National Institute of Environmental Health Sciences
Worker Training Program

FALL 2023 WORKSHOP REPORT

A Pulse on the Nation's Workforce

Addressing the Implications of Emerging Hazards, Careers, and Technologies

August 2024

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Executive Summary

The National Institute of Environmental Health Sciences (NIEHS) Worker Training Program (WTP) hosted its biannual workshop Oct. 18-19, 2023, at the NIEHS headquarters in Durham, North Carolina. Grant recipients and subject matter experts from across the country convened to discuss challenges and opportunities in the field of occupational health and safety. Presentations and conversations centered on strategies for workforce development and implications of emerging technologies and associated hazards. Attendees also discussed the impressive economic return on investment that WTP provides.

Workforce Development

Keynote speaker Bernadette Oliveira-Rivera, co-chair of the U.S. Department of Labor's Advisory Committee on Apprenticeship and assistant director of the Laborers' International Union of North America Training and Education Fund, highlighted growing support at the state and federal level for apprenticeships, which provide paid on-the-job training. Registered apprenticeships are reaching new sectors and audiences as industries recognize that well-paying jobs and workforce retention are a boon to workers and employers alike. An intermediary role has also evolved among local organizations to help employers create apprenticeship programs and recruit applicants.

Providing trainings in workers' rights, safety, and health is essential to equipping new workers for long careers. Presenters representing WTP-funded organizations in New York, Minnesota, and California shared examples of successful collaborations between occupational training centers and educational institutions to teach older teenagers and young adults through curricula that emphasize honest dialogue, mentorship, and community service.

Partnering with small businesses is another strategy to develop workforces. Each year, WTP awards Small Business Innovation Research (SBIR) grants to companies that develop digital training products relevant to worker safety and health. Through the WTP network, SBIR grant recipients can connect with organizations to identify workers for specific needs. For instance, SBIR grant recipient Cell Podium, LLC, partnered with the Green Door Initiative, a Detroit-based environmental justice nonprofit organization, to recruit individuals to build digital components of a computer simulation designed to train hazmat workers.

Implications of Tech Innovations for Worker Health, Safety, and Job Security

Attendees discussed how emerging technologies like electric vehicles and artificial intelligence (AI) will profoundly affect job creation and displacement in addition to health and safety.

As car manufacturers ramp up electric vehicle (EV) production, workers will find new opportunities in vehicle manufacturing, as well as in planning, design, and construction of charging stations, charging networks, distribution systems, and related renewable energy infrastructure.

However, the chemical combinations that power EVs also carry health and safety risks for workers and emergency responders. For example, lithium-ion batteries contain

chemicals that pose combustion and explosion hazards and that may cause physical and developmental harm.

Other automotive innovations present additional challenges. As automakers inch closer toward producing driverless vehicles, new workers may find a niche as safety drivers for vehicles with limited self-automation, field service technicians, vehicle maintenance technicians, and vehicle operations specialists. But humans who drive for a living may need to transition to new careers.

Other industries experience upsides and downsides to AI as well. For instance, drones can provide aerial views of construction but may rattle worker attention. Demolition robots can turn deadly in undertrained hands. Meanwhile, firefighters in California are now using AI to detect fire smoke across wide swaths of land in real time.

In an increasingly digital world, laborers should also be concerned about data privacy and security, speakers noted. Third-party apps designed to monitor productivity or health may provide inaccurate or biased readouts, leading to lost wages or discriminatory practices, among other outcomes. The Federal Trade Commission leads the nation in enforcing privacy policy.

Return on Investment

For perspective on WTP's benefits to workers and society, economist Benjamin Artz, Ph.D., of the University of Wisconsin Oshkosh, analyzed the economic impact of the Environmental Career Worker Training Program (ECWTP) for the years 2014-2022. Compared to a similar study covering 1995-2013, preliminary findings from the new study show that ECWTP's impact has held strong, resulting in increased lifetime earnings for graduates; injury cost savings; employer hiring cost savings; reduced victim and justice system costs; and more.

Glossary

AI: artificial intelligence

DOE: U.S. Department of Energy

ECWTP: Environmental Career Worker Training Program

EV: electric vehicle

HAZWOPER: Hazardous Waste Operations and Emergency Response

NIEHS: National Institute of Environmental Health Sciences

OSHA: Occupational Safety and Health Administration

SBIR: Small Business Innovation Research

Setting the Scene

Sharon Beard, director of the National Institute of Environmental Health Sciences (NIEHS) Worker Training Program (WTP), welcomed participants with a description of workshop goals and objectives:

WTP Director Sharon Beard

- Define how worker training programs can fill existing gaps in workforce development.
- Ensure that worker training programs are appropriate for a broad range of audiences.
- Discuss potential solutions to bring young workers and new trainers into construction, environmental cleanup, waste treatment, and green industries.
- Identify skills that should be developed in training programs to account for different and emerging hazards.
- Address the health and safety implications of emerging technologies, such as electric vehicles (EVs) and artificial intelligence (AI).
- Form working groups to address topics and issues raised during workshop discussions.

Attracting Workers Through Apprenticeships

As the U.S. labor force grapples with a shortage of skilled trade workers, apprenticeships — training programs that pay workers to develop knowledge and skills on the job — can be an effective way to attract and retain new workers. Registered apprenticeships are apprenticeships that have been approved and validated by the U.S. Department of Labor or a state apprenticeship agency.

Bernadette Oliveira-Rivera, co-chair of the U.S. Department of Labor's Advisory Committee on Apprenticeship and assistant director of the Laborers' International Union of North America Training and Education Fund, highlighted several ingredients for apprenticeship success:

- Apprenticeship programs should provide equitable access to anyone who may be interested.
- They should connect workers with well-paying jobs and help elevate them to the middle class.
- They should increase workforce retention by providing workers with skills and knowledge that meet industry needs.
- Employers should be committed and engaged.

In recent years, state and federal governments have shown growing support for apprenticeship programs. For example, the CHIPS and Science Act, focused on expanding the U.S. semiconductor industry, and the Infrastructure Investment and Jobs Act have allocated federal dollars to training programs. The Advisory Committee on Apprenticeship also recommended in a 2023 report that the U.S. Department of Labor require registered apprenticeship programs to guarantee living wages to apprentices after graduation.

