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TO: U.S.EPA Office of Water, Docket ID No. EPA–HQ– OW–2023–0580
FROM: Lenny Siegel, Executive Director, Center for Public Environmental Oversight
SUBJECT: Publicly Owned Treatment Works Influent Poly-Fluoroalkyl Substances Study Data Collection
DATE: May 20, 2024

Thank you for the opportunity to comment on EPA's proposed "Publicly Owned Treatment Works Influent Poly-Fluoroalkyl Substances Study Data Collection."[1] This exercise could generate data enabling comprehensive steps to reduce the release of PFAS into the environment, through both wastewater plant effluent and biosolids.

I suggest that a portion of the study be targeted at publicly owned treatment works that receive wastewater from semiconductor wafer fabrication facilities, for at least five reasons.

1. The CHIPS Program Office at the Department of Commerce has observed, in its first environmental review of semiconductor production: "Wastewater discharge from semiconductor manufacturing facilities presents the greatest risk for PFAS contamination of the environment."[2] In fact, the industry reports that PFAS treatment is the exception, rather than the rule: "Most PFAS are not regulated pollutants and therefore unless company specific provisions are in place, the wastewater from processes that use aqueous wet chemical formulations that contain PFAS would likely

[1] Announced on March 29, 2024 by U.S.EPA's Office of Water at https://www.epa.gov/eg/study-pfas-influent-potws
[2] "Draft Programmatic Environmental Assessment (PEA) for Modernization and Internal Expansion of Existing Semiconductor Fabrication Facilities under the CHIPS Incentives Program," U.S. Department of Commerce CHIPS Program Office, December, 2023, p. B-7, https://www.nist.gov/system/files/documents/2023/12/26/CHIPS%20Modernization%20Draft %20PEA.pdf

be discharged to the publicly owned treatment works without substantive removal of the PFAS."[3]

2. The semiconductor industry, supported by the Department of Defense, considers its use of a wide variety of PFAS compounds to be essential to production, and in turn semiconductor production is considered essential to the U.S. economy, national security, and daily life. Industry has become reliant on PFAS without first examining the human and environmental risks. It explains, "Without PFAS, the ability to produce semiconductors (and the facilities and equipment related to and supporting semiconductor manufacturing) would be put at risk."[4]
3. Supported by federal and state subsidies, domestic semiconductor wafer fabrication is expected to grow substantially in the next decade.
4. Semiconductor manufacturers are aware of the challenges of PFAS wastes and appear willing to develop technologies to monitor and treat chipmaking wastewater.
5. Federal funds supporting chip manufacturing may be used to complement industry investments in technologies for the analysis, removal, and even destruction of PFAS in wastewater.

In collecting information about PFAS in wafer fabrication wastewater, it's important to recognize the diverse natures of PFAS use and discharge. As recently as June, 2023, the industry PFAS Consortium wrote, "At present, only a small percentage of PFAS compounds within typical semiconductor wastewater are detectable and quantifiable using conventional U.S. EPA analytical methods for PFAS-containing materials."[5] This is based, at least in part, upon the findings of Cornell University researchers who concluded that failure to measure total fluorine misses discharges of significant quantities of PFAS pollutants. "[B]ecause many studies of total organic fluorine have shown that total PFAS concentrations are at least 10 times higher than the sum of target PFASs. However, this does reinforce the idea that PFAS monitoring should incorporate complementary target and nontarget analyses or otherwise include measures of total organic fluorine to accurately assess PFAS abundance and potential environmental impacts."[6]

In a more recent study, they reported, "However, the exact identities of these constituents are unknown and transformation reactions that may occur during photolithography may result in the formation of unknown or unexpected PFASs."[7] Measurement of such PFAS should not be

[3] "The Impact of a Potential PFAS Restriction on the Semiconductor Sector," SIA PFAS Consortium, April 13, 2023, p. 3. The SIA PFAS Consortium is made up of chipmakers and their suppliers of equipment and materials. To sign up to receive their technical papers, go to https://www.semiconductors.org/pfas/ .

[4] "The Impact of a Potential PFAS Restriction on the Semiconductor Sector," p. 3.

[5] "PFOS and PFOA Conversion to Short-Chain PFAS-Containing Materials Used in Semiconductor Manufacturing," SIA PFAS Consortium, June 5, 2023, p. 11.

[6] Paige Jacob, Kristas Barzen-Hanson, and Damian Helbling, "Target and Nontarget Analysis of Per- and Polyfluoralkyl Substances in Wastewater from Electronics Fabrication Facilities," *Environmental Science & Technology,* February 16, 2021, p. 2353. https://pubs.acs.org/doi/10.1021/acs.est.0c06690 . This study was sponsored by the semiconductor industry

[7] Paige Jacob and Damian E. Helbling**,** "Exploring the Evolution of Organofluorine-Containing Compounds during Simulated Photolithography Experiments," *Environmental Science and Technology**,*** August, 2023**,**

confined to target compounds or those captured through carbon adsorption, but should use methods designed to identify and quantify all PFAS in production wastewater.

EPA should work with participating treatment works and academic researchers to utilize methods in addition to Method 1633 and Method 1621 to assess the presence of all PFAS, including the measurement of total organic fluorine. Such information is necessary to develop strategies for the routine measurement of liquid PFAS wastes as wells as its pre-treatments—that is, its removal from treatment works influent.

Some have asserted that the release of shorter chain PFAS into the environment need not be carefully managed, based on the assertion that they are less toxic than long-chain compounds such as PFOA and PFOS. This would be a tragic mistake, for at least five reasons:

1. Most PFAS compounds have not been subject to toxicity assessments.
2. Shorter chain PFAS appear to be more mobile and more difficult to remove from liquids.
3. All PFAS appear to be persistent and bioaccumulative in the environment, so their impact on the environment is generally irreversible.
4. Even if shorter chain PFAS are less toxic than PFOA and PFAS, they are likely to become subject to regulatory standards comparable to or even more stringent than those in place for other toxicants, such as volatile organic compounds.
5. An ounce of avoided releases is worth orders of magnitude of cure. Ling found, "current costs to remove and destroy the total PFAS mass released annually into the environment would likely exceed the global GDP of 106 trillion USD. While this level of treatment is not technically or economically achievable, it highlights the unaffordability of using environmental remediation alone to manage environmental PFAS stocks."[8]

Good data on PFAS in wastewater, particularly from semiconductor production, could lead to the use of PFAS pre-treatment technologies designed to address the specific liquid wastes associated with wafer fabrication at the point of use, and even the adoption of End of Pipe, Zero Liquid Discharge systems. Industry is moving in this direction, but in the absence of regulatory requirements such costly best practices appear to be the exception, rather than the rule.

As the federal and state governments provide billions of dollars for semiconductor facility construction and expansion, there is an opportunity to address the growing challenge of PFAS liquid releases from those plants. This data collection program is well situated to support that work.

https://pubs.acs.org/doi/pdf/10.1021/acs.est.3c03410?download=true . This study was sponsored by the semiconductor industry and the National Science Foundation.

[8] Alice L. Ling, "Estimated Scale of Cost to remove PFAS from the Environment at Current Emission Rates," *Science of the Total Environment,* March, 2024, p. 2, https://doi.org/10.1016/j.scitotenv.2024.170647