | | NC† | |
| **MA** | **4:2 FTOH** | 10 (0) | 0.00097 (0.00097–0.00097) | 0% (0) | | NC† | |
| **MA** | **6:2 FTOH** | 10 (0) | 0.00097 (0.00097–0.00097) | 30% (0) | <0.00097 | NA (NA–0.032)‡ | 5 |

| Site | Analyte | # of Samples Collected (Invalid Samples) | Method Detection Limit Median (Range) (ng/cm$^2$) | % Detected from Valid Samples (Estimated Values)* | Minimum (ng/cm$^2$) | Median (25%–75%) (ng/cm$^2$) | Maximum (ng/cm$^2$) |
|---|---|---|---|---|---|---|---|
| **MA** | **7:2 sFTOH** | 10 (0) | 0.00097 (0.00097–0.00097) | 0% (0) | | NC† | |
| **MA** | **8:2 FTOH** | 10 (0) | 0.00097 (0.00097–0.00097) | 0% (0) | | NC† | |
| **MA** | **10:2 FTOH** | 10 (0) | 0.00097 (0.00097–0.00097) | 0% (0) | | NC† | |

*Estimated Values are the number of sample results flagged by the laboratory as less than the reporting limit but greater than or equal to the method detection limit and the concentration is an approximate value.

†NC: Not Calculated: Summary statistics (median, 25%, 75%, and range) could not be calculated due to no detected samples available.

‡NA: Not Applicable: Summary statistics (median, 25% or 75%) could not be calculated due to the ranks of the method detection limits. Refer to Appendix B, Treatment of Non-Detects (ND) in the Data Set.

**Table D- 12. Summary Statistics of Surface Wipe 1: Typically Kitchen Counter (ng/cm$^2$) Results for EOF — DE and MA**

| Site | Analyte | # of Samples Collected (Invalid Samples) | Method Detection Limit Median (Range) (ng/cm$^2$) | % Detected from Valid Samples (Estimated Values)* | Minimum (ng/cm$^2$) | Median (25%–75%) (ng/cm$^2$) | Maximum (ng/cm$^2$) |
|---|---|---|---|---|---|---|---|
| **DE** | **EOF** | 4 (0) | 1.4 (1.4–1.4) | 0% (0) | | NC† | |
| **MA** | **EOF** | 8 (0) | 1.4 (1.4–1.4) | 12% (0) | <1.4 | NA (NA–NA)‡ | 25 |

| Site | Analyte | # of Samples Collected (Invalid Samples) | Method Detection Limit Median (Range) ($ng/cm^2$) | % Detected from Valid Samples (Estimated Values)* | Minimum ($ng/cm^2$) | Median (25%–75%) ($ng/cm^2$) | Maximum ($ng/cm^2$) |
|---|---|---|---|---|---|---|---|

*Estimated Values are the number of sample results flagged by the laboratory as less than the reporting limit but greater than or equal to the method detection limit and the concentration is an approximate value.

†NC: Not Calculated: Summary statistics (median, 25%, 75%, and range) could not be calculated due to no detected samples available.

‡NA: Not Applicable: Summary statistics (median, 25% or 75%) could not be calculated due to the ranks of the method detection limits. Refer to Appendix B, Treatment of Non-Detects (ND) in the Data Set.

## Wipe 2: Typically Closet Floor

**Table D- 13. Summary Statistics of Surface Wipe 2: Typically Closet Floor (ng/cm$^2$) Results for PFAS — DE and MA**

| Site | Analyte | # of Samples Collected (Invalid Samples) | Method Detection Limit Median (Range) (ng/cm$^2$) | % Detected from Valid Samples (Estimated Values)* | Minimum (ng/cm$^2$) | Median (25%–75%) (ng/cm$^2$) | Maximum (ng/cm$^2$) |
|---|---|---|---|---|---|---|---|
| **DE** | **PFBA** | **10 (0)** | 0.0022 (0.0022–0.0022) | 70% (5) | <0.0022 | 0.0025 (NA–0.004)‡ | 0.039 |
| **DE** | **PFPeA** | **10 (0)** | 0.002 (0.002–0.002) | 50% (4) | <0.002 | NA (NA–0.0053)† | 0.048 |
| **DE** | **PFHxA** | **10 (0)** | 0.0016 (0.0016–0.0016) | 70% (6) | <0.0016 | 0.002 (NA–0.0061)† | 0.057 |
| **DE** | **PFHpA** | **10 (0)** | 0.0018 (0.0018–0.0018) | 80% (6) | <0.0018 | 0.0034 (0.0019–0.0062) | 0.055 |
| **DE** | **PFDoA** | **10 (0)** | 0.0015 (0.0015–0.0015) | 60% (5) | <0.0015 | 0.0017 (NA–0.0033)† | 0.042 |
| **DE** | **PFTrA** | **10 (0)** | 0.0011 (0.0011–0.0011) | 50% (4) | <0.0011 | NA (NA–0.0018)† | 0.026 |
| **DE** | **PFTA** | **10 (0)** | 0.0018 (0.0018–0.0018) | 30% (2) | <0.0018 | NA (NA–0.0023)† | 0.013 |
| **DE** | **PFBS** | **10 (0)** | 0.0018 (0.0018–0.0018) | 20% (2) | <0.0018 | NA (NA–NA)† | 0.0076 |
| **DE** | **PFPeS** | **10 (0)** | 0.0018 (0.0018–0.0018) | 0% (0) | | NC‡ | |

| Site | Analyte | # of Samples Collected (Invalid Samples) | Method Detection Limit Median (Range) (ng/cm²) | % Detected from Valid Samples (Estimated Values)* | Minimum (ng/cm²) | Median (25%–75%) (ng/cm²) | Maximum (ng/cm²) |
|---|---|---|---|---|---|---|---|
| **DE** | **PFHpS** | **10 (0)** | 0.0024 (0.0024–0.0024) | 0% (0) | | NC‡ | |
| **DE** | **PFNS** | **10 (0)** | 0.0015 (0.0015–0.0015) | 0% (0) | | NC‡ | |
| **DE** | **PFDS** | **10 (0)** | 0.0025 (0.0025–0.0025) | 10% (1) | <0.0025 | NA (NA–NA)† | 0.003 |
| **DE** | **PFDoS** | **10 (0)** | 0.0023 (0.0023–0.0023) | 0% (0) | | NC‡ | |
| **DE** | **3:3 FTCA** | **10 (0)** | 0.002 (0.002–0.002) | 0% (0) | | NC‡ | |
| **DE** | **5:3 FTCA** | **10 (0)** | 0.0018 (0.0018–0.0018) | 0% (0) | | NC‡ | |
| **DE** | **7:3 FTCA** | **10 (0)** | 0.002 (0.002–0.002) | 0% (0) | | NC‡ | |
| **DE** | **FtS 4:2** | **10 (0)** | 0.0025 (0.0025–0.0025) | 0% (0) | | NC‡ | |
| **DE** | **FtS 6:2** | **10 (0)** | 0.0014 (0.0014–0.0014) | 50% (5) | <0.0014 | NA (NA–0.0057)† | 0.0081 |
| **DE** | **FtS 8:2** | **10 (0)** | 0.0017 (0.0017–0.0017) | 40% (3) | <0.0017 | NA (NA–0.0065)† | 0.017 |

| Site | Analyte | # of Samples Collected (Invalid Samples) | Method Detection Limit Median (Range) (ng/cm²) | % Detected from Valid Samples (Estimated Values)* | Minimum (ng/cm²) | Median (25%–75%) (ng/cm²) | Maximum (ng/cm²) |
|---|---|---|---|---|---|---|---|
| **DE** | **PFOSA** | **10 (0)** | 0.0017 (0.0017–0.0017) | 10% (1) | <0.0017 | NA (NA–NA)† | 0.007 |
| **DE** | **N-MeFOSA** | **10 (0)** | 0.0024 (0.0024–0.0024) | 10% (1) | <0.0024 | NA (NA–NA)† | 0.0049 |
| **DE** | **N-EtFOSA** | **10 (0)** | 0.0023 (0.0023–0.0023) | 0% (0) | | NC‡ | |
| **DE** | **EtFOSAA** | **10 (0)** | 0.0023 (0.0023–0.0023) | 50% (1) | <0.0023 | NA (NA–0.024)† | 0.042 |
| **DE** | **N-MeFOSE** | **10 (0)** | 0.0023 (0.0023–0.0023) | 80% (2) | <0.0023 | 0.02 (0.0041–0.052) | 0.49 |
| **DE** | **N-EtFOSE** | **10 (0)** | 0.0014 (0.0014–0.0014) | 70% (2) | <0.0014 | 0.0026 (NA–0.04)† | 0.053 |
| **DE** | **PFMPA** | **10 (0)** | 0.0012 (0.0012–0.0012) | 0% (0) | | NC‡ | |
| **DE** | **PFMBA** | **10 (0)** | 0.0022 (0.0022–0.0022) | 0% (0) | | NC‡ | |
| **DE** | **HFPO-DA** | **10 (0)** | 0.002 (0.002–0.002) | 0% (0) | | NC‡ | |
| **DE** | **NFDHA** | **10 (0)** | 0.0019 (0.0019–0.0019) | 0% (0) | | NC‡ | |

| Site | Analyte | # of Samples Collected (Invalid Samples) | Method Detection Limit Median (Range) (ng/cm²) | % Detected from Valid Samples (Estimated Values)* | Minimum (ng/cm²) | Median (25%–75%) (ng/cm²) | Maximum (ng/cm²) |
|---|---|---|---|---|---|---|---|
| **DE** | **PFEESA** | **10 (0)** | 0.0016 (0.0016–0.0016) | 0% (0) | | NC‡ | |
| **DE** | **9Cl-PF3ONS** | **10 (0)** | 0.0017 (0.0017–0.0017) | 0% (0) | | NC‡ | |
| **DE** | **11Cl-PF3OUdS** | **10 (0)** | 0.0016 (0.0016–0.0016) | 0% (0) | | NC‡ | |
| **DE** | **ADONA** | **10 (0)** | 0.0019 (0.0019–0.0019) | 0% (0) | | NC‡ | |
| **MA** | **PFBA** | **18 (7)** | 0.0022 (0.0022–0.022) | 9% (0) | <0.0022 | NA (NA–NA)† | <0.022§ |
| **MA** | **PFPeA** | **18 (0)** | 0.002 (0.002–0.02) | 17% (3) | <0.002 | NA (NA–NA)† | <0.02§ |
| **MA** | **PFHxA** | **18 (0)** | 0.0016 (0.0016–0.016) | 50% (8) | <0.0016 | NA (NA–0.0044)† | 0.018 |
| **MA** | **PFHpA** | **18 (0)** | 0.0018 (0.0018–0.018) | 28% (5) | <0.0018 | NA (NA–0.0021)† | <0.018§ |
| **MA** | **PFDoA** | **18 (0)** | 0.0015 (0.0015–0.015) | 6% (1) | <0.0015 | NA (NA–NA)† | <0.015§ |
| **MA** | **PFTrA** | **18 (0)** | 0.0011 (0.0011–0.011) | 0% (0) | | NC‡ | |
| **MA** | **PFTA** | **18 (0)** | 0.0018 (0.0018–0.018) | 6% (1) | <0.0018 | NA (NA–NA)† | <0.018§ |

| Site | Analyte | # of Samples Collected (Invalid Samples) | Method Detection Limit Median (Range) ($ng/cm^2$) | % Detected from Valid Samples (Estimated Values)* | Minimum ($ng/cm^2$) | Median (25%–75%) ($ng/cm^2$) | Maximum ($ng/cm^2$) |
|---|---|---|---|---|---|---|---|
| **MA** | **PFBS** | **18 (0)** | 0.0018 (0.0018–0.018) | 50% (7) | <0.0018 | 0.0019 (NA–0.0023)† | <0.018§ |
| **MA** | **PFPeS** | **18 (0)** | 0.0018 (0.0018–0.018) | 6% (0) | <0.0018 | NA (NA–NA)† | <0.018§ |
| **MA** | **PFHpS** | **18 (0)** | 0.0024 (0.0024–0.024) | 0% (0) | | NC‡ | |
| **MA** | **PFNS** | **18 (0)** | 0.0015 (0.0015–0.015) | 0% (0) | | NC‡ | |
| **MA** | **PFDS** | **18 (0)** | 0.0025 (0.0025–0.025) | 11% (1) | <0.0025 | NA (NA–NA)† | 0.038 |
| **MA** | **PFDoS** | **18 (0)** | 0.0023 (0.0023–0.023) | 0% (0) | | NC‡ | |
| **MA** | **3:3 FTCA** | **18 (0)** | 0.002 (0.002–0.02) | 0% (0) | | NC‡ | |
| **MA** | **5:3 FTCA** | **18 (0)** | 0.0018 (0.0018–0.018) | 0% (0) | | NC‡ | |
| **MA** | **7:3 FTCA** | **18 (0)** | 0.002 (0.002–0.02) | 0% (0) | | NC‡ | |
| **MA** | **FtS 4:2** | **18 (0)** | 0.0025 (0.0025–0.025) | 0% (0) | | NC‡ | |
| **MA** | **FtS 6:2** | **18 (0)** | 0.0014 (0.0014–0.014) | 22% (3) | <0.0014 | NA (NA–NA)† | 0.11 |

| Site | Analyte | # of Samples Collected (Invalid Samples) | Method Detection Limit Median (Range) (ng/cm²) | % Detected from Valid Samples (Estimated Values)* | Minimum (ng/cm²) | Median (25%–75%) (ng/cm²) | Maximum (ng/cm²) |
|---|---|---|---|---|---|---|---|
| **MA** | **FtS 8:2** | **18 (0)** | 0.0017 (0.0017–0.017) | 17% (2) | <0.0017 | NA (NA–NA)† | 0.035 |
| **MA** | **PFOSA** | **18 (2)** | 0.0017 (0.0017–0.017) | 12% (2) | <0.0017 | NA (NA–NA)† | <0.017§ |
| **MA** | **N-MeFOSA** | **18 (0)** | 0.0024 (0.0024–0.024) | 0% (0) | | NC‡ | |
| **MA** | **N-EtFOSA** | **18 (0)** | 0.0023 (0.0023–0.023) | 0% (0) | | NC‡ | |
| **MA** | **EtFOSAA** | **18 (0)** | 0.0023 (0.0023–0.023) | 39% (5) | <0.0023 | NA (NA–0.0036)† | 0.48 |
| **MA** | **N-MeFOSE** | **18 (0)** | 0.0023 (0.0023–0.095) | 50% (4) | <0.0023 | 0.0025 (NA–0.011)† | 0.36 |
| **MA** | **N-EtFOSE** | **18 (0)** | 0.0014 (0.0014–0.19) | 33% (3) | <0.0014 | NA (NA–0.0035)† | <0.19§ |
| **MA** | **PFMPA** | **18 (0)** | 0.0012 (0.0012–0.012) | 0% (0) | | NC‡ | |
| **MA** | **PFMBA** | **18 (0)** | 0.0022 (0.0022–0.022) | 0% (0) | | NC‡ | |
| **MA** | **HFPO-DA** | **18 (0)** | 0.002 (0.002–0.02) | 6% (1) | <0.002 | NA (NA–NA)† | <0.02§ |
| **MA** | **NFDHA** | **18 (0)** | 0.0019 (0.0019–0.019) | 0% (0) | | NC‡ | |

| Site | Analyte | # of Samples Collected (Invalid Samples) | Method Detection Limit Median (Range) ($ng/cm^2$) | % Detected from Valid Samples (Estimated Values)* | Minimum ($ng/cm^2$) | Median (25%–75%) ($ng/cm^2$) | Maximum ($ng/cm^2$) |
|---|---|---|---|---|---|---|---|
| **MA** | **PFEESA** | **18 (0)** | 0.0016 (0.0016–0.016) | 6% (1) | <0.0016 | NA (NA–NA)† | <0.016§ |
| **MA** | **9Cl-PF3ONS** | **18 (0)** | 0.0017 (0.0017–0.017) | 0% (0) | | NC‡ | |
| **MA** | **11Cl-PF3OUdS** | **18 (0)** | 0.0016 (0.0016–0.016) | 0% (0) | | NC‡ | |
| **MA** | **ADONA** | **18 (0)** | 0.0019 (0.0019–0.019) | 0% (0) | | NC‡ | |

*Estimated Values are the number of sample results flagged by the laboratory as less than the reporting limit but greater than or equal to the method detection limit and the concentration is an approximate value.

