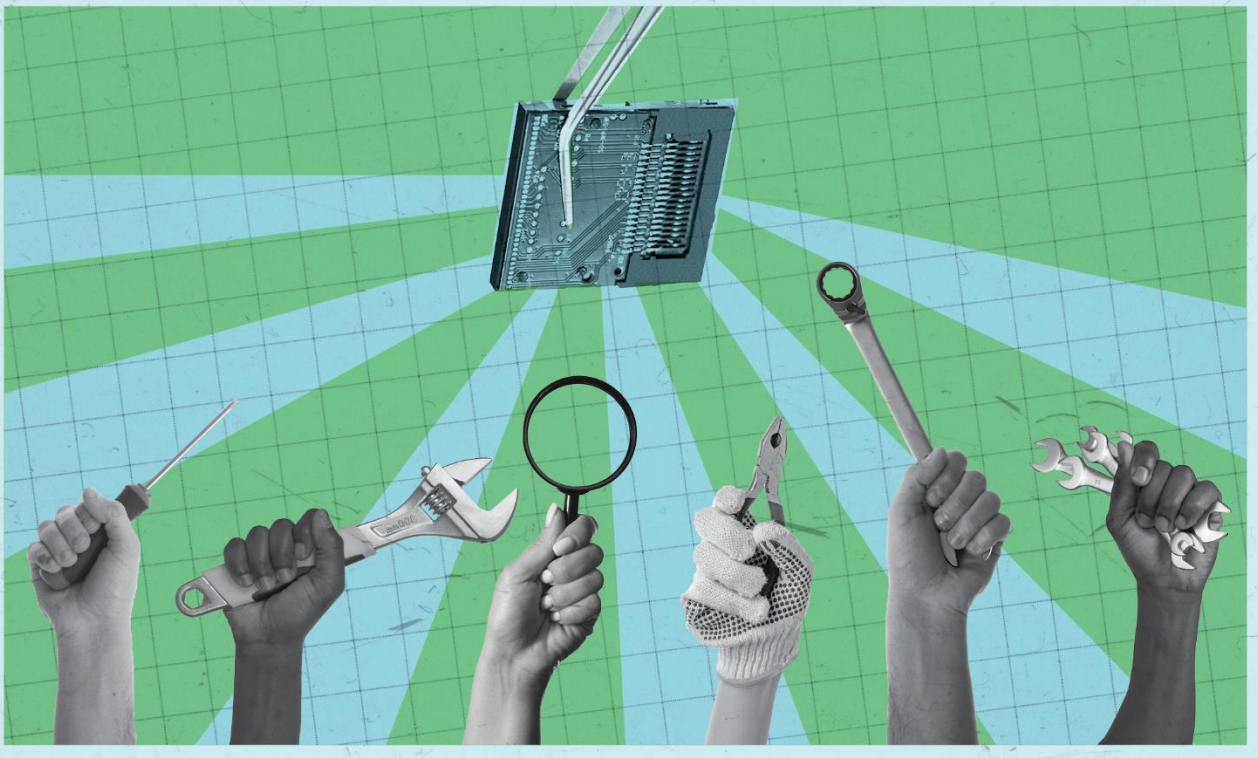

Leveraging the CHIPS Program to Create Good Jobs for *All* Semiconductor Workers

Institute for Policy Studies

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Introduction

The Covid-19 pandemic caused huge disruptions in the global supply chains and production of microchips – critical components in everything from smartphones to washing machines to military radars.

In August 2022, Congress responded by passing the CHIPS and Science Act, legislation aimed at boosting domestic semiconductor production. The bill allocates up to $175 billion to the semiconductor industry including $39 billion for U.S. manufacturing subsidies, $13.2 billion in R&D and workforce development, and $500 million for international communications and supply chain activities. It also provides up to a 25 percent investment tax credit for capital expenses that could end up being worth over $50 billion and opens up $75 billion in loans.

The Biden-Harris administration has expressed a strong commitment to maximize the benefits of the CHIPS Act as part of a broader economic plan to "invest in America, stimulate private sector investment, create good-paying jobs, make more in the United States, and revitalize communities left behind."

