DELAWARE RIVERKEEPER NETWORK

MEMORANDUM

To: File
From: Tracy Carluccio, Deputy Director
Date: July 29, 2013
Re: PFNA in groundwater and surface water in the Delaware River Watershed

Delaware Riverkeeper Network (DRN) is very concerned about Perfluorononanoate acid (PFNA) found in ground and surface waters within the Delaware River Watershed. Various sources of sampling data and reports have revealed that PFNA has been reported in very high levels in groundwater and surface water here.

PFNA is part of a group of perfluorinated chemicals (PFCs) including perfluorooctanoic acid (PFOA), perfluorooctane sulfonate (PFOS), and many others that are of concern as contaminants found in water and the environment.

U.S. Environmental Protection Agency (EPA)

EPA has recognized PFOA, PFOS and other long chain perfluorinated chemicals (PFCs) as important emerging contaminants. In 2009, the agency established a provisional health advisory of 0.2 micrograms per liter (ug/L or ppb) for PFOS and 0.4 ug/L for PFOA in drinking water based on short-term exposure. Eight major manufacturers are part of a voluntary Stewardship Program with EPA and committed to working toward the elimination of PFOA, chemicals that can break down to PFOA, and related higher homologue chemicals from emissions and products by 2015 (http://www.epa.gov/oppt/pfoa/pubs/stewardship/pfoastewardshipbasics.html).

EPA also finalized two Significant New Use Rules (SNURs) in 2002, requiring companies to give 90 days' notice to EPA before manufacturing or importing 88 identified PFOS-related substances and in 2007 added 183 more with longer carbon chain lengths. (http://www.epa.gov/fedfac/pdf/emerging_contaminants_pfos_pfoa.pdf). In 2009, EPA developed an Action Plan for long chain PFCs including PFOA and higher homologues because of the following concerns: "Long-chain PFCs are found world-wide in the environment, wildlife, and humans. They are bioaccumulative in wildlife and humans, and are persistent in the environment. They are toxic to laboratory animals and wildlife, producing reproductive, developmental, and systemic effects in laboratory tests." (http://www.epa.gov/oppt/existingchemicals/pubs/actionplans/pfcs.html)

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EPA is developing drinking water Health Advisories for PFOA and PFOS based on chronic long-term exposure using ongoing and new scientific findings. The EPA Unregulated Contaminant Monitoring Rule 3 includes PFOA, PFOS, PFNA, and other PFCs. It is expected to provide information within a few years about whether there is enough nationwide occurrence of these chemicals to necessitate the development of a nationwide drinking water standard. (http://water.epa.gov/lawsregs/rulesregs/sdwa/ucmr/ucmr3/index.cfm)

The C8 Science Panel

The C8 Science Panel is a group of independent public health scientists charged with assessing whether or not there are is a probable link between PFOA exposure and disease in residents of 6 West Virginia and Ohio water districts contaminated by industrial release of C8 (also known as PFOA) (http://www.c8sciencepanel.org/panel.html). The C8 Science Panel concluded in 2012 that there is a probable link between exposure to PFOA and testicular cancer, kidney cancer, and four other diseases, based on studies in these communities and other information. (http://www.c8sciencepanel.org/pdfs/Probable_Link_C8_Cancer_16April2012_v2.pdf) The Panel has also found many other health impacts in human populations exposed to PFOA in drinking water. (http://www.c8sciencepanel.org/index.html)

Agency for Toxic Substances and Disease Registry (ATSDR)

ATSDR published a draft Toxicological Profile for Perfluoroalkyls in 2009. While PFOA and PFOS are the PFCs for which there is the most information, this comprehensive document also includes information on other PFCs including PFNA (http://www.atsdr.cdc.gov/toxprofiles/tp.asp?id=1117&tid=237). There is a good body of scientific data concerning the health effects of PFNA. Longer carbon chain PFCs are known to be more bioaccumulative and toxic than shorter chain compounds and PFNA is more persistent than PFOA in rodents (ATSDR Toxicological Profile, 2009. http://www.atsdr.cdc.gov/toxprofiles/tp.asp?id=1117&tid=237). In general, PFNA causes similar toxic effects as PFOA, but at lower doses (http://www.state.nj.us/drbc/library/documents/toxics060513_post.pdf).

New Jersey Department of Environmental Protection (NJDEP)

NJDEP has been working to establish a safe drinking water level for PFOA for several years. DRN has been involved with this issue since the beginning, having performed tap water sampling in Salem County communities which DRN submitted to NJDEP in 2006. NJDEP issued an Occurrence Study for PFOA in New Jersey public drinking water in 2007 and established a PFOA drinking water guidance level of 0.04 ppb based on lifetime health effects, the strictest in the nation. Unfortunately, all progress towards establishing a maximum contaminant level has halted since the Drinking Water Quality Institute, an advisory body established by the NJ Safe Drinking Water Act that recommends safe drinking water standards to NJDEP, was shut down after its last public meeting in September 2010.