†NA: Not Applicable: Summary statistics (median, 25% or 75%) could not be calculated due to the ranks of the method detection limits. Refer to Appendix B, Treatment of Non-Detects (ND) in the Data Set.

‡NC: Not Calculated: Summary statistics (median, 25%, 75%, and range) could not be calculated due to no detected samples available.

§The method detection limit for the maximum in the data set was higher than all the detections in the data set. Refer to Appendix B, Treatment of Non-Detects (ND) in the Data Set.

**Table D- 14. Summary Statistics of Surface Wipe 2: Typically Closet Floor (ng/cm$^2$) Results for diPAPs — DE and MA**

| Site | Analyte | # of Samples Collected (Invalid Samples) | Method Detection Limit Median (Range) (ng/cm$^2$) | % Detected from Valid Samples (Estimated Values)* | Minimum (ng/cm$^2$) | Median (25%–75%) (ng/cm$^2$) | Maximum (ng/cm$^2$) |
|---|---|---|---|---|---|---|---|
| **DE** | **6:2 diPAP** | 10 (2) | 0.0017 (0.0017–0.0083) | 100% (0) | 0.013 | 0.024 (0.015–0.13) | 3.5 |
| **DE** | **6:2/8:2 diPAP** | 10 (0) | 0.0036 (0.0036–0.0036) | 80% (5) | <0.0036 | 0.0093 (0.0046–0.031) | 0.13 |
| **DE** | **8:2 diPAP** | 10 (0) | 9e-04 (9e-04–9e-04) | 70% (4) | <9e-04 | 0.0039 (NA–0.017)† | 0.078 |
| **DE** | **10:2 diPAP** | 10 (0) | 0.0053 (0.0053–0.0053) | 10% (1) | <0.0053 | NA (NA–NA)† | 0.0073 |
| **MA** | **6:2 diPAP** | 18 (1) | 0.0017 (0.0017–0.017) | 100% (0) | 0.011 | 0.069 (0.034–0.47) | 45 |
| **MA** | **6:2/8:2 diPAP** | 18 (4) | 0.0036 (0.0036–0.036) | 71% (2) | <0.0036 | 0.035 (NA–0.31)† | 77 |
| **MA** | **8:2 diPAP** | 18 (5) | 9e-04 (9e-04–0.009) | 62% (0) | <9e-04 | 0.032 (NA–0.4)† | 72 |
| **MA** | **10:2 diPAP** | 18 (0) | 0.0053 (0.0053–0.053) | 44% (2) | <0.0053 | NA (NA–0.055)† | 32 |

*Estimated Values are the number of sample results flagged by the laboratory as less than the reporting limit but greater than or equal to the method detection limit and the concentration is an approximate value.

†NA: Not Applicable: Summary statistics (median, 25% or 75%) could not be calculated due to the ranks of the method detection limits. Refer to Appendix B, Treatment of Non-Detects (ND) in the Data Set.

**Table D- 15. Summary Statistics of Surface Wipe 2: Typically Closet Floor (ng/cm$^2$) Results for FTOHs — DE and MA**

| Site | Analyte | # of Samples Collected (Invalid Samples) | Method Detection Limit Median (Range) (ng/cm$^2$) | % Detected from Valid Samples (Estimated Values)* | Minimum (ng/cm$^2$) | Median (25%–75%) (ng/cm$^2$) | Maximum (ng/cm$^2$) |
|---|---|---|---|---|---|---|---|
| **DE** | **4:2 FTOH** | 6 (0) | 0.00097 (0.00097–0.00097) | 0% (0) | | NC‡ | |
| **DE** | **6:2 FTOH** | 6 (0) | 0.00097 (0.00097–0.00097) | 0% (0) | | NC† | |
| **DE** | **7:2 sFTOH** | 6 (0) | 0.00097 (0.00097–0.00097) | 0% (0) | | NC† | |
| **DE** | **8:2 FTOH** | 6 (0) | 0.00097 (0.00097–0.00097) | 0% (0) | | NC† | |
| **DE** | **10:2 FTOH** | 6 (0) | 0.00097 (0.00097–0.00097) | 0% (0) | | NC† | |
| **MA** | **4:2 FTOH** | 10 (0) | 0.00097 (0.00097–0.00097) | 0% (0) | | NC† | |
| **MA** | **6:2 FTOH** | 10 (0) | 0.00097 (0.00097–0.00097) | 10% (0) | <0.00097 | NA (NA–NA)‡ | 0.24 |
| **MA** | **7:2 sFTOH** | 10 (0) | 0.00097 (0.00097–0.00097) | 0% (0) | | NC† | |
| **MA** | **8:2 FTOH** | 10 (0) | 0.00097 (0.00097–0.00097) | 0% (0) | | NC† | |
| **MA** | **10:2 FTOH** | 10 (0) | 0.00097 (0.00097–0.00097) | 0% (0) | | NC† | |

*Estimated Values are the number of sample results flagged by the laboratory as less than the reporting limit but greater than or equal to the method detection limit and the concentration is an approximate value.

†NC: Not Calculated: Summary statistics (median, 25%, 75%, and range) could not be calculated due to no detected samples available.

| Site | Analyte | # of Samples Collected (Invalid Samples) | Method Detection Limit Median (Range) (ng/cm$^2$) | % Detected from Valid Samples (Estimated Values)* | Minimum (ng/cm$^2$) | Median (25%–75%) (ng/cm$^2$) | Maximum (ng/cm$^2$) |
|---|---|---|---|---|---|---|---|

‡NA: Not Applicable: Summary statistics (median, 25% or 75%) could not be calculated due to the ranks of the method detection limits. Refer to Appendix B, Treatment of Non-Detects (ND) in the Data Set.

**Table D- 16. Summary Statistics of Surface Wipe 2: Typically Closet Floor (ng/cm$^2$) Results for EOF — DE and MA**

| Site | Analyte | # of Samples Collected (Invalid Samples) | Method Detection Limit Median (Range) (ng/cm$^2$) | % Detected from Valid Samples (Estimated Values)* | Minimum (ng/cm$^2$) | Median (25%–75%) (ng/cm$^2$) | Maximum (ng/cm$^2$) |
|---|---|---|---|---|---|---|---|
| **DE** | **EOF** | 4 (0) | 1.4 (1.4–1.4) | 50% (0) | <1.4 | NA (NA–NA)† | 6 |
| **MA** | **EOF** | 8 (0) | 1.4 (1.4–1.4) | 25% (1) | <1.4 | NA (NA–NA)† | 36 |

*Estimated Values are the number of sample results flagged by the laboratory as less than the reporting limit but greater than or equal to the method detection limit and the concentration is an approximate value.

†NA: Not Applicable: Summary statistics (median, 25% or 75%) could not be calculated due to the ranks of the method detection limits. Refer to Appendix B, Treatment of Non-Detects (ND) in the Data Set.

## Indoor Air

**Table D- 17. Summary Statistics of Indoor Air (ng/m$^3$) Results for PFAS — DE and MA**

| Site | Analyte | # of Samples Collected (Invalid Samples) | Method Detection Limit Median (Range) (ng/m$^3$) | % Detected from Valid Samples (Estimated Values)* | Minimum (ng/m$^3$) | Median (25%–75%) (ng/m$^3$) | Maximum (ng/m$^3$) |
|---|---|---|---|---|---|---|---|
| **DE** | **PFBA** | 10 (0) | 0.36 (0.35–0.37) | 0% (0) | | NC† | |
| **DE** | **PFPeA** | 10 (0) | 0.045 (0.045–0.047) | 20% (0) | <0.045 | NA (NA–NA)‡ | 0.15 |
| **DE** | **PFHxA** | 10 (2) | 0.018 (0.018–0.019) | 25% (0) | <0.018 | NA (NA–NA)‡ | 0.47 |
| **DE** | **PFHpA** | 10 (0) | 0.017 (0.017–0.018) | 50% (5) | <0.017 | NA (NA–0.029)‡ | 0.032 |
| **DE** | **PFDoA** | 10 (0) | 0.018 (0.018–0.019) | 0% (0) | | NC† | |
| **DE** | **PFTrA** | 10 (0) | 0.016 (0.016–0.016) | 0% (0) | | NC† | |
| **DE** | **PFTA** | 10 (0) | 0.015 (0.015–0.015) | 0% (0) | | NC† | |
| **DE** | **PFBS** | 10 (0) | 0.024 (0.024–0.025) | 20% (2) | <0.024 | NA (NA–NA)‡ | 0.072 |
| **DE** | **PFPeS** | 10 (0) | 0.029 (0.029–0.03) | 20% (0) | <0.029 | NA (NA–NA)‡ | 0.093 |
| **DE** | **PFHpS** | 10 (0) | 0.021 (0.02–0.021) | 20% (2) | <0.02 | NA (NA–NA)‡ | 0.041 |

| Site | Analyte | # of Samples Collected (Invalid Samples) | Method Detection Limit Median (Range) (ng/m$^3$) | % Detected from Valid Samples (Estimated Values)* | Minimum (ng/m$^3$) | Median (25%–75%) (ng/m$^3$) | Maximum (ng/m$^3$) |
|---|---|---|---|---|---|---|---|
| **DE** | **PFNS** | 10 (0) | 0.017 (0.016–0.017) | 0% (0) | | NC† | |
| **DE** | **PFDS** | 10 (0) | 0.014 (0.014–0.015) | 0% (0) | | NC† | |
| **DE** | **PFDoS** | 10 (0) | 0.016 (0.016–0.017) | 0% (0) | | NC† | |
| **DE** | **FtS 4:2** | 10 (0) | 0.0092 (0.0091–0.0095) | 0% (0) | | NC† | |
| **DE** | **FtS 6:2** | 10 (0) | 0.11 (0.11–0.11) | 20% (0) | <0.11 | NA (NA–NA)‡ | 1.7 |
| **DE** | **FtS 8:2** | 10 (0) | 0.0042 (0.0042–0.0043) | 20% (2) | <0.0042 | NA (NA–NA)‡ | 0.018 |
| **DE** | **PFOSA** | 10 (0) | 0.015 (0.015–0.015) | 70% (6) | <0.015 | 0.018 (NA–0.024)‡ | 0.061 |
| **DE** | **N-MeFOSA** | 10 (0) | 0.012 (0.012–0.012) | 90% (2) | <0.012 | 0.077 (0.034–0.14) | 1 |
| **DE** | **N-EtFOSA** | 10 (0) | 0.0084 (0.0083–0.0087) | 100% (1) | 0.015 | 0.11 (0.09–0.21) | 0.28 |
| **DE** | **EtFOSAA** | 10 (0) | 0.018 (0.018–0.019) | 0% (0) | | NC† | |
| **DE** | **N-MeFOSE** | 10 (0) | 0.064 (0.063–0.066) | 90% (0) | <0.065 | 0.72 (0.3–1.6) | 10 |

| Site | Analyte | # of Samples Collected (Invalid Samples) | Method Detection Limit Median (Range) ($ng/m^3$) | % Detected from Valid Samples (Estimated Values)* | Minimum ($ng/m^3$) | Median (25%–75%) ($ng/m^3$) | Maximum ($ng/m^3$) |
|---|---|---|---|---|---|---|---|
| **DE** | **N-EtFOSE** | 10 (0) | 0.031 (0.03–0.032) | 90% (1) | <0.031 | 0.17 (0.12–0.36) | 0.9 |
| **DE** | **HFPO-DA** | 10 (0) | 0.012 (0.011–0.012) | 0% (0) | | NC† | |
| **MA** | **PFBA** | 18 (0) | 0.36 (0.35–0.4) | 11% (2) | <0.35 | NA (NA–NA)‡ | 0.6 |
| **MA** | **PFPeA** | 18 (0) | 0.046 (0.044–0.05) | 6% (0) | <0.044 | NA (NA–NA)‡ | 0.13 |
| **MA** | **PFHxA** | 18 (12) | 0.019 (0.018–0.019) | 0% (0) | | NC† | |
| **MA** | **PFHpA** | 18 (3) | 0.017 (0.017–0.019) | 0% (0) | | NC† | |
| **MA** | **PFDoA** | 18 (0) | 0.019 (0.018–0.021) | 6% (1) | <0.018 | NA (NA–NA)‡ | 0.024 |
| **MA** | **PFTrA** | 18 (0) | 0.016 (0.015–0.018) | 6% (1) | <0.015 | NA (NA–NA)‡ | 0.021 |
| **MA** | **PFTA** | 18 (0) | 0.015 (0.014–0.016) | 6% (1) | <0.014 | NA (NA–NA)‡ | 0.018 |
| **MA** | **PFBS** | 18 (1) | 0.025 (0.024–0.027) | 0% (0) | | NC† | |
| **MA** | **PFPeS** | 18 (1) | 0.03 (0.029–0.033) | 0% (0) | | NC† | |