Two years after passage, tens of billions of CHIPS dollars are about to start flowing to corporations for domestic production, public funds that should support good jobs for all semiconductor workers. For many top tier workers in the industry, salaries are far above the U.S. average. But workers, observers, and lawmakers have raised several concerns about working conditions — including insufficient wages, unsafe workplaces, taxing schedules, and invasive surveillance.

This report brings together publicly available information on semiconductor companies, analyses of employment data, and worker interviews to make the case that workplace conditions in the semiconductor industry must be improved — and that the CHIPS program must do more to ensure that the billions of public dollars being invested in the industry actually create the good jobs that have been promised.

Because of its massive investment in the industry, the federal government has the authority and leverage to compel firms to improve conditions and ensure that the funding to be doled out by the CHIPS Act goes to producing good community-sustaining jobs instead of just enriching executives and shareholders at the taxpayer's expense.

Time is of the essence as several contract agreements between the Department of Commerce and semiconductor firms are in the final stages of negotiation. The CHIPS program represents a historic opportunity for the federal government to use the power of the public purse to transform this key industry into one that can both meet the growing demand for semiconductors and create high-quality jobs for a diverse, empowered labor force. Instituting strong worker protections and transparency requirements in CHIPS subsidy contracts will be essential to achieving these goals.

Industry snapshot

Despite microchips being invented in the United States, the country has lost its preeminence in the industry over the last few decades. In 2001, according to Bureau of Labor Statistics data, the semiconductor industry employed roughly 715,000 U.S. workers. After massive offshoring and gutting of the industry leading up to the 2008 Recession, only about 396,000 jobs remained as of July 2024.

The CHIPS Act seeks to reverse that trend by offering large subsidies to firms that promise to produce semiconductors domestically. As of August 13, 2024, 16 firms had signed non-binding preliminary agreements with the U.S. Department of Commerce for CHIPS subsidies worth more than $30 billion.

Companies with Preliminary CHIPS Grant Agreements			
Company Name	**Potential subsidy amount**	**Proposed funding site(s)**	**Related job creation estimates**
Absolics	$75 million	Covington, GA	1,000 construction jobs and approximately 200 manufacturing and R&D jobs
Amkor Technology, Inc.	$400 million	Peoria, AZ	2,000
BAE Systems, Inc.	$35 million	Nashua, NH	n/a
Entegris	$75 million	Colorado Springs, CO	1,100
GlobalFoundries	$1.5 billion	Malta, NY Burlington, VT	1,500 manufacturing jobs and approximately 9,000 construction jobs
GlobalWafers	$400 million	St. Peters, MO Sherman, TX	1,700 construction and 880 manufacturing jobs
Intel Corporation	$8.5 billion	Chandler, AZ New Albany, OH Hillsboro, OR Rio Rancho, NM	AZ: 3,000 manufacturing and 6,000 construction jobs. NM: 700 manufacturing and 1,000 construction jobs. OH: 3,000 manufacturing and 7,000 construction jobs. OR: several thousand manufacturing and construction jobs.
Microchip Technology	$162 million	Colorado Springs, CO Gresham, OR	Over 700
Micron	$6.14 billion	Boise, ID Clay, NY	NY: 13,500 ID: 6,500
Polar Semiconductor	$120 million	Bloomington, MN	160
Rocket Lab	$23.9 million	Albuquerque, NM	100
Rogue Valley Microdevices	$6.7 million	Palm Bay, FL	75
Samsung Electronics	$6.4 billion	Austin, TX Taylor, TX	17,000 construction jobs and more than 4,500 manufacturing jobs
SK hynix	$450 million	West Lafayette, IN	n/a
Texas Instruments	$1.6 billion	Lehi, UT Sherman, TX	2,000 manufacturing jobs thousands of construction jobs
TSMC Arizona	$6.6 billion	Phoenix, AZ	approximately 6,000 manufacturing jobs
Total	**$32.4 billion**		

Source: U.S. Department of Commerce, National Institute of Standards and Technology, as of August 13, 2024.

Much of that federal money, along with over $450 billion in investments committed by firms, will go to retrofitting old and building new semiconductor fabrication plants, known as fabs. All of those new fabs will inevitably mean more jobs, and one point of contention has been whether there are enough workers to fill those roles.

