



CENTER FOR PUBLIC ENVIRONMENTAL OVERSIGHT

A project of the Pacific Studies Center  
P.O. Box 998, Mountain View, CA 94042

Voice/Fax: 650-961-8918

[LSiegel@cpeo.org](mailto:LSiegel@cpeo.org)

<http://www.cpeo.org>

---

TO: CHIPS for America NEPA Program by e-mail at [CHIPSNEPA@chips.gov](mailto:CHIPSNEPA@chips.gov)  
FROM: Lenny Siegel, Executive Director, Center for Public Environmental Oversight  
SUBJECT: Comments on Draft Programmatic Environmental Assessment  
DATE: February 9, 2024

The Center for Public Environmental Oversight appreciates the opportunity to comment on the December, 2023 “Draft Programmatic Environmental Assessment (DPEA) for Modernization and Internal Expansion of Existing Semiconductor Fabrication Facilities under the CHIPS Incentives Program.”<sup>1</sup> In addition to these comments, we have contributed to the comments of Chips Communities United, a national coalition of community, environmental, and labor organizations.

We agree that the modernization and expansion of chipmaking facilities provides an opportunity for manufacturers to improve their environmental practices, both by source reduction/materials substitution and the better management of hazardous substances and releases. However, the checkered environmental history of this otherwise remarkable industry illustrates the importance of governmental requirements in protecting human health and the environment.

Mountain View, where we are located, is generally considered the birthplace of the semiconductor industry. In fact, in 2018, as Mayor of Mountain View, I spoke at the dedication of the sculpture of a silicon atom at the site of Shockley Semiconductor, founded here in 1955.<sup>2</sup> Unfortunately, in the absence of adequate environmental regulation, the corporate descendants of Shockley poisoned the groundwater throughout much of Silicon Valley with cancer-causing solvents and other hazardous substances. As a community activist,

---

<sup>1</sup> See <https://www.nist.gov/system/files/documents/2023/12/26/CHIPS%20Modernization%20Draft%20PEA.pdf>

<sup>2</sup> See “The Birthplace of Silicon Valley—Shockley Dedication,” Computer History Museum, August 15, 2018  
[https://www.youtube.com/watch?v=u4\\_OmM02R-s&t=130s](https://www.youtube.com/watch?v=u4_OmM02R-s&t=130s)

environmental consultant, and a locally elected official, I have overseen the environmental practices of the industry for nearly five decades. I lead community oversight of the MEW Superfund Study Area in Mountain View, California, one of the largest contamination sites created by the industry. At MEW and other local sites, completion of groundwater remediation remains decades away.

Though little semiconductor manufacturing remains in Silicon Valley, even today the semiconductor industry's environmental practices threaten workers and neighbors—just elsewhere. The industry has introduced a wide variety of hazardous substances—including perhaps hundreds of PFAS compounds—into its production processes, without regard for their known or potential toxicity. In fact, the Semiconductor Industry Association (SIA) PFAS Consortium admits, “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.”<sup>3</sup>

The DPEA refers to “the low and falling rate of injuries and illnesses across the semiconductor manufacturing sector.” The semiconductor industry has made such claims for decades, even though the illnesses and conditions—other than the elevated miscarriage rate—associated with the substances used in wafer fabrication do not manifest themselves for years. Even cardiac birth defects, associated with solvents used in the past by the industry, may not be found for decades. **It's important, therefore, to focus on preventing exposures**, because there is no useful data on environmental or occupational illnesses for which those exposures have had a measurable impact.

We recognize that hazardous substances are essential to semiconductor production, but the industry cannot be counted on to police itself. Not only must the industry be regulated by federal, local, and state agencies, but the **CHIPS Office has the authority and obligation to use the grantmaking process to evaluate and influence the management practices of awardees**. That is, the CHIPS Office should consider companies' environmental practices when evaluating their applications for federal funds. This is particularly important for substances, such as PFAS, for which environmental standards are still evolving. Funding agreements should contain enforceable, transparent environmental language, including monitoring to confirm compliance.

It is integral that environmental, health, and safety requirements be applied uniformly across the industry. Otherwise, the companies that engage in protective practices will be placed at a competitive disadvantage.

