

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

Dear {Participant Name},

We hope this letter finds you and your loved ones well in these trying times. We are writing to provide you with a summary of your remaining personal results for the health markers and per- and polyfluoroalkyl substances (PFAS) that we measured in your blood sample in May 2019 as part of the PFAS-AWARE study.

As you saw in the letters we sent last year, our study measured both health markers with clinical relevance (cholesterol and liver enzymes) and several other compounds that are considered subclinical markers of health (interleukins and other cytokines). For the subclinical markers of health, the available science on their direct clinical relevance is unclear and physicians are not able to make health recommendations based on these results.

The goal of our study was to better understand your exposure to PFAS, and the potential links between exposure and the health markers we collected. The table below summarizes the PFAS (measured at the Colorado School of Mines lab) and health markers (measured at a clinical lab) that were measured in your blood. Please note that we did not evaluate as many PFAS last year as we did in Year 1 of our study. For Year 2 we focused on the PFAS that were measured in a majority of participants in Year 1.

<b>GROUPING:</b>	<b>MEASURED IN THIS STUDY:</b>	<b>BASIC INFORMATION:</b>
<b>PER- AND POLYFLUOROALKYL SUBSTANCES</b>	20 specific PFAS	A group of thousands of man-made chemicals that are known to be long-lasting in both the environment and the body.
<b>LIVER ENZYMES</b>	AST, ALT, GGT	Higher levels of these proteins in the bloodstream may indicate inflammation or damage to the liver.
<b>CHOLESTEROL</b>	Total cholesterol, LDL Cholesterol, HDL cholesterol, Triglycerides	High cholesterol can lead to narrowing of the arteries and greater risk of cardiovascular disease.
<b>INTERLEUKINS AND OTHER CYTOKINES</b>	IL-1 $\beta$ , IL-2, IL-6, IL-10, IFN- $\gamma$ and TNF- $\alpha$	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:**

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**Part 1:** Per- and polyfluoroalkyl substances (PFAS) in your blood.

We have data for 20 PFAS to share with you. For each PFAS you will see your **personal level** as well as **the 50<sup>th</sup> percentile (median) and the highest and lowest levels** measured in the 53 participants who had their blood drawn in Year 2 of the PFAS-AWARE study. You will also see the **percent change in your PFAS levels from the previous year**. For four of the PFAS measured we will also show you how your Year 2 levels compare to available data on the U.S. national median and 95<sup>th</sup> percentile reference range levels developed by the CDC. For most of the PFAS provided in this letter it is not possible to compare your results to national reference levels developed by the CDC because these are not included in the panel of PFAS that CDC evaluates nationally.

Please note that in Year 1 (2018) we measured PFAS at two different labs: the CDC and the Colorado School of Mines. In Year 2 (2019) we only measured PFAS at the Colorado School of Mines. While PFAS data from both labs are reliable, the results may differ between labs due to analytical variability. When calculating your percent change from 2018 to 2019, we used only the Colorado School of Mines data for consistency. **These data differ slightly from what you received in your 2018 letter, which presented only the CDC data.**

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**Part 2:** Health markers in your blood.

We provide your personal level for each marker as well as the study population 50<sup>th</sup> percentile and the range of levels measured in the 53 participants who had their blood drawn in Year 2 of the PFAS-AWARE study. Where applicable, we will also provide health-based normal ranges.

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Although we have not yet finished analyzing the aggregated data, we wanted to share your personal results with you now. Please note that in light of COVID-19 we will not be able to hold public meetings for the next few months. Instead, **we have recorded a video that you can watch at this link to explain the results found in this letter:** <https://youtu.be/son1y026KJ4>. In addition, once it is safe to do so, we will hold an in person meeting. We hope the enclosures and video presentation are informative. However, please either email or call us at the phone numbers below if you have questions or want to discuss your results.

