

# CLIMATE CHANGE VULNERABILITY ASSESSMENT

*A Report Assessing How Climate Change Impacts Worker Health  
and How To Prepare for These Impacts*

The National Clearinghouse for  
Worker Safety and Health Training

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# CLIMATE CHANGE VULNERABILITY ASSESSMENT

## INTRODUCTION/PURPOSE

The impacts of climate change, such as wildfires, extreme weather, intense heat waves, and depleting ozone, are already impacting human health, and will continue to affect and exacerbate existing environmental and health concerns that affect people daily. Those working outdoors, such as in the construction, energy, emergency response, public service industries, and some warehousing and manufacturing jobs, are among those who will be more severely impacted by the consequences of climate change. They are typically more exposed to hazardous materials and hazardous environments. Climate change will alter how these workers operate and how they are trained for their daily work.

To best protect workers from climate-related impacts, they need to be trained to identify climate-related health hazards and how to best mitigate these hazards. While the National Institute of Environmental Health Sciences (NIEHS) Worker Training Program (WTP) has been given the responsibility to help protect workers from hazardous materials, the WTP needs to also recognize its own vulnerabilities to best accomplish its mission.

In 2014, the WTP commissioned the National Clearinghouse for Worker Safety and Health to prepare a report that assesses climate change vulnerabilities that may affect the WTP, its grantees, and its target worker population. The goal of the January 2015 report, was to help the WTP and its grantee community better plan for the health impacts and programmatic changes due to predicted changes in the global climate.

Since the publication of the 2015 report, the impacts of climate change have become more frequent and the human consequences more severe. There is a renewed focus under the Biden Administration's *Executive Orders 13990 Protecting Public Health and the Environment*

*and Restoring Science to Tackle the Climate Crisis, 13995 Ensuring an Equitable Pandemic Response and Recovery, and 13985 Advancing Racial Equity and Support for Underserved Communities Through the Federal Government*, to empower workers and communities and to strengthen their resilience to the impacts of climate change.

This report is an update to the original report to:

- Capture findings from more recent literature reviews and resources regarding climate change
- Update the grantee training population to include additional constituents such as community members, agricultural workers, maritime workers, volunteers, day-laborers, and retail and service industry workers.
- Identify additional climate change related hazards and environments that affect the WTP and its grantee training populations, including extreme weather events (e.g., heat wave in Seattle and winter storm Uri in Texas in 2021) and increased exposure to biohazards, such as infectious diseases, wildlife, and fungi.
- Re-assess issues that the WTP and its grantees will have to take into consideration as they accomplish their mission. For instance, a new section providing early insight on COVID-19, climate change, and worker safety and health has been created.
- Update the list of existing trainings and resources related to climate change and safety and health trainings.

## METHODOLOGY

Like the first assessment report, this report was prepared through a review of the currently available literature on climate change and worker health; a review and assessment of available training and resources on worker health and climate change vulnerability- related modules; and consultation and review by the WTP and grantee community.

The 2015 report included a matrix that demonstrates how industries (associated with the WTP worker population) can be affected by climate change and includes occupational and individual health impacts. The identified climate change vulnerabilities and health outcomes in the report are based on the article “Climate Change and Occupational Safety and Health: Establishing a Preliminary Framework” (Shulte & Chun, 2009), with updated information from the article, “Advancing the Framework for Considering the Effects of Climate Change on Worker Safety and Health” (Shulte et al., 2016). The matrix included as Appendix A is updated to include additional hazards for consideration and new grantee training populations and industries. The matrix can be found in [Appendix A](#) of this report.

A review of current climate change studies and assessments provides better understanding of how climate change will impact the WTP, its trainers, and worker constituents.

To determine what existing training courses and modules are currently available, we conducted a general search on the WTP curricula catalog ([Appendix B](#)) and on the internet for specific training topics that can be applied to mitigate the risks of climate change vulnerabilities ([Appendix C](#)). These topics include, but are not limited to, general climate change information, heat and cold stress, mental health resilience, confined space, and mold.

## BACKGROUND

### NIEHS WTP

The NIEHS WTP was tasked in the Superfund Amendments and Reauthorization Act of 1986 (SARA) to create a grant program to train and educate workers engaged in activities related to hazardous waste removal, containment, and emergency response. Since its inception in 1987, WTP has provided model safety and health training and education to those who work with and clean up hazardous materials, and who respond to emergencies involving hazardous substances. This training is designed to protect these workers, and the communities in which they work, from injury and illness. WTP accomplishes its mission and objectives by funding non-profit organizations with a demonstrated track record of delivering high-quality, peer-reviewed safety and health training to target populations who are, or will be, working in hazardous environments.

Through its efforts and support, the WTP has created a strong network of non-profit organizations that are committed to protecting workers and their communities. The WTP network success is due to delivering high-quality, peer-reviewed safety and health training to target worker populations who may be exposed to hazardous materials during hazardous waste operations, hazardous material transportation, environmental restoration of contaminated facilities, chemical emergency response, or disaster response and recovery. The WTP aids organizations in developing their institutional competency to provide appropriate model training and education programs to hazardous materials and waste workers.

The WTP has created a strong network of non-profit organizations that are committed to protecting workers and their communities.

The WTP accomplishes its mission through four main program areas, including one program that is funded by an Interagency Agreement with the Department of Energy (DOE). The four program areas are:

1. The Hazardous Waste Worker Training Program (HWWTP)
2. The Environmental Career Worker Training Program (ECWTP)
3. The NIEHS/DOE Nuclear Worker Training Program
4. The Hazmat Disaster Preparedness Training Program (HDPTP)<sup>1</sup>

In addition, training is provided on infectious disease and biological hazards.

The core program for the WTP is the HWWTP, which provides model occupational safety and health training for workers who are or may be engaged in activities related to hazardous waste removal, containment, or chemical emergency response. The HWWTP has developed a strong network of nonprofit organizations that deliver high-quality, peer-reviewed safety and health curriculum to hazardous waste workers and emergency responders in every region of the country. These courses have established national benchmarks for quality worker safety and health training, including a strong emphasis on peer instructors and hands-on instruction.

The ECWTP, known until 2014 as the Minority Worker Training Program, was established to provide programs to deliver comprehensive training to increase the knowledge of disadvantaged and underrepresented workers by advancing training to promote a sustainable, environmental career path for workers who deal with hazardous materials handling, waste construction,

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1 This paper will not explore how Small Business Innovation Research (SBIR) E-Learning for HAZMAT Program will be affected by climate change. The SBIR program focuses on the development of e-learning products, such as virtual reality and handheld device applications, to support the health and safety training of hazardous materials workers, emergency responders, and skilled support personnel; community and citizen preparation and resiliency; and research into the acute and long-term health effects of environmental disasters.

and other emerging industries. Initiated in 1992, the NIEHS/DOE Nuclear Worker Training Program provides safety and health training for workers who may be engaged in hazardous substance cleanup or emergency response at DOE nuclear weapons facilities. The HDPTP was established in 2005 in response to the lessons learned from national disasters and supports the development and delivery of disaster-specific training to prepare workers to respond to natural disasters and possible future terrorist incidents involving weapons of mass destruction.



Hillside in California on fire above a row of houses.  
Photo Courtesy of FEMA

## WTP Constituency (Worker Population Impacted by Climate Change)

Across the spectrum of events, from acute severe weather disasters to intense heat waves, the consequences of climate change are directly and indirectly impacting the health of workers. Depending on the location and nature of the work, some impacts may constitute a heavier burden on certain industries and trades.

The NIEHS WTP grantees for all four training program areas primarily work with those who are or will be engaged in: active and inactive waste treatment, storage and disposal, hazardous waste generation, cleanup and remedial action, emergency response, and



Some health consequences will be more prevalent for certain worker populations.

potentially hazardous materials transportation. Target populations for this training include those covered by requirements of Federal Occupational Health and Safety Administration (Code of Federal Regulations, Title 29, Part 1910) and Environmental Protection Agency (CFR, Title 40, Part 311) standards for Hazardous Waste Operations and Emergency Response, regulations governing the NIEHS HWWTP (CFR, Title 42, Part 65), as well as hazardous materials transportation workers regulated by the US Department of Transportation (49 CFR 171-177). Target worker populations include various trades within the construction industry (e.g., carpenter, heavy equipment operator, iron worker mason, welder, etc.), hazardous waste cleanup industry, health care industry, public and private waste collection and disposal industry, public works, transportation industry, maritime, and others. Trainees also include semi-skilled day laborers who work and get paid on a daily or short-term basis. These workers are often involved in construction or in cleanup after disasters.

The WTP grantees under the HDPTP also provide training to workers who are, or may be, involved in the response and recovery of disasters, including emergency responders and skilled support personnel (e.g., construction workers, utility workers, hazardous waste cleanup workers, semiskilled day laborers, and transportation workers). Skilled support personnel can assist in rescuing the injured, demolition of compromised buildings, debris removal, restoring utilities, and rebuilding communities. They are often required to work in locations in which they are exposed to unknown hazards. Grantees have also begun to provide site-specific training to community/worker advocacy groups, community members, volunteers, immigrants, and day laborers following major disasters.

The WTP grantee community also delivers health and safety training to workers with the potential for exposure to infectious diseases and biological hazards. This includes workers in a wide array of occupations and industries, from healthcare to retail.

While it is important to recognize that all worker populations will be affected by the various climate change impacts, some health consequences will be more prevalent for certain worker populations. Of particular focus should be disproportionately impacted communities, such as older workers and workers who may have medical conditions. A second potentially disproportionately impacted community is workers who are entering new industries; these include older workers, day laborers who may not speak English, or workers who have no previous experience working with hazardous materials or working in a hazardous environment. Also of concern are workers from low-income and disproportionately impacted communities, who are also at higher risk to the effects of climate change (Shulte et al., 2016).

### West Coast Wildfires

The occurrence and severity of wildfires have increased over the last few years, and will most likely to continue as an impact of climate change.

In response to protect the safety and health of workers, WTP grantees began to deliver critical hazardous waste training to construction workers, day laborers, and volunteers tasked with cleaning up hazardous ash and debris. The trainings were provided by the International Union of Operating Engineers National Training Fund, part of the consortia funded under CPWR — The Center for Construction Research and Training, and the Western Region Universities Consortium (WRUC).

To ensure that the workers' cultural, social, and economic characteristics are considered in the training materials developed and delivered, WRUC developed Spanish-language training for wildfire second responders in California. The consortium fine-tuned its education for tribal groups in southwest and rural Alaska to account for their unique needs.

## 2017 Hurricane Season

In 2017, hurricanes Harvey, Maria, and Irma brought widespread damage and destruction to Texas, Florida, Puerto Rico, and the U.S. Virgin Islands.

Following the aftermath of these hurricanes, the NIEHS WTP and grantees immediately responded to the need to protect the health of disaster workers and volunteers who were exposed to mold, chemical contamination, and other hazards.

Grantees, including the World Cares Center (WCC) — part of the Atlantic Center for Occupational Safety and Health, the International Chemical Workers Union Council Center for Worker Health and Safety Education (ICWUC), and their partner Fe y Justicia, began to provide safety and health training to volunteers, day laborers, faith groups, and residents of the Gulf Coast on the hazards they would face as they began the recovery process.

WTP grantees and NIEHS staff partnered with local organizations to assess needs of residents and increase the number of trainees in Puerto Rico and the U.S. Virgin Islands. International Union, United Automobile, Aerospace, and Agricultural Implement Workers of America (UAW) provided resiliency training to help workers cope with the stress of disaster recovery and returning to work in difficult and sometimes unsafe conditions. ICWUC partnered with four local groups to provide train-the-trainers to students and workers so that they could continue to deliver training as recovery efforts continue. The Steelworkers Charitable and Educational Organization's Tony Mazzocchi Center (TMC) partnered with Universidad Metropolitana and All Hands and Hearts, to deliver safety and health training to volunteers as they aided in the recovery work in Puerto Rico and the U.S. Virgin Islands. The WCC helped to establish Volunteer Reception Centers across Puerto Rico to distribute personal protective equipment (PPE), and gather and train survivors, students, leaders, and others.

## WTP Responds: Past Disaster Experience

The NIEHS WTP has extensive experience in responding to disasters caused by severe weather events. As part of the U.S. Department of Health and Human Services and the National Institutes of Health, the NIEHS WTP participates in disaster response and recovery efforts under the Worker Safety and Health Support Annex of the National Response Framework and the National Disaster Recovery Framework. Under these frameworks, the WTP, and its grantees have been actively involved in several natural disasters — most recently Hurricane Ida in 2021 and West Coast wildfires — protecting workers who may face unknown threats and hazards while responding and rebuilding in the aftermath of the destruction.

Through experience and evaluation of lessons learned, the WTP and its grantees have developed effective mechanisms for getting needed safety and health resources into the field, including teams of trainers and subject matter experts, printed resource materials, on-line electronic learning tools, personal protective equipment and other training supplies, tailored training to reach underserved communities, and podcasts (audio training tips made available through easy download to trainers in the field). The text boxes above and on the previous page provide examples of how the WTP and its grantee community have effectively protected workers involved in response and recovery activities.

The need for a more climate resilient community was outlined in Presidential Executive Order *Preparing the United States for Climate Change* issued by President Barack Obama. Training workers to become more

The WTP and grantees must consider how to incorporate climate change concerns into the existing workplace objectives and activities.

knowledgeable about climate change vulnerabilities prepares workers, and the communities in which they live, for extreme weather events, such as hurricanes, and climate change related hazards, such as heat waves (Executive Order 13653, 2013). Furthermore, *Executive Orders 13990 Protecting Public Health and the Environment and Restoring Science to Tackle the Climate Crisis, 13995 Ensuring an Equitable Pandemic Response and Recovery, and 13985 Advancing Racial Equity and Support for Underserved Communities*

Through the Federal Government, all speak to empowering workers and communities and strengthening community resilience to the impacts of climate change. Executive Order 14008, *Tackling the Climate Crisis at Home and Abroad*, supports the transition to a clean energy economy and the creation of well-paying jobs that can mitigate climate change factors (e.g., jobs that reduce emissions of toxic substances and greenhouse gases and prevent environmental damage).

## CLIMATE CHANGE VULNERABILITY ASSESSMENT

Extreme weather events caused by climate change, such as heat waves, droughts, and heavy rain, have become a heavy burden to many types of workers across the country. Workers need training to:

- Protect themselves from the hazards of climate change
- Identify how climate change will affect their work
- Minimize climate change-related health impacts

To train workers how to best protect themselves and their communities from climate change-related hazards, the WTP and grantees must consider how to incorporate climate change concerns into the existing workplace objectives and activities.