| Site | Analyte | # of Samples Collected (Invalid Samples) | Method Detection Limit Median (Range) (ng/m$^3$) | % Detected from Valid Samples (Estimated Values)* | Minimum (ng/m$^3$) | Median (25%–75%) (ng/m$^3$) | Maximum (ng/m$^3$) |
|---|---|---|---|---|---|---|---|
| **MA** | **PFHpS** | 18 (1) | 0.021 (0.02–0.023) | 0% (0) | | NC† | |
| **MA** | **PFNS** | 18 (0) | 0.017 (0.016–0.018) | 0% (0) | | NC† | |
| **MA** | **PFDS** | 18 (0) | 0.014 (0.014–0.016) | 0% (0) | | NC† | |
| **MA** | **PFDoS** | 18 (0) | 0.016 (0.016–0.018) | 0% (0) | | NC† | |
| **MA** | **FtS 4:2** | 18 (1) | 0.0093 (0.009–0.01) | 0% (0) | | NC† | |
| **MA** | **FtS 6:2** | 18 (4) | 0.11 (0.11–0.12) | 7% (0) | <0.11 | NA (NA–NA)‡ | 21 |
| **MA** | **FtS 8:2** | 18 (3) | 0.0043 (0.0041–0.0047) | 7% (0) | <0.0041 | NA (NA–NA)‡ | 0.17 |
| **MA** | **PFOSA** | 18 (7) | 0.015 (0.015–0.017) | 9% (0) | <0.015 | NA (NA–NA)‡ | 0.28 |
| **MA** | **N-MeFOSA** | 18 (0) | 0.012 (0.012–0.013) | 72% (4) | <0.012 | 0.053 (NA–0.17)‡ | 1.6 |
| **MA** | **N-EtFOSA** | 18 (0) | 0.0085 (0.0082–0.0094) | 78% (5) | <0.0082 | 0.051 (0.03–0.22) | 0.4 |
| **MA** | **EtFOSAA** | 18 (3) | 0.019 (0.018–0.021) | 0% (0) | | NC† | |

| Site | Analyte | # of Samples Collected (Invalid Samples) | Method Detection Limit Median (Range) (ng/m$^3$) | % Detected from Valid Samples (Estimated Values)* | Minimum (ng/m$^3$) | Median (25%–75%) (ng/m$^3$) | Maximum (ng/m$^3$) |
|---|---|---|---|---|---|---|---|
| **MA** | **N-MeFOSE** | 18 (0) | 0.065 (0.062–0.071) | 100% (6) | 0.068 | 0.25 (0.098–0.64) | 9.7 |
| **MA** | **N-EtFOSE** | 18 (0) | 0.031 (0.03–0.034) | 72% (4) | <0.03 | 0.073 (NA–0.17)‡ | 1 |
| **MA** | **HFPO-DA** | 18 (1) | 0.012 (0.011–0.013) | 0% (0) | | NC† | |

*Estimated Values are the number of sample results flagged by the laboratory as less than the reporting limit but greater than or equal to the method detection limit and the concentration is an approximate value.

†NC: Not Calculated: Summary statistics (median, 25%, 75%, and range) could not be calculated due to no detected samples available.

‡NA: Not Applicable: Summary statistics (median, 25% or 75%) could not be calculated due to the ranks of the method detection limits. Refer to Appendix B, Treatment of Non-Detects (ND) in the Data Set.

**Table D- 18. Summary Statistics of Indoor Air (ng/m$^3$) Results for diPAPs — DE and MA**

| Site | Analyte | # of Samples Collected (Invalid Samples) | Method Detection Limit Median (Range) (ng/m$^3$) | % Detected from Valid Samples (Estimated Values)* | Minimum (ng/m$^3$) | Median (25%–75%) (ng/m$^3$) | Maximum (ng/m$^3$) |
|---|---|---|---|---|---|---|---|
| **DE** | **6:2 diPAP** | 10 (0) | 0.0066 (0.0065–0.0068) | 40% (3) | <0.0065 | NA (NA–0.046)‡ | 0.47 |
| **DE** | **6:2/8:2 diPAP** | 10 (0) | 0.01 (0.01–0.011) | 0% (0) | | NC‡ | |

| Site | Analyte | # of Samples Collected (Invalid Samples) | Method Detection Limit Median (Range) ($ng/m^3$) | % Detected from Valid Samples (Estimated Values)* | Minimum ($ng/m^3$) | Median (25%–75%) ($ng/m^3$) | Maximum ($ng/m^3$) |
|---|---|---|---|---|---|---|---|
| **DE** | **8:2 diPAP** | 10 (0) | 0.0066 (0.0065–0.0068) | 0% (0) | | NC‡ | |
| **DE** | **10:2 diPAP** | 10 (0) | 0.039 (0.039–0.041) | 0% (0) | | NC‡ | |
| **MA** | **6:2 diPAP** | 18 (13) | 0.0067 (0.0064–0.0068) | 80% (4) | <0.0067 | 0.052 (0.033–0.08) | 0.085 |
| **MA** | **6:2/8:2 diPAP** | 18 (0) | 0.01 (0.01–0.011) | 22% (4) | <0.01 | NA (NA–NA)† | 0.022 |
| **MA** | **8:2 diPAP** | 18 (0) | 0.0067 (0.0064–0.0073) | 17% (3) | <0.0065 | NA (NA–NA)† | 0.012 |
| **MA** | **10:2 diPAP** | 18 (0) | 0.04 (0.038–0.044) | 0% (0) | | NC‡ | |

*Estimated Values are the number of sample results flagged by the laboratory as less than the reporting limit but greater than or equal to the method detection limit and the concentration is an approximate value.

†NA: Not Applicable: Summary statistics (median, 25% or 75%) could not be calculated due to the ranks of the method detection limits. Refer to Appendix B, Treatment of Non-Detects (ND) in the Data Set.

‡NC: Not Calculated: Summary statistics (median, 25%, 75%, and range) could not be calculated due to no detected samples available.

**Table D- 19. Summary Statistics of Indoor Air (ng/m³) Results for FTOHs — DE and MA**

| Site | Analyte | # of Samples Collected (Invalid Samples) | Method Detection Limit Median (Range) (ng/m³) | % Detected from Valid Samples (Estimated Values)* | Minimum (ng/m³) | Median (25%–75%) (ng/m³) | Maximum (ng/m³) |
|---|---|---|---|---|---|---|---|
| **DE** | **4:2 FTOH** | 5 (0) | 0.13 (0.13–0.13) | 60% (3) | <0.13 | 0.17 (NA–NA)† | 0.21 |
| **DE** | **6:2 FTOH** | 5 (0) | 0.32 (0.31–0.32) | 100% (0) | 5.8 | 21 (15–32) | 37 |
| **DE** | **8:2 FTOH** | 5 (0) | 0.25 (0.25–0.26) | 100% (0) | 1.1 | 2.4 (1.8–2.4) | 6.5 |
| **DE** | **10:2 FTOH** | 5 (0) | 0.19 (0.19–0.19) | 100% (0) | 0.49 | 0.75 (0.7–1.5) | 1.7 |
| **MA** | **4:2 FTOH** | 5 (0) | 0.13 (0.13–0.26) | 20% (1) | <0.13 | NA (NA–NA)† | <0.26‡ |
| **MA** | **6:2 FTOH** | 5 (0) | 0.33 (0.31–0.65) | 100% (0) | 6.9 | 19 (11–23) | 29 |
| **MA** | **8:2 FTOH** | 5 (0) | 0.26 (0.25–0.52) | 100% (0) | 2.4 | 4.7 (3.7–5) | 21 |
| **MA** | **10:2 FTOH** | 5 (0) | 0.2 (0.19–0.39) | 100% (0) | 2 | 2.1 (2–3.6) | 6.8 |

*Estimated Values are the number of sample results flagged by the laboratory as less than the reporting limit but greater than or equal to the method detection limit and the concentration is an approximate value.

†NA: Not Applicable: Summary statistics (median, 25% or 75%) could not be calculated due to the ranks of the method detection limits. Refer to Appendix B, Treatment of Non-Detects (ND) in the Data Set.

‡The method detection limit for the maximum in the data set was higher than all the detections in the data set. Refer to Appendix B, Treatment of Non-Detects (ND) in the Data Set.

## Wristband

**Table D- 20. Summary Statistics of Wristband (µg/kg) Results for PFAS — DE and MA**

| Site | Analyte | # of Samples Collected (Invalid Samples) | Method Detection Limit Median (Range) (µg/kg) | % Detected from Valid Samples (Estimated Values)* | Minimum (µg/kg) | Median (25%–75%) (µg/kg) | Maximum (µg/kg) |
|---|---|---|---|---|---|---|---|
| **DE** | **PFBA** | 10 (0) | 0.049 (0.048–0.05) | 10% (1) | <0.048 | NA (NA–NA)‡ | 0.053 |
| **DE** | **PFPeA** | 10 (0) | 0.044 (0.043–0.044) | 0% (0) | | NC‡ | |
| **DE** | **PFHxA** | 10 (0) | 0.033 (0.032–0.034) | 0% (0) | | NC‡ | |
| **DE** | **PFHpA** | 10 (0) | 0.0405 (0.04–0.041) | 0% (0) | | NC‡ | |
| **DE** | **PFDoA** | 10 (0) | 0.032 (0.031–0.033) | 0% (0) | | NC‡ | |
| **DE** | **PFTrA** | 10 (0) | 0.022 (0.022–0.023) | 0% (0) | | NC‡ | |
| **DE** | **PFTA** | 10 (0) | 0.0395 (0.039–0.04) | 0% (0) | | NC‡ | |
| **DE** | **PFBS** | 10 (0) | 0.0405 (0.04–0.041) | 0% (0) | | NC‡ | |
| **DE** | **PFPeS** | 10 (0) | 0.0395 (0.039–0.04) | 0% (0) | | NC‡ | |
| **DE** | **PFHpS** | 10 (0) | 0.052 (0.051–0.053) | 0% (0) | | NC‡ | |
| **DE** | **PFNS** | 10 (0) | 0.031 (0.03–0.031) | 0% (0) | | NC‡ | |
| **DE** | **PFDS** | 10 (0) | 0.0555 (0.055–0.056) | 0% (0) | | NC‡ | |

| Site | Analyte | # of Samples Collected (Invalid Samples) | Method Detection Limit Median (Range) (µg/kg) | % Detected from Valid Samples (Estimated Values)* | Minimum (µg/kg) | Median (25%–75%) (µg/kg) | Maximum (µg/kg) |
|---|---|---|---|---|---|---|---|
| **DE** | **PFDoS** | 10 (0) | 0.05 (0.049–0.051) | 0% (0) | | NC‡ | |
| **DE** | **3:3 FTCA** | 10 (0) | 0.044 (0.043–0.044) | 0% (0) | | NC‡ | |
| **DE** | **5:3 FTCA** | 10 (0) | 0.0405 (0.04–0.041) | 10% (1) | <0.04 | NA (NA–NA)† | 0.051 |
| **DE** | **7:3 FTCA** | 10 (0) | 0.044 (0.043–0.044) | 0% (0) | | NC‡ | |
| **DE** | **FtS 4:2** | 10 (0) | 0.054 (0.053–0.055) | 0% (0) | | NC‡ | |
| **DE** | **FtS 6:2** | 10 (0) | 0.029 (0.028–0.029) | 0% (0) | | NC‡ | |
| **DE** | **FtS 8:2** | 10 (0) | 0.037 (0.037–0.038) | 20% (1) | <0.037 | NA (NA–NA)† | 0.43 |
| **DE** | **PFOSA** | 10 (0) | 0.035 (0.035–0.036) | 10% (1) | <0.035 | NA (NA–NA)† | 0.078 |
| **DE** | **N-MeFOSA** | 10 (0) | 0.052 (0.051–0.053) | 10% (1) | <0.051 | NA (NA–NA)† | 0.13 |
| **DE** | **N-EtFOSA** | 10 (0) | 0.05 (0.049–0.051) | 10% (1) | <0.049 | NA (NA–NA)† | 0.06 |
| **DE** | **EtFOSAA** | 10 (0) | 0.051 (0.05–0.052) | 10% (1) | <0.05 | NA (NA–NA)† | 0.063 |
| **DE** | **N-MeFOSE** | 10 (0) | 0.05 (0.049–0.051) | 90% (0) | <0.051 | 1 (0.28–1.9) | 7.3 |

| Site | Analyte | # of Samples Collected (Invalid Samples) | Method Detection Limit Median (Range) (µg/kg) | % Detected from Valid Samples (Estimated Values)* | Minimum (µg/kg) | Median (25%–75%) (µg/kg) | Maximum (µg/kg) |
|---|---|---|---|---|---|---|---|
| **DE** | **N-EtFOSE** | 10 (0) | 0.03 (0.029–0.03) | 80% (2) | <0.029 | 0.24 (0.11–0.36) | 1.2 |
| **DE** | **PFMPA** | 10 (0) | 0.026 (0.025–0.026) | 0% (0) | | NC‡ | |
| **DE** | **PFMBA** | 10 (0) | 0.048 (0.047–0.049) | 0% (0) | | NC‡ | |
| **DE** | **HFPO-DA** | 10 (0) | 0.044 (0.043–0.044) | 0% (0) | | NC‡ | |
| **DE** | **NFDHA** | 10 (0) | 0.043 (0.042–0.043) | 0% (0) | | NC‡ | |
| **DE** | **PFEESA** | 10 (0) | 0.034 (0.034–0.035) | 0% (0) | | NC‡ | |
| **DE** | **9Cl-PF3ONS** | 10 (0) | 0.037 (0.037–0.038) | 0% (0) | | NC‡ | |
| **DE** | **11Cl-PF3OUdS** | 10 (0) | 0.033 (0.032–0.034) | 0% (0) | | NC‡ | |
| **DE** | **ADONA** | 10 (0) | 0.0415 (0.041–0.042) | 0% (0) | | NC‡ | |
| **MA** | **PFBA** | 18 (0) | 0.049 (0.049–0.28) | 6% (0) | <0.049 | NA (NA–NA)† | 1.6 |
| **MA** | **PFPeA** | 18 (0) | 0.044 (0.043–0.045) | 0% (0) | | NC‡ | |
| **MA** | **PFHxA** | 18 (0) | 0.033 (0.033–0.034) | 11% (2) | <0.033 | NA (NA–NA)† | 0.038 |

| Site | Analyte | # of Samples Collected (Invalid Samples) | Method Detection Limit Median (Range) (µg/kg) | % Detected from Valid Samples (Estimated Values)* | Minimum (µg/kg) | Median (25%–75%) (µg/kg) | Maximum (µg/kg) |
|---|---|---|---|---|---|---|---|
| **MA** | **PFHpA** | 18 (0) | 0.041 (0.04–0.041) | 6% (1) | <0.04 | NA (NA–NA)† | 0.042 |
| **MA** | **PFDoA** | 18 (0) | 0.032 (0.032–0.033) | 6% (0) | <0.032 | NA (NA–NA)† | 0.25 |
| **MA** | **PFTrA** | 18 (0) | 0.023 (0.022–0.023) | 11% (2) | <0.022 | NA (NA–NA)† | 0.059 |
| **MA** | **PFTA** | 18 (0) | 0.04 (0.039–0.04) | 6% (1) | <0.039 | NA (NA–NA)† | 0.12 |
| **MA** | **PFBS** | 18 (0) | 0.041 (0.04–0.041) | 0% (0) | | NC‡ | |
| **MA** | **PFPeS** | 18 (0) | 0.04 (0.039–0.04) | 0% (0) | | NC‡ | |
| **MA** | **PFHpS** | 18 (0) | 0.053 (0.052–0.053) | 0% (0) | | NC‡ | |
| **MA** | **PFNS** | 18 (0) | 0.031 (0.031–0.032) | 0% (0) | | NC‡ | |
| **MA** | **PFDS** | 18 (0) | 0.056 (0.055–0.057) | 0% (0) | | NC‡ | |
| **MA** | **PFDoS** | 18 (0) | 0.05 (0.05–0.051) | 0% (0) | | NC‡ | |
| **MA** | **3:3 FTCA** | 18 (0) | 0.044 (0.043–0.045) | 0% (0) | | NC‡ | |
| **MA** | **5:3 FTCA** | 18 (0) | 0.041 (0.04–0.041) | 0% (0) | | NC‡ | |
| **MA** | **7:3 FTCA** | 18 (0) | 0.044 (0.043–0.045) | 0% (0) | | NC‡ | |