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,  
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720.335.5059

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**Part 1: Levels of PFAS found in your blood (ng/ml)**

<b>Chemical Name</b>	<b>Abbreviation</b>	<b>Your 2019 Result</b>	<b>Lowest Result found in this Study in 2019</b>	<b>50<sup>th</sup> percentile* for this Study in 2019</b>	<b>Highest Result found in this study in 2019</b>	<b>Number (%) of participants with detectable levels in this study in 2019</b>	<b>50<sup>th</sup> Percentile* for general U.S. Population</b>	<b>95<sup>th</sup> Percentile** for general U.S. Population</b>
<b>Perfluoroalkanoic acids</b>								
<b>Perfluoro-n-butanoic acid</b>	<b>PFBA</b>		Below Limit of Detection <sup>^</sup>	Below Limit of Detection <sup>^</sup>	<b>0.23</b>	<b>7 (13%)</b>	--	--
<b>Perfluoro-n-hexanoic acid</b>	<b>PFHxA</b>		Below Limit of Detection <sup>^</sup>	Below Limit of Detection <sup>^</sup>	<b>3.6</b>	<b>1 (2%)</b>	--	--
<b>Perfluoro-n-octanoic acid</b>	<b>PFOA</b>		Below Limit of Detection <sup>^</sup>	<b>1.89</b>	<b>13.84</b>	<b>39 (74%)</b>	<b>1.57</b>	<b>4.17</b>
<b>Perfluoro-n-nonanoic acid</b>	<b>PFNA</b>		Below Limit of Detection <sup>^</sup>	Below Limit of Detection <sup>^</sup>	<b>1.14</b>	<b>8 (15%)</b>	<b>0.60</b>	<b>1.9</b>
<b>Perfluoro-n-decanoic acid</b>	<b>PFDA</b>		Below Limit of Detection <sup>^</sup>	Below Limit of Detection <sup>^</sup>	<b>0.31</b>	<b>1 (2%)</b>	<b>0.10</b>	<b>0.70</b>
<b>Perfluoroalkane Sulfonates</b>								
<b>Perfluorobutanesulfonate</b>	<b>PFBS</b>		Below Limit of Detection <sup>^</sup>	Below Limit of Detection <sup>^</sup>	<b>0.11</b>	<b>3 (6%)</b>	--	--
<b>Perfluoropentanesulfonate</b>	<b>PFPeS</b>		Below Limit of Detection <sup>^</sup>	<b>0.36</b>	<b>2.51</b>	<b>42 (79%)</b>	--	--
<b>Perfluorohexanesulfonate</b>	<b>PFHxS</b>		<b>3.58</b>	<b>12.64</b>	<b>123.4</b>	<b>53 (100%)</b>	<b>1.2</b>	<b>4.9</b>
<b>Perfluoroheptanesulfonate</b>	<b>PFHpS</b>		Below Limit of Detection <sup>^</sup>	<b>0.41</b>	<b>3.06</b>	<b>50 (94%)</b>	--	--
<b>Perfluorooctanesulfonate</b>	<b>PFOS</b>		Below Limit of Detection <sup>^</sup>	<b>6.47</b>	<b>37.84</b>	<b>49 (92%)</b>	<b>4.80</b>	<b>18.3</b>
<b>Miscellaneous Emerging Compounds</b>								
<b>Perfluoro-4-ethylcyclohexanesulfonate</b>	<b>PFEtCHxS</b>		Below Limit of Detection <sup>^</sup>	<b>0.08</b>	<b>1.32</b>	<b>31 (58%)</b>	--	--

## Part 1: Levels of PFAS found in your blood (ng/ml)

### Understanding the above tables:

^ **Below Limit of Detection** means there was not enough of the compound in the blood sample for the instrument to provide a confident answer. The limit of detection for these compounds ranged from 0.01 ng/ml to 2.00 ng/ml.

\* **The 50<sup>th</sup> 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 95<sup>th</sup> Percentile** is the level at which 95% of the measurements are below this value.

