Investigation of Per- and Polyfluoroalkyl Substances (PFAS) in US food products

Susan Genuaidi, Lowri deJager, Timothy Begley
Center for Food Safety and Applied Nutrition, Food and Drug Administration, 5001 Campus Drive, College Park, MD 20740

Background

- DuPont phased out PFOA completely in 2015.
- Gen-X (HFPO-DA) – new technology used to make high performance fluoropolymers without PFOA
- Production has shifted towards shorter chain length perfluorinated substances (6 carbons or less) and other classes of polyfluorinated substances.

Potential sources of PFAS to humans

Environmental exposure

Dietary intake exposure from agriculture, seafood, and livestock

Objectives:
- To develop methods to determine the concentrations of Per- and Polyfluoroalkyl substances (PFAS) in a variety of food items utilizing samples from FDA Total Diet Study program.
- To assess the impact of food sources in close proximity to environmental inputs of PFAS chemicals – Investigate location in close proximity to PFAS production facility and location close to Air Force Base where groundwater has been contaminated with Aqueous Film Fighting Foam (AFFF).

Method

Target Analytes

- FPA
- Perfluoroheptanoic acid
- Perfluorooctanoic acid
- PFBS
- PFOS
- PFOA
Objectives:
- To develop methods to determine the concentrations of Per- and Polyfluoroalkyl substances (PFAS) in a variety of food items utilizing samples from FDA Total Diet Study program.
- To assess the impact of food sources in close proximity to environmental inputs of PFAS chemicals—Investigate location in close proximity to PFAS production facility and location close to Air Force Base where groundwater has been contaminated with Aqueous Film Fighting Foam (AFF).

Method

1. Add water and extraction solvent (Acetonitrile)
2. Add QuEChERS salt (4000 mg MgSO₄, and 1500 mg NaCl)
3. Transfer supernatant to SPE tube (400 mg PSA, 400 mg C18 and 1200 mg MgSO₄)

Shake/Centrifuge Step
- Vortex/ Shake 5 minutes at 1500 RPM
- Centrifuge for 5 minutes at 10,000 x g
- Filter extract with a 0.2 μm nylon filter

Analysis using SCIEX 6500 plus

Total Diet Study Samples (TDS)

TDS samples were used because of the diverse food categories (produce, meat, dairy, and grain products) and they were already prepared for analysis. Samples were collected in October 2017 from the Mid-Atlantic Region (see map).

Analytical sample is a composite of 3 cities per collection, in that region of each food item. 91 samples were analyzed, including produce, meat, dairy, and grain products. Non-detects (16 analytes) were reported in 81 of the 91 samples analyzed. Using our current safety assessment methods, the samples with PFOS are not likely to be a health concern.

Produce collected near a PFAS Production Plant in Eastern US

Dairy Farm near Air Force Base in New Mexico
Dairy Farm near Air Force Base in New Mexico

- A dairy farm in New Mexico was found to have contaminated groundwater due to its close proximity to an Air Force Base where AFFFs have been historically and currently used.
- The water sample had a PFOS concentration around 2500 ng/L, which is 35 times greater than the EPA health advisory level of 70 ng/L.
- The impact of the water contamination also resulted in PFAS contaminated silage produced in the area.
- As a result, dairy cows were exposed to contaminated water and silage, resulting in milk contamination.
- PFOS has a slow elimination rate from milk even after exposure is stopped. With a half-life of 56 days, it would take 1.5 years to eliminate PFOS from the cow after a 30 day exposure period (Asselt et al. Food Chem. 2013).
- The profiles of PFAS in milk are similar to profiles of AFFF foams reflecting the long term exposure of these chemicals to the cows and the persistence of the long chain compounds in these animals.

Conclusions:
- PFAS have caused results for PFOS/PFOA in top commodities using a safety assessment based on food consumption.
Produce collected near a PFAS Production Plant in Eastern US

Samples collected traveling downstream from plant

- Produce (mainly lettuce, cabbage, kale, collard greens) were collected at local farmer's markets along the river from above and below the PFAS production plant in June 2018.
- Based on previous studies, longer chain PFAS compounds can uptake into the leafy portion of the plant from contaminated water use, while only the shorter chain compounds will uptake into the fruit. (Blaine et al. ES&T 2014).
- Wells near the PFAS production plant are known to be contaminated with Gen-X (HFPO-DA) and samples collected from a produce stand within 10 miles of the plant had HFPO-DA concentrations~200 ng/kg.