Other encouraging trends include greater integration of technology into instruction to accommodate remote participants and different learning abilities. Oliveira-Rivera has also observed efforts to expand apprenticeship access to diverse groups.

"We see a lot more initiatives around working with youth, around working with immigrant populations, with women and individuals in underserved communities, to make sure that there's this broad-level access to workforce development that's going to lead to increased growth," she said.

Additionally, registered apprenticeships are expanding into new sectors, such as technology, manufacturing, health care, early childhood education, transportation, communications, and the insurance industry, according to Oliveira-Rivera.

A new role has also evolved in the apprenticeship ecosystem. Intermediaries, which tend to be community-based organizations or other workforce development nonprofits, support employers interested in starting registered apprenticeship programs. For example, intermediaries connect employers with trainers who can provide relevant instruction to apprentices, Oliveira-Rivera explained. Intermediaries can also help employers with apprentice outreach and recruitment.

"To be a viable intermediary, the Department of Labor is really looking for someone who has regional capacity or national capacity with sector-based expertise," Oliveira-Rivera said. "Moving forward, there's going to most likely be…more requirements and clarity around what an intermediary should be doing."

For employers interested in starting a registered apprenticeship program, Oliveira-Rivera recommended consulting the ApprenticeshipUSA database. If a similar apprenticeship already exists, employers could consider forming a partnership to avoid duplicating efforts and wasting resources, she suggested.

However, some employers are wary of apprenticeship programs because they entail time-consuming paperwork and require employer monetary contributions.

To build interest among employers in apprenticeship programs, Oliveira-Rivera shared this advice:

- Involve employers from the start.
- Clearly articulate that apprenticeship programs produce workers with skills tailored to the employer's needs.
- Show how apprenticeship programs contribute to the bottom line through increased productivity, greater retention, and decreased turnover.
- Raise awareness of employer tax incentives for offering apprenticeships.

Employers who are part of organized labor are able to pool resources to fund apprenticeship programs. That model could potentially work for other employers, Oliveira-Rivera suggested.

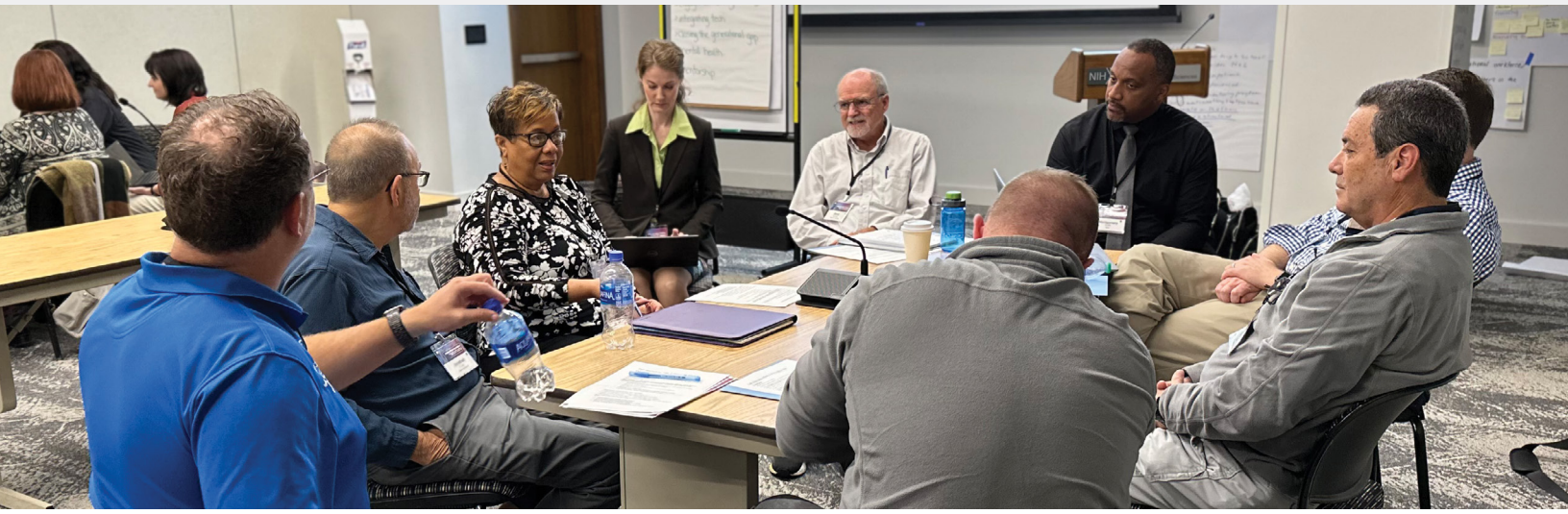
"Perhaps, over time, this idea of contributing into a fund for worker training will actually be the norm, whether you're a part of a collective bargaining unit or not," she said.

For her part, Oliveira-Rivera is optimistic that registered apprenticeships will continue to attract new workers in new sectors.

"Suffice it to say that the future of apprenticeship looks really bright right now," she said.

Expanding Training for Youth

Ensuring that younger workers are adequately trained to safely do their jobs is paramount to workforce longevity. Several speakers from across the country shared examples of successful training strategies. As the examples below indicate, partnerships are key to each effort.



Workshop participants broke into small groups to discuss different themes related to workplace health and safety. (Photo courtesy of the National Clearinghouse)

Example 1: New York Committee of Occupational Health and Safety

Through its Young Worker Program, the New York Committee of Occupational Health and Safety (NYCOSH) recruits junior and senior high school students to learn about health and safety. Through state funding, NYCOSH primarily works with students enrolled in vocational training programs provided by the Boards of Cooperative Educational Services of New York State.

From September to December, NYCOSH provides about three dozen training sessions, according to NYCOSH industrial hygienist Marina Jabsky. Half of each hour-long session covers legal protections for young workers, while the other half delves into workplace hazards.

Interactive activities and discussion keep students engaged, Jabsky said. For example, the kids participate in a hazard-identification activity, which involves examining images for signs of workplace dangers and discussing ways to control them.

