Final report on PFAS Contamination in the St. Mary's River

The Social Political Controversy Related to Our Scientific Study

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March 17, 2021

This report on our PFAS Contamination in the St. Mary's River study is an addendum to our scientific report that reveals the program protocols and process, the sites chosen for study, and the results of EPA-certified laboratory testing. This addendum report will provide a more detailed discussion of the social political atmosphere under which the PFAS controversy plays out within the United States, of the lack of any significant regulatory controls at the federal level while states are quickly stepping up to fulfill this role, and of the dilemma faced by regulatory and academia scientists who study these PFAS compounds in their quest to catch up with industry's rapid introduction of newer PFAS compounds.

Task Force and Field Team

On March 5, 2020, our board of directors appointed four local scientists to a task force to 1) identify sample collection protocols and who is qualified to collect samples; 2) research certified *PFAS*-testing labs, gets quotes, and timelines; 3) determine sampling site selection; 4) oversee the implementation of sampling, submission of samples, and communications with labs or contractors; 5) interpret the lab results, present this information to our board (and yours?), and write a report. Those on the task force included:

- Bob Paul, PhD SMCM Professor Emeritus (Bob left this task force after three weeks as the pandemic pressures took away his time and energy)
- Randy Larsen, PhD SMCM Full Professor environmental chemist
- Tony Pait, PhD NOAA physical scientist
- John Spinicchia, MS SMCM biology department laboratory technician and researcher

All four members of the team are highly qualified in marine sciences. Each brings specific knowledge and expertise to the team. They quickly researched field sampling protocols and laboratories able to test for PFAS compounds. Testing for PFAS is an expensive endeavor and funding dictated the extent of the first round. The task force identified ten sites within the St. Mary's River system for testing, choosing several sites surrounding the Navy facility, Webster Outlying Field, a site suspected as a potential source of PFAS contamination. Meanwhile, the task force assigned work to a student intern to research the bigger picture of PFAS such as: Where does it come from? Where does it collect and concentrate? How extensive and credible are the possible negative health impacts? What are other municipalities and states doing to protect their constituencies?

Pandemic Behaviors and Limitations

The pandemic posed the first problem for our study when in late March Governor Hogan ordered all Marylanders to stay at home unless they served an essential role in the community. Maryland Resources Police were sent out to patrol waters and actively cited anyone who was not actively commercial fishing. We abided by this order and applied to the Governor for a waiver arguing that our work was essential and that we could easily maintain COVID safety protocols such as face coverings and distancing. Receiving no answer back from the governor's office, we pursued testing immediately upon the loosening of the stay-at-home order and collected samples June 4, 2020. The field team was kept to just two people who were both trained in PFAS sample collection via online studies and research with government agencies (including the EPA), academic institutions, and scientific testing laboratories. At all times we actively engaged in safe behaviors including distancing, wearing face coverings even when working outdoors, and hand washing. (Note that some hand sanitizer products sold today contain PFAS chemicals.)

The PFAS Controversy

Per- and polyfluoroalkyl substances (PFAS) are a group of man-made chemicals with carbon atom "backbone" chain either fully linked or incompletely linked to fluorine atoms, and to a "functional" group of atoms. (Perfluoro = fully linked to fluorine; Polyfluoro = incomplete link) PFAS owe their properties to the carbon-fluorine bond, which is one of the shortest and strongest known. This property also makes these chemicals, or the parts of them composed of C–F bonds, highly resistant to breakdown in the environment earning them the nickname "forever chemicals." Compounds with carbon chains of eight or more atoms are referred to as long chain analytes (and may have branches with fluorinated carbon groups). Compounds with six or less carbon atoms are referred to as short chain analytes. C8 analytes, those with 8 carbon atoms in a linear chain, were the first to be manufactured on a large scale more than seventy-five years ago. Common references to two specific compounds of the C8 type are PFOS (perfluorooctane sulfonate) and PFOA (perfluorooctanoic acid). Both have been studied extensively and are associated with known negative health outcomes for lab animals and humans. Eight leading US chemical manufacturers discontinued production of these two compounds more than a decade ago (2008), an acknowledgment that these chemicals are dangerous.

PFAS compounds are very useful, deemed essential by industry, for many products made today. By changing the "functional group" and carbon chain structure to achieve different characteristics, more than 4,800 of these compounds have been developed and marketed. Some estimate the number synthesized to date at over 10,000 worldwide. PFAS compounds can be utilized as firefighting ingredients, industrial surfactants, and to make articles fire-, water-, oil-, and stain-resistant. They are found in firefighting foams (AFFF) and a wide variety of coatings for industrial, commercial, and household products such as paints, clothing, carpets, drapes, food containers, cookware, cosmetics, sunscreens, lotions, hand sanitizers, cosmetics, dental floss, lubricants, paints, and pesticides. Many of these are products we use every day.