---

<sup>3</sup> “The Impact of a Potential PFAS Restriction on the Semiconductor Sector,” Semiconductor Industry Association (SIA) PFAS Consortium, April 13, 2023, p. 90. PFAS stands for per- and polyfluoroalkyl substances. 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/>

Appendix A of the DPEA, which lists Best Management Practices for Modernization and Expansion projects, relies heavily on guidelines prepared by the Semiconductor Equipment and Materials Institute (SEMI). While we do not doubt that the authors of these guidelines have a great deal of expertise, we have two general problems with this reliance. First, **it is a best practice in environmental, health, and safety regulation that a regulated entity not write the regulations to which they are subject.** Second, SEMI’s guidelines were not developed with input from other, relevant stakeholders. In fact, they are only available to non-SEMI members for hundreds of dollars each.

What little we know about SEMI’s guidelines comes from the Semiconductor PFAS Consortium’s May, 2023 paper, “Background on Semiconductor Manufacturing and PFAS.” It states (emphasis added):<sup>4</sup>

### **12.2 SEMI Safety Guidelines for Tool Design**

Most semiconductor manufacturers have a company requirement to purchase semiconductor manufacturing tools designed and certified to comply with SEMI safety guidelines; for a complete list of these safety guidelines, see Appendix C. SEMI safety guidelines cover many aspects of manufacturing tool standardization and design conventions that have enabled a fungible supply of immensely complex and specialized manufacturing tools for installation in fabs across the world.

In particular, the SEMI S2 safety guideline addresses design and performance standards for assuring the isolation or protection of clean-room workers from the chemicals used in semiconductor manufacturing tools. The SEMI S2 safety guideline distinguishes between the concentration of a chemical in the general ambient air surrounding a semiconductor manufacturing tool and the concentration within a “worst-case” PBZ. The SEMI S2 safety guideline also differentiates between three states of tool operation:

- SEMI S2, 23.5.1 states that there should be no chemical emissions to the workplace environment during normal equipment operation. Measurements that show the air concentration to be less than **1% of the occupational exposure limit (OEL)** in the worst-case PBZ demonstrate conformance to this requirement.
- SEMI S2, 23.5.2 states that chemical emissions during maintenance activities should be minimized. Measurements that show a concentration in the anticipated worst-case PBZ during maintenance activities as less than **25% of the OEL** demonstrate conformance to this requirement.
- SEMI S2, 25.5.3 states that chemical emissions during equipment failure should be minimized. Measurements that show a concentration in the anticipated worst-case PBZ during a realistic worst-case system failure as less than **25% of the OEL** demonstrate conformance to this requirement.

---

<sup>4</sup> “Background on Semiconductor Manufacturing and PFAS,” Semiconductor Industry Association (SIA) PFAS Consortium, May 17, 2023, p. 25.

It appears that the OEL's mentioned in this text refer to Permissible Exposure Limits set by the U.S. Occupation Health and Safety Administration. In general, those Limits are outdated and unprotective. Even 1% of existing OELs is unprotective. Furthermore, we are not aware of any OELs for PFAS.

The goal, where PFAS are considered essential to semiconductor production, should be "workers are protected, environmental releases are controlled."<sup>5</sup> This should be achieved by installing and operating Best Available Technologies to control releases and exposures. In situations where numerical screening or action levels are needed, we recommend U.S. EPA's Regional Screening Levels (RSLs). The RSLs, covering a large universe of substances, are found in tables generated from a hierarchy of sources. Though designed to guide environmental cleanup, they are based upon the best available human health toxicity research, and they are updated regularly. They establish levels for both resident and worker exposure. They even include current values for a couple of dozen PFAS compounds.<sup>6</sup>

As the DPEA explains, the expansion and operation of semiconductor manufacturing plants are subject to environmental permitting by federal, state, and local agencies. However, neighbors and workers at these plants are generally unfamiliar with these permitting processes.

**Applicants for CHIPS funding should be required to create and update timetables of permit and permit modification applications so those affected by the plants are aware of the applications and have an opportunity to provide comments, as allowed, indeed encouraged, by most environmental statutes.** Representatives of affected populations not only have a right to know about the potential environmental consequences of CHIPS Act investments. They often have site-specific knowledge unfamiliar to governments, corporations, and their consultants.

Appendix A of the DPEA, "Environmental Due Diligence Process and Best Management Practices," also references the CHIPS Program Office Environmental Questionnaire. We submitted comments about that Questionnaire, but we have not seen the final Questionnaire. Please make the Questionnaire available to the public, as well as responses to the Questionnaire by applicants.