They also watch and discuss a video about a 14-year-old worker who sustained a grisly injury when her arms were crushed by machinery. The video typically elicits disbelief and revulsion from young viewers over how such

an accident could have occurred, Jabsky noted. But their vocal incredulity drives important conversation.

"That's where the engagement comes from, because they don't like [the video]," she said, and they want to express how they feel.

From the safety of their classroom, students see the young worker's missteps as avoidable. But Jabsky explains that, in an intense work environment, someone who is under-trained is prone to making mistakes. That reasoning often resonates with the class.

"Maybe by the end of the hour, a little bit more understanding happens," Jabsky said.

Example 2: University of California Los Angeles and University of California, Berkeley

For about 15 years, the Labor Occupational Safety and Health (LOSH) Program at the University of California Los Angeles (UCLA) has partnered with the University of California (UC), Berkeley to run the state-funded Young Worker Leadership Academy. The academy recruits high school students from across the state to learn about worker rights and safety and health hazards through videos, case studies, and guest speakers.

"There're a lot of risks that go along with being a young worker in the workplace," said Kevin Riley, Ph.D., director of LOSH and principal investigator of the Western Region Universities Consortium, a WTP grant recipient. Young workers are "eager to make a good impression, eager to get started or are feeling the pressure to do what the boss is telling them to do."

A hallmark of the academy is its community service component, Riley said. Students are recruited as teams through their schools and assigned an adult mentor. The teams then complete a project designed to raise awareness among their peers about worker health and safety and labor rights.

"Teams have led trainings, they've created posters, art projects, podcasts — it runs the gamut. It's a very small program, but it's been a very successful one," Riley said, noting that many student teams come from high schools in working-class communities across the state.

Lately, the program has been experimenting with recruiting youth through local worker and community-based organizations. The idea is that these young trainees can implement their community service projects via their respective organizations, according to Riley. For example, a team from an environmental justice nonprofit called Pacoima Beautiful, based in the northeast San Fernando Valley, worked with health promoters to educate workers in their community about the dangers of inhaling silica dust, which can lead to silicosis, or permanent scarring of the lungs.

"In that part of Los Angeles, we have a growing epidemic of silicosis among these young Latino workers who are working in these fabrication shops for artificial stone cutting. It's a serious worker health and environmental health issue," Riley explained.

Riley and colleagues are also exploring a collaboration with a new youth program at the Los Angeles Black Worker Center, an Environmental Career Worker Training Program (ECWTP) partner. The hope is to develop training that helps integrate these young workers into the Black Worker Center's apprenticeship programs.

New state legislation may help widen the reach of the Young Worker Leadership Academy as well. California law now requires high schools to provide classroom instruction about labor rights. The academy could serve as a model to "support and expand training to youth across the state to align with these requirements," Riley said.

Example 3: Midwest Consortium for Hazardous Waste Worker Training

Working with training center partners, the Midwest Consortium for Hazardous Waste Worker Training (MWC), based at the University of Minnesota School

of Public Health, integrates health and safety and hazmat training into various vocational training and apprenticeship programs.

For example, the Greater Cincinnati Occupational Health Center (GCOHC), an MWC training center and subsidiary of the Cincinnati AFL-CIO (American Federation of Labor and Congress of Industrial Organizations) Labor Council, works with technical and community colleges to bring health and safety training to young adults on vocational tracks.

Under the leadership of Brian Griffin, the effort has "essentially doubled GCOHC's training numbers just by pulling together these partnerships in the last couple of years, so that's really been impressive," said Peter Raynor, Ph.D., principal investigator for MWC.

GCOHC is also working with unions to bring health and safety training into apprenticeship programs.

"There's a wide range of different unions involved in that: plumbers, pipe fitters, mechanical equipment services, laborers, electrical workers, and iron workers, too," Raynor said. "So, the training topics vary, and they're geared towards the different needs of the apprenticeship programs."

The GCOHC board has also added members from the Greater Cincinnati Building and Construction Trades Council and the Greater Cincinnati Apprenticeship Council to help expand its involvement in labor apprenticeship programs across southwest Ohio, according to Raynor.

Additionally, GCOHC is a partner in a Building Futures apprenticeship readiness program, led by the Urban League of Greater Southwestern Ohio and modeled after a successful program in Columbus. Through GCOHC, participating youth will receive HAZWOPER (Hazardous Waste Operations and Emergency Response) and OSHA (Occupational Safety and Health Administration) training, as well as other awareness training related to topics like trench safety and confined space safety, Raynor explained.

MWC also supports youth vocational training, delivered by its University of Illinois training center, at the Lincoln's ChalleNGe Academy in Rantoul, Illinois. Run by the Illinois National Guard, the academy recruits older teenagers who are at risk of not graduating from high school or who have already dropped out, helping them with GED prep and building life skills while providing pre-vocational training related to careers in the military, firefighting, industrial work, construction, and the clean energy sector.

The University of Illinois training center, led by program director Chris Hanson, provides hazardous materials and OSHA training to Lincoln's ChalleNGe cadets through a competitive funding process within MWC.

"We decided as a group when we submitted our last five-year proposal to set aside some money to provide training and outreach to workers and community members from underserved populations or populations that we weren't serving very effectively," Raynor said.

In the last year alone, 200 cadets participated in programs delivered by the University of Illinois training center, amassing 3,000 contact hours, according to Raynor.

"It's exciting to train young workers and to be having an impact on people who are just at the beginning of their working lives," he said.

Workforce Development Through Small Business Innovation Research

Each year, WTP awards Small Business Innovation Research (SBIR) grants to companies that develop digital training products relevant to worker safety and health training. That support helps grow businesses and also provides a direct line to the WTP network. SBIR grant recipients can find audiences to help them test their products, as well as connect with potential partners for projects.