PFAS compounds are primarily released from the stacks of manufacturing facilities and incinerators and are transported through the air in particulate form, and then settle to Earth's surface. It is by this transport mechanism, which generally follows the hydrogeologic cycle, that PFAS are ubiquitous and found globally in soils, water, air, organisms and even house dust. Nearly every human being has detectable PFAS in their body. There is also evidence of direct dumping of PFAS into our environment—fire-fighting foams have been washed into ditches and storm drains only to find their way into our lakes and rivers. Household products are also leading sources of environmental contamination as we use and wear away surfaces of cookware; wash clothing, drapes, and carpets that are water-resistant; shower our bodies; and dispose of products containing PFAS in landfills. Therefore, leachate from landfills is a major source as are wastewater treatment plants none of which are capable of removing PFAS chemicals. Likewise, bio solids (sludge) produced in wastewater treatment plants contain PFAS and are frequently applied to agricultural fields where these contaminants may be picked up by food and feed plants and ingested by humans or animals.

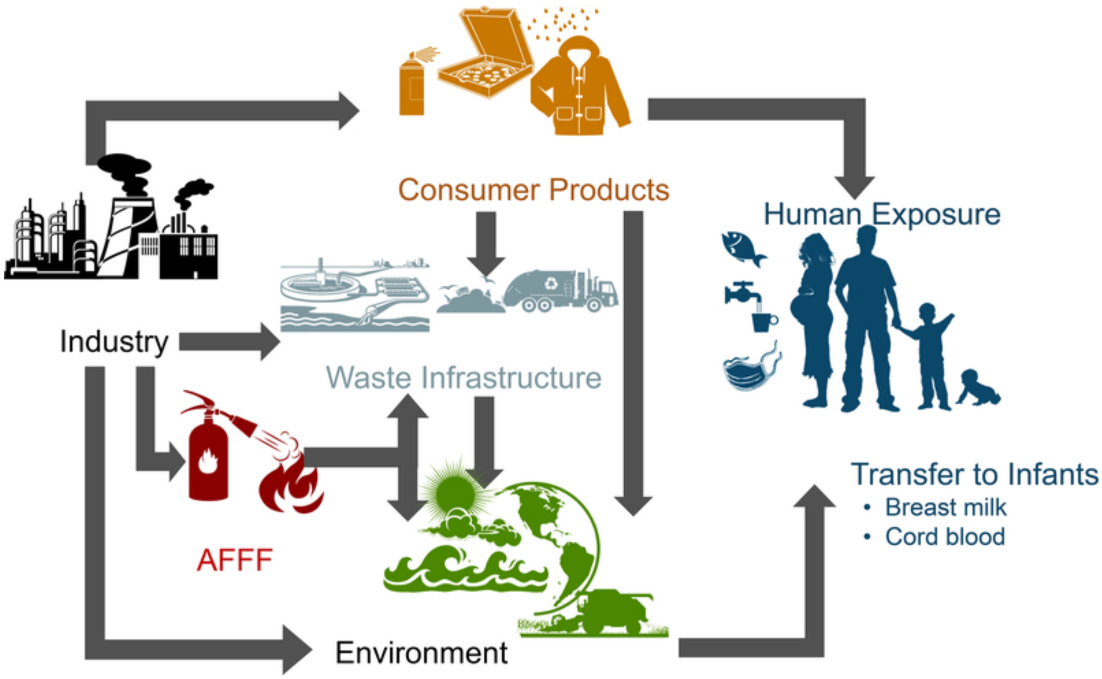

Figure 1. Overview of PFAS exposure pathways for different human populations outside of occupational settings. Source: Sunderland et al. (2019) Retrieved February 10, 2020 from https://www.ncbi.nlm.nih.gov/pmc/articles/PMC6380916/

Extensive studies of health effects of PFOS and PFOA, the original C8 chemicals, agree that these two compounds are major health hazards and are accumulating in our environment and in our bodies. They are known to cause suppressed immune function (less vaccine effectiveness), thyroid disease, testicular and kidney disease, cancers, and liver damage. Other recent studies have associated PFOS and PFOA more broadly with hepatotoxicity, neurotoxicity, reproductive toxicity, immunotoxicity, thyroid disruption, cardiovascular toxicity, pulmonary toxicity, and renal toxicity in laboratory animals and suggest these conditions may affect in-vitro human systems. These two compounds are no longer manufactured in the US.

Manufacturers have introduced replacement chemicals for PFOS and PFOA, many of which are short chain or GenX compounds. They claim that these newer chemicals are safe and not associated with negative health impacts. They argue that because they are short chain, they break down over time in our environment and are less bio accumulative in the environment and in our bodies. Non-industry science on these newer chemicals is emerging and in disagreement with manufacturers' claims.