Industry groups have claimed that there is a shortage of the technicians, computer scientists, and engineers needed for a competitive semiconductor industry in the United States. More than a million additional skilled workers will be needed to meet worldwide semiconductor demand by 2030, Deloitte projects.

But employers across industries have often deployed labor shortage claims to deflect from legitimate concerns about working conditions, placing the blame for understaffing on unwilling workers or inadequate training programs rather than poor pay and benefits. Worker shortage narratives are also often used to justify bringing in foreign workers rather than local ones, like in the case of TSMC which has relocated hundreds of workers from Taiwan to Arizona. And indeed, some academic research suggests the chips industry could be employing that diversionary tactic.

Howard University's Ron Hira argues that claims of shortages of science, technology, engineering and mathematics (STEM) workers tend to rely on faulty predictions, use the wrong baseline employment rates, and ignore slowing wage growth in the workforce.

"Rather than assuming looming shortages, the conversation would benefit from systematic investigation of whether shortages exist and in which fields, and how today's complex labor market can be more effectively characterized," Hira wrote in 2022.

There is compelling evidence that demand for new microchip workers will be gradual and that there is an ample supply of workers that could fill those roles. The Bureau of Labor Statistics forecasts that by 2032 employment in the semiconductor sector will expand to 417,000, a modest growth of roughly 3,000 jobs a year from current workforce estimates. Industry groups have estimated that CHIPS will create 42,000 new semiconductor jobs.

The alleged shortage looks even less serious given that 140,000 bachelor's degrees in engineering were conferred in 2022. Past years have been in that same range. That being said, many STEM graduates are opting against working in their fields because of job quality concerns.

Uncompetitive wages, grueling schedules, and the constant threat of layoffs has turned America's youth off from working in the field, University of California, San Diego, professor John Skrentny recently argued.

A recent survey by McKinsey supports this theory. In 2023, 53 percent of workers in semiconductors and electronics said they were likely to leave their jobs in the next three to six months, up from 40 percent two years prior. Among the most commonly cited reasons for wanting to change jobs: lack of career advancement opportunities, inadequate pay, and unsafe workplace environments.

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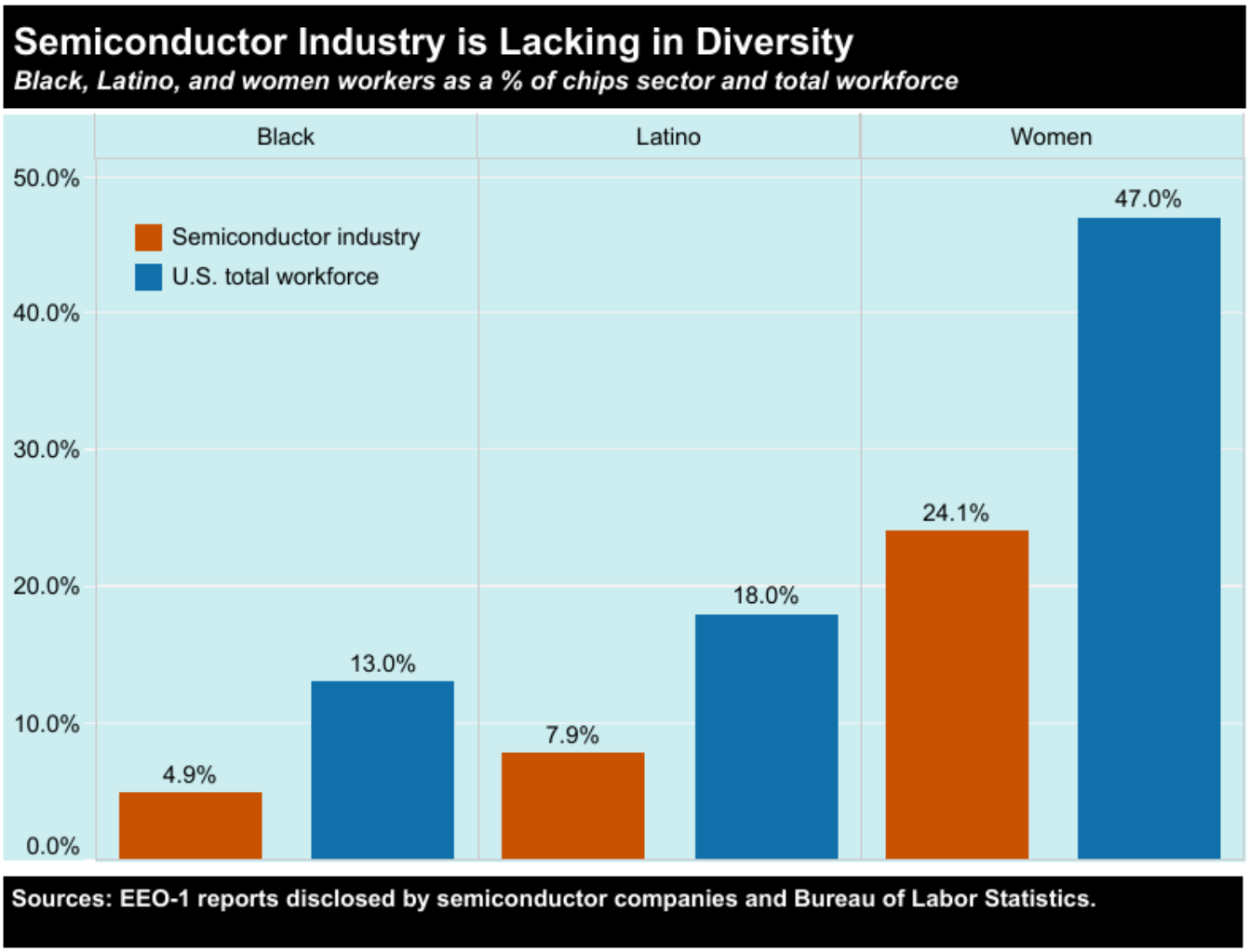
> — Wafer fab operator
> Analog Devices
> Beaverton, Oregon, facility