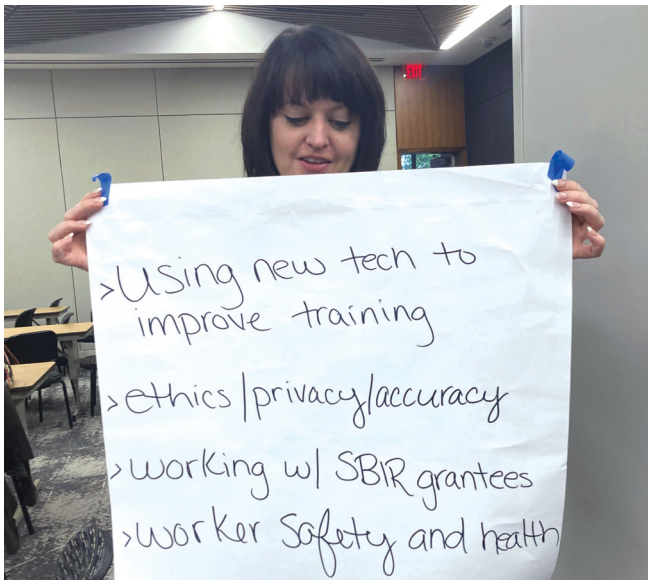
In 2022, a new partnership took root at the MWC meeting when Domiana Carter, chief operations manager of the Detroit-based Green Door Initiative, met Peter Schmitt, Ph.D., principal investigator of Cell Podium, LLC, a long-time WTP SBIR grant recipient. As a nonprofit, the Green Door Initiative promotes environmental justice and workforce development in the clean energy sector, focusing on low-income neighborhoods and communities of color. Cell Podium develops training products and services for public health and emergency response workers.

Carter and Schmitt saw an opportunity to help each other. Green Door students were hungry for hands-on experience with technology, and Cell Podium needed assistance developing digital components of a computer simulation for training hazmat workers. Such labor is typically outsourced, according to Schmitt, but he and Carter wondered, "Why can't we do it in Detroit?"

Carter's and Schmitt's teams together incorporated a computer programming curriculum into the Green Door Initiative's 13-week environmental career worker training course. The nonprofit's new technology hub — built with funding from various supporters, including the Dell Foundation and the United Way of Southeast Michigan — provided the perfect setting for learning.

Their ongoing collaboration could serve as a template for other workforce development initiatives because programming skills are transferrable to all kinds of jobs, Schmitt explained. And there's an additional benefit for instructors:

"Staying up there in front in front of all these students is enjoyable work — really delightful," he said.



Ashlee Fitch, director of the United Steelworkers Tony Mazzocchi Center, holds a large piece of paper with workshop topics. (Photo courtesy of the National Clearinghouse)

Clean Energy and Evolving Technologies: Implications for Workers

Electric Vehicles Speed Ahead

The 2021 Infrastructure Investment and Jobs Act included $7.5 billion in funding to create the nation's first electric vehicle (EV) charging network along highways and within communities. The funding is part of federal efforts to address climate change and support domestic manufacturing jobs by promoting EV adoption. However, EV growth presents new risks to worker safety and health — and could also translate to job losses in the fossil fuel industry. Speakers highlighted challenges and opportunities they have observed in their fields.

California is leading the charge.

In California, commitment to EV technology foreshadows what could occur across the nation, according to Rania Sabty, Ph.D., program manager and educator for the Western Region Universities Consortium (WRUC), a four-university partnership led by UCLA-LOSH.

For example, by 2030, the California Energy Commission anticipates needing:

- 1.01 million chargers to support the 7.1 million light-duty plug-in EVs.
- 114,500 chargers to support 155,000 medium-duty and heavy-duty plug-in EVs.

The state also indicates that by 2035, zero-emission EVs will comprise all new sales of passenger cars and trucks, all freight trucks running from ports (called drayage trucks), and, where feasible, off-road vehicles and equipment. California is planning for all operating medium-duty and heavy-duty vehicles to be zero-emission EVs by 2045.

Surging demand for EVs will profoundly affect job creation and displacement, Sabty said. For instance, workers in oil and gas extraction and refining will face difficulties, such as loss of high-paying jobs, health insurance, retirement pension contributions, and worker safety and health protections secured through union contracts, according to Sabty.

However, embracing EVs will lead to new jobs in vehicle manufacturing and in planning, design, and construction of charging stations, charging networks, distribution systems, and related renewable energy infrastructure.

"A lot of money is going into building the infrastructure: about $385 million coming to California over five years, just to build the charging infrastructure, and about $2.8 billion of discretionary grant funds that would be available for the state or other nonprofits to tap into developing further the infrastructure for charging," Sabty said.

"We do have a great opportunity for job creation, in terms of building the charging stations…But the transition from extraction and refining jobs does not look like it is fair right now. It's one thing to train the new workforce, and it's another to retrain," she said. "For folks that are later in their careers or close to retirement, that really is just not going to happen for most."

EV batteries bedevil emergency responders.

Lithium-ion batteries have revolutionized how we charge devices small and large, from phones and laptops to

electric bicycles and EVs. Lightweight and long-lasting, they provide more energy than traditional lead-acid batteries. However, they are a unique hazard to emergency responders, noted Trish Davies, former program director at OAI (Opportunity, Advancement, Innovation in Workforce Development), Inc., in Chicago.

"We're at a pivotal moment. We're seeing a fundamental transformation in the energy landscape," Davies said. "That shift towards more sustainable energy offers many benefits, but it also poses significant safety challenges, particularly for our first responders."

EVs present combustion and explosion hazards that stem from lithium-ion battery construction and composition. A single battery consists of a group of compartments, or cells, that contain a flammable liquid substance.

"When there is a cell that ignites, it can spread much like matches in a matchbox," Davies explained, adding that this chain reaction can occur hours after an initial flame has been extinguished.

For instance, two years ago, emergency responders thought they had put out a fire following a Tesla vehicular crash, only to discover additional flares under the wreckage hours later.

"It took them seven hours and 28,000 gallons of water to extinguish this fire. For context, that's the amount of water they typically use in a month," Davies said, noting that disasters like this are increasing across the country.

Exposure to extreme heat can also cause batteries to off-gas, or release, flammable chemicals. Such an incident occurred at a residence in Colorado in April 2023 when gas buildup inside a garage from a hybrid Jeep led to an explosion that blew off the garage door.

When it comes to addressing these emergencies, responders are essentially learning on the job, Davies said.

"This is new territory for us. Data on fires that involve lithium-ion batteries are just now starting to be collected," she said. "CBS did a survey [in 2023] of 24 of our largest fire departments [across the country] and found that only 38% had hands-on training to respond to these sorts of fires."