This section provides an overview of the challenges that the WTP and its grantees may face as climate change-



Participants learn skills that can protect them during disaster cleanup in a Hazardous Waste Operations and Emergency Response training course in Florida, offered by DSCEJ under the Historically Black Colleges and Universities Consortium. (Photos courtesy of Kim Dunn)



related impacts become more prominent and frequent over time. This section identifies the climate change health impacts and related occupational health effects and the anticipated training needs associated with the specific impact. It also provides an overview of other considerations that may impact how workers can best mitigate climate change hazards, including employer/work environment-related concerns.

## Emerging Climate Change Challenges

Climate change is creating a new workforce population as industries are affected by severe weather changes, such as drought and flooding. New weather patterns have also shifted across the nation —intense heat waves in Seattle, WA, extreme wildfires in the west coast, flash flooding in the northeast, and life-threatening cold waves in Texas. These are new concerns that employers and workers need to take into consideration in addition to existing threats they are already facing.

As efforts to mitigate the effects of climate change are under consideration, several “climate friendly,” low carbon, or green industries are emerging. These include building retrofitting, recycling, and alternative energy production. The transition from fossil fuel industries to renewable energy sources has started to take place (Tomer et al. 2021). These changes will bring a new cadre of workers and transitional workers to the workforce (Shulte et al. 2016). The WTP and its grantees need to be prepared to address these indirect consequences of climate change, including emergence of new worker populations and new industries. The grantees will need to increase organizational capacity to be able to provide quality training to the new workforce, and the WTP will need to have the capacity to provide technical assistance to the grantees.

It is important to remember that not all “green jobs” are inherently safe; many potential links between green jobs and health effects are still under investigation. While the goal of some “green” industries is to eliminate or reduce the use or production of certain hazardous materials, the use of other hazardous materials may be introduced.

For instance, the manufacturing, construction, and maintenance of solar energy materials present various dangers, such as exposure to UV radiation and heat. Biodiesel production exposes workers to caustic, volatile, and flammable chemicals. The wind energy industry subjects workers to various risks, including chemical composites, confined spaces, and falls. Workers in the recycling industry can be exposed to various toxic metals, ergonomic, and biological hazards. The health effects of nanomaterials are still largely unknown. These newer industries will potentially require additional training and curriculum development.

As the frequency and severity of extreme weather events increase, and new weather hazards are introduced, the WTP and its grantees will need to provide additional training to all workers who assist in the response and cleanup of disasters. This population will include semi-skilled day laborers, community members, and volunteers, who may have little or no training on responding or rebuilding following disasters. Of consideration are workers who have suffered through repeated impacts of climate change, such as emergency or first responders, or essential workers (e.g., utility workers) whose communities have been severely impacted by severe weather events. Not only are these workers exposed to physical hazards on the job, but they may experience mental fatigue and stress.

## Early Insights into COVID-19 and Climate Change

While more research is needed to determine a causal relationship between and impact of climate change and occupational exposure to COVID-19, it is noteworthy that some worker populations are at greater risk of exposure due to changes in the climate. Populations of workers that perform job duties outside or near others are more likely to contract an infectious disease like COVID. In hot temperatures, wearing face coverings, especially filtering facepiece respirators like N95s, can be uncomfortable and put workers at risk of heat-related illnesses. For example, utility or construction workers working in confined spaces or trenches wearing PPE

(e.g., hard hats, steel toed boots, fire retardant clothing, etc.), to protect them from work-related exposures, in addition to a face covering, may suffer from heat stress.

Additionally, workers who have underlying health issues like asthma, diabetes, metabolic disorders, auto-immune disorders, and heart disease can experience exacerbated symptoms in environments that are overly damp, dry, dusty, hot, or cold. This is also true in communities where poor air quality due to air pollution is occurring. Negative physical impacts can be made worse by having to wear a face covering to protect them from workers, customers, or the public who may be infected with COVID. This is the case with changing climates and the nature of work. A person working in a heavily polluted or extreme weather environment with underlying cardiac, metabolic, or respiratory disease is at greater risk of experiencing moderate to severe COVID disease because their immune function is impaired. This is likely to result in hospitalization or death.

In the case of extreme weather events, like tornadoes, hurricanes, floods, and fires, workers responding to the needs of communities in distress and working through recovery efforts are at a higher risk. Heavy physical exertion during rescue, remediation, and recovery during extreme weather events, while also attempting to be mindful of COVID prevention strategies, such as wearing respirators or face coverings and physically distancing, can increase risk of both acute and chronic injury and illness.

## Climate Change Occupational Health Impacts and Anticipated Training Needs

The workers trained under the WTP are vulnerable to a wide range of climate change impacts due to the nature and location of much of their work. However, in addition to the vulnerabilities and impacts described below, other factors, including workplace establishments and individual health factors, also play a role in workers' increased susceptibility to climate change-related threats. These factors are discussed at the end of this

section. Climate change training and capacity building must address the health impacts described below.



### Air Pollution

The changing climate can exacerbate the effects of bad air quality on health. Poor air quality days increase as warm, stagnant air increases the formation of ground-level ozone (U.S. Environmental Protection Agency, 2021). High wind events, such as tornadoes and hurricanes, can generate dust particles. Outdoor workers, such as transportation workers, utility workers, agricultural workers, and construction workers, are also most vulnerable to increased emissions of greenhouse gases and air pollutants, including particulate matter, carbon monoxide, lead, ozone, nitrogen oxides, and sulfur dioxide. Increases in air pollution will be coupled with increases in naturally occurring pollutants, such as ragweed pollen – which may become more prevalent as the pollen season occurs earlier and lasts longer (Jay et al., 2018). Wildfires are contributing to the increase in particulate matter and ozone compounds especially in the western U.S. in the recent years (Kalshnikov, et al. 2022). In fact, California Division of Occupational Safety and Health (Cal/OSHA) has developed standards to protect outdoor workers from exposure to PM2.5 when air quality is impacted by wildfires.

Indoor workers may also be vulnerable to the impacts of air pollution, as indoor air pollution can reach two to five times the concentration of pollution in outdoor air (U.S. Environmental Protection Agency, 2021). Indoor air pollution can be caused by outdoor air pollution, central heating and cooling systems, humidification devices, mold, and radon. Increases in air pollutants can affect workers who spend most of their time exposed to these threats. Illnesses that can be exacerbated

by air pollutants include respiratory illnesses, such as asthma, allergic disorders, and other chronic lung diseases. Workers exposed long-term to ozone can also develop or exacerbate cardiopulmonary and respiratory diseases (EPA, 2018).

While air pollution is prominent across the U.S. in urban areas, workers in the Northeast, West, Midwest, and Southeast regions of the U.S. may be most vulnerable due to wildfires, increased extreme heat waves, emissions, and increases in pollen (Jay et al. 2018).<sup>2</sup>

### ***Anticipated Training Needs***

Workers should be able to recognize how increasing temperatures can interact with air pollutants to affect health. Workers should be able to recognize the various air pollutants they may be exposed to at work, and the possible short- and long-term health effects these pollutants may cause for them. Further, workers may need to recognize how pollen allergies can affect their productivity at work, as a significant correlation has been observed between an increase in pollen counts and a decrease in productivity for workers with allergies (Burton et al. 2001). Indoor workers should be able to identify whether their workplace has appropriate ventilation systems. Additionally, training should include regulatory protections available in the State that the employers should follow.

2 Southeast: The Southeast region includes the states of Alabama, Arkansas, Florida, Georgia, Kentucky, Louisiana, Mississippi, North Carolina, South Carolina, Tennessee, and Virginia, as well as Puerto Rico and the U.S. Virgin Islands. Northeast: The Northeast region includes the states of Connecticut, Delaware, Maine, Maryland, Massachusetts, New Hampshire, New Jersey, New York, Pennsylvania, Rhode Island, Vermont, West Virginia, and the District of Columbia. Northwest: Idaho, Oregon, and Washington Southwest: Arizona, California, Colorado, Nevada, New Mexico, and Utah Midwest: Illinois, Indiana, Iowa, Michigan, Minnesota, Missouri, Ohio, and Wisconsin Great Plains: Kansas, Montana, Nebraska, North Dakota, Oklahoma, South Dakota, Texas, and Wyoming



### ***Biological Hazards (previously Vector-borne Disease and Expanded Habitats)***

The long-term changing ambient temperatures, humidity, rising sea level, and environment have altered vector, pathogen, and host habitats. Vector-borne infectious diseases (such as Zika, Malaria, West Nile, and Lyme diseases), poisonous plants, and venomous wildlife have become more widespread, putting workers at risk for exposure (Jay et al. 2018). If exposed to these threats, workers can contract infectious diseases, dermatitis (from poisonous plants), and other related injuries and illnesses. That said, the use of pesticides to eliminate these vectors can also pose a threat to workers if not used appropriately.

Other biological hazards, such as certain fungi, are also predicted to increase illness and injury in outdoor workers. For instance, there has been an increase in Valley Fever in the Southwest among outdoor workers due to the longer, drier weather conditions. Valley Fever is caused by a fungus that lives in the soil and is inhaled when the soil is disturbed and aerosolized. A study conducted by University of California Irvine, projects that Valley Fever will double its range during this century due to climate change effects, stretching to areas previously unaffected across the western U.S. (Gorris et al., 2019).

Climate change related weather events, such as wildfires and storm surges, have severe impact on diverse ecosystems on the wildlife habitats. Wild animals, such as snakes, rodents, birds, and other wildlife (e.g., bears, coyotes, moose, etc.) have been displaced from their normal habitats to suburban and

**It is necessary to prepare workers for unexpected shifts in the weather.**

urban areas. This increases hazards that workers and communities face. These animals can carry diseases or can cause injury if not handled by a professional.

Outdoor workers, such as construction workers, disaster site cleanup workers, and laborers, are most vulnerable to these types of exposures. Healthcare workers, airline workers, and workers who travel frequently are also at risk of exposure, as they may meet infected individuals.

Water-related illnesses, relating to the rising sea temperature and the increased rainfall and flooding, combined sewage overflows and a lack of access to potable drinking water can cause viral and bacterial contamination in recreational water and drinking water sources, increasing exposure to pathogens that lead to gastrointestinal illness (Jay et al., 2018).

Workers should be able to recognize the various air pollutants they may be exposed to at work.

### ***Anticipated Training Needs***

Vector-borne and allergy-related illnesses will affect the Midwest, Southwest, Northwest, and Southeast regions of the U.S. Workers will need additional knowledge on these vectors and allergens and how to best protect themselves against disease-carrying vectors by using safe, effective methods, including safe insecticides, protective clothing, or other preventative measures, such as taking allergy medication. Training on how to appropriately use pesticides and insecticides should also be provided. Workers may need additional training on identifying symptoms of diseases caused by vectors and water-related pathogens.

Training may be needed for workers on what to do when they encounter wildlife, and how to handle (or not handle) wildlife or stray animals.

For workers or volunteers/community members who work in disaster response or work in post-disaster environment (especially post-flooding), it is essential to provide site-specific information on the hazards of flood water, as well as non-potable drinking water and wild animals.

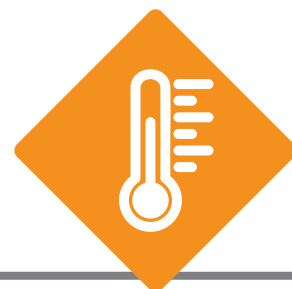


### ***Ozone Depletion***

Ozone depletion increases outdoor workers' exposure to harmful ultraviolet (UV) radiation. UV radiation exposure has caused the loss of approximately 1.5 million disability-adjusted life years, and 60,000 premature deaths in the year 2000 (Schulte & Chun, 2009). UV radiation can be directly attributed to increased risk of several eye diseases, including cataracts, conjunctival neoplasms, and ocular melanoma; skin cancers; and disturbed immune function (Jaggernath et al, 2013). Ozone depletion will be most prominent in the Southeast, Midwest, Great Plains, and Southwest regions of the U.S. (U.S. Global Change Research Program, 2014).

### ***Anticipated Training Needs***

Workers should be trained to protect themselves from UV radiation, such as wearing sunscreen and sunglasses, wearing hats and lightweight clothing that cover arms and legs as well as identify symptoms of UV-related diseases.



### ***Extreme Ambient Temperatures***

Most hazardous waste cleanup work takes place outdoors, such as that conducted at Superfund or Brownfield sites. Construction work, some utility/infrastructure work, and waste collection work is



also primarily conducted outdoors. Outdoor workers are most susceptible to direct ambient temperature-related impacts, such as heat or cold stress. Indoor workers, who do not have adequate ventilation, air conditioning, or heating, can also be exposed to ambient temperature-related stresses.

Global average temperatures have increased at an unprecedented manner, with the last few years seeing record-breaking climate-related weather extremes and each year's heat record surpassing the previous year (Jay et al, 2018; Lindsey and Dahlman, 2020). Heat waves, a notorious result of climate change, have caused severe injury and death in various populations. In a study conducted by the Centers for Disease Control and Prevention (CDC) in 2012-2013, 20 cases of work-related heat illness or death were reviewed over a two-year period. Nine deaths occurred in the first three days of working on the job, and four of them occurred on the first day of work. These workplaces either had inadequate or no heat illness prevention program, and new workers were not acclimatized to the heat. In many cases, with immigrant agricultural workers, workers are particularly vulnerable to heat exertion due to the nature of the work. For example, many agricultural workers receive commission pay (rather than hourly wages), which discourages break time; shade and water break locations are often located far from their working station (Migrant Clinicians Network, 2021).

While heat stress is most often a concern for outdoor workers, such as construction workers, hazardous waste site workers, emergency responders, and agricultural workers, one should also consider other types of "outdoor" workers, such as delivery truck drivers, who may not have proper air conditioning in their vehicles. Further, indoor workers, such as manufacturing workers engaged in manufacturing processes and intermittent hot work, can be affected if the buildings they work in does not have proper ventilation. Workers exposed to high ambient temperatures in which the total heat burden exceeds the capacity of the body to maintain normal body functions without excessive strain can cause heat

stress and stroke, decreased chemical tolerance (as chemicals are more easily absorbed during the body's thermoregulation), and fatigue (National Institute for Occupational Safety and Health (NIOSH), 2013). The loss of labor productivity and increased risk of accidental injuries can be attributed to heat-related illnesses. In fact, the Adrienne-Arsht Rockefeller Foundation Resilience Center estimates that without adaptation, deaths related to extreme heat can increase more than sixfold (2021). Furthermore, extreme heat is associated with near-surface ozone pollution, which can have negative impacts on human health, increasing cardiopulmonary and respiratory systems distress (Archer et al., 2019).

Similarly, extreme cold weather, such as the "polar vortex" during the winters or Winter Storm Uri in Texas in 2021, can have a tremendous impact on workers. Exposure to extreme cold can lead to serious injury, illness, and even death. Outdoor workers, such as those trying to restore power or utilities following a storm, are at risk for cold stress. Susceptible workers include those who work in areas that are poorly insulated or have no heat, and those who have no shelter. Indoor workers in cold, damp conditions may be less productive at work (due to decline in cognitive function and dexterity) (NIOSH, 2019). Indirect consequences for cold stress include illnesses and fatalities that are attributed to carbon monoxide poisoning (due to improper ventilation when using generators) and transportation accidents.

