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TO: Micron Project, Office of Economic Development, Onondaga County
FROM: Lenny Siegel, Center for Public Environmental Oversight
DATE: October 30, 2023
SUBJECT: SEQRA Scope of Work for Micron Semiconductor Fabrication

Thank you for the opportunity to comment on the September 12, 2023 Draft SEQRA Scope of Work for Micron Semiconductor Fabrication. I have been asked by residents of Onondoga County to offer my comments.

I have nearly five decades of experience monitoring and influencing the worker health and environmental impacts of the semiconductor industry, through the Pacific Studies Center, the Project on Health and Safety in Electronics, the Silicon Valley Toxics Coalition, and the Center for Public Environmental Oversight, as well as my service as Council Member and Mayor of Mountain View, the birthplace of the commercial semiconductor industry.

The semiconductor industry produces remarkable products that we all use. Unfortunately, its environmental and workplace health record is less than remarkable. The MEW Superfund Area here in Mountain View was the home of some of the earliest successful integrated circuit manufacturers. The wafer fabs are gone, but despite the scores (hundreds?) of millions of dollars spent thus far on subsurface remediation, the contamination—including the risk of public exposure—will remain for decades more, if not longer. The same is true at other Silicon Valley sites.

The SEQRA process provides an opportunity to identify and minimize, in advance, the environmental hazards of semiconductor production. By doing so, it can lead to appropriate regulation, research on waste management and pollution prevention, and investments in safer facilities.

Semiconductor production is essentially a series of chemical processes that use a wide variety of hazardous substances. The industry explains, “While in the 1980s semiconductor fabs used

fewer than 20 elements, today they are using over 50% of the nonradioactive elements in the periodic table."[1] Those include toxic heavy metals. The industry is a major user of Per- and Polyfluorinated Substances (PFAS), also known as "Forever Chemicals" because they persist and bioaccumulate in the environment and even human bloodstreams. As New York state agencies are well aware, these compounds are toxic, even at extremely low exposure concentrations, through multiple pathways. But 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."[2]

Use and release of the industry's hazardous building blocks are regulated by both state and federal statutes and regulations, but the public is generally unaware of the series of upcoming permit applications that Micron is expecting to make. The SEQRA review should list **all** anticipated permitting processes, with the anticipated schedule of public comment periods, and it should require public notification to interested parties of each permit application as it is submitted.

It should also identify hazardous substances, whether or not they currently have promulgated exposure standards. For example, the industry reports, "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 be discharged to the publicly owned treatment works without substantive removal of the PFAS."[3]

Furthermore, potential workplace exposures should not be ignored because exposures are below the Occupational Exposure Level (OEL) or even a fraction of the OEL, as industry suggests.[4] In most cases OELs, such as the Occupational Safety and Health Administration's (OSHA) Permissible Exposure Limits (PELs), are orders of magnitude above what the science—including U.S. EPA studies—dictates.

While the draft Scope of Work proposes many useful Technical Chapters, there is room for more specificity. I focus on the use and release of hazardous substances.

For **Solid Wastes and Hazardous Materials**, the Scope of Work states, "The chapter will identify any hazardous materials (including any chemical or petroleum bulk storage) that would be used, stored, transported, or generated by the Proposed Project and measures to protect

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[1] "Background on Semiconductor Manufacturing and PFAS," Semiconductor Association (SIA) PFAS Consortium, May 17, 2023, p. 54. 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/ . I am attaching this document.

[2] "The Impact of a Potential PFAS Restriction on the Semiconductor Sector," SIA PFAS Consortium, April 13, 2023, p. 3. I am also attaching this document.

[3] "The Impact of a Potential PFAS Restriction on the Semiconductor Sector," SIA PFAS Consortium, April 13, 2023, p. 3

[4] "Background on Semiconductor Manufacturing and PFAS," SIA PFAS Consortium, May 17, 2023, p. 25.

against releases to the environment. Any warranted remedial approaches for addressing identified or potential contaminated materials would be described." I suggest that the Review describe any permitting required for the Treatment, Storage, and Disposal of hazardous materials and solid wastes, and that it list the storage requirements, such as double-walled tanks and piping, necessary to prevent environmental releases. Furthermore, how will employees be educated about the risk from leaks and spills, as well as what to do when they occur?