To complicate matters, not all EVs are built the same way. Davies mentioned that an existing firefighter-led effort to digitally assemble all emergency response guides for EVs in a centrally accessible location is a short-term fix that could help emergency responders. But long-term solutions are imperative.

"Clearly, we have our work cut out for us when responding to the prevalence of lithium-ion batteries in our daily lives," she said.

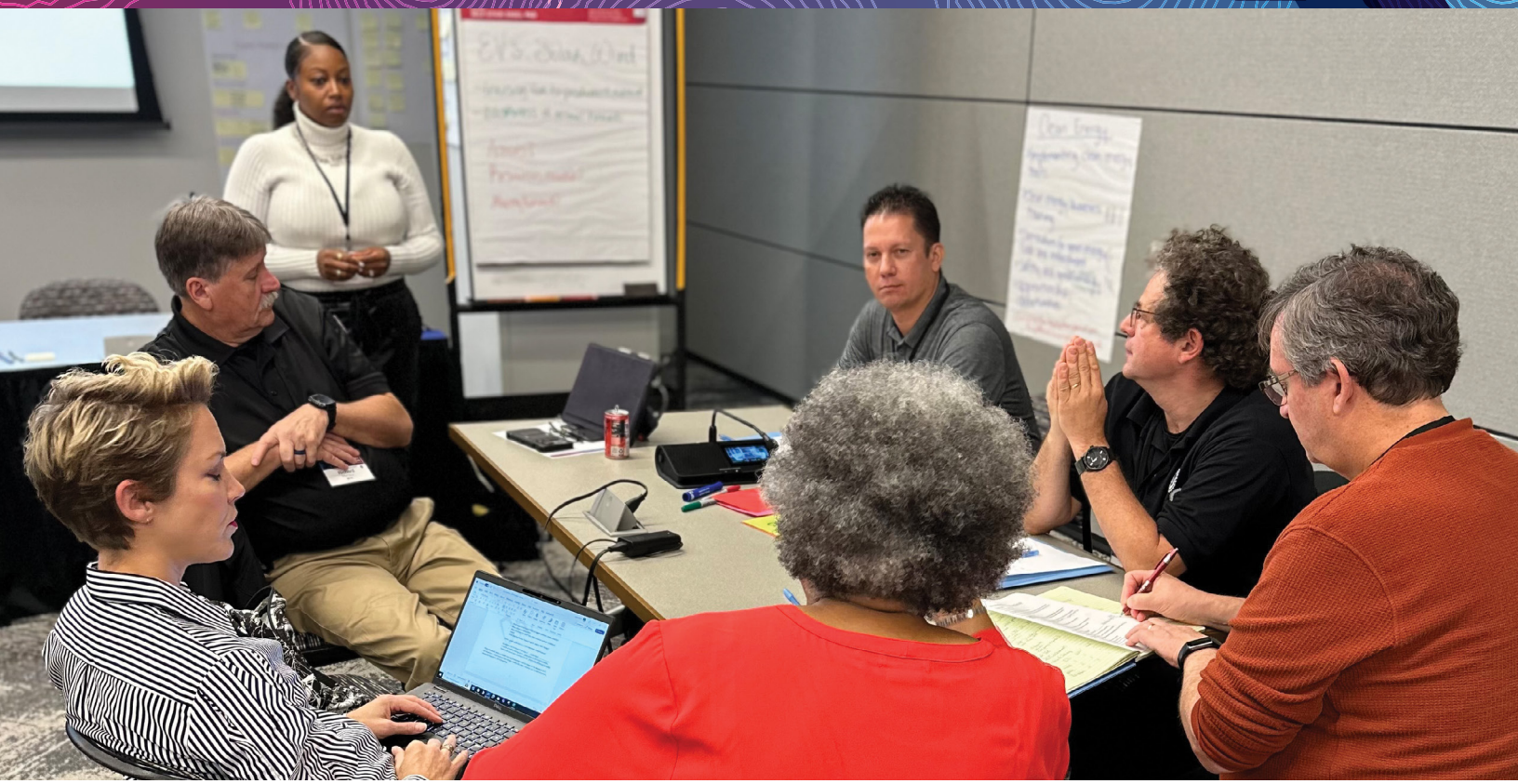
Auto workers need better protections.

Under the Inflation Reduction Act, the EV industry is expected to receive $220 billion in government subsidies by 2031, according to Darius Sivin, Ph.D., an international representative for the United Auto Workers and its principal investigator on a grant from the NIEHS Hazardous Waste Worker Training Program. As EV demand grows, the nation's approximately 2 million auto workers will encounter new health and safety risks.

"We believe that subsidies should carry conditions related to health and safety environmental justice and workers' rights," Sivin said.

Lithium-ion batteries contain various chemicals that can cause injury or otherwise threaten the health of exposed individuals. For example, exposure to the solvent N-methylpyrrolidone, or NMP, may harm developing fetuses, pregnant people, and people of childbearing age, and may irritate the respiratory tract, among other problems, according to Sivin.

Another highly flammable compound called lithium hexafluorophosphate forms highly toxic hydrogen fluoride upon contact with water, including water in the eyes, mucous membranes, and saliva. And carbon nanotubes — used to improve battery efficiency and reduce weight — can cause germ cell mutations and cancer of the lungs through a mechanism similar to asbestos, Sivin added.



Krystal Hepburn (standing), Ph.D., of OAI, Inc., moderated a breakout session on clean energy and safety implications for workers. (Photo courtesy of the National Clearinghouse)

Through the Toxic Substances Control Act (TSCA), the U.S. Environmental Protection Agency (EPA) regulates chemicals found in batteries. From the time a company submits a chemical application, EPA has 90 days to determine its health risks. To inform its ruling, the agency uses whatever data is available, such as information from the National Toxicology Program and proprietary studies submitted by the manufacturer.

Under TSCA, information about certain battery components, such as NMP, is publicly available, noted Sivin. However, the TSCA New Chemicals Program, which regulates newer compounds, operates through private consent order between EPA and companies that manufacture, distribute, or use the chemicals. As a result, chemical names, location of use, and other information is kept private. Ultimately, the lack of transparency means that workers and communities may not know about existing hazards, whether companies have committed to adequately addressing them, or whether companies are following through with those commitments.