| Site | Analyte | # of Samples Collected (Invalid Samples) | Method Detection Limit Median (Range) (µg/kg) | % Detected from Valid Samples (Estimated Values)* | Minimum (µg/kg) | Median (25%–75%) (µg/kg) | Maximum (µg/kg) |
|---|---|---|---|---|---|---|---|
| **MA** | **FtS 4:2** | 18 (0) | 0.055 (0.054–0.056) | 0% (0) | | NC‡ | |
| **MA** | **FtS 6:2** | 18 (0) | 0.029 (0.029–0.029) | 6% (1) | <0.029 | NA (NA–NA)† | 0.037 |
| **MA** | **FtS 8:2** | 18 (0) | 0.038 (0.037–0.37) | 11% (2) | <0.037 | NA (NA–NA)† | 1.7 |
| **MA** | **PFOSA** | 18 (0) | 0.035 (0.035–0.036) | 11% (2) | <0.035 | NA (NA–NA)† | 0.14 |
| **MA** | **N-MeFOSA** | 18 (0) | 0.053 (0.052–0.053) | 17% (2) | <0.052 | NA (NA–NA)† | 0.27 |
| **MA** | **N-EtFOSA** | 18 (0) | 0.05 (0.05–0.051) | 6% (1) | <0.05 | NA (NA–NA)† | 0.16 |
| **MA** | **EtFOSAA** | 18 (0) | 0.052 (0.051–0.052) | 11% (2) | <0.051 | NA (NA–NA)† | 0.086 |
| **MA** | **N-MeFOSE** | 18 (0) | 0.05 (0.05–0.051) | 100% (3) | 0.054 | 0.46 (0.28–1.2) | 5.2 |
| **MA** | **N-EtFOSE** | 18 (0) | 0.03 (0.03–0.031) | 83% (11) | <0.03 | 0.082 (0.039–0.2) | 3.1 |
| **MA** | **PFMPA** | 18 (0) | 0.026 (0.025–0.026) | 0% (0) | | NC‡ | |
| **MA** | **PFMBA** | 18 (0) | 0.048 (0.048–0.049) | 0% (0) | | NC‡ | |
| **MA** | **HFPO-DA** | 18 (0) | 0.044 (0.043–0.045) | 0% (0) | | NC‡ | |

| Site | Analyte | # of Samples Collected (Invalid Samples) | Method Detection Limit Median (Range) (µg/kg) | % Detected from Valid Samples (Estimated Values)* | Minimum (µg/kg) | Median (25%–75%) (µg/kg) | Maximum (µg/kg) |
|---|---|---|---|---|---|---|---|
| **MA** | **NFDHA** | 18 (0) | 0.043 (0.042–0.044) | 0% (0) | | NC‡ | |
| **MA** | **PFEESA** | 18 (0) | 0.034 (0.034–0.035) | 0% (0) | | NC‡ | |
| **MA** | **9Cl-PF3ONS** | 18 (0) | 0.038 (0.037–0.038) | 0% (0) | | NC‡ | |
| **MA** | **11Cl-PF3OUdS** | 18 (0) | 0.033 (0.033–0.034) | 0% (0) | | NC‡ | |
| **MA** | **ADONA** | 18 (0) | 0.042 (0.041–0.042) | 0% (0) | | NC‡ | |

*Estimated Values are the number of sample results flagged by the laboratory as less than the reporting limit but greater than or equal to the method detection limit and the concentration is an approximate value.

†NA: Not Applicable: Summary statistics (median, 25% or 75%) could not be calculated due to the ranks of the method detection limits. Refer to Appendix B, Treatment of Non-Detects (ND) in the Data Set.

‡NC: Not Calculated: Summary statistics (median, 25%, 75%, and range) could not be calculated due to no detected samples available.

**Table D- 21. Summary Statistics of Wristband (µg/kg) Results for diPAPs — DE and MA**

| Site | Analyte | # of Samples Collected (Invalid Samples) | Method Detection Limit Median (Range) (µg/kg) | % Detected from Valid Samples (Estimated Values)* | Minimum (µg/kg) | Median (25%–75%) (µg/kg) | Maximum (µg/kg) |
|---|---|---|---|---|---|---|---|
| **DE** | **6:2 diPAP** | 10 (0) | 0.036 (0.036–0.037) | 70% (1) | <0.036 | 0.35 (NA–1.5)‡ | 14 |
| **DE** | **6:2/8:2 diPAP** | 10 (0) | 0.079 (0.078–0.08) | 40% (2) | <0.078 | NA (NA–0.46)† | 1.3 |

| Site | Analyte | # of Samples Collected (Invalid Samples) | Method Detection Limit Median (Range) (µg/kg) | % Detected from Valid Samples (Estimated Values)* | Minimum (µg/kg) | Median (25%–75%) (µg/kg) | Maximum (µg/kg) |
|---|---|---|---|---|---|---|---|
| **DE** | **8:2 diPAP** | 10 (0) | 0.02 (0.02–0.021) | 90% (5) | <0.02 | 0.068 (0.056–0.52) | 0.92 |
| **DE** | **10:2 diPAP** | 10 (0) | 0.12 (0.11–0.12) | 10% (0) | <0.11 | NA (NA–NA)† | 1.8 |
| **MA** | **6:2 diPAP** | 18 (0) | 0.036 (0.036–0.36) | 100% (1) | 0.17 | 1.8 (0.68–3.1) | 74 |
| **MA** | **6:2/8:2 diPAP** | 18 (0) | 0.079 (0.078–0.081) | 94% (13) | <0.079 | 0.18 (0.12–0.35) | 2.5 |
| **MA** | **8:2 diPAP** | 18 (0) | 0.02 (0.02–0.021) | 100% (12) | 0.049 | 0.14 (0.09–0.49) | 2.4 |
| **MA** | **10:2 diPAP** | 18 (0) | 0.12 (0.12–0.12) | 22% (3) | <0.12 | NA (NA–NA)† | 0.57 |

*Estimated Values are the number of sample results flagged by the laboratory as less than the reporting limit but greater than or equal to the method detection limit and the concentration is an approximate value.

†NA: Not Applicable: Summary statistics (median, 25% or 75%) could not be calculated due to the ranks of the method detection limits. Refer to Appendix B, Treatment of Non-Detects (ND) in the Data Set.

**Table D- 22. Summary Statistics of Wristband (µg/kg) Results for FTOHs — DE and MA**

| Site | Analyte | # of Samples Collected (Invalid Samples) | Method Detection Limit Median (Range) (µg/kg) | % Detected from Valid Samples (Estimated Values)* | Minimum (µg/kg) | Median (25%–75%) (µg/kg) | Maximum (µg/kg) |
|---|---|---|---|---|---|---|---|
| **DE** | **4:2 FTOH** | 5 (0) | 22 (21–22) | 0% (0) | | NC‡ | |
| **DE** | **6:2 FTOH** | 5 (0) | 22 (21–22) | 0% (0) | | NC† | |
| **DE** | **7:2 sFTOH** | 5 (0) | 22 (21–22) | 0% (0) | | NC† | |
| **DE** | **8:2 FTOH** | 5 (0) | 22 (21–22) | 0% (0) | | NC† | |

| Site | Analyte | # of Samples Collected (Invalid Samples) | Method Detection Limit Median (Range) (µg/kg) | % Detected from Valid Samples (Estimated Values)* | Minimum (µg/kg) | Median (25%–75%) (µg/kg) | Maximum (µg/kg) |
|---|---|---|---|---|---|---|---|
| **DE** | **10:2 FTOH** | 5 (0) | 22 (21–22) | 0% (0) | | NC† | |
| **MA** | **4:2 FTOH** | 10 (0) | 37 (21–54) | 0% (0) | | NC† | |
| **MA** | **6:2 FTOH** | 10 (0) | 21.5 (21–23) | 0% (0) | | NC† | |
| **MA** | **7:2 sFTOH** | 10 (0) | 21.5 (21–23) | 0% (0) | | NC† | |
| **MA** | **8:2 FTOH** | 10 (0) | 37 (21–54) | 0% (0) | | NC† | |
| **MA** | **10:2 FTOH** | 10 (0) | 21.5 (21–23) | 0% (0) | | NC† | |

*Estimated Values are the number of sample results flagged by the laboratory as less than the reporting limit but greater than or equal to the method detection limit and the concentration is an approximate value.

†NC: Not Calculated: Summary statistics (median, 25%, 75%, and range) could not be calculated due to no detected samples available.

**Table D- 23. Summary Statistics of Wristband (µg/kg) Results for EOF — DE and MA**

| Site | Analyte | # of Samples Collected (Invalid Samples) | Method Detection Limit Median (Range) (µg/kg) | % Detected from Valid Samples (Estimated Values)* | Minimum (µg/kg) | Median (25%–75%) (µg/kg) | Maximum (µg/kg) |
|---|---|---|---|---|---|---|---|
| **DE** | **EOF** | 6 (0) | 140 (140–140) | 0% (0) | | NC‡ | |
| **MA** | **EOF** | 8 (1) | 140 (140–140) | 0% (0) | | NC† | |

*Estimated Values are the number of sample results flagged by the laboratory as less than the reporting limit but greater than or equal to the method detection limit and the concentration is an approximate value.

†NC: Not Calculated: Summary statistics (median, 25%, 75%, and range) could not be calculated due to no detected samples available.

## Soil

**Table D- 24. Summary Statistics of Residential Soil (µg/kg) Results for PFAS — DE and MA**

| Site | Analyte | # of Samples Collected (Invalid Samples) | Method Detection Limit Median (Range) (µg/kg) | % Detected from Valid Samples (Estimated Values)* | Minimum (µg/kg) | Median (25%–75%) (µg/kg) | Maximum (µg/kg) |
|---|---|---|---|---|---|---|---|
| **DE** | **PFPrA** | 10 (3) | 0.028 (0.027–0.029) | 0% (0) | | NC‡ | |
| **DE** | **PFBA** | 10 (0) | 0.044 (0.042–0.046) | 100% (0) | 0.36 | 0.71 (0.56–1) | 2.5 |
| **DE** | **PFPeA** | 10 (0) | 0.0395 (0.038–0.041) | 100% (0) | 0.51 | 0.69 (0.66–1.4) | 2.4 |
| **DE** | **PFHxA** | 10 (0) | 0.03 (0.028–0.031) | 100% (0) | 0.26 | 0.48 (0.4–1.3) | 1.6 |
| **DE** | **PFHpA** | 10 (0) | 0.037 (0.035–0.038) | 100% (0) | 0.4 | 0.63 (0.43–0.9) | 1.2 |
| **DE** | **PFDoA** | 10 (0) | 0.029 (0.027–0.03) | 100% (0) | 0.49 | 1.2 (0.94–1.9) | 6.9 |
| **DE** | **PFTrA** | 10 (0) | 0.02 (0.019–0.021) | 100% (0) | 0.27 | 0.75 (0.48–1.1) | 3.4 |
| **DE** | **PFTA** | 10 (0) | 0.036 (0.034–0.037) | 100% (1) | 0.14 | 0.37 (0.32–0.54) | 3.8 |
| **DE** | **PFHxDA** | 10 (0) | 0.037 (0.035–0.038) | 100% (5) | 0.078 | 0.16 (0.14–0.24) | 2.1 |
| **DE** | **PFODA** | 10 (0) | 0.064 (0.06–0.066) | 10% (1) | <0.06 | NA (NA–NA)‡ | 0.19 |
| **DE** | **PFPrS** | 10 (0) | 0.029 (0.027–0.03) | 0% (0) | | NC† | |

| Site | Analyte | # of Samples Collected (Invalid Samples) | Method Detection Limit Median (Range) (µg/kg) | % Detected from Valid Samples (Estimated Values)* | Minimum (µg/kg) | Median (25%–75%) (µg/kg) | Maximum (µg/kg) |
|---|---|---|---|---|---|---|---|
| **DE** | **PFBS** | 10 (0) | 0.037 (0.035–0.038) | 10% (1) | <0.035 | NA (NA–NA)‡ | 0.086 |
| **DE** | **PFPeS** | 10 (0) | 0.036 (0.034–0.037) | 0% (0) | | NC† | |
| **DE** | **PFHpS** | 10 (0) | 0.047 (0.045–0.049) | 0% (0) | | NC† | |
| **DE** | **PFNS** | 10 (0) | 0.028 (0.027–0.029) | 0% (0) | | NC† | |
| **DE** | **PFDS** | 10 (0) | 0.05 (0.048–0.052) | 30% (3) | <0.048 | NA (NA–0.062)‡ | 0.077 |
| **DE** | **PFDoS** | 10 (0) | 0.045 (0.043–0.047) | 0% (0) | | NC† | |
| **DE** | **3:3 FTCA** | 10 (0) | 0.0395 (0.038–0.041) | 0% (0) | | NC† | |
| **DE** | **5:3 FTCA** | 10 (0) | 0.037 (0.035–0.038) | 100% (5) | 0.096 | 0.17 (0.15–0.37) | 0.63 |
| **DE** | **6:2 FTCA** | 10 (0) | 0.0975 (0.092–0.1) | 0% (0) | | NC† | |
| **DE** | **7:3 FTCA** | 10 (0) | 0.0395 (0.038–0.041) | 50% (5) | <0.039 | NA (NA–0.046)‡ | 0.16 |
| **DE** | **8:2 FTCA** | 10 (0) | 0.039 (0.037–0.04) | 0% (0) | | NC† | |
| **DE** | **10:2 FTCA** | 10 (0) | 0.024 (0.023–0.025) | 0% (0) | | NC† | |