In many places the DPEA describes industry's efforts to limit pollution. While we applaud such efforts, we know of no data base of semiconductor industry environmental compliance. In evaluating applications for funding, does the CHIPS Office have the ability to independently discover environmental violations or incidents? Here are two examples that have recently been brought to our attention:

---

<sup>5</sup> See the testimony of U.S. EPA Assistant Administrator Michael Freedhoff before the U.S. Senate Committee on Environment and Public Works, "Hearing on Oversight of Toxic Substances Control Act Amendments Implementation," January 24, 2024, [https://www.epw.senate.gov/public/\\_cache/files/4/2/42353b9c-a490-4fff-9f80-19c5afccdaf9/F7CE2746FC88B5FDC3BBE7ADAD90B409.spw-01242024-oversight-of-tsca-amendments-implementation.pdf](https://www.epw.senate.gov/public/_cache/files/4/2/42353b9c-a490-4fff-9f80-19c5afccdaf9/F7CE2746FC88B5FDC3BBE7ADAD90B409.spw-01242024-oversight-of-tsca-amendments-implementation.pdf) p. 56.

<sup>6</sup> See U.S. EPA, "Regional Screening Levels (RSLs)—User's Guide" at <https://www.epa.gov/risk/regional-screening-levels-rsls-users-guide#toxicity>

In July, 2023 the Oregon Department of Environmental Quality penalized Intel Corporation for violations of its Air Contaminant Discharge Permit.

In April, 2021, a phosphine leak at Apple Computer's fab in Santa Clara, California, caused the evacuation of 50 employees.

As we mentioned above, the semiconductor industry has a long history of groundwater and other contamination. We do not expect the history of site contamination to prevent any manufacturer from receiving CHIPS funds, but such companies should provide evidence that remedial actions have been taken that 1) protect public health and the environment and 2) are designed to reach remedial action objectives.

Furthermore, in the absence of comprehensive regulation of PFAS [per- and polyfluoroalkyl substances] releases, it is possible that PFAS releases into the subsurface have comingled with legacy contaminants, such as trichloroethylene (TCE). There is evidence that treatment systems designed to remove other chemicals, such as TCE, do not capture certain PFAS compounds. Monitoring and if necessary, additional treatment, should be required to ensure that groundwater treatment and extraction systems are *not* actually spreading PFAS in the environment.

By now, all federal and state environmental agencies are aware of the widespread health risks posed by releases of PFAS into the environment. They are persistent, bioaccumulative, and toxic, even at extremely low concentrations. Yet the semiconductor industry has introduced perhaps hundreds of them into the production process, without any knowledge of their specific risks. Similarly, regulatory agencies are only now developing mandatory exposure standards for PFAS, and those are only for a handful of PFAS compounds, some of which, according to the industry, are no longer used in production. It is important, therefore, to monitor both air, water, and solid wastes for total organic fluorine, and to implement management practices that remove all PFAS from releases. That is, **because we'll all be dead and gone before all the PFAS compounds used by the industry are evaluated for their toxicity, it is essential to regulate them as a class.**

That includes fluoropolymers (including PTFE, or Teflon), which are widely used in semiconductor production and products. However, these PFAS and their transformation products pose serious risks to public health and the environment during their production (including the release of climate super-pollutants), in semiconductor production wastes, and at the end of life of semiconductor products.

The DPEA explains, "Wastewater discharge from semiconductor manufacturing facilities presents the greatest risk for PFAS contamination of the environment." Furthermore, the presence of PFAS in wastewater indicates the possibility that leaks and spills may cause PFAS to enter groundwater, where they are likely to remain and spread. Until regulatory agencies develop standards and other requirements for the capture and possibly the destruction of all PFAS in waste streams, the CHIPS Program Office due diligence process may be our best

opportunity to limit the discharge of PFAS. **Specifically, producers should be required to pre-treat wastewater— that is, remove for subsequent treatment - all PFAS at the point of use.** This is necessary because it is much more difficult and costly to remove specific chemicals when they are mixed with other wastes. While at some point the operators of Publicly Owned Treatment Works will have the knowledge and ability to enforce such a requirement, the CHIPS Office can establish this as an industry standard by making it a criterion for approval of federal funding.

Because some filtration systems in current use do not adequately remove all PFAS from water, facility operators should be required to demonstrate – through monitoring—that their wastewater pre-treatment systems are designed to remove all PFAS. Indeed, they should be designed to remove all hazardous substances.

