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**Sent:** 5 May 2016 09:16:18 -0400  
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**Subject:** Clinician Counseling FAQ for PFASs  
**Attachments:** Physician PFASs Counseling Fact Sheet May 5th 2016.docx  
**Importance:** High

Jimmy,

Attached is the clinician counseling FAQ for PFASs. I am sending for your advanced review and will send to Selene for her review shortly. If you are think we are ready to share with the group, I will send to John Decker to distribute.

*Michael*

## An Overview of Perfluoroalkyl and Polyfluoroalkyl Substances for Clinicians Responding to Patient Exposure Concerns

### Introduction

The purpose of this fact sheet is to aid physicians with patient consultations on per- and polyfluoroalkyl substances (PFASs). It highlights what PFASs are, specifies which chemicals fall into this category of substances, identifies health effects associated with exposure to various PFASs, and suggests how to address patient concerns about potential PFASs exposure.

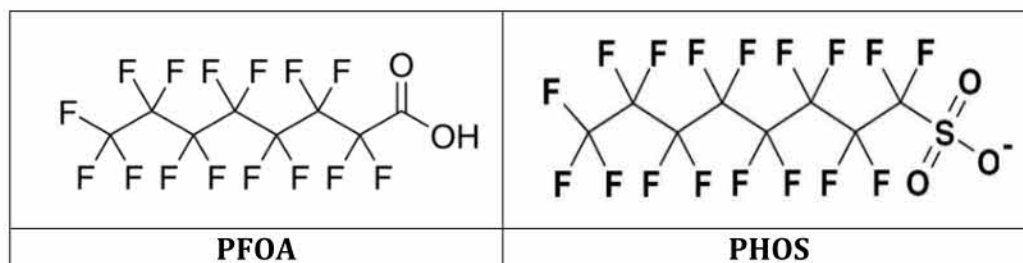
### What are PFASs?

Per- and polyfluorinated alkyl substances (PFASs), sometimes known as PFCs (per- and polyfluorinated chemicals) are synthetic chemicals and do not occur naturally in the environment. There are many different types of PFASs such as perfluorocarboxylic acids (PFOAs, sometimes called C8, or PFNAs) and perfluorosulfonates (PFOS and PFHxS). These chemicals have been used since the 1950s in many commercial applications, as well as in industrial and consumer products because of their surfactant and stain- and water-repellant properties. Specifically, these chemicals have been used in adhesives, cosmetics, cleaning products, and firefighting foams.

### Why are PFASs a possible health concern?

According to the US. Environmental Protection Agency (EPA), PFASs are considered emerging contaminants. An “emerging contaminant” is a chemical or material that is characterized by a perceived, potential, or real threat to human health or the environment or by a lack of published health standards.

PFOS and PFOA are two of the most studied PFASs. Exposure to PFOA and PFOS is widespread and global. PFASs are extremely persistent in the environment and resistant to typical environmental degradation processes. The source pathway for dispersion of these chemicals appears to be long-range atmospheric and oceanic currents transport. Several PFASs and their potential precursors are ubiquitous in the urban environment. Some long-chain PFASs bioaccumulate in animals and can enter the human food chain. The term ‘long chain’ perfluorinated substances refers to PFASs with carbon chain lengths C8 and higher (including PFOA) and PFASs with carbon chain lengths C6 and higher (including PFOS).



PFOS and PFOA also persist in the human body and are eliminated slowly. Both PFOS and PFOA can be found in the blood, urine, breast milk and in umbilical cord blood.

PFOS and PFOA pose potential adverse effects for human health given their potential toxicity, mobility and bioaccumulation potential.

### **What are the main sources of exposure to PFASs?**

For the general population, ingestion of PFASs is considered the major human exposure pathway. The major types of human exposure sources for PFASs, include:

- Drinking contaminated water
- Ingesting food that may contain high levels of PFASs, such as certain types of fish and shellfish
- Ingesting food contaminated by packaging materials containing PFASs (e.g., popcorn bags, fast food containers, and pizza boxes)
- Hand-to-mouth transfer from surfaces treated with PFAS-containing stain protectants, such as carpets, which is thought to be most significant for infants and toddlers
- Workers in industries or activities that manufacture, manipulate or use products containing PFASs may be exposed to higher levels than the general population.

### **What are other low level exposure sources?**

Individuals can also be exposed by breathing air that contains dust contaminated with PFASs (from soil, carpets, upholstery, clothing, etc.), or from certain fabric sprays containing this substance.

Dermal exposure is a minor exposure pathway. Dermal absorption is slow and does not result in significant absorption.

### **What are the potential PFASs exposure risks to fetuses and children?**

Recent research evaluating possible health effects to fetuses from PFAS exposures have shown that developing fetuses can be exposed to PFASs when umbilical cord blood from their mothers cross the placenta during pregnancy. It is important to note that different PFASs have varying levels of permeability to the placental barrier.

Newborns can be exposed to PFASs through breast milk. Older children may be exposed to PFASs through food and water, similar to adults. In addition, young children have a higher risk of exposure to PFASs from carpet cleaners and similar products, largely due to time spent lying and crawling on floors in their early years.