While some regions may be better acclimated to these temperature extremes, it is necessary to prepare workers for unexpected shifts in the weather, especially in areas that traditionally have not experienced extreme heat or cold.

### ***Anticipated Training Needs***

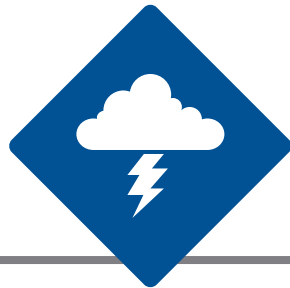
Current training should ensure that workers recognize heat and cold stress, including related symptoms and signs, and when and how to seek help. Additional training should help workers identify how climate change will begin to alter the temperatures of their work environment, and how these extreme temperature

changes may impact their health in the long term.

Workers may become acclimatized to the heat, while being exposed gradually to the hot environment. However, full acclimatization to the heat may take approximately 14 days (Arbury, 2014). New workers entering a hot environment need to be slowly exposed to the workplace and will need plenty of rest and water. Workers need to be able to recognize the real health hazards associated with heat exposure, and learn strategies to compensate, such as acclimatization, and the proper use of a rest, water, and shade.

Similarly, workers should also be able to identify the symptoms of cold stress, which can cause hypothermia, frostbite, trench foot, and chilblains — all illnesses with possible permanent damage to the body.

Training should include regulatory protections that might be in place that employers must follow. For instance, heat exposure standards exist in California, Washington, and Minnesota, and wildfire smoke standards are in California, Washington, and Oregon.



### ***Extreme Weather***

Extreme weather events are some of the most notable impacts of climate change. From droughts to heavy downpours to wildfires to intense hurricanes and flooding, climate change results in more intense and frequent weather-related events that can have catastrophic consequences for workers in a variety of direct and indirect ways. An extreme weather event is defined as “a time and place in which weather, climate, or environmental conditions — such as temperature, precipitation, drought, or flooding — rank above a threshold value near the upper or lower ends of the range of historical measurements (Herring, 2020).”

These events typically cause devastating impact on communities or ecosystems.

Across the U.S., there has been an increase in the number of severe weather events over the last 50 years, and these will continue to increase in intensity and frequency (Jay et al., 2018). Disasters, such as hurricanes and tornadoes, have caused severe damage to infrastructure, such as buildings and roads, creating hazardous debris and unstable work areas. For instance, recent ice and winter storms have increased the vulnerability of various workers and communities in the Midwest, Northeast, Southwest, and Southeast. Urban areas in the Northeast were also devastated by flash flooding caused by hurricanes and heavy rain. Workers, such as construction workers or day laborers, may work in environments they are not familiar with, such as confined spaces or extreme weather, leading to increases in traumatic injuries. Workers who are assisting with the cleanup, demolition, or rebuilding of buildings and infrastructure, can be exposed to hazards, including solid waste, mold, oil, sharp debris, chemicals, and other toxins, as well as work in unfamiliar environments. Exposure to these can cause physical injury, rashes, and various respiratory diseases.

Workers are also exposed to ambient temperature stress, including heat stress, vector-borne infectious diseases, poisonous plants, and wildlife. Furthermore, inappropriate use of equipment, such as generators, can lead to carbon monoxide poisoning. Homeowners, community members, and volunteers who have little or no experience with disaster recovery are at greatest risk for injury when trying to rebuild their communities.

In addition to the toxic and physical dangers resulting from disasters, these events can have a tremendous impact on the mental health of workers. As demonstrated in recent hurricanes and storms, workers who are residents of the impacted community can be affected, mentally and physically, when their families, homes, and communities are impacted by a severe weather event. Disasters can disrupt the daily routine for workers and their families by adding new stressors to their lives. Workers worry about

the well-being of their own family, in addition to the continuity of their daily work. Some workers, such as utility workers, may be working following disasters to restore public utilities in hazardous environments. Furthermore, the consequences of climate change tend to cause greater damage in disproportionately affected communities, as they are already exposed to environmental hazards. Often these communities are also devastated by disasters at more frequent intervals. For instance, Hurricane Katrina caused widespread damage to the Gulf Coast region, causing distress to the vulnerable communities located in the region. Five years after the hurricane, the region was devastated by the Deepwater Horizon oil spill — while the communities were still recovering from the destruction caused by the Hurricane. Communities in the Gulf Coast have experienced repeated hurricanes and flooding between 2019-2021, including a winter storm in 2021, in the middle of a pandemic. These compounding devastations can take a heavy toll on the mental health of those living in the area.



High floodwaters impacted businesses in Kinston, North Carolina. Photo Courtesy of FEMA

Moreover, workers at disaster sites are often under stress due to the intensity of the work, the experience of enduring the disaster, and being away from family and friends. Disaster work related-stress and exposure to traumatic events without the proper care can lead to depression, post-traumatic stress, disorder, and


substance abuse, and can exacerbate cardiovascular and respiratory diseases. Methods to recognize, refer, and mitigate these stressors are necessary for the well-being of the disaster site worker.

Healthcare providers can face several mental and physical stressors when an extreme weather event occurs. Healthcare settings can become easily overwhelmed during emergency situations, especially if an evacuation is required. Healthcare workers often work overtime in emergency situations if the healthcare facility is overwhelmed. The evacuation process can be stressful, as healthcare providers must move patients quickly during a short time and often with limited resources. Additionally, because of the severe damage caused by these weather events, the amount of work required to reopen some facilities is extensive, such as the case of Charity Hospital in New Orleans following Hurricane Katrina. The situation has worsened for workers in healthcare settings due to the COVID-19 pandemic, as workers are already overwhelmed with the response to the pandemic.

### ***Anticipated Training Needs***

Disaster responders, including skilled support personnel, and cleanup workers should have disaster site training prior to being deployed to any site. In the best scenario, all volunteers and day laborers should receive disaster site training prior to starting any recovery work. All workers should receive site-specific training to be aware of site-specific hazards and risks. Workers need training on recognizing stress, identifying mental health symptoms, ways to cope, and ways individuals can increase resilience to trauma and stress.

**Workers responding and working during and following the flooding or hurricane disasters should pay special attention to debris, confined spaces, and mold.**



Employers will have the responsibility to change and adapt work environments and processes for employees.

It is important to ensure that the training and resources shared are at a level and language that is easily understood by the audience, especially when reaching out to day laborers, immigrant workers, volunteers, and community members. Further training for immigrant and day laborers should include worker's right laws and regulations to prevent pay theft and abuse.

While acute weather events will have severe, multifaceted impacts on workers in all regions across the U.S., some regions may face specific types of disasters. For instance, workers in the Northeast coastal region, Southeast, Midwest, and some areas of the Southwest will face more frequent and intense tropical cyclones, torrential rain, and flooding. Workers who will be responding and working during and following the flooding or hurricane disasters should pay special attention to debris, confined spaces, and mold. Workers in the Great Plains, Northwest, and some Southwest regions will face increasing drought and wildfires.

However, it is necessary to remember that climate change has shifted weather patterns across the nation, and regions may experience extreme weather events that they have not anticipated previously. For instance, in 2021, Hurricane Ida brought torrential rain and unprecedented flooding to urban cities in the Northeast, ultimately killing at least 50 people (CNBC, 2021). In 2022, a tornado swept through the New Orleans metropolitan area, resulting in the destruction of many homes. A good resource to follow is the NFPA 1670 Standard on Operations and Training for Technical Search and Rescue Incidents, which provides the foundation for proper handling of events.

Preparing for the impacts of extreme weather can also be considered during training. Workers can be trained on how to identify potential risks that can become a hazard following a weather event. Further training consideration can include impacts on disaster site workers who live or work in coastal communities that are impacted by rising sea level and adaptation strategies for coastal infrastructure in response to the rising sea level.

## Work-Related Factors to Consider

The climate change impacts mentioned above can be either mitigated, or exacerbated, by workplace conditions. For instance, while PPE is extremely important to protect workers from physical hazards, the equipment may cause workers to be subjected to even more heat stress. However, not wearing the equipment properly can lead to hazardous exposures. Employers and workers together can find solutions to address the impacts of climate change by finding work practices that can mitigate hazards. Regarding heat stress and protective equipment, heat stress can be alleviated by providing workers with adequate work/rest cycles and access to water.

Of special consideration is how health and safety precautions taken to prevent the spread of the coronavirus can impact the health and safety precautions workers need to take to mitigate the impacts of climate change. For instance, wearing an N95 respirator during a heat wave can be uncomfortable for workers.

Workers need to be trained to recognize and identify situations in which climate change may have a hazardous impact on their health and inform employers about these issues and concerns. Employers have the responsibility to change and adapt work environments and processes for employees.

## Individual Health-Related Factors to Consider

Individual health conditions must be considered when looking at how climate change may impact a person's health. Some individual health factors may increase a person's susceptibility to climate-related occupational hazards, such as age, weight, degree of acclimatization, metabolism, and pre-existing medical conditions, and use of recreational and medicinal drugs. Other factors, including a person's genetics, may make them more predisposed to air pollutants. (Schulte and Chun, 2009)



## BALANCING INDIVIDUAL AND COMMUNITY RESILIENCY

Workers are part of the community in which they live. During times of severe weather disasters, local workers are often called upon to help with recovery and rebuilding efforts. Worker injury and illness can be compounded by the stress of helping rebuild communities, while also ensuring the safety and health of their own family and rebuilding their own homes. Thus, workers should be as prepared as possible for the consequences of climate change. Individually, workers can plan with their families, recognizing vulnerable populations (e.g., elderly, young, and those with pre-existing conditions), and prepare them for any likely event. To build community resiliency, trained workers should take their skills and training to prepare and train their communities and respond when there is a local event.

Underserved, and overburdened communities are often most disadvantaged and suffer the most disastrous consequences following extreme weather events, especially if the community is already enduring disproportionate environmental, health, economic, education, and social challenges. Members of these communities often do not have community-level disaster plans, and do not have the resources to adequately prepare for, respond to, and recover from disasters. Often, these disadvantaged communities do not have evacuation or shelter-in-place strategies or lack effective communications plans to alert members.

WTP grantee communities have been essential in providing safety and health training prior to and after disasters to various disadvantaged and underserved communities across the U.S. WTP grantees have and should continue to provide disaster preparedness training to communities, including providing information on developing family evacuation plans, creating to-go bags, and helping communities conduct hazard and vulnerability assessments to develop a community level disaster plan. WTP trained personnel can help develop community and individual resilience by serving as


neighborhood responders before anyone gets activated or deployed. They can apply their skills and training to prepare the community, and respond, if there is an event. As with individual resilience, they need to start by recognizing and preparing vulnerable populations in the community — including the young, the old, and those with preexisting conditions.

### EJ and Natural Disasters Committee

NIEHS is co-chair to the White House Interagency Council for Environmental Justice (EJ), EJ and Natural Disasters Committee. Since 2019, NIEHS has led the effort in the Committee to determine how the Federal Government can better support underserved, overburdened, and disadvantaged communities to better prepare for, respond to, and recover from natural disasters. As part of this effort, the Committee participated in and hosted several focus group meetings, including three virtual regional townhall meetings held in 2021 to gather more input from stakeholders on EJ as it relates to natural disasters and the COVID-19 pandemic. In addition, NIEHS and grantees also hosted disaster preparedness and response training for interested stakeholders, each focused on natural disasters that impact the specific U.S. region of focus during the townhall meetings. Participants learned about preparedness, mental health resilience, and response related to the disasters of their region.

Furthermore, WTP grantees can serve as liaisons and help connect community leaders with local and state emergency management officials prior to disasters so that emergency managers understand the concerns and needs of the community residents before a disaster.

As part of an after-action meeting conducted following the Deepwater Horizon oil spill, NIEHS determined that



disaster worker training and education required additions to address behavioral health consequences faced by workers who assist with response and recovery activities following disasters. In June 2012, the WTP, with support from the Substance Abuse and Mental Health Services Administration (SAMHSA), launched the Gulf Responder Resilience Training Project (GR RTP), to develop behavioral health training for disaster-impacted communities.

Three unique sets of awareness-level [training materials](#) have been designed to educate and empower those impacted by disasters to:

- Recognize signs and symptoms of disaster work-related stress
- Obtain support through an employer/organization or community resources
- Build resilience by understanding stress reduction and coping strategies

The Disaster Worker Resiliency Training is targeted towards disaster-impacted workers and community members, such as paid employees, volunteers, and homeworkers in disaster impacted area. The Disaster Supervisor Resiliency Training is designed for supervisors who are responsible for supervising work or teams of volunteers during disaster rescue and recovery. This training includes a component that explores balancing team resilience and personal needs. The Disaster Care Provider Training explores the connection between behavior and physical health, post-disaster behavioral health risk factors, and the screening/detection and management of mental health consequences following disasters. This training is designed for community care centers, clinics, health care offices, or disaster recovery centers.

## EXISTING RESOURCES AND NEEDED RESOURCES

As mentioned previously in the report, the NIEHS WTP has been actively involved in the response to various natural disasters. In mobilizing its resources to assist in the disasters, WTP created various training tools in PowerPoint and booklet format. These are awareness-level training tools used by trainers that provide basic information to workers who are assisting in the response and cleanup of various disasters. To date, the NIEHS National Clearinghouse has developed training tools, and booklets for: hurricanes, earthquakes, avian influenza, mold, floods, radiological dispersion devices or dirty bombs, and wildfires. Some of these booklets and training tools are also available in various languages. For more information, please visit the NIEHS Disaster Response webpage: <https://tools.niehs.nih.gov/wetp/index.cfm?id=556>.

While direct courses on the impact of climate change on worker health are limited, modules that deal with several vulnerabilities and hazards related to climate change are available, such as cold stress, heat stress, and biological hazards. Topics that may need further development include introduction to climate change, outdoor and indoor air pollution (natural and manmade pollutants), UV radiation, vector-borne diseases, diseases that can be passed from animal to humans, and encounters with wildlife. Nonetheless, workers should be aware of what climate change is, and how it will impact them individually, in the workplace, and impact their communities in the long-term.

A preliminary assessment of available courses and resources by WTP grantees can be found in Appendix B. An assessment of available resources and materials from other organizations can be found in Appendix C.

# NIEHS WTP PROGRAM AND GRANTEE VULNERABILITY ANALYSIS

## Program Staff and Resource Capacity

WTP is a multidisciplinary program that considers worker safety awareness, community safety and health, emergency response, economic and social wellbeing of workers, and environmental impacts. The Program has successfully supported the effective training of workers and raised awareness of emerging worker safety and health issues. As the science behind the health impacts of climate change on workers evolves and the list of climate-related vulnerabilities expands, WTP will need to reassess its priorities and focus areas, as well its staff and resource capacity to better respond to climate change vulnerabilities, as well as other non-climate change-related worker safety and health concerns. Currently, the WTP consists of five fulltime staff, who are tasked to oversee the four program areas and its grantee networks. As the WTP continues to meet its goals and objectives in the face of the overwhelming worker safety and health issues, it will need to consider whether its current staff and resources will allow it to also address climate change concerns.