| Site | Analyte | # of Samples Collected (Invalid Samples) | Method Detection Limit Median (Range) (µg/kg) | % Detected from Valid Samples (Estimated Values)* | Minimum (µg/kg) | Median (25%–75%) (µg/kg) | Maximum (µg/kg) |
|---|---|---|---|---|---|---|---|
| **DE** | **FtS 4:2** | 10 (0) | 0.049 (0.047–0.051) | 0% (0) | | NC† | |
| **DE** | **FtS 6:2** | 10 (0) | 0.026 (0.025–0.027) | 0% (0) | | NC† | |
| **DE** | **FtS 8:2** | 10 (0) | 0.034 (0.032–0.035) | 0% (0) | | NC† | |
| **DE** | **FtS 10:2** | 10 (0) | 0.037 (0.035–0.038) | 0% (0) | | NC† | |
| **DE** | **PFOSA** | 10 (0) | 0.032 (0.03–0.033) | 10% (1) | <0.03 | NA (NA–NA)‡ | 0.052 |
| **DE** | **N-MeFOSA** | 10 (0) | 0.047 (0.045–0.049) | 0% (0) | | NC† | |
| **DE** | **N-EtFOSA** | 10 (0) | 0.045 (0.043–0.047) | 0% (0) | | NC† | |
| **DE** | **EtFOSAA** | 10 (0) | 0.046 (0.044–0.048) | 0% (0) | | NC† | |
| **DE** | **N-MeFOSE** | 10 (0) | 0.045 (0.043–0.047) | 20% (2) | <0.043 | NA (NA–NA)‡ | 0.093 |
| **DE** | **N-EtFOSE** | 10 (0) | 0.027 (0.026–0.028) | 100% (10) | 0.055 | 0.11 (0.081–0.12) | 0.16 |
| **DE** | **PFMOAA** | 10 (0) | 0.02 (0.019–0.021) | 80% (5) | <0.02 | 0.074 (0.032–0.21) | 0.33 |
| **DE** | **PFMPA** | 10 (0) | 0.023 (0.022–0.024) | 0% (0) | | NC† | |

| Site | Analyte | # of Samples Collected (Invalid Samples) | Method Detection Limit Median (Range) (µg/kg) | % Detected from Valid Samples (Estimated Values)* | Minimum (µg/kg) | Median (25%–75%) (µg/kg) | Maximum (µg/kg) |
|---|---|---|---|---|---|---|---|
| **DE** | **PMPA** | 10 (2) | 0.029 (0.028–0.03) | 25% (0) | <0.028 | NA (NA–NA)‡ | 3.3 |
| **DE** | **PFMBA** | 10 (0) | 0.0435 (0.041–0.045) | 0% (0) | | NC† | |
| **DE** | **PEPA** | 10 (0) | 0.05 (0.048–0.052) | 0% (0) | | NC† | |
| **DE** | **HFPO-DA** | 10 (0) | 0.0395 (0.038–0.041) | 0% (0) | | NC† | |
| **DE** | **PFPE-1** | 10 (0) | 0.034 (0.032–0.035) | 0% (0) | | NC† | |
| **DE** | **R-EVE** | 10 (0) | 0.0425 (0.04–0.044) | 0% (0) | | NC† | |
| **DE** | **NFDHA** | 10 (0) | 0.039 (0.037–0.04) | 0% (0) | | NC† | |
| **DE** | **PFO2HxA** | 10 (0) | 0.056 (0.053–0.058) | 30% (3) | <0.053 | NA (NA–0.066)‡ | 0.12 |
| **DE** | **PFO3OA** | 10 (0) | 0.039 (0.037–0.04) | 0% (0) | | NC† | |
| **DE** | **PFO4DA** | 10 (0) | 0.044 (0.042–0.046) | 0% (0) | | NC† | |
| **DE** | **PFO5DA** | 10 (0) | 0.066 (0.062–0.068) | 0% (0) | | NC† | |
| **DE** | **Byproduct 4** | 10 (0) | 0.05 (0.048–0.052) | 0% (0) | | NC† | |

| Site | Analyte | # of Samples Collected (Invalid Samples) | Method Detection Limit Median (Range) (µg/kg) | % Detected from Valid Samples (Estimated Values)* | Minimum (µg/kg) | Median (25%–75%) (µg/kg) | Maximum (µg/kg) |
|---|---|---|---|---|---|---|---|
| **DE** | **PFEESA** | 10 (0) | 0.031 (0.029–0.032) | 0% (0) | | NC† | |
| **DE** | **9Cl-PF3ONS** | 10 (0) | 0.034 (0.032–0.035) | 0% (0) | | NC† | |
| **DE** | **11Cl-PF3OUdS** | 10 (0) | 0.03 (0.028–0.031) | 0% (0) | | NC† | |
| **DE** | **NVHOS** | 10 (0) | 0.13 (0.12–0.14) | 0% (0) | | NC† | |
| **DE** | **ADONA** | 10 (0) | 0.038 (0.036–0.039) | 0% (0) | | NC† | |
| **DE** | **Hydro-EVE** | 10 (0) | 0.028 (0.027–0.029) | 0% (0) | | NC† | |
| **DE** | **Byproduct 5** | 10 (0) | 0.065 (0.061–0.067) | 0% (0) | | NC† | |
| **DE** | **PFecHS** | 10 (0) | 0.0425 (0.04–0.044) | 0% (0) | | NC† | |
| **MA** | **PFPrA** | 18 (0) | 1.025 (0.027–7) | 0% (0) | | NC† | |
| **MA** | **PFBA** | 18 (0) | 0.044 (0.042–0.046) | 94% (15) | 0.043 | 0.089 (0.053–0.11) | 0.27 |
| **MA** | **PFPeA** | 18 (0) | 0.04 (0.037–0.041) | 44% (8) | <0.037 | NA (NA–0.059)‡ | 0.16 |
| **MA** | **PFHxA** | 18 (0) | 0.03 (0.028–0.031) | 44% (8) | <0.028 | NA (NA–0.051)‡ | 0.15 |
| **MA** | **PFHpA** | 18 (0) | 0.037 (0.035–0.038) | 61% (11) | <0.035 | 0.037 (NA–0.062)‡ | 0.16 |

| Site | Analyte | # of Samples Collected (Invalid Samples) | Method Detection Limit Median (Range) (µg/kg) | % Detected from Valid Samples (Estimated Values)* | Minimum (µg/kg) | Median (25%–75%) (µg/kg) | Maximum (µg/kg) |
|---|---|---|---|---|---|---|---|
| **MA** | **PFDoA** | 18 (0) | 0.029 (0.027–0.03) | 100% (17) | 0.029 | 0.073 (0.058–0.092) | 0.19 |
| **MA** | **PFTrA** | 18 (0) | 0.02 (0.019–0.021) | 100% (18) | 0.023 | 0.047 (0.037–0.058) | 0.065 |
| **MA** | **PFTA** | 18 (0) | 0.036 (0.034–0.037) | 33% (6) | <0.034 | NA (NA–0.038)‡ | 0.061 |
| **MA** | **PFHxDA** | 18 (0) | 0.037 (0.035–0.038) | 0% (0) | | NC† | |
| **MA** | **PFODA** | 18 (0) | 0.064 (0.06–0.065) | 0% (0) | | NC† | |
| **MA** | **PFPrS** | 18 (0) | 0.029 (0.027–0.03) | 0% (0) | | NC† | |
| **MA** | **PFBS** | 18 (0) | 0.037 (0.035–0.038) | 6% (1) | <0.035 | NA (NA–NA)‡ | 0.04 |
| **MA** | **PFPeS** | 18 (0) | 0.036 (0.034–0.037) | 0% (0) | | NC† | |
| **MA** | **PFHpS** | 18 (0) | 0.047 (0.045–0.049) | 0% (0) | | NC† | |
| **MA** | **PFNS** | 18 (0) | 0.028 (0.026–0.029) | 0% (0) | | NC† | |
| **MA** | **PFDS** | 18 (0) | 0.05 (0.047–0.052) | 11% (2) | <0.047 | NA (NA–NA)‡ | 0.17 |
| **MA** | **PFDoS** | 18 (0) | 0.045 (0.043–0.047) | 0% (0) | | NC† | |

| Site | Analyte | # of Samples Collected (Invalid Samples) | Method Detection Limit Median (Range) (µg/kg) | % Detected from Valid Samples (Estimated Values)* | Minimum (µg/kg) | Median (25%–75%) (µg/kg) | Maximum (µg/kg) |
|---|---|---|---|---|---|---|---|
| **MA** | **3:3 FTCA** | 18 (0) | 0.04 (0.037–0.041) | 0% (0) | | NC† | |
| **MA** | **5:3 FTCA** | 18 (0) | 0.037 (0.035–0.038) | 22% (4) | <0.035 | NA (NA–0.035)‡ | 0.098 |
| **MA** | **6:2 FTCA** | 18 (0) | 0.0975 (0.092–0.1) | 0% (0) | | NC† | |
| **MA** | **7:3 FTCA** | 18 (0) | 0.04 (0.037–0.041) | 11% (2) | <0.037 | NA (NA–NA)‡ | 0.057 |
| **MA** | **8:2 FTCA** | 18 (0) | 0.039 (0.036–0.04) | 0% (0) | | NC† | |
| **MA** | **10:2 FTCA** | 18 (0) | 0.024 (0.023–0.025) | 0% (0) | | NC† | |
| **MA** | **FtS 4:2** | 18 (0) | 0.049 (0.046–0.051) | 0% (0) | | NC† | |
| **MA** | **FtS 6:2** | 18 (0) | 0.026 (0.025–0.027) | 6% (1) | <0.025 | NA (NA–NA)‡ | 0.044 |
| **MA** | **FtS 8:2** | 18 (0) | 0.034 (0.032–0.035) | 0% (0) | | NC† | |
| **MA** | **FtS 10:2** | 18 (0) | 0.037 (0.035–0.038) | 0% (0) | | NC† | |
| **MA** | **PFOSA** | 18 (0) | 0.032 (0.03–0.033) | 0% (0) | | NC† | |
| **MA** | **N-MeFOSA** | 18 (0) | 0.047 (0.045–0.049) | 0% (0) | | NC† | |

| Site | Analyte | # of Samples Collected (Invalid Samples) | Method Detection Limit Median (Range) (µg/kg) | % Detected from Valid Samples (Estimated Values)* | Minimum (µg/kg) | Median (25%–75%) (µg/kg) | Maximum (µg/kg) |
|---|---|---|---|---|---|---|---|
| **MA** | **N-EtFOSA** | 18 (0) | 0.045 (0.043–0.047) | 0% (0) | | NC† | |
| **MA** | **EtFOSAA** | 18 (0) | 0.046 (0.044–0.048) | 17% (2) | <0.044 | NA (NA–NA)‡ | 0.21 |
| **MA** | **N-MeFOSE** | 18 (0) | 0.045 (0.043–0.047) | 6% (1) | <0.043 | NA (NA–NA)‡ | 0.055 |
| **MA** | **N-EtFOSE** | 18 (0) | 0.027 (0.026–0.028) | 100% (18) | 0.037 | 0.074 (0.065–0.094) | 0.17 |
| **MA** | **PFMOAA** | 18 (0) | 0.02 (0.019–0.021) | 0% (0) | | NC† | |
| **MA** | **PFMPA** | 18 (0) | 0.023 (0.022–0.024) | 0% (0) | | NC† | |
| **MA** | **PMPA** | 18 (0) | 0.029 (0.027–0.03) | 0% (0) | | NC† | |
| **MA** | **PFMBA** | 18 (0) | 0.0435 (0.041–0.045) | 0% (0) | | NC† | |
| **MA** | **PEPA** | 18 (0) | 0.05 (0.047–0.052) | 0% (0) | | NC† | |
| **MA** | **HFPO-DA** | 18 (0) | 0.04 (0.037–0.041) | 0% (0) | | NC† | |
| **MA** | **PFPE-1** | 18 (0) | 0.034 (0.032–0.035) | 0% (0) | | NC† | |
| **MA** | **R-EVE** | 18 (1) | 0.042 (0.04–0.044) | 0% (0) | | NC† | |

| Site | Analyte | # of Samples Collected (Invalid Samples) | Method Detection Limit Median (Range) (µg/kg) | % Detected from Valid Samples (Estimated Values)* | Minimum (µg/kg) | Median (25%–75%) (µg/kg) | Maximum (µg/kg) |
|---|---|---|---|---|---|---|---|
| **MA** | **NFDHA** | 18 (0) | 0.039 (0.036–0.04) | 0% (0) | | NC† | |
| **MA** | **PFO2HxA** | 18 (0) | 0.056 (0.053–0.058) | 0% (0) | | NC† | |
| **MA** | **PFO3OA** | 18 (0) | 0.039 (0.036–0.04) | 0% (0) | | NC† | |
| **MA** | **PFO4DA** | 18 (0) | 0.044 (0.042–0.046) | 0% (0) | | NC† | |
| **MA** | **PFO5DA** | 18 (0) | 0.066 (0.062–0.067) | 0% (0) | | NC† | |
| **MA** | **Byproduct 4** | 18 (0) | 0.05 (0.047–0.052) | 0% (0) | | NC† | |
| **MA** | **PFEESA** | 18 (0) | 0.031 (0.029–0.032) | 0% (0) | | NC† | |
| **MA** | **9Cl-PF3ONS** | 18 (0) | 0.034 (0.032–0.035) | 0% (0) | | NC† | |
| **MA** | **11Cl-PF3OUdS** | 18 (0) | 0.03 (0.028–0.031) | 0% (0) | | NC† | |
| **MA** | **NVHOS** | 18 (0) | 0.13 (0.12–0.13) | 0% (0) | | NC† | |
| **MA** | **ADONA** | 18 (0) | 0.038 (0.036–0.039) | 0% (0) | | NC† | |
| **MA** | **Hydro-EVE** | 18 (0) | 0.028 (0.026–0.029) | 0% (0) | | NC† | |

| Site | Analyte | # of Samples Collected (Invalid Samples) | Method Detection Limit Median (Range) (µg/kg) | % Detected from Valid Samples (Estimated Values)* | Minimum (µg/kg) | Median (25%–75%) (µg/kg) | Maximum (µg/kg) |
|---|---|---|---|---|---|---|---|
| **MA** | **Byproduct 5** | 18 (0) | 0.065 (0.061–0.066) | 0% (0) | | NC† | |
| **MA** | **PFecHS** | 18 (0) | 0.0425 (0.04–0.044) | 0% (0) | | NC† | |

*Estimated Values are the number of sample results flagged by the laboratory as less than the reporting limit but greater than or equal to the method detection limit and the concentration is an approximate value.

†NC: Not Calculated: Summary statistics (median, 25%, 75%, and range) could not be calculated due to no detected samples available.

‡NA: Not Applicable: Summary statistics (median, 25% or 75%) could not be calculated due to the ranks of the method detection limits. Refer to Appendix B, Treatment of Non-Detects (ND) in the Data Set.