Many environmental and health organizations also disagree and are advocating for regulatory control over all PFAS compounds. Some states are moving quickly to enact maximum levels of certain PFAS in drinking water and fish.

Dr. Linda Birnbaum, former director of the National Institute for Environmental Health Sciences, argues that even minute amounts of PFAS are health concerns and that newer compounds act very similarly on lab rats. Therefore, she argues, the whole class of PFAS compounds should be regulated as one. (Watch the Maryland Public Interest Research Group's November 16, 2020 panel discussion on PFAS in Maryland)

"If you look at the data, pancreatic tumors are present at very, very low concentrations from PFOA [in rats]," Birnbaum told the audience at the conference. (Northeastern University second annual conference on

PFAS, 2019) “If you use the pancreatic tumors in the rats in the [National Institute for Environmental Health Science National Toxicology Program] study to calculate what would really be a virtually safe dose, you’re getting down at about 0.1 ppt. [parts per trillion] Well, that’s really low. And that’s only for one PFAS.”

Dr. Birnbaum spoke about many, if not all, of the PFAS family of chemicals. Studies in lab rats found similar health responses to the newer "short chain" and GenX chemicals at extremely low doses as they had with PFOA and PFOS.

So what is a safe level? The EPA has set the health advisory level for drinking water at a maximum of 70 ppt (parts per trillion) for each of the two compounds PFOS and PFOA. Sweden has set a slightly higher regulatory limit at 90 ppt, but it includes a *total of all PFAS detected* in drinking water. The European Union's regulatory limit is 200 ppt total sum for 20 specific compounds. US states have also set limits most notably Illinois has set a Health Advisory Level (HAL) at 2 ppt for eight PFAS compounds in drinking water. Michigan set its drinking water health advisory level at 20 ppt for the total sum of six PFAS compounds. More than a dozen states either have health advisory limits for drinking water or have these advisories nearing regulatory completion. Some states have regulated or are nearing regulatory advisories for fish caught in specific waterways. They include Alabama, Massachusetts, Michigan, Minnesota, New Hampshire, New Jersey, and North Carolina. Maryland does not regulate PFAS; currently Maryland is examining the extent of contamination in both drinking water and surface waters with the intent to reduce the flow of these contaminants into our environment. It is estimated that more than 400 municipal potable water suppliers in Maryland may be periodically providing their customers with drinking water that does not meet the EPA’s advisory level of 70 ppt.

Testing we conducted detected minute quantities for PFAS in oysters and a sister study (October 2020) confirmed our findings for oysters and also detected significantly more PFAS in a 23-inch rockfish caught in Cornfield Harbor near the mouth of the Potomac River. The Maryland Department of the Environment (MDE) regulates health advisories for fish and seafood. They were informed immediately of our testing results. In response to our testing results and result from testing MDE conducted in summer 2020, both on surface waters and oysters in the St. Mary’s River, on October 5, 2020 MDE issued a statement stating, “A new report shows that sampling of surface water and oysters in the St. Mary’s River for per- and polyfluoroalkyl substances, or PFAS, found no levels of concern.” We questioned this statement in the Maryland PIRG panel discussion mentioned above and MDE Secretary Ben Grumbles countered the written press release stating that the levels in the rockfish were a “concern.”

The CDC’s Agency for Toxic Substances and Disease Registry (ATSDR) argues that the EPA’s 70 ppt limit is ten times too high.

Except for Illinois, these regulatory limits are not even close to what Dr. Birnbaum and others suggest. Birnbaum, along with the Environmental Working Group, Toxic-Free Future, and other health advocacy groups, are pushing for the safe drinking water limit to be 0.1 ppt total sum for all PFAS compounds detected. This level, 0.1 ppt, is below the detection ability of most laboratories in the US and is 20 times lower than Illinois’ current maximum contaminant level (MAL).

<u>Health Risk Assessments</u>

Toxicologists currently do not agree on human tolerance and appropriate health advisory levels. Some argue that the EPA’s 70 ppt drinking water level is sufficient but that additional compounds should be regulated. Others, as we have mentioned, disagree and call for much lower regulatory levels. Dr. Birnbaum is calling for the end of PFAS production and use for all non-essential needs. In fish tissue, states have set regulatory consumption advisory levels for certain PFAS compounds as low as 230 ppt in New Jersey (eat no more than once weekly) to 10,000 ppt in Minnesota (eat no more than once weekly) to 41,000 ppt in Alabama (eat no more than once weekly). These advisory levels are not even in the same ballpark, even though they are regulating the same two most researched compounds in the PFAS family of synthetic chemicals. Moreover, the emerging science on existing newer compounds can never catch up with industries' rapid introductions of the newest PFAS compounds.

