colorado school of public health
UNIVERSITY OF COLORADO
COLORADO STATE UNIVERSITY
UNIVERSITY OF NORTHERN COLORADO

{Participant Name}
{Address}
{City, CO Zip}

Dear {Participant Name},

We are writing to thank you for participating in our research study "Exposure and Health Effects from Poly- and Perfluoroalkyl Substances in Colorado Water" (PFAS-AWARE) and to provide you with a summary of your personal results for the health markers and perfluoroalkyl substances that we measured in your blood sample in June 2018.

As you may recall, the study measured both health markers with clinical relevance (cholesterol and liver enzymes) and several other compounds in your body, all considered subclinical markers of health (interleukins and other cytokines). For the subclinical markers of health the underlying science on their direct clinical relevance is unclear and physicians are not able to make health recommendations based on these results.

The goal of this study was to better understand your exposure to perfluoroalkyl substances, and the potential links between exposure and the health markers we collected. The following markers were measured to help evaluate the relationship between exposure and potential health effects:

GROUPING:	MEASURED IN THIS STUDY:	BASIC INFORMATION:
PERFLUOROALKYL SUBSTANCES	48 specific fluorinated compounds	A group of thousands of man-made chemicals that are known to be long-lasting in both the environment and the body.
LIVER ENZYMES	AST, ALT, GGT	Higher levels of these proteins in the bloodstream may indicate inflammation or damage to the liver.
CHOLESTEROL	Total cholesterol, LDL Cholesterol, HDL cholesterol, Triglycerides	High cholesterol can lead to narrowing of the arteries and greater risk of cardiovascular disease.
INTERLEUKINS AND OTHER CYTOKINES	IL-1β, IL-2, IL-4, IL-5, IL-6, IL-8, IL-10, GM-CSF, IFN-ɣ and TNF-α	These proteins are normally present in the bloodstream and higher levels may reflect inflammation and immune response in the body. These are considered subclinical markers of health.

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Included with this letter:

Part 1: Perfluoroalkyl substances in your blood. For each compound you will see your personal level as well as the 50th percentile (median) and the range of levels measured in all participants in the PFAS-AWARE study. Where possible we also compare your results to national reference levels developed by the US Centers for Disease Control. At this time we have data for 18 compounds to share with you.

Part 2: Health markers in your blood. We will provide your personal level for each marker as well as the study population 50th percentile and the range of levels measured in all participants in the PFAS-AWARE study. Where applicable, we will also provide health-based normal ranges. At this time we have cholesterol and liver enzyme results to share with you.

In a subsequent letter you will receive:

- The remaining 30 perfluoroalkyl substances that were measured
- The interleukins and other cytokine blood biomarker results

Expect this letter to arrive in early 2019.

Although we have not yet finished analyzing all of the data, we wanted to share these personal results with you now. In addition, we will be holding multiple public meetings to discuss these results and answer any questions you may have (see flyer). We hope the enclosures are informative. Please call either of us - John Adgate at (303)724-4692 or Anne Starling at (303)724-8483 -- if you have questions or want further information.

If you have questions or concerns about your health, we suggest you share these findings with your physician.

Thank you again for your participation in our study.

Sincerely,

John Adgate, PhD
Colorado School of Public Health
(303)724-4692

Anne Starling, PhD
Colorado School of Public Health
(303)724-8483

Part 1: Levels of Perfluoroalkyl Substances found in your Blood (ng/ml)