For robust growth, the industry will also need to address diversity issues. A recent analysis of large semiconductor firms' filings with the U.S. Equal Employment Opportunity Commission found that Latino, Black, and women workers are underrepresented in the workforce and are concentrated in lower-paying and more dangerous jobs.

To ensure a sufficient supply of qualified workers to meet semiconductor demand, more should be done to guarantee that the jobs created by the CHIPS Act are attractive and accessible to a diverse set of workers.

Pay and Advancement

Almost every worker interviewed for this report had the same basic complaint: wages are too low and avenues to get raises are too narrow.

Workers at one of Oregon's largest semiconductor manufacturers, Analog Devices, delivered a petition to management earlier this summer criticizing the company over low wages and forced unpaid time off. Pay at the fab reportedly hovers around $21 an hour, well below the $27.05 estimated to be a living wage for the area for a single person without children. And that's before taking into account facility shutdowns when hourly workers have to dip into their paid time off or go fully without pay.

"I think [the CHIPS Act] is a farce," said one fabrication operator at Analog's Beaverton, Oregon facility in an interview. "The money is supposed to make good family jobs and instead it's going to line the bosses' pockets."

Analog is reportedly seeking federal CHIPS subsidies and has already received $12 million from the Oregon CHIPS Act to expand a factory in the state.

Like all workers we spoke to for this report, the Beaverton employee requested to remain anonymous for fear of employer retaliation.

Concerns about pay like those expressed by Analog workers are abundant in the semiconductor industry.

According to the Bureau of Labor Statistics, semiconductor jobs paid $87,940 on average in 2023. But that average is skewed by professional and management salaries that belie the low wages earned by frontline production workers and a far cry from the six-figures averages that have been touted by industry and elected officials. While production workers only make up 38 percent of workers in the industry currently, that share may expand as more firms expand their manufacturing operations domestically.

Employment and Pay in Major Semiconductor Occupations			
Occupation	**Employment**	**Percent of total industry employment**	**Annual average wage**
Production Occupations - total	149,150	38%	$46,070
Largest production occupations:			
Assemblers and Fabricators	70,170	18%	$40,540
Electrical, Electronics, and Electromechanical Assemblers	57,100	15%	$40,160
Metal Workers and Plastic Workers	16,560	4%	$46,150
Other occupations:			
Business and Financial Operations Occupations	26,280	7%	$100,970
Computer and Mathematical Occupations	29,090	7%	$141,470
Architecture and Engineering Occupations - combined	89,090	23%	$111,480
Engineers only	62,660	16%	$129,810
Installation, Maintenance, and Repair Occupations	14,810	4%	$66,320
Management Occupations	37,440	10%	$183,010
Office and Administrative Support Occupations	23,330	6%	$54,780
All	**392,080**	**100%**	**$87,940**

Source: U.S. Bureau of Labor Statistics, May 2023 National Industry-Specific Occupational Employment and Wage Estimates, NAICS 334400 - Semiconductor and Other Electronic Component Manufacturing.

