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Subject: PFAS Exposure Assessment Test Results

Dear Jane Smith,

Thank you for being a part of the Centers for Disease Control and Prevention (CDC) and the Agency for Toxic Substances and Disease Registry (ATSDR) exposure assessment of per- and polyfluoroalkyl substances (PFAS). We are grateful for the time and effort you gave to this project.

This letter provides your test results along with how they compare to others in your community and in the United States. Research to better understand the health effects associated with PFAS exposure is ongoing, because scientists are not currently certain of how PFAS levels in the blood can affect a person's health. However, there are steps you can take to reduce your exposure that are described below in this letter.

This exposure assessment assesses people's past exposures to PFAS. The Air Force has taken action to reduce levels of PFAS in drinking water at homes near Eielson Air Force Base. Based on the information available to ATSDR, the alternative drinking water provided by the Air Force (whether through filters, bottled water, or tanks) currently meets all federal and state guidelines for PFAS. ATSDR recommends that community members continue to use these alternative water sources. The long-term solution is to connect your home to piped water from a source that meets all federal and state drinking water guidelines for PFAS.

We understand that you may have questions about your test results. Feel free to share these results with your doctor or reach out to the ATSDR exposure assessment team (Rhonda Kaetzel, PhD, DABT at 206-553-0530). In light of the ongoing pandemic of respiratory illness called COVID-19, we acknowledge this might be a difficult time to reach your health care provider. If you decide to engage the health care system, we strongly urge you to follow COVID-19 prevention guidance put forward by your clinic and by public health agencies. Many facilities and public health agencies advise calling your health care provider first or using telemedicine mechanisms to discuss non-urgent, non-COVID-19 issues. Such guidance often strongly discourages in-person visits to healthcare facilities because providers are often dealing with large numbers of COVID-19 patients, and presence in such facilities may pose a risk of infection.

The remainder of this letter summarizes your blood and urine sample results. As a reminder, only 10% of urine samples collected from study participants have been analyzed at this time. If your results are not provided in this letter, they were not randomly selected as part of these 10% of urine samples. Should ATSDR decide to analyze all urine samples based on the results of the initial 10% analysis, ATSDR will mail you a summary of your results at a later date.

What Do These Results Mean to Your Health?

These results tell you how much PFAS are currently present in your body from all sources combined, such as water, food, and other environmental sources. You can compare your results with others from your community and also with people across the United States.

A large number of studies have examined possible relationships between levels of PFAS in blood and harmful health effects in people. However, not all of these studies involved the same groups of people, the same type of exposure, or the same PFAS. These different studies therefore reported a variety of health outcomes. Research involving humans suggests that high levels of certain PFAS may lead to the following:

- Increased cholesterol levels
- Changes in liver enzymes
- Decreased vaccine response in children
- Increased risk of high blood pressure or pre-eclampsia in pregnant women
- Small decreases in infant birth weights
- Increased risk of kidney or testicular cancer

At this time, scientists are still learning about the health effects of exposures to mixtures of different PFAS.

One way to learn about whether PFAS will harm people is to do studies on lab animals.

- Most of these studies have tested doses of PFAS that are higher than levels found in the environment.
- These animal studies have found that PFAS can cause damage to the liver and the immune system.
- PFAS have also caused birth defects, delayed development, and newborn deaths in lab animals.

Humans and animals react differently to PFAS, and not all effects observed in animals may occur in humans. Scientists have ways to estimate how the exposure and effects in animals compare to what they would be in humans.

It is important to remember that the likelihood of adverse health effects depends on several factors, such as the concentration of PFAS, as well as the frequency and duration of exposure. More frequent exposure can increase risk. Higher concentration and length of time exposed can lead to increased risk.

Your participation in this study, when combined with others, may eventually help us better understand any potential health risks from PFAS exposure in the future.

The Results of Your Blood Test

Table 1 provides a list of all the specific PFAS that we measured in your blood. The table also lists the acronyms for the PFAS.