Scientific Studies

Several studies, including a recent report by Rockwell and others (April 2013), show immunotoxic effects in mice from PFNA (http://www.omicsonline.org/2161-1459/2161-1459-S4-

002.php?aid=14207). As reviewed in the Rockwell paper, PFNA also causes other effects in animals including liver toxicity, decreased survival and developmental effects in pups, and male-specific reproductive toxicity. It has been associated with increased cholesterol, including LDL (bad) cholesterol in humans.

A 2007 report in Environmental Health Perspectives found PFNA and several other PFCs in the blood serum of more than 98% of U.S. residents tested, and it showed that the blood serum level of PFNA increased in the periods studied (http://www.ncbi.nlm.nih.gov/pubmed/18007991), while other perfluorinated compounds stayed constant or declined. Rockwell and colleagues (April 2013) discuss concerns about those people with higher than average blood serum levels due to individual variations or occupational exposures.

Environment Canada found PFCs, including PFNA, in wildlife throughout the globe, including polar bears (PFNA at 400 ppb), seals and birds (http://www.chem.utoronto.ca/symposium/fluoros/pdfs/Fluoros-PFAbiomonitoring(Muir).pdf). A 2005 report in Environmental Science and Technology reported very high levels of PFNA in the blood plasma of bottlenose dolphins from the Delaware Bay, higher than other PFCs that were tested for.

PFNA in the Delaware River Watershed

Data collected by the Delaware River Basin Commission (DRBC) and published in a report in July 2012 revealed high levels of PFNA in surface water in samples between 2007-2009 in the Delaware River (http://www.state.nj.us/drbc/library/documents/contaminants-of-emerging-concernJuly2012.pdf). The highest locations were between River Mile 50 and 88/90. PFNA was elevated starting at River Mile 88/90 and was extremely high at River Mile 80. Samples were analyzed for other PFCs as well, with high results for PFOA and PFHxA.

The DRBC report showed extraordinarily high levels of PFNA in the Delaware River. The report states that PFNA "…at a maximum of 976 ng/L was the PFAS with the highest concentrations in the DRBC surveys Table 9". The report cites other studies that have found significant levels in surface water, but none as high as the Delaware River's 976 ng/L. In fact, in reviewing the literature available on line, no level that was nearly as high can be found in surface water elsewhere. Fish flesh analysis conducted for the study found PFCs between River Mile 58 and 128 with the highest concentrations at River Mile 80 and 91 for PFNA and perfluoroundecanoic acid (PFUnA, C11).

Solvay Solexis

Available information strongly suggests that the source of the PFNA in the Delaware River beginning at River Mile 88/90 was the Solvay Solexis plant in West Deptford/Thorofare, NJ on the Delaware River near River Mile 90. EPA reports in its Region 2 Fact Sheet on Solvay Specialty Polymers USA LLC that fluorocarbon manufacturing at this site began in the 1970's when it was owned by Pennwalt, and it then changed hands to Elf Autochem and Ausimont USA, and finally to the Solvay Group in 2002. Fluorocarbons and fluoroelstomers are manufactured there. The facility has a permit from NJDEP for onsite hazardous waste storage and incineration.

Groundwater and soil contamination resulted from plant operations which are now under a RCRA cleanup. (http://www.epa.gov/region02/waste/fsausimo.htm).

In 1985, Pennwalt filed a patent (US Patent 4,569.978) as the original user of Surflon S111, a fluorinated surfactant. The EPA Region 2 Fact Sheet on Solvay Solexis Polymers USA LLC states that new operations to manufacture vinylidene fluoride monomers, fluoropolymers, and fluorocarbons began in this same year, 1985. PFNA (also known as APFN or C9) is the main component of Surflon 111, with lesser amounts of longer chain perfluorinated compounds C11 and C13. PFNA is used to make PVDF (polyvinylidene fluoride) from vinylidene fluoride monomers, in the same way that PFOA is used to make PTFE (DuPont's Teflon). PFNA and PFOA act to "solubilize fluoromonomers to facilitate their aqueous polymerization" (http://pubs.acs.org/doi/abs/10.1021/es0512475 p. 34).