Workers in production roles in the semiconductor industry earn a median hourly wage of $20.02, or $40,840 annually, according to BLS data. An Economic Policy Institute analysis of Occupational Employment Statistics microdata on *all* semiconductor workers found that 25 percent make $20.57 per hour or less, which works out to just $42,986 per year for full-time employees.

Firms that have reached preliminary memorandum of terms (PMT) with the Department of Commerce are offering similar rates. Microchip Technology is hiring material handlers for as little as $17 hourly while GlobalFoundries is currently recruiting technicians starting at $32,000 per year. By comparison, the U.S. average salary in 2022 was $63,795.

Low pay has been exacerbated by frequent operation shutdowns, leaving hourly workers struggling to make ends meet. A production specialist at Microchip Technology's fab in Gresham, Oregon, lamented that their facility has had two two-week long shutdowns since the Commerce Department announced a $162 million preliminary CHIPS agreement with the company in January 2024.

"Basically anytime anybody's asked questions, like, 'Hey, what are we supposed to do about our bills during this time?' because we can't just not pay our bills for two weeks, we basically get told, 'Oh, just go to unemployment. The company's not going to help you with that at all'," they explained. "We're getting all this CHIPS Act money soon — well, why are we not benefiting from this at all?"

Opportunities for internal advancement are limited as well. A manufacturing technician at Micron's Manassas, Virginia, fab who is planning to leave the company soon said that after five years at Micron, they have been unable to advance in their role and have only received yearly wage increases of 5 to 10 cents an hour and one $1 market adjustment.

"I have a co-worker who's been there 23 years and they've nickel and dimed her the whole time," the Micron technician added. "I've been there five, and she doesn't make more than one or two more dollars than me an hour."

When internal positions did open up, multiple technicians and engineers reported listings being taken down before they even had a chance to apply. Another worker at Micron's Manassas fab reported being expected to work extra unpaid hours on top of 12-hour shifts to be considered for promotions. Semiconductor employees who participated in the McKinsey survey cited a lack of career advancement opportunities as the number one reason they were looking to leave their positions.

The survey also found frustration with work schedules, an issue that was consistently brought up by workers interviewed for this report. Intel workers have reported exhausting hours. At one of the company's manufacturing hubs, engineers complained of working up to 80 hours a week and having to rotate between day and night shifts. An engineer at Taiwan Semiconductor Manufacturing Company (TSMC) called the work-life balance "brutal" pointing out that 12-hour shifts are standard and many people wind up sleeping in the office for days on end. Even engineers with more standard schedules said in interviews that they often work more than 8-hour days and are expected to be available after hours and on weekends.

Job security is also an issue for semiconductor workers. Intel, which stands to receive nearly $8.5 billion in CHIPS subsidies and another $11 billion loans, announced this August that it was laying off 15 percent of its workforce. The company currently employs over 125,000 workers, so layoffs could affect as many as 19,000 people. One facility technician at Intel said that their coworkers have a lack of confidence in their employers because of constant hiring and firing boom-bust cycles.

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> — Fabrication operator, Analog Devices facility in Beaverton, Oregon

Frustrations about low pay and job insecurity are compounded by semiconductor companies' track

records of enriching executives and shareholders at the expense of workers. A recent report by the Institute for Policy Studies and Americans for Financial Reform found that the 11 companies in line at the time to receive subsidies had spent more than $41 billion combined on stock buybacks between 2019 and 2023. This financial maneuver artificially inflates the value of company shares – and the value of CEO stock-based pay.

At the eight companies with preliminary CHIPS agreements that disclose compensation data, CEO pay averaged $13.6 million and the average gap between CEO and median worker pay stood at 200 to 1 in 2023. Micron Technology CEO Sanjay Mehrotra took in the largest compensation, with a total package valued at $25.3 million, while half of Micron employees made less than $54,570 last year.