To what degree will disposal—including landfilling and incineration—create off-site hazards? Industry reports, "Organic waste, including organic liquids containing PFAS, is typically segregated, collected, and containerized to be treated at an offsite licensed treatment and disposal facility, as a blended fuel by high temperature incineration or reprocessing."[5] Perfluorinated compounds are particularly difficult to destroy using incineration. Furthermore, even when permitted by regulatory agencies, incineration may release products of incomplete combustion into the atmosphere.

For **Air Quality**, the Scope of Work barely mentions the potential emissions of highly toxic air contaminants. Historically the industry has used lethal gases such as arsine and phosphine, as well as toxic gases such as hydrogen chloride (the gaseous form of hydrochloric acid). Micron should identify plans to notify first responders and public of any toxic air releases, and first responders should be provided in advance with training and equipment to respond safely to such releases. Employees should be warned about the toxicity of gases used by the industry and trained to protect themselves from potential releases, both at low levels associated with chronic toxicity as well as higher levels with acute toxicity.

I am surprised and disappointed that no chapter is listed for **Wastewater and Stormwater**. The release of toxic contaminants through water pathways is one of the most serious threats of semiconductor productions. Releases of certain contaminants in wastewater could compromise the operations of the Oak Orchard Wastewater Treatment Plant, even undermining compliance with its discharge permit. The draft Scope of Work mentions industrial pre-treatment. Not only should that be described in an environmental review chapter, but the review should identify ways to pre-treat hazardous chemicals, perhaps even reusing some, before comingling with other wastes. This is particularly important for PFAS, because in the future more PFAS compounds are likely to be subjected to enforceable environmental standards, many at very low concentrations.

In fact, given the vast number of PFAS used by the semiconductor industry, the Review should identify methods for sampling total organic fluorine, not just targeted compounds. "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

[5] "Background on Semiconductor Manufacturing and PFAS," SIA PFAS Consortium, May 17, 2023, p. 30.

materials."[6] However, U.S. EPA has a draft method (1621) for measuring total organic fluorine.[7] Furthermore, academic researchers are finding 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."[8]

Furthermore, there should be a chapter on **Life-Cycle Environmental Impacts.** What hazardous substances remain in the finished semiconductor products, including packaging. At the end-of-life, are there mechanisms for preventing the environmental release of semiconductor hazardous substances? Industry's PFAS Consortium reports, "At the end-of-life of the product containing the semiconductor, or any parts replaced during the manufacture of semiconductors, would enter waste disposal streams where any PFAS contained therein could enter the environment."[9] Are manufacturers responsible for end-of-life pollution?

Finally, there are those who argue that a thorough environmental review, as I have suggested, would unnecessarily delay the operation of new, advanced wafer fabrication plants. I find it hard to believe that documenting potential hazardous substance and waste impacts in advance would hamper the construction of a factory that is not expected to begin production until 2032. Micron—indeed, all semiconductor manufacturers—**should** already know what hazardous substances it uses and releases. Shouldn't the public also know? The semiconductor and computer manufacturing industry, such as IBM's complex in Endicott, New York, has a long history of causing pollution that threatens public health and the environment. An industry that claims that PFAS—chemicals that are persistent, bioaccumulative, and extremely toxic in low concentrations—are essential to its operations should be required to **come clean** about its environmental and public health hazards.

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

[7] Draft Method 1621: Screening Method for the Determination of Adsorbable Organic Fluorine (AOF) in Aqueous Matrices by Combustion Ion Chromatography (CIC), U.S. EPA, April 2022, https://www.epa.gov/system/files/documents/2022-04/draft-method-1621-for-screening-aof-in-aqueous-matrices-by-cic_0.pdf

[8] 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

[9] "The Impact of a Potential PFAS Restriction on the Semiconductor Sector," SIA PFAS Consortium, April 13, 2023, p. 90,