**Table D- 25. Summary Statistics of Residential Soil (µg/kg) Results for diPAPs — DE and MA**

| Site | Analyte | # of Samples Collected (Invalid Samples) | Method Detection Limit Median (Range) (µg/kg) | % Detected from Valid Samples (Estimated Values)* | Minimum (µg/kg) | Median (25%–75%) (µg/kg) | Maximum (µg/kg) |
|---|---|---|---|---|---|---|---|
| **DE** | **6:2 diPAP** | 10 (0) | 0.033 (0.031–0.034) | 80% (7) | <0.032 | 0.042 (0.034–0.12) | 2 |
| **DE** | **6:2/8:2 diPAP** | 10 (0) | 0.0715 (0.068–0.074) | 20% (2) | <0.068 | NA (NA–NA)‡ | 0.14 |
| **DE** | **8:2 diPAP** | 10 (0) | 0.018 (0.017–0.019) | 50% (5) | <0.017 | NA (NA–0.086)† | 0.14 |
| **DE** | **10:2 diPAP** | 10 (0) | 0.11 (0.1–0.11) | 0% (0) | | NC‡ | |
| **MA** | **6:2 diPAP** | 18 (0) | 0.033 (0.031–0.034) | 67% (9) | <0.031 | 0.037 (NA–0.15)† | 0.73 |
| **MA** | **6:2/8:2 diPAP** | 18 (0) | 0.0715 (0.067–0.073) | 17% (2) | <0.068 | NA (NA–NA)† | 0.54 |

| Site | Analyte | # of Samples Collected (Invalid Samples) | Method Detection Limit Median (Range) (µg/kg) | % Detected from Valid Samples (Estimated Values)* | Minimum (µg/kg) | Median (25%–75%) (µg/kg) | Maximum (µg/kg) |
|---|---|---|---|---|---|---|---|
| **MA** | **8:2 diPAP** | 18 (0) | 0.018 (0.017–0.019) | 56% (9) | <0.017 | 0.018 (NA–0.086)† | 0.35 |
| **MA** | **10:2 diPAP** | 18 (0) | 0.11 (0.099–0.11) | 0% (0) | | NC‡ | |

*Estimated Values are the number of sample results flagged by the laboratory as less than the reporting limit but greater than or equal to the method detection limit and the concentration is an approximate value.

†NA: Not Applicable: Summary statistics (median, 25% or 75%) could not be calculated due to the ranks of the method detection limits. Refer to Appendix B, Treatment of Non-Detects (ND) in the Data Set.

‡NC: Not Calculated: Summary statistics (median, 25%, 75%, and range) could not be calculated due to no detected samples available.

**Table D- 26. Summary Statistics of Residential Soil (µg/kg) Results for FTOHs — DE and MA**

| Site | Analyte | # of Samples Collected (Invalid Samples) | Method Detection Limit Median (Range) (µg/kg) | % Detected from Valid Samples (Estimated Values)* | Minimum (µg/kg) | Median (25%–75%) (µg/kg) | Maximum (µg/kg) |
|---|---|---|---|---|---|---|---|
| **DE** | **4:2 FTOH** | 10 (0) | 19 (19–20) | 0% (0) | | NC‡ | |
| **DE** | **6:2 FTOH** | 10 (0) | 19 (19–20) | 0% (0) | | NC† | |
| **DE** | **7:2 sFTOH** | 10 (0) | 19 (19–20) | 0% (0) | | NC† | |
| **DE** | **8:2 FTOH** | 10 (0) | 19 (19–20) | 0% (0) | | NC† | |
| **DE** | **10:2 FTOH** | 10 (0) | 19 (19–20) | 0% (0) | | NC† | |
| **MA** | **4:2 FTOH** | 10 (0) | 20 (9.5–98) | 0% (0) | | NC† | |
| **MA** | **6:2 FTOH** | 10 (0) | 20 (9.5–98) | 0% (0) | | NC† | |
| **MA** | **7:2 sFTOH** | 10 (0) | 20 (9.5–98) | 0% (0) | | NC† | |

| Site | Analyte | # of Samples Collected (Invalid Samples) | Method Detection Limit Median (Range) (µg/kg) | % Detected from Valid Samples (Estimated Values)* | Minimum (µg/kg) | Median (25%–75%) (µg/kg) | Maximum (µg/kg) |
|---|---|---|---|---|---|---|---|
| **MA** | **8:2 FTOH** | 10 (0) | 20 (9.5–98) | 0% (0) | | NC† | |
| **MA** | **10:2 FTOH** | 10 (0) | 20 (9.5–98) | 0% (0) | | NC† | |

*Estimated Values are the number of sample results flagged by the laboratory as less than the reporting limit but greater than or equal to the method detection limit and the concentration is an approximate value.

†NC: Not Calculated: Summary statistics (median, 25%, 75%, and range) could not be calculated due to no detected samples available.

**Table D- 27. Summary Statistics of Residential Soil (µg/kg) Results for EOF — DE and MA**

| Site | Analyte | # of Samples Collected (Invalid Samples) | Method Detection Limit Median (Range) (µg/kg) | % Detected from Valid Samples (Estimated Values)* | Minimum (µg/kg) | Median (25%–75%) (µg/kg) | Maximum (µg/kg) |
|---|---|---|---|---|---|---|---|
| **DE** | **EOF** | 10 (0) | 140 (140–150) | 0% (0) | | NC‡ | |
| **MA** | **EOF** | 10 (0) | 140 (140–140) | 0% (0) | | NC† | |

*Estimated Values are the number of sample results flagged by the laboratory as less than the reporting limit but greater than or equal to the method detection limit and the concentration is an approximate value.

†NC: Not Calculated: Summary statistics (median, 25%, 75%, and range) could not be calculated due to no detected samples available.

## Outdoor Air: Low Flow

**Table D- 28. Summary Statistics of Community Outdoor Air: Low Flow (ng/m$^3$) Results for PFAS — DE and MA**

| Site | Analyte | # of Samples Collected (Invalid Samples) | Method Detection Limit Median (Range) (ng/m$^3$) | % Detected from Valid Samples (Estimated Values)* | Minimum (ng/m$^3$) | Median (25%–75%) (ng/m$^3$) | Maximum (ng/m$^3$) |
|---|---|---|---|---|---|---|---|
| **DE** | **PFBA** | 1 (0) | 0.72 (0.72–0.72) | 0% (0) | | NC† | |
| **DE** | **PFPeA** | 1 (0) | 0.091 (0.091–0.091) | 0% (0) | | NC† | |
| **DE** | **PFHxA** | 1 (0) | 0.037 (0.037–0.037) | 100% (0) | | | 0.12‡ |
| **DE** | **PFHpA** | 1 (0) | 0.034 (0.034–0.034) | 0% (0) | | NC† | |
| **DE** | **PFDoA** | 1 (0) | 0.037 (0.037–0.037) | 0% (0) | | NC† | |
| **DE** | **PFTrA** | 1 (0) | 0.032 (0.032–0.032) | 0% (0) | | NC† | |
| **DE** | **PFTA** | 1 (0) | 0.029 (0.029–0.029) | 0% (0) | | NC† | |
| **DE** | **PFBS** | 1 (0) | 0.049 (0.049–0.049) | 0% (0) | | NC† | |
| **DE** | **PFPeS** | 1 (0) | 0.059 (0.059–0.059) | 0% (0) | | NC† | |
| **DE** | **PFHpS** | 1 (0) | 0.041 (0.041–0.041) | 0% (0) | | NC† | |

| Site | Analyte | # of Samples Collected (Invalid Samples) | Method Detection Limit Median (Range) (ng/m$^3$) | % Detected from Valid Samples (Estimated Values)* | Minimum (ng/m$^3$) | Median (25%–75%) (ng/m$^3$) | Maximum (ng/m$^3$) |
|---|---|---|---|---|---|---|---|
| **DE** | **PFNS** | 1 (0) | 0.033 (0.033–0.033) | 0% (0) | | NC† | |
| **DE** | **PFDS** | 1 (0) | 0.028 (0.028–0.028) | 0% (0) | | NC† | |
| **DE** | **PFDoS** | 1 (0) | 0.032 (0.032–0.032) | 0% (0) | | NC† | |
| **DE** | **FtS 4:2** | 1 (0) | 0.018 (0.018–0.018) | 0% (0) | | NC† | |
| **DE** | **FtS 6:2** | 1 (0) | 0.22 (0.22–0.22) | 0% (0) | | NC† | |
| **DE** | **FtS 8:2** | 1 (0) | 0.0084 (0.0084–0.0084) | 0% (0) | | NC† | |
| **DE** | **PFOSA** | 1 (0) | 0.03 (0.03–0.03) | 0% (0) | | NC† | |
| **DE** | **N-MeFOSA** | 1 (0) | 0.024 (0.024–0.024) | 0% (0) | | NC† | |
| **DE** | **N-EtFOSA** | 1 (0) | 0.017 (0.017–0.017) | 0% (0) | | NC† | |
| **DE** | **EtFOSAA** | 1 (0) | 0.037 (0.037–0.037) | 0% (0) | | NC† | |
| **DE** | **N-MeFOSE** | 1 (0) | 0.13 (0.13–0.13) | 0% (0) | | NC† | |

| Site | Analyte | # of Samples Collected (Invalid Samples) | Method Detection Limit Median (Range) ($ng/m^3$) | % Detected from Valid Samples (Estimated Values)* | Minimum ($ng/m^3$) | Median (25%–75%) ($ng/m^3$) | Maximum ($ng/m^3$) |
|---|---|---|---|---|---|---|---|
| **DE** | **N-EtFOSE** | 1 (0) | 0.062 (0.062–0.062) | 0% (0) | | NC† | |
| **DE** | **HFPO-DA** | 1 (0) | 0.023 (0.023–0.023) | 0% (0) | | NC† | |
| **MA** | **PFBA** | 1 (0) | 0.37 (0.37–0.37) | 0% (0) | | NC† | |
| **MA** | **PFPeA** | 1 (0) | 0.047 (0.047–0.047) | 0% (0) | | NC† | |
| **MA** | **PFHxA** | 1 (0) | 0.019 (0.019–0.019) | 0% (0) | | NC† | |
| **MA** | **PFHpA** | 1 (0) | 0.018 (0.018–0.018) | 0% (0) | | NC† | |
| **MA** | **PFDoA** | 1 (0) | 0.019 (0.019–0.019) | 0% (0) | | NC† | |
| **MA** | **PFTrA** | 1 (0) | 0.016 (0.016–0.016) | 0% (0) | | NC† | |
| **MA** | **PFTA** | 1 (0) | 0.015 (0.015–0.015) | 0% (0) | | NC† | |
| **MA** | **PFBS** | 1 (0) | 0.025 (0.025–0.025) | 0% (0) | | NC† | |
| **MA** | **PFPeS** | 1 (0) | 0.03 (0.03–0.03) | 0% (0) | | NC† | |

| Site | Analyte | # of Samples Collected (Invalid Samples) | Method Detection Limit Median (Range) (ng/m³) | % Detected from Valid Samples (Estimated Values)* | Minimum (ng/m³) | Median (25%–75%) (ng/m³) | Maximum (ng/m³) |
|---|---|---|---|---|---|---|---|
| **MA** | **PFHpS** | 1 (0) | 0.021 (0.021–0.021) | 0% (0) | | NC† | |
| **MA** | **PFNS** | 1 (0) | 0.017 (0.017–0.017) | 0% (0) | | NC† | |
| **MA** | **PFDS** | 1 (0) | 0.015 (0.015–0.015) | 0% (0) | | NC† | |
| **MA** | **PFDoS** | 1 (0) | 0.017 (0.017–0.017) | 0% (0) | | NC† | |
| **MA** | **FtS 4:2** | 1 (0) | 0.0095 (0.0095–0.0095) | 0% (0) | | NC† | |
| **MA** | **FtS 6:2** | 1 (1) | | | | § | |
| **MA** | **FtS 8:2** | 1 (0) | 0.0043 (0.0043–0.0043) | 0% (0) | | NC† | |
| **MA** | **PFOSA** | 1 (0) | 0.015 (0.015–0.015) | 0% (0) | | NC† | |
| **MA** | **N-MeFOSA** | 1 (0) | 0.012 (0.012–0.012) | 0% (0) | | NC† | |
| **MA** | **N-EtFOSA** | 1 (0) | 0.0087 (0.0087–0.0087) | 0% (0) | | NC† | |
| **MA** | **EtFOSAA** | 1 (0) | 0.019 (0.019–0.019) | 0% (0) | | NC† | |

| Site | Analyte | # of Samples Collected (Invalid Samples) | Method Detection Limit Median (Range) (ng/m³) | % Detected from Valid Samples (Estimated Values)* | Minimum (ng/m³) | Median (25%–75%) (ng/m³) | Maximum (ng/m³) |
|---|---|---|---|---|---|---|---|
| **MA** | **N-MeFOSE** | 1 (0) | 0.066 (0.066–0.066) | 0% (0) | | NC† | |
| **MA** | **N-EtFOSE** | 1 (0) | 0.032 (0.032–0.032) | 0% (0) | | NC† | |
| **MA** | **HFPO-DA** | 1 (0) | 0.012 (0.012–0.012) | 0% (0) | | NC† | |

*Estimated Values are the number of sample results flagged by the laboratory as less than the reporting limit but greater than or equal to the method detection limit and the concentration is an approximate value.

†NC: Not Calculated: Summary statistics (median, 25%, 75%, and range) could not be calculated due to no detected samples available.

‡A single sample was collected and was detected. The result is stated as a maximum.

§Summary statistics (median, 25%, 75%, and range) could not be calculated because the sample was invalidated during data analysis.

**Table D- 29. Summary Statistics of Community Outdoor Air: Low Flow (ng/m³) Results for diPAPs — DE and MA**

| Site | Analyte | # of Samples Collected (Invalid Samples) | Method Detection Limit Median (Range) (ng/m³) | % Detected from Valid Samples (Estimated Values)* | Minimum (ng/m³) | Median (25%–75%) (ng/m³) | Maximum (ng/m³) |
|---|---|---|---|---|---|---|---|
| **DE** | **6:2 diPAP** | 1 (0) | 0.013 (0.013–0.013) | 0% (0) | | NC† | |
| **DE** | **6:2/8:2 diPAP** | 1 (0) | 0.021 (0.021–0.021) | 0% (0) | | NC† | |

| Site | Analyte | # of Samples Collected (Invalid Samples) | Method Detection Limit Median (Range) (ng/m$^3$) | % Detected from Valid Samples (Estimated Values)* | Minimum (ng/m$^3$) | Median (25%–75%) (ng/m$^3$) | Maximum (ng/m$^3$) |
|---|---|---|---|---|---|---|---|
| **DE** | **8:2 diPAP** | 1 (0) | 0.013 (0.013–0.013) | 0% (0) | | NC† | |
| **DE** | **10:2 diPAP** | 1 (0) | 0.079 (0.079–0.079) | 0% (0) | | NC† | |
| **MA** | **6:2 diPAP** | 1 (1) | | | | ‡ | |
| **MA** | **6:2/8:2 diPAP** | 1 (0) | 0.011 (0.011–0.011) | 0% (0) | | NC† | |
| **MA** | **8:2 diPAP** | 1 (0) | 0.0068 (0.0068–0.0068) | 0% (0) | | NC† | |
| **MA** | **10:2 diPAP** | 1 (0) | 0.041 (0.041–0.041) | 0% (0) | | NC† | |

*Estimated Values are the number of sample results flagged by the laboratory as less than the reporting limit but greater than or equal to the method detection limit and the concentration is an approximate value.