For instance, to better respond to climate change-related risks, the WTP needs the capacity to maintain awareness of how climate change will affect the various components of the program, including who will be impacted by climate change and how, and the health and safety training that workers receive. To best protect workers, WTP needs to anticipate, and not react to, potential health concerns, and relate these in a timely manner to its grantees. In addition, just as new scientific knowledge regarding the risks of climate change on health emerges, so are new findings on ways to best mitigate or adapt to certain hazards. WTP needs to be aware of the science behind the adaptation and mitigation methods that reduces vulnerability to climate change (e.g., building flood defenses, planning for extreme temperatures, retrofitting old buildings, improve water storage and use) and be able to communicate

these new findings to the grantees in an effective and efficient manner.

The WTP needs to take into consideration its capacity to provide support (technical and financial) to grantees who are responding to acute weather events, provide climate change health impact training or training on emerging green jobs or deliver other climate change training support. The grantees are an important component of WTP's success and response to climate vulnerabilities in the workplace. Program staff rely on grantees' expertise to recognize health and safety needs and deliver training to protect workers from the impacts of climate change.

Of further significance is the change to the training population post-disaster to include more community members, immigrant workers, day laborers, and volunteers, who many have limited or no experience in disaster recovery work. Many of the community members and immigrant workers also do not speak English. The need to provide disaster training materials in languages other than English and perhaps in other formats is increasing as climate change related disasters repeatedly devastate the most disproportionately impacted communities. The WTP, grantees, and partners may need to dedicate funding to address these language justice concerns, as well as to make sure that a repository for these materials and resources are easily available and accessible to those who need it the most. Partnering with local community, faith-based, and worker organizations can help extend the reach of training to hard-to-reach communities.



High floodwaters impacted businesses in Kinston, North

Carolina. Photo Courtesy of FEMA

## Grantee Staff and Resource Capacity

The WTP grantees need to maintain awareness of climate change concerns and issues and find ways to integrate climate change-related health information creatively and effectively into its training for workers. To accomplish this, the grantees need the capacity (staff and resources) to be able to keep up with current scientific information and incorporate these findings into their training to best prepare workers for climate change-related health issues.

For those grantees who conduct post-disaster outreach and training, consideration should be made to use peer trainers and promotoras to reach community members who have been devastated by the disasters. The peer trainers and promotoras can be assets to the training staff as they have the trust of the community members and are often able to relate culturally and linguistically with their target audience.

## NEXT STEPS

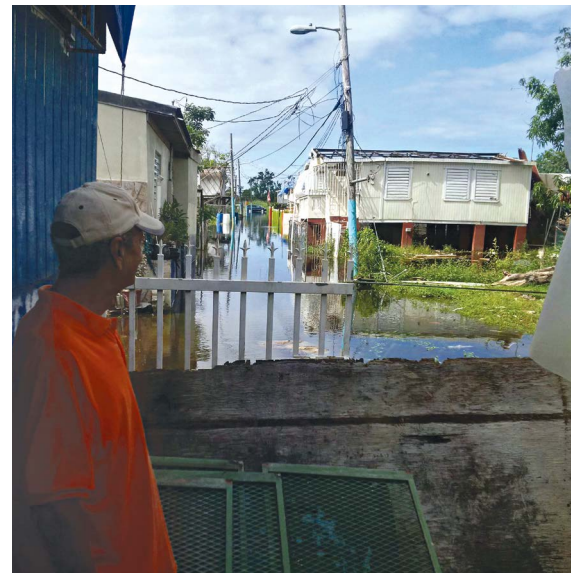
The consequences of climate change are already having impacts on workers as demonstrated by recent severe weather disasters and rising ambient temperatures. While some workers have made great strides to prepare for these disasters, other impacts should be anticipated, and prepared for, especially those which may be more gradual and less obvious. Emerging climate challenges to examine — and proactively address — include the effects of bad air quality, severe weather events, and biohazards on worker health.

Employers also have the responsibility to be aware of the hazards their employees will face as a result of climate change and implement the safeguards necessary to protect the health and safety of their workers (e.g., providing sufficient water break times, providing adequate PPE). Employers are also responsible to ensure that the employees are aware of

and appropriately trained on climate-related hazards that they may face on the job.

While seeking to address these consequences, current training programs need to be enhanced and developed to address potential gaps in worker training. Some training priorities include: 1) instilling a more robust understanding of the impacts of exposure to extreme temperatures; 2) teaching workers to recognize how increasing temperatures and wildfires can interact with air pollutants; 3) enhancing worker knowledge on protection from UV rays; 4) strengthening training on trauma and stress to improve resilience; 5) improving training to recognize and prevent injury and illnesses developed from disease-carrying vectors, waterborne illnesses, and wild animals; and 6) continuing to reach out and provide effective safety and health training to community members, day-laborers, and immigrant laborers.

By addressing existing gaps, as a first step, the NIEHS WTP and its grantees can play a vital role to prepare workers to deal with already present and emerging challenges related to the impacts of climate change.



Man overlooking flooding caused by Hurricane Maria in Puerto Rico



## APPENDIX A. CLIMATE VULNERABILITY MATRIX



### AIR POLLUTION

Industry	Affected Population	New Hazards/ Vulnerabilities	Occupational Health Effects	Work Related Factors	Individual Factors	Locations Most Affected
<b>Agriculture</b>	Farm workers Immigrants Day Laborers	Increased particulates and pollutants (taking into consideration changing weather and season patterns)	Respiratory illnesses, cardiovascular disease, increased allergens	Work practices, work/rest cycles, protective gear	Age, weight, degree of physical fitness, metabolism, use of alcohol or drugs, medical conditions, clothing worn	Outdoor, mostly rural
<b>Community/ Worker Advocacy Groups</b>	Community members Homeworkers Immigrant workers Day laborers	Increased particulates and pollutants (taking into consideration changing weather and season patterns) and by newer "greener" cleaning agents	Respiratory illnesses, cardiovascular disease, increased allergens	Work practices, work/rest cycles, protective gear	Age, weight, degree of physical fitness, metabolism, use of alcohol or drugs, medical conditions, clothing worn	Indoor and outdoor; mostly urban
<b>Construction</b>	Construction workers (including all construction trades: carpenter, electrician, heavy equipment operator, ironworker, laborer, mason, plasterer, plumber, pipefitter, sheet metal worker, and welder), day- laborers, solar install, or maintenance workers	Increased particulates and pollutants (taking into consideration changing weather and season patterns)	Respiratory illnesses, cardiovascular disease, increased allergens	Work practices, work/rest cycles, protective gear	Age, weight, degree of physical fitness, metabolism, use of alcohol or drugs, medical conditions, clothing worn	Indoor and outdoor; mostly urban
<b>Emergency Response</b>	Emergency/First responders; responders, EMT, firefighters, disaster site workers, skilled support personnel, day laborers, Community Emergency Response Team (CERT), National Guard, safety professionals/ industrial hygienists	Increased particulates and pollutants	Respiratory illnesses, cardiovascular disease, increased allergens	Work practices, work/rest cycles, protective gear	Age, weight, degree of physical fitness, metabolism, use of alcohol or drugs, medical conditions, clothing worn	Indoor and outdoor; urban and rural

Industry	Affected Population	New Hazards/ Vulnerabilities	Occupational Health Effects	Work Related Factors	Individual Factors	Locations Most Affected
<b>Energy sector</b>	DOE facility workers, renewable energy workers, alternative energy workers, miners, oil refinery workers, electric power workers, nuclear facility workers, pipeline construction and maintenance workers, shale gas/oil extraction workers	Increased particulates and pollutants (taking into consideration changing weather and season patterns)	Respiratory illnesses, cardiovascular disease, increased allergens	Work practices, work/rest cycles, protective gear	Age, weight, degree of physical fitness, metabolism, use of alcohol or drugs, medical conditions, clothing worn	Indoor and outdoor; urban and rural
<b>“Essential” Retail/ Service Industries</b>	Retail workers, tourism service workers	Increased particulates and pollutants caused by newer “greener” cleaning agents, indoor air pollutants	Respiratory illnesses, cardiovascular disease, increased allergens	Work practices, work/rest cycles, protective gear, proper ventilation	Age, weight, degree of physical fitness, metabolism, use of alcohol or drugs, medical conditions, clothing worn	Indoor and outdoor; urban and rural
<b>Hazardous Waste Cleanup</b>	Cleanup workers, DOE legacy site cleanup workers, disaster responders and workers, construction workers	Increased particulates and pollutants	Respiratory illnesses, cardiovascular disease, increased allergens	Work practices, work/rest cycles, protective gear	Age, weight, degree of physical fitness, metabolism, use of alcohol or drugs, medical conditions, clothing worn	Indoor and outdoor; mostly urban
<b>Health care</b>	Nurses, doctors, workers who work in health care settings, homecare workers; assisted living and retirement home workers	Increased particulates and pollutants caused by newer “greener” cleaning agents, indoor air pollutants	Respiratory illnesses, cardiovascular disease, increased allergens	Work practices, work/rest cycles, protective gear, hazard exposure	Age, weight, degree of physical fitness, metabolism, use of alcohol or drugs, medical conditions, clothing worn	Indoor
<b>Infrastructure (i.e., Utility work and Public works)</b>	Workers of electrical generation (nuclear and fossil fuel), electrical transmission and distribution, gas transmission and distribution, water treatment, distribution, and purification, road and building repair, public and private waste collection and disposal, facility, and grounds maintenance	Increased particulates and pollutants	Respiratory illnesses, cardiovascular disease, increased allergens	Work practices, work/rest cycles, protective gear	Age, weight, degree of physical fitness, metabolism, use of alcohol or drugs, medical conditions, clothing worn	Indoor and outdoor; urban and rural

Industry	Affected Population	New Hazards/ Vulnerabilities	Occupational Health Effects	Work Related Factors	Individual Factors	Locations Most Affected
<b>Manufacturing</b>	Manufacturing and industrial trades, chemical manufacturing plant workers, product manufacturing plant workers	Increased indoor particulates and pollutants	Respiratory illnesses, cardiovascular disease, increased allergens	Work practices, work/rest cycles, protective gear, proper ventilation	Age, weight, degree of physical fitness, metabolism, use of alcohol or drugs, medical conditions, clothing worn	Indoor and outdoor; urban and rural
<b>Maritime</b>	Port workers Ship workers Commercial fishermen	Increased particulates and pollutants (taking into consideration changing weather and season patterns)	Respiratory illnesses, cardiovascular disease, increased allergens	Work practices, work/rest cycles, protective gear.  Potential chemical/hazard exposure	Age, weight, degree of physical fitness, metabolism, use of alcohol or drugs, medical conditions, clothing worn	Indoor and outdoor
<b>Transportation</b>	Truck drivers, public transportation operators, hazardous waste material transport drivers, construction drivers, public transportation systems (e.g., rail workers, mass-transit system workers)	Increased particulates and pollutants (taking into consideration changing weather and season patterns)	Respiratory illnesses, cardiovascular disease, increased allergens	Work practices, PPE, amount of time spent on route, indoor air quality	Age, weight, degree of physical fitness, metabolism, use of alcohol or drugs, medical conditions, clothing worn	Indoor and outdoor



# BIOHAZARDS

Industry	Affected Population	New Hazards/ Vulnerabilities	Occupational Health Effects	Work Related Factors	Individual Factors	Locations Most Affected
<b>Agriculture</b>	Farm workers, Immigrants, day laborers	Increase and changed pathogens, increase in plant allergens, increase/ changed insect distribution; animal bites; waterborne illnesses	Vector-borne infections caused by insects (e.g., mosquitos and ticks), allergies/ asthma, dermatitis, infectious disease; injury, gastrointestinal diseases	Work practices, protective equipment	Age, weight, degree of physical fitness, medical conditions, clothing worn, use of insecticides, medication used	Mostly outdoor
<b>Community/ Worker Advocacy Groups</b>	Community members Homeworkers Immigrant workers Day laborers	Increase and changed pathogens, increase in plant allergens, increase/ changed insect distribution; animal bites; waterborne illnesses	Vector-borne infections caused by insects (e.g., mosquitos and ticks), allergies/ asthma, dermatitis, infectious disease; injury, gastrointestinal diseases	Work practices, protective equipment	Age, weight, degree of physical fitness, medical conditions, clothing worn, use of insecticides, medication used	Mostly outdoor
<b>Construction</b>	Construction workers (including all construction trades: carpenter, electrician, heavy equipment operator, ironworker, laborer, mason, plasterer, plumber, pipefitter, sheet metal worker, and welder), day- laborers, solar install, or maintenance workers	Increase and changed pathogens, increase in plant allergens, increase/ changed insect distribution (taking into consideration changing weather and season pattern, pollen season); animal bites	Vector-borne infections caused by insects (e.g., mosquitos and ticks), allergies/ asthma, dermatitis, infectious disease; injury	Work practices	Age, weight, degree of physical fitness, medical conditions, clothing worn, use of insecticides, medication used	Mostly outdoor; mostly rural
<b>Emergency Response</b>	Emergency/First responders; responders, EMT, firefighters, disaster site workers, skilled support personnel, day laborers, Community Emergency Response Team (CERT), National Guard, safety professionals/ industrial hygienists	Increase and changed pathogens, increase in plant allergens, increase/ changed insect distribution; water- borne illnesses, animal bites	Vector-borne infections caused by insects (e.g., mosquitos and ticks), allergies/ asthma, dermatitis, infectious disease; gastrointestinal diseases; injury	Work practices, protective equipment	Age, weight, degree of physical fitness, medical conditions, clothing worn, use of insecticides, medication used	Mostly outdoor; urban and rural