### **How long do PFASs remain in the body?**

Different PFASs have different half-lives. PFASs usually persist in the blood more than 1000 days. PFOS and PFOA have half-lives in humans ranging from 2 to 9 years.

### **What are exposure limits for PFASs in drinking water?**

The Environmental Protection Agency (EPA) has determined that the concentration of PFOA and PFOS in drinking water, either individually or combined, should not be greater than 0.07 parts per billion. If this concentration is exceeded, EPA advises that an alternative drinking source should be used.

### **What are PFASs levels in the American population?**

Most people in the United States and in other industrialized countries have measurable amounts of PFASs in their blood.

The National Health and Nutrition Examination Survey (NHANES) is a program of studies conducted by the Center for Diseases Control and Prevention (CDC) to assess the health and nutritional status of adults and children in the United States. NHANES (2011–2012) measured the concentration of PFASs in the blood of the general U.S. population (12 years of age and older). The average blood levels found were as follows:

- PFOA: 2.1 parts per billion, with 95% of the general population at or below 5.7 parts per billion
- PFOS: 6.3 parts per billion, with 95% of the general population at or below 21.7 parts per billion
- PFHxS: 1.3 parts per billion, with 95% of the general population at or below 5.4 parts per billion

Based on data collected from previous NHANES survey years, levels of PFASs are decreasing in the blood of the general population.

### How can PFASs potentially affect human health?

There is limited evidence about the health effects on humans from PFASs.

#### Animal Studies:

Adverse health effects have been demonstrated in animal studies, but these occurred at levels higher than those found in people. The main health effects observed were: increase in liver weight, changes in spleen, thymus, and developmental endpoints. Adenomas of the liver, testis, and pancreas were observed in rats exposed to PFOA. Liver adenomas were also found in those rats exposed to PFOS. Toxicological studies give us important clues, but the exact link between the health effects of PFASs on animals and how that relates to human health has not been established yet.

#### Human Studies:

([http://www.c8sciencepanel.org/prob\\_link.html](http://www.c8sciencepanel.org/prob_link.html))

<b>Cholesterol</b>	Some epidemiological studies demonstrated statistically significant associations between serum PFOA and PFOS levels and total cholesterol in: <ul style="list-style-type: none"><li>• workers exposed to PFASs,</li><li>• residents of communities with high levels of PFOA in the drinking water compared to NHANES data the US general population,</li></ul> Other studies have found no association between PFASs exposures and the total cholesterol endpoint.
<b>Uric acid</b>	Several studies have evaluated the possible association between serum PFOA and serum PFOS levels and uric acid. Significant associations were found between serum PFOA and uric acid levels at all evaluated exposure levels.
<b>Liver effects</b>	A number of human studies have used liver enzymes as biomarkers of possible liver effects. In occupational studies, no

	associations between liver enzymes and serum PFOA or PFOS levels were consistently found. A study of highly exposed residents demonstrated significant associations but the increase in liver enzymes was small and not considered to be biologically significant.
<b>Cancer</b>	Increases in prostate, kidney, and testicular cancers have been found in workers exposed to PFASs and people living near a PFOA facility. These results should be interpreted cautiously because the findings were not consistent, and most studies did not control for other potential factors including smoking. Additional research is needed to clarify this association. The International Agency for Cancer Research (IARC), however, has classified PFOA as possibly causing some cancers. No other PFASs have been evaluated by the IARC.

There are still important research gaps about these chemicals that need to be addressed but the toxicity in animals, mobility, persistence, and bioaccumulation of these substances in the environment raise concerns about possible human health effects.

**What are potential health effects from prenatal PFASs exposure to fetuses?**

There is evidence to suggest that high serum PFOA or PFOS levels may possibly be associated with lower birth weights. Although some studies have found this association, the decreases in birth weight were small and were not considered clinically significant. A study found that 1-ng/mL increase in prenatal PFOS and PFOA levels that were associated with a 5.00 gram reduction in birth weight for PFOS and 14.72 gram reductions in birth weight for PFOA (Verner et.al. DOI:10.1289/ehp.1408837). While the lower birth weight is not seen as clinically significant, any decrease in birthweight is a concern warranting further study.

**Information to answers questions patients may have for the clinician.**

As a clinician, you know careful listening and patient engagement is critical for ensuring quality patient care, especially when health concerns are raised. Perhaps the most difficult challenge in speaking with patients about their health concerns is addressing uncertainty. If your patient has concerns about an exposure to PFASs, you may face the challenge of helping your patient cope with the uncertainty of potential health effects from a PFAS exposure.

Based on feedback from clinicians and from individuals who have spoken to their health care provider about their PFAS exposure concerns, a set of patient questions have been identified. To assist you in speaking with your patients about their concerns, key messages and supporting facts needed to answer the anticipated patient questions are provided in the table below for your use.

Before the patient questions are presented, a reminder about communicating uncertainty is offered. These tips are:

- Listen carefully to your patients and try not to rush to a solution.
- Do not downplay concerns.