"So, this is a real problem, which we have been speaking to the EPA about changing," Sivin said. "Basically, workers can be working with a chemical that has a legally binding consent order, specifying health and safety procedures, but neither they nor their representatives know that the order exists, or what's in it."

"Electric vehicle batteries may be climate-friendly, but they have many hazards," Sivin continued. "The transition to electric vehicles must not leave workers in more dangerous jobs with fewer rights…The TSCA New Chemicals Program must be made more transparent so those who are intended to be protected can know that the protections exist."

Advantages and Challenges to Working With AI

Incorporating AI can enhance worker safety and improve productivity, among other benefits. But these systems can also undermine job security and subject workers to different occupational hazards. Speakers shared benefits and drawbacks to AI and other computer-based technologies.

For construction workers, drones and robots help and harm.

Construction companies aiming to improve efficiency and worker safety through AI should proceed with caution, said Chris Cain, executive director of the nonprofit CPWR - The Center for Construction Research and Training.

For example, an unmanned aerial vehicle, or drone, can inspect a tall communication tower in lieu of a person, who risks falling. However, a CPWR-supported study found that drones also distract workers in the vicinity, endangering their safety.

"So, if you think about adding a mental stressor [like drone surveillance] to a worker who may be working at heights or in other somewhat dangerous conditions, it's probably not the best thing to do," Cain said.

Other robots, such as demolition devices, can protect workers from job hazards like flying debris or dust. But workers controlling these machines still face risks, especially if they are under-trained or do not follow protocol.

For instance, a report published by the Washington State FACE Program, which receives funding from the National Institute for Occupational Safety and Health, described two cases where workers sustained major injuries while operating demolition robots. In one case, the worker did not hit the emergency stop button; in the other instance, the worker was under-trained in operating the machine.

Recognizing the advantages and disadvantages of emerging technologies is imperative to ensuring worker safety and job security, Cain noted.

"The apprenticeship and training programs and the building trades are absolutely moving with the technology, but we're trying to be mindful of some of the bad that comes with it," she said.

For her part, Cain would like to see more emphasis on using technology to improve worker safety among small companies. Construction workers employed by contractors with 20 or fewer employees face a disproportionate risk of dying on the job, she said.

"[Those companies] don't have money to have a safety department, they don't have money to have a lot of understanding, even, of OSHA rules," Cain explained. "How does this technology benefit the industry in that regard?"

At the head of the table, Lisa Orloff, founder of the World Cares Center, talks with members of her breakout session. (Photo courtesy of the National Clearinghouse)

Truckers expect workforce changes down the road.

Industries that rely on human drivers are gearing up for EV fleets, said Charles Austin, an industrial hygienist and principal investigator for the International Brotherhood of Teamsters. Although fully automated cars do not yet exist, auto companies predict a future in which driverless cars and trucks cruise along roads, ferrying people and goods.

The trucking industry sees multiple benefits to relying on driverless vehicles, Austin said. Fully autonomous trucks will not need to follow certain Federal Motor Carrier Safety Administration (FMCSA) rules and regulations, like taking regular breaks or undergoing drug and alcohol testing. Such trucks could also travel more closely together, in a formation called platooning, which could improve efficiency and productivity.

"Right now, it takes generally four to five days to take any kind of freight from the West Coast to the East Coast. With autonomous trucking with platooning...it takes two days. You can move freight much faster," Austin explained.

But deploying wheeled robots on roads also raises practical concerns about safety, maintenance, and transportation statutes. People complain when their phones cannot connect to the internet, Austin said. "Imagine now an 80,000-pound truck is going down a road, and it loses its internet connection."

Given the mileage they will clock, automated freight trucks will require more frequent inspection and maintenance. Car manufacturers will also need to program driverless vehicles to abide by different state laws, such as speed limits and right-hand turn rules. How software updates will occur and who will be responsible for ensuring proper installation are important concerns as well, according to Austin.

Other challenges include autonomous vehicle performance during severe weather, such as heavy rain, snow, and fog, Austin explained. Insurance companies and litigators will face the task of defining responsibility during an accident between a human driver and an autonomous vehicle. Additionally, in the warehousing industry, use of autonomous vehicles or equipment could increase the pace of work and lead to collisions between vehicles and workers, he added.

For humans who drive for a living, a pressing concern about autonomous vehicles is job competition.

"Our membership right now is 1.3 million. We have roughly half a million who are in trucking, so of course, [EV fleets] would affect us dramatically," Austin said.

Improved job security in the auto sector may come with roles in software development, engineering, field service technical assistance, vehicle maintenance, safety driving for vehicles with limited self-automation, and vehicle operations, he noted.

Firefighters see AI as another tool in the toolbox.

For firefighters, who regularly face hazards under intense time pressure, AI can be a critical tool — but it will not supplant human emergency responders, noted Jamie Burgess, deputy director of training at the International Association of Fire Fighters.

"Until you develop a technology that not only operates on datasets from a technical standpoint, but is also able to make emotional life-safety, split-second decisions, I don't foresee robots being able to replace firefighters," Burgess said. "But to the extent that [AI] can help make our jobs safer, help make us more efficient, and help us provide a better service to the public, I certainly think that we have an obligation to embrace this technology as much as possible."

Indeed, firefighters in California are already employing AI. In September, a team that included the state's Department of Forestry and Fire Protection, better known as CAL FIRE; the University of California San Diego's public safety program, ALERTCalifornia; and internet service provider DigitalPath rolled out an AI-based tool to all 21 CalFire dispatch centers. Using a sprawling network of cameras placed across the state, the system alerts firefighters

when it detects smoke. If trained watchers vet and confirm the sighting, firefighters respond to the fire in its early stages.

Firefighters also use robotic vehicles to investigate hazardous environments where they might otherwise encounter chemical exposures, Burgess noted. Reducing such risks is critical in an industry where cancer is the leading cause of death. To that end, researchers are developing wearable sensors to track firefighter exposure to cancer-causing agents and other chemicals, according to Burgess.

Other advanced technology is facilitating firefighter training, too.

"Use of virtual reality as a training tool has grown exponentially in the fire service over the last decade, to the point where you can essentially submerse yourself into a virtual environment and feel like you're actually at an emergency scene," Burgess noted.