C&EN News
https://cen.acs.org/articles/96/i7/who-sees-still-going-in-the-water-
downstream-of-a-chemours-plant.html
A dairy farm in New Mexico was found to have contaminated groundwater due to its close proximity to an Air Force Base where AFFFs have been historically and currently used.

- The water sample had a PFOS concentration around 2500 ng/L, which is 35 times greater than the EPA health advisory level of 70 ng/L.
- The impact of the water contamination also resulted in PFAS contaminated silage produced in the area.
- As a result, dairy cows were exposed to contaminated water and silage, resulting in milk contamination.
- PFOS has a slow elimination rate from milk even after exposure is stopped. With a half-life of 56 days, it would take 1.5 years to eliminate PFOS from the cow after a 30 day exposure period (Asselt et al. Food Chem. 2013).
- The profiles of PFAS in milk are similar to profiles of AFFF foams reflecting the long term exposure of these chemicals to the cows and the persistence of the long chain compounds in these animals.

Conclusions:

- The FDA has reviewed results for PFOS/PFOA in top commodities using a safety assessment based on food consumption data and the EPA reference doses. Use of the developed method and a robust sampling plan will provide a better understanding of potential dietary exposure to consumers that might include TDS and other sampling assignments.
  - Safety assessment was used to advise the New Mexico dairy farm that their milk was unfit for human consumption, the product was discarded.
  - PFAS concentrations measured in lettuce and other produce grown near a PFAS production plant were not likely a human health concern from consumption.
  - Results indicate PFAS concentrations measured in produce samples and TDS samples were not likely a human health concern from consumption.
- Water sources and foods grown near potentially contaminated sites will be monitored to ensure the safety of foods being introduced into commerce in the US.
Investigation of Per- and Polyfluoroalkyl Substances (PFAS) in US food products

Background

PFAS

Objectives:
- To develop methods to determine the concentrations of Per- and Polyfluoroalkyl substances (PFAS) in a variety of food items utilizing samples from the Total Diet Study program.
- To assess the impact of potential sources on the presence of PFAS in the environment and assess the levels of PFAS in different food products. Identify the primary contamination sources for PFAS from food products and food items.

Method

Total Diet Study Samples (TDS)

Dairy Farm near Air Force Base in New Mexico

Produce collected near a PFAS Production Plant in Eastern US

Conclusion:
- The FDA has reviewed results for PRODS/PFOA in top commodity crops using a dietary exposure assessment. The EPA reference levels, the developed method, a robust sampling plan, and a statistically validated laboratory method for the same were used. The method was validated using the top commodity crops. The concentrations of PFAS in the food items were measured and compared with the EPA reference levels.
- The results indicate that PFAS concentrations measured in top commodity crops were not高于 the EPA reference levels.
Investigation of Per- and Polyfluoroalkyl Substances (PFAS) in US food products

Susan Genusaidi, Lowri deJager, Timothy Begley
Center for Food Safety and Applied Nutrition, Food and Drug Administration, 5001 Campus Drive, College Park, MD 20746

**Background**

- PFAS are a group of chemical compounds with a long history of use in various industries.
- PFAS are known for their persistence in the environment and their bioaccumulation.
- PFAS have been associated with various health effects, including endocrine disruption.

**Objectives**

- To develop methods to determine the concentrations of Per- and Polyfluoroalkyl substances (PFAS) in a variety of food items utilizing samples from FDA Total Diet Study program.
- To assess the impact of food sources in three processing environments (PFAS) on health risks to consumers.
- To identify and recommend strategies to minimize exposure to PFAS.

**Method**

- Total Diet Study Samples (TDS)
- Dairy Farm near Air Force Base in New Mexico
- Produce collected near a PFAS Production Plant in Eastern US

**Conclusions**

- The FDA has revised its criteria for the Total Diet Study program, focusing on potentially harmful chemicals.
- The study highlights the importance of understanding PFAS concentrations in food sources.
- Recommendations include implementing strategies to reduce PFAS exposure, such as improving food processing methods and implementing stricter regulations on PFAS use.