†NC: Not Calculated: Summary statistics (median, 25%, 75%, and range) could not be calculated due to no detected samples available.

‡Summary statistics (median, 25%, 75%, and range) could not be calculated because the sample was invalidated during data analysis.

**Table D- 30. Summary Statistics of Community Outdoor Air (ng/m³): Results for FTOHs — DE and MA**

| Site | Analyte | # of Samples Collected (Invalid Samples) | Method Detection Limit Median (Range) (ng/m³) | % Detected from Valid Samples (Estimated Values)* | Minimum (ng/m³) | Median (25%–75%) (ng/m³) | Maximum (ng/m³) |
|---|---|---|---|---|---|---|---|
| **DE** | **4:2 FTOH** | 1 (0) | 0.13 (0.13–0.13) | 0% (0) | | NC† | |
| **DE** | **6:2 FTOH** | 1 (0) | 0.33 (0.33–0.33) | 100% (0) | | | 6.7‡ |
| **DE** | **8:2 FTOH** | 1 (0) | 0.26 (0.26–0.26) | 0% (0) | | NC† | |
| **DE** | **10:2 FTOH** | 1 (0) | 0.2 (0.2–0.2) | 0% (0) | | NC† | |
| **MA** | **4:2 FTOH** | 1 (0) | 0.13 (0.13–0.13) | 0% (0) | | NC† | |
| **MA** | **6:2 FTOH** | 1 (0) | 0.33 (0.33–0.33) | 100% (1) | | | 0.36‡ |
| **MA** | **8:2 FTOH** | 1 (0) | 0.26 (0.26–0.26) | 0% (0) | | NC† | |
| **MA** | **10:2 FTOH** | 1 (0) | 0.2 (0.2–0.2) | 0% (0) | | NC† | |

*Estimated Values are the number of sample results flagged by the laboratory as less than the reporting limit but greater than or equal to the method detection limit and the concentration is an approximate value.

†NC: Not Calculated: Summary statistics (median, 25%, 75%, and range) could not be calculated due to no detected samples available.

‡A single sample was collected and was detected. The result is stated as a maximum.

## Outdoor Air: Higher Flow

**Table D- 31. Summary Statistics of Community Outdoor Air: Higher Flow (ng/m³) Results for PFAS — DE and MA**

| Site | Analyte | # of Samples Collected (Invalid Samples) | Method Detection Limit Median (Range) (ng/m³) | % Detected from Valid Samples (Estimated Values)* | Minimum (ng/m³) | Median (25%–75%) (ng/m³) | Maximum (ng/m³) |
|---|---|---|---|---|---|---|---|
| **DE** | **PFBA** | 1 (0) | 0.081 (0.081–0.081) | 0% (0) | | NC† | |
| **DE** | **PFPeA** | 1 (0) | 0.01 (0.01–0.01) | 100% (0) | | | 0.026‡ |
| **DE** | **PFHxA** | 1 (0) | 0.0041 (0.0041–0.0041) | 100% (0) | | | 0.061‡ |
| **DE** | **PFHpA** | 1 (0) | 0.0039 (0.0039–0.0039) | 100% (1) | | | 0.011‡ |
| **DE** | **PFDoA** | 1 (0) | 0.0041 (0.0041–0.0041) | 0% (0) | | NC† | |
| **DE** | **PFTrA** | 1 (0) | 0.0036 (0.0036–0.0036) | 0% (0) | | NC† | |
| **DE** | **PFTA** | 1 (0) | 0.0033 (0.0033–0.0033) | 0% (0) | | NC† | |
| **DE** | **PFBS** | 1 (0) | 0.0055 (0.0055–0.0055) | 0% (0) | | NC† | |
| **DE** | **PFPeS** | 1 (0) | 0.0066 (0.0066–0.0066) | 0% (0) | | NC† | |
| **DE** | **PFHpS** | 1 (0) | 0.0046 (0.0046–0.0046) | 0% (0) | | NC† | |

| Site | Analyte | # of Samples Collected (Invalid Samples) | Method Detection Limit Median (Range) (ng/m$^3$) | % Detected from Valid Samples (Estimated Values)* | Minimum (ng/m$^3$) | Median (25%–75%) (ng/m$^3$) | Maximum (ng/m$^3$) |
|---|---|---|---|---|---|---|---|
| **DE** | **PFNS** | 1 (0) | 0.0037 (0.0037–0.0037) | 0% (0) | | NC† | |
| **DE** | **PFDS** | 1 (0) | 0.0032 (0.0032–0.0032) | 0% (0) | | NC† | |
| **DE** | **PFDoS** | 1 (0) | 0.0036 (0.0036–0.0036) | 0% (0) | | NC† | |
| **DE** | **FtS 4:2** | 1 (0) | 0.0021 (0.0021–0.0021) | 0% (0) | | NC† | |
| **DE** | **FtS 6:2** | 1 (0) | 0.025 (0.025–0.025) | 0% (0) | | NC† | |
| **DE** | **FtS 8:2** | 1 (0) | 0.00095 (0.00095–0.00095) | 0% (0) | | NC† | |
| **DE** | **PFOSA** | 1 (0) | 0.0034 (0.0034–0.0034) | 0% (0) | | NC† | |
| **DE** | **N-MeFOSA** | 1 (0) | 0.0027 (0.0027–0.0027) | 0% (0) | | NC† | |
| **DE** | **N-EtFOSA** | 1 (0) | 0.0019 (0.0019–0.0019) | 0% (0) | | NC† | |
| **DE** | **EtFOSAA** | 1 (0) | 0.0041 (0.0041–0.0041) | 0% (0) | | NC† | |

| Site | Analyte | # of Samples Collected (Invalid Samples) | Method Detection Limit Median (Range) (ng/m³) | % Detected from Valid Samples (Estimated Values)* | Minimum (ng/m³) | Median (25%–75%) (ng/m³) | Maximum (ng/m³) |
|---|---|---|---|---|---|---|---|
| **DE** | **N-MeFOSE** | 1 (0) | 0.014 (0.014–0.014) | 0% (0) | | NC† | |
| **DE** | **N-EtFOSE** | 1 (0) | 0.0069 (0.0069–0.0069) | 0% (0) | | NC† | |
| **DE** | **HFPO-DA** | 1 (0) | 0.0026 (0.0026–0.0026) | 0% (0) | | NC† | |
| **MA** | **PFBA** | 1 (0) | 0.11 (0.11–0.11) | 0% (0) | | NC† | |
| **MA** | **PFPeA** | 1 (0) | 0.014 (0.014–0.014) | 0% (0) | | NC† | |
| **MA** | **PFHxA** | 1 (0) | 0.0055 (0.0055–0.0055) | 0% (0) | | NC† | |
| **MA** | **PFHpA** | 1 (0) | 0.0051 (0.0051–0.0051) | 0% (0) | | NC† | |
| **MA** | **PFDoA** | 1 (0) | 0.0055 (0.0055–0.0055) | 0% (0) | | NC† | |
| **MA** | **PFTrA** | 1 (0) | 0.0047 (0.0047–0.0047) | 0% (0) | | NC† | |
| **MA** | **PFTA** | 1 (0) | 0.0044 (0.0044–0.0044) | 0% (0) | | NC† | |
| **MA** | **PFBS** | 1 (0) | 0.0073 (0.0073–0.0073) | 0% (0) | | NC† | |

| Site | Analyte | # of Samples Collected (Invalid Samples) | Method Detection Limit Median (Range) (ng/m$^3$) | % Detected from Valid Samples (Estimated Values)* | Minimum (ng/m$^3$) | Median (25%–75%) (ng/m$^3$) | Maximum (ng/m$^3$) |
|---|---|---|---|---|---|---|---|
| **MA** | **PFPeS** | 1 (0) | 0.0088 (0.0088–0.0088) | 0% (0) | | NC† | |
| **MA** | **PFHpS** | 1 (0) | 0.0061 (0.0061–0.0061) | 0% (0) | | NC† | |
| **MA** | **PFNS** | 1 (0) | 0.0049 (0.0049–0.0049) | 0% (0) | | NC† | |
| **MA** | **PFDS** | 1 (0) | 0.0042 (0.0042–0.0042) | 0% (0) | | NC† | |
| **MA** | **PFDoS** | 1 (0) | 0.0048 (0.0048–0.0048) | 0% (0) | | NC† | |
| **MA** | **FtS 4:2** | 1 (0) | 0.0027 (0.0027–0.0027) | 0% (0) | | NC† | |
| **MA** | **FtS 6:2** | 1 (0) | 0.033 (0.033–0.033) | 0% (0) | | NC† | |
| **MA** | **FtS 8:2** | 1 (0) | 0.0013 (0.0013–0.0013) | 0% (0) | | NC† | |
| **MA** | **PFOSA** | 1 (0) | 0.0045 (0.0045–0.0045) | 0% (0) | | NC† | |
| **MA** | **N-MeFOSA** | 1 (0) | 0.0035 (0.0035–0.0035) | 0% (0) | | NC† | |

| Site | Analyte | # of Samples Collected (Invalid Samples) | Method Detection Limit Median (Range) ($ng/m^3$) | % Detected from Valid Samples (Estimated Values)* | Minimum ($ng/m^3$) | Median (25%–75%) ($ng/m^3$) | Maximum ($ng/m^3$) |
|---|---|---|---|---|---|---|---|
| **MA** | **N-EtFOSA** | 1 (0) | 0.0025 (0.0025–0.0025) | 0% (0) | | NC† | |
| **MA** | **EtFOSAA** | 1 (0) | 0.0055 (0.0055–0.0055) | 0% (0) | | NC† | |
| **MA** | **N-MeFOSE** | 1 (0) | 0.019 (0.019–0.019) | 0% (0) | | NC† | |
| **MA** | **N-EtFOSE** | 1 (0) | 0.0092 (0.0092–0.0092) | 0% (0) | | NC† | |
| **MA** | **HFPO-DA** | 1 (0) | 0.0035 (0.0035–0.0035) | 0% (0) | | NC† | |

*Estimated Values are the number of sample results flagged by the laboratory as less than the reporting limit but greater than or equal to the method detection limit and the concentration is an approximate value.

†NC: Not Calculated: Summary statistics (median, 25%, 75%, and range) could not be calculated due to no detected samples available.

‡A single sample was collected and was detected. The result is stated as a maximum.

**Table D- 32. Summary Statistics of Community Outdoor Air: Higher Flow (ng/m$^3$) Results for diPAPs — DE and MA**

| Site | Analyte | # of Samples Collected (Invalid Samples) | Method Detection Limit Median (Range) (ng/m$^3$) | % Detected from Valid Samples (Estimated Values)* | Minimum (ng/m$^3$) | Median (25%–75%) (ng/m$^3$) | Maximum (ng/m$^3$) |
|---|---|---|---|---|---|---|---|
| DE | 6:2 diPAP | 1 (0) | 0.0015 (0.0015–0.0015) | 0% (0) | | NC† | |
| DE | 6:2/8:2 diPAP | 1 (0) | 0.0023 (0.0023–0.0023) | 0% (0) | | NC† | |
| DE | 8:2 diPAP | 1 (0) | 0.0015 (0.0015–0.0015) | 0% (0) | | NC† | |
| DE | 10:2 diPAP | 1 (0) | 0.0089 (0.0089–0.0089) | 0% (0) | | NC† | |
| MA | 6:2 diPAP | 1 (1) | | | | ‡ | |
| MA | 6:2/8:2 diPAP | 1 (0) | 0.0031 (0.0031–0.0031) | 0% (0) | | NC† | |
| MA | 8:2 diPAP | 1 (0) | 0.002 (0.002–0.002) | 0% (0) | | NC† | |
| MA | 10:2 diPAP | 1 (0) | 0.012 (0.012–0.012) | 0% (0) | | NC† | |

*Estimated Values are the number of sample results flagged by the laboratory as less than the reporting limit but greater than or equal to the method detection limit and the concentration is an approximate value.

†NC: Not Calculated: Summary statistics (median, 25%, 75%, and range) could not be calculated due to no detected samples available.

‡Summary statistics (median, 25%, 75%, and range) could not be calculated because the sample was invalidated during data analysis.

## Produce

**Table D- 33. Summary Statistics of Community Produce (µg/kg) Results for PFAS — DE and MA**

| Site | Analyte | # of Samples Collected (Invalid Samples) | Method Detection Limit Median (Range) (µg/kg) | % Detected from Valid Samples (Estimated Values)* | Minimum (µg/kg) | Median (25%–75%) (µg/kg) | Maximum (µg/kg) |
|---|---|---|---|---|---|---|---|
| **DE** | **PFBA** | 6 (0) | 0.079 (0.079–0.08) | 50% (1) | <0.079 | NA (NA–0.23)† | 0.48 |
| **DE** | **PFPeA** | 6 (0) | 0.02 (0.02–0.02) | 67% (1) | <0.02 | 0.022 (NA–0.13)† | 0.19 |
| **DE** | **PFHxA** | 6 (0) | 0.02 (0.02–0.02) | 33% (0) | <0.02 | NA (NA–0.14)† | 0.2 |
| **DE** | **PFHpA** | 6 (0) | 0.02 (0.02–0.02) | 33% (2) | <0.02 | NA (NA–0.021)† | 0.042 |
| **DE** | **PFBS** | 6 (0) | 0.04 (0.04–0.04) | 0% (0) | | NC‡ | |
| **DE** | **PFPeS** | 6 (0) | 0.02 (0.02–0.02) | 0% (0) | | NC‡ | |
| **DE** | **PFHpS** | 6 (0) | 0.02 (0.02–0.02) | 0% (0) | | NC‡ | |
| **DE** | **HFPO-DA** | 6 (0) | 0.099 (0.099–0.1) | 0% (0) | | NC‡ | |
| **DE** | **9Cl-PF3ONS** | 6 (0) | 0.02 (0.02–0.02) | 0% (0) | | NC‡ | |
| **DE** | **11Cl-PF3OUdS** | 6 (0) | 0.02 (0.02–0.02) | 0% (0) | | NC‡ | |
| **DE** | **PFDoA§** | 6 (0) | 0.02 (0.02–0.02) | 0% (0) | | NC‡ | |
| **DE** | **PFTrA§** | 6 (0) | 0.02 (0.02–0.02) | 0% (0) | | NC‡ | |