Table 2 shows the concentration of specific PFAS we found in your blood. Your result is in units of micrograms per liter ($\mu\text{g/L}$). One $\mu\text{g/L}$ equals one part per billion, equivalent to about one drop of ink in a large tanker ship. The table also compares your PFAS levels to people in the United States, namely, the geometric mean and 95th percentile values, when available.

Table 3 shows your results compared to results from other members in your community who also participated in this assessment. These are preliminary results for your community. Our final report will include a more detailed analysis.

The Results of Your Urine Test

Table 4 provides a list of all the specific PFAS that we measured in your urine. The table also lists the acronyms for the PFAS.

Table 5 shows the concentration of specific PFAS we found in your urine. Your result is in units of $\mu\text{g/L}$. The table also shows range of PFAS levels for people in the United States, namely, the geometric mean and 95th percentile values, when available.

Table 6 shows your results compared to results from other members in your community who also participated in this assessment. These are preliminary results for your community. Our final report will include a more detailed analysis.

Suggestions for Interpreting the Results

The tables in this letter provide a lot of information. To fully understand all this information, it helps to know about a survey called NHANES (the National Health and Nutrition Examination Survey).

Every year, the CDC examines about 5,000 people from across the country. As part of the survey, CDC takes blood and urine samples and tests them for chemicals including PFAS. The NHANES blood and urine tests for PFAS come from a representative sample of members of the U.S. population.

Having a representative sample of the U.S. population means NHANES helps CDC estimate, for example, the levels of PFAS in the U.S. population. That is how we can compare the results of your blood and urine tests to reference values for people in the United States.

Now, let's talk about interpreting your results, presented in Tables 2, 3, 5, and 6. The diagrams below should help you understand the data we are giving you.

This column lists each different PFAS that we measured in your blood or urine.

This column shows the geometric mean ("average") of results from NHANES (e.g., Table 2) or your community (e.g., Table 3).

PFAS	Your Level in $\mu\text{g/L}$	Geometric Mean in $\mu\text{g/L}$	95 th Percentile in $\mu\text{g/L}$
PFDA			

This column shows the concentration that we found in your blood or urine.

This column shows the 95th percentile of results from NHANES (e.g., Table 2) or your community (e.g., Table 3).

A couple of important notes:

- If your PFAS result is in **bold**, then it is higher than the 95th percentile. When comparing to the U.S. population, this means that your result is higher than what is measured in most people in the United States. When comparing to your community, this means that your result is higher than that measured in most people living in your community.

- If your result is not in bold, then it is equal to or lower than the 95th percentile and is at or below what is measured in either most people in the United States or most people in your community.

What about Your Exposure?

Results from your blood sample:

- While your results were above the 95th percentile for people living in the United States for *<Insert PFAS species that exceeded the 95th percentile value>* and above the 95th percentile in the Fairbanks North Star Borough, AK community for *<Insert PFAS species that exceeded the 95th percentile value>*, it is important to remember that scientists do not know what these levels mean for your health.
- Please see the included handouts for more information about PFAS and how to reduce your exposure.

Results from your urine sample:

- While your results were above the 95th percentile for people living in the United States for *<Insert PFAS species that exceeded the 95th percentile value>*, it is important to remember that scientists do not know what these levels mean for your health.
- Please see the included handouts for more information about PFAS and how to reduce your exposure.

Next Steps

Please call Rhonda Kaetzel, PhD, DABT at 206-553-0530 to discuss any questions you may have. Your personal test results will be kept private. ATSDR will analyze all the data from your community to determine what they tell us about exposure in the community and will provide a more detailed analysis in our final report. Your results may be combined with other participants in your community and used in the summary report; however, no one will be able to identify you.

You can lower your exposure to PFAS in these ways:

- Based on the information available to ATSDR, the alternative drinking water provided by the Air Force (whether through filters, bottled water, or tanks) currently meets all federal and state guidelines for PFAS. ATSDR recommends that community members continue to use these alternative water sources. The long-term solution is to connect your home to piped water from a source that meets all federal and state drinking water guidelines for PFAS.
- If your water source changes in the future and is contaminated with PFAS above levels specified by the EPA or your state government, use an alternate water source for drinking, preparing food, cooking, brushing teeth, and any other activity when you might swallow water. If you do not know if your water is contaminated, ask your state health department.
- Avoid eating contaminated fish. Check with your state health and environmental quality departments for fish advisories in your area and follow the advisories.