Industry	Affected Population	New Hazards/ Vulnerabilities	Occupational Health Effects	Work Related Factors	Individual Factors	Locations Most Affected
<b>“Essential” Retail/ Service Industries</b>	Retail workers, tourism service workers	Increase and changed pathogens, increase in plant allergens, increase/ changed insect distribution;	Vector-borne infections caused by insects (e.g., mosquitos and ticks), allergies/ asthma, dermatitis, infectious disease	Work practices, protective equipment	Age, weight, degree of physical fitness, medical conditions, clothing worn, use of insecticides, medication used	Indoor and outdoor
<b>Hazardous Waste Cleanup</b>	Cleanup workers, DOE legacy site cleanup workers, disaster responders and workers, construction workers	Increase and changed pathogens, increase in plant allergens, increase/ changed insect distribution; animal bites	Vector-borne infections caused by insects (e.g., mosquitos and ticks), allergies/ asthma, dermatitis, infectious disease; injury	Work practices, protective equipment	Age, weight, degree of physical fitness, medical conditions, clothing worn, use of insecticides, medication used	Mostly outdoor; mostly rural
<b>Health care</b>	Nurses, doctors, workers who work in health care settings, homecare workers; assisted living and retirement home workers	Increase and changed pathogens, increase in plant allergens, increase/ changed insect distribution (taking into consideration changing weather and season pattern, pollen season), contact with sick patients	Vector-borne infections caused by insects (e.g., mosquitos and ticks), allergies/ asthma, dermatitis, infectious disease, patient-provider infection	Work practices, PPE	Age, weight, degree of physical fitness, medical conditions, medication used, properly worn PPE	In hospitals, health care facilities
<b>Infrastructure (i.e., Utility work and Public works)</b>	Workers of electrical generation (nuclear and fossil fuel), electrical transmission and distribution, gas transmission and distribution, water treatment, distribution, and purification, road and building repair, public and private waste collection and disposal, facility, and grounds maintenance	Increase and changed pathogens, increase in plant allergens, increase/ changed insect distribution; animal bites	Vector-borne infections caused by insects (e.g., mosquitos and ticks), allergies/ asthma, dermatitis, infectious disease; injury	Work practices, protective equipment	Age, weight, degree of physical fitness, medical conditions, clothing worn, use of insecticides, medication used	Mostly outdoor; mostly rural
<b>Maritime</b>	Port workers Ship workers Commercial fishermen	Increase and changed pathogens, increase in plant allergens, increase/ changed insect distribution; animal bites; waterborne illnesses	Vector-borne infections caused by insects (e.g., mosquitos and ticks), allergies/ asthma, dermatitis, infectious disease; injury, gastrointestinal diseases	Work practices, protective equipment	Age, weight, degree of physical fitness, medical conditions, clothing worn, use of insecticides, medication used	Mostly outdoor



# EXTREME WEATHER

Industry	Affected Population	New Hazards/ Vulnerabilities	Occupational Health Effects	Work Related Factors	Individual Factors	Locations Most Affected
<b>Agriculture</b>	Farm workers, Immigrants, day laborers	Extreme weather events	Respiratory illnesses, cardiovascular disease, rashes, allergens, vector- born infections, mental stress, heat stroke, cold stress, traumatic injuries, skin irritations	Work practices, work/rest cycles, access to water, access to shade/ cooling/heating, protective gear	Age, weight, degree of physical fitness, medical conditions, previous experience with disasters, medical conditions, type of clothing worn	All
<b>Community/ Worker Advocacy Groups</b>	Community members Homeworkers Immigrant workers Day laborers	Floods, droughts, and disaster clean up related hazards (such as hazardous debris, mold, sediments, etc.)	Respiratory illnesses, cardiovascular disease, rashes, allergens, vector- born infections, mental stress, heat stroke, cold stress, traumatic injuries, skin irritations	Work practices, work/rest cycles, access to water, access to shade/ cooling/heating, protective gear	Age, weight, degree of physical fitness, medical conditions, previous experience with disasters, medical conditions, type of clothing worn	All
<b>Community/ Worker Advocacy Groups</b>	Community members Homeworkers Immigrant workers Day laborers	Mental stress	Mental stress, cardiovascular disease, headaches, depression, stress	Work practices, work/rest cycles	Age, medical conditions, previous experience, mental health	All
<b>Construction</b>	Construction workers (including all construction trades: carpenter, electrician, heavy equipment operator, ironworker, laborer, mason, plasterer, plumber, pipefitter, sheet metal worker, and welder), day- laborers, solar install, or maintenance workers	Extreme weather events (e.g., wildfire, hurricane, floods, droughts, etc.), and disaster clean up related hazards (such as hazardous debris, mold, sediments, etc.)	Respiratory illnesses, cardiovascular disease, rashes, allergens, vector- born infections, mental stress, heat stroke, cold stress, traumatic injuries, skin irritations	Work practices, work/rest cycles, access to water, access to shade/ cooling/heating, protective gear	Age, weight, degree of physical fitness, medical conditions, previous experience with disasters, medical conditions, type of clothing worn	Indoor and outdoor; urban and rural
<b>Construction</b>	Construction workers (including all construction trades: carpenter, electrician, heavy equipment operator, ironworker, laborer, mason, plasterer, plumber, pipefitter, sheet metal worker, and welder), day- laborers, solar install, or maintenance workers	Mental stress	Mental stress, cardiovascular disease, headaches, depression, stress,	Work practices, work/rest cycles	Age, medical conditions, previous experience, mental health	Indoor and outdoor; urban and rural

Industry	Affected Population	New Hazards/ Vulnerabilities	Occupational Health Effects	Work Related Factors	Individual Factors	Locations Most Affected
<b>Emergency Response</b>	Emergency/First responders; responders, EMT, firefighters, disaster site workers, skilled support personnel, day laborers, Community Emergency Response Team (CERT), National Guard, safety professionals/ industrial hygienists	Floods, droughts, and disaster clean up related hazards (such as hazardous debris, mold, sediments, etc.), exposure to chemicals, confine space	Respiratory illnesses, cardiovascular disease, rashes, allergens, vector-borne infections, mental stress, heat stroke, cold stress, traumatic injuries, skin irritations	Work practices, work/rest cycles, access to water, access to shade/cooling/heating, protective gear	Age, weight, degree of physical fitness, medical conditions, previous experience with disasters, medical conditions, type of clothing worn	All
<b>Emergency Response</b>	Emergency/First responders; responders, EMT, firefighters, disaster site workers, skilled support personnel, day laborers, Community Emergency Response Team (CERT), National Guard, safety professionals/ industrial hygienists	Mental stress	Mental stress, cardiovascular disease, headaches, depression, stress	Work practices, work/rest cycles	Age, medical conditions, previous experience, mental health	All
<b>Energy sector</b>	DOE facility workers, renewable energy workers, alternative energy workers, miners, oil refinery workers, electric power workers, nuclear facility workers, pipeline construction and maintenance workers, shale gas/oil extraction workers	Extreme weather events (e.g., wildfire, hurricane, floods, droughts, etc.), and disaster clean up related hazards (such as hazardous debris, mold, sediments, etc.)	Respiratory illnesses, cardiovascular disease, rashes, allergens, vector-borne infections, mental stress, heat stroke, cold stress, traumatic injuries, skin irritations	Work practices, work/rest cycles, access to water, access to shade/cooling/heating, protective gear	Age, weight, degree of physical fitness, medical conditions, previous experience with disasters, medical conditions, type of clothing worn	All
<b>Energy sector</b>	DOE facility workers, renewable energy workers, alternative energy workers, miners, oil refinery workers, electric power workers, nuclear facility workers, pipeline construction and maintenance workers, shale gas/oil extraction workers	Mental stress	Mental stress, cardiovascular disease, headaches, depression, stress	Work practices, work/rest cycles	Age, medical conditions, previous experience, mental health	All

Industry	Affected Population	New Hazards/ Vulnerabilities	Occupational Health Effects	Work Related Factors	Individual Factors	Locations Most Affected
<b>“Essential” Retail/ Service Industries</b>	Retail workers, tourism service workers	Disaster clean up related hazards (such as hazardous debris, mold, sediments, etc.)	Respiratory illnesses, cardiovascular disease, rashes, allergens, vector- born infections, mental stress, heat stroke, cold stress, traumatic injuries, skin irritations	Work practices, work/rest cycles, access to water, access to shade/ cooling/heating, protective gear	Age, weight, degree of physical fitness, medical conditions, previous experience with disasters, medical conditions, type of clothing worn	Indoor
<b>“Essential” Retail/ Service Industries</b>	Retail workers, tourism service workers	Mental stress	Mental stress, cardiovascular disease, headaches, depression, stress	Work practices, work/rest cycles	Age, medical conditions, previous experience, mental health	All
<b>Hazardous Waste Cleanup</b>	Cleanup workers, DOE legacy site cleanup workers, disaster responders and workers, construction workers	Extreme weather events (e.g., wildfire, hurricane, floods, droughts, etc.), and disaster clean up related hazards (such as hazardous debris, mold, sediments, etc.)	Respiratory illnesses, cardiovascular disease, rashes, allergens, vector- born infections, mental stress, heat stroke, cold stress, traumatic injuries, skin irritations	Work practices, work/rest cycles, access to water, access to shade/ cooling/heating, protective gear	Age, weight, degree of physical fitness, medical conditions, previous experience with disasters, medical conditions, type of clothing worn	Indoor and outdoor; urban and rural
<b>Hazardous Waste Cleanup</b>	Cleanup workers, DOE legacy site cleanup workers; disaster responders and workers, construction workers	Mental stress	Mental stress, cardiovascular disease, headaches, depression, stress	Work practices, work/rest cycles	Age, medical conditions, previous experience, mental health	Indoor and outdoor; urban and rural
<b>Health care</b>	Nurses, doctors, workers who work in health care settings, homecare workers; assisted living and retirement home workers	Extreme weather events (e.g., wildfire, hurricane, floods, droughts, etc.), and disaster clean up related hazards (such as hazardous debris, mold, sediments, etc.)	Respiratory illnesses, cardiovascular disease, rashes, allergens, vector- born infections, mental stress, traumatic injuries	Work practices, work/rest cycles, access to water, PPE, location and condition of workplace	Age, weight, degree of physical fitness, medical conditions, previous experience with disasters, medical conditions, type of clothing worn	All
<b>Health care</b>	Nurses, doctors, workers who work in health care settings, homecare workers; assisted living and retirement home workers	Mental stress	Mental stress, cardiovascular disease, headaches, depression, stress	Work practices, work/rest cycles	Age, medical conditions, previous experience, mental health	All

Industry	Affected Population	New Hazards/ Vulnerabilities	Occupational Health Effects	Work Related Factors	Individual Factors	Locations Most Affected
<b>Infrastructure (i.e., Utility work and Public works)</b>	Workers of electrical generation (nuclear and fossil fuel), electrical transmission and distribution, gas transmission and distribution, water treatment, distribution, and purification, road and building repair, public and private waste collection, and disposal, facility, and grounds maintenance	Floods, droughts, and disaster clean up related hazards (such as hazardous debris, mold, sediments, etc.) (when responding to restore utilities)	Respiratory illnesses, cardiovascular disease, rashes, allergens, vector-borne infections, mental stress, heat stroke, cold stress, traumatic injuries, skin irritations	Work practices, work/rest cycles, access to water, access to shade/cooling/heating, protective gear	Age, weight, degree of physical fitness, medical conditions, previous experience with disasters, medical conditions, type of clothing worn	All
<b>Infrastructure (i.e., Utility work and Public works)</b>	Workers of electrical generation (nuclear and fossil fuel), electrical transmission and distribution, gas transmission and distribution, water treatment, distribution, and purification, road and building repair, public and private waste collection and disposal, facility, and grounds maintenance	Mental stress	Mental stress, cardiovascular disease, headaches, depression, stress	Work practices, work/rest cycles	Age, medical conditions, previous experience, mental health	All
<b>Manufacturing</b>	Manufacturing and industrial trades, chemical manufacturing plant workers, product manufacturing plant workers	Mental stress	Mental stress, cardiovascular disease, headaches, depression, stress	Work practices, work/rest cycles	Age, medical conditions, previous experience, mental health	All
<b>Maritime</b>	Port workers Ship workers Commercial fishermen	Extreme weather events, especially flooding and hurricanes	Respiratory illnesses, cardiovascular disease, rashes, allergens, vector-borne infections, mental stress, heat stroke, cold stress, traumatic injuries, skin irritations	Work practices, work/rest cycles, access to water, access to shade/cooling/heating, protective gear	Age, weight, degree of physical fitness, medical conditions, previous experience with disasters, medical conditions, type of clothing worn	Outdoor
<b>Maritime</b>	Port workers Ship workers Commercial fishermen	Mental stress	Mental stress, cardiovascular disease, headaches, depression, stress	Work practices, work/rest cycles	Age, medical conditions, previous experience, mental health	All



Industry	Affected Population	New Hazards/ Vulnerabilities	Occupational Health Effects	Work Related Factors	Individual Factors	Locations Most Affected
<b>Transportation</b>	Truck drivers, public transportation operators, hazardous waste material transport drivers, construction drivers, public transportation systems (e.g., rail workers, mass-transit system workers)	Extreme weather events (e.g., wildfire, hurricane, floods, droughts, etc.), and disaster clean up related hazards (such as hazardous debris, mold, sediments, etc.)	Dangers of driving in disaster sites, driving in hazardous conditions	Work practices, route location, road conditions, work/rest cycles	Age, previous experience with disasters, driving experience	Outdoor
<b>Transportation</b>	Truck drivers, public transportation operators, hazardous waste material transport drivers, construction drivers, public transportation systems (e.g., rail workers, mass-transit system workers)	Mental stress	Mental stress, cardiovascular disease, headaches, depression, stress	Work practices, work/rest cycles, route location, road conditions	Age, medical conditions, previous experience, mental health	Outdoor



## EXTREME AMBIENT TEMPERATURES

Industry	Affected Population	New Hazards/ Vulnerabilities	Occupational Health Effects	Work Related Factors	Individual Factors	Locations Most Affected
<b>Agriculture</b>	Farm workers, Immigrants, day laborers	Heat stress/ stroke, decreased chemical (pesticides) tolerance,	Heat stress (dehydration, heat rash, heat cramps, heat exhaustion, heat fatigue, heat syncope/ fainting, heat stroke), cardiovascular disease, fatigue,	Work practices, work/rest cycles, access to water, access to shade/ cooling, properly worn PPE	Age, weight, degree of physical fitness, degree of acclimatization, metabolism, use of alcohol or drugs, medical conditions, prior heat injury, clothing worn	Mostly outdoor
<b>Community/ Worker Advocacy Groups</b>	Community members Homeworkers Immigrant workers Day laborers	Heat stress/ stroke, decreased chemical tolerance, cold stress	Heat stress (dehydration, heat rash, heat cramps, heat exhaustion, heat fatigue, heat syncope/ fainting, heat stroke), cardiovascular disease, fatigue, Cold stress (frost bite, hypothermia, chilblains)	Work practices, work/rest cycles, access to water, access to shade/ cooling/heating, properly worn PPE	Age, weight, degree of physical fitness, degree of acclimatization, metabolism, use of alcohol or drugs, medical conditions, prior heat injury, clothing worn	Mostly outdoor