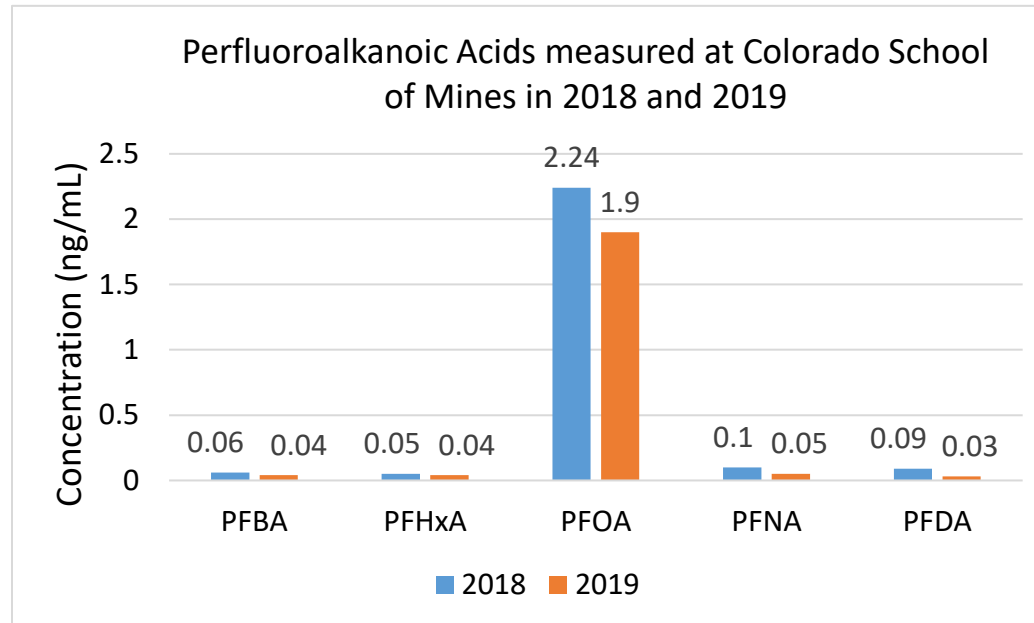
**The values for the 50<sup>th</sup> and 95<sup>th</sup> percentiles in the general U.S. Population can be found here:**

[https://www.cdc.gov/exposurereport/pdf/FourthReport\\_UpdatedTables\\_Volume1\\_Jan2019-508.pdf](https://www.cdc.gov/exposurereport/pdf/FourthReport_UpdatedTables_Volume1_Jan2019-508.pdf)

## Part 1: Levels of PFAS found in your blood (ng/ml)

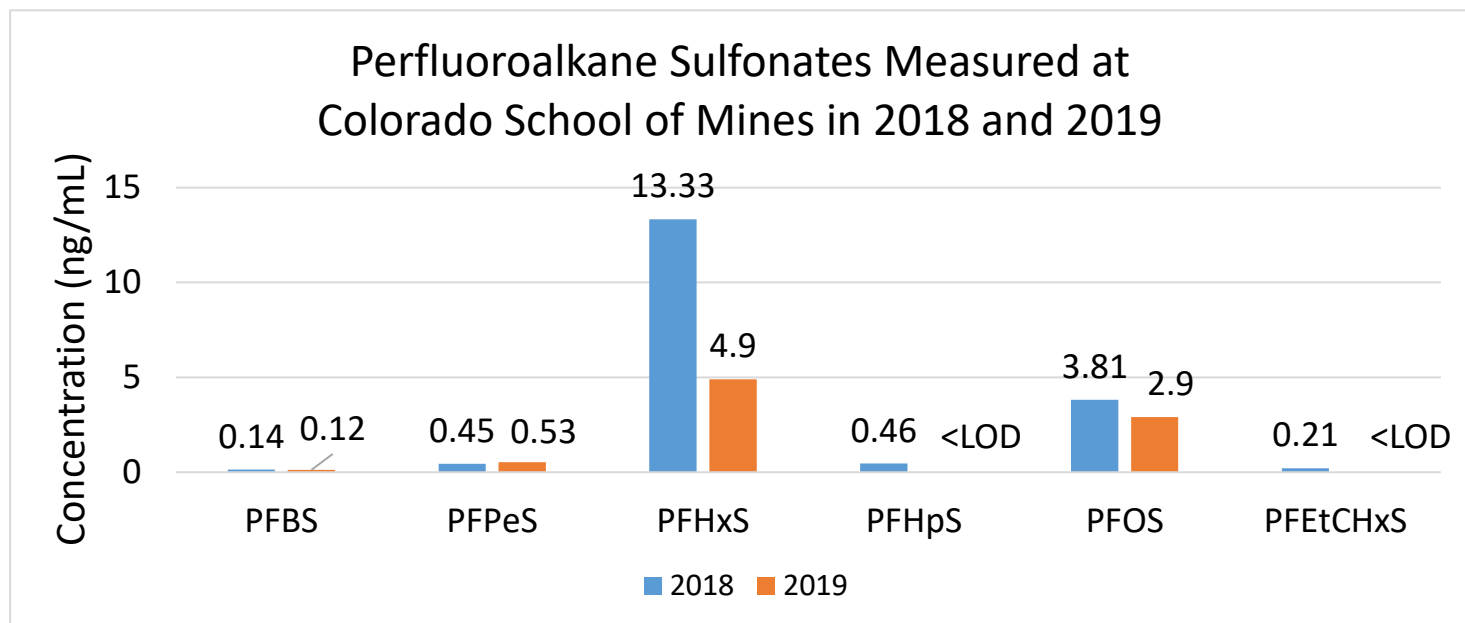
**\*\*Note this is just an example and does not represent a real participant. \*\***