- Even though recent efforts to remove PFAS have reduced the likelihood of 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.

Because PFAS are at low levels in some foods and in the environment (air, water, soil, etc.) completely eliminating exposure is unlikely.

More Information

- If you or your doctor have any medically related questions about these results or wish to further discuss these results, please contact Rhonda Kaetzel, PhD, DABT by phone at 206-553-0530 or email at rkaetzel@cdc.gov. Please also refer to the enclosed clinician guidelines for additional information.
- For additional information about PFAS from the CDC and ATSDR, please visit: <http://www.atsdr.cdc.gov/pfas/index.html>.
- For additional information about PFAS from the U.S. Environmental Protection Agency, please visit: <https://www.epa.gov/PFAS>.

Thank you again for being part of the PFAS assessment.



Bradley P. Goodwin, PhD
LT, U.S. Public Health Service

Table 1: List of PFAS measured in blood and corresponding acronyms

PFAS	Acronym
perfluorohexane sulfonic acid	PFHxS
total perfluorooctane sulfonic acid	PFOS
sodium perfluoro-1-octanesulfonate	n-PFOS
mixture of sodium perfluoro-5-methylheptane sulfonate isomers	Sm-PFOS
total perfluorooctanoic acid	PFOA
ammonium perfluorooctanoate	n-PFOA
mixture of perfluoro-5-methylheptanoic acid isomers	Sb-PFOA
perfluorononanoic acid	PFNA
perfluorodecanoic acid	PFDA
perfluoroundecanoic acid	PFUnA
N-methyl perfluorooctanesulfonamidoacetic acid	MeFOSAA

Table 2: Your PFAS blood levels compared to what has been measured in the general U.S. population

PFAS	Your Level in µg/L	U.S. Population (all ages) Geometric Mean in µg/L ^a	U.S. Population (all ages) 95 th Percentile in µg/L ^a
PFHxS		1.18	4.90
PFOS ^b		4.72	18.3
n-PFOS		3.20	12.8
Sm-PFOS		1.42	5.70
PFOA ^b		1.56	4.17
n-PFOA		1.46	4.10
Sb-PFOA		*	**
PFNA		0.577	1.90
PFDA		0.154	0.700
PFUnA		*	0.400
MeFOSAA		*	0.600

Note: U.S. Population results above from 2015-2016 NHANES.

ND – Not detected (limit of detection = 0.1 µg/L)

* Geometric mean was not calculated because not enough people had results that were detectable.

** 95th percentile was below the limit of detection, 0.1 µg/L.

^a Source: CDC. Fourth National Report on Human Exposure to Environmental Chemicals, Updated Tables, January 2019. Available at: <https://www.cdc.gov/exposurereport/>

^b PFOA was calculated by adding n-PFOA and Sb-PFOA results. PFOS was calculated by adding n-PFOS and Sm-PFOS results. When one ND and one measured value are reported, a value of 0.07 µg/L is substituted for ND values, which equals 0.1 µg/L (the limit of detection) divided by the square root of two.

Table 3: Your PFAS blood levels compared to other people who participated in this assessment from Fairbanks North Star Borough, AK

PFAS	Your Level (µg/L)	Geometric Mean in your Community in µg/L ^a	95 th Percentile in your Community in µg/L ^a
PFHxS		11.7	115
PFOS ^b		18.3	146
n-PFOS		12.0	99.5
Sm-PFOS		6.07	49.0
PFOA ^b		2.12	8.73
n-PFOA		2.03	8.66
Sb-PFOA		*	*
PFNA		0.321	0.780
PFDA		*	0.330
PFUnA		*	0.220
MeFOSAA		0.137	0.580

ND- Not detected (limit of detection = 0.1 µg/L)

* Geometric mean was not calculated because not enough people had results that were detectable.

^a The statistics shown here are based on results from 88 participants in your community.