The second highest production capacity for PVDF (2002) in the world was found at Solvay Solexis in Thorofare at 7.7 ktonne/year. Even if not operating at full capacity, PFNA was used extensively at the Solvay Solexis facility in West Deptford/Thorofare and thousands of metric tons of PVDF were produced. Of the three commercial PFCA products analyzed, only Surflon S111 contains a significant amount of PFNA.
(http://pubs.acs.org/doi/abs/10.1021/es0512475 Supporting Information Table S2 and pages 17-18). This results in up to several metric tons of PFNA emitted yearly at the Solvay facility, calculated at approximately 60% emitted during the manufacture of PVDF (http://pubs.acs.org/doi/abs/10.1021/es0512475 Supporting Information, page 19).

In the 2008 Report from Solvay Solexis to EPA a Mass Balance graphic illustrates that of the total PFNA used, 3-10% goes into the product, but most is either exhausted to the air (25-32%) or released into wastewater (62.7%). These percentages are quite startling from an environmental perspective (http://www.epa.gov/opptintr/pfoa/pubs/!Solvay%20Solexis%20report.pdf).

Measures were supposed to be put in place to capture and reuse much of the emissions. However, one of the striking characteristics of all PFCs, including PFNA, is that they do not degrade in the environment. Thus, groundwater and soil contamination is persistent and intractable posing substantial threat from historic/legacy pollution at the Solvay Solexis site, even if less or none were to be emitted today.

In other words, the pollution is persistent in the soil and groundwater from years of use. This means aquifers that supply drinking water will remain contaminated, exposing those who consume it. Also, groundwater feeds the base flow of surface waterways so PFNA can continue to discharge from the Solvay site to nearby streams such as Mantua Creek and/or the Delaware River.

<u>New Jersey Department of Environmental Protection Recent Actions</u>
NJDEP conducted a second round of drinking water sampling for PFCs in 2009. DRN requested through the Open Public Records Act (OPRA) a copy of the 2009 Occurrence Study several times. One of our OPRA requests was filed in May 2011 and in response we were informed that the report regarding the 2009 "…PFOA Occurrence Study of 30 different sampling locations

collected from 29 different public community and noncommunity water systems" was underway and was expected soon after the completion of sampling.

The report has never been issued, and as recently as April 2013, the Department declined DRN's request for the report due to the "deliberative" nature of the document. After refiling an OPRA asking for the raw data and copies of notifications sent to water suppliers regarding the 2009 sampling, DRN received information from the Department between July 16 and 18, 2013, including data on 10 PFCs in 33 samples taken by the Department from 32 water supplies throughout New Jersey.

Notably, PFNA was found in a raw groundwater sample from Paulsboro Water Department at 96 ng/L. Paulsboro is about two miles from the Solvay Solexis plant (www.solvaysolexis.com). This is an extremely high level of PFNA. It is not only the highest level of PFNA found in New Jersey, but a literature search turned up no values as high as this in drinking water anywhere. A copy of the NJDEP data is attached. We have reported our concerns regarding PFNA, PFOA and the family of perfluorinated chemicals to NJDEP based on this newly received data by letter dated July 25, 2013. A copy is attached. Another public water supply in the vicinity, labeled "PWS-B" in http://www.state.nj.us/drbc/library/documents/toxics060513_post.pdf also had very high levels of PFNA (up to 72 ng/L). Treatment has been installed at this site by NJ American Water, and PFCs are not detected in the finished water.

Continuing Pollution Issues and Evidence

We reiterate that the high groundwater and surface water levels of PFNA seem clearly linked to the Solvay Solexis facility in West Deptford/Thorofare in the Delaware River Watershed. Surface water results show extremely high levels of PFNA as you move downstream on the river from River Mile 90, the approximate location of the Solvay Solexis facility. PFCs used in manufacturing are emitted to both air and water, and PFOA has been shown to contaminate groundwater many miles away through air transport. Also, groundwater supplies the base flow of surface waterways so PFNA can be continuing to discharge from the Solvay site to nearby streams such as Mantua Creek and/or the Delaware River. Therefore, contamination of the environment could be through various pathways from the site -- air transport as well as release to water and soil.

Additionally, the extremely high levels of PFUnA (C11) found in fish flesh sampled for the DRBC study of emerging contaminants further point to Solvay Solexis because PFUnA is found in the Solvay Solexis' patented Surflon S111 manufactured and used at the West Deptford/Thorofare site (http://www.state.nj.us/drbc/library/documents/delaware-co_env_summit021613_macgillivray-pres.pdf Fish Fillet Table, slide 15 of power point). Further, the elevated levels of PFUnA in Delaware River water, in contrast to other locations where PFUnA was sampled for by the DRBC, also point to the Solvay Solexis site as a likely source. (http://www.state.nj.us/drbc/library/documents/contaminants-of-emerging-concernJuly2012.pdf Appendix B Tables B8, B9, B10, pages 64-66). This additional information can be considered to be another likely "marker" for Solvay's discharged chemicals.