### **How your Levels Changed from 2018 to 2019**



- Your **PFBA** levels **decreased 33%** from 2018 to 2019.
- Your **PFHxA** levels **decreased 20%** from 2018 to 2019.
- Your **PFOA** levels **decreased 15%** from 2018 to 2019.
- Your **PFNA** levels **decreased 50%** from 2018 to 2019.
- Your **PFDA** levels **decreased 66%** from 2018 to 2019.

## Part 1: Levels of PFAS found in your blood (ng/ml)



- Your **PFBS** levels **decreased 14%** from 2018 to 2019.
- Your **PFPeS** levels **increased 18%** from 2018 to 2019.
- Your **PFHxS** levels **decreased 63%** from 2018 to 2019.
- Your **PFHpS** levels **decreased to non-detectable** from 2018 to 2019.
- Your **PFOS** levels **decreased 24%** from 2018 to 2019.
- Your **PFEtCHxS** levels **decreased to non-detectable** from 2018 to 2019.

### What does it mean if some of my PFAS concentrations have increased since last year?

- If your PFAS level is slightly higher this year it may be that it has essentially remained unchanged but appears slightly higher due to measurement uncertainty.
- While the public water systems are now providing water with PFAS concentrations below the health advisory, you may still be exposed to PFAS in other ways like through diet or consumer products.

Part 1: Levels of PFAS found in your blood (ng/ml)

**Additional compounds that we tested for that were below the limit of detection in every member of the study population:**

Chemical Name	Abbreviation	Number (%) of participants with detectable levels in this study
<b>Perfluoroalkanoic acids</b>		
Perfluoro-n-heptanoic acid	PFHpA	0 (0%)
Perfluoro-n-undecanoic acid	PFUdA	0 (0%)
<b>Perfluoroalkane Sulfonates</b>		
Perfluoropropanesulfonate	PFPrS	0 (0%)
Perfluorononanesulfonate	PFNS	0 (0%)
Perfluorodecanesulfonate	PFDS	0 (0%)
Perfluorododecanesulfonate	PFDoS	0 (0%)
<b>Chlorinated perfluoroalkane sulfonates</b>		
8-chloroperfluoro-1-octanesulfonate	Cl-O-PFOS	0 (0%)
9-chlorohexadecafluoro-3-oxanonane-1-sulfonate	Cl-O-PFNS	0 (0%)
11-chloro-3-oxa-perfluoroundecane sulfonate	Cl-O-PFUnS	0 (0%)

## Part 1: Levels of PFAS found in your blood (ng/ml)

### **Additional Information about Per- and Polyfluoroalkyl Substances:**

#### **How are people exposed to perfluoroalkyl substances (PFAS)?**

- The most common exposure pathway for these compounds is through eating or drinking PFAS-contaminated food or water.
- PFAS have also been found to accumulate in dust.
- Some fast food and microwavable containers contain detectable levels of PFAS.
- PFAS are present in certain household items such as stain-resistant and water-resistant clothing, fabrics, carpeting 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 PFAS in my blood are high?**

- A level of concern has not yet been established for PFAS levels measured in blood.
- Previous studies have shown possible associations between PFAS 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 system 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 grease repellent packaging.
- 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 PFAS in dust.