Note that studies—including some sponsored by the semiconductor industry—show that the concentrations of non-targeted PFAS compounds significantly exceed those of targeted (and better known and better studied) PFAS in industrial waste streams, so monitoring should measure both targeted compounds and total organic fluorine.<sup>7</sup>

We are pleased that the DPEA describes U.S. EPA’s Chemical Accident Prevention program. The routine use of even small quantities of potentially lethal chemicals such as arsine and phosphine poses a risk to workers, first responders, and neighbors. Risk Management Plans (RMPs) are essential, but EPA’s threshold quantities for requiring RMPs are not sufficiently protective. We recommend that CHIPS awardees be required to use the thresholds in California’s Accident Release Prevention Program.<sup>8</sup>

The DPEA does a good job of identifying emissions of greenhouse gases, such as fluorinated gases, from semiconductor wafer fabrication. It reports, **“modernization projects present an opportunity for facilities to modernize their tools and change processes to minimize direct emissions from semiconductor manufacturing processes.”** What will the CHIPS Office do to ensure that this happens? The following sentence from the DPEA (p. 29) appears to provide both a literal and figurative escape valve: “Even if such improvements are not made, however, the marginal increase in GHG emissions from an individual modernization project would be *negligible* compared to overall U.S. emissions and emissions from the semiconductor industry sector.” Such reasoning should be rejected, for it would excuse emissions of greenhouse gases around the globe that seem low but have a significant cumulative impact. Furthermore, any equipment installed to capture and destroy greenhouse gas emissions should be evaluated for secondary releases, such as products of incomplete combustion from incineration.

---

<sup>7</sup> See Paige Jacob, Krista A. Barzen-Hanson, and Damian E. Helbling, “Target and Nontarget Analysis of Per- and Polyfluoroalkyl Substances in Wastewater from Electronics Fabrication Facilities,” *Environ. Sci. Technol.* 2021, 55, 4, 2346–2356 Publication Date: January 26, 2021, <https://pubs.acs.org/doi/10.1021/acs.est.0c06690>

<sup>8</sup> See “California Accidental Release Prevention Program—Resources,” California Environmental Protection Agency, <https://calepa.ca.gov/california-accidental-release-prevention/california-accidental-release-prevention-program-resources/>

Transparency and public engagement are essential to environmental protection. That is, **people have a right to know what hazardous substances to which they, their families, their communities, and their environment may be exposed.** However, the semiconductor, industry has used the claim of confidential business information (CBI) to conceal information about its use and release of hazardous substances. In conducting its due diligence and sharing the results with the public, **the CHIPS Office should narrowly define CBI.** That is, while specific chemical formulations may be concealed as CBI, the presence of any hazardous substance should be disclosed publicly.

Despite the use of industrial robots and particle-free “clean rooms,” at some point workers in semiconductor fabrication facilities may be exposed to industrial chemicals. This is particularly important in the American semiconductor industry, where **it is difficult for employees to file suggestions or complaints because they have no presumption of job security,** as they would have in plants where there is recognized labor representation. Employers should be required to ensure that employees are properly trained to work in an environment where hazardous substances are used and/or hazardous wastes are generated. They should also be required to develop procedures for employees to raise health and safety concerns without fear of retribution.

The document should provide more details about the disposal of hazardous wastes. Where will hazardous wastes be disposed? Will they be shipped across state lines? Will the wastes be “treated” in environmental justice communities? If incineration is used to destroy wastes, what will be done to prevent the releases of products of incomplete combustion or transformation products? Like other industries, the semiconductor industry has “cradle to grave” responsibility for the materials it uses.

If applicants for modernization or expansion funding have acquired production facilities from other companies—such as Bosch’s acquisition of TSI’s facilities in Roseville, California—how will the CHIPS Office evaluate funding requests? Will buyers be held responsible for or credited with the environmental record of previous operators? Will past permits be transferred to the new owners?

**In summary, we support the goals of the CHIPS Act to revitalize semiconductor production in the United States and reduce the vulnerability of the industry’s supply chains. We also rely on the National Environmental Policy Act to identify environmental impacts, particularly the use and release of substances that pose risks to human health. The Draft Programmatic Environmental Assessment should unite those goals, providing a mechanism for dissemination of information to the public and creating avenues for public engagement to ensure that Federal investments in the domestic chipmaking industry benefit public health, employee safety, and the natural environment.**