Analog Devices paid its CEO even more. Vincent Roche took in $25.5 million in 2023 – 527 times as much as the firm's median worker pay of $48,425.

"It is a huge concern of mine that a multi-billion-dollar company that pays its CEO $25.5 million per year and spends billions on stock buybacks doesn't provide its employees with wages that can support a single person in the area, let alone provide family wages," a wafer fab operator at Analog's Beaverton facility said. "As a single person who could not afford to live without a roommate, it worries me that my coworkers with families to support are trying to provide what they need to on the same or similar wages as me."

Health and Safety

Producing semiconductors is an inherently dangerous line of work because of the toxic chemicals used in the fabrication process.

Semiconductor companies and their suppliers consider their complex chemical formulations to be proprietary and often argue against public disclosure. In many cases, chip manufacturers do not even know what is in the products they use. In an industry-sponsored study on replacing the toxic forever chemicals PFOS and PFOA in manufacturing, researchers noted "semiconductor device makers did not know exactly which chemical products contained PFOS and PFOA, as safety data sheets do not regularly disclose this information."

"In other instances, the use of the substances was classified as confidential business information (CBI) and shared only by generic names such as 'surfactant' or 'photoacid generator,' without a corresponding Chemical Abstracts Service registry number," the study continued.

Despite lack of public knowledge on the thousands of chemicals used today in semiconductor manufacturing and the health effects associated with exposure, the industry has a well-documented history of harming workers and their children here in the United States and around the globe.

As the industry was expanding during the second half of the 20th century fab workers were exposed to chemicals linked to cancer and miscarriages.

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Three industry-backed studies published in 1992 found higher than expected rates of miscarriages among women who worked in semiconductor fabs, an issue connected to the ethylene glycol ethers used in chip coating.

Companies pledged to rid their facilities of these chemicals in the 1990s after a wave of critical coverage, but health outcomes for workers at fabs outside of the United States suggest that those commitments were not enough. A Bloomberg investigation from 2017 found that the toxins phased out domestically were still being used in Asia where much of the production moved.

A 2014 analysis of epidemiological studies of semiconductor production across the world found increased risk of miscarriages and negative impacts on fertility. While evidence of increased cancer rates were equivocal, excess risks for non-Hodgkin's lymphoma, leukemia, brain tumor, and breast cancer were observed at fabs.

Protections in place to avoid exposure to dangerous chemicals are woefully outdated and inadequate. The Occupational Safety and Health Administration acknowledges that its exposure standards, known as permissible exposure limits (PELs), have not been updated in 50 years and "are outdated and inadequate for ensuring protection of worker health." Even if PELs were stringent enough, they have only been assigned for some 500 chemicals while workers are now exposed to thousands of new toxins that were not in use when those limits were developed.

One study of 10 chemicals that are covered by OSHA found that the agency's exposure limits are magnitudes less restrictive than thresholds developed by California, the National Institute for Occupational Safety and Health, and the nonprofit American Conference of Governmental Industrial Hygienists. Only OSHA's limits are enforceable at the federal level, leaving workers virtually unprotected against known harm.

Workplace safety concerns are not just limited to toxic chemical exposure. A survey conducted by the newly formed Samsung Electronics Group Union Solidarity in Korea found that workers at the chip and cellphone giant have elevated rates of musculoskeletal issues, sleep disorders, and depression. The culprit, the organization says, is the excessive work intensity and performance pressures at their facilities.

Samsung Electronics workers in Korea, including thousands of semiconductor producers, were on strike for most of July demanding improvements to wages and paid time off.

U.S.-based semiconductor workers surveyed for this report cited a litany of other safety concerns, including on-going chemical exposures (including hydrofluoric acid), inadequate personal protective equipment (PPE), insufficient training, lack of emergency telephones at workstations, and insufficient time off that forces workers to come in sick or injured.

> ***"Anytime anybody's asked questions [during a forced work stoppage], like, 'Hey, what are we supposed to do about our bills during this time?' because we can't just not pay our bills for two weeks, we basically get told, 'Oh, just go to unemployment. The company's not going to help you with that at all.'"***
>
> — Production worker, Microchip Technology fab in Gresham, Oregon

Recommendations

The CHIPS program is coming into force at a time when workers are increasingly demanding a stronger voice in the workplace and fair rewards for their labor. And we are starting to see that trend in the traditionally non-union semiconductor sector with the Samsung strike in Korea and the petition brought by Analog Devices workers in Oregon.