### **For more information on PFAS:**

- **Guidance for Physicians:** [https://www.atsdr.cdc.gov/pfas/docs/ATSDR\\_PFAS\\_ClinicalGuidance\\_12202019.pdf](https://www.atsdr.cdc.gov/pfas/docs/ATSDR_PFAS_ClinicalGuidance_12202019.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://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

### **2019 Liver Enzyme Results:**

ALT (Units/L):

AST (Units/L):

GGT (Units/L):

Your <b>Liver Enzyme</b> levels:			
Study 50 <sup>th</sup> percentile <b>Liver Enzyme</b> levels:	Men: 22.5 Women: 16	Men & Women: 22	Men: 23 Women: 16
Study range for <b>Liver Enzymes</b> :	Men: 12 to 130 Women: 8 to 30	Men & Women: 14 to 93	Men: 6 to 1211 Women: 10 to 52
Laboratory Reference range for <b>Liver Enzymes</b> :	Men: 0 to 44 Women: 0 to 32	Men & Women: 0 to 40	Men: 0 to 65 Women: 0 to 60
<b>Please note:</b> 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 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

### 2019 Cholesterol Results:

Total cholesterol (mg/dL):                      LDL (mg/dL):                      HDL (mg/dL)\*:                      Triglyceride (mg/dL):

Your cholesterol levels:				
Study 50 <sup>th</sup> percentile cholesterol levels:	181	106	37	138
Study range of cholesterol:	110 to 241	47 to 163	0 to 83	53 to 347
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
<b>Please note:</b> 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

### 2019 Interleukin Results:

	IL-1 $\beta$ (pg/ml):	IL-2 (pg/ml):	IL-6 (pg/ml):	IL-10 (pg/ml):
Your <b>IL-1<math>\beta</math>, IL-2, IL-6, IL-10</b> levels:				
Study <b>IL-1<math>\beta</math>, IL-2, IL-6, IL-10</b> 50 <sup>th</sup> percentile levels:	Below Limit of Detection	Below Limit of Detection	0.87	Below Limit of Detection
Study Range for <b>Interleukins:</b>	Min: < LOD Max: 0.23	Min: < LOD Max: 0.33	Min:< LOD Max: 7.46	Min:< LOD Max: 1.74
Detected in what Percent of Study participants?	6%	2%	57%	23%
Expected Range for <b>Interleukins:</b>	<b>Not Established</b>			
<b>Please note:</b> If your results are significantly different than the average found in this study, it does not necessarily mean you have a health problem. If you have any concerns, you should consult your physician.				

**Below Limit of Detection (<LOD)** means there was not enough of the compound in the blood sample for the instrument to provide a confident answer.

### Basics of interleukins:

Interleukins are proteins in the bloodstream that belong to a larger molecular group called cytokines. A cytokine is a type of molecule that assists in communication between cells during immune responses and helps to direct cells towards areas of inflammation, infection and trauma. Interleukins are released in short bursts in response to events that the body may view as a threat. There are 15 different interleukins, each with a slightly different function.

Interleukins play an important role in the immune system, and in particular, inflammation. Inflammation is part of the body's natural response to injury or infection and often is displayed as redness, heat, pain and/or swelling. There are both pro-inflammatory and anti-inflammatory interleukins and there must be a balance between the two for proper functioning of this process. The body can exhibit signs of chronic inflammation for many reasons including but not limited to: chronic stress, poor diet, exposure to certain air pollutants and certain chronic diseases.

**Pro-inflammatory:** Pro-inflammatory cytokines are sent to sites of injury or infection to help heal the body or fight the infectious agents.