Industry	Affected Population	New Hazards/ Vulnerabilities	Occupational Health Effects	Work Related Factors	Individual Factors	Locations Most Affected
<b>Construction</b>	Construction workers (including all construction trades: carpenter, electrician, heavy equipment operator, ironworker, laborer, mason, plasterer, plumber, pipefitter, sheet metal worker, and welder), day- laborers	Heat stress/ stroke, decreased chemical tolerance, cold stress	Heat stress (dehydration, heat rash, heat cramps, heat exhaustion, heat fatigue, heat syncope/ fainting, heat stroke), cardiovascular disease, fatigue, Cold stress (frost bite, hypothermia, chilblains)	Work practices, work/rest cycles, access to water, access to shade/ cooling/heating, properly worn PPE	Age, weight, degree of physical fitness, degree of acclimatization, metabolism, use of alcohol or drugs, medical conditions, prior heat injury, clothing worn	Mostly outdoor; urban and rural
<b>Emergency Response</b>	Emergency/First responders; responders, EMT, firefighters, disaster site workers, skilled support personnel, day laborers, Community Emergency Response Team (CERT), National Guard, safety professionals/ industrial hygienists	Heat stress/ stroke, decreased chemical tolerance, cold stress	Heat stress (dehydration, heat rash, heat cramps, heat exhaustion, heat fatigue, heat syncope/ fainting, heat stroke), cardiovascular disease, fatigue, cold stress (frost bite, hypothermia, chilblains)	Work practices, work/rest cycles, access to water, access to shade/ cooling/heating, properly worn PPE	Age, weight, degree of physical fitness, degree of acclimatization, metabolism, use of alcohol or drugs, medical conditions, prior heat injury, clothing worn	Mostly outdoor; urban and rural
<b>Energy sector</b>	DOE facility workers, renewable energy workers, alternative energy workers, miners, oil refinery workers, electric power workers, nuclear facility workers, pipeline construction and maintenance workers, shale gas/oil extraction workers	Heat stress/ stroke, decreased chemical tolerance, cold stress	Heat stress (dehydration, heat rash, heat cramps, heat exhaustion, heat fatigue, heat syncope/ fainting, heat stroke), cardiovascular disease, fatigue, cold stress (frost bite, hypothermia, chilblains)	Work practices, work/rest cycles, access to water, access to shade/ cooling/heating, properly worn PPE	Age, weight, degree of physical fitness, degree of acclimatization, metabolism, use of alcohol or drugs, medical conditions, prior heat injury, clothing worn	Indoor and outdoor; urban and rural
<b>Hazardous Waste Cleanup</b>	Cleanup workers, DOE legacy site cleanup workers, disaster responders and workers, construction workers	Heat stress/ stroke, decreased chemical tolerance, cold stress	Heat stress (dehydration, heat rash, heat cramps, heat exhaustion, heat fatigue, heat syncope/ fainting, heat stroke), cardiovascular disease, fatigue, Cold stress (frost bite, hypothermia, chilblains)	Work practices, work/rest cycles, access to water, access to shade/ cooling/heating, properly worn PPE	Age, weight, degree of physical fitness, degree of acclimatization, metabolism, use of alcohol or drugs, medical conditions, prior heat injury, clothing worn	Mostly outdoor; urban and rural

Industry	Affected Population	New Hazards/ Vulnerabilities	Occupational Health Effects	Work Related Factors	Individual Factors	Locations Most Affected
<b>Infrastructure (i.e., Utility work and Public works)</b>	Workers of electrical generation (nuclear and fossil fuel), electrical transmission and distribution, gas transmission and distribution, water treatment, distribution, and purification, road and building repair, public and private waste collection and disposal, facility, and grounds maintenance	Heat stress/ stroke, decreased chemical tolerance, cold stress	Heat stress (dehydration, heat rash, heat cramps, heat exhaustion, heat fatigue, heat syncope/ fainting, heat stroke), cardiovascular disease, fatigue, cold stress (frost bite, hypothermia, chilblains)	Work practices, work/rest cycles, access to water, access to shade/ cooling/heating, properly worn PPE	Age, weight, degree of physical fitness, degree of acclimatization, metabolism, use of alcohol or drugs, medical conditions, prior heat injury, clothing worn	Mostly outdoor; urban and rural
<b>Manufacturing</b>	Manufacturing and industrial trades, chemical manufacturing plant workers, product manufacturing plant workers	Heat stress/ stroke, decreased chemical tolerance, cold stress	Heat stress (dehydration, heat rash, heat cramps, heat exhaustion, heat fatigue, heat syncope/ fainting, heat stroke), cardiovascular disease, fatigue, cold stress (frost bite, hypothermia, chilblains)	Work practices, work/rest cycles, access to water, access to shade/ cooling/heating, properly worn PPE	Age, weight, degree of physical fitness, degree of acclimatization, metabolism, use of alcohol or drugs, medical conditions, prior heat injury, clothing worn	Mostly outdoor; urban and rural
<b>Maritime</b>	Port workers Ship workers Commercial fishermen	Heat stress/ stroke, decreased chemical tolerance, cold stress	Heat stress (dehydration, heat rash, heat cramps, heat exhaustion, heat fatigue, heat syncope/ fainting, heat stroke), cardiovascular disease, fatigue, Cold stress (frost bite, hypothermia, chilblains)	Work practices, work/rest cycles, access to water, access to shade/ cooling/heating, properly worn PPE	Age, weight, degree of physical fitness, degree of acclimatization, metabolism, use of alcohol or drugs, medical conditions, prior heat injury, clothing worn	Mostly outdoor
<b>Transportation</b>	Truck drivers, public transportation operators, hazardous waste material transport drivers, construction drivers, public transportation systems (e.g., rail workers, mass-transit system workers)	Heat stress/ stroke, decreased chemical tolerance, cold stress	Heat stress (dehydration, heat rash, heat cramps, heat exhaustion, heat fatigue, heat syncope/ fainting, heat stroke), cardiovascular disease, fatigue, cold stress (frost bite, hypothermia, chilblains)	Work practices, work/rest cycles, access to water, access to AC/ heating in transportation, amount of time spent on route	Age, weight, degree of physical fitness, degree of acclimatization, metabolism, use of alcohol or drugs, medical conditions, prior heat injury, clothing worn	Mostly outdoor



# INDUSTRIAL TRANSITIONS AND EMERGING INDUSTRIES

Industry	Affected Population	New Hazards/ Vulnerabilities	Occupational Health Effects	Work Related Factors	Individual Factors	Locations Most Affected
<b>Construction</b>	Construction workers (including all construction trades: carpenter, electrician, heavy equipment operator, ironworker, laborer, mason, plasterer, plumber, pipefitter, sheet metal worker, and welder), day- laborers, solar install, or maintenance workers	Job security/ new hazard scenario	Musculoskeletal disorders, mental stress, cardiovascular disease, unknown disease	Work practices, work/rest cycles, protective gear	Age, medical conditions, degree of physical fitness, socio-economic factors, medical conditions, PPE	Indoor and outdoor; urban and rural
<b>Energy sector</b>	DOE facility workers, renewable energy workers, alternative energy workers, miners, oil refinery workers, electric power workers, nuclear facility workers, pipeline construction and maintenance workers, shale gas/oil extraction workers	Job security/ new hazard scenario (renewable, green energy growth)	Musculoskeletal disorders, cardiovascular disease, unknown disease, traumatic injury, biological hazards	Work practices, work/rest cycles, protective gear	Age, medical conditions, degree of physical fitness, socio-economic factors, medical conditions, PPE	All
<b>Energy sector</b>	DOE facility workers, renewable energy workers, alternative energy workers, miners, oil refinery workers, electric power workers, nuclear facility workers, pipeline construction and maintenance workers, shale gas/oil extraction workers	Mental stress from job insecurity and the unknown	Mental stress, cardiovascular disease, musculoskeletal disorder, depression	Work practices, future of industry	Age, medical conditions, mental health, socio-economic status	All
<b>Hazardous Waste Cleanup</b>	Cleanup workers, DOE legacy site cleanup workers, disaster responders and workers, construction workers	Job security/ new hazard scenario	Musculoskeletal disorders, mental stress, cardiovascular disease, unknown disease	Work practices, work/rest cycles, protective gear	Age, medical conditions, degree of physical fitness, socio-economic factors, medical conditions, PPE	Indoor and outdoor; urban and rural
<b>Infrastructure (i.e., Utility work and Public works)</b>	Workers of electrical generation (nuclear and fossil fuel), electrical transmission and distribution, gas transmission and distribution, water treatment, distribution, and purification, road and building repair, public and private waste collection and disposal, facility, and grounds maintenance	Job security/ new hazard scenario	Musculoskeletal disorders, mental stress, cardiovascular disease, unknown disease	Work practices, work/rest cycles, protective gear; type of new chemicals or hazards used in treatments	Age, medical conditions, degree of physical fitness, socio-economic factors, medical conditions, PPE	All

Industry	Affected Population	New Hazards/ Vulnerabilities	Occupational Health Effects	Work Related Factors	Individual Factors	Locations Most Affected
<b>Manufacturing</b>	Manufacturing and industrial trades, chemical manufacturing plant workers, product manufacturing plant workers	Job security/ new hazard scenario	Musculoskeletal disorders, cardiovascular disease, unknown disease, traumatic injury, biological hazards	Work practices, protective gear	Age, medical conditions, degree of physical fitness, socio-economic factors, medical conditions, PPE	All
<b>Manufacturing</b>	Manufacturing and industrial trades, chemical manufacturing plant workers, product manufacturing plant workers	Mental stress from job insecurity and the unknown	Mental stress, cardiovascular disease, musculoskeletal disorder, depression	Work practices, future of industry	Age, medical conditions, mental health, socio-economic status	All
<b>Transportation</b>	Truck drivers, public transportation operators, hazardous waste material transport drivers, construction drivers, public transportation systems (e.g., rail workers, mass-transit system workers)	Job security/ new hazard scenario	Musculoskeletal disorders, mental stress, unknown disease	Work practices, work/rest cycles,	Age, medical conditions, degree of physical fitness, socio-economic factors, medical conditions, PPE	All



## OZONE DEPLETION

Industry	Affected Population	New Hazards/ Vulnerabilities	Occupational Health Effects	Work Related Factors	Individual Factors	Locations Most Affected
<b>Agriculture</b>	Farm workers, Immigrants, day laborers	Increased UV radiation	Skin cancer, eye effects, immune dysfunction	Work practices, work/rest cycles	Age, weight, degree of physical fitness, metabolism, use of alcohol or drugs, medical conditions, clothing worn, sunblock	Outdoor
<b>Community/ Worker Advocacy Groups</b>	Community members Homeworkers Immigrant workers Day laborers	Increased UV radiation	Skin cancer, eye effects, immune dysfunction	Work practices, work/rest cycles	Age, weight, degree of physical fitness, metabolism, use of alcohol or drugs, medical conditions, clothing worn, sunblock	Outdoor



Industry	Affected Population	New Hazards/ Vulnerabilities	Occupational Health Effects	Work Related Factors	Individual Factors	Locations Most Affected
<b>Construction</b>	Construction workers (including all construction trades: carpenter, electrician, heavy equipment operator, ironworker, laborer, mason, plasterer, plumber, pipefitter, sheet metal worker, and welder), day- laborers, solar install, or maintenance workers	Increased UV radiation	Skin cancer, eye effects, immune dysfunction	Work practices, work/rest cycles	Age, weight, degree of physical fitness, metabolism, use of alcohol or drugs, medical conditions, clothing worn, sunblock	Mostly outdoor; urban and rural
<b>Emergency Response</b>	Emergency/First responders; responders, EMT, firefighters, disaster site workers, skilled support personnel, day laborers, Community Emergency Response Team (CERT), National Guard, safety professionals/ industrial hygienists	Increased UV radiation	Skin cancer, eye effects, immune dysfunction	Work practices, work/rest cycles	Age, weight, degree of physical fitness, metabolism, use of alcohol or drugs, medical conditions, clothing worn, sunblock	Mostly outdoor; urban and rural
<b>Energy sector</b>	DOE facility workers, renewable energy workers, alternative energy workers, miners, oil refinery workers, electric power workers, nuclear facility workers, pipeline construction and maintenance workers, shale gas/ oil extraction workers	Increased UV radiation	Skin cancer, eye effects, immune dysfunction	Work practices, work/rest cycles	Age, weight, degree of physical fitness, metabolism, use of alcohol or drugs, medical conditions, clothing worn, sunblock	Mostly outdoor; urban and rural
<b>Hazardous Waste Cleanup</b>	Cleanup workers, DOE legacy site cleanup workers, disaster responders and workers, construction workers	Increased UV radiation	Skin cancer, eye effects, immune dysfunction	Work practices, work/rest cycles	Age, weight, degree of physical fitness, metabolism, use of alcohol or drugs, medical conditions, clothing worn, sunblock	Mostly outdoor; urban and rural
<b>Infrastructure (i.e., Utility work and Public works)</b>	Workers of electrical generation (nuclear and fossil fuel), electrical transmission and distribution, gas transmission and distribution, water treatment, distribution, and purification, road and building repair, public and private waste collection and disposal, facility, and grounds maintenance	Increased UV radiation	Skin cancer, eye effects, immune dysfunction	Work practices, work/rest cycles	Age, weight, degree of physical fitness, metabolism, use of alcohol or drugs, medical conditions, clothing worn, sunblock	Mostly outdoor; urban and rural
<b>Maritime</b>	Port workers Ship workers Commercial fishermen	Increased UV radiation	Skin cancer, eye effects, immune dysfunction	Work practices, work/rest cycles	Age, weight, degree of physical fitness, metabolism, use of alcohol or drugs, medical conditions, clothing worn, sunblock	Outdoor

## APPENDIX B. AVAILABLE WTP TRAINING COURSES/RESOURCES



### CONFINED SPACE (FOR EMERGENCY RESPONSE)

Awardee/Provider	Course Title	Type of Course	Link (if available online)	Notes
<b>Alabama Fire College</b>	Confined Space Rescue Technician (40 Hrs.)	Confined Space	<a href="https://tools.niehs.nih.gov/wetp/public/course_detail.cfm?crs_det_id=226">https://tools.niehs.nih.gov/wetp/public/course_detail.cfm?crs_det_id=226</a>	
<b>International Association of Fire Fighters</b>	Training for Hazardous Materials Response: Confined Space Rescue	Confined Space	<a href="https://tools.niehs.nih.gov/wetp/public/course_detail.cfm?crs_det_id=31">https://tools.niehs.nih.gov/wetp/public/course_detail.cfm?crs_det_id=31</a>	
<b>Kirkwood Community College</b>	Confined Space Rescue	Confined Space	<a href="https://tools.niehs.nih.gov/wetp/public/course_detail.cfm?crs_det_id=124">https://tools.niehs.nih.gov/wetp/public/course_detail.cfm?crs_det_id=124</a>	
<b>Kirkwood Community College</b>	Non-Entry Confined Space Rescue	Confined Space		
<b>Kirkwood Community College</b>	Site Specific Confined Space Rescue	Confined Space	<a href="https://tools.niehs.nih.gov/wetp/public/course_detail.cfm?crs_det_id=1625">https://tools.niehs.nih.gov/wetp/public/course_detail.cfm?crs_det_id=1625</a>	
<b>Midwest Consortium</b>	Confined Space Rescue	Emerg. Resp. for Specific Hazards	<a href="https://mwc.umn.edu/catalog/product/csr-confined-space-rescue/">https://mwc.umn.edu/catalog/product/csr-confined-space-rescue/</a>	
<b>University of Buffalo</b>	Introduction to Confined Space Rescue	Confined Space		