New technology raises ethical concerns in workplaces.

In 2022, the Federal Trade Commission (FTC) submitted a report to Congress entitled Combatting Online Harms Through Innovation, in which it identified possible scenarios involving AI that could lead to violence, harassment, and other harmful actions.

"Those potential issues apply in the employment and work context as well," said David Walko, an attorney within the FTC Division of Privacy and Identity Protection.

For example, employers may ask employees to use their personal phones to install third-party apps that collect biometric data or track productivity. However, such apps may compromise personal data or employment status.

"A key challenge here is, how would the employer be storing that data? Is it encrypted at rest? Is it not? Ideally, they should be treating it as sensitive information," Walko said, adding that employers should also ask, "Is collecting the health data necessary? Or is it simply nice to have?"

App readouts that do not accurately reflect productivity could lead to lost wages, difficult work schedules, or disciplinary action, Walko explained. Further, if the data used to train the app is unrepresentative of the population being monitored, workers may also experience discrimination on the job.

"The algorithm could reflect developer bias, and that can lead to discriminatory outcomes," Walko explained.

Who holds parties accountable ultimately depends upon the agency that has jurisdiction, which may or may not be the FTC, Walko noted. The FTC Act declares that "unfair or deceptive acts or practices in or affecting commerce" are unlawful — a stipulation that in some cases could apply to workers using third-party apps.

Case Study: Economic Impacts of the Environmental Career Worker Training Program

Guest speaker Benjamin Artz, Ph.D., an economist at the University of Wisconsin Oshkosh, shared preliminary findings from a new study that illustrates the positive economic and social impacts of ECWTP. The study, which covers the years 2014-2022, builds on findings from an earlier report analyzing ECWTP's impact during 1995-2013.

Artz shared ECWTP's impact across several categories, including lifetime earnings benefits for graduates; injury cost savings; employer hiring cost savings; reduction in victim and justice system costs; societal savings due to increased federal tax revenues; matching funds and in-kind donations from organizations; and sustained earnings and employment during the COVID-19 pandemic.[1]

Artz presented preliminary findings from a new study about ECWTP's economic and social impacts. (Photo courtesy of the National Clearinghouse)

1 Results from the new economic impact study are featured in a report, Impact Evaluation of Workforce Development in Disadvantaged Communities: The NIEHS Environmental Career Worker Training Program. The report is available on the ECWTP webpage.

The study also showed that trainees who completed an ECWTP program were more likely to find a job than trainees who dropped out. What's more, those jobs typically benefit the environment and society.

"The workers in the program are trained to do environmentally conscious jobs and socially conscious ones as well," such as working in lead abatement, hazardous waste removal, and the public sector, Artz explained.

Another finding also stood out. Compared to trainees in the earlier study, trainees from the recent cohort collectively had more education and lower unemployment history. In other words, before embarking on training, the recent cohort was already statistically equipped to find higher-paying jobs. Yet, results indicated that ECWTP still provided economic benefits beyond what trainees would have otherwise achieved.

"What I saw was that, even though the better-prepared people in this study versus the last study would have earned more and had better careers without the training program, the training program still took those better-prepared people and made them even better," Artz said. "So, this is good evidence that a training program like ECWTP could scale to a far larger audience."

For individual ECWTP programs interested in commissioning their own economic impact studies, Artz

suggested several regional universities with economic research centers as potential partners:

- **Texas:** Stephen F. Austin State University Center for Business and Economic Research
- **California:** Chapman University Anderson Center for Economic Research
- **Oregon:** Portland State University Northwest Economic Research Center
- **Louisiana:** University of New Orleans Institute for Economic Development and Real Estate Research
- **Florida:** University of West Florida Haas Center
- **Illinois:** University of Illinois Chicago Center for Urban Economic Development

"I think, overall, [ECWTP] is a very impactful program, and I applaud you for your efforts," Artz said.

Brainstorming a Better Future

During Q&As and small group discussions, attendees shared concerns about multigenerational training and the many implications of emerging technologies on worker health, safety, and job security. Grantees discussed specific difficulties facing their organizations and the populations they serve, as well as programmatic victories that could be models for others. The tables below describe various challenges described by participants, as well opportunities for addressing them:

Youth Engagement

Challenge	Opportunity
It can be difficult to attract younger workers to the trades and to offer relatable trainings once they are interested.	• Grantees can connect with local partners that engage with local schools, like federally funded health centers that offer high school programs. • High school programs can be designed around discussing the hazards students and family members face at work, to prime them for eventual health and safety training. • The International Brotherhood of Teamsters visits high schools to talk about union jobs, and how training can bridge the pathway from school to job. • Recruiters from vocational schools could be resources for ideas on how to recruit younger workers. • The WTP National Clearinghouse for Worker Safety and Health Training has resources for training younger people. • Grantees can capitalize on recent high-profile union wins, like Starbucks unionizations, to raise the profiles of both unions and unionized career fields.

Challenge	Opportunity
Many older trainers do not want to conduct Zoom trainings, even though young students usually like online training systems. Also, American Indian Tribes often do not have computers. Most members have phones but encounter difficulty using them for Zoom training.	A blended approach was suggested: • Grantees suggested advocating for mostly in-person trainings because social cohesion and class interaction boost learning and mental health. Also, health and safety professionals must interact with other workers on the job to help them stay safe, so in-person training is helpful. In-person training is especially beneficial for Tribes who grapple with technology gaps. • However, grantees noted a need to adapt trainings for online delivery to reach more workers, and to use gamification and interactive scenarios to engage younger workers with the training material. • The Volpentest HAMMER Federal Training Center runs a training simulation akin to an escape room.
Many trainers are aging out of the field without adequate numbers of younger trainers entering.	Grantees agreed that the future of health and safety training depends on robust trainer development programs, peer-to-peer training, and peer leadership.
There is a need to bridge the gap between "impatient" young people and experienced older people.	Collaborations with other grantees and organizations to develop a structured mentoring program could help.
Young workers do not always respond well to multigenerational mentoring.	Some grantees found peer mentoring to be powerful. For example, young firefighters can be taught to deliver training and mentoring to peers and younger recruits.
Recreational use of marijuana is becoming common, especially among young workers, but company policies and drug testers still treat marijuana as an illegal street drug.	Some industries are examining if personal marijuana use is truly detrimental to the workplace and revisiting company drug-testing policies. If marijuana use is still deemed detrimental, even on personal time, then employer policies must be made clear early and often.
Young workers struggling with mental health issues and addiction may have difficulty accessing or relating to treatment.	Unions have member assistance programs to pair recovering members with members trying to recover. The idea is that a knowledgeable person can look for signs of trouble or relapse.