^b PFOA was calculated by adding n-PFOA and Sb-PFOA results. PFOS was calculated by adding n-PFOS and Sm-PFOS results. When one ND and one measured value are reported, a value of 0.07 µg/L is substituted for ND values, which equals 0.1 µg/L (the limit of detection) divided by the square root of two.

Table 4: List of PFAS measured in urine and corresponding acronyms

PFAS	Acronym
perfluorobutane sulfonic acid	PFBS
perfluorohexane sulfonic acid	PFHxS
total perfluorooctane sulfonic acid	PFOS
sodium perfluoro-1-octanesulfonate	n-PFOS
mixture of sodium perfluoro-5-methylheptane sulfonate isomers	Sm-PFOS
perfluorobutanoic acid	PFBA
perfluoropentanoic acid	PFPeA
perfluorohexanoic acid	PFHxA
perfluoroheptanoic acid	PFHpA
total perfluorooctanoic acid	PFOA
ammonium perfluorooctanoate	n-PFOA
mixture of perfluoro-5-methylheptanoic acid isomers	Sb-PFOA
perfluorononanoic acid	PFNA
perfluorodecanoic acid	PFDA
perfluoroundecanoic acid	PFUnA
hexafluoropropylene oxide dimer acid	HFPO-DA (GenX)
4,8-dioxa-3H-perfluorononanoic acid	DONA
9-chlorohexadecafluoro-3-oxanone-1-sulfonic acid	9Cl-PF3ONS

Table 5: Your PFAS urine levels compared to what has been measured in the general U.S. population

PFAS	Your Level in µg/L	U.S. Population (all ages) Geometric Mean in µg/L ^a	U.S. Population (all ages) 95 th Percentile in µg/L ^a
PFBS		*	**
PFHxS		*	**
PFOS ^b		*	**
n-PFOS		*	**
Sm-PFOS		*	**
PFBA		*	0.3
PFPeA		*	**
PFHxA		*	0.5
PFHpA		*	**
PFOA ^b		*	**
n-PFOA		*	**
Sb-PFOA		*	**
PFNA		*	**
PFDA		*	**
PFUnA		*	**
HFPO-DA (GenX)		*	**
DONA		*	**
9CI-PF3ONS		*	**

Note: Above results from NHANES 2013–2014.
 ND – Not detected (limit of detection = 0.1 µg/L)
 * Geometric mean was not calculated because not enough people had results that were detectable.
 **95th percentile was below the limit of detection, 0.1 µg/L.
^aSource: Calafat, A., Kato, K, Hubbard, K., et al (2019). Legacy and alternative per- and polyfluoroalkyl substances in the U.S. general population: Paired serum-urine data from the 2013–2014 National Health and Nutrition Examination Survey. Environment International, 131.
^b PFOA was calculated by adding n-PFOA and Sb-PFOA results. PFOS was calculated by adding n-PFOS and Sm-PFOS results. When one ND and one measured value are reported, a value of 0.07 µg/L is substituted for ND values, which equals 0.1 µg/L (the limit of detection) divided by the square root of two.

Table 6: Your PFAS urine levels and the range of PFAS urine levels found in other people in your community who were tested

PFAS	Your Level in µg/L	Range of levels in your community (10% of study participants) in µg/L
PFBS		ND
PFHxS		ND
PFOS ^a		ND
n-PFOS		ND
Sm-PFOS		ND
PFBA		ND
PFPeA		ND
PFHxA		ND
PFHpA		ND
PFOA ^a		ND
n-PFOA		ND
Sb-PFOA		ND
PFNA		ND
PFDA		ND
PFUnA		ND
HFPO-DA (GenX)		ND
DONA		ND
9Cl-PF3ONS		ND

ND – Not detected (limit of detection = 0.1 µg/L)
^a PFOA was calculated by adding n-PFOA and Sb-PFOA results. PFOS was calculated by adding n-PFOS and Sm-PFOS results. When one ND and one measured value are reported, a value of 0.07 µg/L is substituted for ND values, which equals 0.1 µg/L (the limit of detection) divided by the square root of two