# DISASTER CLEANUP

Awardee/Provider	Course Title	Type of Course	Link (if available online)	Notes
Deep South Center for Environmental Justice	Environmental Preparation	Environmental Preparation		
Deep South Center for Environmental Justice	Mold and Moisture Awareness	Microbial Remediation: Mold and Mildew	<a href="https://tools.niehs.nih.gov/wetp/public/Course_download2.cfm?tranid=11944">https://tools.niehs.nih.gov/wetp/public/Course_download2.cfm?tranid=11944</a>	
Deep South Center for Environmental Justice	Mold Awareness	Microbial Remediation: Mold and Mildew		
Deep South Center for Environmental Justice	Mold Remediation Worker	Microbial Remediation: Mold and Mildew		
International Chemical Workers Union Council Center for Worker Health and Safety Education	Disaster Site Worker	16 Hour Disaster Site Worker	<a href="https://tools.niehs.nih.gov/wetp/public/Course_download2.cfm?tranid=3775">https://tools.niehs.nih.gov/wetp/public/Course_download2.cfm?tranid=3775</a>	
International Chemical Workers Union Council Center for Worker Health and Safety Education	Four Part Series ICWUC Muck Gut module 1	Muck and Gut		
International Chemical Workers Union Council Center for Worker Health and Safety Education	Four Part Series ICWUC Muck Gut module 1 Spanish	Muck and Gut	<a href="https://tools.niehs.nih.gov/wetp/public/course_detail.cfm?crs_det_id=5263">https://tools.niehs.nih.gov/wetp/public/course_detail.cfm?crs_det_id=5263</a>	In Spanish
International Chemical Workers Union Council Center for Worker Health and Safety Education	Four Part Series ICWUC Muck Gut module 2	Muck and Gut		
International Chemical Workers Union Council Center for Worker Health and Safety Education	Four Part Series ICWUC Muck Gut module 2 Spanish	Muck and Gut	<a href="https://tools.niehs.nih.gov/wetp/public/course_detail.cfm?crs_det_id=5265">https://tools.niehs.nih.gov/wetp/public/course_detail.cfm?crs_det_id=5265</a>	In Spanish
International Chemical Workers Union Council Center for Worker Health and Safety Education	Four Part Series ICWUC Muck Gut module 3	Muck and Gut		
International Chemical Workers Union Council Center for Worker Health and Safety Education	Four Part Series ICWUC Muck Gut module 3 Spanish	Muck and Gut		
International Chemical Workers Union Council Center for Worker Health and Safety Education	Four Part Series ICWUC Muck Gut module 4	Muck and Gut	<a href="https://tools.niehs.nih.gov/wetp/public/Course_download2.cfm?tranid=11327">https://tools.niehs.nih.gov/wetp/public/Course_download2.cfm?tranid=11327</a>	

Awardee/Provider	Course Title	Type of Course	Link (if available online)	Notes
<b>International Chemical Workers Union Council Center for Worker Health and Safety Education</b>	Four Part Series ICWUC Muck Gut module 4 Spanish	Muck and Gut		In Spanish
<b>International Union of Operating Engineers National Training Fund</b>	Mold Awareness	General Hazard Awareness	<a href="https://tools.niehs.nih.gov/wetp/public/course_detail.cfm?crs_det_id=2784">https://tools.niehs.nih.gov/wetp/public/course_detail.cfm?crs_det_id=2784</a>	
<b>Kirkwood Community College</b>	Mold Awareness and Inspection	Environmental Technician	<a href="https://tools.niehs.nih.gov/wetp/public/course_detail.cfm?crs_det_id=236">https://tools.niehs.nih.gov/wetp/public/course_detail.cfm?crs_det_id=236</a>	
<b>Laborers' International Union of North America Training and Education Fund</b>	Microbial Remediation	Microbial Remediation	<a href="https://tools.niehs.nih.gov/wetp/public/Course_download2.cfm?tranid=2841">https://tools.niehs.nih.gov/wetp/public/Course_download2.cfm?tranid=2841</a>	
<b>Midwest Consortium</b>	Mold Remediation	Emerg. Resp. for Specific Hazards	<a href="https://tools.niehs.nih.gov/wetp/public/course_detail.cfm?crs_det_id=2164">https://tools.niehs.nih.gov/wetp/public/course_detail.cfm?crs_det_id=2164</a>	
<b>Midwest Consortium</b>	Volunteer Preparedness	Emerg. Resp. for Specific Hazards	<a href="https://mwc.umn.edu/catalog/product/vol-volunteer-preparedness/">https://mwc.umn.edu/catalog/product/vol-volunteer-preparedness/</a>	
<b>New York Committee for Occupational Safety &amp; Health</b>	Know Your Rights	Disaster Site Safety Awareness	<a href="https://tools.niehs.nih.gov/wetp/public/Course_download2.cfm?tranid=12002">https://tools.niehs.nih.gov/wetp/public/Course_download2.cfm?tranid=12002</a>	In Spanish
<b>OAI, Inc.</b>	Disaster Site Worker Hazard Awareness	Disaster Site Safety Awareness	<a href="https://tools.niehs.nih.gov/wetp/public/Course_download2.cfm?tranid=10465">https://tools.niehs.nih.gov/wetp/public/Course_download2.cfm?tranid=10465</a>	
<b>The Steelworkers Charitable and Educational Organization</b>	Pre-Startup Safety Review - Hurricane Project, Edition 1.5 March 2014	Disaster Site Worker Train-the- Trainer		
<b>UMDNJ</b>	Disaster Site Worker	16 Hour Disaster Site Worker		
<b>World Cares Center</b>	1-hour Flood Response and Recovery	Disaster Site Safety Awareness		
<b>World Cares Center</b>	1-hour Radiological Safety Awareness	Disaster Site Safety Awareness		
<b>World Cares Center</b>	2-hour Managing Stress in Disaster Response	Disaster Site Safety Awareness		
<b>World Cares Center</b>	4-hour Flood Response and Recovery	Disaster Site Safety Awareness		



# EMERGENCY RESPONSE

Awardee/Provider	Course Title	Type of Course	Link (if available online)	Notes
<b>Alabama Fire College</b>	Air Monitoring Basics in Hazmat Response (8 Hrs.)	Emerg. Resp. for Specific Hazards	<a href="https://tools.niehs.nih.gov/wetp/public/course_detail.cfm?crs_det_id=163">https://tools.niehs.nih.gov/wetp/public/course_detail.cfm?crs_det_id=163</a>	
<b>Alabama Fire College</b>	ICS 300: Intermediate ICS for Expanding Incidents	Incident Management Systems Awareness	Manual is available for download from FEMA's Emergency Management	
<b>Alabama Fire College</b>	ICS 400: Advanced ICS Command and General Staff - Complex Incidents	Incident Management Systems Awareness	Manual is available for download from FEMA's Emergency Management	
<b>CSEA-Local 1000. Inc - AFSCME</b>	(304) Emergency Response Awareness - Temporary Traffic Control	Emerg. Resp. Awareness		
<b>Deep South Center for Environmental Justice</b>	8 Hr. Emergency Response Refresher	Emerg. Resp. Awareness		
<b>Deep South Center for Environmental Justice</b>	Emergency Preparedness and Response	Emerg. Resp. Awareness		
<b>Kirkwood Community College</b>	Incident Command	Emerg. Resp. Incident Command	<a href="https://tools.niehs.nih.gov/wetp/public/course_detail.cfm?crs_det_id=170">https://tools.niehs.nih.gov/wetp/public/course_detail.cfm?crs_det_id=170</a>	
<b>Make the Road New York</b>	5-hour Disaster Response and Resiliency	Emergency Response		
<b>New York Committee for Occupational Safety &amp; Health</b>	8-hour First Responder Awareness	Emerg. Resp. Basic Oper.		
<b>New York Committee for Occupational Safety &amp; Health</b>	Emergency Response Operations	Emerg. Resp. Basic Oper.	<a href="https://tools.niehs.nih.gov/wetp/public/course_detail.cfm?crs_det_id=4188">https://tools.niehs.nih.gov/wetp/public/course_detail.cfm?crs_det_id=4188</a>	
<b>The New England Consortium-Civil Service Employees Association</b>	(302) Emergency Responders Basic Health & Safety Course 24hr	Emerg. Resp. Basic Oper.		



Awardee/Provider	Course Title	Type of Course	Link (if available online)	Notes
<b>The New England Consortium-Civil Service Employees Association</b>	(304) Emergency Response Awareness Work Zone Safety & HAZMAT Incidents	Emerg. Resp. Awareness		
<b>The New England Consortium-Civil Service Employees Association</b>	(304) Emergency Response Awareness Work Zone Safety & HAZMAT Incidents	Emerg. Resp. Awareness		
<b>The Steelworkers Charitable and Educational Organization</b>	Emergency Response Workbook Edition 2.0, February 2014	Emerg. Resp. Awareness	<a href="https://tools.niehs.nih.gov/wetp/public/Course_download2.cfm?tranid=10324">https://tools.niehs.nih.gov/wetp/public/Course_download2.cfm?tranid=10324</a>	
<b>The Steelworkers Charitable and Educational Organization</b>	Hazardous Waste Operations and Emergency Response (HAZWOPER) 40-Hour Workbooks 1,2,3 Edition 4.0 April 2016	Haz. Waste Operations	<a href="https://tools.niehs.nih.gov/wetp/public/course_detail.cfm?crs_det_id=4859">https://tools.niehs.nih.gov/wetp/public/course_detail.cfm?crs_det_id=4859</a>	
<b>UCLA LOSH</b>	CAMEO	CAMEO		
<b>University of Medical/Dental NJ-Robert Wood Johnson Medical School</b>	21-Hour Disaster Preparedness Trainer Course	Training Methods/Trainer Development		
<b>University of Utah Rocky Mountain Center for Occupational and Environmental Health</b>	16 Hour First Responder Operations Level	Emerg. Resp. Basic Oper.	<a href="https://tools.niehs.nih.gov/wetp/public/course_detail.cfm?crs_det_id=4577">https://tools.niehs.nih.gov/wetp/public/course_detail.cfm?crs_det_id=4577</a>	
<b>University of Utah Rocky Mountain Center for Occupational and Environmental Health</b>	Community Emergency Response Team (Hybrid CERT)	Emerg. Resp. Basic Oper.		
<b>University of Utah Rocky Mountain Center for Occupational and Environmental Health</b>	Neighborhood Emergency Response Planning (NERP) Online	Emerg. Resp. Awareness		
<b>University of Utah Rocky Mountain Center for Occupational and Environmental Health</b>	OSHA 40 Hour Hazardous Waste Operations & Emergency Response	Haz. Waste Operations	<a href="https://tools.niehs.nih.gov/wetp/public/course_detail.cfm?crs_det_id=4574">https://tools.niehs.nih.gov/wetp/public/course_detail.cfm?crs_det_id=4574</a>	
<b>University of Washington</b>	Emergency Response for Specific Hazard	Emerg. Resp. for Specific Hazards		



## GREEN JOBS

Awardee/Provider	Course Title	Type of Course	Link (if available online)	Notes
<b>CPWR – The Center for Construction Research and Training</b>	Introduction to Green Weatherization/Awareness & Hands-on Training	Basic Construction Skills	<a href="https://tools.niehs.nih.gov/wetp/public/Course_download2.cfm?trandid=8021">https://tools.niehs.nih.gov/wetp/public/Course_download2.cfm?trandid=8021</a>	
<b>International Union of Operating Engineers National Training Fund</b>	Green Chemistry & Green Awareness	General Hazard Awareness	<a href="https://tools.niehs.nih.gov/wetp/public/course_detail.cfm?crs_det_id=3264">https://tools.niehs.nih.gov/wetp/public/course_detail.cfm?crs_det_id=3264</a>	
<b>Midwest Consortium</b>	Weatherization	General Hazard Awareness	<a href="https://tools.niehs.nih.gov/wetp/public/course_detail.cfm?crs_det_id=3284">https://tools.niehs.nih.gov/wetp/public/course_detail.cfm?crs_det_id=3284</a>	
<b>New York Committee for Occupational Safety &amp; Health</b>	Green Job Safety and Health Training	Basic Construction Skills		
<b>UCLA LOSH</b>	Decoding Green Chemistry for Workers	Toxic Use Reduction	<a href="https://tools.niehs.nih.gov/wetp/public/Course_download2.cfm?trandid=8459">https://tools.niehs.nih.gov/wetp/public/Course_download2.cfm?trandid=8459</a>	
<b>UCLA LOSH</b>	Introduction to Green Jobs	Toxic Use Reduction	<a href="https://tools.niehs.nih.gov/wetp/public/Course_download2.cfm?trandid=8619">https://tools.niehs.nih.gov/wetp/public/Course_download2.cfm?trandid=8619</a>	
<b>University of Washington</b>	Green Building Construction Workers Safety and Health	Green Building Awareness	<a href="https://tools.niehs.nih.gov/wetp/public/course_detail.cfm?crs_det_id=3909">https://tools.niehs.nih.gov/wetp/public/course_detail.cfm?crs_det_id=3909</a>	



## HEAT STRESS

Awardee/Provider	Course Title	Type of Course	Link (if available online)	Notes
<b>Arizona State University</b>	Heat Illness Prevention	Heat Illness Prevention	<a href="https://tools.niehs.nih.gov/wetp/public/course_detail.cfm?crs_det_id=5403">https://tools.niehs.nih.gov/wetp/public/course_detail.cfm?crs_det_id=5403</a>	
<b>UCLA LOSH</b>	Heat Illness Prevention Awareness	Heat Illness Prevention	<a href="https://tools.niehs.nih.gov/wetp/public/Course_download2.cfm?trandid=12182">https://tools.niehs.nih.gov/wetp/public/Course_download2.cfm?trandid=12182</a>	