Chemical Name	Abbreviation	Your Result	Lowest Result found in this Study	50th percentile* for this Study	Highest Result found in this study	Number (%) of participants with detectable levels in this study	50th Percentile* for general U.S. Population	95th Percentile** for general U.S. Population
Perfluoroalkanoic acids								
Perfluoro-n-butanoic acid	PFBA		Below Limit of Detection^	Below Limit of Detection^	Below Limit of Detection^	0 (0%)	--	--
Perfluoro-n-pentanoic acid	PFPeA		Below Limit of Detection^	Below Limit of Detection^	Below Limit of Detection^	0 (0%)	--	--
Perfluoro-n-hexanoic acid	PFHxA		Below Limit of Detection^	Below Limit of Detection^	0.5	55 (25%)	--	--
Perfluoro-n-heptanoic acid	PFHpA		Below Limit of Detection^	Below Limit of Detection^	0.5	20 (9%)	Below Limit of Detection^	0.200
Perfluoro-n-octanoic acid	PFOA		Below Limit of Detection^	2.9	13.8	219 (99.5%)	2.07	5.57
Perfluoro-n-nonanoic acid	PFNA		Below Limit of Detection^	0.4	4.2	219 (99.5%)	0.700	2.00
Perfluoro-n-decanoic acid	PFDA		Below Limit of Detection^	Below Limit of Detection^	1.7	99 (45%)	0.200	0.700
Perfluoro-n-undecanoic acid	PFUnDA		Below Limit of Detection^	Below Limit of Detection^	1.0	37 (17%)	Below Limit of Detection^	0.500
Perfluoro-n-dodecanoic acid	PFDoA		Below Limit of Detection^	Below Limit of Detection^	0.2	4 (2%)	Below Limit of Detection^	0.200

^ Below Limit of Detection means the value was below 0.1 ng/ml. There was not enough of the compound in the blood sample for the instrument to provide a confident answer.

Part 1: Levels of Perfluoroalkyl Substances found in your Blood (ng/ml)

Chemical Name	Abbreviation	Your Result	Lowest Result found in this Study	50th percentile* for this Study	Highest Result found in this study	Number (%) of participants with detectable levels in this study	50th Percentile* for general U.S. Population	95th Percentile** for general U.S. Population
Perfluoroalkane Sulfonates								
Perfluorobutanesulfonate	PFBS		Below Limit of Detection^	Below Limit of Detection^	0.2	1 (0.5%)	Below Limit of Detection^	Below Limit of Detection^
Perfluorohexanesulfonate	PFHxS		Below Limit of Detection^	14.8	199.5	219 (99.5%)	1.40	5.60
Perfluoroheptanesulfonate	PFHpS		Below Limit of Detection^	0.2	2.4	180 (82%)	--	--
Perfluorooctanesulfonate	PFOS		Below Limit of Detection^	9.7	68.1	219 (99.5%)	5.20	18.5
Chlorinated perfluoroalkane sulfonates								
9-chlorohexadecafluoro-3-oxanonane-1-sulfonate	Cl-O-PFNS		Below Limit of Detection^	Below Limit of Detection^	Below Limit of Detection^	0 (0%)	--	--
Perfluoroalkane sulfonamido acetic acids								
N-methylperfluoro-1-octanesulfonamidoacetic acid	MeFOSAA		Below Limit of Detection^	Below Limit of Detection^	1.8	77 (35%)	Below Limit of Detection^	0.600
N-ethylperfluoro-1-octanesulfonamidoacetic acid	EtFOSAA		Below Limit of Detection^	Below Limit of Detection^	0.2	4 (2%)	Below Limit of Detection^	0.110

^ Below Limit of Detection means the value was below 0.1 ng/ml. There was not enough of the compound in the blood sample for the instrument to provide a confident answer.

Part 1: Levels of Perfluoroalkyl Substances found in your Blood (ng/ml)

Chemical Name	Abbreviation	Your Result	Lowest Result found in this Study	50th percentile* for this Study	Highest Result found in this study	Number (%) of participants with detectable levels in this study	50th Percentile* for general U.S. Population	95th Percentile** for general U.S. Population
Miscellaneous Emerging Compounds								
Dodecafluoro-3H-4,8-dioxanonanoate	NADONA		Below Limit of Detection^	Below Limit of Detection^	Below Limit of Detection^	0 (0%)	--	--
Tetrafluoro-2-(heptafluoropropoxy)propanoic acid	GENX or HFPO-DA		Below Limit of Detection^	Below Limit of Detection^	Below Limit of Detection^	0 (0%)	--	--

Interpreting the above tables:

* **The 50th Percentile** is the same thing as the median. It is the mid-point of all the measurement results, or the level at which half the measurements are higher and half the measurements are lower.