It is in the interest of semiconductor corporations and the federal government to respond to these growing worker demands by moving this critical industry for our economy's future in a more equitable direction. The Biden-Harris administration has already taken some positive steps. For example, corporations receiving more than $150 million in CHIPS subsidies are required to submit plans to provide child care services for their manufacturing and construction workers, although questions remain about the quality of those programs. Workers involved in the construction of fabs built with CHIPs funding are guaranteed Davis-Bacon prevailing wage rates as well.

But more should be done to ensure that this innovative program meets its full potential for American workers.

1. Labor Department cooperation: The Department of Commerce has taken the lead in administering the CHIPS program. They should collaborate more closely with experts at the Department of Labor during the due-diligence phase to ensure that CHIPS grantees are abiding by the "Good Jobs Principles," which Commerce and Labor co-released in 2022, and that strong workforce commitments are included into the final set of terms.

These principles cover essential elements of a good job, including recruitment and hiring, pay and benefits, job security and career advancement, collective bargaining rights, and working conditions. They also provide guidance on ensuring workplace diversity, equity, inclusion and expanding access to those from underserved communities. Making wage and benefit standard enforcement an interagency endeavor can effectively leverage the expertise of the Labor Department to ensure the jobs created through this historic investment are the high-quality ones that have been promised.

2. Transparency & Accountability: Commerce should include strong, transparent, and enforceable workforce commitments like minimum job creation numbers, training investments, and minimum living wages and benefits broken down by job classification. These commitments should be subject to transparent quarterly public reporting with strong certification requirements as well as clawback provisions for non-compliance. Communities and workers deserve to know what specific commitments companies have made in exchange for billions of public dollars. Access to that information will enable them to work with the government to hold funding recipients accountable to the future-facing commitments they are making right now.

Commerce should also require chip companies to provide full transparency regarding chemicals in use. This information will empower Commerce, workers, and communities to understand how to protect their health and safety before any long-term exposure to toxic chemicals occurs.

3. Stop executive enrichment: The Department of Commerce should use its statutory authority to ban CHIPS recipients from engaging in stock buybacks rather than just giving preferential treatment to bids

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> — Manufacturing technician,
> Micron fab in Manassas, Virginia

that agree to forgo them. Adding strong teeth to regulations on buy backs would help ensure that federal money flowing to semiconductor companies makes its way to employees in the form of improved wages, training, and safety measures.

4. Protect worker rights: The administration should also take steps to ensure that the right of workers to organize is not infringed on by CHIPS recipients.

Although the CHIPS Workforce Development Guide says that companies "should remain neutral during organizing activity," the semiconductor industry has a history of harsh responses to unionization efforts and responses to some early organizing efforts demonstrate that the same hostility towards labor remains. One Microchip worker, for example, detailed being subjected to anti-union presentations during required meetings in July 2024. Commerce could avoid history repeating itself by promoting labor peace agreements between semiconductor firms and unions.

These sorts of deals are not without precedent in the industry — Akash Systems entered into a formal agreement with the Communications Workers of America in 2023 as it builds a semiconductor facility in Oakland, California.

Many of these proposals for CHIPS grantee conditions were floated in a letter from Senators Ed Markey (Mass.), Elizabeth Warren (Mass.), Bernie Sanders (Vt.) and Ben Ray Luján (NM) to Commerce Secretary Gina Raimondo earlier this summer, as well as two letters from the House with hundreds of co-signers each.

Taking all possible steps to ensure that jobs created by CHIPS Act are well-paid and safe is not only important for protecting workers but for the success of the whole program.

"We have hands on the product," said one manufacturing technician at Micron. "Without us in that fab, there would not be a product to sell."

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About the report:

This is the second in a series of Institute for Policy Studies reports this year on how to maximize the benefits of the CHIPS program for working people. The first, focused on the need for restrictions on stock buyback spending among CHIPS grantees, is available here**.**

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Cover design: Sarah Gertler, Institute for Policy Studies.

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