Challenge	Opportunity
Youth are more experienced with technology and social media than many older workers.	• Use social media to advertise and recruit. • Use personal protective equipment (PPE) training as an opportunity to encourage social sharing of health and safety protocols. • Explore the possibility of an organization creating an app that can scan a selfie of a person wearing PPE and check for proper usage. Such a feature would be popular with young trainees.
Placement of older workers with physical limitations can be difficult.	Older workers have knowledge and skills they can apply to less physically demanding roles.
Some jobs have minimum age limits to apply or intimidating requirements for entering the field, making it hard to attract younger workers.	A grantee suggested following the model of pre-emergency medical service programs, which offer a window into the field. Students can get certified in high school, then have a job or apprenticeship when they come out.

Implications of Emerging Technologies

Challenge	Opportunity
Emerging technologies carry the possibility of making some jobs redundant.	Trainers must adapt to help workers retrain for new roles that arise as technology develops. For example, training in the transportation sector could prepare people to work as software developers, engineers, field service technicians, vehicle maintenance technicians, safety drivers, or vehicle operations specialists.
Data-collecting technology presents new hazards to workers. For instance, • Services that collect and store personal data could be hacked. • Third-party apps that track worker hours do not make clear how data is secured in motion and in storage.	• Organizations that collect data must consider privacy and security, and be transparent about policies. • The FTC may be able to defend individual workers when certain rights are violated. The FTC website provides examples of data threats. • A fact sheet that helps workers navigate federal regulations on data privacy could be developed.

Challenge	Opportunity
Confidential business information status enables companies to gain exemptions from revealing what chemicals their manufacturing workers are handling. Consequently, workers cannot protect themselves adequately.	Avenues for lobbying for policy changes must be explored.
AI can be a crutch for workers who typically rely on training and a safety mindset to do their jobs.	Industries like firefighting can integrate AI into the job in productive ways, without developing a false sense of security. • Firefighters are using AI to detect smoke from fires. • Trainers can use AI to generate emergency scenarios for training. • Hazmat workers use drones for bird's-eye views of spill sites to supplement their ground view. • Police are using drones in active shooter situations. • Firefighters are using drones during emergencies and natural disasters to find trapped people.
Health and safety training is time-consuming, compared to many other types of trainings in industries that have embraced technological advances.	• Web-based trainings can allow for more efficient use of time. • ChatGPT can be used to help trainers develop presentations and self-paced, asynchronous courses without overburdening their own schedules.

Implications of Green Technologies

Challenge	Opportunity
Safety and health training and awareness must be integral to the development of, and response to, issues involving clean energy — namely, EVs, solar, and wind — for the sake of workers, emergency responders, and communities.	• Grantees could leverage available information from the National Electrical Code and International Fire Code to inform training and awareness programs. • Grantees could identify funding streams to support these activities.
New batteries and new technologies requiring batteries are released onto the market with little acknowledgement of health and safety.	Workers, unions, and advocates need to push for more information and transparency.

Challenge	Opportunity
There is a problem with clean energy "greenwashing," in which tech companies overstate the environmental friendliness of their products and processes, as well as gloss over their health and safety impacts.	Accurate terminology is necessary. Instead of "clean energy," use "climate-friendly energy."
EV fires are more dangerous than combustion-engine vehicle fires.	• Firefighters must receive training that warns them against breaking open EV batteries or assuming a fire is out when more battery cells could ignite. • Dip tanks are the least hazardous means of fighting EV fires; fire department investment in dip tanks will be necessary.
All types of first responders need training that covers the hazards of EVs and their batteries.	• Any existing community awareness program on EVs and batteries could be used for emergency responders as well. • Existing information from vehicle manufacturers about manufacture-to-disposal considerations could be useful to incorporate into trainings. • Regulatory work is needed to combat the trend of battery and electrical product manufacturing in low-regulation countries that do not meet U.S. safety standards.
Building codes are written with old technology in mind and have not caught up with technological advances, such as the need to accommodate EV charging stations or solar panels.	Building codes must accommodate charging station and solar panel specifications.
Solar and wind power are growing industries, but the number of workers trained cannot meet demand.	Apprenticeship programs focused on installation for solar and wind would be useful.
Solar panel installation and maintenance present new hazards and regulatory needs.	Only trained and licensed electricians should work on solar panels. Installation companies must adequately address new risks, such as electric shock, working at heights, and exposure to heat and cold.

Challenge	Opportunity
Wind turbine construction and installation require specialized training, such as training in confined spaces, scaling heights, and harnessing.	Grantees offered two potential training resources: • CPWR - The Center for Construction Research and Training. • Chris Hanson, director of Hazardous Materials Training at the School of Labor and Employment Relations at the University of Illinois Urbana-Champaign.
Some green jobs will naturally disappear over time, such as solar and wind farm installers, because a finite number of farms can be built.	Trainers need to maintain an understanding of the employment landscape and be prepared to help workers retrain for new roles as technology progresses.

Funding Sources

Various funding sources exist to support worker training programs. Often the challenge is knowing where to look. Several options came up during the workshop:

- The Interstate Renewable Energy Council has a track record of receiving funding from the U.S. Department of Energy (DOE).
- The Inflation Reduction Act authorized monies for EV development that could also be directed to health and safety training.
- WTP offers three different types of funding: two cooperative agreements with different criteria (U45, UH4) and funding for SBIR (R43/44). The U45 mechanism funds programs that train and educate workers engaged in activities related to hazardous materials and waste generation, removal, containment, transportation, and emergency response. The UH4 mechanism funds programs that train workers who are or may be engaged in activities related to hazardous waste removal, containment, or emergency response at DOE nuclear weapons complex.

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