** **The 95th Percentile** is the level at which 95% of the measurements are below this value.

^ Below Limit of Detection means the value was below 0.1 ng/ml. There was not enough of the compound in the blood sample for the instrument to provide a confident answer.

The values for the 50th and 95th percentiles in the general U.S. Population can be found here:
https://www.cdc.gov/exposurereport/pdf/FourthReport_UpdatedTables_Volume1_Mar2018.pdf

Part 1: Levels of Perfluoroalkyl Substances found in your Blood (ng/ml)

Additional Information about Perflouroalkyl Substances:

How are people exposed to perfluoroalkyl substances (PFASs)?

- The most common exposure pathway for these compounds is through eating or drinking PFAS-contaminated food or water.
- PFASs have also been found to accumulate in dust.
- Some fast food and microwavable containers contain detectable levels of PFASs.
- PFASs are present in certain household items such as stain-resistant and water-resistant clothing, fabrics, carpets and furniture, as well as non-stick cookware.
- People who work in the manufacturing or installation of these household items may be at risk for higher PFAS exposure.

What does it mean if the levels of PFASs in my blood are high?

- A level of concern has not yet been established for PFASs levels measured in blood.
- Previous studies have shown possible associations between PFASs in blood and health impacts including: thyroid disease, high cholesterol, liver damage, immune system suppression, decreased fertility, and giving birth to infants with decreased birth weight. Some studies have also shown an increased risk of kidney and testicular cancer.

How can I reduce my exposure to PFAS?

- Investigate if your drinking water PFAS levels are below the USEPA health advisory levels. If you are on a private well have it checked for PFAS contamination. The Water Authorities in Security, Widefield, and Fountain have changed their water supplier and/or have added treatment systems to ensure that their systems delivers water to customers at levels below the EPA health guidance levels for PFOA and PFOS.
- Limit eating at fast food restaurants or eating microwave meals that use packaging that may be grease repellant.
- Avoid buying stain and water-resistant products (e.g., clothing and furniture) where possible.
- Wash hands before eating and keep floors and surfaces clean to reduce possible exposure from PFASs in dust.

For more information on Perfluoroalkyl Substances:

- https://www.atsdr.cdc.gov/pfc/docs/pfas_clinician_fact_sheet_508.pdf
- https://www.colorado.gov/pacific/cdphe/pfcs
- http://securitywsd.com/wp-content/uploads/2017/05/Security-fact-sheet-updated-2_11_16.pdf
- http://www.c8sciencepanel.org/index.html
- http://www.pfashealth.info/index.html

Part 2: Health Marker Results

Liver Enzyme Results:

	ALT (Units/L):	AST (Units/L):	GGT (Units/L):
Your **Liver Enzyme** levels:			
Study 50th percentile **Liver Enzyme** levels**:**	Men: 16 Women: 12	Men & Women: 20	Men: 24 Women: 15
Study range for **Liver Enzymes**:	Men: 3 to 62 Women: 3 to 64	Men & Women: 10 to 60	Men: 6 to 151 Women: 6 to 79
Laboratory Reference range for **Liver Enzymes:**	Men: 0 to 44 Women: 0 to 32	Men & Women: 0 to 40	Men: 0 to 65 Women: 0 to 60
Please note: If your results are outside the laboratory reference range it does not necessarily mean you have a health problem. If you have any concerns, you should consult your physician.			

The Basics of ALT:

ALT stands for alanine transaminase. It is an enzyme produced by liver cells. ALT breaks down proteins in your liver so they may be more easily absorbed by your body. A majority of ALT resides in the liver, but if the liver is damaged or inflamed this may result in higher levels of ALT in blood.