Goals and Conclusions

Our primary goal in this study was to quickly determine whether PFAS was present in surface waters and oysters in the St. Mary's River and, if so, was the level a health concern that necessitated immediate health advisories by MDE. A secondary goal was to impart a feeling of urgency to Maryland's assessment of PFAS contamination, to PFAS mitigation through source prohibitions or filtering and clean ups, and to setting regulatory health advisories. These goals were determined after the Navy presented in a public meeting March 3, 2020 information about the presence of PFAS at Patuxent Naval Air Station. Stories of heavily contaminated environments and drinking water adjacent to other US Department of Defense sites throughout the world swirled around in the conversations between attendees at that informal March 4 poster session meeting. Many left feeling afraid and angry accusing the Navy of moving too slowly here locally and not answering their questions.

We now know that PFAS is present in at least some of the oysters living in the St. Mary's River. And given that PFAS are ubiquitous, we also know that in many areas of the river the surface waters are also contaminated at levels well above background presence. And yet the levels we found in the St. Mary's River were not comparable to levels found at many military sites around the country—some heavily contaminated military sites being 1,000 to 10,000 times higher levels of contamination that we found near Webster Outlying Field along the St. Mary's River. The state's St. Mary's River Pilot PFAS testing program (July-October 2020) included a site near Maryland's eastern shore, Fishing Bay, as a control—an area they determined to have little anthropomorphic input. Total PFAS detected in surface waters at Fishing Bay was 12.4 ppt—the third highest level detected in the thirty-one sites MDE tested. No military or industrial sites are found around Fishing Bay. Given the data we and the state were able to collect, no clear indication of PFAS contamination sources can be drawn. PFAS is, in fact, just about everywhere—80% of the sites we tested and 100% of the sites the state tested had PFAS detected in the surface waters. More likely, there are multiple sources of PFAS contamination in the St. Mary's River such as air deposition, agricultural runoff (fields treated with sludge), and products used every day as we go about our lives. At least four of the compounds we detected have been or are currently being used in aqueous film forming foam (AFFF), a firefighting product used a most military installations and blamed as the leading source at most of the heavily contaminated military sites nationwide.

With regards to the oysters we tested, the first seven sites we tested and all ten sites the state tested were completed by two laboratories that could not detect at parts per trillion—both were limited to approximately 4 parts per *billion* as their lowest level of detection. We retested oysters at two sites and a sister testing program completed by a community volunteer tested oysters at a third site, all within the tidal St. Mary's River, and sent these samples to a laboratory whose minimum detection level was 200 ppt in animal tissue. PFAS was detected in all oyster samples collected and total PFAS detected at each site ranged from 1020 ppt to 1100 ppt. The sister study included a blue crab with 6850 ppt total PFAS and a 23-inch rockfish caught a few miles away in the Potomac with 23,100 ppt total PFAS.

Studies elsewhere, such as New Jersey, New Hampshire, and North Carolina, have had similar results comparing fish and oysters. Generally, it appears that fish have about ten or more times as much PFAS as oysters.

The data results suggest that more testing is needed. More important is for regulatory, health, and academic institutions to form a consensus on maximum contaminant levels (MCLs) and health advisory levels (HALs). Only then can government set regulatory standards and manage enforcement. Our partners in this project are not and certainly we are not capable of determining whether consumption of oysters from the St. Mary's River is a health concern. We did succeed in building momentum for PFAS product prohibitions, testing, and advisory setting at the state level both in MDE and in the Maryland General Assembly. We also have succeeded in informing the public through four e-newsletter on the project, two interviews for regional media, and for our small part in supporting the Maryland PIRG panel discussion. We have published a "PFAS in the St. Mary's County" webpage that we will continue to update quarterly throughout the coming year: http://smrwa.org/PFAS.html

Links to study resources and documents:

Final report on PFAS Contamination in the St. Mary's River - Scientific Study
http://smrwa.org/pdfdocs/PFAS_scientificreport.pdf

Maryland PIRG November 16, 2020 panel discussion – begins a couple minutes into the video:
https://www.facebook.com/watch/live/?v=3280753385384475&ref=watch_permalink

Laboratory test results for June sampling by SMRWA:
http://smrwa.org/pdfdocs/PFAS_Rpt_RTI_2020-06.pdf

MDE's report on St. Mary's River PFAS Pilot Study – July sampling:
http://smrwa.org/pdfdocs/PFAS_Rpt_MDE_2020-09.pdf

Laboratory test results for October sampling by SMRWA:
http://smrwa.org/pdfdocs/PFAS_Rpt1_Eurofins_2020-10.pdf

Laboratory test results for November sampling by community volunteer:
http://smrwa.org/pdfdocs/PFAS_Rpt2_Eurofins_2020-11.pdf