**Anti-inflammatory:** Anti-inflammatory cytokines help to regulate and control the pro-inflammatory cytokine response.

- **IL-1 $\beta$ :** This interleukin is a pro-inflammatory cytokine.
- **IL-2:** This interleukin is a pro-inflammatory cytokine.
- **IL-6:** This interleukin is a pro-inflammatory cytokine.
- **IL-10:** This interleukin is an anti-inflammatory cytokine.

## Part 2: Health Marker Results

### 2019 Other Cytokine Results:

	IFN- $\gamma$ (pg/ml):	TNF- $\alpha$ (pg/ml):
Your <b>IFN-<math>\gamma</math></b> and <b>TNF-<math>\alpha</math></b> levels:		
Study average <b>IFN-<math>\gamma</math></b> and <b>TNF-<math>\alpha</math></b> 50 <sup>th</sup> percentile levels:	Below Limit of Detection	6.97
Study Range for <b>IFN-<math>\gamma</math></b> and <b>TNF-<math>\alpha</math></b> :	Min: < LOD Max: 13.6	Min: 2.51 Max: 21.19
Detected in what Percent of Study participants?	4%	100%
Expected Range for <b>IFN-<math>\gamma</math></b> and <b>TNF-<math>\alpha</math></b> :	<b>Not Established</b>	
<b>Please note:</b> If your results are significantly different than the average found in this study, it does not necessarily mean you have a health problem. If you have any concerns, you should consult your physician.		

**Below Limit of Detection (<LOD)** means there was not enough of the compound in the blood sample for the instrument to provide a confident answer.

#### Basics of interferon gamma (IFN- $\gamma$ ):

Interferon gamma is a signaling protein. It is a type of cytokine that plays an important role in the body's adaptive immune response, particularly against viral and bacterial infections. It is also important in fighting off allergic diseases like asthma.

- **IFN- $\gamma$ :** This cytokine has both pro- and anti-inflammatory properties.

#### Basics of tumor necrosis factor (TNF- $\alpha$ ):

Tumor necrosis factors are a family of proteins that are also within the cytokine group. The proteins in this family are part of the body's immune response system and can cause cell death. As the name suggests, tumor necrosis factors also play a role in defending the body against tumor growth.

- **TNF- $\alpha$ :** This is a pro-inflammatory cytokine.

## Part 2: Health Marker Results

### **If I have a high level (or a low level) of the cytokines (markers of immune function and inflammation) does that mean I'm sick?**

- No.
  - *All of the cytokines (including the interleukins)* evaluated in this study are considered “subclinical” and at this time have no clear diagnostic meaning. This means that although there is research about associations between levels of these compounds and specific health effects, nothing conclusive has been determined by the medical community.
  - There is no defined “healthy range” for any of the cytokine proteins.
  - Because there is no “healthy range” for the levels of these compounds, you can only compare yourself to the PFAS-AWARE study population. The study population is a small group of people and may not be representative of the general population.
- Many things can affect cytokine levels in your blood including but not limited to:
  - Exercise level
  - Medications
  - Age
  - Diet
  - Stress

## 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](http://www.heart.org/HEARTORG/Conditions/Cholesterol/Cholesterol_UCM_001089_SubHomePage.jsp)

#### **Basics of Interleukins:**

- <https://www.britannica.com/science/interleukin>

#### **Tumor Necrosis Factor:**

- [https://www.hss.edu/professional-conditions\\_the-history-basic-science-biology-tnf.asp](https://www.hss.edu/professional-conditions_the-history-basic-science-biology-tnf.asp)

#### **Chronic Inflammation:**

- <http://health.usnews.com/health-news/family-health/articles/2009/11/02/chronic-inflammation-reduce-it-to-protect-your-health>

#### **Guidance for Physicians:**

- [https://www.atsdr.cdc.gov/pfas/docs/ATSDR\\_PFAS\\_ClinicalGuidance\\_12202019.pdf](https://www.atsdr.cdc.gov/pfas/docs/ATSDR_PFAS_ClinicalGuidance_12202019.pdf)

**Note:** We have links to all these sites and the video presentation on the [www.PFAS-AWARE.org](http://www.PFAS-AWARE.org) website.