| Site | Analyte | # of Samples Collected (Invalid Samples) | Method Detection Limit Median (Range) (µg/kg) | % Detected from Valid Samples (Estimated Values)* | Minimum (µg/kg) | Median (25%–75%) (µg/kg) | Maximum (µg/kg) |
|---|---|---|---|---|---|---|---|
| **DE** | **PFTA§** | 6 (0) | 0.02 (0.02–0.02) | 0% (0) | | NC‡ | |
| **DE** | **PFNS§** | 6 (0) | 0.02 (0.02–0.02) | 0% (0) | | NC‡ | |
| **DE** | **PFDS§** | 6 (0) | 0.02 (0.02–0.02) | 0% (0) | | NC‡ | |
| **DE** | **PFDoS§** | 6 (0) | 0.02 (0.02–0.02) | 0% (0) | | NC‡ | |
| **DE** | **FtS 4:2§** | 6 (0) | 0.06 (0.059–0.06) | 17% (0) | <0.059 | NA (NA–NA)† | 0.6 |
| **DE** | **FtS 6:2§** | 6 (0) | 0.06 (0.059–0.06) | 0% (0) | | NC‡ | |
| **DE** | **FtS 8:2§** | 6 (0) | 0.06 (0.059–0.06) | 0% (0) | | NC‡ | |
| **DE** | **PFOSA§** | 6 (0) | 0.02 (0.02–0.02) | 0% (0) | | NC‡ | |
| **DE** | **N-MeFOSA§** | 6 (0) | 0.05 (0.049–0.05) | 0% (0) | | NC‡ | |
| **DE** | **N-EtFOSA§** | 6 (0) | 0.05 (0.049–0.05) | 0% (0) | | NC‡ | |
| **DE** | **EtFOSAA§** | 6 (0) | 0.02 (0.02–0.02) | 0% (0) | | NC‡ | |
| **DE** | **N-MeFOSE§** | 6 (0) | 0.05 (0.049–0.05) | 0% (0) | | NC‡ | |
| **DE** | **N-EtFOSE§** | 6 (0) | 0.05 (0.049–0.05) | 0% (0) | | NC‡ | |

| Site | Analyte | # of Samples Collected (Invalid Samples) | Method Detection Limit Median (Range) (µg/kg) | % Detected from Valid Samples (Estimated Values)* | Minimum (µg/kg) | Median (25%–75%) (µg/kg) | Maximum (µg/kg) |
|---|---|---|---|---|---|---|---|
| **DE** | **ADONA§** | 6 (0) | 0.02 (0.02–0.02) | 0% (0) | | NC‡ | |
| **MA** | **PFBA** | 9 (2) | 0.08 (0.079–0.08) | 0% (0) | | NC‡ | |
| **MA** | **PFPeA** | 9 (2) | 0.02 (0.02–0.02) | 43% (1) | <0.02 | NA (NA–0.06)† | 0.21 |
| **MA** | **PFHxA** | 9 (2) | 0.02 (0.02–0.02) | 29% (2) | <0.02 | NA (NA–0.043)† | 0.049 |
| **MA** | **PFHpA** | 9 (2) | 0.02 (0.02–0.02) | 0% (0) | | NC‡ | |
| **MA** | **PFBS** | 9 (2) | 0.04 (0.039–0.04) | 0% (0) | | NC‡ | |
| **MA** | **PFPeS** | 9 (2) | 0.02 (0.02–0.02) | 0% (0) | | NC‡ | |
| **MA** | **PFHpS** | 9 (2) | 0.02 (0.02–0.02) | 0% (0) | | NC‡ | |
| **MA** | **HFPO-DA** | 9 (2) | 0.1 (0.099–0.1) | 14% (0) | <0.099 | NA (NA–NA)† | 0.24 |
| **MA** | **9Cl-PF3ONS** | 9 (2) | 0.02 (0.02–0.02) | 0% (0) | | NC‡ | |
| **MA** | **11Cl-PF3OUdS** | 9 (2) | 0.02 (0.02–0.02) | 0% (0) | | NC‡ | |
| **MA** | **PFDoA§** | 9 (2) | 0.02 (0.02–0.02) | 0% (0) | | NC‡ | |
| **MA** | **PFTrA§** | 9 (2) | 0.02 (0.02–0.02) | 0% (0) | | NC‡ | |

| Site | Analyte | # of Samples Collected (Invalid Samples) | Method Detection Limit Median (Range) (µg/kg) | % Detected from Valid Samples (Estimated Values)* | Minimum (µg/kg) | Median (25%–75%) (µg/kg) | Maximum (µg/kg) |
|---|---|---|---|---|---|---|---|
| **MA** | **PFTA§** | 9 (2) | 0.02 (0.02–0.02) | 0% (0) | | NC‡ | |
| **MA** | **PFNS§** | 9 (2) | 0.02 (0.02–0.02) | 0% (0) | | NC‡ | |
| **MA** | **PFDS§** | 9 (2) | 0.02 (0.02–0.02) | 0% (0) | | NC‡ | |
| **MA** | **PFDoS§** | 9 (2) | 0.02 (0.02–0.02) | 0% (0) | | NC‡ | |
| **MA** | **FtS 4:2§** | 9 (2) | 0.06 (0.059–0.06) | 14% (1) | <0.059 | NA (NA–NA)† | 0.15 |
| **MA** | **FtS 6:2§** | 9 (2) | 0.06 (0.059–0.06) | 0% (0) | | NC‡ | |
| **MA** | **FtS 8:2§** | 9 (2) | 0.06 (0.059–0.06) | 0% (0) | | NC‡ | |
| **MA** | **PFOSA§** | 9 (2) | 0.02 (0.02–0.02) | 0% (0) | | NC‡ | |
| **MA** | **N-MeFOSA§** | 9 (2) | 0.05 (0.049–0.05) | 0% (0) | | NC‡ | |
| **MA** | **N-EtFOSA§** | 9 (2) | 0.05 (0.049–0.05) | 0% (0) | | NC‡ | |
| **MA** | **EtFOSAA§** | 9 (2) | 0.02 (0.02–0.02) | 0% (0) | | NC‡ | |
| **MA** | **N-MeFOSE§** | 9 (2) | 0.05 (0.049–0.05) | 0% (0) | | NC‡ | |
| **MA** | **N-EtFOSE§** | 9 (2) | 0.05 (0.049–0.05) | 0% (0) | | NC‡ | |

| Site | Analyte | # of Samples Collected (Invalid Samples) | Method Detection Limit Median (Range) (µg/kg) | % Detected from Valid Samples (Estimated Values)* | Minimum (µg/kg) | Median (25%–75%) (µg/kg) | Maximum (µg/kg) |
|---|---|---|---|---|---|---|---|
| **MA** | **ADONA** § | 9 (2) | 0.02 (0.02–0.02) | 0% (0) | | NC‡ | |

*Estimated Values are the number of sample results flagged by the laboratory as less than the reporting limit but greater than or equal to the method detection limit and the concentration is an approximate value.

†NA: Not Applicable: Summary statistics (median, 25% or 75%) could not be calculated due to the ranks of the method detection limits. Refer to Appendix B, Treatment of Non-Detects (ND) in the Data Set.

‡NC: Not Calculated: Summary statistics (median, 25%, 75%, and range) could not be calculated due to no detected samples available.

§ Additional PFAS Analytes in produce – refer to Appendix A, Analytes and Method Selection.

**Table D- 34. Summary Statistics of Community Produce (µg/kg) Results for FTOHs — DE and MA**

| Site | Analyte | # of Samples Collected (Invalid Samples) | Method Detection Limit Median (Range) (µg/kg) | % Detected from Valid Samples (Estimated Values)* | Minimum (µg/kg) | Median (25%–75%) (µg/kg) | Maximum (µg/kg) |
|---|---|---|---|---|---|---|---|
| **DE** | **4:2 FTOH**† | 6 (0) | 99 (99–100) | 0% (0) | | NC‡ | |
| **DE** | **6:2 FTOH**† | 6 (0) | 99 (99–100) | 0% (0) | | NC‡ | |
| **DE** | **7:2 sFTOH**† | 6 (0) | 99 (99–100) | 0% (0) | | NC‡ | |
| **DE** | **8:2 FTOH**† | 6 (0) | 99 (99–100) | 0% (0) | | NC‡ | |
| **DE** | **10:2 FTOH**† | 6 (0) | 99 (99–100) | 0% (0) | | NC‡ | |

| Site | Analyte | # of Samples Collected (Invalid Samples) | Method Detection Limit Median (Range) (µg/kg) | % Detected from Valid Samples (Estimated Values)* | Minimum (µg/kg) | Median (25%–75%) (µg/kg) | Maximum (µg/kg) |
|---|---|---|---|---|---|---|---|
| **MA** | **4:2 FTOH†** | 7 (2) | 99 (20–100) | 0% (0) | | NC‡ | |
| **MA** | **6:2 FTOH†** | 7 (2) | 99 (20–100) | 0% (0) | | NC‡ | |
| **MA** | **7:2 sFTOH†** | 7 (2) | 99 (20–100) | 0% (0) | | NC‡ | |
| **MA** | **8:2 FTOH†** | 7 (2) | 99 (20–100) | 0% (0) | | NC‡ | |
| **MA** | **10:2 FTOH†** | 7 (2) | 99 (20–100) | 0% (0) | | NC‡ | |

*Estimated Values are the number of sample results flagged by the laboratory as less than the reporting limit but greater than or equal to the method detection limit and the concentration is an approximate value.

†Additional PFAS Analytes in produce – refer to Appendix A, Analytes and Method Selection.

‡NC: Not Calculated: Summary statistics (median, 25%, 75%, and range) could not be calculated due to no detected samples available.

**Table D- 35. Summary Statistics of Community Produce (µg/kg) Results for EOF — DE and MA**

| Site | Analyte | # of Samples Collected (Invalid Samples) | Method Detection Limit Median (Range) (µg/kg) | % Detected from Valid Samples (Estimated Values)* | Minimum (µg/kg) | Median (25%–75%) (µg/kg) | Maximum (µg/kg) |
|---|---|---|---|---|---|---|---|
| **DE** | **EOF†** | 6 (0) | 140 (130–140) | 0% (0) | | NC‡ | |
| **MA** | **EOF†** | 7 (2) | 140 (130–140) | 0% (0) | | NC‡ | |

| Site | Analyte | # of Samples Collected (Invalid Samples) | Method Detection Limit Median (Range) (µg/kg) | % Detected from Valid Samples (Estimated Values)* | Minimum (µg/kg) | Median (25%–75%) (µg/kg) | Maximum (µg/kg) |
|---|---|---|---|---|---|---|---|

*Estimated Values are the number of sample results flagged by the laboratory as less than the reporting limit but greater than or equal to the method detection limit and the concentration is an approximate value.

†Additional PFAS Analytes in produce – refer to Appendix A, Analytes and Method Selection.

‡NC: Not Calculated: Summary statistics (median, 25%, 75%, and range) could not be calculated due to no detected samples available.

## Total Oxidizable Precursor (TOP) Analysis

**Table D- 36: TOP Analysis Pre-Treatment and Post-Treatment Results (µg/kg) – DE and MA**

| Analyte | DE Pre-Treatment TOP Median | DE Post-Treatment TOP Median | MA Pre-Treatment TOP Median | MA Post-Treatment TOP Median |
|---|---|---|---|---|
| PFHxS | NA | NA | 11 | 8.6 |
| PFOS | NA | NA | 36 | 27 |
| PFOA | NA | NA | 9.7 | 58 |
| PFNA | NA | NA | 3.8 | 25 |
| PFDA | NA | NA | 2.4 | 9 |
| PFUnA | NA | NA | NA | 6.2 |
| MeFOSAA | NA | NA | NA | NA |
| PFPrA | NA | NA | NA | 84 |
| PFBA | NA | NA | 5.5 | 140 |
| PFPeA | NA | NA | 4.1 | 140 |
| PFHxA | NA | NA | 8.2 | 68 |
| PFHpA | NA | NA | 4.3 | 66 |

| | | | | |
|---|---|---|---|---|
| PFDoA | NA | NA | NA | 2.7 |
| PFTrA | NA | NA | NA | 2 |
| PFTA | NA | NA | NA | NA |
| PFHxDA | NA | NA | NA | NA |
| PFODA | NA | NA | NA | NA |
| PFPrS | NA | NA | NA | NA |
| PFBS | NA | NA | 43 | 43 |
| PFPeS | NA | NA | NA | NA |
| PFHpS | NA | NA | NA | NA |
| PFNS | NA | NA | NA | NA |
| PFDS | NA | NA | NA | NA |
| PFDoS | NA | NA | NA | NA |
| 6:2 diPAP | NA | NA | 100 | 10 |
| 6:2/8:2 diPAP | NA | NA | 9.8 | NA |
| 8:2 diPAP | NA | NA | 9.4 | 2.7 |
| 10:2 diPAP | NA | NA | NA | NA |
| 3:3 FTCA | NA | NA | NA | NA |
| 5:3 FTCA | NA | NA | NA | NA |
| 6:2 FTCA | NA | NA | NA | NA |
| 7:3 FTCA | NA | NA | NA | NA |
| 8:2 FTCA | NA | NA | NA | NA |
| 10:2 FTCA | NA | NA | NA | NA |
| FtS 4:2 | NA | NA | NA | NA |
| FtS 6:2 | NA | NA | 1.9 | NA |
| FtS 8:2 | NA | NA | NA | NA |
| FtS 10:2 | NA | NA | NA | NA |
| PFOSA | NA | NA | NA | NA |

| | | | | |
|---|---|---|---|---|
| N-MeFOSA | NA | NA | NA | NA |
| N-EtFOSA | NA | NA | NA | NA |
| EtFOSAA | NA | NA | 3.1 | NA |
| N-MeFOSE | NA | NA | 30 | NA |
| N-EtFOSE | NA | NA | 14 | NA |
| PFMOAA | NA | NA | NA | NA |
| PFMPA | NA | NA | NA | NA |
| PMPA | NA | NA | NA | NA |
| PFMBA | NA | NA | NA | NA |
| PEPA | NA | NA | NA | NA |
| HFPO-DA | NA | NA | NA | NA |
| PFPE-1 | NA | NA | NA | NA |
| R-EVE | NA | NA | NA | NA |
| NFDHA | NA | NA | NA | NA |
| PFO2HxA | NA | NA | NA | NA |
| PFO3OA | NA | NA | NA | NA |
| PFO4DA | NA | NA | NA | NA |
| PFO5DA | NA | NA | NA | NA |
| Byproduct 4 | NA | NA | NA | NA |
| PFEESA | NA | NA | NA | NA |
| 9Cl-PF3ONS | NA | NA | NA | NA |
| 11Cl-PF3OUdS | NA | NA | NA | NA |
| NVHOS | NA | NA | NA | NA |
| ADONA | NA | NA | NA | NA |
| Hydro-EVE | NA | NA | NA | NA |
| Byproduct 5 | NA | NA | NA | NA |
| PFecHS | NA | NA | NA | NA |

For DE, n = 2. For MA, n = 11.
NA: Not Applicable: Median could not be calculated due to the ranks of the method detection limits. Refer to Appendix B, Treatment of Non-Detects (ND) in the Data Set.