## OTHER

Awardee/Provider	Course Title	Type of Course	Link (if available online)	Notes
<b>International Association of Fire Fighters</b>	Resiliency Online Training	Resiliency	<a href="https://tools.niehs.nih.gov/wetp/public/Course_download2.cfm?tranid=12223">https://tools.niehs.nih.gov/wetp/public/Course_download2.cfm?tranid=12223</a>	
<b>International Chemical Workers Union Council Center for Worker Health and Safety Education</b>	ICWUC Infectious Diseases and DOT Program	HazMat Training for Infectious Diseases		
<b>International Chemical Workers Union Council Center for Worker Health and Safety Education</b>	Resiliency During a Pandemic	Resiliency	<a href="https://tools.niehs.nih.gov/wetp/public/course_detail.cfm?crs_det_id=5784">https://tools.niehs.nih.gov/wetp/public/course_detail.cfm?crs_det_id=5784</a>	
<b>Laborers' International Union of North America Training and Education Fund</b>	Firewatch	Fire Watch	<a href="https://tools.niehs.nih.gov/wetp/public/Course_download2.cfm?tranid=2281">https://tools.niehs.nih.gov/wetp/public/Course_download2.cfm?tranid=2281</a>	
<b>Make the Road New York</b>	40-hour Health and Science Specialty Skills	Resiliency		
<b>OAI</b>	Career Development	Life Skills	<a href="https://tools.niehs.nih.gov/wetp/public/Course_download2.cfm?tranid=7760">https://tools.niehs.nih.gov/wetp/public/Course_download2.cfm?tranid=7760</a>	This course is designed to meet the basic educational needs of pre-apprentices and individuals entering the construction and environmental remediation industries
<b>The Steelworkers Charitable and Educational Organization</b>	Resiliency — Overcoming Difficult Situations	Resiliency	<a href="https://tools.niehs.nih.gov/wetp/public/Course_download2.cfm?tranid=12022">https://tools.niehs.nih.gov/wetp/public/Course_download2.cfm?tranid=12022</a>	
<b>World Cares Center</b>	2-hour COVID-19 Disaster Volunteerism Safety	Infectious Disease Awareness		

## APPENDIX C. AVAILABLE “EXTERNAL” TRAINING COURSES/RESOURCES



### GENERAL CLIMATE CHANGE

Name of Training	Group Sponsoring Training	Description of Training	URL
<b>Climate Change Adaptation Training</b>	U.S. Environmental Protection Agency	This tailored training increases the adaptive capacity of its own staff as well as the communities and local governments it serves. The training illustrates how our climate is changing, what services will be affected, and how to strengthen our climate resiliency.	<a href="https://www.epa.gov/arc-x/climate-change-adaptation-training">https://www.epa.gov/arc-x/climate-change-adaptation-training</a>
<b>Climate Change and Children's Health (Web Based) — WB4269R</b>	National Center for Environmental Health/ Agency for Toxic Substances and Disease Registry	The goal of this activity is to enhance the knowledge of physicians and other healthcare providers about the adverse health impacts due to climate change. It will provide resources to healthcare providers they may not be aware of to help educate and prepare patients for extreme weather events. This module begins by providing an overview of climate change, including the definition of climate, climate change and Greenhouse Effect, as well as identifying key gases that negatively impact this natural process. Mental, emotional, and physical health impacts will be explored, as well as the potential relationship of negative birth outcomes. Hurricane Maria and its impact on Puerto Rico is used as a case study to demonstrate the impact of climate change and its impact on children. By enhancing and re-enforcing their knowledge, physicians and other healthcare providers can better assess patients, specifically children and pregnant women, who are more vulnerable to negative health effects due to climate change.	<a href="https://www.train.org/main/course/1075161/">https://www.train.org/main/course/1075161/</a>
<b>Climate Learning Network eLearning Program</b>	U.S. Department of Agriculture	CLN eLearning is designed to help Extension Professionals, Professional Crop Advisors, and Professional Foresters incorporate climate change into their existing program areas and become Climate Literate.	<a href="http://climatelearning.net/e-learning-modules/">http://climatelearning.net/e-learning-modules/</a>
<b>Health and Climate Change Toolkit</b>	World Health Organization	This toolkit contains a comprehensive set of guidance, tools, and training manuals on a wide range of topics on climate change and health.	<a href="https://www.who.int/activities/building-capacity-on-climate-change-human-health">https://www.who.int/activities/building-capacity-on-climate-change-human-health</a>
<b>Human Health and Climate Change</b>	One UN Climate Change Learning Partnership (UN CC:Learn)	This course introduces the health challenges, as well as the opportunities, that can be associated to climate change.	<a href="https://www.train.org/main/course/1075161/">https://www.train.org/main/course/1075161/</a>
<b>Impact of Climate Change on the Health of Women &amp; Children: Information for the PEHSUs</b>	Centers for Disease Control and Prevention	This course is offered as part of the Pediatric Environmental Health Specialty Units webinar series. This in-depth and interactive series provides a platform for learning and discussion about issues that focus on current and emerging aspects of pediatric and reproductive environmental health.	<a href="https://www.train.org/main/course/1065459/">https://www.train.org/main/course/1065459/</a>

<b>U.S. State Climate Summaries</b>	National Oceanic and Atmospheric Administration	The State Climate Summaries provided here were initially produced to meet the demand for state-level climate information in the wake of the Third U.S. National Climate Assessment. This 2022 version provides new information and extends the historical climate record to 2020 for each state. The summaries cover assessment topics directly related to NOAA's mission, specifically historical climate variations and trends, future climate model projections of climate conditions during the 21st century, and past and future conditions of sea level and coastal flooding.	<a href="https://statesummaries.ncics.org/">https://statesummaries.ncics.org/</a>
<b>U.S. Climate Resilience Toolkit Story Maps</b>	United States Global Change Research Program	The U.S. Climate Resilience Toolkit is a website designed to help people find and use tools, information, and subject matter expertise to build climate resilience. The Toolkit offers information from all across the U.S. federal government in one easy-to-use location.	<a href="https://toolkit.climate.gov/content/storymaps">https://toolkit.climate.gov/content/storymaps</a>



## EXTREME AMBIENT TEMPERATURES

Name of Training	Group Sponsoring Training	Description of Training	URL
<b>Employer Sample Procedures For Heat Illness Prevention</b>	California Division of Occupational Safety and Health	California employers with any outdoor places of employment must comply with the Heat Illness Prevention standard, California Code of Regulations, title 8, section 3395 (8 CCR 3395). These procedures have been created to assist employers in establishing their own heat illness prevention procedures and to reduce the risk of work-related heat illnesses to their employees.	<a href="https://www.dir.ca.gov/dosh/dosh_publications/HIP-sample-procedures.pdf">https://www.dir.ca.gov/dosh/dosh_publications/HIP-sample-procedures.pdf</a>
<b>Heat Illness Prevention Training</b>	California Division of Occupational Safety and Health	This training reviews the regulatory language of Title 8 California Code of Regulations section 3395: Heat Illness Prevention in Outdoor Places of Employment; reviews heat illness preventive measures; and increases awareness and commitment to safety and health at all work sites.	<a href="https://www.dir.ca.gov/dosh/documents/Heat-Illness-Prevention-Training.pdf">https://www.dir.ca.gov/dosh/documents/Heat-Illness-Prevention-Training.pdf</a>
<b>Heat Illness Prevention</b>	Occupational Safety and Health Administration	This website contains a series of fact sheets and pamphlet on how to prevent heat illness.	<a href="https://www.osha.gov/publications/bytopic/heat-illness-prevention">https://www.osha.gov/publications/bytopic/heat-illness-prevention</a>
<b>Heat Safety — Outdoor Worker Toolkit</b>	Arizona Department of Health Services	The toolkit provides outdoor workers and employers with resources to prevent, recognize, and treat heat illness utilizing information developed by the Occupational Safety and Health Association (OSHA).	<a href="https://www.azdhs.gov/preparedness/epidemiology-disease-control/extreme-weather/heat-safety/index.php#heat-outdoor-workers">https://www.azdhs.gov/preparedness/epidemiology-disease-control/extreme-weather/heat-safety/index.php#heat-outdoor-workers</a>
<b>Heat &amp; Health Tracker</b>	Centers for Disease Control and Prevention	The CDC Heat & Health Tracker provides local heat and health information so communities can better prepare for and respond to extreme heat events.	<a href="https://ephracking.cdc.gov/Applications/heatTracker/">https://ephracking.cdc.gov/Applications/heatTracker/</a>
<b>Recognizing, Preventing and Treating Heat-Related Illness</b>	Centers for Disease Control and Prevention	This training provides users information about the different types of heat-related illnesses (HRI). It enables users to learn to recognize, treat, and prevent HRI.	<a href="https://www.cdc.gov/nceh/hsb/extreme/Heat_Illness/page204.html">https://www.cdc.gov/nceh/hsb/extreme/Heat_Illness/page204.html</a>





## AIR POLLUTION

Name of Training	Group Sponsoring Training	Description of Training	URL
<b>Air Pollution Training Institute</b>	U.S. Environmental Protection Agency	This EPA website provides course content for user air pollution training needs. Users can access a curriculum that will chart you through a learning objective-based path. Users can also choose a complete online course from the course list.	<a href="https://www3.epa.gov/ttn/apti/index.html">https://www3.epa.gov/ttn/apti/index.html</a>
<b>Indoor Air Quality in Commercial and Institutional Buildings</b>	Occupational Safety and Health Administration	This OSHA guidance document on indoor air quality (IAQ) provides practical recommendations that will help prevent or minimize IAQ problems in commercial and institutional buildings and help resolve such problems quickly if they do arise. It provides flexible guidance to employers to help them keep their buildings free of pollutants or conditions that lead to poor IAQ. It also provides information on good IAQ management, including control of airborne pollutants, introduction and distribution of adequate make-up air, and maintenance of an acceptable temperature and relative humidity.	<a href="https://www.osha.gov/sites/default/files/publications/3430indoor-air-quality-sm.pdf">https://www.osha.gov/sites/default/files/publications/3430indoor-air-quality-sm.pdf</a>
<b>EPA AirNow</b>	U.S. Environmental Protection Agency	This EPA website offers air quality information at state, national, and world views. It uses the official U.S. Air Quality Index (AQI), a color-coded index designed to communicate whether air quality is healthy or unhealthy in the selected area.	<a href="https://www.airnow.gov/">https://www.airnow.gov/</a>



## OZONE DEPLETION

Name of Training	Group Sponsoring Training	Description of Training	URL
<b>Ultraviolet Radiation As A Hazard In The Workplace</b>	World Health Organization	This fact sheet provides information about UV radiation, as well as health risks associated with UV radiation in the workplace.	<a href="https://www.who.int/uv/publications/en/occupational_risk.pdf">https://www.who.int/uv/publications/en/occupational_risk.pdf</a>
<b>UV Toolbox Talks</b>	Emory University	This toolbox talk can be used by supervisors to talk to their employees about the hazards on UV radiation.	<a href="https://www.ehso.emory.edu/documents/toolbox-training-uv-facts.pdf">https://www.ehso.emory.edu/documents/toolbox-training-uv-facts.pdf</a>



# EXTREME WEATHER

Name of Training	Group Sponsoring Training	Description of Training	URL
<b>Cleanup/Recovery</b>	Occupational Safety and Health Administration	This website provides fact sheets and pamphlets on safety and health information for those working in recovery or disaster cleanup.	<a href="https://www.osha.gov/sites/default/files/publications/OSHA3907.pdf">https://www.osha.gov/sites/default/files/publications/OSHA3907.pdf</a>
<b>Climate Change, Extreme Weather, Natural Disaster &amp; Human Health and Integrating Climate and Public Health Data into the Hazard Vulnerability Analysis Process</b>	Region 2 Public Health Training Center	The first half of this webinar focuses on the specific health risks associated with extreme weather conditions. High temperatures and humidity increase hospital admission rates due to respiratory disease, cardiovascular disease, renal disease, and total mortality; conversely, cold temperatures contribute to an increase in asthma and incidence of congenital cataracts. Vulnerabilities due to severe weather, based on post-Hurricane Sandy health evaluations, include but are not limited to mental health and substance abuse, kidney disease, and COPD. The webinar outlines the risks, vulnerabilities, and health burden associated with climate change, and offers next steps for addressing these issues in the future.	<a href="https://www.train.org/main/course/1063656/?activeTab=about">https://www.train.org/main/course/1063656/?activeTab=about</a>
<b>Fire Department Preparedness for Extreme Weather Emergencies and Natural Disasters</b>	U.S. Department of Homeland Security	This report examines the impact of extreme weather and natural disasters on the fire service. It also addresses the types of service calls most likely to arise because of these disasters and what equipment and planning are needed in order to be prepared. Safety, mutual aid, shift management, resource identification, logistics, and other related issues are discussed, along with examples from case studies of fire departments that have learned from experience what can happen. The report provides information that fire departments can use to enhance their level of preparedness and ensure greater safety the next time disaster strikes.	<a href="https://www.usfa.fema.gov/downloads/pdf/publications/tr_162.pdf">https://www.usfa.fema.gov/downloads/pdf/publications/tr_162.pdf</a>
<b>National Disaster Preparedness Training Center</b>	University of Hawai'i	NDPTC is authorized to develop and deliver training and educational programs related to homeland security and disaster management, with a specific focus on natural hazards, coastal communities, and the special needs and opportunities of islands and territories.	<a href="https://ndptc.hawaii.edu/about/">https://ndptc.hawaii.edu/about/</a>
<b>Ready Responder Resources from the Department of Homeland Security</b>	Federal Emergency Management Agency; U.S. Department of Homeland Security	The Ready Responder Toolkit is designed to provide emergency response agencies with a series of planning tools to help prepare their personnel and families for emergencies. These tools are flexible and customizable to be used by planners to meet the needs of their agency or department.	<a href="https://www.ready.gov/ready-responder">https://www.ready.gov/ready-responder</a>
<b>Worker Protection From Wildfire Smoke</b>	California Division of Occupational Safety and Health	This fact sheet provides information from California Division of Occupational Safety and Health's wildfire smoke standard.	<a href="https://www.dir.ca.gov/chswc/SASH/Publications/Wildfire-Smoke-Protection-Factsheet_SASH_2021.pdf">https://www.dir.ca.gov/chswc/SASH/Publications/Wildfire-Smoke-Protection-Factsheet_SASH_2021.pdf</a>



# VECTOR-BORNE DISEASES AND EXPANDED HABITATS

Name of Training	Group Sponsoring Training	Description of Training	URL
<b>Tick-Borne Diseases: Recommendations</b>	The National Institute for Occupational Safety and Health (NIOSH)	Webpage provides background on why workers are especially at risk of exposure to tick-borne diseases; frequently asked questions on the topic; recommendations for employers and workers to protect individuals from tick-borne diseases; and several helpful resources.	<a href="https://www.cdc.gov/niosh/topics/tick-borne/default.html">https://www.cdc.gov/niosh/topics/tick-borne/default.html</a>
<b>West Nile Virus Overview and Resources</b>	The National Institute for Occupational Safety and Health (NIOSH)	Webpage offers background on why West Nile virus (WNV) presents risks to outdoor workers and laboratory, field, and clinical workers. Page also provides links to several NIOSH and CDC resources on the topic.	<a href="https://www.cdc.gov/niosh/topics/outdoor/mosquito-borne/westnile.html">https://www.cdc.gov/niosh/topics/outdoor/mosquito-borne/westnile.html</a>



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