The Basics of AST:

AST stands for aspartate transaminase. It is an enzyme produced by liver cells that can also be found in many different organs including the liver, muscles, heart, kidney, and red blood cells. If the liver is damaged or inflamed this may result in higher levels of AST in blood.

The Basics of GGT:

GGT stands for gamma-glutamyl transpeptidase. It is an enzyme produced by liver cells that can be found in many different organs including the liver, bile ducts, heart, kidney, and pancreas. If the liver or bile ducts are damaged or inflamed, this may result in higher levels of GGT found in blood.

Part 2: Health Marker Results

Cholesterol Results:

	Total cholesterol (mg/dL):	LDL (mg/dL):	HDL (mg/dL)*:	Triglyceride (mg/dL):
Your **cholesterol** levels:				
Study 50th percentile **cholesterol** levels:	178	103	44	133
Study range of **cholesterol:**	99 to 302	38 to 207	0 to 129	34 to 499
Mayo Clinic ranges of **cholesterol** levels:	Healthy: Below 200 Borderline High: 200-239 High: 240 and above	Healthy: Below 100 Borderline High: 100-159 High: 160-189 Very High: 190 and above	Low: Below 40 Borderline Low: 40-59 Healthy: 60 and above	Healthy: Below 150 Borderline High: 150-199 High: 200-499 Very High: 500 and above
Please note: If your results are outside the Mayo Clinic healthy ranges it does not necessarily mean you have a health problem. If you have any concerns, you should consult your physician.				

The Basics of total cholesterol

Cholesterol is produced and stored in the liver and then released into the bloodstream as needed. Cholesterol may also be introduced to the body via dietary sources (i.e., animal products). Cholesterol is used by the body to develop cell membranes and hormones, metabolize vitamin D, and help with digestion. If there is too much cholesterol in the blood, it can build up along artery walls narrowing the arteries and increasing risk of cardiovascular disease or stroke. Total cholesterol includes LDL cholesterol ("bad" cholesterol), HDL cholesterol ("good" cholesterol) and triglycerides.

The Basics of LDL and HDL cholesterol

LDL stands for low density lipoprotein cholesterol. This type of cholesterol is considered "bad"; it can lead to fat buildup in arteries and increase risk of cardiovascular disease.

HDL stands for high density lipoprotein cholesterol. This type of cholesterol is considered "good"; it carries cholesterol back to the liver to keep it from building up along artery walls. Higher levels of HDL cholesterol can help reduce the risk of cardiovascular disease.

*Note that HDL cholesterol was not measured directly. It was calculated by an equation called the Friedewald equation. This equation may not be accurate for individuals with extremely high triglyceride or LDL levels.

The Basics of Triglycerides

Triglycerides are the main form of fat in the body. The body converts calories that aren't immediately used, in particular carbohydrates and fats into triglycerides. These are then used to provide your body with energy. Too many triglycerides can contribute to hardening of the arteries and increase risk of cardiovascular disease.

Part 2: Health Marker Results

For more information about blood biomarker levels:

Liver Enzymes:

- https://liverfoundation.org/for-patients/about-the-liver/the-progression-of-liver-disease/diagnosing-liver-disease/#1503683241165-6d0a5a72-83a9
- https://www.mayoclinic.org/symptoms/elevated-liver-enzymes/basics/definition/sym-20050830
- https://www.mdedge.com/ccjm/article/95275/gastroenterology/when-and-how-evaluate-mildly-elevated-liver-enzymes-apparently

Cholesterol:

- https://www.nhlbi.nih.gov/files/docs/public/heart/wyntk.pdf
- http://www.heart.org/HEARTORG/Conditions/Cholesterol/Cholesterol_UCM_001089_SubHomePage.jsp

Note: We have links to all these sites on the www.PFAS-AWARE.org website.