Paulsboro, Thorofare, West Deptford, the Delaware River and the Region

DRN is extremely concerned about the public health, ecosystem and environmental implications of the unregulated chemicals in the perfluorinated family, focusing on PFNA in this Memorandum. Our concerns are heightened by the lack of ongoing monitoring for PFNA to find out if releases to surface water are continuing or have caused fish or wildlife impacts as well as harmful impacts to the ecosystems of the Delaware River, Estuary and Bay. We are concerned by the apparent lack of action by any agency to target PFNA for cleanup in New Jersey or elsewhere and the lack of an established safe drinking water standard for any PFCs, including PFNA.

We are gravely concerned by the lack of public knowledge that PFNA is present in New Jersey drinking water, and that there are many more water supply wells in Paulsboro and in other nearby municipalities in the Solvay Solexis vicinity that have not been tested for PFCs.. As above, Rockwell (April 2013) discusses concerns about those people with higher than average blood serum levels of PFNA. This would almost definitely include people with exposure to high levels of PFNA in drinking water as have been reported in New Jersey.

Residents of this region are likely exposed to PFNA through other routes besides drinking water, including consumption of contaminated local fish. Other possible exposure sources such as air contamination, soil contamination, and consumption of fruits and vegetables grown in contaminated soil, have not been studied and need to be investigated. Infants and children may be at especially high risk because they have higher exposures than adults and they are a target for the developmental effects of these chemicals.

People with higher than average blood serum levels of PFNA due to occupational exposure (workers at the facility who live in the community, first responders who may have been exposed during an accidental release, etc.) or other individual characteristics or exposures are also at higher risk. The evidence is clear that the public has been exposed and is likely still being exposed to dangerous levels of PFNA and is unaware of the potential health threats this poses, depriving them of the opportunity to take actions to protect themselves and their families.

Environmental Justice

The areas surrounding the Solvay Solexis facility and neighboring Paulsboro where the raw water sample was obtained by NJDEP are exposed to a large number of potential pollution sources. Paulsboro in particular is an industrialized borough with many refineries, manufacturing, and laboratory facilities. Paulsboro recently experienced a train derailment that released potentially deadly vinyl chloride to the air and water; a rail yard is housed nearby. These all combine to impose a disproportionately heavy environmental burden, with negative consequences.

NJDEP defines environmental justice as EPA does, stating that it strives for fair treatment so that "…no group of people, including a racial, ethnic, or socioeconomic group, should bear a disproportionate share of the negative environmental consequences resulting from industrial, municipal, and commercial operations …" http://www.nj.gov/dep/ej/index.html NJDEP's current Goals Statement on its website includes five goals. Goal 3 "Restoration and Enhanced Protection in Environmentally Overburdened Communities" is to "…develop a new paradigm for the protection of communities overburdened by environmental stresses through a multimedia approach focusing on human health and the environmental impacts; ensure that we work in

concert to address issues related to air, water, preservation, acquisition, and affordable access to parks." (http://www.state.nj.us/dep/docs/depgoals.pdf) DRN considers Paulsboro and other areas adjacent to these pollution sources to fit the definition of environmental justice areas. Action is needed to lift this burden and protect these vulnerable communities.

Paulsboro's public water supply system is comprised of six groundwater wells and four treatment facilties, 2 active and 2 inactive. As far as we know, only one of these wells was sampled by NJDEP for PFCs. We do not know if further sampling has been done for these substances or if the treatment system removes these pollutants. Removal of PFCs is not listed in the treatment information on their website.
https://www11.state.nj.us/DEP_WaterWatch_public/JSP/WSFacilities.jsp?tinwsys=158

Needed Actions

A full investigation of PFC contamination in New Jersey is needed. The public health and environmental effects of the presence of PFCs, including PFNA at extremely high recorded levels, must be assessed and action taken to prevent further pollution, to clean up sources of pollution, and to protect the public from contaminated drinking water and other environmental exposures. Safe drinking water levels need to be established and water suppliers need to be required to provide effective treatment to their water supplies for these chemicals.

We see an urgent need for guidance from health and environmental authorities regarding these chemicals. What is the safe drinking water level for these PFCs? How can treatment be provided? What are the health effects and warning signs? How can people avoid or limit exposure and how can communities protect their residents from water contaminated with PFCs, especially the most vulnerable populations such as children, the elderly, the over-exposed and the infirm? Considering DRBC's findings regarding the concentration of PFNA in fish flesh (2012), what are the safe limits for fish consumption? These are critical and pressing questions that must be addressed to protect public health and the environment.

In closing, DRN urges in the strongest possible manner that the responsible agencies take immediate action to address this pollution issue and to publicly release all relevant findings regarding PFNA and all PFCs.